

Climbing

**Beyond
the Basics**

*Stronger
Faster
Healthier*

Second Edition

Michael A. Layton, D.C.

CHAPTER EIGHT: HEALTH CONCERNS

The information in this chapter is not a substitute for the accurate diagnosis and treatment of a qualified medical practitioner tailored to your individual history and symptoms. This information should be used in conjunction with a qualified practitioner, or for spawning questions to ask your caregiver. A lot of information has already been presented that may be pertinent to your condition or inquiry so I suggest you at least skim through the previous chapters.

FIELD AND TRAVEL MEDICINE

LIFE THREATENING CONDITIONS

Before you venture outside and put you, your partner, or potential rescuers at risk, at least take a first aid and CPR class. Better yet, be responsible and take a Wilderness First Responder (WFR) class. Too many city slickers and gym climbers are heading into the hills have no right to put their partner's lives at risk by not knowing how to handle an emergency. If you are knowledgeable but your partner isn't, then educate them, or make them take a class. If you're initiating someone into backcountry climbing, then it's your responsibility to not only teach them about camping and climbing, but about rescue and first aid. Just because an area is popular like the Hulk or Diamond, and doesn't feel that remote doesn't mean that it isn't. In rescue situations, wilderness means an hour from an ambulance ride. It is also your responsibility to alert your partner of any medical conditions you have that could be relevant (severe allergies, seizures, etc.). This section is not a substitute for a class or dedicated volume on wilderness medicine. This same lecture will be rehashed in the self-rescue section later.

The big problem with many self-rescue and emergency medicine books/classes is the watering down of important information with useless information. I expect to get torn apart on the following comments. Will you remember acronyms, steps, Venn diagrams, flow-charts, etc., in the field when it actually counts, and will they really help? Are you going to really write a SOAP note when your partner is dying next to you? The harsh reality is that there is very little you

can do or feasibly bring with you to help unless you are exceptionally trained in surgery. If an injury was bad enough to kill you, you'll probably die. Your first aid kit, no matter how well stocked, will look like a children's art box at your first day of art school. If an injury doesn't kill your friend, then your primary concern is to keep the victim comfortable and evacuate. Some situations require an understanding of injury consequences. In other words, even if you don't see a bone sticking out or a gaping wound, you at least need to be aware of the high risks involved with head injuries and internal bleeding. If a fall was severe enough, knowing to look for warning signs of more serious injury or playing it safe and pre-evacuating is an important skill. It is important to know when an injury can become serious enough to evac or seek medical attention sooner rather than later instead of just "walking it off".

Here is a small list of what you need to know how to assess, perform, or deal with:

- CPR, Rescue Breathing, and Choking
- Finding a Pulse (including the limbs)
- Asses Pupillary Response
- Shock and Sunstroke
- Severe Bleeding and Burns
- How to Stitch a Wound
- Frostbite and Hypothermia
- Open and Tension Pneumothorax
- Dislocations, Open and Closed Fractures, and when to and when not to apply In-Line Traction
- Lightning Strikes

- Unconsciousness, Concussions, and Changes in Consciousness/Mental Status
- Rattlesnake, Black Widow, and Scorpion Bites
- Anaphylaxis
- Abdominal Pain (severe with no trauma or trauma induced)
- HAPE, HACE, and acute AMS

You need to be able to recognize and deal with symptoms or mechanisms of injury that may not be so noticeable, like:

- Cranial Swelling via Internal Bleeding, Edema, and Concussion
- Airway Obstruction
- Lung Edema
- Internal Bleeding and Appendicitis
- Spine and Spinal Cord Damage
- Ischemia
- Heart Attack, Appendicitis, Gall Stones, Kidney Stones, Hernia
- When to stay with the victim, when to run to a phone or for help, when to assist the victim to get out together, and what injuries the victim should attempt to ambulate on their own

Other Need to Know Information

If the lists mentioned above made you feel unprepared, keep your climbing activities closer to the road and within cell phone range. The rest are some tips on not so obvious stuff you should have learned in your WFR class.

Use a trekking pole, pack stay, or branch to devise a traction splint for a femur fracture. With a harness, water bottle, and some cord you can rig a quick setup. Some authorities do not recommend using mechanical traction like this with a femur fracture – do whatever you need to when far from help. Only pull traction if it alleviates pain and there is no hip or knee joint damage. Traction is required with a compound fracture or dislocation far from help. With any mechanism of injury that could have

damaged a spinal cord or broken a vertebrae, immobilize the spine and call for rescue. Clearing the spine for injury requires some medical training so if you aren't trained, you are forgiven for calling in a rescue.

Mild head trauma, especially with loss of consciousness, can be life threatening. Be extra vigilant about monitoring for strange symptoms even if your partner just got a little bump. If they got knocked out evac even if they feel fine afterwards. Concussions can be subtle. Keep the patient upright to reduce cranial pressure and keep your eye on them (don't let them belay you or rappel on their own). Monitor them for 24 hours to see if any symptoms develop – but you do not have to keep them awake when it's time to go to sleep. If you got knocked-out, definitely evacuate. Symptoms of brain injury can last for months.

Multiple concussions have a compound effect and can lead to lifetime neurological problems. Symptoms can include headaches, trouble concentrating, memory problems, emotional imbalance (mood swings, inappropriate emotions, combative behavior), seizures, speech problems, and motor problems (parasthesia, paralysis). These symptoms can all be permanent, leaving you unable to work or lead a normal life. Expect crayons for your next birthday if you don't like wearing helmets.

If you suffered a concussion or traumatic brain injury then problems associated with high altitude can be compounded. Post-concussion syndrome symptoms are the last neurologic symptoms that can last for months to years. Subdural hemorrhages from minor blows to the head can start off completely asymptomatic and leave you in a pine box without any warning. Get thee to a hospital! If you suspect shock and your injured partner says they are fine, be extra vigilant about monitoring their conditions.

CPR probably won't start the heart, it just keeps blood flowing. If there is no possibility of rescue for a long time, do it, but don't exhaust yourself. If the victim doesn't revive within 30 minutes and help in the form of an airlift or defibrillator isn't coming, stop CPR. The heart may start on its own if lightning was the cause or take a while if buried by an avalanche or in cold water, so give this victim a lot more time. Hypothermia can severely mask vital signs. An old saying goes, "you're not dead until you are warm and dead".

If there is no breathing, but there is a heartbeat – don't do CPR, but do not stop rescue breathing. Back blows are just as effective as the abdominal thrusts in choking situations – do them first. A camelback tube can be used for an emergency tracheotomy. The incision goes in the indentation below the Adam's apple. Impaled? If it's deeper than skin and muscle leave it in.

Most severe bleeding can be controlled with direct pressure. A tourniquet should only be applied in a situation so dire that losing a limb is no longer a concern. Stick your fingers in the hole or stuff it with cloth – whatever you can do to stop bleeding. A femur or pelvic fracture is a life threatening conditions due to the large amount of blood that can be lost. Knee and hip dislocations are life threatening. Do not relocate the dislocation. Hanging in a harness pools venous blood and can kill you via clots or old coagulated blood.

A cold can turn into pneumonia, which is a life-threatening condition. Pressing firmly on the eyeballs (closed lids!) can help reduce an elevated heart rate (and stop hiccups).

FIRST AID KIT

Most first aid tools can be fashioned from what you already have on you. Be creative. You can make a traction splint with a few simple items, a breathing tube with a knife and a hydration tube, or a splint from a backpack stay. Big first aid kits just aren't practical unless you are on an extended trip or out of the country. Most injuries can either be dealt with until you get to civilization, or are so disastrous that a first aid kit won't cut it. Bring stuff that you commonly suffer from, be it diarrhea, blisters, headaches, allergies, whatever. Guides and instructors have a lot more liability (and clients have a lot more issues) so their kits are going to be much bigger.



Here is a basic first aid kit you can fit in your climbing pack:

- **Clotting Agent**– Quick Clot is a small vacuum-sealed dressing with clotting agents that can stop severe bleeding, and Celox is clotting granules you pour into the wound and may be more useful. Check the expiration dates.
- **Epi Pen** – If you or your partners are highly allergic to bee stings or anything else. You can develop severe reactions from repeated exposure or from substances you haven't been normally exposed to (rare). Every guide needs to carry one, and it should be in every climber's first aid kit regardless of your experience with bee stings, etc. just in case.
- **Tape** – Athletic and a small roll of Duct Tape. Indispensable.
- **Nu Skin or Super Glue** - For minor cuts while cragging.

- **Syproflex** – Weighs nothing and good for closing up large wounds or covering blisters.
- **NSAIDs** and **Vicodin** (or other opiate) – For aches and pains. Morphine-like painkillers may be necessary on longer expedition to subdue the victim as normal prescription and OTC painkillers probably won't do much.
- **Knife** – It's amazing how useful, even lifesaving, a small knife can be. Always have one on you when roped climbing.
- **Phone, Radio, or PLB** - I'll spare the lecture for later on, and assume you'll use them for real emergencies or leave them at home if you want to be hard-core. Text messages can sometimes get through when calls can't. Text a friend who can talk to the local SAR. Calling for rescue should be because of possible loss of life or limb. If you can get out on your own (even if it means an extra bivy or two, getting yelled at or work or home) then do it. Suck it up and suffer if you chose to climb in the wilderness. Getting rescued when you could have done so yourself is pathetic.

Depending on the length and location of your adventure, here are some other first aid items to pack or at least have in the car. For huge expeditions far from Western medical care consult an expedition doctor.

- **ACE Wraps** – Sprains and strains.
- **Allergy Medication** – Non-drowsy allergy medications like Claritin D can be lifesavers. Many "colds" are just obnoxiously symptomatic allergies. Even if you don't normally have allergies, traveling to new areas or higher elevations can expose you to new allergens.
- **Aloe Lotion** – Reduce symptoms of sunburn or rashes.
- **Altitude Drugs** – Prevent or reduce symptoms of HAPE, HACE, or AMS (discussed later).
- **Antibiotic Ointment** – Prevent infection, decrease healing time.
- **Anti-Diuretic** – Reducing diarrhea.
- **Antihistamine** – Non-immediate treatment for anaphylaxis, allergies.
- **Birth Control** – You never know!
- **Blister Pads** – Prevent blisters or reduce pain (moleskin, duct-tape, Leukotape, Band-Aid style).
- **Bodyglide** – Prevent blisters and chaffing.
- **Book on First Aid** – On long trips without an expedition doctor or you don't have a WFR instructor in your group.
- **Broad Spectrum Antibiotics** – Cure bacterial infections or disease. Vital on long remote trips. Can upset your gut flora so take some pre/probiotics well.
- **Bug Dope, Permethrin, Citronella Candles, Bug Clothing** – Preventing bites and diseases.
- **Chap Stick** – You'll know you needed it when you forgot it. Sunscreen can work in a pinch.
- **Calamine Lotion, Cortisone Cream** – Rashes.
- **Clove Oil** – For numbing dental problems.
- **Cold and Cough Medication** – Decongestants, expectorants, lozenges.
- **CPR Mask** – Preventing communicable disease during rescue breathing.
- **Dental Emergency Kit** – Ask your dentist. Cavit and Clove oil can help.
- **Eye Kit** – If you need glasses then bring a second pair or extra contacts and lens solution.
- **Eyedrops** - Can also help stop blood loss from minor cuts or a bloody nose or they can help with dry eyes in the field.
- **EMT Shears** – To cut clothing (or rock shoes) off.
- **File or Emory Board** – Reduce calluses to prevent hot spots, blisters, or split tips.
- **Foot Powder and Antiperspirant** – Reduce or absorb sweat in hands, feet, or groin.
- **Hand Salve** – Repair dry or cracked skin (water and oil based).

- **Heartburn/Antacid Tablets** – Roloids, Pepto, Zantac, Tagamet, etc. Upset tummies are very common reason for bailing when you're scared.
- **Hemorrhoid Cream/Suppository** – Sitting on cold surfaces and straining can cause or irritate these buggers.
- **Hydration Kit** – For heat exhaustion or food poisoning. OTC kit, or ½ tsp. salt and 3 tbs. sugar per liter.
- **Iodine** – Wound cleaning.
- **Latex Glove** – Prevent transmission of communicable diseases from body fluids.
- **Pepto-Bismol, Roloids, or Zantac** – For reducing heartburn or indigestion.
- **Nail Clippers** – Prevent hangnails and ingrown nails, cut flappers.
- **Needle and Thread** – Stitches, subungual hematoma, blisters, splinters, wound debridement (and equipment repair).
- **Safety Pins** – Attaching bandages, splints, and repairing items.
- **SAM Splint** – Splinting sprains, fractures.
- **Soap, Hand Sanitizer, Clorox Wipes, Lysol Spray** – Preventing infection or illness.
- **Sterile Gauze** – Wound cleaning, sterile bandage, wound packing.
- **Sunscreen, Lip Balm, Sun Clothing** – Prevent sunburn.
- **Tecnu** – Poison ivy wash.
- **Thermometer** – For longer trips.
- **Tincture of Benzoin** – Toughen skin on hot spots, helps tape and bandages stick.
- **Tweezers (or Tick Remover)** – Ticks, splinters.
- **Vaginal Infection Medication** – Treatments for bladder and yeast infections.
- **Various Bandages** – Sterile bandaging, minor bleeding, preventing infection. Options are Spyroflex, Steri-Strips (butterfly closures), Band-Aids of various sizes, breathable membrane bandage (bad scrapes, burns, puncture wound), Second Skin (burns, blisters).
- **Water Purification** – Wound cleaning, preventing illness.

DISEASES

The CDC is the best online resource to get information on the following information. If you are bitten or suspect an infection that isn't just a cold, explore their website and see a doctor. If traveling abroad, you really need to educate yourself.

Diarrhea

To treat diarrhea you also need to treat the cause. Infection is a common cause, as is a change in diet or medication, as well as anxiety. The gut can be finicky and various nerves and reflexes can cause abnormal bowel movements and diarrhea on climbing trips. Stress, physical activity, and any change in diet are easy triggers – basically your normal climbing trip. It helps to recognize if you are susceptible to these normal triggers so you can plan ahead by finding more agreeable foods, timing your meals

and waking hours, or remembering to bring some extra water and TP for the climb. Taking **Immodium** may also be a useful preventive measure, but try this at home in case you get rebound constipation, which can be just a bad for you (and your tent mate).

When you do get the squirts, you must replace the fluids lost with an isotonic solution containing 6 tsp. sugar and ½ tsp. salt, in other words, a **sports drink**. Begin increasing the solidity of food when the diarrhea starts to improve. Hard foods are difficult to digest and will compound the problem. **Oral rehydration salt packets** are available if you are on an extended expedition. If fever and severe cramping aren't accompanying the diarrhea, you can take **anti-motility drugs** like Imodium.

Cryptosporidium diarrhea can last weeks and be carried for about 2 months. You can get symptoms two days to a week after ingestion. Severely painful, explosive diarrhea with vomiting is most likely toxin-related food poisoning and develops rapidly after you ate or drank the organism or its toxin. Many cases are self-limiting to several hours to a day and a high fever may accompany the other symptoms. E. Coli can be severe and cause bloody diarrhea. Unfortunately antibiotics and anti-motility drugs can make it worse. You have to ride this one out and stay hydrated, but bloody stool should be an immediate evac if hemorrhoids, irritable bowel, or dry-cracked skin around the anus are ruled out.

Giardia is probably the most well known cause of water-borne diarrhea for hikers and climbers. Incubation takes one to three weeks so a sudden case is likely to be from something else. Diarrhea is crampy, foul smelling, flatulent, and often explosive. It usually resolves on its own after a month or two, but can continue for months. There is no evidence that states once you get Giardia you are less susceptible to getting it again or it creates immunity. So don't try and get it once to get it over with. It is also highly contagious so you can get it from fecal contamination from your climbing partner. The more giardia cysts you ingest, the higher chance you have of developing symptoms, however. If you are taking a chance by not purifying water, chose a highly renewable source of non-stagnant water (like a snowmelt river or spring upstream from animal life or pooping climbers).

Colds and Flu

There is no cure for the common cold. Any or all drugs and OTC supplements only help to boost the immune system, treat the symptoms, or reduce the severity. It's amazing what we allow as a "scientific" society to treat a cold compared to the scrutiny we

place on other questionable medical practices. I tip my hat Rhinovirus. Circumstantial evidence reigns supreme. The most effective things that still only have mild to no evidence on the market are **zinc lozenges**, **echinacea** (more is better), **Airborne** (because of the echinacea, zinc, and adaptogens I suspect), **Emergan-C** (I think it's mainly a placebo), and chicken soup.

One of the best ways to treat a throat or sinus infection is by gargling with **salt water**, or a saline nasal lavage (snorting salt water or using a Netti Pot). Substituting with Listerine will not help in a nasal lavage (although it does make sense why it would). Rest, proper nutrition, **antihistamines**, **expectorants**, and **anti-inflammatories** and **antipyretics** are probably your other best bet. Ingesting silver nitrate or colloidal silver does not work and can have actually negative health effects. For those traveling abroad, it is prudent to get a prescription for a strong **broad-spectrum antibiotic** to treat bacterial infections. The best defense against sickness and infection is repeated hand washing, avoiding contact with your hands to your face (good luck), using hand sanitizer after you poop, and getting a current flu vaccine. Wipe down surfaces with **bleach or Lysol** you contact if they are suspicious. Diluted **iodine** can also work, especially for cleaning wounds.

Skin and Wound Infection

If your wound gets very red around the edges, starts producing lots of puss, or causes red streaks (immediate evac!), you need to go to the hospital to treat the infection. Vigorously scrub and irrigate any injury with clean **soap and water**. Bone ends, burns, and frostbite require cleaning and irrigation, but not so much on the scrubbing. You can get tetanus infections from soil contamination or a puncture wound. Get your booster shots.

Insect or Animal Borne Diseases

Although not dangerous except in malaria infested equatorial climates, mosquitos still suck. Clothes are your first line of defense. If you know you'll be near areas of high mosquito concentrations, especially post-snow melt alpine zones as they hatch when standing water develops, then you may want to wear **baggier pants and loose long sleeve shirts** over those tighter climbing pants and tops. A **hat and bandana** help with both sun and bugs, followed by an actual mosquito **head net**. If you get a small non-wire, or non-brimmed head net you'll need a ball cap to keep the netting off your face. Spraying your clothes, socks, and jacket that you'll wear at dawn or dusk temps with **Permethrin** helps a ton. Don't freak out by the "DO NOT SPRAY ON SKIN" warnings. It is not hazardous to you or pets, no matter what your friends who also freak out about fluorinated water say. It really should read, "Does not work on skin" because it is quickly absorbed and metabolized. It does significantly reduce the swarm of bugs around you though! Permethrin is actually an insecticide, not a repellent, but it kills them so quickly it seems like a repellent. Step three in prevention is using a mixed bug dope product containing at least 30% **DEET** in areas of exposed skin. Finally, carry another small bottle, spray stick, or wipe (my favorite) of 100% DEET for extremely bad insects and apply it to their favorite snacking locations. Permethrin or **citronella coils and sticks** that you burn are another extra line of defense, and don't weigh very much. Being careful not to burn down the forest, light a perimeter (accounting for prevailing winds) of mosquito sticks.



Mosquito coil, permethrin, DEET stick, mixed repellent cream and wipe.



Covering up with baggy clothes is the best defense

Still miserable? You may be in a mosquito zone for whatever reason and moving camp just a few yards could change everything. Hop in your tent, or better yet, use a large hanging **bug tarp** or a take the tarp off a tent that has a mesh interior. Full-on **bug suits** could even be worth the hassle in notoriously awful places like Alaska or the Wind Rivers on a bad day.

Don't tell your partner about this next trick: because mosquitos are drawn to your CO2 emissions and CO2 rises, the bugs will attack the person who is higher up. This works pretty well inside netless tarp tents as the vast majority of the mosquitos will be aimlessly buzzing around the tent ceiling and

the only exposed skin should be your face. A light piece of cloth over your face and some earplugs should finish the job.

Bites should disappear much quicker if you don't scratch them and set off an inflammation response beyond just the bite. Some people, especially younger kids, are just more prone to developing long lasting itchy bites, or actually naturally attract mosquitos more than others. You can become desensitized to the bites over time. If you are one of the unlucky types, bring along some **anti-itch cream**.

Check to see if the country you are going to has malaria with the CDC and follow their precautions and suggestions. There are no useful vaccines so the key is prevention. There is medication you can take to make you resistant, but some folks react very poorly (go crazy) due to side effects. There are plenty of other diseases to prepare for, so do your homework. West Nile virus is another major one transmitted via mosquito, and it is becoming more common in the United States. Symptoms are flu-like, a red bumpy rash, and an aversion to light. Only about 20% of infected people get symptoms, less than 1% have severe symptoms, and death is uncommon. The thing to worry about mainly is fatigue and mental issues from even mild infections that can last a very long time. Get tested several times if you suspect infection.

Ticks are usually just unsettling more than painful, irritating or dangerous. Nothing develops long lasting bonding like performing a tick check on your partner back at camp. If you get one burrowed in your skin, be careful not to rip its head or mouthparts off when pulling it off. You can use a tick remover or tweezers, but you probably won't have those. Scrub the area with lots of soap and water and monitor the skin for a rash. The old match, nail polish, or Vaseline trick doesn't work – just pull it out.

Don't squeeze the tick's body as it can further release disease into your body.

Lyme disease is the most common tick borne infection in the United States. Summer and fall are the more common times to get it. The small deer tick is a common carrier in the Northeast, Midwest, and South while the Western blacklegged tick is more common in the West. These ticks are tiny, and the nymphs that transmit the disease are miniscule. A tick check may not catch these guys, especially in hairy areas. The most easily noticeable symptom is a rash, usually in a bull's eye shape that occurs about a week after a bite. Flu-like symptoms and joint/muscle pain show up around the same time. Get tested! Long-term consequences to the disease can be severe and debilitating joint pain and arthritis, mental and neurological problems, and organ damage.

Dog and wood ticks transmit Rocky Mountain spotted fever, most commonly in late spring and early summer in the Southeastern United States. You develop a high fever about a week post bite and then a red spotted rash on your hands and feet including the palms and soles, and the rash spread and deepens over the body. Hopefully this would clue you in that you have something that is not normal going on! However, some don't get a rash at all. It can be deadly.

Hantavirus is a serious and deadly disease and climbers are at risk. The virus is inhaled from particles of rodent droppings. There is no cure and 38% of cases die. Don't camp in trail shelters, they are mice heaven. 10 cases were recently reported in the camping cabins in Yosemite, another reason to avoid the Village. Luckily, the disease is rare, with less than 600 cases reported from 1993 to 2011. It is more prevalent in the Western United States.

If an animal bites you, then you are at risk for rabies. The best way to determine if you

were infected is to dissect the animal's brain. If the animal can't be dissected, any animal bite or scratch should be treated for rabies. Symptoms may take a very long time so get treated regardless. Clean the wound like you are obsessive. Untreated rabies will kill you and the symptoms are unimaginably awful. Once symptoms develop there is just above zero chance you will live. Don't take any chances and get started on treatment ASAP!!!

The best cure for snakebites is **antivenom**, something you may want to carry if you're on your own. Luckily most bites are not a medical emergency. If you suspect venom, however, get your ass to the hospital. Try and get a photo of the snake for the hospital doctor, especially important for the Mojave rattlesnake. Venom extractors are not recommended as they can concentrate the venom in one spot and make it much worse. Pressure bands or even direct pressure may also have the same negative effect. Treat the bite for infection, however. Ice can make the tissue destruction worse so don't use it. Coral Snake bites require a different approach, as do snakes in Australia, Africa, and South America as they inject a neurotoxin. In this case apply direct pressure over the bite with a broad bandage and immobilize the limb after washing the site....and get to a hospital very quickly.

Africanized bees are becoming a problem, and one climber fatality has already occurred in Arizona. These bees aren't more poisonous, but are more aggressive and can swarm and chase you for up to a mile! Other nearby bees get recruited and a swarm of thousands may descend. Don't piss off any bees in the Southwest or California or have fruit smells near you. Dark colors anger bees. If you don't know if you are highly allergic (you can become sensitive later in life), pop 50-100 mg of **Benadryl** ASAP. Get the stinger out to prevent further allergic reaction or infection immediately.

Black widow and brown recluse spiders are the ones to really look out for. A black widow bite isn't usually painful, but the symptoms that follow sure can be. Thankfully the vast majority of bites aren't deadly, but the symptoms can last a couple days. A brown recluse bite may hurt a bit, followed by swelling or a blister, and aching. Over time the bite area dies and ulcerates – about a week. Go to the hospital. Scorpion stings are incredibly painful. Symptoms to follow are pain, and some neurologic symptoms. Some scorpions are just about as bad as a bee sting while others will kill you. Check under the outhouse seat and in woodpiles. Shake out your boots and bag if left in the open. If you want to lay awake all night, shine a UV light around to see how many are out there.

Food Borne

If traveling abroad, or at a real backwater restaurant or grocery store in the States, beware lettuce and other unwashed veggies, ice cubes, anything made with tap-water (including mixed drinks), undercooked meat, unpeeled fruit, dairy, room temperature sauces (including condiments), unrefrigerated sausages, or hot drinks not brought to a boil. Basically, scrutinize everything: how it was prepared, its age, and what the ingredients are and where they came from. I never eat the veggies on a hamburger or a sandwich from low-income areas or mountain-town pubs that employ climbers in the kitchen after getting sick on too many trips. Seriously, restaurants in mountain towns low on tourists don't get inspected often and can employ dirt bags, drifters, or profit hungry owners. Contamination is also likely to have come from your grubby hands, so wash up. If boiling water to treat for fecal contamination, go for a few minutes.

Worms

You can get worms from a variety of sources: water, plant, animal, and insect. However, it is very unlikely to get worms in the United States unless you are eating animals you have hunted. If traveling abroad, check with the CDC and your doctor about medication to help prevent an infection, and follow up if you experience any gastro-intestinal distress – you may have a stowaway.

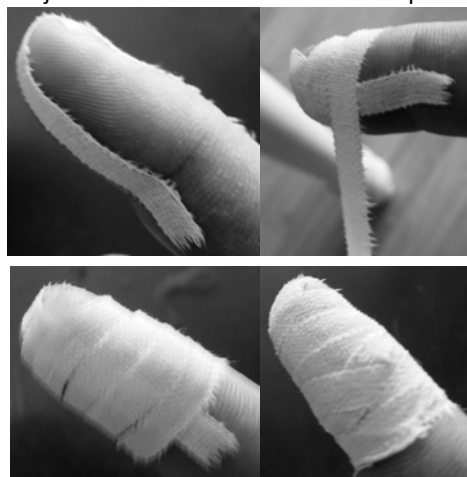
MINOR INJURIES

Minor Cuts

Cuts, flappers, and gobies all heal quicker in a clean moist anaerobic (no air) environment. Large cuts and puncture wounds require extra cleaning and debridement with **sterile water** (boiled and with **iodine** in the field). Never tape a puncture wound closed, however. Take about three times as long with three times as much water and scrubbing (yes scrubbing) as you think necessary. A **needle and thread** is light and can provide emergency stitching if it will be a long while before the hospital is reached. **Super glue** and **Nu Skin** can hold together flappers while they heal, and cover scrapes and gobies as well. **Antibiotic ointment** helps prevent infection and also helps provide an air seal over cuts and scrapes. **Granulated sugar** can work in a pinch to prevent infection on minor cuts to prevent infection as well. Large nasty rashes can be helped by wrapping the rash in **plastic wrap** after a good cleaning. If swelling and redness grow around the wound, infection is setting in. If the area starts to streak, get to a hospital as fast as possible. No matter what the wound, thorough cleaning and protection will reduce the chance of infection and decrease healing time. Nu Skin can be a lifesaver, as can packing the wound with chalk and sealing with tape if that's all you've got (and you care more about climbing than infection).



Tape split tips with thin strips of **athletic tape** to protect the split for the rest of the day or trip. The tape will interfere with grip, so take it off before the big send and expect the trip to be over afterwards. Put a ¼" strip of tape over your finger followed by overlapping wraps down your finger down to just above the joint. Secure with a figure 8 wrap at the bottom of the wrap and over the joint. Secure with a few extra wraps.



If you get a nasty cut and need stitches, you only have a few hours (about 5) before stitches become too difficult to apply and your wound will take much longer to heal, increase the chance of infection, be super gross, and leave a nasty scar for a long time.

Boils and Abscesses

If you get a boil or abscesses for whatever reason, don't try and lance it or squeeze it in the field, as the risk of further infection is very high. Pad around the area, and apply

cortisone creams and antibiotics to reduce the inflammation. If you just have to lance and pop it treat it like an infected puncture wound.

Poison Ivy and Oak

Some folks are deathly allergic while others can bathe in poison ivy. It is a good idea to learn what it looks like so you can avoid contact with your skin or gear. Gear that's been in contact with poison ivy can affect someone allergic to it for long time after the initial contact was made. Some areas are notorious for poison ivy, like the Black Canyon. Long pants and sleeves and a pair of hiking poles or long thin branches forked at the end (please don't rip branches off) can serve as pokers to move leaves out of your way as you move like a ninja through the plants. **Tecnu** is a compound that helps deactivate the poison ivy oils – you can and should wash yourself, clothes and gear with it even if you aren't allergic to protect a significant other or future partners. **Calamine lotion, aloe, and cortisone creams** help with rashes. Serious reactions require heavier doses of steroids. If making a campfire, be sure you aren't burning poison ivy or oak and inhale the oils into your lungs!



Sweating

If sweaty hands or feet (or groin) are a problem, you can use **antiperspirant** besides just in your armpits. You can get little travel sized sprays or bars. Apply about an hour before climbing if using the bar, or right away if it's a liquid or spray. You can also put antiperspirant on your feet to help prevent blisters and cold sweaty feet in the winter.

Chafing and Blisters

Blisters are the most common foot problem for climbs that require a long approach or wearing mountaineering boots. They are also very common injury when jugging, hauling, or climbing rough holds (especially jugs) all day. Friction causes blisters, so the goal is to minimize friction. Calluses cause a great deal of friction, so first try and reduce those. Wet conditions make the skin more fragile and will compound the effects friction. Ultra heavy or overly warm shoes are also blister factories. One person's blister prevention can be another's cause, so prepare for some trial and error. **Thicker socks, liner socks, double layer socks, wool socks, inorganic socks, and foot powder** are good options or may cause blisters. Slippery or rough insoles, too low or too high volume shoes (too tight/loose) can also create blisters. No matter how much you love your boots, if they cause blisters they are worthless.

All the suggestions for dry skin and sweating can prevent blisters and hot spots. Should you pop your blister? It depends on how much it is bothering you and how well you can prevent infection or further irritation. If you decide to drain it, first sterilize your **knife, needle, or clippers** and clean the skin and your hands with soap and water. Make a small hole or incision at the base in an area that won't get rubbed and tear open the blister. Finish the job by covering it with **protective tape or Band-Aids**.

To help prevent blisters and chafing on your feet, groin, butt crack, or wherever before they start, products like **Bodyglide** are available to lubricate hot spots. Bodyglide is excellent as it allows the area to breathe under the lotion. Tiny micro sticks are available to go in the pack. It is difficult to tape over the area if applied once a blister develops, so this stuff is better as a precaution. Thick clothing or double layers can help absorb friction before your skin does.

Duct tape and athletic tape are usually available in the climber's measly first aid kit and can both be used to reduce chafing on the skin. Duct-tape will stick and glide better, but the glue can cause irritation, especially if the area is already inflamed. **Mole-skin** provides a lot of protection, but can also fall off quite easily and much better products are available like **Second Skin** and **Spyroflex**. Cutting a doughnut hole out of **molefoam** around a blister can also work, but is not as commonly used. **Leukotape** is stronger, stickier, and offers less friction than athletic tape and could be a better alternative to duct tape, which can also easily fall off with sweating. **Pre-tape spray and tincture of benzoin** can help the padding stay on better. There are some great smooth stretchy and thin **Band-Aid Blister Pads** available that do a pretty good job preventing blisters, hot spots, and stay on. In a pinch use a shiny candy wrapper under whatever tape you have available.



Dry Skin and Calluses

Keeping your hands clean by washing them with soap and water and applying lotion after a day of climbing is key in keeping your hands in use longer and avoiding flappers and painful cuticles. There are tons of **hand salves** out there – some marked directly towards climbers, some for cow udders. **Water-based salves** absorb quickly and **oil-based salves** leave your hands greasy but have a longer lasting effect. Apply the water based first, then the oil-based. Use hand salve after every day of climbing.



Constant bouldering, climbing on rough rock, and dry hands can split the tips or crack the hands. Wearing **belay gloves** when doing anything but climbing is great prevention. Calluses can catch and rupture

the skin, so keep them at bay with a **nail file**, **emory board**, or those **sandpaper sponges** used to refinish paint. Filing down your foot calluses with the above or a **pumice stone** can really help prevent blisters and hot spots.



Tincture of benzoin is sticky and stinky, and is sometimes used to get athletic tape to stick. It also toughens the skin. It's probably too messy for your hands, but it really helps to put on blisters and hot spots (coved in tape) to toughen them up.

I don't know who discovered **Antihydral**, but it has swept the bouldering community. Antihydral is a cream with the active ingredient Methenamine (13%). Right now you can only get it from Germany or a foosball Internet website (seriously!) in the states. It is sold to reduce hand and foot sweating, but it also hardens your skin by inhibiting growth of new cells causing callus buildup. Some top climbers call it their secret weapon. It will turn your hands yellow with too much use. Rub a dime-sized dap on your fingertips, middle of your finger, and/or your palms once or twice a day. Do not get it on your joints or they will crack and bleed. File down any excess calluses, and discontinue when your skin turns yellow, or gets to hard or glassy. You can definitely overdo it.

If you are allergic to formaldehyde you shouldn't use it according to the label. For-

maldehyde is a controlled substance due to its toxic and carcinogenic effects, so I don't know how you would know if you were allergic to it or not in advance. Methenamine's main prescriptive use is as an oral long-term antibiotic for urinary tract infections. The acidic urea reacts with methenamine and creates some formaldehyde that kills bacteria. Since sweat also contains urea, this must be where the warning comes from. A paper released in 2007 by the European Commission on Health and Consumer Protection by the Scientific Committee on Health and Human Risks entitled "Risk Assessment Report on Methenamine" states a few findings. The most important finding states that it can be detected in placental blood and in mother's milk...so don't use it if you are pregnant or breast-feeding. The paper states that although toxicity and carcinogenic effects were not shown in rats and cosmetic use likely has no toxic or carcinogenic concerns in humans, there still needs to be more research. So unless you are sensitive, pregnant, or allergic, you are probably in the clear.



Foot Problems

Athlete's foot and fungal nail infections can plague a climber's foot. Gross gym floors and showers, dirty climbing shoes, and wet unclean feet can all lead to both conditions. If your nail crumbles when you trim it, you've probably got an infection. The best treatments are **prescription fungicides** taken orally or mixed in with nail polish remover for chronic infections. **OTC fungicide cream** can work for acute or mild infections. Wash and dry your foot and apply it relig-

iously. **Foot powder** is absolute magic to help prevent athlete's foot and sooth nasty feet as long as you wash out your shoes before it turns to foot glue. **Lysol** has a good chance at killing the fungus or bacteria inside your climbing shoes, but do a thorough scrubbing of the inside lining first.

Ingrown nails in the toes can be more painful than a broken bone. You can try and take some pressure off by wedging something soft under the pressure point for a temporary fix, but some foot doctors warn against this as it can increase the chance of infection. You can use tape to wrap around the bottom and sides of your toe to try and spread the skin open next to the nail. This option works well when rock shoes compound the problem. After spreading the skin apart from the nail, wrap another strip of tape around the whole toe to keep things in place. You may need to wrap surrounding toes to prevent chafing from the adjacent tape. Otherwise wait for the nail to grow out enough that it's not pressing into your nail bed if possible, and then trim the nail so it can't happen again. Don't cut the nail too short or curved so it can dive down into the skin. If this doesn't work or isn't possible, you should get the toe numbed up and trimmed by a nurse, doctor, or a really good manicurist. Going one step further (I've done this) is to have a compound applied to the nail bed that permanently kills the cells so the nail won't regrown back, aka **chemical cauterization**.

Hangnails plague climbers, and as stupid of a problem as they sound, they hurt and can bleed like crazy. Wearing belay gloves constantly, trimming your nails and carrying **nail clippers** en route are the best ideas. Keeping your hands clean and hydrated with balms/lotions will reduce the likelihood of getting them.



This disgusting individual has a fungal infection from the looks of it. Taping an ingrown nail.

Blood under the nails (subungual hematoma) or nails that have become bruised so bad they're going to fall off also can be exceptionally painful. Next time, careful padding above the toe and meticulous nail trimming can prevent this. **Toecaps** may be necessary if even constant trimming doesn't help. To relieve pressure in the field of a subungual hematoma, you can heat up a thin sharp piece of metal to puncture the nail and relieve the blood. Be aware of infection that can occur from doing minor surgical procedures in the dirt. The sooner you drain the blood before it clots the better chance you have of keeping your toenail.

Eyes

It's easy to get something in your eye – on the trail from a branch, or on the climb from debris or lichen. If you have water that you can spare, irrigating the eye is a good start. A scratched cornea may feel like something is still there even when the particle is removed. Next pull back the eyelid and try and get it out lightly with a wet cloth or cotton swab. Blood in the eye can occur from excessive straining or coughing. Worry about it if it hurts, interferes with vision, or other symptoms occur. Otherwise it will go away. If your partner develops an eye infection, it can spread to you very easily. Be careful if any abscess occurs on or around

the eye, infection can spread to the brain and spinal cord.

Teeth

Thanks to the nerves inside each tooth, dental issues can be trip ending painful ordeals. **Cavit** can also be used to patch a tooth problem and cavity, and it along with **clove oil** can be used to help numb a cavity, lost filling, crown, or sore. You probably won't have either substance on you ever, but if guiding or on a long expedition, you might want to stock some. Ask your dentist for suggestions about other dental emergency suggestions.

ENVIRONMENTAL INJURIES

Altitude

If you're attempting a high altitude climb, don't rely on this book for complete information since it deserves an entire book, or at least a long chapter. These two books are the best: "[Altitude Illness: Prevention and Treatment](#)" by Stephen Bezruchka, and "[Going Higher: Medicine Man and Mountains](#)" by Charles Houston. A great field reference is "[Guidelines for Field Treatment of Altitude Illness \(AI\), AMS, HACE, HAPE](#)" by Alan Oram, D.O. Another excellent article can be found by searching online for, "[Wilderness Medical Society Consensus Guidelines for the Prevention and Treatment of Acute Altitude Illness](#)". Peter Hackett, MD at highaltitudemedicine.org is one of the foremost experts on this subject and has a library of info available. Contact him if in doubt. Please talk to a doctor with experience in dealing with high altitude. The supplements and medication listed are to help guide you. Talk to an expedition doctor before taking any. Many climbers consider using oxygen, diamox, and other drugs cheating. Relying on drugs and oxygen can create a false sense of security and wind up getting you into more trouble than they are intended to solve.

- **Baby Aspirin** helps improve circulation and is helpful for altitude and cold weather. 325 mg of aspirin administered at the onset of a heart attack can also limit the severity.
- **Ibuprofen** may help prevent altitude related acute mountain sickness (AMS), but due to its effects on your stomach with dehydration you need to be careful.
- **Diamox (Acetazolamide)** taken one day before an ascent and two days at altitude may help prevent and treat AMS, high altitude pulmonary edema (HAPE) and less so for high altitude cerebral edema (HACE). Diamox makes blood more acidic and increases respiration to help oxygenate blood. Diamox is a very strong diuretic. It improves blood oxygenation and can help with sleep and breathing problems while sleeping.
- **Viagra** and **Cialis** may improve performance at altitude by relaxing blood vessels in the lungs, and may help prevent or treat HAPE. No studies I know of have been done on their effects at increasing circulation to the hands and feet in cold weather.
- **Nifedipine** dilates blood vessels the lungs and can be used as a treatment for HAPE, but usually only for those who have had it before. Not for prophylactic use.
- **Dexamethasone** is a steroid that reduces brain swelling. It can be used as an emergency treatment for HAPE and HACE while descending. It can prevent AMS but should not be used for this.
- **Ginkgo Biloba** is a common herbal supplement shown to increase circulation to the extremities, which, like aspirin, is useful for cold and altitude. Some studies say it helps, some say it offers no help at all.
- **Garlic** is another common supplement for cold tolerance, but its efficacy is also up for debate as well.

- The company Mountain Might markets a supplement that supposedly improves blood oxygen saturation, oxygen delivery to tissues, and breathing performance that simulates the adaptation that occur from long term exposure to high altitude while remaining at sea level. Their theory is that the antioxidant **N-acetylcysteine (NAC)** will stimulate the production of red blood cells as well as strengthen lung ventilation and that supplementing with **sodium phosphate** will decrease oxygen's affinity to hemoglobin so it will improve oxygen delivery to tissues. They also suggest that supplementing with **iron** and large amounts of **B12** will aid in the utilization of these compounds. Anecdotal evidence suggests some positive results. One study showed that NAC supplementation reduced respiratory muscle fatigue, while another showed that NAC provided hematological adaptations. The amounts of NAC and sodium phosphate per dose were 1600 mg each respectively.

You urinate more at high altitude, and therefore during first few days' blood gets thicker via diuresis. However, it takes 1+ months for your blood to get thicker because you grew more red blood cells. Because of this blood clots can be a problem, so be sure to move around to avoid venous blood pooling. Baby aspirin could possibly help with this. The body deteriorates above about 16-17,000 feet – in other words you don't recover at this altitude, and your cells don't get enough oxygen. To acclimatize properly you should spend roughly one night per 1000 feet above 10,000 feet - perhaps more. Every three days return to the previous altitude to recover and adapt. Climb high, but return to a lower elevation to sleep. The longer you spend at altitude, the better your chances are. A **pulse oximeter** is a useful tool in monitoring your re-

sponse. There will be a pulse oximeter smartphone app in the near future.



Photo courtesy Brooks Range

AMS can occur at or above 8,000 feet, which is pretty low. Many climbers are caught off guard when they climb in these mid-elevation areas from 8,000-10,000 feet and climb poorly or feel sluggish. If you live at low elevation and plan on climbing a Cascade volcano, or a trip to the Rockies, and wind up bonking don't be surprised. If a climb is very important to you, then spend the time to acclimatize on a nearby non-technical peak. Even those with experience at altitude can have a totally different experience if they spent a lot of time at lower elevations.

More serious conditions like HAPE, or fluid in the lungs, and HACE, or fluid in the brain, generally don't occur below 14,000 feet. If you start developing symptoms (feeling like shit is a good sign), then descend 1-3,000 feet, noting where symptoms first started. If HAPE or HACE is suspected, minimize the victim's effort in descending, administer bottled oxygen, get in a **Gamow Bag**, and take drugs (including diuretics not mentioned in the nutrition chapter). FYI: sleeping pills make you breathe less and can kill you.



Photo courtesy Chinook Medical Gear

If you suffer from migraines, check to see if you have a patent foramen ovale (congenital hole in the heart that can cause migraines), because that could really complicate things at altitude. Get a complete check up by a medical doctor familiar with altitude if you plan on going above 14k because everything wrong with you will be amplified at altitude. You may have to travel to get your check-up from a good doctor. Do this even if you have previous altitude experience. You may vary in your response to altitude each time you travel. A recent cold can also increase your chances to getting mountain sickness, as will prolonged exertion. People who have had Lasik or RK (radial keratotomy) should be fine at altitude, but RK procedures to correct nearsightedness are at risk for blurred vision or a shift towards farsightedness. Talk to your optometrist.

Cold

Frostbite occurs when cells freeze and die. Killing off blood vessels and nerves makes it almost impossible for tissues to regenerate, kind of like getting severe burns. Once frostbitten your scarred tissue becomes much more susceptible to re-injury in the cold. . Frost-nipped (mild frostbite) fingers and toes should be rewarmed without rubbing the tissue or using scalding hot water. Descend before it's too late. Once fingers and toes start to hurt, you don't have much time. **Ibuprofen** is a good choice to treat the pain, and **hand and toewarmers** can stave off the cold for a while.. Frostbite from severe hypothermia should wait for rewarming when at hospital is nearby. Infection and off the scale pain can't be handled in the backcountry. If you can't keep an area rewarmed, do not rewarm it.

Hypothermia is really easy to get. Shivering means you have it. If you suspect it, treat it and descend immediately. You can get hypothermia on a warm day if it's windy or a mild 50-60° day if you aren't moving. Any

altered mental status is clear sign. If you can't get extra clothes on, eat sugar and get your metabolism to start warming you.

Besides dying, the worst part of hypothermia is you become stupid and make stupid mistakes. Having a lighter and compact fire starter is a lifesaver during unplanned bivies, as are emergency space blankets. It's a great idea on any climb that you could conceivably epic on to have a kit that only weighs a couple ounces containing **fire-making material and a lightweight space blanket**. Sharing body heat, or using your warm stomach or armpit to warm a miserable partner's foot is a great get to know you activity.

Trench foot is a miserable condition that occurs when your feet are wet and cold for an extended period of time. On long trips have at least on **extra pair of socks** buried in your sleeping bag, and maybe even a pair of camp shoes to change into or hike out in if your regular boots and socks get soaked beyond fixing. Heavy waterproof breathable boots sound like they would help prevent this, but in reality they usually get just as wet but take ten times as long to dry. Be vigilant about drying your socks out in your sleeping bag, and changing out of vapor barrier liner socks.

Heat

Most of the injuries that occur from heat are from the sun. Heat exhaustion is very common and can severely impact performance and judgment. The benefits from carrying **extra water** are huge compared to the weight drawbacks are huge on long hot climbs or approaches. Water helps your body thermoregulate, as well as the obvious reasons of water loss via sweating. If your partner is adamant about only carrying a quart on a long climb because "they'll be fine," then be a better climber and sneak an extra quart (or two) in their pack or yours because they will wind up asking to drink

your water. An isotonic or hypotonic (more diluted than blood concentrations) **drink mix with some sugar and electrolytes** helps you hydrate way better than normal water because of the osmolality (see the nutrition section).

Once you overheat into your brain, heat stroke develops. You're pretty screwed if this happens on a climb. The only treatment is rapid cooling. Wear **long sleeved clothes** that aren't tight so air can exchange, and a collar or bandana to protect your neck in hot areas. Cotton clothes can be nice as they cool as you sweat into them. If you start getting sick, tired, stupid, or nauseous on a climb because of heat and you find a shady or windy spot, hang out for a bit. Treat heat illnesses like hypothermia – if it's hot and you suspect it, you probably have it. Moving generates heat, so take a solid break. NSAIDs will not help, and they can do a lot of liver or kidney damage because you are obviously dehydrated too.

Sunburns are obviously avoided by proper clothing and re-applying **sunscreen**. On alpine starts, put the sunscreen on in the dark because you'll most likely forget or not want to break the momentum once on the climb. Always have sunscreen squirreled away somewhere on long climbs – in your pack, your pocket, or chalk bag. **NSAIDs** can help with painful sunburns as does ice, and cooling gels like **aloe**. NSAIDs can also be used prophylactically to reduce the severity of sunburns in fair skinned folks. **Spray on sunscreen** is nice to avoid getting your hands greasy, and to get the top of your scalp. Make sure the sunscreen is UVA and UVB rated, and don't bother with anything below SPF 30. Higher SPFs tend to stay on longer, although extra amount of protection offered is negligible above SPF 30.

Make sure to get your ears and back of your legs as those are areas skin cancer can attack. Getting the inside of your nose can

prevent inter-nasal burns from water and snow, or very reflective rock. **Lip balm** is a lifesaver in dry, sunny, or high altitude areas. Once your lips get burned or cracked, especially the side of your lips, you'll never forget the lip balm again. Unfortunately your need to re-apply sunscreen every 2-4 hours, something most alpinists never do and craggers rarely do. It is also suggested to use about 2 oz. of sunscreen per application, which borders on ludicrous when compared to what climbers normally apply. If you are a pale while red head then you may want to follow those precautions, otherwise save the slathering for your kids. Protect yourself from melanoma and looking like a leather handbag when you get older.

Protecting your skin during the first 18 years of your life reduces your risk later in life by 75%! Too late for you, but not your kids. There are some concerns about toxic ingredients in some sunscreens, although it would take daily application over decades to reproduce the toxicity on the rat subjects. If you are sensitive or have kids then it may be important. There are some ingredients to possibly avoid, like oxybenzone, an active ingredient, and vitamin A (also called retinyl palmitate), a preservative. It is unclear whether nano particle of zinc or titanium in sunscreen are harmful, but you can get sunscreen with "non-nano" ingredients. The risks of cancer outweighs any risks from sunscreen ingredients by a billion to one. **Zinc and titanium creams** do offer the best protection, as does **covering exposed skin with SPF rated clothing**. All clothing protects from solar radiation to some degree. However, those with very fair skin, high risk factors, or those out in the sun on a constant basis may want to invest in clothing that has a decent SPF rating. Even though you may not get sunburned through your clothing, solar radiation can still damage your skin without the evidence of a sunburn or tan.



Burns from fire or rope burns are extremely prone to infection in the backcountry since you just cooked a little meal for bacteria and killed all of your repair cells. Ice or dip the area in cold water (generally easy to find at camp) for longer than you think: five to twenty minutes. Treat for inflamma-

tion and infection immediately. Bandage the area and apply **antibiotic ointment**. Large second degree and any third degree burns require immediate evacuation due to the extremely high risk of infection and permanent loss of function if left untreated. **Second Skin** is a very helpful covering for burns as it cools and doesn't stick.

Your eyeballs can get burned from the sun on water or snow if you don't wear **sunglasses with UVA/UVB lenses**, or if light reflects back into your eye from improper sunglasses. Snow blindness usually doesn't show up until several hours after exposure. Treat the symptoms.

Who to See and How to Be Seen

NMS – I will use the abbreviation NMS for *neuromusculoskeletal injuries, which are the most common injuries sustained in climbing. These are injuries involving nerves, muscles, bones, and supporting connective tissues.*

SECOND OPINIONS

Get a second opinion from similar practitioners and from practitioners with a slightly different scope and specialization. Some specialists can be myopic and generalists not specialized enough. If a hammer is your only tool, everything starts looking like nails. Recommendations and treatments can vary wildly from practitioner to practitioner. Some are very conservative, will try one thing, wait, and then try another. This is fairly standard practice. However, if there are multiple things going on or unique circumstances then this approach can become slow and frustrating. On the flip side, a "shot-gun" or less conservative approach can become equally costly. Start with the least invasive therapy and most inexpensive options first unless things get worse. But again, I highly recommend getting at least two opinions and stand up for yourself if you think the practitioner is missing something important. Trust your gut. Write eve-

rything down you've been concerned about so you don't forget something during your history.

Before you see anyone, make sure they are licensed in your state. Don't go see that weird guy your friend knows at his or her house unless you enjoy wasting your time. No matter who you see, be it therapist, doctor, or surgeon, find someone that specialized in the condition or body part. It is very difficult to specialize in everything. It can be very useful to be co-treated by more than one therapist. Not only is it difficult to specialize in an area, it is also difficult to specialize in a type of treatment. Beware the doctor or therapist that has an answer to everything.

Also keep in mind that the same conditions can be viewed through different lenses or models. For instance, the human body can be viewed from the eyes of a mechanic – your body is made of parts and they all work together somehow, just like a car. Your body can be looked at as a complex system of chemical reactions. It can also be viewed like a computer programmed via DNA and executed via the nervous system.

It can be looked at in biological way, like a how biologist looks at how plants, animals, and cells react to their local and internal environment. You could look at the body through a physical sense, affected by external and internal forces. All of these filters could possibly explain the same condition and successfully treat it.

If you feel that your doctor either doesn't know what he or she is talking about, isn't offering you options, or is reluctant to pursue more conservative, aggressive, or experimental treatments then tell them how much time and money you have been spending on this issue, how extremely important climbing is to you, how this injury is affecting you personally, and to please refer you to someone that will get the job done.

MANUAL THERAPY PRACTITIONERS

Chiropractors

Doctors of Chiropractic (DC's) actually receive an education on par with medical doctors as far as the first four years of schooling go, but with a lot more emphasis on NMS conditions than they do in prescriptions and surgical procedures (although they do get some training in both). They are trained as primary care providers, but their scope limits them from prescribing prescription drugs and performing most surgeries. A good chiropractor should be able to diagnose other health problems besides NMS conditions so they can refer to appropriate specialists, or at least treat conservatively through nutritional and lifestyle education.

Unless you need prescription drugs or surgery, a good chiropractor could be a climber's best source of care. However, I want to rant just a bit to help you steer clear of a bad experience. There are many problems with a lot of chiropractors, and these are the ones that give the whole profession a bad name. Some see patients as cash flow and provide as little treatment as possible, but prescribe many many visits.

Some distrust any treatment or theory that isn't "mainstream medical" for whatever grudge they hold against the medical establishment. Some ignore current medical knowledge and hang onto an over one hundred year old monocausal theory of disease (bone out of place causes all disease by interfering with the nervous system) with religious fanaticism. Some see all these as a niche to make money by brainwashing and playing to patients' fear to make a lot of money.

Adjusting the skeleton, aka joint manipulation, is only one tool among thousands of manual and physical therapies a chiropractor can do. If all you need is a quick adjustment, then adjusting skill is better than the doctor's intelligence or ethics – that type of chiropractor is more like a Jiffy-Lube when you need an oil change vs. a good mechanic when something is really wrong. Most of the time it's not a one-time fix, but beware of anyone selling you package deals or pre-paid treatments over 6-12 per year. Google any specialized treatments that sound strange. Almost all therapies have a valid theory behind them, but few technique systems have real research behind them (but a lot of marketing to both the doctor and the patient).

Because of the bad chiropractors, the many good ones get a bum rap too. It can be very tempting to go into the practice of high-volume clinics, especially when reimbursement is so difficult. A good chiropractor should be on top of your health concerns, offering solid advice and conservative treatments, while applying the exact same manual therapies as a physical therapist and most likely specializing in joint manipulation therapy. PT's also love joint manipulation, so any discrepancies between the two are the fault of the practitioner, not the profession.

Joint dysfunction is synonymous with “subluxation,” but subluxation carries with it the unscientific belief that a misaligned vertebra can cause other health problems and are the root cause of disease. Run, don’t walk out of those clinics. However, some good practitioners may present it this way to “dumb it down” for the patient, which can be more than understandable. It’s also not a bad idea to get an X-ray of the problem area – all other practitioners do it. But beware the D.C. that uses X-ray as a scare tactic to show how screwed-up you are. See a DC for anything you’d see a PT for, especially for joint manipulation and posture. A referral is not needed. Some states allow DC’s, especially those in rural areas, to do blood work, lab tests, minor surgery, prostate and gyno exams, and deliver babies.

Physical Therapists

Most PT’s graduating are now DPT’s, Doctors of Physical Therapy (PhD-type doctor). They are trained to rehabilitate patients using manual therapy. Many states no longer require a referral to DPT’s. PT’s do not diagnose in the legal sense of the term (although they can be excellent at it). Look for sports PT’s or PT’s who work with orthopedic doctors or clinics. Just like chiropractors, some PT’s are amazing while others just offer the same routine treatments to everyone. Avoid high volume, franchise-style PT clinics.

Massage Therapists

Massage therapists, or LMT’s (licensed massage therapists) use their hands or certain instruments to relax muscles, connective tissue, drain edema, and release fascia among other things. They can be generalists, or perform specialized techniques. Beware of any technique that sounds new age or has a little trademark symbol next to it! Roling is a type of deep tissue massage that focuses on muscle fascia. Even though massage therapy requires less education than DC’s or PT’s, some massage therapists pro-

vide more intelligent treatments and are gifted in their technique. Not to be bigoted (your LMT could be a genius – Einstein was a patent clerk after all), but take any diagnostic or home care advice with a grain of salt. I’ve heard some pretty ridiculous advice and diagnosis. Also, tight muscles and sore spots (trigger points) aren’t always a bad thing. Don’t let your LMT make you feel bad about your tight “whatever”, or make you think you’re more screwed up than you actually are.

Athletic Trainers, Coaches, and Personal Trainers

Athletic trainers (ATC), personal trainers, and coaches should all have some certification from a governing agency to be considered. Athletic trainers have a degree, while coaches and personal trainers have certificates from national agencies. You may find one without any certification, but there are too many out there to pick without one if you don’t know a good one. Sometimes it takes a fresh set of eyes to help you with technique, training, and weakness. A good one should prove invaluable, but it may be difficult to find one that specializes in climbing. The trainer that comes free with a new gym membership may be excellent and struggling to find work, or just worth the free consultation to humor the gym. Athletic trainers should have at least a bachelor’s degree and be certified by NATABOC, personal trainers should be certified by NASM, ACSM, ACE, and NSCA (best), but there are many others. Being certified by a type of exercise (yoga, Pilates, CrossFit, etc.) is great if you’re taking a class, but not so great for knowing anything but that type of exercise and no national certification or regulation (especially when it comes to evaluating your health and safety).

Other Manual Therapists

Occupational therapists (OT’s) are kind of like physical therapists, but their goal is to get you back to work or to performing ac-

tivities of daily living. They also deal with non-physical conditions that require rehabilitation. Hand therapists may be of special interest to climbers. Both PT's and occupational therapists perform specialized hand therapy (although any practitioner with a basic scope could be an excellent non-certified hand therapist).

There are a lot of other practitioners that perform manual therapy, but I'd avoid the mystical ones that deal with reflexology and energy (unless you're into that sort of thing).

NON-MANUAL THERAPY PRACTITIONERS

Allopathic Doctors

Medical and Osteopathic Doctors (M.D.'s and D.O.'s) have pretty much unlimited scope and specialization. Their primary tool is prescribing medication, or performing surgical intervention. Osteopathic doctors are almost identical to MD's, however very few also practice joint manipulation (they were basically chiropractors in the early days). Family doctors (general practitioners) are great for routine physicals, minor medical conditions requiring a prescription or minor surgery, and routine laboratory diagnosis. If you have a complex medical problem, see a specialist in that area. If you have a life-threatening injury – go to the ER! Climbers will most likely visit orthopedic or neurological specialists, the dermatologist for all that sun exposure, or a podiatrist for foot problems. I urge climbers to get a consult from both a manual therapist and an orthopedic/neurological specialist for NMS conditions. However, that can get expensive. If you're not suffering from a serious loss of function, see a manual therapy practitioner first unless you are convinced drugs or surgery is the solution. Don't let the MD or DO boss you around or treat you like an inferior. Big egos are not hard to find in the orthopedic wing at the hospital. If you are debating between an orthopedist vs. a neurologist, see the neurologist. Even if you

don't get surgery or a prescription, prepare to spend big bucks on X-rays, MRIs, and office visits for a bottle of ibuprofen you could have picked up at the gas station in a lot of cases.

Nurses and Physician Assistants

Nurses run the gamut from basic bedside caregivers (CNA's), general examination and therapy givers (RN's) to stand-alone primary caregivers (N.P.'s). Along with Physician Assistants (PA's), they are quickly becoming the main caregiver in hospital and private practice setting so more patients have access to care. The big difference between NP's/PA's, and MD's/DO's is the lack of a residency and fellowship (clinical rotations are not the same thing). This goes for DPT's, ND's and DC's as well.

Naturopathic Doctors

Naturopathic Doctors or N.D.'s are trained for primary care, but differ from the allopathic, or the traditional Western medicinal approach. Like chiropractors, you have the vitalists who believe in some sort of innate intelligence, and you have the physicians that combine the science of Western medicine with the use of more natural treatments and prescriptions. If there is a condition you want to try treating without the standard medical regiment, give an ND a try. To call yourself an ND, you must attend an accredited 4-year doctorate college just like MDs, DOs, and DCs. They have excellent educations. There are a few out there without that degree, are not N.D.'s, but have a similar sounding title: run away from those. ND's often use homeopathic solutions to treat their patients. The mechanism of a homeopathic treatment is similar to that of traditional acupuncture, that is, it does not follow a Western-based scientific model. I am very skeptical of homeopathic treatments based on the proposed mechanism at work (sorry).

Acupuncturists

Traditional acupuncture (L.Ac) is an Eastern medicine, and does not follow a Western medical science paradigm. Although I find their theories a bit mystical (but what do I know about our reality), they have been shown to offer relief for pain, and other conditions. Perhaps the needles help short circuit pain pathways gone haywire, help reduce muscle inhibition, and help restore neural pathways. If nothing seems to be working or you're feeling adventurous – give acupuncture a try. The use of needling combined with electrical current is not acupuncture (different principles and described later), and not all use of acupuncture needles is acupuncture (usually trigger point therapy). Make sure your acupuncturist is licensed by ACAOM or NCCAOM. Some practitioners have a degree in another field but are certified to practice acupuncture. Check with your state boards lest you waste your money or walk out with a staph infection or worse.

WHEN TO GO TO THE DOCTOR OR HOSPITAL

When to go to the ER should be painfully obvious. But if you hate hospitals and doctors, or can't afford them here are some not-so-obvious reasons to go. Sometimes really painful or scary symptoms like abdominal pain, blood where it shouldn't be, numbness/tingling, dizziness, fatigue, earaches, chest pain have really benign explanations. It never hurts to get checked out (except your wallet) and better safe than sorry. If a symptom doesn't resolve or get worse, then you should be fairly motivated to get checked out. For those of you with no insurance or high deductibles, nothing is worse than wasting your money for no reason. It isn't out of the question to talk to an expert over the phone or via live chat to see if you really need to be seen.

Reasons to Go

- Moderate to severe ankle sprain: you may have a fracture. Follow up with a 2nd X-ray in two weeks to be sure the first X-ray was accurate. Make an appointment unless it is too painful to deal.
- Deep cuts and punctures, even if you've controlled the bleeding: The risk of infection is high. Go to the ER.
- Trauma to your head, neck, or spine.
- An injury that is not improving or getting worse: you've sucked it up long enough, make an appointment.
- Any chronic symptom, especially unexplained ones: we all feel exhausted, get headaches, and get weird things going on in our bodies: stress is generally the culprit. But we either adapt, the source of stress goes away, and things get better in benign conditions: make an appointment or try and get free advice over the phone.
- An acute symptom that has no explanation: try calling first for some free advice.
- Abdominal pain lasting more than 6 hours: try calling first for some free advice.
- Any illness you are pretty sure needs antibiotics ASAP: try calling first for some free advice.
- Dangerous looking moles and skin lesions: make an appointment or see if you can email a photo.

HISTORY, PHYSICAL, TESTING, DIAGNOSIS, AND TREATMENT

Unless a treatment randomly cures you out of sheer luck or placebo effect, you need an accurate diagnosis to find out what is actually wrong with you. Any good practitioner follows these steps. First a chief complaint history is taken. This should include: location, onset, chronology/timing, severity, modifying factors, associated symptoms, and previous treatments. The great history takers know what specific questions to ask

inside those basic questions. You may have pain, but is it only at night? Does it only hurt in certain positions? They use these questions to rule conditions in and out. By the end of the history, they should have a differential list of diagnosis (DDx). There are other important history questions that sometimes need to be asked besides the basic list. Family history of disease and mortality is very important for ruling out genetic conditions. A detailed past health history is extremely useful for relating your current symptoms to past conditions. Everything can be a clue. Finally, a personal history should be taken to rule out environmental and emotional factors. This can include questions about your diet, living conditions, social and love life, mental status, drug intake, activity level, work, life, school, and stresses.

Your ego may get in the way of an accurate diagnosis here. Sometimes we would rather have bad news about something we have no control over than admit the problem lies within. A lot of the non-chief complaint questions are usually check boxes or fill-in-the-blank questionnaires during intake. A good practitioner will actually look at these and ask follow-up questions (and not always believe all of your answers).

After a differential list of diagnosis is created, the practitioner needs to test their hypothesis. This is first done by a physical examination. Usually vitals and basic information are taken such as height, weight, pulse, blood pressure, etc. Next a physical is performed. Depending on your differential, it could be whole body, or it could be regional. Sometimes you'll be asked to fill out a questionnaire that has been developed to help pin down the severity or specifics of certain conditions. There are millions of physical tests that can be done. The practitioner should choose a few that have either a high positive predictive value or negative predictive value (tests that have a mathe-

matically high chance of ruling in or out a condition). Lower predictive value tests are generally done to narrow down towards more specific tests.

For an NMS injury the basic order of testing is: observation (looking at the exposed area), palpation (touching it), a vascular and neurological exam, strength testing, active and passive range of motion (AROM and PROM), orthopedic tests (tests to rule in or out specific conditions), and functional tests (gait, specific movements, etc.). Your practitioner gets bonus points if he or she takes measurements (specific degrees of motion, size of the area, etc.) mainly to use for follow-ups to note improvement. The practitioner should also look at other related body areas to see if they are affected, or contributing to the problem (major bonus points). The more the practitioner tells you what they are doing and why, the better.

One of the most difficult problems in orthopedic medicine and manual therapy and the greatest asset to achieving the most effective treatment is to pinpoint exactly where the pain is coming from. This is much harder than it sounds and imaging won't always help. Some physical therapists and technique instructors love to ham up their report of findings to their patients by stating overly detailed or esoteric descriptions of the injury location when in reality they are just following routine treatment protocols on a general body area.

At this point, if not by the end of the initial history, your diagnosis (Dx) should be in the bag. However, laboratory testing or imaging as a follow-up can really nail the diagnosis. Sometimes these are the only tests required, and sometimes they are useless. Lab tests rule in or out genetic, systemic, or infectious causes – or can provide extra clues. They can also screen for other conditions that may be caused by your initial condition. Imaging (X-ray, MRI, ultrasound,

etc.) done by a skilled practitioner can provide instant diagnosis by basically just showing you on film or monitor what's going on inside of you. Imaging can also rule out certain diseases that present with some of your symptoms.

X-rays are the goto choice because they are cheap and visualize bone and hard tissues very well. They do not show soft tissues well. MRI machines visualize an area in thin slices, and are excellent at showing soft tissues. They are very expensive. Imaging is also especially helpful in difficult to diagnose injuries, or chronic complaints. MRI's don't catch everything and a negative MRI should not be the end game of a diagnosis. MRI technology is advancing with different forms like qualitative MRI, 3-D MRI, multi-center MRI, and functional or weight bearing MRI tests.

CT's or CAT scans are also fairly useful. They take many X-ray images to create a 3-D image of an area, and can show a bit more soft tissue than a standard X-ray. Bone scans measure uptake of an injected radioactive substance and can show hard to detect fractures, cancers, and areas of inflammation. Ultrasound can be used as a cheap MRI substitute, but negative tests should follow up with an MRI. There are also many other complex tests that fall between imaging and lab testing. These include muscle EMG and NCV tests that measure nerve propagation in a muscle or nerve, among many other tests. Finally a surgeon could just take a look for him/herself via a scope. Sometimes this is the best way to see what is really going on with the added benefit of surgery on the spot.

Getting an X-ray is kind of a no-brainer (unless you may be or are pregnant). But getting an MRI is a bit tricky – the main reason being the cost of the MRI vs. the treatment options. In other words, if the treatment for the differential list of diagnoses is going to

be the same regardless of what an MRI will reveal, then why get one? Good reasons would be to rule surgery in or out, a chronic condition that is not getting better or continuously reoccurring, or to rule out a suspected serious condition. But, if you just have to know and the cost isn't prohibitive, getting an MRI can sometimes give you peace of mind, or cut down on wasted time and treatments.

A great practitioner will tell you that some tests are optional and expensive. Nothing is worse than getting a bill for a test you didn't need, or had recently by another practitioner. There are diminishing returns to too much testing: they may not change the treatment or find false positives or statistical outliers that cloud diagnosis. A course of treatments on an unproven diagnosis may be cheaper with a high probability of success. History should provide a short differential list, an exam should clinch it, and lab tests or imaging should confirm it. Occasionally exploratory surgery is the only way to actually see what's really happening inside you.

After all the history, physical, and testing is complete your practitioner should have pared down their differential list by removing some, and by ordering the list from most likely (which takes the statistical prevalence of your condition into account) to least likely. Now treatment can begin. You should also get some sort of prognosis to give you an idea on the severity, duration, and consequences of your condition. Sometimes a good prognosis cannot be given until some treatment has begun.

Figuring out what treatment to use can be tricky, especially if a diagnosis is not 100% certain. The problem with treating everything with every possible treatment at once is if something makes you better or worse, you won't know what did it. Treatment usually begins with the most cost-effective

and most conservative treatment options before progressing to more expensive and dangerous treatments (surgery). However, it is up to you to tell your practitioner what you want. Maybe you're totally sick of rehab not working and you want to take the risks of other treatments like surgery or drugs with side effects. It's also up to you to go back to the practitioner and tell them things are or are not working. Nothing is more frustrating when a patient you saw over a year ago comes back and complains they aren't better from your first and only treatment. Get second opinions, but go back as well. The practitioner may have had a game plan that you weren't aware of. At least call. Doctors have the ability to speak on the phone.

The best treatment should cure what is causing your symptoms, but unfortunately many treatments just help dim down the symptoms. Curing symptoms does not always cure the underlying condition. If an underlying condition is essentially untreatable, the next best treatment should address getting you back to a level of desired function, regardless of the symptoms. It depends on what you desire more. In other words, what's better, lying in bed pain free, or returning to your activity with continued pain? Finally, in regards to treatment options: a great practitioner will tell you of all alternative treatments, risks, and costs. If a practitioner doesn't know what you want out of your visit and treatment, they won't be able to help very much.

Finally, here are some suspect exams I've come across in various chiropractic, massage, and physical therapy offices:

- **Posture stations:** You stand in front of a grid, and the practitioner maps your posture. This can be a very effective general screening tool or a marketing campaign.
- **Muscle or Spinal EMG:** The level of muscle activity is measured by touching electrodes to your skin or down your spine. This test is way too sensitive and unreliable. It can either be done poorly, or be done by someone who wants your money and can easily make the results to make you look like a hypertonic mess of overactive muscles.
- **Applied Kinesiology:** The practitioner uses muscle testing not to test for grades of weakness as done in standard muscles testing, but for highly subjective nuances in the feel of the muscle test usually relating the response to ailments in the spinal column. Some even pair the testing with smelling or tasting substances for nutritional or allergy diagnosis. Rubbish.
- **Postural X-ray:** X-rays are taken to show minute postural problems, often paired with lines and measurement written all over the film. Some are very complicated looking X-ray setups or interpretations, especially on the upper cervical spine. While being able to visual how postural problems affect the spine, or visa-versa isn't a bad thing, but most practitioners use this as a marketing tool or are misinformed about the validity of this type of exam. Hopefully you'll get the marketing vibe. Gross structural problems can be shown on film, but minute rotations or minor incorrect orientations of individual bones or joints are bogus. There are a lot of small genetic variations in the shape of our bones that can be mistaken (or deceived) as a structural problem. Ask for a copy of your films and take them in for a second opinion.
- **Pushing hard on a trigger point** that everyone has or blaming everything on tight muscles.
- **Lab tests** for things you can't test for, don't need to test for, or sent to labs with questionable results. You'll have to research this on your own – ask the name of the lab and test to aid in your research.
- **Anything that shouts B.S.!** Measuring your cranium, looking at your pee, dangling crystals, anything to do with energy, using a device meant for one thing to diagnose another, etc.

NMS BASICS

In these following few sections I will try and explain many common injuries that ail climbers and their corresponding treatments. However, many treatments and causes overlap which is why I already presented much of the information in this chapter, and throughout the entire book, including the nutrition section and exercise sections. Rehashing this information for every condition would take hundreds of pages, and I hope that by having explained much and presented the basics of injury and many of the treatments, you can piece together a plan of action. Many conditions can be self-treated in this way. You can also arm yourself with knowledge by being proactive for conditions that require a doctor or therapist. After reading about the type of injury or specific injury, go through the treatment options already listed as most of them can be applied to any body area.

Revisit this chapter, the nutrition chapter, and the exercise chapter (especially the warm-up, antagonist, and stretching sections) to get ideas on how to rehabilitate a particular body area. Besides some new exercises I will present in this chapter, most rehab exercises have already been shown with enough information provided for you to design your own rehab regimen. There are no perfect exercises (or treatments) to rehab an area. The universe did not create specific exercises solely designed to correct or fix an area, so don't get too hung up on finding exact exercises. The point of rehab exercises (and treatments) is to help restore function to a damaged area, and the best (sometimes end stage) exercise is just like the theory behind any exercise for any reason – to mimic the natural function and movement a specific area. As with all the information in this book, I hope you take it upon yourself to use the info I've presented as a guide or stepping stone to do your own independent research. Even the best therapists and doctors in the world will offer dif-

ferent exercises and treatments for the exact same condition with the same results.

REASONS FOR INJURY

To figure out how to fix an injury or to prevent one, it's important to know some basic and common reasons why you get injured. Figuring out the reasons for pain or dysfunction is more complicated than brain surgery for a few reasons. First is that there may be one or more underlying issues, many of which are not directly related to the site of pain or dysfunction. Next is that pain is a multifaceted and poorly understood phenomenon. Finally, we just don't have the technology to pinpoint the anatomic or functional problems occurring. Instead we must rely on very astute observation and there is much subjective and objective variability. The reliability of the patient's response to pain, testing, or history is also severely compromised. In other words: it's a complicated mess.

The most obvious reasons don't need much explanation: direct trauma, disease, genetic conditions, stress, and not taking care of yourself via stress, sleep, and nutrition. Age also plays a part – the older you get the less pliable your tissues are, the more little things add up, and the slower you recover and repair. But figuring out why you got injured when these factors weren't a major player, or if they were, then how to lessen their effects takes a bit of detective work. The three major players are poor technique, genetics, overtraining, and biomechanical imbalances.

Repetitive microtrauma (or stress/overuse) gets blamed a lot for being the cause of many injuries, but it doesn't really explain why one person would get an injury doing the same repetitive task someone else can do forever without complaint. Repetitive stress explains the mechanism of injury, but not the cause. Some common non-climbing

repetitive strain producers are looking down at screens and books all day, note taking, sitting for hours, driving, keyboards, mice, texting, large vibrations (like driving machinery or construction), standing on a hard surface for hours, heavy lifting, lifting and twisting, and lifting overhead. Climbing may have tweaked something that you've been damaging through school or work for years.

Technique

Good technique puts your body in a position that creates efficient movement to minimize stress, and act as a buffer to minimize impact just enough to avoid injury. Running is such a good example that even though it's not climbing related, it's worth using for clarification. Running used to be thought of as bad for your knees until fairly recently. The repetitive shock just couldn't be good. But studies have shown that people who run have healthier knee joints on average than those who don't. However, running can injure your knees if you use crappy shoes, don't pay attention to the trail, and have poor technique. It wasn't the running, but how you ran. Same with climbing.

Genes

Sometimes technique isn't an adequate enough buffer to prevent you from getting an injury. The easiest culprit to blame is how your genes developed your structure. I'm not going to discuss extremely rare or bizarre genetic abnormalities – those causing injuries should be pretty obvious. But we all have different ratios of arm, leg, and torso length, body mass and strength in one area compared to another, and the shape and length each of our bones can vary from side to side.

Doing day-to-day activities or low stress physical exertion usually doesn't rock the boat, but doing high stress motions can. It usually takes an injury to even notice a

structural variance or anomaly. It doesn't even have to be an anomaly, anything that doesn't fit into the "perfect mold" for climbing, even a specific style of climbing can create a weak link in the chain. There are an infinite number of genetic differences that could create or prevent injury in climbing. In some of the specific injury descriptions, I will try and highlight some very common genetic anomalies than are a main culprit for injury of that area. On the flip side, some genetic conditions like some forms of scoliosis look like they would wreak havoc on your body when they wind up only being cosmetic. We are very good at compensating. Long standing genetic conditions and variations in our bodies generally won't create new injuries unless something drastically changes elsewhere in your body, your activity level, or age (usually after 30 years old).

Nutritional and other Chemical Reasons for Injury

Tissues can become damaged by improper nutrition. If you are dehydrated your tissues become less pliable and have a greater chance for injury. Low blood sugar can lead to mistakes in technique that cause injury, or can lead to centralized fatigue. Fatigue can create chemical imbalances that lead to a depressed central nervous system, which creates a downward spiral in health and performance. Overtraining, stress, and fatigue as well as sleep issues can mess up your body's internal repair processes and also increase tissue breakdown from catabolic hormones like cortisol. Stress and overtraining also depress your immune system leading to sickness. Improper nutrition and stress increase generalized inflammation and lead to poor repair and increased injuries. Not eating enough protein will increase the chances of injury and tissue breakdown. Very low body fat decreases natural padding in your joints, decreases key hormone production, and suppresses your nervous system. As we age our bodies

slow down and don't produce the hormones and chemicals that kept us resilient as we once were.

This list could go on and on, but the key points are that chemical changes in your body from poor nutrition, lifestyle, and stress both physical and mental can lead to injury and poor health just as easily as physical forces can. So if you keep getting injured, an injury never heals, or you are always feeling in poor health, take a look at your lifestyle and make some changes. Your body can heal itself better than any treatment or therapy if given the right conditions (to a point obviously).

Biomechanical Imbalances via Movement

Even if you have a perfectly genetically engineered body for climbing, you can still screw it up. These are considered functional versus anatomical since there's nothing structurally wrong, but there is something biomechanically wrong (the parts aren't working together well). I've discussed open and closed chain exercises earlier, and they concept comes into play here as well. Your body at motion is considered a kinetic chain. A motion at one joint effects joints up and down the chain either by moving them or using them for energy absorption.

If an area moves too much or with too much force, something down the line is going to have to absorb that extra energy or move more than it's used to. Likewise if an area isn't moving enough or strong enough, it may cause other areas up and down the chain to compensate more than they were designed to. The weak link in the chain can be where the pain developed but the area that caused the problem, or visa vera.

Distal (farther away) areas usually affect proximal (closer) areas on the same limb, or up the spine from where they attach during closed chain activities. The farther away, the more energy is dispersed and less likely to injure unless the more remote areas also

have problems too. In other words foot problems from running (a closed chain activity) should affect your feet, then your knees, then your hips, then your low back, then your neck. But your low back may hurt before your knees if you also have back problems. Areas that have less shock absorption are also more prone to get injured first (so your feet would be less likely to be injured than less forgiving ankles or knees).

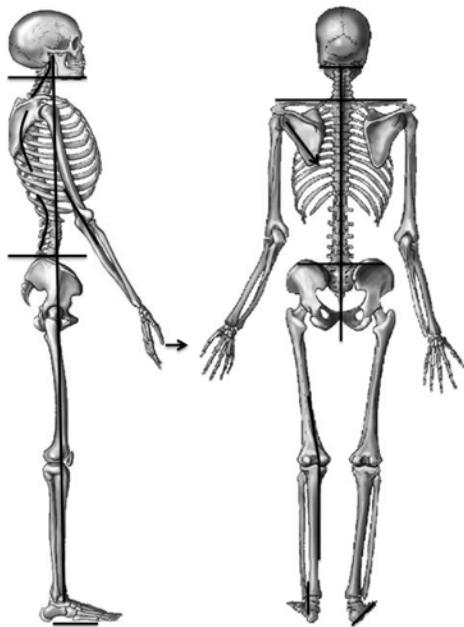
Open chain activities are much more likely to injure the area or joint that is performing the main action of movement and spare the other joints and areas of that limb, but can manifest in other areas (especially the spine) if posture and technique is poor in that area. So if you're doing bicep curls – expect to hurt your biceps and maybe even your neck if you are compensating. Compensating for an injury or imbalance can also affect the opposite side. Problems with the spine usually manifest in proximal joints and areas, but weak links far away can be affected. Nerves only affect downstream from the neck, although there are rare cases that nerve pain is felt upstream.

Biomechanical Imbalances via Posture

Posture plays an extremely important role in injury development. I think everyone reading this book can easily grasp the concept that if a body part (especially your spine and lower limbs) is out of whack, then other areas up or down the chain will have to compensate and can become injured themselves. There's more to it than that, however. Your frame is held together by connective tissues and muscles in a way that is designed to reduce stress on your muscles, joints, and connective tissue no thanks to gravity.

It's not just when you're sitting or standing either. Posture is a dynamic shift in the position each of your joints to provide maximum stress reduction during activity. Screw up that posture and joints and areas get

stressed more than designed due to compensation. Your joints, bones, and connective tissue have viscoelastic properties. That means they are hard when stressed quickly, and soft when stressed slowly. Glaciers are viscoelastic: they flow smoothly like rivers slowly over time, but when stressed they crack and break. Injuries that push your tissues past their ability to maintain structure should make sense (like breaking a bone). However, you can injure yourself by the slow stress of poor posture over time – known as creep. For example, sitting slouched all day slowly changes your anatomical structure.



Posture analysis lines

Left photo: head tilted up or down, C-curve in cervical-thoracic-lumbar spine (S-shaped overall), pelvis not tipped, straight line from arm-forearm, palms forward, feet not over pronated/supinated/flat, scapula not winged out. Center line: head not forward, passes through shoulder joint, hip joint, knee joint, ankle.

Right Photo: Head not tilted left or right, shoulders and hips even, normal Q-angle at knee, knee not bowed or squinting, ankle not bowed in or out, feet slightly everted, spine straight, torso not rotated. Check leg length when laying down as well.



A reversed cervical curve post car accident



SI issues on left cause the left leg to be higher (see by height of trochanter, ischium, and slight lumbar scoliosis)



Sacrum is rotated quite a bit forward putting more force on L5/S1 disc and nerve roots.

Biomechanical Imbalances via Shortening and Stretching

Whatever the posture, one side gets stretched out more. When this happens with muscles or the surrounding joints, the muscles become de-activated via sensors in the muscles and joints. The muscles don't always get weaker when used on their own, but when performing with other muscles in a firing pattern (order of muscle activation). They may not fire properly and other nearby muscles must exert more force that shouldn't, and those are the muscles that get injured. Joints and connective tissues that get over-stretched out become weaker, unstable, and more prone to become injured. Hypermobility of a muscle or joint is almost always the pain generator in chronic or overuse injuries. Correcting hypermobility will naturally fix tight or weakened muscles. Tissues become hypermobile from poor posture or technique and fixing this can only really occur by correcting posture or technique over time.

On the flip side, tissues can shorten and become tight due to creep, overuse (hypertonic or over-activated), injury (scar tissue and splinting), or overcompensation. See the section on stretching for more info. This limits range of motion and can cause injury if overstretched during a motion that would normally be safe. Paradoxically, the muscles that cover the joints that get stretched out instinctively protect and splint that joint by becoming tighter. It takes an astute clinician to determine if a tight muscle is protecting a weak area, is tight from already being constantly stretched, or if the tight muscle is from shortening.

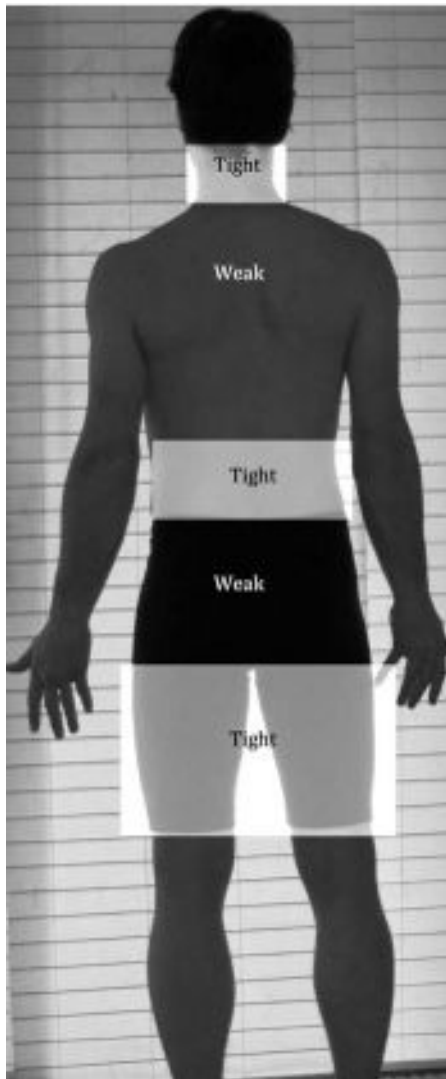
Not all tight muscles are pathologic – some people are just tight. Lower cross and upper cross syndrome as well as layered syndrome are terms coined for patterns of tightness and weakness due to poor posture in the upper and lower body. I will talk about specific injuries caused by poor posture later

on. Shortened or over-stretched muscles and joints can create postural problems by making another area overcompensate, causing other areas to become overly tight or loose, postural problems, limit range of motion, or exceed normal range of motion. Your body will either adapt or something will give.



Upper Cross Syndrome: weak anterior cervicals and posterior rhomboids and lower traps. Tight pectorals and upper traps/suboccipitals. **Lower Cross Syndrome:** weak abdominals and glut max. Tight hip flexors and back extensors.

Chronic positions from sitting, sleeping, and standing in one place are major culprits. However, sitting is hands down the worst. Sitting for too long not only leads to a whole host of musculoskeletal problems, it will also kill you. That's right, sitting for prolonged periods shortens your life expectancy. Find a way not to sit or take very frequent breaks. Climbing activities, both active and passive, not only put you in sustained postures that shorten or overstretch tissues, but also over engage certain postural muscles which is why it is vitally important to exercise and train antagonist groups and not over train overdeveloped or shortened muscles.



Layered Syndrome: weak and tight layers. The anterior view is opposite: weak neck, abs, quads; tight chest, hip flexors

Biomechanical Imbalances via Muscles

Muscle imbalances can create injuries from seemingly out of nowhere. The first type of muscle imbalance is when the same muscle on one side is stronger or weaker than the other side in the limbs. This generally isn't much of an issue, especially the more distal the imbalance becomes, except that the overdeveloped side has a higher probability of getting injured. Unless a task is totally one side dominant (usually due to handedness), the strength difference is usually small. The second type of muscle imbalance is when core and spinal musculature have

strength differences from side to side, and the culprit is usually shortening and deactivation due to postural problems. This type of imbalance can create injuries locally or down the line.

The third type of muscle imbalance is when one muscle is much stronger or weaker than the other muscles it works with. If a muscle is much stronger than its antagonist or stabilizer, the antagonist or stabilizer can get injured. If a muscle, especially one of the major large muscles of the body (a prime mover) is overdeveloped from an activity (like climbing), the stabilizer muscles are too weak and can get torn.

For example let's say your lats, delts, and pecs are huge, but your rotator cuff muscles are puny in comparison. Your rotator cuff muscles help with small, fine movements in positioning your arm just where you want it. Your rotator cuff is now like a child trying to take a rabid elephant for a walk. There needs to be a ratio of strength gains between your prime movers, stabilizers, and antagonists or something will be pushed beyond its tensile strength. There is no specific strength ratio for exactly how much stronger a prime mover should be compared to smaller stabilizers. However there are generic ratios for gross movements of the limbs.

The ratio between internal rotation and external rotation should be close to 3:2, extension to flexion should be around 5:4, and adduction to abduction is around 2:1.
Orthop Clin North Am. 2000 Apr;31(2):159-76

Overtraining

You can also injure an area by simply applying more force than it can structurally hold. If the muscle is the weak link, it will tear. If a tendon, ligament, or bony attachment is the weak link, it will tear. The quicker the force is applied, the more likely less pliable structures will get torn or broken first (bone,

ligament, tendon, then muscle), and likewise the slower the force is applied the more likely more pliable structures will get injured (muscle first). Overtraining (or overdoing it while climbing) pushes your muscles, joints, tendons, and ligaments past the point of what they can withstand.

Muscles adapt much more quickly than your connective tissues, and injuries usually occur at the tendinous attachments of muscle to bone, ligaments, and joint structures from overtraining. Constant inflammation further weakens these tissues and also limits range of motion (which increases the likelihood of injury). It can take months to recover from overtraining. Intense training has a negative effect on your immune system and athletes can be more susceptible

to getting colds as the white blood cell count drops post-exercise. Eating well, sleeping well, and wearing warm clothes post-exercise can help.

Besides not trying hard enough, the biggest limiting factor for improvement is not resting adequately. Make your training days count and make your rest days count. You could invest in a **heart rate monitor** to chart your resting heart rate in the am, heart rate variability, orthostatic heart rate (change in heart rate from laying to standing), and time it takes to lower heart rate after exertion to see if you have exceeded your training limit. Check out Polar, Suunto, and Garmin for heart rate monitors that have programs for this - Polar being the current best.

Common Inhibited or Weak Muscles

- Deep Neck Flexors (Longus Coli and Rectus Capitus)
- Supraspinatus, and External Rotators (Infraspinatus and Teres Minor)
- Serratus Anterior
- Lower and Middle Traps
- Back Extensors
- Gluts
- Transverse Abs
- Pelvic Floor Muscles
- Vastus Medialis Oblique (VMO) of the Quads
- Intrinsic Foot muscles
- Upper Extremity Extensors (Triceps, Wrist Extensors, Posterior Deltoids)
- Forearm Supinators

Common Overpowered Stabilizer and Antagonists (Weak and Tight)

- Sub-Occipitals
- Scalenes
- Levator Scapula
- Intrinsic spinal musculature
- Rotator Cuff muscles (Supraspinatus, Infraspinatus, Teres Minor, Subscapularis)
- Wrist Extensors and Supinators
- Hip Rotators and Abductors
- Tibialis Anterior

Common Tight Shortened Muscles (Usually Strong)

- SCM and large Posterior and Lateral Cervical Spine muscles
- Upper Traps
- Pectorals
- Lats
- Biceps (and Brachialis)

- Wrist Flexors and Pronators
- Hip Adductors
- Hip Flexors
- Quadratus Lumborum (usually one-sided)
- Hamstring at the Knee
- Rectus Femoris
- Gastroc and Soleus

Common Tight Overstretched Muscles (Weak and Tight)

- Posterior Cervicals (from looking down) or Anterior (from belying)
- Rotator Cuff
- Rhomboids
- Low Back Extensors
- Quadratus Lumborum (usually one-sided)
- Gluts
- Piriformis
- Hamstrings at the Hip
- Peroneus Longus of the Foot

PAIN PATTERNS

Differentiating types of pain can help you or your practitioner figure out where the pain is coming from. External injuries don't need a lot of clarification since you can actually see the injury. Injuries to tissues such as muscle, tendon, and bone generally show pain in the area and radiate in the same area. Stretching the area or direct compression can cause pain in the site of injury. Depending on the age, location, and severity of the injury the pain can be sharp, dull, throbbing, and stabbing, just to name a few descriptions.

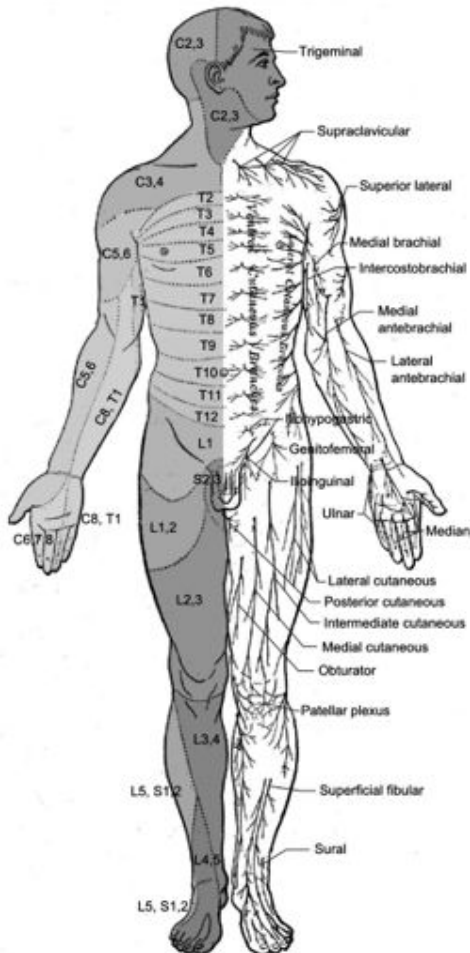
Nerve damage can cause similar feeling pain, but most cases the pain feels more electrical, and sometimes travels along the nerve (down the arm, leg, etc.). Nerve compression can also cause tingling, numbness, weakness, pins and needles, or having the area "fall asleep". Compression of blood vessels can also make an area "fall asleep" but damage to the supported tissues occurs quickly and pain is intense. Almost all cases of tingling and numbness are from nerve compression, not compression of blood vessels. Nerve pain that travels is known as radicular pain and follows a dermatomal (or skin) pattern. Compression of minor nerve

pathways, especially around the spine, can cause scleratogenous pain, or referred pain. This type of pain is not easily diagnosed, and can be easily missed in imaging and nerve conduction studies.

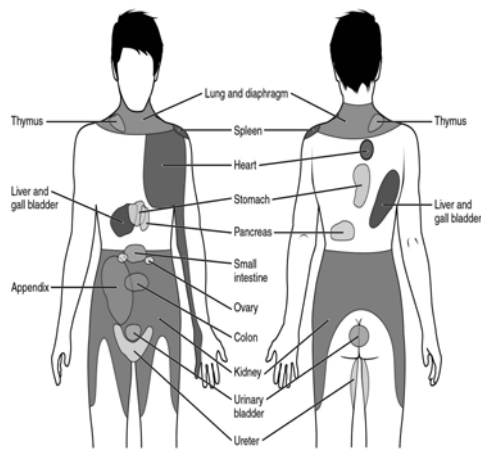
Injury to an area will refer pain to another area. Many times myofascial trigger points (MFTP) will develop in muscles. These are painful "knots" in muscles that radiate pain when pressed on. A lot of wasted time and pain can be had treating these trigger points, when they are only symptoms of a problem elsewhere, or a practitioner is actually pressing on a nerve. Joint damage will many times present as a scleratogenous pain pattern because of complex neural pathways. Damage to the structures inside of a joint are usually relieved by stretching or tractioning the joint, while damage to the outside of the joint can be increased by compressing or stretching the joint – depending on which side of the joint capsule is damaged.

Visceral (organ or internal) pain can also radiate, or present in odd scleratogenous-like pain patterns, masking itself as a neuromusculoskeletal type injury. Pain is felt and presented in as many ways as the in-

terpretation of pain varies wildly from person to person. Pain is felt in our brains and not by our tissues, and by the time the signal reaches our conscious interpretation of the signal, it can be anybody's guess as to what the pain actually means. Not all pain means you are injured and vice versa. This can mean you are about to get injured or that pain signals are going haywire somewhere.



Dermatomal pain patterns



Visceral pain patterns

Common Trigger Points. Can be at origin, insertion, or belly. (Sorry, no photo for the referred pain patterns - use Google).

- Suboccipital insertion
- Scalenes origin
- SCM origin
- Pec Major and Minor
- Latissimus Dorsi
- Subscapularis (inter-axillary)
- Infraspinatus
- Teres Major & Minor
- Supraspinatus
- Biceps
- Wrist Extensor and Pronator
- Interossei and Lumbricals (especially between the thumb and 1st finger)
- Upper Trap
- Levator Scapula
- Rhomboids
- Rectus Abdominis
- Diaphragm
- Erector Spinae
- Multifidus
- Quadratus Lumborum
- Tensor Fascia Lattea
- Glut Medius and Minimus
- Piriformis
- Hamstring (origin is deep)
- Hip Adductors
- Deep Hip Flexors
- Soleus
- Soles of the Feet

STAGES OF INJURY REPAIR

Acute and Sub-Acute Phase

New injuries are acute – they just happened. Immediately following a new injury, inflammation occurs. Inflammation is a complex cascade of events your body uses as a way to protect the area and to begin healing.

The acute stage ends with a marked reduction of inflammation. In a normal injury, the acute inflammatory stage lasts a few hours to about three days and up to seven. An injury progresses to the sub-acute phase when the symptoms of the acute stage persist but are decreased in severity. Old injuries can also become flare-ups, an old injury gets re-injured and begins the acute stage once again. Treatment can begin immediately in the acute phase with the PRICED protocol (described later), and some physical modalities can be employed during the sub-acute phase to accelerate healing times.

Inflammation

Normal inflammation is a good thing. Inflammation brings nutrients to heal tissues, and cells to remove waste, debris, and damaged tissue. The byproducts of inflammation are what get the bad press: pain, swelling, and loss of motion. But, without inflammation, your body would not heal. The key to dealing with inflammation is to promote healing and removing the waste (swelling).

Swelling (edema, bruising) is the waste product of the healing process and is removed through the lymphatic system. The lymphatic system is not powered by the heart like the vascular system. It is a passive drainage system that must fight gravity to finally return to the heart and reenter the vascular system. Gravity is one way to get swelling to return to the heart, and this is why elevating an injury while resting is pre-

scribed. But the main engine driving the fluid is muscular contraction.

The paradigm of trying to stop inflammation is wrong. Let inflammation do its thing and promote healing. Help the body flush out the byproducts of inflammation instead. Recommendations to deal with inflammation in this chapter should focus on reducing swelling or dealing with pain if necessary. But, there are times when inflammation itself must be addressed. Very high fevers, compartment syndrome, and preparation for surgery are good examples. Sometime inflammation can run amok, and this is when it needs to be addressed. An area can be stuck in the acute/subacute phase by constant re-injury for so long that a bout of ice and rest are needed to reset the cycle. However, chronic injuries caused by a lack of space and rubbing like, herniations, impingement and some rotator cuff tendinitis may require a bout of aggressive inflammation reduction once chronic to remove the pressure which causes the vicious cycle of inflammation, rubbing, injury, and more inflammation.

As explained later, some injuries just won't respond to any conservative treatments (try them first though), like plantar fasciitis, and may even require a shot of corticosteroids. Start with ice first, then NSAIDS to see if that does the trick for these pesky chronic conditions before going for the needle. Generalized, systemic inflammation though improper diet, stress, fatigue can affect your whole body health and increase your risk of injury. Changes in diet, lifestyle, and taking certain drugs/supplements can address this.

Repair Phase

Once past the acute and sub-acute phase, the repair phase begins. During this phase your body patches up the area quickly. These patch-jobs are known as scar tissue in soft tissues, scabs on the skin, or calluses in bones. Adhesions are scar tissues that

bridge two tissues and limit motion between the two. At this point swelling and redness/heat are markedly reduced, range of motion begins to restore somewhat, but pain persists. This phase can take several days from a very minor sprain/strain or cut, to about 8 weeks.

During the repair stage many therapies can be employed. Physical modalities and manual therapies can be used to speed healing, and get a head start on the upcoming remodeling phase to prevent early scar tissue prevention, begin restoring gentle range of motion. Near the middle to end of the repair stage basic stretches, strengthening exercises, and functional/proprioceptive exercises can be if not pushed past the elastic limits of the healing tissue.

Remodeling Phase

Once the structural integrity of the tissue has been restored, your body begins the final remodeling stage. This is the stage where the scar tissues are slowly replaced with normal tissues. Fibers align in their correct orientation to achieve maximum strength, usually in the direction of pull or stress, versus the chaotic weave of scar tissue. The area is re-vascularized and innervated (nerves and vessels grow where they should), and the wound is healed. One of the reasons for pain and tenderness of newly healing tissue (in the repair phase) is that nerves and vessels are either in over or under-abundance, setup like an emergency aid station to the injured area.

Remodeling (or proliferation) phase takes about 3 weeks to a year, unless major neurologic damage or severe trauma (like major burns) has occurred, most function is restored by about one year in most cases – although chance of re-injury is high until fully healed. During this stage one can begin deep manual therapies and full ROM, advanced stretching, strengthening, and proprioceptive/functional re-training exer-

cises. If therapy began early, then therapy in this stage will be drastically easier and shorter. Unfortunately most people don't begin real rehab until this stage, either because they didn't know, or their surgeon or doctor is only good for the scalpel, needle, and thread.

Chronic Phase

Injuries that have been ongoing from months are said to be chronic, usually stuck bouncing between the acute phase and the repair phase. If the cause or aggravating factor hasn't been removed, the injury becomes chronic. Tissues can never fully heal with continued re-injury. Generally acute injuries that are inflammatory in nature get the suffix “-itis”. The acronym PRICED outlines the steps to dealing with an acute injury, and is discussed below. Some extremely chronic injuries go on for so long, or get so screwed up in the healing stages that inflammation is absent, yet the symptoms persist. These injuries get the suffix “-osis”. This is still a poorly understood condition. These injuries may be more neurological in nature, and some of the tissue may actually become necrotic (dead or dying). Sometimes these long standing chronic injuries need to be stimulated back to the inflammation stage to restart the entire healing process, or the neural pathways need to be re-established or relearned by stimulating nerves in the muscles, tendons, ligaments, and joints and re-training complex movement skills in an affected limb or body area.

WHEN TO PUSH THROUGH PAIN

I'm sitting here waffling on how to answer this question as the answer is so subjective and dangerous and the advice “stop if it hurts” is not only good, it's safe. However, sometimes you need to push through the pain to make a breakthrough in healing or training. Starting any new exercise routine creates muscle soreness, and this is also true in rehab. Since the area is weak, simple exercises may feel painful and dangerous,

when it's really just a neurological safeguard. Except under the care of extremely talented therapists, I would call it a safe bet to never push past a pain threshold with an injury (or a non-injury that you are worried is about to become a real injury) unless you can clearly attribute the pain to delayed soreness (DOMS), burning fatigue-type pain, pain from a minor disuse (new exercise or activity), or major disuse of the area (just out of a cast, etc.).

Pushing past the pain does not mean blasting full-steam ahead, but going until it hurts and keeping the intensity there for a short time. Then re-test the area the following time, and going baby-steps a bit farther. The pain should not linger for more than a day or two, and should definitely not intensify after you've stopped for any length of time. If this happens, back off a bit in intensity, or wait a few more days before attempting whatever it is you are trying again. If any pain is sharp or stabbing then you definitely want to stop.

NMS TREATMENTS

ACUTE TREATMENT "PRICED"

These are the steps to help begin the healing on a new injury or a flare-up. For almost every injury, the key steps are to stop injuring the area and to help flush out swelling. The ice and drugs steps are only for pain relief if necessary. Avoid re-injury, promote healing, remove waste, and deal with pain if necessary.

PRICED

- **Protect:** The immediate part of protect means padding, splinting, or bandaging the area so it doesn't get infected or injured more – especially important in the field. Once stabilized, protect means not aggravating the area further by using splints, taping, and casts. Protecting also means one further step – stop doing the thing that caused the injury or is making it worse. This could be an activity (climbing), a poor posture, or motion (offwidthing, dynos, etc).
- **Rest:** Along the same lines as the last stages of protect – don't use that injured area. A minor tweak could mean just a few days, a major blow out could mean 6 months. Rest can and should be active if possible. If you injured your hand, you can still use the other arm and the rest of your body. You can begin passive range of motion (ROM), active ROM, light resistance, or light stretching depending on the severity and integrity to the area. Passive rehab modalities can be employed at this time. The more you do earlier in the game, the quicker you'll heal. Too aggressive rehab can re-injure the area, however. Remember that a muscle contraction is what pushes out swelling. The moment the tissue is strong enough to move in a way that doesn't aggravate it, rest for that area should end, and slowly progress towards functional weight bearing activity.
- **Ice:** Ice reduces inflammation and pain. Ice does not help heal an area. In fact, ice inhibits healing by reducing blood flow, and the good parts of inflammation. Too much ice can damage tissue. So why ice? Simple – pain relief or when inflammation must be addressed (reduce swelling rapidly for surgery, compartment syndrome, swelling damages tissues more). Ice can be used to paradoxically bring more blood to an area, called reactive hyperemia. This is an effective therapy for sore tired muscles and chronic injuries. Ice or bags of frozen corn can be applied directly; chemical packs must be buffered via a towel. Ice for 20 minutes, and then wait one hour before re-applying the ice.

- **Compress:** When you injure an area fluids get pumped in via vessels, but fluids also leak in via ruptured cells and osmotic changes. Applying constant pressure with sleeves, bands, and wraps to the injured area reduces swelling by simply pushing the fluid out. You don't want to cut off circulation and injure the area more, however. Snug is a good description for how tight to compress. Massage is an excellent form of compression to push the waste out. Electrical stimulation devices can also be successfully used to use the muscles around an injury to help squeeze out the fluid without moving the area that was injured. If you are severely bleeding compression takes on a whole new level of importance. Apply direct pressure over the wound – but still not so tight that everything below the area gets circulation cut off.
- **Elevate:** If there is going to be a lot of swelling (sprained ankle, fairly serious injury), elevating the area above the level of your heart will help drain the exudative fluid and venous blood out of the area via simple gravity.
- **Drugs:** Check out the nutrition section for drugs that reduce inflammation and pain (ice does both very well).

PROTECTIVE DEVICES AND IMMOBILIZATION

Non-removable casts, splints, and braces and removable protective devices all immobilize an area. **Casts** are used almost exclusively for fractures and avulsions and stay on for about 8 weeks depending on the size, location, and severity of the fracture.

Splints are used to almost completely limit motion in soft tissue injuries and small fractures and are usually left on for a few days to 8 weeks depending on the size, location, and severity. The reason behind total immobilization is to prevent further injury from movement of the area, and to allow the area to fuse properly. The downside to immobilization is that the area around the healing tissues weakens, atrophies, and adhesions develop making rehabilitation more difficult and prolonged. Some splints provide constant stretching, kind of like braces for your teeth, to realign joints.

Braces comprise between limiting motion for protection and allowing some range of motion either in all directions or only in a limited direction. If an area is transitioning from repair to remodeling, a brace can help the area heal properly by allowing motion but protect it from motions that the area is not yet ready for. Areas with chronic instability or the experience chronic flare-ups sometimes require a brace to allow activity and reduce inflammation and re-injury.

However, braces never allow an area to truly heal and compensation usually occurs, affecting another area or performance negatively. If you wear a brace on a continued basis, or have been prescribed one, then find a therapist that considers braces only a temporary fix.



There are certain times when the pros of immobilization outweigh the cons in some cases of chronic joint instability or connec-

tive tissue injuries. Loose, hypermobile joints can create pain by altering biomechanics or causing tissues to rub and create inflammation, pain, and tissue damage. Immobilization can cause scar tissue and adhesions to develop. Normally this is a bad thing, but for hypermobile joints this could be bad turned to good. If exercise and other forms of rehab just aren't working on a chronic injury, it may be worth it to try immobilization. The rehab for this type of injury is a fine line between tightening up the joint, and mobilization of the joint to find a happy middle ground. Immobilization of a chronic area combined with icing may also stop low-grade inflammation that has been secretly hindering healing for all this time.

How long to immobilize depends on the severity and chronic nature of the injury. Total immobilization for a couple weeks, or just immobilizing the area when you sleep or perform aggravating activities for several weeks could be the key. There's no equation, but if it seems to help but flares up again, go for a bit longer next time. Injuries to connective tissues require movement for nutrients to reach the area, so on/off immobilization make more sense with these types of injuries. Rehabbing the area after a trial of immobilization is extremely important.

If you wind up with **crutches**, be very careful to not support your weight in your armpit on the crutches. You can develop a neural-crush injury and get two injuries for the price of one. Being wheelchair bound, laid-up in bed, or in crutches sucks. Getting exercise is extremely important during this time. It aids in healing, and helps even more by fighting depression. After a brief bout of doing nothing and feeling sorry for yourself, start exercising and getting out as much as safely allowed.

COMPRESSIVE DEVICES

Some braces, like **tennis elbow braces**, **ITB straps**, or **infrapatellar straps** are designed to take pressure off a tendon that is overly stressed, or rubbing against the area below it. These should not become permanent fixes. **ACE wraps** are almost exclusively used to compress a newly injured area, and mildly limit range of motion. **Coban** is sometimes used to wrap an area that experiences exercise-induced inflammation, but it doesn't work as well as **Spandex sleeves**. **Compression underwear** is also very useful for endurance and recovery as it helps push swelling and inflammatory products produced through exercise out of the area. Some compressive underwear has motion-limiting areas built in to prevent excessive movement, reduce injury, and improve posture – similar to Kinesiotape. The results are subtle, but can be affective.

One company in particular, Thermo Active, makes an amazing compressive device that does dual duty as an ice or hot pack. Each unit is shaped for the desired body area and a pump gently squeezes in all directions. It can be put in the freezer or heated depending on the desired effect.





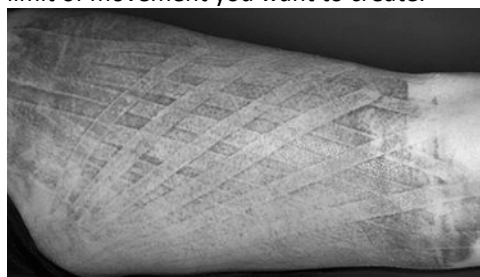
Elbow sleeve, Coban, compression tights, elbow brace, Thermoactive cooling/heating compression

SUPPORTIVE DEVICES

Some areas require protective support because of biomechanical weakness, especially those with weak arches or ankles. Rehabbing these areas is possible, but taping or bracing may be required during times of high impact or exertion. **Taping areas for support** should only be done for support during the desired activity. Cotton **athletic tape** works best in most situations, but a product called **Leukotape** works well in areas that receive high impact because it does not stretch and stays on for a few days. Taping fingers that are rehabbing a pulley or tendon issue is important to prevent further injury, but the goal should be to strengthen the area so tape is no longer necessary. It is difficult for the tendon or pulley to heal properly without stressing it, and too much tape can disrupt the remodeling stage by creating weaker scar tissues. Preventative taping should only be done if you are doing a very dangerous climbing move like dynoing to crimps, or one finger pockets.

Also, preventative taping is useful if training or climbing repetitive high stress moves. But too much taping will prevent the tendon or pulley that should be stressed from getting stronger.

Kinesiotape is a fairly new form of taping invented by a Japanese chiropractor that is designed to aid in swelling, limit specific movements, and provide proprioceptive feedback. There are now several brands of this tape available. Kinesiotape is stretchy in one direction, but becomes stiff at the end range. The glue holding the tape on is applied to the tape in strips, so when applied it bunches up the skin underneath. The theory behind this is that it pulls up on the skin, creating a negative pressure below, allowing accumulated fluids to be sucked out. When applied to joints at specific levels of tautness, the tape can limit dangerous movements at end range, and also serve as a proprioceptive “check,” training your body to unlearn dangerous movements. The tape is usually cut (or comes pre-cut) in patterns tracing muscles that create specific movement patterns, or is cut in thin strips to provide lymphatic drainage. There is also a theory that applying the tape from either muscle insertion to origin, or taping in the opposite direction can help activate or deactivate a muscle. I buy the theory, but don’t think it really makes any difference. When applying the tape, stretch it so that it becomes tight enough that when the joint nears the end range of movement or at the limit of movement you want to create.



Kinesiotape on a bruise

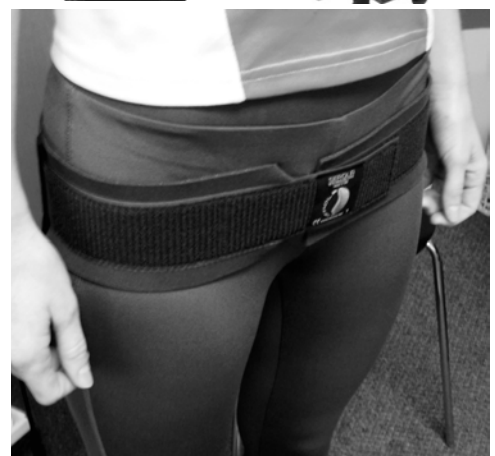


Tight elastic wraps, aka floss (like Voodoo Floss), are gaining popularity with CrossFitters. Much of the theory is similar to Kinesiotape, but the wraps add an element of compression, a bit more joint stabilization, and even a bit of “pin and stretch” therapy can be added (what they call “flossing”). You can use a bike tube split open if you want. Simply wrap the area up and move the joint. This therapy works well on limbs and on the hips. Bands can also be used for swelling, but wrap them looser towards the heart, move the joint, and take them on and off every few minutes for 15-30 minutes. See stretching section for photos.

Thoracic supports are available in compression shirts with limiting bands across the back and shoulders, and elastic straps are available for wearing over a shirt to help pull your shoulders back and relieving stress on your mid-back. I’ve never recommended these because simple rehab exercises and quick stretches provide quick relief. But if you’re hunched over a computer all day and need to start somewhere, these can provide relief.

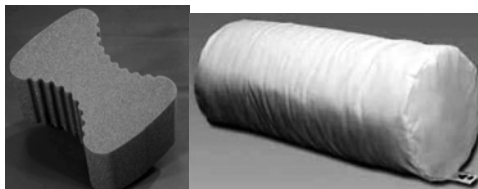


SI belts (sacroiliac) and **trochanter belts** (around your hip joint) are helpful at providing support for those with unstable SI joints, especially pregnant or recently pregnant women. **Lumbar belts and braces** also help with unstable low backs, but not as much as SI belts do with SI joints. SI joints are difficult to tighten, as there are no muscles that cross the SI joint. Low back supports and braces should only be used very temporarily, or for lifting very heavy objects at work. It is extremely important to maintain the use and function of your back muscles – just a little bit of detraining can compound a back injury even further.



Back brace, back pillow, & SI or trochanter belt.

The same advice goes with **cervical collars** – they should only be used after surgery, a fracture, or for a very short time during the acute phase. Low profile **low back pillows** are excellent, however, because they really just serve as a reminder to sit properly. If you spend a lot of time in your car, or especially in a truck with bench seat, a back pillow can be a lifesaver. Finally, there are several types of special supportive **pillows for your neck** (cutout, rolls, water pillows) to help maintain correct neck posture when sleeping, and special **pillows for under or between your knees** to reduce low back pressure or aid in sleeping while pregnant. Other supportive devices help to correct or assist with anatomic flaws like **foot orthotics and inserts** all the way up to prosthetic limbs.



Knee pillow and cervical roll

PHYSICAL MODALITIES

Physical modalities use elemental natural properties to promote healing. They are labeled as such for convention, not because of any mystical belief in elemental forces

Heat

Heating an area increases blood flow and metabolism to carry nutrients away, removes waste, and also makes tissues more supple helping to relax muscles and improve motion. Heat is very useful once past the acute stage, for stiff sore joints and muscles, contracted tissues, and in most arthropathies (inflammatory and non-inflammatory arthritis). The therapeutic temperature range for heat is 104-113° F (40-45 C), but the heat source must usually be hotter than that to achieve the desired tissue temperature. **Hot packs** with protective padding and towels are usually 165-170° F (74-77° C). Treatment time for heat is

usually 15-30 minutes. Wet heat penetrates a bit deeper than dry heat.

Hot baths, or hot packs in a hydrocollator do a great job. Dry electric or microwavable hot packs are a good at home therapy if soaking the area is difficult. **Whirlpools and dry baths** of air-circulated sawdust (**fluidotherapy**) also help to rapidly and deeply warm an area. Fluidotherapy, acts like water, but allows for tolerance of much higher temperatures. **Paraffin dips** are extremely helpful in hand arthropathies.



Fluidotherapy

Cold

The basics of icing an area were stated above in the PRICED section. There are some other ways to cool an area besides **ice and chemical ice packs**. **Soaking** an area in a cold basin of water or bath (cold tap water with some ice cubes) really penetrates deeply. Ice for 20 minutes on and 60 minutes off. **Whole body cryotherapy** using liquid nitrogen is becoming increasingly popular as a way to quickly cool your entire body and helps in speeding recovery between workouts or with injuries. If your gym is lucky enough to have one (or your very rich), try it out.

Although icing is generally used to decrease inflammation and for pain relief, a much better application known as **reactive hyperemia**, or the Lewis Reaction, can be useful in chronic or subacute injuries to in-

crease blood flow to the area. This means blood will flow back to an area as a reaction to short-term cold exposure. To do this only ice for 5-10 min instead of 20. Wait an hour before repeating.



Cold pack fitted for a shoulder injury. Many other body part shaped cold packs are available and work so much better than just a standard pad.

Alternating Hot and Cold

Contrast therapy is extremely effective in rehabbing chronic injuries, or new injuries somewhere in the subacute healing phase and on. The basic principle is to heat, and then cool an area to promote blood flow and to flush out waste. You can use a shower, your faucet, or two tubs/buckets of water. The cold water should be fairly cold: add a few ice cubes to cold tap water. The hot water should not be scalding, but on the hot side of tolerable hot shower. The ratio of hot to cold should be 3:1, ending with cold. A good system is three minutes of hot, and one minute of cold for thirty minutes total.

Plain old heat and contrast therapy are the two best physical therapy modalities you can use to promote healing and repair or even to prevent injuries. Full body contrast therapy feels like you've been born again! For full effect you can to contract and relax the muscle or joint throughout the hot/cold therapy.

Electricity

Electricity can be modulated in many different ways to strengthen muscles, relax muscles, re-train muscles, dull pain, decrease edema, and accelerate healing. Nerves work via electrical impulses (action potentials), and electricity from batteries or wall sockets and be modulated to mimic different types of nerve impulses, usually pain signals and muscle contraction signals.

The most popular form of electric stimulation are portable **TENS** units (transcutaneous electrical nerve stimulation) used to block pain pathways. Although they don't actually fix anything, they can provide relief for chronic or acute pain without the need for opiate pain relievers or muscle relaxers.

The **H-Wave** device may be even more effective than a TENS device for blocking acute or chronic pain and it may also promote healing.



TENS unit

The other most popular form of muscle stim (as made popular by Bruce Lee and subsequent muscle fitness scams) is **Russian Current**. The electrical impulse contracts a muscle, and it is strengthened by resisting the impulse or lengthening the muscle after contraction. It doesn't really work unless you're suffering from pathologic muscle atrophy, or already have made as much strength gains as genetically possible by standard weight training. The Russian stim

activates muscle fibers in reverse order than your body normally recruits the muscle, so the results don't translate well into real world strength gains. There may be some benefit in using this device for training explosive power moves (dynoing), but other forms of training are cheaper and more effective. Ab belts and the like do not work. There are fun to play with, however.



Multifunction E-Stim unit

The most useful form of electrical stimulation for NMS conditions are the **high-volt**, **SINE**, and **biphasic** electrical modalities, followed a bit behind by **interferential current**. All of these can be modulated to either block pain, contract a hypertonic muscle until it fatigues and relaxes, or by disrupting the nerve signal from a hypertonic muscle or trigger point to help it relax. The results don't last very long, but they feel amazing and the temporary relaxation or pain reduction can create a window of opportunity for a therapist to perform other therapies.

One of my personal favorites is the combination of **high volt with ultrasound**. The metal ultrasound head acts as the electrical stimulator and is excellent at pinpointing trigger points and inflamed areas.... all the while the ultrasound blasts the area (discussed below).



Dry-needling (acupuncture without the philosophical/religious component) with the needles hooked up to an electrical stim machine is another favorite tool for relaxing muscles or destroying trigger points. It can be a bit painful for obvious reasons...but it's a good hurt.



Microcurrent is an electric modality used to aid in healing. This can be done in a clinic or with a take-home device, similar to a TENS unit. The current is sub-sensory (you don't feel it) but the modulation of the electrical current helps tissues heal much much faster, mainly via increasing cellular metabolism to the immediate area. Healing times from cuts, tears, sprains, and strains can be drastically reduced with this neglected therapy. The nice thing about microcurrent is that you can slap on some electrode pads, put the device in your pocket and forget about it.

One newer device, the **InterX**, is gaining fast popularity as multipurpose electrical modality. It uses various waveforms to block pain, relax muscles, re-training muscles, and promote healing at a cellular and neurologic level.



Also new on the scene is **Pulsed Electro-Magnetic Field Therapy (PEMFT)**, also known as **Pulsed Magnetic Resonance Therapy**. Rather than using current, this uses electromagnetic waves to stimulate healing in bone and soft tissue injuries and to help with pain. It has also been used transcranially to help with depression.



The **Marc Pro** device is a new e-stim unit that uses fancy waveforms to help train muscles, aid in muscle recovery, or warm up muscles by neurostimulation. This helps by also flushing out toxins, increasing blood flow, and increasing nitrous oxide levels. It also claims to be used when exercise is not possible to delay regression. It is not meant to be used to build muscles like other bogus devices you see in magazines. In theory it can be used to reduce forearm pump before, during, and after climbing sessions, so

if you have access to a portable unit by all means give it a whirl.



Bone stimulator devices are also fairly new on the scene. They deliver an electrical charge directly to the bone (usually after spinal fusion surgery) or over the skin or cast to speed up the cellular processes to speed up fracture healing. More and more portable devices are being developed.

Electrical stim machines can also be used for **biofeedback** to retrain an atrophied muscle or to relax a hypertonic muscle. A number is displayed representing muscle activation and the patient focuses on contracting or relaxing the area to bring the number displayed up or down. Some other forms of electrical stim help therapists activate nerves and muscles in patients with nerve damage or other debilitating diseases, or make a muscle pump fluid and edema out of an area.

Sound

Ultrasound used in therapeutic frequencies (versus low level diagnostic ultrasound) vibrates a target area very quickly so the area quickly heats up. Ultrasound is basically a heat therapy, but it can penetrate much deeper than any hot pack or bath. In fact the therapist can burn your bone if they aren't paying attention. Ultrasound may be done underwater to reduce the intensity for superficial structures. Ultrasound is a great quick way to heat an area to promote blood flow and loosen tissues. Ultrasound may

also break up scar tissue, calcium deposits, and can push swelling and edema out of an area effectively. It may help with bone spurs. Low frequency ultrasound (30 watt/cm²) has also been shown to aid in fracture healing. Special units designed for fracture healing are known as **Sonic Accelerated Fracture Healing Systems**.

Extracorporeal Shock Wave Lithotripsy is a hard-core use of therapeutic ultrasound. It can be used to blast kidney stones, but turned down a bit it (using a different device) has been shown useful in treating chronic tendinosis like plantar fasciitis or elbow tendinosis, and for breaking up scar tissue and adhesions in chronic injuries. It can also be used to cause local inflammation to kick-start the repair process. Lower intensity shock wave therapy can be performed with a handheld device, doesn't need to be numbed with local anesthesia, is much cheaper, but may not be as effective as the more powerful units.



Handheld and surgical shock wave devices

Light

Diathermy (basically safe microwave radiation) and **infrared** (heat lamps) are both used to deeply heat and penetrate areas hot packs won't reach. They are especially useful in older patients, and those with chronic arthritis. Don't have any metal on if being treated with diathermy (microwave metal and see what happens). **Ultraviolet** radiation is another form of light therapy, but mainly used as an antimicrobial treatment.



Diathermy unit

L.E.D., cold laser (class III or low level laser), and **high powered laser** (Class IV) therapy are fast becoming very popular therapies to accelerate healing to difficult areas by accelerating metabolism and promote healing. They are extremely helpful in chronic knee, shoulder, or other joint problems that other forms of rehab just won't help, but surgery isn't doing to help much either. Cold and high-powered laser penetrate fairly deep, so it can get inside those joints and promote tissue regrowth and repair. The best units emit constant LED with pulsed variations in intensity-clustered laser.



Various laser and infrared devices

Vibration

Vibration is a fairly good therapy used to relax an area, especially large generally tight muscle groups. Some professional **vibration machines** (the G5 in particular) are terrifically effective!

Whole body vibration is a fairly new therapy used to strengthen spinal and postural muscles, and may have some general systemic benefits, including bone strengthening. You stand on a vibrating platform and perform exercises.



G5 and whole body vibration

MANUAL THERAPIES

Manual therapy means therapies done by hand. Tools can be used to aid the therapist, and devices can be used to relieve the therapist, but essentially it's all done via human contact.

Massage: Compression and Friction

There are many styles and forms of massage, and I urge you to stay away from new age or trademarked styles. The basic gist of massage is compression and provocation of tissues to improve circulation, relax muscles, aggravate areas to promote healing, or break up scar tissue and adhesions.

Compression of muscles is the most basic form of massage, and it can be performed in various ways and styles. Compression removes blood from the area temporarily, and the resulting ischemia (lack of blood) can cause the muscle to relax. Reactive hyperemia causes blood to rush back in and help heal the area and remove waste products (the dreaded ubiquitous "toxins"). Compression can also inhibit motor reflexes and activation, especially near the attachments. Unless there is injury to the muscle itself, manual therapy at the musculotendinous junction can be a lot more effective

(and painful). These basic forms of massage feel great, and can help overcome overall tightness. However, unless other therapies, exercises, and lifestyle modifications occur along with a strict regimen of massage (at least twice per week for several weeks), the effects of the massage are only temporary. Overall reduction of stress and its subsequent symptoms can actually be the main benefit of getting a once in a while massage.

There are thousands of **self-massage devices** that utilize compression: from chairs, foam rollers, Theracanes, balls (lacrosse, golf, and softballs are nice) and rollers with spikes and knobs, to climbing specific forearm massagers. Several items have already been shown in the stretching section. Taping two lacrosse balls together creates a nice divot to avoid bony landmarks, like your spine. You can passively press into the tissue you are trying to release, actively roll over the device, or keep the device in one spot actively contract and relax your muscle over it, similar to pin and stretch. Use large deep motions or small oscillating motions over a small space. Self-massage is a cheap, quick, and very effective. Don't do any deep massage before an activity, however. It can cause injury by inhibiting muscles.



Courtesy Arm Relief Massager



Lay on the nubs for trigger points



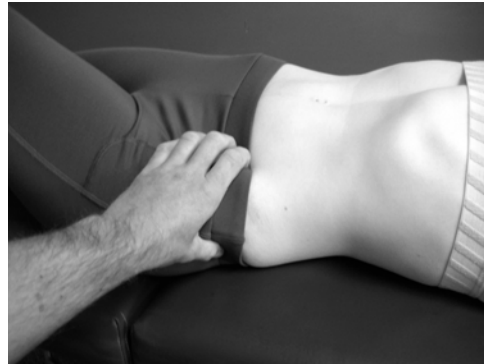
Courtesy Armaid (left), Theracane (right)



Popular foot and trigger point rollers and balls

Trigger point therapy is merely pinpoint compression of tight nodules in the muscles for a brief time. There are several **home care devices** that you can lay on, or press into, to help relieve these painful spots.

Finally, **Active Release Technique** (or the non-trademarked **pin and stretch technique**) combines stretching with compression to provide pain relief and to loosen tight muscles or remove scar tissue and adhesions. There are many subtleties to the technique, but the basics are that shorten the muscle to be worked, pin down the trouble spot, and then lengthen the muscle. It is painful, but effective.



Active release on the psoas – move the leg up and down while squeezing the iliospsoas muscle.

Scar tissue is very difficult and painful to remove via massage, but can be done via vigorous **cross-friction techniques** such as by hand (literally rubbing back and forth for about twenty minutes), or with instruments like **Graston Technique, SASTM, or IASTM**. Most friction techniques, like Graston, use a hard tool to literally scrape scar tissues, adhesions, tight muscles, tendons, ligaments, or trigger points. These techniques offer excellent results over a short amount of time (about six sessions). They can lead to some seriously nasty looking bruises over the area, but the bruising is superficial. The scraping can either reduce scar tissue or adhesions, or promote tissue regeneration in tendons and ligaments. Don't confuse the traditional Gua Shua technique with these therapies as Gua Shua is a drastic traditional Chinese therapy whose purpose is to create an extreme amount of inflammation for spiritual reasons.



Courtesy Graston Technique

Ice massage is an excellent form of friction massage that combines the benefit of cross-friction with the healing powers of ice. Take an ice cube, or peel back a frozen paper cup of ice, and rub it back and forth firmly across the area until the ice melts – for about 15 to twenty minutes.



Other forms of massage use various forms of stretching, compression to reduce edema and lymph, or physical therapy modalities like hot, cold, and vibration. Some forms of massage, like **Rolfing or Kinesis Myofascial Integration (KMI)**, claim to work on fascia. Besides friction techniques, spreading or gliding (**effleurage**) tissues apart by really getting in there can separate fascial layers that are stuck to improve movement along the kinetic chain. This could be helpful in chronic injuries or for postural problems.



See the stretching chapter for more photos.

Stretching

Traction is passive stretching by separating joints to relieve pressure or stretch the joint capsule. Spinal traction is most commonly used to relieve pressure off of torn or herniated discs. Traction is an excellent treatment for joint damage due to excessive compressive forces, inflammation of the joint, freeing entrapped meniscoid tissues, stretching tight joint capsules, or relieving pressure of nerves and nerve roots.

Spinal decompression machines are extremely expensive, and supposedly target specific joints. I'm a bit leery that this is true, and find less expensive traction machines very effective (although they still cost \$20-50 thousand dollars for the clinic to buy). There are basically two protocols for traction: slow steady traction to stretch tissue, and cycled pull/relax traction to help "pump" disc herniations back into place.

Flexion-distraction is a type of spinal traction where the therapist stabilizes the spine with their hand above the area intended for traction, and the bottom of the table is lowered and raised. Traction can also be very effectively performed by the therapist simply pulling on the area, or spreading the joint apart by hand, although it can be very tiring (but way cheaper).

There are many forms of **home traction** for various areas like the wrist, neck, and low back. The best home spinal traction units

are made by Saunders and cost around \$500 each. I've already mentioned earlier in the exercise section that **gravity boots** can provide traction to the spine and leg, as can very inexpensive store-bought **inversion devices**.

Other forms of traction are **pelvic blocks** that are inserted on the hip crest or trochanter (or both) to slowly rotate the pelvis back into place. Shoes can be used at home by laying on them on the floor. Traction can be applied to the sacrum by lying on a **sacral pillow** and scooting down enough that the friction pulls slowly on the sacrum. The final type of traction device climbers may seek out are **wrist traction** devices. See the stretching section for more info and photos.



Gravity boots

Passive stretching is identical to traction, except joints aren't separated, but a sustained stretch is still provided with the patient doing nothing. **Night splints** and special socks are used to stretch the foot and lower leg for plantar fasciitis, **toe straps** are used in hallux valgus malformations. Passive stretching is used in restoring a cervical curve by corrective therapy chiropractors. Passive stretching also can be describe as a normal slow steady stretch for 20 seconds to several minutes to stretch tight muscles

and joints as mentioned in the stretching section.



Carpal tunnel and hallux valgus stretches, plantar fasciitis splint

Active Stretching has already been discussed in detail in the stretching section, but again, it is an excellent way to get fast results in chronically tight muscles. Another interesting form of active stretching is called **nerve flossing**. Occasionally nerves become trapped in their sheaths by scar tissue adhesions, resulting in pain or tingling – especially in the nerves in your brachial plexus. Your sciatic nerve is more easily stretched by the active stretching techniques on the hamstring and piriformis. Bring the nerve slowing in and out of tension by performing the following motions to end range and then backing off. Don't go farther than when you feel symptoms, and don't force it. A similar technique can be used for the tendons in your fingers. See the stretching chapter for more info and photos.

Joint Manipulation



Chiropractors and physical therapists both perform joint manipulation as a major therapy, although PT's technically can't legally perform **high velocity-low amplitude** (the crack!) manipulations most states – but

they usually do it anyways and just don't bill as such. Again, avoid technique systems with fancy names and protocols – it's usually a marketing scam.

There are **several grades to joint mobilization** – from gently moving of a joint back and forth to the chiropractic crack. Joint mobilization provides several benefits: pain relief via release of natural pain killers (endorphins) and pain-gate mechanisms in the joint and central nervous system (CNS), reduction of a minor dislocation (subluxation), relieves pressure off irritated or compressed joints nerves and discs, restores proper biomechanics by getting an area to move that was stuck or out of place, and milking nutrients into degenerated joints. Any joint in the body, including the almost fused joints in the skull, can be mobilized if proper techniques are used.

Just like any long-term problem and therapy to provide relief, joint manipulation is rarely a one-time fix. Tools are sometimes used to provide the mobilization, from the doorstep looking handheld device known as the Activator, to vibratory units like the Pro-Adjuster, to tables with a drop piece. I've never been convinced that the Activator or jack-hammer device like the Pro-Adjuster delivers enough force to do anything, but **drop tables** are acceptable tools for large difficult joints like the SI or very large patients. I am also wary of manipulation techniques that claim to cure or help with systemic diseases, or techniques that are claimed as a cure-all such as upper-cervical techniques or postural re-alignment systems. There is plenty of anecdotal evidence and a few studies supporting those claims (basically pressure on a nerve or spinal cord can inhibit function to a body system), but not enough to warrant spending thousands of dollars, or using round-about techniques to cure things that have much more valid specific treatments.

Performing self-manipulation can be just as safe and effective as having a chiropractor do it. The problems arise when cracking your own neck, back, or whatever becomes habitual or addictive. Too much of a good thing can lead to chronic joint instability. Also, if you go beyond end range of the joint or try to force a "pop" you can sprain a muscle or ligament, unless you were really forceful – then real damage could result. Getting your neck manipulated is usually very safe. A chiropractor would have to want to break your neck to actually harm you. Usually pain comes from apprehensive resistance, and a small muscle sprain could result. There are a few cases where the vertebral artery in the neck has ruptured following cervical manipulation. Although that's sad, these victims would have stroked out turning their head to change lanes in traffic. Getting your spine, or limbs manipulated won't change you in a fundamental way that will make you require continued care for the rest of your life...that's what crafty sales-doctors are for.

Manipulation under anesthesia is generally reserved for cases post-surgery, like after knee surgery, to restore more range of motion and to break up scar tissue without the patient consciously or subconsciously resisting.

Another type of joint mobilization is to use light to heavy tubing (depending on the joint) to distract a joint into a neutral position while performing an exercise. Kenny Starrett, a popular CrossFit P.T., calls this "**banded flossing**". The idea is a chronically shortened, overstretched, or pathologic joint will create faulty movement patterns or tissue damage and that by passively placing the joint in a correct position will allow you to either perform an exercise through its full and correct range of motion for better results, or to establish a new pattern to correct old ones.

Continuous Passive Motion (CPM)

This is that dreaded device that passively moves your knee (and other parts) after surgery for hours to reduce scar tissue, lubricate and heal the joints and tissues, and to keep the joint from freezing up. Mostly used after knee surgery.

Movement Therapies

Combining movement with manual therapy and exercise can be the key to unraveling chronic pain patterns brought on by dysfunctional movement patterns. I can't personally endorse any of these as I have not used them - they are just for your reference. The **Vojita Method** combines developmental function movement patterns, like crawling and turning, with other manual therapies to reestablish correct patterns in an adult. The **Primal Reflex Release Technique** is similar but uses developmental reflex arcs (babies have different reflexes than adults). **Feldenkrais** is a method that looks at movement patterns used consciously or subconsciously to correct imbalances. **Neurokinetic Therapy** looks at and retrains compensation patterns in the body by reprogramming the motor control in the limbic system. **Positional Release Technique** has the patient placed in various positions that reduce the pain with gentle manual therapies added to address pain syndromes.

There are many other methods, most of which blend various modalities and theories to correct movement dysfunction. Correcting sport specific movement dysfunction or the deeply learned intrinsic patterns could be the final step in fixing an area that always seems to get hurt or is painful.

Muscle Activation Therapies

Many of the manual therapies mentioned also directly influence muscle activation of de-facilitated muscles, but some therapies combine joint positions with manual therapy to help facilitated weakened muscles.

The most common technique is **Muscle Activation Technique**.

DRUGS

The purpose of most drugs in NMS conditions is to reduce inflammation, relax muscles, aid in repair, or lessen pain due to inflammation or nerve issues. Many medications and some anti-inflammatory medications hinder with the healing process and should only be used through the sub-acute stage if possible. Chronic conditions may require prolonged use of anti-inflammatory medications. Electrical stim machines and ultrasound can be used to deliver pain and anti-inflammation medications, including corticosteroids. This is known as **iontophoresis and phonophoresis** respectively. They are helpful in chronic conditions to get the medication directly to the site of injury, and possibly avoiding some systemic side effects of administering the drugs orally or intravenously. Both can be used to treat pain, inflammation, calcium deposits and bone spurs, among other things.

Prolotherapy is a technique that contains a pharmacological agent (either a natural supplement, saline, or prescription drug) and is injected into a hypermobile joint to cause irritation. The irritation supposedly causes controlled inflammation to active proliferative cells that help regenerate and strengthen the joint. Because hypermobile joints are very difficult to treat, prolotherapy presents as one of the few non-surgical options available to tighten up loose, pain-causing joints. However, its efficacy is still hotly debated.

Platelet-rich therapy injections are another non-surgical (or at least minimally invasive) option for treating painful joints that have become arthritic and degenerated, or for chronic tendinosis. The patient donates blood, which is spun down, and the plasma is collected and serum discarded. What is left is plasma rich in platelets, growth fac-

tors, repair cells, and chemical constituents. Some clinics are also including stem cells from marrow biopsies. This is injected into the injured area, and the concentrated healing potion is supposed to regenerate tissue growth to the affected area. This is expensive, but for many, a last resort after failed surgery, an attempt to avoid surgery, or when surgery is no longer an option.

Biopuncture is another form of injection that is supposed to aid in pain and inflammation relief, and to help accelerate or stimulate healing in chronic areas. Biopuncture is simply injecting a painful area with medication. How it differs from tradition medication injections is that the solution injected is in very (actually ultra) low doses of mainly botanical or naturally occurring products. It varies from homeopathy in that homeopathy potions have zero dose of the ingredient (I know!), and the potions are usually not injected. Anyway, the theory is that the substances injected aren't supposed to do the healing, but are there to wake up healing reaction from within the body. Yes, it sounds dumb but it's fairly similar to the basis of prolotherapy, except the injections are into tissues, not joint cavities. Most likely it's not what's injected, but the reaction from the injection.

Painful chronic trigger points are often injected with **lidocaine, cortisone, and or botox** to relieve pain and reduce the local spasm. Artificially oiling your joints by injecting **hyaluronic acid** directly into the joint over 3-5 treatments can really help to reduce pain and stiffness and lasts about 6-8 months. Other slightly more invasive injection procedures are described below under surgery.

Foods to Avoid for Pain and Inflammation

Inflammation in a non-injured area can create a vicious cycle, effectively ceasing repair of an injury, or create whole-body systemic problems. One way to avoid inflammation is

to avoid foods that promote creation of inflammatory products. Plants of the night-shade variety can lead to inflammation. These include tomatoes, white potatoes, eggplants, peppers (not black pepper), and tobacco. Foods that cause an individual to have an allergic reaction (low grade to acute) also cause systemic inflammation. Other foods that could promote inflammation are coffee, animal and dairy products (egg whites are ok), and alcohol.

Pharmacologic Pain and Inflammation Drugs

NSAIDs (non-steroidal anti-inflammatory drugs) are almost all over-the-counter (OTC) medications and they aid in pain relief, fever reducing (antipyretic) and reducing inflammation. Higher doses are needed for anti-inflammatory response. Chronic use can affect liver and kidney health, and even mild use can delay or hinder the healing process. NSAIDs include: **aspirin** (not recommended at high doses or long term use due to severe gastrointestinal irritation), **ibuprofen**, and **naproxen**. **Diclofenac and ketoprofen**, along with many others are NSAIDs only available by prescription. Most NSAIDs work on the same basic mechanism, but each requires a different dosage. Some NSAIDs, like ibuprofen, must be taken at higher levels to provide any sort of anti-inflammation benefit. If you are unfortunate enough to need long-term NSAID therapy, you may want to rotate through the different kinds every few months.

Acetaminophen, aka Tylenol, is not an NSAID. It does not relieve inflammation, but is effective for fever and pain. It can be very hard on the liver, and taking it with even a small amount of alcohol can kill you. Short-term effects are pretty safe, however. Combining Tylenol with NSAIDs or even better, anti-inflammatory supplements (below) is a good non-narcotic way to reduce pain and inflammation safely over the short term, as ice good old fashioned ice.

Besides NSAIDs, there are many more prescription pain and inflammation drugs, but with much more powerful (and addictive side-effects) like **COX-2 inhibitors**, **opiates**, **synthetic opiates**, and various combinations. **Muscle relaxers** are commonly prescribed for muscle pain. They have their place, but I feel they are over-prescribed. Use your judgment whether the doctor is prescribing them because they will help, or that he or she has a limited toolkit. **Botox** of all things may be an excellent replacement for muscle relaxers, but it is still being tested.

Corticosteroids (cortisone) are extremely powerful and extremely effective prescription drugs that quickly eliminate inflammation. They can be injected or taken orally. They have extreme side effects like severely weakening connective tissues, drastically increasing risks of systemic or local infection, or creating systemic disease like Cushing's disease, high blood pressure, and diabetes. They should be used very sparingly. They can be the magic bullet and totally worth a shot if not contraindicated and a vicious cycle of inflammation is the big thing holding back recovery. However, beware if your doctor goes straight for the needle, or suggests multiple injections.

Some medications are strictly designed for nerve pain, and most are prescribed by your doctor. **Gabapentin** is a common prescription, but keep in mind that it can make your groggy in the morning. Other **antidepressants** and **anticonvulsants** are also commonly prescribed.

Pain and Inflammation Supplements

Some OTC supplements have been shown quite effective for pain and inflammation. These include (from best evidence to weakest): **capsaicin**, a topical pain relieve derived from cayenne pepper, **SAMe**, very effective but takes almost a month to get working, **white willow bark**, a precursor to aspirin but easier on the stomach, **ginger**, **boswel-**

lia, **turmeric** (also as **curcumin**), and **devils claw**. **Ginger** has shown some promise for relieving pain due to osteoarthritis and inflammation. **Limbrel** is a prescription supplement that is more like a natural supplement than an NSAID, COX-2 inhibitor, or narcotic you can try. Too much can be very toxic to the liver, however.

There are many **topical balms** sold for pain relief (especially muscle and joint). The problem is that the ointment needs to pass through a lot of tissue before it gets to its intended target (if at all). Many make you feel better, but no studies have been done to show if they actually do any good. The active ingredient in most balms is **menthol**, which produces a cooling feeling. Biofreeze is incredibly popular, but is hard to get outside of a physical medicine facility. Balms can act as the transmission gel for ultrasound and the active ingredients can be delivered via phonophoresis. Capsaicin is one the most effective topical creams that actually works. Some creams and pain patches contain the NSAID diclofenac (and other ingredients like DMSO) and have also been shown to be effective. Common brands are **Voltaren**, **Pennsaid**, and **Flector**.



There are a few OTC supplements that are only for inflammation relief and do not directly relieve pain. These include the **proteolytic enzymes**: **bromelain** (take on an empty stomach), **trypsin**, and **chymotrypsin** and the **flavonoids rutin and quercetin**.

Omega-3 fatty acids like **fish oil** can reduce inflammation over time. **Flaxseed oil** requires too much ingested required in order to be useful. **Evening primrose oil (EPO)** and other forms of **gamma linoleic acid (GLA)** is sometimes used to reduce inflammation, but you need to take a lot since it broken down into more pathways than fish oils. There is insufficient evidence for **D-phenylalanine's (DPA)** effect on inflammation to recommend. **Vitamin B6, magnesium, and zinc** are all cofactors for optimal prostaglandin metabolism. B6 used in high doses can help with peripheral neuropathies. Ice is the most effective OTC pain, fever, and inflammation product available.

Osteoarthritis (OA) and Degenerative Joint Disease (DJD) Supplements

Many of the above drugs and supplements are also effective for joint pain due to OA and DJD. The following are specific to joint pain due to a lack of or injury to cartilage and connective tissue containing cartilage, most often manifesting as osteoarthritis or DJD. However, not all injuries to cartilage and joints are due to DJD, it can also be from a trauma, immobilization, or biomechanical stress. Inflammatory arthropathies like rheumatoid arthritis (RA), lupus, ankylosing spondylitis (AS), etc. are systemic, sometimes life-threatening conditions, and are to be treated by a qualified health care provider.

Glucosamine sulfate and **chondroitin sulfate** are extremely popular OTC remedies to help rebuild or support cartilage. You can take either, but be sure to get quality supplements that end in “-sulfate”, not “-HCL”. Glucosamine HCL is much easier to find on the shelf, but may not have any effect. Relief is not immediate, and it can take several months. You can take it in divided doses or all at once. After a few months, you can take a few weeks off and start again because the drugs stay in your system for quite some time. Both have come under fire

recently for possibly being ineffective. If no relief is offered in six months, stop using them – they are cheap and safe.

MSM and **hyaluronic acid** are usually taken in addition to glucosamine or chondroitin. Both have shown to be slightly effective for joint pain. Hyaluronic acid is also occasionally injected into the joint itself. **SAMe** is a chemical the body produces but has been shown to help with arthritis symptoms as well as depression and is recommended. **Avocado-soybean unsaponifiable** have been shown to help protect cartilage via anti-inflammation properties and is also recommended. **Calcium** and **vitamin D** supplementation have already been discussed the bone-loss related aspects of DJD, but of course, I just read a study showing both to be ineffective! **Ipriflavone** is a useful supplement to aid in and maintain bone density. It has been used to aid in boosting metabolism, but there is a big lack of evidence for that.

Tendon Repair Drugs and Supplements

B6 and **vitamin E** are showing a lot of promise in helping treat tendon injuries. **Nitric oxide** has also been shown to be very effective at accelerating healing of tendinopathies. To get to the tendon prescription grade transdermal patches of **glyceryl trinitrate (GTN)** are applied over the area. Sublingual spray and supplementing with **arginine** is less effective.

Tissue Repair Supplements

There is no magic healing pill. Supplements that aid in tissue repair mainly act as supporting enzymes, building blocks to tissue building cells or processes, or antioxidants. A basic list of tissue repair promoting supplements is: **vitamin C, calcium, magnesium, zinc, vitamin-D, vitamin E, B-vitamins, fish oils, selenium, manganese, copper, iron, calcitonin, protein, and amino acid supplements.**

EXERCISE AND STRETCHES

Most of the rehab exercises are also already listed in the training chapter since many of the rehab exercises should have been pre-hab exercises to being with. New exercises will be presented in the next section of this chapter alongside the condition or area they help with. Besides a quick fix, the one thing people love to get is rehab exercises and stretches – it's something you can do. Rehab exercises serve to re-pattern muscles and strengthen weak/torn or post-surgical muscles. But a lot of times, exercises are not what you need to heal until you've reached the proper stage so re-injury doesn't occur. The order of exercises to do is different than the order presented in the training section. The starting point depends on the severity and progression of healing of the injury.

Exercises aren't just to strengthen or stretch muscles. Rehab exercises and stretches are also meant to re-train your body to correct bad technique, posture, and imbalances (see reasons for injury). Exercise for rehab is the final polish on the recovery and repair of an injury (although it can begin immediately in some cases) and is what will train you to not re-injure yourself again. Although not presented in detail in this book, performing range of motion and body-weight exercises in a swimming pool can be very effective in post-acute or post-surgical rehab.

To remind yourself to do your exercises, set a timer or use an app to ring if you need to do an exercise multiple times, especially stretches.

SURGERY

Surgery should be the final line of treatment for pretty much anything wrong with you. Not only is it dangerous and expensive, it can also fail or cause more problems than it fixes. Any good surgeon should tell you this. Obviously there are times when you need

surgery, and it's a good idea to get at least two opinions. Sometimes surgery can be a quick enough fix with fairly a good outcome guarantee that months or years of continued rehab just to maintain a level of function just isn't worth it.

Surgery doesn't fix everything either. Obvious tears or tumors are one thing, but spinal surgery and joint repair sometimes just don't work. Become informed on the risks, post-surgical rehab involved, and percentage of positive outcomes for whatever surgery you are considering.

Ask around and find the best surgeon you can – travel if you have to. Surgeons, especially orthopedic surgeons can be total know-it-all divas (but not all!). They are very good at finding fractures, tears, and tumors on film, but often terrible at diagnosing other conditions – especially conditions that require an understanding of physiology and biomechanics. If they can't cut it out, it doesn't show up on film or a nerve study, then you don't have a problem in their view. If this happens to you, consult a neurological surgeon instead or a non-surgical specialist in the area that's bothering you. They may be able to help via drugs or injections, and possibly do a minor surgical procedure your orthopod should have done in the first place.

However, if you think you need surgery, try and make your first appointment with a surgeon, not a specialist that doesn't perform surgery (assuming you've exhausted non-surgical treatments). Why pay to see someone who will either tell you to get surgery not. If you need a springboard for ideas on conservative care vs. surgery then see the specialist first (or a highly recommended therapist). It is very frustrating to spend money for no reason on doctors telling you that you've essentially wasted your time.

Listen to the surgeon's advice regarding healing times and wound care, but don't count on their advice concerning activity modification or rehabilitation as being in your best interest. Go to a highly recommended sports therapist (a good PT or DC) before the surgery for tips on how to be in the best condition possible so recovery is minimal, and then immediately after surgery to begin rehab. Trauma from the surgery itself can prove to be more difficult to rehab than actual area that was repaired!

There are more surgical procedures out there besides opening you up, cutting something out, cleaning up a mess, sewing/stapling/screwing/pinning loose ends together, or creating artificial joints.

Grafting cartilage harvested from another joint in your body is more and more common. Using cadaveric meniscus **allografts** has been around for a while and is still an option. Heat can also be used in arthroscopic surgery to literally shrink-wrap a joint, tendon, or ligament to reduce hypermobility and instability.

However, as technology advances so do surgical procedures to minimize evasiveness and maximize self-healing. Instead of fusing vertebrae, surgeons are starting to use **prosthetic discs** instead. One newer surgical method is **Micro Fracture**, where small fractures are created on the underlying bone to stimulate cartilage regrowth in areas like the knee. Another method is called **Autologous Cartilage Transplantation** where cartilage is harvested, grown, and transplanted back into your joint. **Scaffolds** are starting to be used to patch soft tissues using pig or your own tissues. When scaffolding is combined with the cartilage transplantation described above you get a procedure called **Matrix Induced Autologous Chondrocyte Implantation (MACI)**.

Bone morphogenic proteins (BMP) can be used to enhance fracture and cartilage repair, and hopefully connective tissue injuries in the future. **Hydrogels**, mixtures of bioactive materials and growth factors can be literally spackled into a damaged area to patch and accelerate repair. Radio waves can be used to stimulate repair of fascia and tendons in **Coblation Microtenotomy**, which is a minimally invasive surgical procedure. **Bioabsorbable screws and sutures** use also being used more to reduce problems down the line and also to not have to have another procedure done to remove the objects. However, I was pretty keen on using my titanium pins for ultralight V-threader applications.

Gene and stem cell therapies will no doubt be the wave of the future. Your local hospital probably won't offer any of these procedures any time soon so you may have to travel. The FDA is painfully slow and inefficient at approving many procedures or allowing something approved for the knee to be done in the shoulder for instance. You may have to find a doc willing to go "off label", or go to another country.

WEIGHT LOSS, NUTRITION, CARDIO, HEAVY LIFTING, AND HEALTHY LIVING

None of these are direct therapies but can have a profound effect on rehab or prevention. First off, being overweight has a direct biomechanical link to whatever injury you have. Make your injury a wake-up call if weight is an issue for you. Proper nutrition is better than any supplement. Not only does your body make what it needs to fix you when it gets a wide range of nutrients and proteins, but also eating well reduces overall inflammation, which has a huge detrimental effect in the rehab process. Getting in at least a ½ hour of cardio three times a week and 2 days of heavy lifting (more than bodyweight) has a huge effect on your general health – down to the cellular level. Finally all those other bad for you things (you

know what they are), especially being stressed-out and unhappy are seriously contributing to becoming injured and slow recovery.

SKETCHY TREATMENTS

I've already listed a few borderline treatments, but all of the above-mentioned treatments have good evidence to back them up unless otherwise mentioned. Many treatments may have a reasonable theory behind them, but do not translate into providing a substantial enough outcome. Some are just plain metaphysical.

- Most commercial nutritional supplements and programs (motivation to show up or the placebo effect is what makes most of them work).
- Most detox treatments, especially foot baths
- Anything to do with manipulating or reading energy
- Anything with quantum physics in the description that cost under several million dollars
- Reflexology
- Magnet therapy
- Bio-Identical Hormone Therapy
- Homeopathy - Diluting a substance until no trace of the solute is present

TREATMENT PLANS

Assuming you aren't fixed by your therapist in one shot, you'll have to go back for more care. The stricter you are about following home care advice (ask for it!), the less you have to go back. You actually never have to go back – it's all about how you heal, how fast you want to heal, and what you're willing to live with. After an initial response to treatment therapy including exercises and

stretches, there may be a long (1-3 month) period of no improvement – even some flare-ups. After this plateau, if you continue treatment, there is slow continued improvement. Stick with it.

A standard treatment plan for a new injury or a long-standing chronic injury is two to three times per week for a few weeks, once a week for a couple months, then a follow-up visit or two. Figure on about twelve visits if you're optimistic, to twice that if you're a mess. Strict home care and lifestyle modification can cut those numbers in half. Pay your therapist at visit once you think you're feeling better. There may be unfinished business to get an area to fully healed, and you may pay the price ten-fold down the road by not finishing your treatment plan. I would never pre-pay for packages of services, or sign any contracts. Also you usually get what you pay for, so \$25 visits are usually crappy care, or a lure to get you to sign a contract for more expensive care.

Some therapists, especially massage therapists and chiropractors, will recommend you come in for general maintenance care to keep you healthy. If you suffered major trauma, or are exposed to repeated trauma (which is usually the case in climbing), and if you can afford it and feel better from treatment, go ahead. There is little evidence, however, that massage or chiropractic adjustments will prevent arthritis of the spine or disease and illness. However microtrauma through work, sport, or lifestyle causes constant stress and poor posture, so preventative care is really about fixing small problems before they become big ones.

QUICK TREATMENT REFERENCE

TREATMENT SUMMARY

Therapies that Protect or Immobilize

- Rest, Activity Modification, Bandaging, Padding, Splinting, Casting, Bracing, Taping, Strapping, Compression, Orthotics, Supports, Pillows, and other types of Immobilization.

Therapies to Reduce Pain

- Ice, Heat, E-stim, Diathermy, Ultrasound, Drugs/Supplements, Injections, Massage, Joint Manipulation, Traction, Exercise/Stretching

Therapies to Reduce Inflammation

- Ice, Ionto/Phonophoresis, Drugs/Supplements, Injections

Therapies to Reduce Swelling

- Elevation, Compressive Devices, Electric Stim, Ultrasound, Massage, Joint Manipulation

Therapies to Reduce Joint Pressure

- Stretching, Traction, Joint Manipulation, Surgery

Therapies that Promote Healing

- Heat, Lewis Icing, Contrast Icing, Diathermy, E-stim, Ultrasound, Laser/LED, Massage, Injections, Surgery, Supplements, Stretching/Exercise

Therapies that Improve Range of Motion and Reduce Muscle Tension*

- Stretching/Exercise, Heat, Diathermy, Electric Stim, Ultrasound, Dry needling, Biofeedback, Infrared, Vibration, Massage, Injection, Flossing, Traction, Joint Manipulation, Drugs/Supplements, Movement Therapy

Therapies that Stretch Areas

- Traction, Stretching/Exercise, Flossing, Massage, Joint Manipulation

Therapies that Strengthen Muscles and Tendons

- Electric Stim, Biofeedback, Vibration, Exercises/Stretches, Drugs/Supplements, Injections

Therapies that Reduce Scar Tissue and Promote Correct Tissue Remodeling

- Heat, Ultrasound, E-stim, Massage, Stretching/Exercise, Flossing, Surgery, Joint Manipulation, Traction, Movement Therapy, Drugs/Supplements, Injections

Therapies to Stabilize Joints, Ligaments, and Tendons

- Immobilization, Supports, Injections, Exercises, Surgery

**Therapies that relax muscles should be carefully examined before applying. Painful tight muscles may be splinting a hypermobile joint or may be tight and painful because they are actually weak. Relaxation followed by activation and/or loading could cause significant damage to the muscle, joint, or tendon. Once out of the inflammation stage, focus on therapies that strengthen or heal.*

REHAB BASICS

The basics of rehabbing an injury are as follows:

- **Identify the Cause**
 - ✓ Diagnosis of injured area and cause of injured area
- ✓ **Stop, Fix, or Remove the thing that's making it worse**
 - ✓ Cease or modify activity, protect the area, drugs, surgery, lifestyle modification, manual therapy
- **Help Remove Swelling**
 - ✓ Flushing out the waste products of inflammation allows more nutrients in, decreases pain, and allows for movement
- **Heal Damaged Tissues**
 - ✓ Promote blood flow, proper nutrition/supplements
 - ✓ Remodel scar tissue
 - ✓ Manual therapy and physical modalities
 - ✓ Movement, exercises, and stretches
- **Restore Range of Motion**
 - ✓ Manual therapy and physical modalities
 - ✓ Exercises and stretches
- **Fix Imbalances**
 - ✓ Exercises and stretches
- **Restore Full Strength**
 - ✓ Exercises

- **Retrain Coordination and Movement Patterns**

- ✓ Proprioceptive exercises and technique: single joint or multi-joint movement patterns challenged and retrained via instability, biofeedback (a mirror), oscillation (Bodyblade or TheraBand Flex-Bar for example), or drop and catch (dropping a limb and quickly stopping it without support)
- ✓ Biofeedback on sport specific performance (could be as simple as looking in a mirror or recording video)

ORDER OF EXERCISE PROGRESSION FOR INJURIES

- Passive pain free range of motion movements
- Active pain free range of motion with gravity and bodyweight gradually introduced
- Light active stretching at end range with more focus on the counter resistance than the stretch
- Eccentric contractions with gradual addition of resistance using tubing or light weights, and begin light pain free stretching. Begin with slow, mid-range of motion, then faster mid-range, then slow full range to faster full range.
- Concentric resistance training using tubing progressing to bodyweight or heavier weights (continued throughout the rest of the rehab until full strength is restored) and increased difficulty of eccentric contractions.
- Add isometric holds in various angles while continuing progressively deeper stretches, possibly pushing past pain barriers to restore full range of motion
- Functional movement pattern exercises, plyometric exercises, and proprioceptive exercises to restore correct muscle and movement patterns
- Build endurance tolerance up to normal levels

After these steps you can have at it to regain maximal strength and power.

EXERCISES

- New exercises introduced in the next few sections
- Warm-Up section from aerobic to balance
- Antagonist and Stabilizers section
- Stretching chapter
- Later stage: Intense Core section, Non-Climbing Supplemental Upper and Lower Body section, and some of the strength exercises in the Climbing Specific Exercises section.

NMS INJURIES BY TISSUE TYPE

To narrow down repeating information for every of specific named conditions, I'll begin by describing injuries by the type of injury to various tissues. If you didn't find what you were looking for in the rest of the chapter, it's probably here. Not every treatment will be listed for each condition, but if some treatments are particularly effective, they will be mentioned. Looks at the list of treatments, stretches, or exercises for more ideas.

What Exercises and Treatments Should I Do?

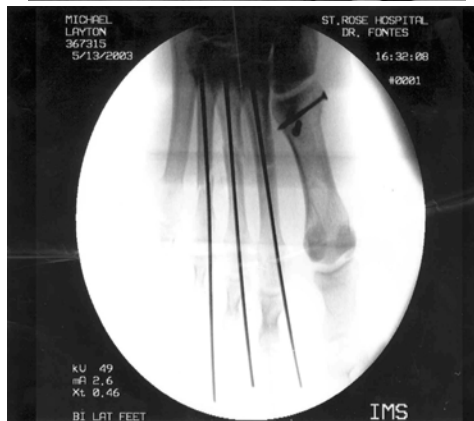
Just like in the training section, there are way too many individual differences be-

tween even similar injuries for me to hammer out a specific list of treatments and exercises for each condition. I have already given you the tools by listing all the current available treatments and what they address, and countless exercises and ways to do them. What I have done for you in the following sections is to explain the different structures and types of injury that commonly occur as well as more specific injuries that happen to different areas of the body. Combine this with having read and understood why and how injuries can happen and you should be able to come up with a game plan or add to a plan laid out by a therapist. You may want to reread the first few chap-

ters of the training section along with this chapter to help you sort through the information that best applies to you and your condition.

BONES

Fracture



Yours truly after breaking all the metatarsals in both feet

Breaking a bone can sometimes be a mixed blessing. Broken bones follow a fairly predictable healing pattern and timeline, and recovery from a minor break without complications is usually complete. The problem arises when joints and ligaments are also damaged because they take a lot longer to heal completely. It's obviously important to

cast, or immobilize a fracture so the bones can join properly. A cartilaginous callus should form around the break in about two weeks. During the next few weeks, new bone replaces the callous. New bone is constantly deposited, and old areas are reabsorbed until the fracture is as good as new. This process of deposition and absorption actually occurs in all of your bones all the time. It takes about five years to completely remodel your entire skeleton. A fracture generally takes 6-12 weeks to stabilize and become able to bear weight.

Bones can develop small hairline or stress fractures that can mimic muscle or joint pain. They usually heal on their own in about a month to three months, but complications can arise if the fracture is made worse by continued stress or activity. The pain may be difficult to pinpoint and may be difficult to reproduce, confounding diagnosis. X-ray may or may not show a fracture, especially if it is very small, or in an area that is difficult to view such as an ankle or wrist. It takes about two weeks for a callus to develop over the fracture, and may not be visible on X-ray until then. Be sure to get a follow-up X-ray after two weeks if it's still on the table as a possible diagnosis.

Avascular necrosis (AVN) can develop in untreated fractures, as can chronic joint instability. AVN occurs when a section of bone is cut off from blood supply and dies. High-risk areas for AVN can be detected with a bone scan, and sometimes a CT. Be extra diligent about possible undiagnosed fractures in ankle and wrist sprains.

There are many different types of fractures. Some only require immobilization to heal, while others require surgery to realign the bone, patch together or remove bone fragments. In most cases, the surrounding soft tissues require more prolonged rehab than the healing of the actual fracture – either due to injury to those tissues, or due to im-

mobilization. Fractures that are close to, or extend into a joint are very susceptible to future arthritis.

Returning the area to optimal function post-fracture healing will decrease the likelihood of developing arthritis (or degenerative joint disease). Some fractures that are stabilized with pins, screws, or plates do not require these implants to remain after the fracture has fully healed. At this point it is just a game of what's worse: minor surgery to remove the implants and the subsequent month or so of inactivity, or dealing with any pain from the implants.

Make sure you are getting at least your RDA of calcium, vitamin C, other minerals and plenty of protein. Don't try to bear weight on the area, or support yourself on the area, even with a cast on. Let your body do its job, and don't make it worse by aggravating the area. As with any injury, staying as active as possible will dramatically increase your healing time, assuming you don't aggravate the injured area.

Once the cast is off, you can go to town on beginning to rehab the area. Begin with slow progression to weight bearing, as the fracture is probably not fully stable. Much of your rehab will be restrengthening, regaining range of motion, and healing the surrounding muscles, joints and ligaments that have atrophied during immobilization or have been injured from the accident or surgery. Make an appointment with a therapist the day your cast comes off.

Avulsion or Rupture

An avulsion or rupture occurs when a tendon (holds muscles to bones) or ligament (holds bones to bones) is stronger than its bony connection, and instead of snapping, it pulls off a section of bone. This usually occurs on the larger muscle groups such as the Biceps tendon of the arm, or Achilles tendon of the lower leg. These can surprisingly

heal on their own, but surgical repair can be necessary. Definitely get a consult. Prognosis, treatment, and rehab are very similar to a fracture. However, it is easier to re-injure the area during healing since you've got a large muscle that will be tensioning the area. Also, it is very likely that the tendon, joint, and or muscle have sustained some injury as well.

Follow rehab protocols for those areas as well. Extra diligence is required to ease into weight bearing activity. Chance of re-injury is high which is a bummer because you'll have to be careful for quite some time after everything has healed. Having someone evaluate your technique or for muscular imbalances is a great idea, since unless the tissues in that area was just especially weak (genetics), there is a good chance that you were over-favoring that area.

Dislocation

Dislocations can be chronically annoying problems, or life-threatening injuries. Dislocations in the knee, hip, and spine should never be reduced except in the hospital as major arteries or the spinal cord could become severed or damaged killing or paralyzing you. Dislocations in other areas should only be reduced in the field if the victim has had this happen before and knows what to do, or if it will be a long time before you reach a hospital. In-line traction is the safest and most effective emergency treatment. Dislocations stretch out and weaken the joints, ligaments, and connective tissues holding the joint in place and can become chronically unstable. Scar tissue can develop from one or repeated dislocations. Use rehab to address damaged tissues and scar tissue, as well as rehab to strengthen unstable joints, muscles, tendons, and ligaments.

Bone Bruise

Blunt trauma, even overuse can cause your bone to become bruised, and swelling oc-

curs between the bone and surrounding periosteum. This is almost always just an additional symptom to another injury, but the pain can mimic other conditions or confuse diagnosis. An MRI for a different condition is most likely what will pick up a bone bruise. Treatment for other underlying conditions will most likely resolve the pain from a bone bruise. If a bone bruise is the only thing wrong, rest, reducing inflammation, and minor immobilization are the best treatments.

Spurs, Bunions, and Malformations

Bones can form spurs and bunions due to increased pressure over an area or develop malformations due to genetic anomalies. The problem arises when the extra bone causes inflammation due to pressure or friction on an outside surface (usually shoes), or puts extra pressure on internal tissues such as nerves and tendons. Finally, changes in shape can cause biomechanical problems. I will address common examples in the section that addresses specific, common injuries. Treatment can be as simple as getting a better fitting shoe, to surgically repairing the area. Mobilization of surrounding joints could help minimize the impact of a bone spur. Immediate treatment is usually dealing with inflammation from the pressure or friction.

JOINTS

Joints are tricky because many structures converge here, and issues can be from one or more damaged tissues including tissues inside the joint tissues and tissues that connect to or into the joint, as well as from biomechanical problems relating to movement or aberrant motion (or lack thereof). Joints are surrounded by a capsule made of connective tissue, and contain cartilage that covers the bone, ligaments connecting bones, and a meniscus made of dense connective tissue in some joints for extra protection. The joint is filled with synovial fluid that lubricates the joint and provides nutri-

ents via absorption, as the tissues mentioned do not have direct blood supply.

One good way to rule in joint problems is that compression of a joint is often painful compared to when muscle or tendon injuries are not.

Subluxation and Joint Dysfunction

A subluxation is a minor dislocation where a bone is slightly out of place either due to trauma, one side is being pulled too much, or one side is excessively tight. Some chiropractors use the term to also mean that a joint is not moving properly (too much or too little), and is also defined as joint dysfunction. Any of these causes can create inflammation, edema, pain due to lack of motion (joints that don't move signal pain), referred pain to other areas, nerve pain and nervous system symptoms due to pressure or inflammation, and biomechanical problems locally or elsewhere due to aberrant motion.

Facet syndrome is a common joint injury in the spine due to joint dysfunction. Facets are the articulating surfaces in your vertebrae and can become inflamed. There are many nerve receptors in and near the vertebral facet joints, and the pain can be intense and simulate more complicated problems such as disc or nerve root injury. Facet syndrome can be caused by poor posture, instability, muscle imbalance, or trauma. Treating consists of addressing inflammation, and removing the cause of the pressure. Addressing underlying causes such as posture or imbalance takes time and a smart therapist.

Joints that don't move properly are either stuck in one or more directions or are unstable and move too much in one or more directions. Joints become stiff if structures tighten via disuse or scar tissue from injury, poor posture, or improper biomechanics (one or more weak-links in the chain). Many

times a joint will be stuck because one or more joints up or down the line are hypermobile (too loose). Tight joints may also be from splinting of surrounding muscles to protect the joint.

Joint dysfunction is almost always an indirect result of a problem elsewhere or a direct result of an injury to the joint. If nothing seemingly caused the problem, investigation of the underlying cause should take place instead of just treating the immediate area. Stuck joints can be unstuck by stretching, mobilization, manipulation, and by addressing underlying causes. Over treating tight joints can cause more problems than it fixes by making the joint hypermobile and paradoxically creating more tightness by having surrounding tissue splint the joint further. It would take months of overtreatment to create this problem, however, so a few adjustments or therapy sessions probably won't hurt if they are being applied properly.

Joint instability/hypermobility is very hard to fix. Not only is it more difficult to tighten up a joint than it is to loosen it, as mentioned, unstable/loose joints can present as tight joints due to splinting or inflammation. Joint instability usually presents as chronic pain in the area that gets better with treatment, but reoccurs soon after treatment. Occasionally clicking, popping, or shifting sounds will present – aiding diagnosis. Motion imaging can be done to inspect the joint motion, but is expensive and exposes the patient to excessive doses of radiation unless diagnostic ultrasound is an option. A series of X-rays taken at the end ranges of motion can help determine instability, but many times the instability is too minor to detect on film.

Joints that are excessively tight in one direction can cause the other direction to become too loose, or vice versa. Usually the tight side is treated, hoping that the aber-

rant motion will normalize. Joints that are loose or unstable can have tight muscles surrounding the area, multiple myofascial trigger points, and referred pain patterns. If in the spine, you may feel the desire to constantly self-adjust (pop) the area. Chronic injury to an area may be the result of an unstable joint.

Treatment involves getting stuck side to move and strengthening the loose side as well as removing any scar tissue. Finding the underlying reason elsewhere in the kinetic chain can be very difficult, but may be necessary to stop the imbalance or compensation that is occurring.

Arthritis

Osteoarthritis (OA) and degenerative joint disease (DJD) are basically synonymous genetic disorders that occur as one ages, usually appearing around middle age but can begin as early as in your mid to late twenties. They are not to be confused with inflammatory arthropathies like rheumatoid arthritis (RA) and lupus, which are more serious conditions usually autoimmune and genetic in nature and should be managed by a rheumatologist.

The joint space between articulating bones begins to decrease, generally due to the destruction of cartilage and growth of bony spurs. The cortical bone (surface of the bone) begins to erode and weaken and can form bone spurs. Fusion of bone and total destruction of the joint can occur in later stages.

The key to treating arthritis is early prevention. Inflammation and trauma are usually what triggers the onset and progression of arthritis, therefore controlling inflammation and rehabbing injuries fully in joint-related injury is very important. Disuse and immobilization will also accelerate arthritis - so keep moving. Remember, it's not motion that causes the problem (motion nourishes

and strengthens joints) – it's incorrect motion causing inflammation or damage that's the problem. Repetitive trauma or trauma from a single event can cause arthritis down the line. It may not develop for years, but the chances for developing arthritis in a damaged joint skyrocket.

Non-prescription medications may help. Other prescription meds can help if OTC treatment isn't helping. Some surgeries can be performed to remove spurs, replace the joint (cover it in metal), and stimulate regrowth of cartilage if conservative treatment isn't helping – as well as some newer injection treatment options. Occasionally surgical fusion of the joint is necessary to prevent further irritation.

Arthritis is usually stiff and achy in the morning, or before a solid warm-up, and improves as the day progresses unless aggressive use of the joint causes inflammation. Heat, especially moist heat, is helpful at getting stiff achy joints feeling better, and reducing inflammation when they begin to hurt. Traction can also be helpful sometimes.

Other consequences of arthritis are joint mice, loose bodies of cartilage or bone inside the joint, or calcification of cartilage and connective tissues inside the joint. It is difficult if not impossible to reverse calcification or degeneration of subchondral bone. Occasionally calcified tendons (calcific tendinitis) can be repaired via ultrasound.

Capsulitis and Contracture

Joint capsules can become inflamed, or overly tightened due to scar tissue, immobilization, or posture. Painful or tight joint capsules are difficult to diagnose as symptoms can be confused with sprains/strains to muscle and ligament, tight muscles, or joint dysfunction. Cortisone injections may be necessary to break the inflammation cycle as cold may not reach the joint and

drugs won't reach the area due to the poor blood supply. Deep manual therapy and constant end-range stretching or traction may be necessary to loosen up the tight, fibrotic tissue.

Articular Connective Tissue

As mentioned, a meniscus is a thick fibrous cartilaginous connective tissue that covers the surface of several joints, also known as fibrocartilage. The most famous and most injured is the meniscus inside the knee. Another very common structure, the labrum in the shoulder, is very similar to the meniscus.

A meniscus or similar structure can be torn, a flap can develop and get in the way of joint movement, develop microtears, or become bruised, degenerated, or dislocated. Signs and symptoms are deep pain, pain with pressure or certain movements, or catching/clicking/popping with movement. Small tears and bruises often resolve on their own, but can take months of active rest (the joint still needs movement to heal). Surgery to sew up the tear or replacement with cadaver tissues can often become necessary as healing larger tears or degeneration is very difficult. Other commonly injured articular discs are inside the jaw (TMJ), and wrist (triangular fibrocartilage). Meniscoids are smaller menisci in the spine that can literally get pinched and trapped in a joint, causing pain. Relief is usually instant with joint manipulation or traction. Plicae are folds of synovial tissue inside the knee that can become damaged or pinched similar to a meniscus or disc.

Intervertebral discs are generally famous for the herniations they can create. These semi-cartilaginous structures provide shock absorption for the spine and have softer interiors, or nuclei. With enough pressure or degeneration, the nucleus can bulge or fully rupture and compress the spinal cord or nerve roots coming off the spinal cord. The

thoracic spine generally doesn't herniate (although degeneration and discogenic pain in the mid back is common), and specifics on neck and low back disc problems will be discussed in greater detail later. Bulges and herniations can and often do resolve on their own, but treatment can help and surgery is sometimes necessary.

It's interesting to note that many people have herniations with absolutely no symptoms, and many people with symptoms of herniations don't actually have them. Think about that before you rush to get surgery. Discs are very pain sensitive, and discs can have micro tears of their annular fibers of varying degrees. Inflammation because of this can mimic a herniation, facet syndrome, or a sprain. Discs usually get injured due to poor posture (too much flexion/creep) combined with a rotatory force and/or forceful loading. Constant vibration can also predispose a disc to injury. When a nerve root becomes compressed or irritated, pain can zing down an arm or leg, followed by numbness or motor weakness. However, pain can be local or radiate in a scleratogenous pattern even if the spinal cord nerve roots aren't involved.

Injuries to articular cartilage not related to DJD or trauma are almost always a result of poor technique, muscle imbalance, and posture.

Bursitis

Sacks of synovial fluid cover several joints in your body to act as protective pillows. These sacks, or bursa can become inflamed from blunt trauma or repetitive pressure. Common areas in climbers are over the elbows, fingers (especially from ice climbing), and over the shoulder. Bursitis is very difficult to treat, again, because there is no direct blood supply to the area. The bursa will get inflamed and swell causing pain, and then take forever to de-swell and heal.

Ice helps, but avoiding re-injury is the best treatment. NSAIDs can help, but not much. Injections may help drain it, and a cortisone shot may offer relief, but generally this treatment is only used in severe or chronic cases. Bursitis from ice climbing can be prevented by using gloves with knuckle padding or using leashless ergo-style tools and by sewing/gluing light kneepads into your bibs.

TENDONS AND LIGAMENTS

Sprain

A sprain is when a ligament becomes stretched and torn. The same thing can happen to a tendon, known as a strain, but the effects are more similar to a strain than a sprain. Sprains and strains are graded by how much the structure has been torn – from micro tears to full ruptures. Interestingly enough, small tears are often much more painful than larger tears, and sometimes complete ruptures are painless. Surgery is sometimes necessary in very large tears and ruptures. Interestingly enough, even full ruptures can heal on their own if fully immobilized for several weeks. Always get a surgical consult, but sometimes conservative management (full bracing) can result in more successful outcomes if the surgery is particularly invasive.

Sprains are usually caused by a single trauma, but repetitive microtrauma can wear down a ligament or tendon over time. Treating for inflammation along with partial to complete immobilization depending on the size of the tear is usually the standard treatment. Once the ligament or tendon is able to bear weight, rehab can begin gradually working range of motion and light stretching, to strengthening the surrounding muscles. Scar tissue can develop and treatments to reduce it are very helpful.

Ligaments can become lax, or overstretched causing joint instability. Either the surrounding structures can be strengthened, or

injections and surgery may be necessary of stabilizing surrounding structures isn't good enough. Some people can be so strong, that they can have ruptured ligaments without even knowing it.

Tendinitis, Tendinosis, Tendinovaginitis, & Tendinosynovitis

Tendinitis is probably the most common type of injury that climbers get. Tendinitis is inflammation of tendons, which connect the muscle to the bone. Too much force concentrated over a small area causes micro-trauma and therefore inflammation. For climbers, this is generally in the fingers, elbows, shoulders, or knees. Because tendons don't get direct blood supply, recovery and treatment are difficult.

The best treatment is prevention by correct posture and technique, not over-training or pushing yourself too hard, limiting dangerous activities and postures like crimping, dynoing, and offwidths, and exercising antagonists and agonist muscles to spread forces over a broader area. Tendons and ligaments get stronger by constant force (like bone and skin), but take years to adapt to hard climbing. Injury obviously weakens them, and a vicious cycle of re-injury can develop. Tendons can also become loose, or develop scar tissue. Generally, pain occurs when the area is out under load or is compressed.

Once inflammation has been controlled, treat to reduce scar tissue and strengthen the tendon. Cortisone injections can sometimes instantly cure a bout of tendinitis, but is dangerous because the tissue is severely weakened by the injection. The best post-acute treatment is to figure out the cause – usually poor technique, overtraining, and muscular imbalances. Immobilization may be necessary in acute or chronic cases. Tendinitis can be very slow to heal and may take a year to resolve, or at least calm down

enough to become manageable if other factors limit healing.

Chronic tendinitis can become tendinosis, and as discussed, this becomes less of an inflammation problem and more of a degeneration and nervous system issue. Stimulating the area via manual therapy, mobilization, or injection may become necessary. Too much strain or impact on tendon makes scar tissue thicken the tendon. The thickened tendon then rubs on the sheath covering the tendon causing tendinovaginitis or synovitis. This friction causes more inflammation, and a vicious cycle begins.

Treatment for this is 1-2 weeks of immobilization, 1-2 weeks of additional rest coupled with NSAIDs, ice, and possibly a cortisone injection. This is a case when you want to stop inflammation because it has created scar tissue that is creating more inflammation. Manual therapies are also effective. Many times the muscles that develop tendinitis are ones that are supposed to stabilize. Therefore progressive eccentric training can be effective for tendinitis and very effective for tendinosis. Practice eccentric exercises daily to 3 times per week doing 3 sets of 10-15 reps that walk the line between pain-free and painful near the end of each set.

MUSCLES

Strain

The big injury to muscles that hasn't been discussed yet is a muscle strain, or pulled/torn muscle. Just like a sprain, strains are graded on the severity of a tear. Muscle strains can hurt quite a bit, but luckily this is because they have an excellent blood supply.

Treat mainly for inflammation and swelling, and rest and protect the sprained muscle. Begin stretching and rehab after the swelling and acute stage has passed. Manual

therapy can help speed recovery and remove any scar tissue that may have formed. Pain can last for quite some time after the tissue has healed in moderate strains when smaller nerves to the area are damaged, or new nerve proliferate into the area. This condition requires more aggressive rehab, and may require you to push through the pain. Electrical stimulation is especially useful in muscle strains, or pain syndromes due to muscle injury. Depending on the severity of the strain, begin exercises and stretches from the most basic to the most functional, especially eccentric training and proprioceptive training. A minor grade I strain heals in about 2-6 weeks, a moderate grade II strain heals in about 6-8 weeks, and a major grade III strain will take 8 weeks to about a year to fully mend.

Bruise

Bruising occurs when a crushing or tearing injury to the muscles causes capillaries and other cells (like muscle cells) to rupture and leak fluid. The fluid has nowhere to go, and it takes time to reabsorb. Most bruises are benign, but some bruises mask larger scale tissue damage. Sometimes the bruise calcifies inside the muscle, a condition known as myositis ossificans. Ice and protection are the best treatment, but Kinesiotape and ultrasound can aid in accelerating recovery.

Deactivation, Shortening, and Tightness

This has also been discussed a few times in much more detail, but to summarize, muscles can be deactivated or defacilitated due to chronic postural over-stretching and nearby joint dysfunction or joint dysfunction near the spinal cord. A posturally over-stretched muscle may feel tight, as could a muscle covering an unstable joint. Active stretching resulting in a muscle “letting go” is a good way to determine if a muscle is tight due to postural or biomechanical reasons, versus muscles that are tight from being shortened. Shortened muscles are generally the result of trauma and scar tis-

sue, or creep due to postural problems or muscle imbalances. Muscles that are over-facilitated and feel tight are generally muscles that get a lot of use and are proportionally too large compared to other agonists or their antagonists.

Cramps

In my opinion, detraining, or not being used to the demands you are placing on the muscle is the most common cause of cramping, especially repeated eccentric and isometric contractions in flexor groups like the calf, biceps, and forearms.

If you really want to prevent cramping, train the muscles predisposed to cramping by overloading them in the way you will be using them. Constant stemming, sloping belays, and ice climbing are common times to get leg cramps. Long all-day face climbs and crack climbs are common times to get forearm and biceps cramps. Jugging, hauling, belaying a stiff toprope, or any constant rope-pulling activity like belaying, hauling, and rope management also are very common times to develop cramps. Train for these situations.

Dehydration (especially via a hangover) is number two on my list of common causes, very closely followed by low blood sugar. Being too hot can also cause cramps via losing the thermoregulatory properties of water and being dehydrated or actual overheating from exercising and outside temps. Muscle contractile proteins can stop working or denature at certain temperatures. See the section on water for more info. Depleting muscle glycogen combined low blood sugar will start to cause muscle breakdown and the metabolic byproducts could also cause cramping. Also, when breathing hard you may not be exhaling enough to CO₂ to buffer the acid build up in your blood. Try overdoing your exhale and taking a large abdominal breath to flush out excess CO₂ and to re-oxygenate the blood.

Electrolyte imbalances have never been proven causes and chances are that you've got plenty of stored electrolytes – just not enough sugar and water in your blood. Not enough magnesium (helps muscle relax), calcium (helps muscles contract – good because it helps weaker muscles) and sodium/potassium (helps nerve propagation) can all predispose you to cramps. If supplementing with electrolytes, make sure you get all of these minerals.

The new supplement making big headlines in treating exercise cramps is **pickle juice!** The science behind this isn't there yet, but major sports teams are already using it as their go-to cramp reliever. It's unclear if it's the high sodium or acetic acid content (or placebo) that is helping. **Acetic acid (vinegar)** is a precursor to acetylcholine, a major neurotransmitter in muscle activation. If cramps are an issue and the other tips haven't helped, you may want to try a small vial.

Fascia

Fascia is the tissue that covers, protects, compartmentalizes, and lubricates muscles, muscle fibers, and even large sections of body area to stabilize and help coordinate movement. Some movement therapists and anatomists have dissected fascial planes that show how structure helps dictate movement and function. Fascia is subject to contracture via postural shortening, and to developing scar tissue and adhesions. Local problems in muscles and joints can occur when the muscle fibers don't glide properly, and can cause global effects because the fascial planes connect multiple areas – so adhesion and restriction in one area can also restrict movement in another area. Reducing tightness and adhesion in muscles or fascial planes can help relieve postural and movement problems, relieve pain, and increase range of motion.

Compartment Syndrome

This is a fairly rare but very serious injury that can actually occur from overuse, trauma, and infection. Common areas for climbers are in the forearm, and in the antero-lateral side of the lower leg or calf from running. What happens is that inflammatory products, edema, and swelling from an injury or overuse are not able to drain from an area walled off by connective tissues or other structures. The swelling and pressure cuts off blood and nerve supply. Surgery is necessary and often necessary immediately. Pain and or loss of sensation should get your butt to the ER before you wind up reading this for help in self-diagnosis. Basically if symptoms don't reduce with ice and elevation in a few hours you need to go the hospital.

A more chronic version of this is exercise induced chronic compartment syndrome (EICC), and although serious, it is usually not life and limb threatening. Symptoms are similar but not as severe and go away with rest. Getting continually and abnormally pumped in the forearm is a yellow (not quite red) flag. A surgical fascial release is required.

Rhabdomyolysis

This is a condition that would never have made it into a book like this without thanks to hard-core training modalities – specifically CrossFit. Rhabdo occur when muscle tissue is broken down too quickly or too often from overexertion, and the kidneys begin to fail with the toxic proteins polluting the blood.

NERVES

Nerves take longer to heal than any other tissue. Severely damaged nerves can never heal. Even minor injuries to nerves take at least a couple months to regain normal sensation. Nerves, like any other tissue, can be stretched too far, compressed too much, bruised, and inflamed. Injuries to nerves can

be felt as local pain, numbness, tingling, or shooting pain down a limb.

Nerves conduct information via electrical propagation, and even light pressure can interfere and cause symptoms described above. Muscles innervated by nerves can become victims by becoming weak, deactivated, or paralyzed. Pressure at multiple points along a nerve pathway are more than just additive, they effects become multiplied. This is known as double crush: two minor nerve problems that wouldn't cause problems on their own now cause pain, weakness, or tingling. This can make diagnosis quite difficult if the source of pressure is minimal. As mentioned earlier, nerves can generate local, radicular, referred, and scleratogenous pain.

Traction injuries to nerves from trauma are usually longer lasting due to damage to the nerve or neural sheath. Compression injuries can resolve if the pressure is removed and the nerve was only compressed, not damaged. Nerves can be compressed by swelling and inflammation of surrounding structures, by scar tissue and bone spurs, subluxations, or by disc bulges and herniations. Compression of nerves due to extreme crimping, and jamming can also occur to cutaneous nerves (skin nerves), often resulting in paresthesia, or mild numbness. Tight clothing or equipment can cause this elsewhere. This can take a month to a couple years to fully resolve.

Nerves reside inside a sheath, much like tendons, and adhesions or irritation can occur. Short-term compression of a nerve causes that awful pins and needles feeling, and can also cause an area to go numb, or "fall asleep". Numb limbs or tingling are almost always a result of nerve compression and not compression of an artery or vessel. Cutting off the nerve supply to an area temporarily or intermittently will not damage the affected tissues. Long-term reduction in

nerve impulse will cause muscles to weaken and atrophy, however. Even a small amount of pressure on a nerve can result in a marked loss of strength to a muscle. Cold injuries can damage nerves for a long time as well.

Rehabbing nerve injuries begins by treating for inflammation and stopping whatever is causing the problem. Removing the problem usually provides an instant fix unless cell damage to the nerve or nerve sheath has occurred, then you are pretty much limited to rest and waiting with the exception of certain electrical modalities. Do not apply cold to nerve injuries, but around them. Most direct therapies should not be applied directly to nerve injuries. Fix around them and wait for them to heal.

BLOOD VESSELS

Most NMS injuries also wind up injuring surrounding blood vessels (causing swelling, bruising, and inflammation), but specific injuries to blood vessels is fairly uncommon. Injuries to arteries and vessels are usually diseases of age, lifestyle, or genetics. The obvious exception is cuts and punctures from the outside or inside (usually due to fractures and dislocations) that cause bleeding. This is discussed in the First Aid section.

Any injury that damages major vessels, limits circulation or causes ischemia is an immediate trip to the ER. Ischemia means that the blood supply to an area has been cut off due to blockage or compression. Unlike compression of a nerve, compression of a vessel will kill the area that it supplies. Pressure to veins or lymph channels can impede drainage and create swelling – which can in turn cut of arterial flow (causing ischemia). Ischemia is incredibly painful. Ischemic areas can become white, purple, or blue, and will hurt very badly, and may become cold or numb. Numbness without a lack of color to the skin is almost always from nerve compression. Once the blood supply is re-

stored, pins and needles sensation may occur, but again, pain is a predominant symptom (put a rubber band around your finger for a few minutes to find out).

AVERAGE HEALING TIMES*

- Bone – 3 to 4 months
- Cartilage – 2 to 6 months
- Ligament – 5 to 12 months
- Muscle – 1 to 6 months
- Tendon – 5 to 12 months to regain 90% strength**

**time will depend on many factors*

***may never fully regain complete strength*

NMS UPPER BODY CONDITIONS

Even specific conditions have repetitive patterns, causes, and fixes that intermingle with other conditions. I strongly urge you to read as much as possible instead of skipping to the exact point of concern. For example: problems in your feet can cause problems in your knees, etc. In the next few sections I will discuss specific, or named conditions to help you diagnose and treat the area. Many specific injuries are the same injuries to other body parts or tissues, therefore if no specific treatments are listed check with the Injuries by Body Area, and Treatment sections to get ideas. For specific exercise not listed in under an injury, follow the Rehab Progression and Exercise Progression guides and pick out exercises from the first few chapters of the book that target that area and fit the specific protocol.

HEAD AND NECK PAIN

Head and Neck Posture

The muscles, nerves, and joints of the neck are very pain sensitive and most neck pain is a result of postural or muscle imbalance problems that can cause sprains, strains, facet syndrome, or discogenic pain from compression or tearing of discs and nerve roots. The head is very heavy and is constantly supported by the spine and muscles that attempt to keep it perfectly balanced. They are in a constant tug-of-war so your head doesn't just flop to one side, messing up your sense of balance and visual tracking. Changes in this balance can put excessive strain on tissues, causing pain. Constant

forward head posture from driving, reading, and staring at various types of computer screens all day long also puts a big strain on the neck. Get a book stand if you're a student or read sitting at a table and make sure your computer monitor is high up enough (it probably is too low if using a laptop). All of these bad postures mess up the normal curve of the neck, which puts extra pressure on the joints, ligaments, and discs. Symptoms can range from neck pain, headaches, sore traps and upper shoulder blades. Problems in the upper thoracic spine and shoulders can also cause neck pain or refer into the neck. Chronic neck issues can also lead to cervical spine instability that will only exacerbate the problems that lead to the unstable neck. Leading with your neck and traps, especially when inappropriately doing ballistic movements while lifting weights, can quickly lead to neck and shoulder issues.

Climbers constantly stretch out the front of their neck, and compress the back of it by belaying. **Prism glasses** are lifesavers and I highly recommend them. Since we spend about a 1/3rd of our life laying down sleeping, one way to prevent neck problems is to improve sleep posture via pillow choice. Basically, you want your neck in the same position sleeping as it is while awake. The best sleep position is on your back, but this just isn't possible unless you really suffer a bit and practice. There are many options

out there like rolls, cut outs, memory foam, and water-based pillows.

All treatments are game depending on the nature of the injury, but the best solution is to fix the postural problem or habit causing the neck pain. Too much treatment to neck muscles may result in rebound pain. Retraining correct head posture isn't as simple as trying to maintain perfect posture all day. Forcing perfect neck posture will probably just result in more headaches and neck pain. Strengthen the scapular stabilizers and do neck retraction exercises.

If strengthening areas doesn't fully work, you may need to do some more intense postural re-training. This involves combining cervical traction with passive use of a **neck orthotic**. Traction isn't always necessary, but it sure helps. A neck orthotic is really just a firm wedge you lay on to passively stretch your neck (see stretching chapter). They can be hard to find (check chiropractic and PT suppliers), so a firm roll of paper towels, rolled up bath towel, or lying over the side of the bed may have to do. The key is to have the apex of the wedge tucked tight up against the top of your shoulders and at the very base of your neck. Begin by laying for 5 or so minutes, and work up to twenty minutes.

Finally head weights, which look totally absurd, can help. By placing a small amount of weight on the front of your head, you will reflexively pull your head back and train the weak links automatically. Sitting on a Swiss ball or wobble chair while wearing head weights will help get all the correct muscles fired up. Extension exercises on a Med-X machine if you can find one are very helpful.

I have performed, and been subject to a fairly disconcerting (aka scary) chiropractic cervical traction adjustment. I wouldn't recommend this as the initial go-to treatment,

but for some it is the miracle treatment. The chiropractor, using their hands, a towel, seatbelt strap, or a water-ski rope with a neck harness for the grand-daddy adjustment pulls quickly up on the skull releasing pressure off the joints and discs in a vertical direction.

There are some named technique systems for totally retraining spinal posture, specifically CBP and Pettibon practitioners. While the intent is good, many docs use these systems as marketing tools and scare tactics to retain patients. There isn't overwhelming evidence that perfect spinal posture can fix future problems or delay DJD, or that the results will last.

Neurologic Neck Pain

The neck contains all the nerve roots of the nerves that innervate your shoulder to your fingertips. Unexplained pain or neurologic symptoms in the upper extremity should always consider pathology from the discs, facets, and nerve roots of the neck or the brachial plexus (bundle of nerves from the neck to shoulder). Because of the double crush syndrome explained earlier, even minor problems up the line can help compound symptoms distally (toward the fingers). One source of neurologic pain/symptoms from the neck is a genetic abnormality known as a cervical rib. These lucky folks have an extra pair of ribs on their last cervical vertebrae. The problem is that there isn't always enough room for the rib and the brachial plexus of nerves and vessels that should pass unobstructed through the area. Therapy for this is to try and correct posture to allow more room, or unfortunately, surgery. Cervical ribs are usually looked for when patients complain of symptoms that pattern thoracic outlet syndrome (described later).

Disc herniations are fairly uncommon for those under 50, but can happen, especially in traumatic injuries. When a cervical disc

bulges into a nerve root, pain, tingling, numbness, or muscle weakness can result down the arm. Excessive inflammation, stenosis (see a specialist), and DJD can mimic symptoms of a disc injury because they occlude the space the nerve roots occupy in the spine. Unlike low back pain, neck surgery is a lot more successful – but a lot more dangerous. The first goal is to reduce swelling and inflammation, then apply any or all therapies that make sense, especially traction, hoping the disc will reduce on its own.

Headaches

Headaches can be from quite a few causes, but muscle tension headaches are the most common. These respond to OTC pain medication, heat, and gentle manual therapy. Climbers are especially susceptible to headaches due to low blood sugar and dehydration. The solution to that should be obvious. Some headaches, migraines for example, are caused by too much blood from over-dilating blood vessels. A great treatment for this is an ice pack under the base of the skull and forehead (sometimes a hot/cold combo on the forehead/neck works too). Manual therapy that puts short bursts of fairly firm bilateral pressure over the mastoid process works great, as does laying the sub-occipitals over a pair of curled-up fingers and using the weight of the head for pressure. Spinal manipulation is also a decent therapy to try.

Migraines and other systemic headaches may require meds or OTC supplements. Magnesium seems to help those with migraines. If migraines are chronic, get your heart checked for a patent foramen ovale, a genetic leftover and usually benign small hole in the heart linked to migraines.

Neck Key Movement Test

A good screening tool for neck, upper back, even shoulder problems is to first look for forward head posture. The movement

screen is a pass/fail on prone neck retraction. If shaking or chin jutting occurs within 8 seconds, then there are postural or muscular imbalances. See the warm-up section for photos of neck retraction.

MID BACK/CHEST PAIN

Mid back pain is almost always sentinel pain from postural problems in the neck or muscle imbalances in the shoulder, although sprains and strains can occur. Stretch tight muscles, strengthen the neck and shoulder, and fix your posture. Massage and other direct therapies usually just alleviate symptoms temporally. Mild to moderate aerobic activity is very good way to relieve tension. Besides postural problems or issues in your neck and shoulder, joint dysfunction, instability, and facet syndrome can occur here as well. Chronic popping or the need to feel like your mid back needs to pop are signs of instability and you should follow rehab and strengthening advice for the neck and shoulder/scapula.

Rib subluxations and sprains can present as pinpoint extremely painful muscular trigger points along the spine and cause mid back or anterior chest pain. Out of place rib heads usually take a few treatments of joint manipulation before they “stick”. Strengthening scapular stabilizers, lats, and rhomboids can help firm up the joint. Rib subluxations, rib sprains to the costochondral joint or costovertebral joint, and MFTPs in the muscles between ribs (intercostal muscles) can create similar pain in chest and sternal area. Anterior rib subluxations are more difficult to reduce, but it is possible.

Sprains, or fractures to the ribs are awful because you can’t do much to stabilize the area (no cast). Even minor sprains can take months to become pain free. The best advice is to just be careful. Follow inflammation protocols to help with healing and pain. After a sprain or rib fracture there’s a good chance that MFTPs will develop in the inter-

costal muscles. These MFTPs are also exquisitely painful, can mimic more serious pain from the heart. Kinesiotape is very helpful in thoracic sprains, strains, and fractures to check but not fully limit breathing.

If you have unexplained rib pain, had chickenpox as a child, and you're past your prime, get checked for shingles. GERD (acid reflux) can also cause chest and thoracic pain. Worry about heart attacks if you've got risk factors, have a sudden sense of impending doom (really), or you get referred pain down your arm – especially your right arm.

One final common injury climbers get in their chest is a sternal-clavicular (SC) sprain. The AC joint of the clavicle (see shoulder) is usually the one to go, but sometimes the mechanism of injury (MOI) affects the SC joint. Usually the sprain is just a mild subluxation that can be reduced. Again, the area is very hard to stabilize, so treat for inflammation and protect the area the best you can.

Thoracic Outlet Syndrome (TOS), Shoulder-genic Neuropathies, Referred Pain

TOS presents with numbness and tingling in the hands from compression of one or more nerves in the brachial plexus as the nerves pass through the neck and shoulder. Occasionally the radial artery is also compressed. Shoulder impingement syndrome often compounds this syndrome (see shoulder below). Cervical ribs or excessive scar tissue from trauma can be the cause, as could a beaked acromion (a genetic bone spur on your anterior shoulder blade). X-ray should be able to diagnose either abnormality cause easily, but not scar tissue or inflammation from injured tissues in the shoulder or neck. Forward head posture or poor posture may also lead to thoracic outlet syndrome.

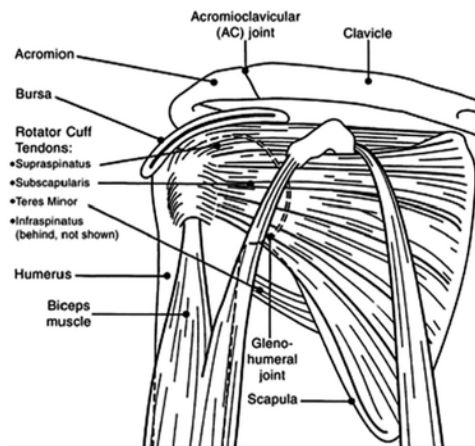
MFTPs in the scalenes, SCM muscles of the neck, and MFTPs in the subclavius muscle, pectorals, lats, rhomboids, levator scap, and subscap can mimic numbness and tingling from thoracic outlet syndrome. Orthopedic tests that measure your pulse while you are put in several positions can help rule out a vascular involvement. Nerve conduction tests can be performed to confirm a compressed nerve and aid in locating the area of pressure (ruling in TOS or other areas of nerve pressure along the upper limb). TOS can affect one or all of the nerves that go down into your arm. Depending on what structures are causing the compression, a combination of therapy for cervical posture retraining and shoulder impingement (below) are useful.

Scar tissue and entrapment of nerves can be reduced with various therapies to the shoulder, chest, scapula, armpit, and neck area to loosen muscles and reduce trigger points. Nerve flossing to affected nerves can help reduce entrapment as well. Injuries to the neck, elbow, and wrist can all add to symptoms down the line.

There are other neuropathies to the axillary, musculocutaneous, long thoracic, and suprascapular nerves that can mimic TOS and entrapment/compression of the ulnar and median nerve. If treatment for TOS or common causes fail, explore these other neuropathies. They are fairly uncommon, but can develop from chronic muscle tightness, or from inflammation and scar tissue from a direct or nearby trauma to the neck, trunk, or shoulder. They can also present as chronic and impossible to reduce MFTPs.

SHOULDER PAIN

The Shoulder Joint



Here are the top reasons for why your shoulder hurts: rotator cuff strain or tendinitis of the supraspinatus, infraspinatus, teres minor, or subscapularis muscle or tendon and impingement of the supraspinatus tendon, bursa, or biceps tendon. A labral tear and arthritis are very common as well. Referred pain from the neck and upper back can also be quite common. There's more, but these are the top culprits. In the acute stage, they may all present with non-specific pain from climbing.

There are several orthopedic and muscle tests that can help determine where the problem is coming from, but X-ray and MRI usually provide definitive diagnosis. MRI is a great option if the pain is severe or chronic enough that surgery sounds like it may be on the table, or if therapy has not been effective because of a misdiagnosis. X-ray should show arthritic changes, but even with degeneration, the pain may be due to another reason. There is often more than one injury going on at once. Resistance in certain ranges of motion points toward a tear or tendinitis (which can go hand in hand with chronic pain).

Pain with compression, especially with clicks, pops, or catching points towards

labrum damage. Surgery is often necessary if the labrum is moderately torn. Pain at the upper 1/3rd of arm abduction points towards impingement. Pinpoint pain at where the biceps inserts into the shoulder points towards biceps impingement, tendinitis, or bursitis.

Pay attention to exactly what movements you were doing, and at what times your shoulder hurts. Going in to get your shoulder checked when everything hurts won't help the diagnosis, so unless it's a new injury that needs immediate treatment, de-inflate that shoulder first. Before expensive imaging, rehab is usually a bit of trial and error. Luckily most treatments and exercises overlap. A hard-core PRICED regime is usually necessary – even in old chronic cases.

Impingement occurs when the space between the head of the humerus and the top of the acromion of the scapula decreases, and soft tissues like the rotator cuff, biceps tendon, and bursa gets inflamed or torn in the process. The greater tuberosity of the humerus is generally to blame as it decreases space even more when the arm is abducted above 90°, and compounded by simultaneous externally rotated.

Besides treating for inflammation in a shoulder injury, most therapies mentioned can help reduce inflammation, heal tissues, and reduce scar tissues. Kinesiotape is very useful at checking movements that hurt your shoulder. It has been my experience that the shoulder is too unstable or loose of a joint to suffer from subluxation, so be wary of shoulder joint manipulation (but don't rule it totally out). During shoulder rehab, it is very important that you limit motions that cause pain, especially over the head or external rotation. Immobilizing the shoulder a sling for a couple weeks may be necessary with moderate sprains and labral tears.

Unless the injury is due to trauma, then muscular imbalance, technique, and posture of the neck and shoulders are the heavy hitters. Even if arthritis is causing the impingement, the solution (besides dealing with inflammation) is to address these issues to increase the available space for tissues, and avoid overloading the rotator cuff. While fixing imbalances, you can also rehab the injured tendon or other tissues by progressively healing and strengthening the injured tissue.

Follow the recommendations for dealing with forward head posture, scapular stabilization – including additional exercises for the rhomboids and serratus anterior. Go through shoulder, neck, and upper back exercises looking for weak links and correcting them. After pain has diminished, begin with proprioceptive retraining exercises like the sword and seatbelt – paying extreme attention to keeping those shoulders down and back through the entire range of motion.

Shoulder Instability

Chronically unstable or dislocating shoulders often wind up needing injections or surgery, but that doesn't mean you can't try! The shoulder generally dislocates to the front, or anterior side. The posterior capsule may be extra tight causing extra pressure on the sloppy side. Treatment could involve reducing scar tissue or getting extra tight muscles to relax, especially stretching and working on the posterior capsule. To tighten up the shoulder via exercise, you need to figure out what muscles are weak and allowing the instability (if the joint and ligaments aren't so stretched out that extra muscle bulk won't help). Scapular stabilizer exercises, and exercises that work the rotator cuff are a good place to start. Assuming your pulling and compression generating muscles are strong (enough) since you climb, explore exercises that involve pushing and external rotation.

Immobilizing the shoulder in a sling (no more than 2 weeks) could be a last resort before you hit the knife or needle, but immobilizing the shoulder for too long greatly increases the risk of developing frozen shoulder. Surgery is often indicated for younger folks after their very first dislocation since the likelihood of re-injury skyrockets.

Frozen Shoulder

Frozen shoulders are evil – the more you try and get them to loosen, the more they overreact and seize up. They can also take months to resolve, even with treatment. There are three ways to fix the problem. The first is to do nothing and hope the muscle splinting resolves. The second is to force it free. This aggressive treatment sometimes works, but you need to find a therapist that has had success with this option, or have manipulation under anesthesia performed.

The third option is to slowly try and loosen it up. Begin by treating for inflammation, because it probably froze-up due to trauma. After a few days you can begin heating it. If it gets worse, go back to ice. Manual therapy, ultrasound, and electrical stim may or may not help. Passive, therapist applied, range of motion exercises can be done in a clinic, but doing exercises like wands, circumduction, and wall walks can be done at home (also useful for regaining ROM for post-shoulder surgery).

AC Sprain and Broken Clavicle

The acromial-clavicular (AC) joint is particularly susceptible to separating during a traumatic shoulder injury, and can become chronically unstable. Most AC sprains that fully rupture are left in place without surgery. The best rehab for AC sprains are therapies that aid in healing and reducing scar tissue, and immobilizing the shoulder while the joint heals for 1-3 weeks.

Breaking your clavicle (collar bone) is just an awful experience. The clavicle is like the coat hanger for your upper limbs and supports a lot of weight. Expect prolonged immobilization for a major AC blowout (2-8 weeks in a sling) or a clavicular fracture, but do not push it.

Shoulder Key Movement Patterns

First look at your posture. Is one shoulder much higher than the other, are your shoulders rounded forward? A screening tool for shoulder and scapular imbalance is to have someone watch you with your shirt off from behind. Bend your elbows and abduct (raise) your arms to 90°. There should be symmetrical upward rotation of the scapular and arms. Compensating by elevating a shoulder, or asymmetry in how the scapula and arms move suggest imbalances or restricted movement. Excessive winging of a scapula suggests a weak serratus anterior. The AC and SC joint are both supposed to rotate as your arm is raised over your head. If it is subluxated you may compensate and injure your shoulder, AC /SC joint, or neck. It can be mobilized. The subclavius muscle below the clavicle is commonly tight and full of trigger points.



Look how screwed up I am. Left shoulder unable to abduct to 90, left scapula not raising up, left arm externally rotated, left trap lower, and I'm tilted to the side to compensate.

ARM AND FOREARM PAIN

Arm Posture

Stand relaxed with your arms at your side. Palms facing inwards or behind you sug-

gests overly tight chest, shoulder, arm, or forearms muscles.

Arm Sprain/Strain

Spraining a biceps, triceps, or a wrist flexor in the muscle belly or at the elbow is very common. Small tears to complete ruptures of the tendon happen when the load exerted is greater than the tissues can support. The first thing you can blame is bad technique: bad footwork and balance aren't stabilizing some of the weight, or an overly eager dyno. As mentioned, connective tissues don't strengthen as fast as the muscles they support. Apply gains in skill or strength that create extreme forces to joints slowly and carefully, especially as you age.

After the inflammation stage is taken care of (or surgery), begin slow resistance exercises especially focusing on eccentric contractions and strengthening antagonists. Manual therapy and PT therapies that promote healing and reducing scar tissue will help aid in recovery. Kinesiotape or compressive sleeves can be applied for several weeks.

Medial & Lateral Epicondylitis

One of the most common injuries climbers get is epicondylitis, or inflammation of the elbow. Epicondyles are the bony bumps on either side of your elbow. The inside condyle (with palms facing forward) attaches the wrist flexors that flex your wrist and fingers, and inflammation there is called medial epicondylitis or golfer's elbow. The outside condyle attaches your wrist extensors that eccentrically controls and stabilizes your wrist. Inflammation here is called medial epicondylitis or tennis elbow.

Medial epicondylitis is usually due to climbing too much, too hard, or overtraining. The attachment point gets overstressed and becomes inflamed (at the tendon attachment) or the flexor muscles get strained. Although it can become chronic and turn

into a tendinosis, this condition usually presents as acute inflammation.

Treatment begins with rest, lying off the crimpers, dynos or forearm intensive climbing, along with a strong bout of inflammation control. Most forms of therapy that promote healing and reduction of scar tissue (if repetitively injured or severely sprained) will help. Extra stretching and warming up will help prevent re-injury. Kinesiotape is effective at limiting motion and helping with swelling and edema. Don't use a strap over the elbow as in lateral epicondylitis, instead place any compressive device at least an inch or two lower. Using a forearm compression strap can help or hinder healing. Try it out when using your forearm, and taper off use as you get better. Some therapists are very anti-elbow brace and they are partially correct. It can hinder healing in some, but can help others.

Lateral Epicondylitis is much more likely to turn into tendinosis and present with chronic pain. The injury has the same etiology as medial epicondylitis, but this time the extensor tendons get over-stressed by being unable to control and check the wrist flexors. The wrist extensors and pronators counter-act the acceleration of the flexors and supinators (prime movers) and will get injured if imbalanced, like a pair of old brakes on the car.

These muscles maintain isometric control when grabbing and pulling down, motions that cause natural flexing and supinating movements – otherwise your hand would flex and turn in instead of staying in one place and exerting power. This is the one injury you can develop over time from belaying someone on top rope! To avoid repetitive strain by eccentrically pulling the stiff rope through your belay device, the using your body and legs to squat down to pull on the rope then stand up and pull the slack in quickly.

Rest and inflammation control efforts must be doubled to prevent this from becoming a lifelong problem, or to get the condition out of a chronic tendinosis. An elbow brace can be employed during the healing phase to take the pressure off the elbow attachment and put the pressure under the brace where injury is less likely. All modes of therapy are fair game, but some have been shown to work better than others.

Friction type massage and ice massage can help stimulate the tendon to begin healing, especially if the injury became extra-chronic and is in tendinosis stage. Injection therapy can help, but is usually done only in chronic injuries that aren't responding to manual therapy and rehab. Manipulation of the elbow has been shown to be very effective. Lack of joint motion can stall the healing process, and improper alignment of the radius and ulna at the humeral articulation can create extra rubbing of the tendon and poor biomechanics. Eccentric pronation and wrist extension exercises help re-train the muscle and strengthen it for the actual job it is designed for while concentric exercises help prevent. TheraBand makes a giant licorice looking device that helps with this exercise, the TheraBand Twist. Eccentrically lowering a dumbbell and pronating with a hammer or ½ a dumbbell are other excellent exercises. You can use tubing to work into heavier weights if the injury is severe enough. Occasionally working radial and ulnar deviation are missing links in elbow rehab, and sometimes weak triceps contribute to the condition. Stretch and massage the flexors while working the other muscles.

Although there's not much you can do about it, a genetic variant in a change in the normal angle formed by your arm and forearm re-route the trajectory of your flexors and extensors, making them more predisposed to rubbing over the condyles. Occasionally the ligament between your radius

and ulna (radioulnar ligament) at the elbow can get sprained as well, presenting as epicondylitis. Treatment is very similar, except manual therapy should be targeted at this exquisitely tender spot. Be wary of doc's reaching for the cortisone needle. Short-term reduction in pain and inflammation may be offset in long-term damage to the tissues.

Nerve Pain of the Elbow/Forearm

The ulnar nerve is very exposed when it passes through the elbow. Anyone that has bumped his or her "funny bone" just dinged the ulnar nerve. Injury to the elbow or scar tissue and adhesions to the neural sheath can create pain in the elbow, forearm, or hand along with numbness or tingling. This is known as cubital tunnel syndrome. Manual therapy and nerve flossing can help free up the ulnar nerve. The median nerve (the culprit of carpal tunnel syndrome) can get compressed by the pronator teres muscle in your forearm that helps the biceps pronate the wrist. Tightness, swelling, or contraction of the pronators, pronator teres syndrome, can cause nerve pain, numbness, or tingling in the forearm into the wrist and hand. Carpal tunnel syndrome can sometimes be misdiagnosed when the compression is in the forearm, and climbers are more susceptible for obvious reasons. Pin and stretch therapy works well as does friction type massage on the pronator. Since the ulnar nerve is so exposed at the elbow, aggressive therapy can result in more damage. Don't apply ice directly over the nerve.

WRIST AND HAND PAIN

Wrist pain can be complicated to diagnose since there is a ton of stuff packed into your wrist. First you've got the carpals, tiny wrist bones. Carpals can be fractured, dislocated, or have instability issues. A meniscus-like tissue called triangular fibrocartilage is on the medial side of the wrist and can be torn or sprained. Flexor tendons pass under a bridge of connective tissue called the flexor

retinaculum. The flexor tendons can develop tendinitis, or the tendon sheaths can develop tendosynovitis, and the retinaculum can be sprained. Finally, the median nerve passes through the carpal tunnel (exactly what it sounds like) and the ulnar nerve passes through the tunnel of Guyon in the ulnar side of the wrist. These nerves can get compressed or inflamed causing wrist pain, tingling, and numbness.

Fracture of any of the carpals can be fairly serious as avascular necrosis (AVN) can set in since the carpals don't have a great blood supply, especially the scaphoid bone below the thumb, followed by the lunate in the center of the wrist. Get an X-ray and don't rule out fracture until a follow-up X-ray is taken 2 weeks later. If fractured, see an orthopedic surgeon. The hook of the hamate below the thumb is another common site of fracture or avulsion.

The carpals can also become subluxated, can develop wrist instability, or dislocate. Chronic clicking and popping or point tenderness over the wrist are signs of instability. The lunate is the most unstable of all the carpals. Mobilization of subluxing carpals or the distal radial ulnar joint can restore proper biomechanics, and immobilization or injections can help shore up loose joints. Applying a layer of tape or strapping the wrist can reduce instability during activity. Chronic and severe wrist instability can lead to a whole host of really bad other wrist problems – see an orthopedic surgeon if moderate or worse symptoms appear. Usually the wrist is placed in a cast or splint for 6-8 weeks if not operated on.

If the triangular fibrocartilage on the medial side of the wrist or the flexor retinaculum is damaged, rest and immobilization are the best conservative therapy. You may need to splint for 4-8 weeks. Larger tears may require surgical intervention or injection. Scar tissue may develop and therapies to reduce

this are useful. Wrist traction with a device (hard to find) or just by sustained pulling with your other hand can help. Laser and microcurrent are both acceptable option to try and help the cartilage or tendons heal.

The flexor tendons can easily develop tendinitis, especially under the flexor retinaculum. Tendinovaginitis and tendosynovitis also commonly occur in the wrist as the inflamed tissue rubs against the inside of the tendon sheath. Squeaky grinding sounds from flexing your fingers or wrist is a sign that the sheath is also affected. A special type of tendinitis called Dequervain's synovitis commonly develops in the tendon sheath of the extensor pollicis brevis that extends the thumb and the abductor pollicis longus, which abducts the thumb. An excellent test for this is to tuck your thumb into your fist and then ulnar deviate (the opposite of a hitchhiking move). Sharp sudden pain is a positive result. Rest and ice help, as does immobilization with a wrist brace with a thumb spica.



Dequervain's test (above) and wrist brace with thumb spica (below)

Because there isn't a lot of padding in the wrist and it's mostly bone, nerve and tendon, manual or other physical therapies can be difficult or cause more damage than healing. Light friction massage over the wrist or underwater ultrasound can help, as can deeper therapies to the hand and forearm. Cold laser is an excellent choice because it doesn't cause tissue damage.

Nerve Pain in Hands and Fingers

There are several reasons why you would get numb or tingling hands and fingers (TOS, referred pain from other areas, cubital tunnel syndrome, and pronator teres syndrome have been discussed already). Serious reasons could include spinal cord trauma or cervical disc herniations, diabetes, alcoholism, malnutrition, and a lot of other diseases. But specific to climbing would be carpal tunnel and Guyon tunnel syndrome if the source were actually in the wrist. Guyon tunnel syndrome affects the ulnar nerve as it passes through the tunnel of Guyon in the wrist. This is generally a result of direct trauma to the wrist, and is also known as handlebar palsy from injuries due to bike riding. Get an X-ray to rule out fracture, deal with inflammation, and splint the wrist.

Carpal tunnel syndrome is a lot more common. The median nerve becomes compressed as it passes through the carpals. Symptoms are shooting electrical hand and wrist pain with occasional or constant numbness and tingling. The flexor tendons are directly above the median nerve, and injury to them can also create inflammation and pressure on the median nerve. Carpal subluxation and instability can also contribute to decreasing the space inside the carpal tunnel. Repeated, sustained flexion of an unsupported wrist is what gets office dwellers. Surgery for this condition is very common as it is fairly easy and can be done fairly non-invasively to release the nerve.

Conservative treatment should begin with rest and all things anti-inflammatory. A cock-up splint helps for a period of immobilization or activity (like typing – not climbing) with the wrist in partial extension. Wearing the splint at night is quite effective. If you think your computer is a culprit be sure to use a wrist pad below the keyboard and to take frequent breaks. The position of everything from your chair, armrest, mouse, and computer all can contribute to the problem. Seek out ergonomic advice for positioning these items.

Drilling and hand drilling bolts can definitely contribute to the problem for climbers. Pulling down on holds when your wrist is in a flexed or extended position and also pivoting off this position under strain can exacerbate any wrist problems. Try and keep your wrist straight – good advice for general climbing to maintain strength and keep from pumping out. Therapies that promote healing and reduction of scar tissue work well, as does joint manipulation. Although hard to find, wrist traction devices can also help. There are tons of passive stretching devices that help spread the hand open and marketed to help treat carpal tunnel syndrome.



Taping wrist and cock-up splint

Raynaud's phenomenon is another disease that can cause neurological or vascular symptoms in the hand. The main symptoms are unexplained white cold fingers. Women are affected more than men, especially younger women. Raynaud's is a vascular overreaction to cold or stress and can be idiopathic (unknown cause) or due to another more serious disease. Most therapies are drug therapies. Some supplements that have been shown at least mildly effective are ginkgo biloba, fish oil, and arginine (increases nitric oxide). See a rheumatologist if symptoms are severe. Training for cold by cold water immersion or carrying snowballs will make it worse. Ice climbers will suffer the most. Carry gloves or warm socks if you have frequent attacks.

The "screaming barfies" or hot aches occur when cells freeze and re-thaw in your digits. It usually only happens once, as blood supply gets increased to the area to prevent future cell damage. As with Raynaud's, cold training makes matters worse. It does help with tolerance, but long term blood supply is actually reduced which is why old ice climbers have it worse. To avoid the hot aches on lead or following that first pitch, try and get the hot aches on the approach where it's easier to deal with. Better yet, don't get them at all by properly warming up, keeping a loose grip (thick gloves can be counterproductive), and using handwarmers over your wrist. See the section on gloves.

Dupuytren's Contracture

This genetic condition affecting mostly males thickens and contracts the palmar fascia of the hand. It is painless, but over time can debilitate the hands. It's a stretch to include this in this book, but it has affected a few climbers I know. The condition progresses with age. Surgical intervention can help, but the scar tissue from surgery can actually compound the condition, especially if multiple surgeries are performed. There are many treatment options to manage or halt the progression, but see an OT hand specialist. In the meantime, heat therapies can help with range of motion.

Ganglion Cysts

These are actually fairly common, and overuse and inflammation or just bad luck are common causes. These painless nodules grow on tendon sheaths, generally over the extensor tendons of the hand. Do not try and bust these (the old Bible Smack), they will get worse. The best treatment is no treatment, so leave 'em alone unless they become painful or interfere with activity.

FINGER PAIN

Finger Sprain

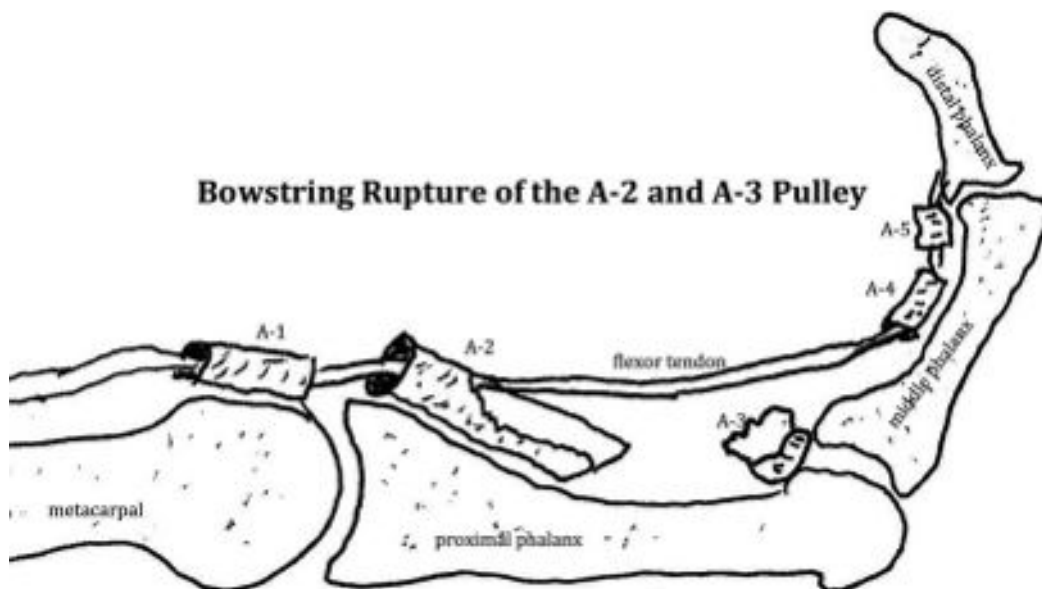
A strain of a finger pulley is the most common debilitating injury climbers get. The flexor tendons extend up into the fingers, as there are no muscles in the fingers themselves. Because of the length and multiple joints they cross, the tendons need attachment to the bones so that they don't bow-string out, much like a bridge on a guitar. With enough force or irritation, the pulley tears or ruptures. The tendons could be the targets of injury, but the pulleys usually lose out. The ring finger followed by the index finger is the most likely to be injured in a pulley tear. Because of leverage the pulley gets more stress in the closed crimp when the tip of the finger is pointed down, the middle of the finger is parallel to the ground, and the base of the finger is vertical. The A2 pulley on the finger flexor ten-

don sheath, which is located just below the middle knuckle, is most commonly ruptured of the individual pulleys followed by the A4 pulley, which is located just below the top knuckle.

Symptoms can be just pain and soreness over the base of finger, swelling and increased pain with decreased ROM, bow-stringing of the tendon, or the dreaded popping sound of the pulley rupturing completely. Amazingly enough, even a fully ruptured pulley can repair itself without surgery.

Treatment is to immobilize the finger with tape splinting or buddy taping in bad tears, and in all cases then waiting until pain and swelling are gone enough to move your finger without pain – about 1-3 weeks in minor case or 3-5 weeks in moderate/non-surgical cases. Let pain in the active range of motion be your guide. Painful mild tears and moderate tears should progress for two weeks of low resistance exercises, four weeks of only using large hold easy climbing, then four weeks on large holds on steep routes. After this you can ease back into normal climbing. Painful moderate or severe tears can take an additional 8-16 weeks of rehab.





Various finger splinting devices

Most of the time an inexpensive ultrasound Dx can be made without needing an MRI. Mild tears can be painful, but won't need as much rest and rehab as the recommendations given. Go through the steps (immobilize, low resistance ROM, easy climbing, etc.) and use pain as your guide to progress. Still plan on 6-8 weeks of being very careful. The worst case is surgical intervention if there are multiple total ruptures. Expect a return to climbing in 6 months after surgery.

The collateral ligament on the side of your finger joints can also be injured. If they avulse, then surgery is usually needed. If intact the prognosis and treatment is the same as pulley strain. Total time is around 1 week to 6+ months.

As with all sprains, full anti-inflammation protocols should be employed including cold water soaks and contrast therapy. Treatments such as friction massage, laser, and all therapies that promote healing and reduction of scar tissue can be employed. Atomik Pull-up Bombs are great rehab pull-up tools for finger pulley injuries since they don't stress the finger flexors (much).

If you are concerned about injuring a pulley, or have before, it can be helpful to tape for proprioceptive feedback so you don't overcrimp and to tape during high-stress climbing. Taping may be necessary rehab for acute sprains, but taping your pulley doesn't absorb that much force off the pulley. Wean yourself off the tape or tape preventively if you will be climbing something crimpy because it will unfortunately weaken the tendon or prevent repair since it needs load to maintain its strength.

H-Taping

Take a 4" strip of athletic tape and cut it down the middle on both ends, but leaving 1 cm uncut to make an X. Put the middle of the X on the joint to be stabilized and wrap the left (or right) arms of the X below the joint. Flex the joint and tightly wrap the

other arms of the X, but not cutting off circulation. You should be able to flex, but not extend the joint. You can further stabilize the tape by laying down a small, thin strip of tape along the palm side of your finger before wrapping the tape.



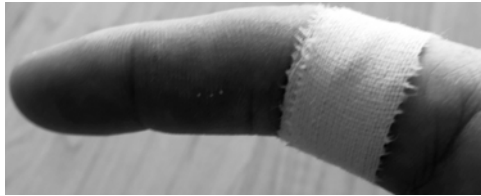
X-Taping

Using a long thin strip of tape, make two wraps just under the first PIP joint, cross under the joint, then two wraps just over the first PIP joint, cross under the joint again with another wrap or two forming an X.



Circular Taping

If the H or X taping isn't helpful then tape tightly just above the A2 pulley with a thin 1/3rd inch piece of tape, basically just below the first PIP joint. If you're in a hurry, a few wraps around the first phalanx with medium width tape can do in a pinch, but isn't as supportive.



Finger Fracture and Dislocation

Sometimes you can get away with continuing to use a hairline fracture of a finger by buddy taping it to another finger, or splinting it and just not using it if it doesn't get in the way too badly. If not, finger fractures heal very quickly (4-8 weeks) and since there's not a lot of soft tissue around to get damage, you may get off with little to no rehab. Dislocated fingers can be set in the field since risk of bleeding to death with a severed artery is really really low. If a fracture extends into the joint capsule, or you seriously jam the joint, healing and function can be severely comprised. Swelling and acute reduction in ROM should prompt a more thorough investigation.

Other Common Finger Avulsions

Game keeper's thumb or skier's thumb is a common injury when a fall causes the thumb to get bent backwards. The medial

collateral ligament of the thumb gets sprained and can avulse some bone. See an orthopedist if you suspect that a dislocation seriously impacted the joint capsule, or any moderate to severe fracture or sprain to check bony alignment and for joint instability.

Jersey finger is the named condition when you rupture the flexor digitorum profundus tendon off the last distal finger joint. You'll know you've got it if you can make a fist without being able to bend the tip of your affected finger.

NMS LOWER BODY CONDITIONS

LOW BACK PAIN

Low back pain can be quite an enigma. Most cases have no clear defined MOI or reason that can be directly attributed to the pain. Even MRI's showing a disc bulge or herniation may not be the real reason for the pain. The muscles, joints, ligaments, discs, and nerves in the lower back are very pain sensitive and the pain isn't always localized to one spot that hurts when you push on it. Pinched nerves and strains are usually to blame in non-disc herniation issues but I'll discuss the most common things that can go wrong and reasons why things can go wrong.

Low Back Posture

The joints and discs in your low back must support more than half of your bodyweight. This stress is increased during flexion, and rotation puts the weight on one side. Prolonged flexion from things like sitting or cramped positions like hanging around in a harness all day increases the risk of injury, as does repetitive vibration. The supporting muscles and connective tissues usually do their job at reducing the load or distributing the weight. However, too much force, weight, or poor coordination between muscle groups can overstress the weak link. This is why proprioceptive balance exercises, and working the abs, back extensors, and side-benders are often prescribed for treating or preventing low back injuries. Once a muscle group stops firing in the correct sequence or is substantially weaker than another group you can get immediate low back pain. This is why many people injure

their back doing simple activities like brushing their teeth or tying their shoes – no one's paying attention. Bad posture coupled with the theories of creep and muscle de-activation are the base of the iceberg in developing this pain.

Bad posture from your head down to your feet can affect the low back. Some observation signs of poor posture or bad alignment are having one leg shorter than the other when laying down, which is indicative of a pelvic joint or muscle imbalance. Having one leg become shorter than another when lying down is called a functional short leg. This is different from the more rare anatomical short leg where the bones are of different length. When standing, you won't be walking tipped to one side because something will compensate.

Usually the sacroiliac joint gets over-rotated, or a small functional (it goes always lying down) scoliosis (laterally curved spine) may be present usually presenting as high hip or shoulder on one side. The compensation can occur elsewhere like the upper back or neck, but the low back is the closest point of weakness if it's not in tip-top shape. Besides a functional short leg, rotated pelvis, or scoliosis, the low back can compensate by tipping forward or backward (anterior or posterior rotated pelvis) – especially if the abs or back extensors are weak or tight. If a joint in your low back, especially L5, the last vertebra, or the sacrum are stuck in a direction of rotation or isn't moving properly in a certain direction,

aka subluxation, then that joint or other joints down the line can send pain signals and create inflammation.

Tight muscles that attach to or affect the low back, especially the hamstrings, piriformis, iliopsoas, leg extensors, and back extensors can wreak biomechanical havoc and severely contribute to low back pain. The same goes for weak or inhibited muscles, especially the gluts, abs, and lateral benders. Remember that tight muscles may be that way because they are being posturally overstretched and actually need some strengthening. The pattern of weak abs and gluts with tight hip flexors and back muscles, called lower cross syndrome, is a common imbalance. The curve in your low back, or lordosis, just like in your neck, gets pulled straight. This ruins the supporting mechanics of the curve and the L5-S1 joint, which contains the last disc in your spine and bears the brunt of most of your weight.

Joint instability in the lumbar spine or SI joints is very common, especially in pregnant women because of the hormone relaxin. Unstable joints in the lumbar area can be splinted with additional muscles strengthening, at least more so than other areas. There are, of course, some genetic abnormalities that may (but usually don't) contribute to poor biomechanics and back pain. Occasionally L5 fuses with the sacrum, or the top of the sacrum becomes a new "6th" lumbar vertebra with an extra smaller disc known as a transitional vertebra. L5 can travel forward (a lot in some instances) because of repetitive stress or genetic variation known as spondylolisthesis. Oddly enough, there isn't a ton of evidence that shows these anomalies directly contribute to low back pain.

Whatever the cause, the effects can cause a sprain or strain in the iliolumbar ligaments, sacroiliac ligaments, sacrotuberous ligaments, the multifidus muscles or other

small back stabilizers, the facet joints, and discs. The resulting inflammation or actual pressure can also inflame or compress the spinal nerve roots exiting your spine causing even more pain or neurological symptoms. There's more to get tweaked or smooshed, but those are the most common. Pain in the low back can be intense, and referred or scleratogenous pain traveling into the buttocks or behind the upper leg is quite common. Severe inflammation or compression of the nerve roots or spinal cord from a herniation can cause pain to zing into the leg and foot, and cause numbness, tingling, weakness – even incontinence. Compression of the sciatic nerve, known as sciatica, is usually from an overly tight piriformis muscle and can also cause traveling pain, numbness, and tingling. When your legs fall asleep, it is usually from compression of the sciatic nerve – not your blood vessels.

Most causes of LBP are treated very similarly; the first goal in everything from a herniation to a muscle strain is to reduce the inflammation. Unfortunately hot tubs usually make low back pain feel a lot better initially. Don't do it! When the relief of loosening tight muscles wears off, the pain will come back with a vengeance. The first real goal in a disc herniation is to reduce the neurologic pain from the leg to centralize the pain just in the back itself. The disc can reabsorb the herniation on its own, but in some cases surgery is required. Unfortunately the resurgence of low back pain is extremely high in surgical cases, so most decent surgeons will really push conservative rehab first. A cortisone injection may be necessary if neurological symptoms or pain are extreme, or at least some high-grade pain relievers or muscle relaxers. I'm not saying you have to or should, just that it is common. To help get the disc nucleus or bulge reduced, traction is often employed and is effective. Not everyone with a disc injury will be helped via traction. Sprains and strain to the disc (disc derangement,

like in the neck), or other muscles and ligaments may not react so good to being stretched. Other forms of traction like flexion distraction or various exercises may be a more suitable therapy if standard traction makes things worse.

Joint manipulation has been very effective at treating low back pain. Don't expect the miracle adjustment, but it does happen here and there. Any and all therapies are fair game. Electric stim is popular because it feels really good, and can help take the edge of the pain. But be careful when doing anything that causes muscle relaxation. Because the muscles are very pain sensitive, the pain usually reduces substantially. But since the problem is still there, the minute you get off the table the injured area gets all the weight minus the help of your now relaxed muscles. Many patients either collapse in pain immediately or shortly after a relaxing massage, hot pack, or e-stim treatment. Always do some light exercises for the back after any relaxation therapy to get the muscles to wake up and do their job.

The SI joint is really difficult to stabilize because there aren't any muscles that cross the joint. SI joint rehab requires that you fix any imbalances throughout the low back and feet. Bracing with SI or trochanter belts may be necessary. Low back braces are helpful if your job requires dangerous lifting or postures, but prolonged use will only defacilitate stabilizing muscles. Back pillows for the car or office are great if they don't support your back as much as they remind you to sit correctly with a neutral pelvis. Occasionally sitting on a Swiss ball or inflatable disc can help you maintain good posture, and work stabilizing postural muscles as well. Sitting on a wedge shaped cushion can help your low back from slumping.



Always examine your feet and gait if you have problems with low back pain (described below). Your mattress can be a source of low back pain as well. There are no exact rules on what type of mattress to use except that you get what you pay for. Memory foam offers great support, but if you sleep warm you may overheat. Pillow tops over firm mattress act as a sort of memory foam if you can't spend the cash or don't want to overheat. Adjustable firmness or gel mattresses are excellent.

If you need to find a position to get comfortable with very acute LBP, try lying on your back with legs and knees propped up on a chair at 90 each. Lying on your side with a long pillow between your legs can be very helpful. Whatever position you can find to reduce pain or centralize nerve symptoms is the best.



This last photo was the only one my wife enjoyed taking

Flexibility of your low back isn't extremely important because your back should be locked in place with core strength to perform most motions. However, if one side is tighter than the other you can develop problems. Also, low back strength isn't as important as hip strength. Movement should always be initiated by the hips. The low back is a stabilizer, not a mover. Stability, posture, and correct movement patterns are important to maintain a neutral spine during movement or during static loading. Flexion and sitting are the worst things for your low back. Muscle coordination is more important than being strong. In fact, focusing on strength can increase the risk of back injury! If exercising for the low back then doing more reps every day is much better than doing high load exercises three times a week.

Doing a combination of eccentric, proprioceptive, and isometric exercises that work the core – including the abs, transverse abs, back extensors, side benders, and pelvic stabilizers is the best rehab for fixing your back. Focus on the least coordinated and weakest areas. The gluts are almost always de-facilitated and weak with back and hip problems, so training them is critical. Also, stretch tight hip flexors, gluts, hamstrings, and piriformis muscles. For almost every low back exercise, keep the low back locked in a neutral pelvis position with the core engaged. The three best exercises are curl-ups, quadruped, and side-bridges. All stability exercises will help the low back. The Turkish get-up is another fantastic end-stage low back rehab exercise, as are squats, lunges, and side-bending exercises. Focus on low back posture and core activation when climbing and hiking. If doing back extension exercises, scoot back or forward on the weight bench to isolate different sections of muscles. I should also mention that aerobic exercise is just as important of an exercise, if not more, for the low back as

repetitive strengthening exercise. Just keep a neutral and stable spine.

Rehabbing the low back requires a lot of core training. The exercises in the lumbar warm-ups, core stability warm-ups, hip warm-ups, intense core (late stage), whole body stretches, hip leg and lumbar stretches, even the balance exercises and some non-climbing supplemental exercises are all good for a full re-training of the low back area. Extension exercises on a Med-X machine if you can find one are very helpful.

Low Back Key Movement Patterns

A postural evaluation should show even level hips and a neutral pelvis.

Do a sit-up maintaining posterior pelvic tilt with your knees bent, arms across your chest, and feet flat on the ground. Do ten reps, and hold the last rep for 30 seconds. Weakness and imbalance are present if shaking occurs, the feet lift up, you lead with your head, if the movement is fluid or rigid (your spine doesn't curl), or your low back arches.



Next lie on your stomach and have someone put his or her hand on your glut, hamstring, and low back. Extend your leg at the hip. Weakness and imbalance are present if the order of muscles firing doesn't occur in this sequence: gluts with hamstrings, opposite side back, then same side back. The neck and shoulders shouldn't tighten up either.



HIP, THIGH, AND GROIN PAIN

The hip is the joint where your leg attaches into your pelvis. Pain in the hip can be coming from a strain, tendinitis, or contracture of the rectus femoris, iliopsoas, tensor fascia latae (TFL), adductors, piriformis, and hamstring muscles or the joint capsule, as well as bursitis and arthritis. Inner thigh and groin pain at or near the hip at the groin can occur from a strain to the adductors or abdominals, or from a mild to full hernia. Chronically snapping or popping hips with pain can be a common of hip pain. The labrum inside the hip can be torn just like in the shoulder or knee, and AVN can occur as you get older.

The hip joint has quite a bit of range of motion, but is under tremendous pressure from the tightly packed joint and strong muscles that attach. Arthritis is common as the joint space decreases and cartilage wears down. Hip replacements are not uncommon for those as young as those in their 40's. Capsular tightening can be caused from chronic flexion or an imbalance of tight thigh and hip musculature, especially the hip flexors and piriformis. Bursa or inflamed, tight capsules in and near the joint can mimic arthritis, quite like the shoulder joint. Bursa that are on the side of the hip joint can develop trochanteric bursitis, and the bursa in the iliopsoas muscle, and on the ischial tuberosity (butt bone) can also develop bursitis. The bursa usually gets inflamed by friction from tight muscles and tendons. Bursitis, like in the shoulder, can be caused by surrounding microtrauma, not

just a direct hit as in elbow (or knee) bursitis.

Hamstring, groin (adductor), quad, and lower abdominal strains are quite common – usually a result of a single traumatic force, but chronically tight muscles from imbalance, poor posture, or problems with foot biomechanics can cause repetitive microstrains over time. Treatment for these is the same a treatment for other strains. Weak side-benders and adductors like the quadratus lumborum or glut medius, along with tight hamstrings, weak quads, and poor foot biomechanics can irritate the side of the hip and knee causing bursitis over the hip, TFL pain, or a painful iliotibial band (ITB). The ITB usually hurts near the outside of the knee, but can hurt all the way up to the hip and TFL muscle it attaches to. Too much ab work or hip flexion (hiking/slogging, too much Pilates, or driving for hours after climbing) can over time shorten the hip flexors and lower abs, causing pain and can also inhibit the gluts.

The key to fixing areas in the hip is constantly stretching the larger tight muscles, and exercising stabilizers like the gluts, external rotators and adductors of the leg, and the abs or back extensors depending which one is weaker. Fixing problems in the back or foot can directly influencing problems in the hip. Hip traction is wonderful, but also very difficult. If you can find a DC or PT that can effectively mobilize or traction the hip, refer them to your friends.

ITB Syndrome

Pain at the hip, side of the leg, and side of the knee can all be part of iliotibial band syndrome. The ITB is an extremely tough fibrous band that connects your hip to your knee. The TFL muscle, as mentioned, attaches to it. A tight TFL can cause the ITB to rub, or cause pain at the TFL itself. The TFL and rotators of the hip are very similar to the rotator cuff of the shoulder. If overpow-

ered, they will hurt. Fixing imbalances at the hip is a good place to start if the pain is at the TFL or nearby gluteal muscles like the glut medius. Stretching the quads and hip flexors while strengthening the gluts should also help.

Pain in the leg or at the knee is the standard presentation of ITB Syndrome however. The ITB rubs receptively over the condyles at the knee. Most therapy incorrectly focuses on the ITB itself. The ITB is so thick and tough that the idea of actually stretching it is a joke. Stretching to get at the TFL is an option, and does relieve pain. However the TFL is probably not actually tight. The problem is usually due to an imbalance in the hip, or an imbalance between the quads and hamstrings that is pulling incorrectly on the ITB. Stretch both the quads and hams attempting to isolate the tight area. Remember there are three separate hamstring muscles and four quadriceps muscles. You hamstrings may be tight, but they may also be weak. However, the main culprit of weakness in the leg is in the quads, specifically the VMO or vastus medialis oblique. This is the muscle that bulges in the medial side of your quad at the knee when you straighten your leg at the knee.

Problems of foot overpronation can also cause tracking issues at the knee that can cause your ITB to rub. While correcting hip, leg, and foot imbalances, you can do some pain and inflammation relief. The ITB stretch will help, as will rolling over a foam roller with bodyweight. Manual therapy from deep tissue to friction massage can help to address trigger points and adhesions directly over the ITB. Prepare to scream. Ice massage is another great therapy.



ITB strap

Key Movement Pattern for the Hip

Lie on your side and abduct (raise to the side) your leg and hold five seconds. Imbalance is present if your hike your hip, your foot externally or internally rotates, or your leg swings forward.



KNEE PAIN

Knee pain is often insidious, it develops gradually and when the pain strikes, it's hard to know what happened. The main pain generators in the knees are the meniscus, the cartilage of the knee and patella (knee cap), the infrapatellar ligament, and the prepatellar ligament. Patellar pain often shows up negative on many tests and imaging and can be frustrating. The meniscus can be bruised, ripped, and torn. Meniscus symptoms are usually pain when loading, sharp pain on or inside the knee, locking of the joint, swelling, and pain with over flexion and extension. Bruising and small tears are usually self-limiting whereas larger tears or degeneration may require surgery. The cartilage inside the knee and under the patella can wear down with arthritis or get

damaged when over stressed, known as chondromalacia patella. Symptoms are similar to meniscal pain, but X-ray and several orthopedic tests can help rule them in and the meniscus out. Folds of synovial tissue, or plica, can also get damaged and inflamed – again mimicking a meniscal lesion. Tendinitis or tendinosis of the infrapatellar tendon is also common. Pain after periods of prolonged sitting or walking downhill is common with chondromalacia patella and infrapatellar tendinitis.

Loading the knee while twisting is a frequent MOI in knee injuries. Walking and running with poor foot or back biomechanics can chronically cause tracking issues. Overpronation is a common foot problem that can lead to knee pain. In climbing, twisting out of the “frog” position can really mess up your knee and your hip. Drop knees can also tear your medial meniscus. Imbalances in the muscles of the leg and hip can cause your knee to rotate too much in a certain direction, as can a weak VMO muscle.

A good knee examination will also look into problems in your low back, hip, and foot – including your gait. Lifting a heavy load with your feet over-rotated, as well as having your knees too far forwards (past your ankles) can put excessive strain to your knees. There are a few anatomical variations that can also affect your knee and create problems that haven’t been mentioned. The angle that your lower leg forms at the knee with your upper leg, or Q-angle, can be over and under-pronounced. Women have a larger Q-angle than men. The angle can be genetic, or functional as in over and under-pronated feet. If the angle has your knees too close together (*genu varum*) then more pressure is on the medial knee, and likewise knees too wide apart (*genu valgum*) puts extra strain on the outside of the knees. An anatomic or functional short leg can emphasize more weight on one leg than an-

other as well. A more rare condition, *genu recurvatum*, occurs when the upper and lower leg angle bow inwards. The knee is a common point of compensation for the parts of your lower body, but unfortunately the knee is a very weak link.

The ligaments that keep your knee together often get sprained or ruptured, especially with a traumatic force. The two ligaments on the outside of your knee that commonly get injured are the medial collateral ligament (MCL) and the lateral collateral ligament (LCL). Inside the knee are two ligaments that make it so your lower leg doesn’t slide past your upper leg. These are the anterior cruciate ligament (ACL) and posterior cruciate ligament (PCL). Both can rupture, but the ACL is much more common to rupture. Surgery is often necessary to fix these ligaments, but not always. There is a newly discovered ligament in the knee that may also be torn and could be the culprit when ACL surgery doesn’t work. Minor tears can be rehabilitated much like any other ligament or tendon can, but recover can take months. Sometimes the knee is super-stabilized by well-developed musculature and other supporting tissue that even a full blow out isn’t even noticed.

Your patella can get dislocated or develop serious instability. It can be stabilized with taping and bracing along with strengthening the quads. Chronic patellar instability often requires surgery. Injuries to the prepatellar ligament, aka jumper’s knee, and infrapatellar ligament are usually due to tracking issues, quad weakness, or repetitive strain from high impact plyometric activities (like jumping). Arthritic knees should avoid high impact bending activities like heavy or deep squats, running downhill, and although plodding downhill with a heavy pack may be impossible to avoid, at least use trekking poles and go slow. Cycling on a properly adjusted bike can be excellent therapy for most knee conditions.

Therapy is the usual anti-inflammatory, tissue healing, and scar tissue reduction regime as most other areas. Injection therapy is becoming more common to treat knee injuries, and cold laser therapy is helpful because most structures are too deep to directly treat with other “normal” therapies. However, cortisone injections are highly contraindicated in patellar tendinitis because the chance of rupture. Muscle rehab can be slow after surgery, and baby steps from passive range of motion to basic strengthening exercises must be done. Some tracking issues, especially injuries due to infrapatellar tendinitis and chondromalacia patella can be partially resolved by an **infrapatellar strap** (aka **ChoPat**). You can tape the patella to pull it up or medially, but it is an obnoxious and must be done often. Make a little tab with the first layer of tape to pull off of with the next layer.



Chopat-style knee brace (above), or taping the patella upwards.

Knee braces aren't as bad for you in the long term as some people say they are. In fact that can actually improve proprioception and generally won't de-train or become a permeant crutch. Run of the mill **neoprene braces** don't offer much protection but can help warm the joint (good post-acute) and offer some proprioceptive protective feedback. **Palumbo or Shields style braces** help with patellar instability. **Unloading style knee braces** are helpful for knee alignment or OA issues. There are lots of other types of knee braces that offer options like lateral stiffness for collateral issues.



Palumbo, Shields, unloading, and lateral stiffness braces

Exercises that focus on the partial or terminal knee extension, and the VMO for tracking issues should be emphasized, especially concentrically loading and stretching the quads. Wall squats are helpful. The knee joint can be manipulated, including a subluxated patella and head of the fibula at the knee. This is occasionally useful, especially in tracking issues and stiff knees due to degeneration. Try some of the hip warm-ups and core exercises, balance exercises, lower

body stabilizer/antagonist exercises, and lower body supplemental exercises.

LOWER LEG PAIN

The most common sources of lower leg pain are shin splints, calf strains, and a stress fracture of the tibia. Both the stress fracture and shin splints can present with anterior lower leg pain, but shin splints go away with rest. The stress fracture is a result of too much impact or poor running technique. Tibial stress fractures are high risk for complications. Prepare for 6-8 weeks of rest and possible casting if it is a high-risk stress fracture. After confirmation with X-ray or a followup X-ray after two weeks, rest and a course of anti-inflammation treatment are usually all that are needed more a non-complicated stress fracture. You should perform an investigation of your shoes and running technique.

A calf strain to the gastrocnemius or soleus has a similar MOI, but weakness and inability of the muscle or tendon to meet the demands placed is more likely. After being treated with modalities that aid in healing and reduction of scar tissue, begin training both concentric and eccentric calf raise-type exercises followed by plyometric training.

There is a bursa inside the two heads of the gastroc behind your knee that can get inflamed or rupture, called a Baker's cyst. If mild, treat like any other bursitis, but if ruptured (it will feel weird) you may want to go a knee specialist and also to see if you may have ruptured a tendon as well.

Shin splints occur from overstrengthening and inflaming the tibialis anterior muscle or the connective tissue attachments to the tibia. Although its specific action is to dorsiflex (raise) the foot, the tibialis anterior's main function is to eccentrically stabilize the foot during foot strike and toe off, counteracting the gastrocnemius. The peroneus longus can also be a culprit, as it aids in foot pro-

duction during propulsion. If shin splints are becoming chronic, you need to rest for a bit and address the inflammation first. Then begin eccentric training involving lowering your foot and turning it in under resistance. Concentric training may also be useful if the muscles are particularly weak (do the opposite motion). Short foot and balance exercises are also helpful. Overpronation can directly lead to shin splints as can landing on your heel vs. flat or the balls of your feet depending on your preferred new school running technique will increase stress to the anterior leg muscles as more force is generated since the lever is longer and the distance is greater that they must stabilize.

ANKLE PAIN

Sprained ankles are the most common climbing specific lower limb injury. The common MOI's are hiking, bouldering, hitting a ledge/ground or slamming into the cliff during a fall. I suspect alcohol influenced hijinks makes it onto the top reasons as well. The more you sprain your ankle, the weaker and more stretched out the tendons and ligaments get, and the more you are susceptible to spraining it again. Knowing this, it's amazing how many climbers do nothing for chronic ankle sprains. If you can't take more than a few steps on your sprained ankle, definitely get it X-rayed. Chronic pain from an ankle sprain is a warning sign for an undiagnosed fracture. X-rays aren't that expensive, get one after two weeks of pain or immediately if the sprain is bad. Poorly healed fractures can ruin your ankle and lead to surgical, fusion, joint replacement, and arthritis. Rupture of the ligaments near your anklebone, and tearing or avulsion of the tendons that control foot inversion are most commonly injured. Spraining the inside side of your foot in an eversion sprain usually requires a serious force. Go to the hospital in the case of an eversion sprain just to be extra careful.

If you're in the field, find some cold water, ice, or snow to immediately ice your sprained ankle. The more function you can squeeze out of your injured ankle, the quicker it will heal or you'll be able to walk out on it. If you have any **athletic tape** handy, do your best to make a supportive wrap. At home, use all the tricks to get inflammation and swelling down. To tape a sprained ankle make a couple stirrups from the heel to above the ankle. Then make figure 8's in both directions starting from the ankle over the top of the foot, down under the arch, continuing around the heel, then around the ankle. Use extra tape to secure and to dampen any creases or loose ends.



Rock shoe compatible



Follow the numbers to tape a sprained ankle



Various ankle braces

Depending on the severity, it may require a week of on/off all day icing. Once the pain and swelling have subsided, beginning range of motion exercises is essential to prevent problems down the road. Progress to easy balance and strengthening exercises. Once stable, progress further to more difficult balance exercises and strengthening of weak areas like plantar flexion and inversion. Reducing scar tissue and getting the tendons or ligaments to heal in proper alignment of force is essential to prevent future injury. Chronically stretched out tendons can heal by more aggressive friction treatments, or injections. When attempting activities that will pre-dispose you to tweaking your ankle again, learn to do a good preventative tape job. You can use other devices to stabilize the ankle, but few will fit inside a pair of climbing shoes. Many runners get their ankles and feet adjusted by chiropractors because biomechanical flaws in the feet can lead to many problems down the line.

Be sure and practice the balance exercises religiously, and visit some of the lower body antagonist/stabilizer exercises.

POSTERIOR ANKLE AND HEEL PAIN

Calcaneal bursitis, plantar fasciitis (described later), and Achilles tendinitis can all make the back of your ankle or heel hurt. The Achilles tendon can also rupture, and is pretty obvious when that happens. Poor shoe selection and tight/weak gastrocnemius muscles are usually to blame here. Achilles tendon ruptures sometimes requires surgical repair, or at least casting/bracing. Inflammation treatment, concentric and especially eccentric calf strengthening exercises will help with rehab the area. Strains and tendinitis to the Achilles respond well to friction massage. Do not get a cortisone injection in your Achilles due to the high chance of rupture. Also be very careful when crossing frigid streams. Your Achilles has a very high chance of rupturing

in this activity, and sometimes you can actually hear or feel the creak and moan of the tendon on long crossings with wobbly rocks beneath.

FOOT PAIN

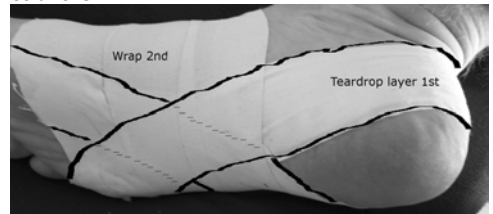
Plantar fasciitis presents as chronic foot or heel pain and is very similar to tendinosis that can occur in medial epicondylitis. The sheet of connective tissue on the bottom of your foot, or plantar fascia, gets inflamed and can go on for months eventually slipping into a necrotic-type degeneration of the tissue. Rest and anti-inflammation therapies help in acute cases or flare-ups. In acute or flare-up scenarios, rest and protection via orthotics and supportive yet shock-absorbing footwear is necessary. Manual therapy and other modalities that promote healing and scar tissue reduction can help, but for many they can be painfully ineffective. That said, they should be the first line of therapy. There are many home-care massage tools available for self-treatment, including ice massage. For tough cases, a **Strassburg sock** or **posterior night splint** may become necessary to really stretch the foot and gastroc. Injection therapies may be helpful in tough cases to reduce inflammation or to regenerate degenerating tissues. Extracorporeal shock wave lithotripsy has also been shown partially successful at treating this. Standard ultrasound would be a weaker version of this therapy. Age and weight can also affect the likelihood of developing this syndrome as degeneration and excess force can weaken the fat pad and shock absorbency of your feet. Check your walking or running technique and footwear or explore new lacing techniques explained in the gear section. Balance exercises and foot exercises can be very helpful as well.



Plantar fasciitis support



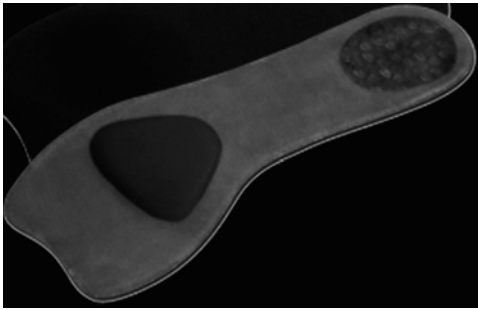
Cold roller



Taping arches (lowdye)

Stress fractures are very common in the smaller, yet extreme weight bearing bones of the feet. Many times you can simply limp through the pain, while other instances, especially stress fractures in the calcaneus and talus bones of the ankle can get worse and require casting or even surgery. Broken toes are fairly benign in the long run, much like broken fingers. Severe pain and swelling of the joint may mean the joint is involved and more attention may be needed besides rest or a splint.

Metatarsalgia, or pain in the metatarsals below the toe joint is often confused with Morton's neuroma, and is usually due to shock or a collapse of the transverse metatarsal arch. A **metatarsal pad** under the ball of the foot and under the toes can help, as can balance exercises.



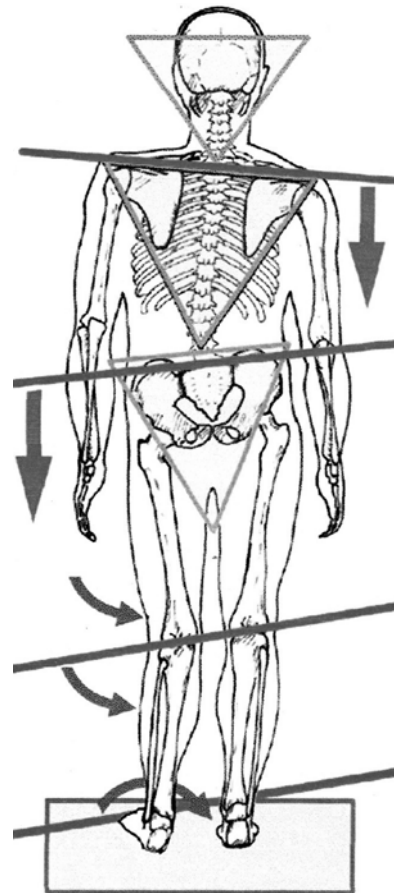
Metatarsal pad

A Morton's neuroma is caused when a nerve between one of your metatarsals gets inflamed. Symptoms are foot pain and sometimes numbness or tingling in the foot and toes. It may even feel like there's a pebble in your shoe. Changing footwear, increasing padding, and anti-inflammation therapies are generally helpful. Sometimes surgery is necessary, and outcomes are generally successful. Alcohol can be injected into the nerve to kill or severely disable it, as can gas injections (**cryogenic neuroablation**), and **radiofrequency cauterization**. You'll probably lose feeling in a toe or two with surgery.

FOOT ABNORMALITIES

Pronation is the big buzz-work in gait and for blaming other painful conditions on. Pronation is complex motion of the foot that mainly involves dorsiflexion, abduction, and eversion to propel you forward, and stabilize and shock absorb force when you land. However, pronation can also describe in the biomechanical shape of your foot at rest. An overpronated foot falls into a pronated position because of muscle and ligament laxity. An overpronated foot offers less shock absorption, and because the motion of pronation is necessary but the foot is already in a pronated position, the force and shock absorption must be compensated for and by other areas. Signs of an anatomically overpronated foot are signs of excessive shoe wear on the inside of the heel, inward bowing of the Achilles tendon when standing, and low arches. Standing on one

foot and having the arch disappear is another sign of overpronation.



How overpronation can affect other areas

Rigid feet with low arches can mask themselves as overpronated feet, a condition called pes planus, and will not respond well to orthotics to encourage arch support or rigidity and can make things worse. An underpronated or supinated foot generally has a high arch and signs of wear on the outside of the heel. Rigid feet with high arches, called pes cavus, are more akin to a foot that underpronates. Weight bearing foot scans can help show where the pressure is and where it should be. The next best test is to have your gait examined at an expert running shop. These folks do this day in and day out. Although they may not have advanced degrees, they should know their

stuff. A podiatrist would be the best next step. See the section on orthotics below.

Underpronated feet usually require footwear that is suppler and shock absorbing, while overpronating feet generally do well with more stable, rigid, corrective type footwear. Foot strengthening exercises from short foot, to balance training, to barefoot running will help strengthen your feet so they can provide their own shock absorption and proper gait biomechanics and wean you off corrective shoes and orthotics. Subluxated foot and ankle joints can mess with proper foot biomechanics as well and lead to overpronation.

Two foot malformations can contribute to overpronation. Forefoot varum is a congenital malformation of the metatarsals and tarsals can lead to an inverted forefoot and overpronation. A **medial forefoot post** in an orthotic can help. Rearfoot varum, or inversion of the calcaneus, is one of the most common anatomical variations that lead to overpronation syndromes. A **medial rear-foot post** in an orthotic may help.

Our hand's ugly cousins seem more pre-disposed to genetic malformation than most body areas, as well as acquired ones from poor footwear. Bunions and calluses develop for too much pressure or rubbing in one area over time. The most obvious treatment is to get better fitting shoes - even if the shoes causing the problem are the best shoe for rock climbing or a \$600 pair of ice or ski boots. Pain severely limits performance. It's amazing what cobblers can do, and spending \$5-30 per shoe can be a lot cheaper and easier than getting surgery.

Bunions formed by swelling of the bone or new bone growth can be reduced partially via various aggressive inflammation treatment or possibly ultrasound to break up non-calcified callus material. Temporary

padding of a bunion in the field will help it from getting bigger or worse. If you get a pump bump, a bunion on the back of your heel at the Achilles, aka Haglund's deformity, do not use a heel lift for long to treat it as your calf and Achilles will shorten and weaken. Unfortunately bunions usually get worse, not better, and if a certain point of discomfort is reached, surgery may be the only option. You can usually walk out of surgery, but will have to wait weeks before putting the rock shoes back on. Calluses can be taken care of with a **pumice stone**, and should be to prevent blisters and changes in gait.

Hammer toes and claw toes can be congenital, or by looking at many climbers' nasty feet, acquired. Thankfully most cases aren't painful, or painful enough to sacrifice performance by switching to more comfortable shoes. Hallux rigidus, a rigid big toe, is generally caused due to chronic irritation. Joint manipulation may help, but traction, constant stretching, splinting, or most likely surgery as a last resort may be necessary in painful cases. **Rocker bottom soles** are helpful for painful toe problems.



One solution for reducing hammer toes

Hallux valgus can also be acquired, but usually is congenital. This is when your big toe faces in towards your other toes at an odd direction. Pain is usually from the joint that is now poking out – not the actually align-

ment of the big toe. Tailor's bunions form on the side of the little toe in a similar way. There are some passive stretching options available to help reduce the misalignment, like the Healthy Toe Stretcher, among others.



Some solutions for reducing hallux valgus

FOOTWEAR AND ORTHOTICS

As I prophesied in the first edition, **minimal footwear and barefoot shoes** have finally gone mainstream. The concept is that landing on your heels during running creates too much shock to your body and creates an abnormal muscle firing pattern that can lead to a whole host of foot, ankle, leg, knee, back, even neck issues. Midfoot or forefoot (balls of your feet) strike uses your body's natural shock absorption system and promotes a more natural running gait and minimal footwear forces you to run on your feet correctly. Running technique has been described earlier in the Aerobic Training section. Minimal footwear also strengthens your feet because of the lack of support that can help correct foot, ankle, knee, and low back problems mainly from correcting overpronation by strengthening your feet. The short foot and balance exercises in this book will also help. Most fancy running shoes have turned up toes to prevent stubbing, but this interferes with a normal toe-off. Most running shoes also have a higher heel than forefoot for landing on you heel. This makes landing on your mid or forefoot difficult, and will mess with your squat form (wink to CrossFitters). Many minimal shoes champion a 3 mm or less heel rise. I know a prominent podiatrist that runs in Crocs and Converse All Stars (Chuck Taylors), and many many people run in sandals, all of which can be marketed as "barefoot style shoes".



Climbers should have fairly strong feet by using their feet actively during climbing, but not all do. I highly recommend barefoot or minimal running shoes, but remember to follow the recommended break-in period. Barefoot and minimal running can also create as many problems as they attempt to solve. Use them carefully and intelligently.

Extreme overpronators should start with a more rigid shoe and get some miles in and do some active rehab before going "barefoot". Extremely stiff supinators will benefit from the floppy, flexible shoes, but may need more cushioning. Try inserting a **shock absorbing insole and or padded heel cup** if at all possible. If not, go with a minimal shoe that will allow extra cushioning added if you underpronate.



Barefoot and minimal shoe running can cause problems for those with poor form and just don't want to deal with fixing it, those with inflexible feet, are just predisposed to injury, those that don't run that often, or people that run a lot. Thankfully there is backlash to the barefoot revolution. Extra cushioned, yet very lightweight shoes with a more enlightened biomechanical design (less rise, upturn toe, etc.) have started to become popular. Be careful rolling your ankle with these.



Hoka One

If you have other abnormal foot deformities, see a podiatrist. You may need a **wedge or post** placed inside the heel or forefoot (a varus or valgus wedge/post), arch support, or a metatarsal lift. Before seeing a podiatrist, you can save some money and buy over-the-counter **semi-custom orthotics**. Superfeet makes a good pair, and there are some custom moldable varieties. Generally it is best to fit the orthotic to your feet, than your feet to an orthotic, but about 80% of foot problems are solved with an inexpensive semi-custom orthotic than an expensive prescribed one made at a lab. Don't go the middle ground and buy a \$300 pair of orthotic made by someone who doesn't absolutely specialize in them, especially if the mold is made from a foot scan.

Orthotics made from a foot scan are much more expensive than store bought ones, but may be no better. If spending the cash, you might as well pay the big bucks to an expert and get a mold taken from a non-weight bearing, neutral mold of your foot. Plaster casts and boxes of foam are the best. Non-weight bearing molds give you biomechanical correction, and are very hard to do-it-yourself. Weight bearing scans and heat moldable orthotics don't correct foot problems – they are accommodating and very useful for certain foot conditions (congenital deformities, spurs, Diabetes, etc.). Also, most orthotics made from foot scans are actually semi-custom. Your foot is matched to one of several pre-made orthotics, not custom made in a lab. Most foot problems are very similar in the general population,

so chances are yours are too, so why not save some coin and buy some Superfeet or cheap moldable ones, or inexpensive ones from a scan.



If you are in doubt, get a consultation. You may find that your foot condition can be corrected instead of relying on orthotics as a crutch. They may be helping your feet but weakening other areas in your body.

If you have an anatomical leg length inequality, or a functional one that won't go away with treatment, a **heel lift** may solve many issues for you. There are some quick checks. First lay face down with your head facing straight down. Turning your head may alter the results. Have someone pull both of your legs to straighten you out and have them look at the inside of your ankle-bones (medial malleolus). One would be higher than the other with a leg length inequality. Next flip over and repeat. Now do a sit-up. If the leg length equalized, then the problem may be in your pelvis. If they switched sides, you may have a leg length inequality and a pelvic problem. One final quick check that I invented is to stand up straight barefooted. Swing one leg back and forth. Now swing the other. Does one foot catch up on the ground?

Leg length inequalities need to be fixed gradually, a few millimeters at a time. If it is severe, you may need an X-ray Scan-O-Gram to measure it exactly. You may also

need a **complete lift of the sole** since lifting your heel up too much can cause problems. Work your way up to the desired lift. You may get an unwanted rebound effect and wind up with more pain. If this is the case, decrease the height or don't use a heel lift. A heel lift will raise the femur by the same size as the lift, your sacrum by half that amount, and L5 by $\frac{1}{4}$ the size of the lift. Also get your feet, knees, hips, pelvis, and low back checked for muscle imbalances and joint dysfunction. There are several heel lifts out there, starting with a simple heel cup from the grocery store or a ridged lift you may need to get from a PT or DC. Get a bunch for all your shoes and tape them securely to your shoe insoles.



Heel lifts

Another type of orthotics is **rocker bottom shoes**, also inappropriately marketed as toning shoes. These have a rocker board integrated into the sole of the shoe. They're not a bad idea as they do help training balance, and promote some core work. However, the benefit may or may not be worth the extra money and looks/questions you'll be getting. If you walk around all day at work and you want to splurge – give them a try. They really shine for people with forefoot problems, arthritis, or Diabetes. As with any type of orthotic, if you don't need them they can cause more problems than indented to fix.

I wouldn't make a habit out of taping your arches, but if you need too in order to get your feet strong enough, just tape them for a short time. **Leukotape** works best since it does not stretch. Taping over a sore spot is a good idea to run on while the area heals.

OTHER SELECTED CONDITIONS

CHECK-UPS

If you haven't had a physical in a while, you probably should now. You can check your own resting heart rate at home, and it can be mildly useful to gauge training progress or signs of overtraining. A high resting heart rate doesn't necessarily mean you are unhealthy or have poor cardiovascular health, it can also be genetic. If you find that you have high blood pressure, stay on top of it and check it regularly. Training may help, but you may need medication. Get your blood checked for the following and follow your doctor's advice: lipids and cholesterol, complete blood count including iron levels, liver enzymes, glucose levels, and hormone levels including testosterone and thyroid. Get a check-up from your dermatologist at some point, it could save your life, especially since climbers tend to be out in the

sun for long periods. Don't ignore those men's and women's special health checks. Pap smear, mammogram, and routine gynecologist visits for women of certain ages. Testicle, colonoscopy and prostate exams for men of certain ages. Ask your primary care physician for when you should begin these routine screenings.

For those suffering from fatigue and or digestive issues check the following: environmental and food allergies, inflammatory conditions such as RA, lupus, and other inflammatory arthropathies, lyme disease (from ticks outdoors), a sleep-study, or adrenal levels (from saliva). Low-level viral infections like mono, or low-grade sinus infections can contribute to a chronic sense of fatigue. General food allergy testing usually only tests for severe allergic reactions.

Check out a naturopath for non-traditional approaches for ailments like chronic fatigue syndrome, irritable bowel syndrome, and fibromyalgia. Visit a nutritionist for advice on healthy eating and weight loss.

A warning: you can spend a lot of money investigating nutritional and naturopathic issues. Each practitioner, book, and Internet search will give you a million different answers. You may find the magic bullet and solve a lifelong health concern, or you may wind up wasting a lot of time and money. My advice is to start simply and make common-sense changes before going down other paths.

OTHER SELECTED CONDITIONS

ALLERGIES AND SENSITIVITIES

True allergies are IgE mediated antibody reactions. They can be mild with cold-like symptoms, or severe causing rashes, hives, or anaphylaxis. They can be caught with a simple skin or blood test at any doctor's office. Another type of allergy can be described as a low-level allergy or a sensitivity. These are IgG antibody mediated allergies, and they are the source of much pseudoscience and debate. Either type of allergy can cause an immune response and leave you feeling tired, sick, or worse. If, for instance, you are mildly allergic to blueberries and eat them every morning on a backcountry trip with your oats, your performance could suffer. Wheat gluten is the evil villain in food-Nazi land, and I suspect certain people would be upset if they were not allergic to it! There are a few ridiculous tests for food allergies you should avoid, one specifically being Applied Kinesiology which uses muscle strength testing to diagnose allergies.

Allergy testing is very sensitive (it should catch everything), but not too specific (many false positives). There isn't a lot of evidence suggesting IgG tests are valid or reproducible between labs. Food allergy testing can also be done with an ELISA panel

or delayed sensitivity test (Cellular Immune Food Reaction Test). Confirm any positives with a food challenge. ALCAT Laboratories is one of the more popular food sensitivity testing labs.

A food challenge is a practical, but subjective test designed to identify food allergies. Remove all suspect foods from your diet for 1-3 weeks. Eat lamb/turkey, rice/potato, any vegies but corn, legumes, and tomatoes, any fruit but citrus, any fats but dairy, corn, or soybean oil if you don't have any suspects. Avoid wheat, corn, citrus, soy, legumes, nuts, animal/fish products, coffee, tea, chocolate, and yeast. Introduce new foods every two days by eating it at least in two separate meals and see what causes a reaction. After 3-6 months of avoiding the offending food, re-challenge suspect foods to see if tolerance has been built.

CHRONIC FATIGUE, CHRONIC PAIN, ADRENAL INSUFFICIENCY, FIBROMYALGIA, AND DEPRESSION

The problem with these syndromes is that we know little about them. We can all relate to anxiety or stress fatigue, but whether this can create an actual chronic syndrome of reduced cortisol levels or not is up for debate. Those suffering from chronic fatigue syndrome and or pain will no doubt know that the problems are real. I believe climbers are more susceptible to developing these syndromes because of the extreme mental and physical stress hard climbs can produce. In fact, a very hard climb can leave one feeling post-climb depression, or with symptoms synonymous with post-traumatic stress disorder (PTSD). As stated, **magnesium, folic acid, malic acid, SAMe, licorice, DHEA** for men, and **progesterone** supplementation for women have been shown to be somewhat effective.

Saliva tests that show reduced sub-clinical levels of cortisol in blood tests have little scientific evidence, as do most supplements containing animal adrenal gland and hypo-

thalamus. Low-level cortisol supplementation to give the adrenals a break has even been stated as a cure. This isn't to say they are bogus, but just that the research isn't there or is looking in the wrong places. You can order your own saliva testing kits without a prescription from many labs. Low levels of neurotransmitters seen with depression have been suggested, and treatment would consist of taking depression medication. **Adaptogens** and vitamins (**vitamin C, E, B-complex, calcium**) that aid in stress may help, but again, there is little evidence. Depression and sleep disorders can be contributing co-factors, but are not always the case.

Some non-medication suggestions are too seriously cut back on stimulants, alcohol, and sugar. One benefit of cutting back on the caffeine is that after about a month, the effects of a cup of coffee (or whatever) will be more pronounced for when you really need it, like at 4 am cold and scared. Improper (meaning not just inadequate, but possibly too much) nutrition, exercise, and sleep as well as allergies should be looked into as possible causes. Get a complete blood count (CBC), get tested for Lyme disease, R.A., lupus, and M.S., check your thyroid and sex hormone levels, and your liver enzymes to rule out other conditions.

Anxiety and depression are very closely related and may be symptoms of the same thing. Talking about more severe forms of depression and mental illnesses are way outside the scope of this book, but many climbers suffer from mental disease. Depression and anxiety can be low level, but no matter the severity, they can both severely affect performance and motivation. Climbing something fun is an excellent treatment, as is exercising on a regular basis. Sticking to a regular schedule, getting plenty of rest and normal sleep (not too much and normal hours), having friends or loved ones close, and having something to

look forward to (your next climb) are all great treatments. However, even with the best intentions and surroundings, depression and anxiety can be impossible to break free from without medication. There are some new cleaner drugs on the market. Because there is no real test to determine what drug will work best, you may have to try several, giving each a few weeks trial.

GASTROINTESTINAL PROBLEMS

Irritable bowel syndrome, or as I like to call it, fibromyalgia of the gut, should be investigated if you are having digestion or bowel issues – after more serious conditions like ulcerative colitis, stomach ulcers, and Crohn's disease have been ruled out. You may want to get your colon irrigated, or start taking some **probiotics and prebiotics**. **Ginger and licorice** are other possibly helpful supplements.

If you get the squirts from over-doing it on the supplements or wind up with diarrhea from eating space food, **antispasmodics** slow down your gut so water has more time to absorb before they start pressing against your sphincter. Some, like **Imodium Multi Symptom** also contain a drug to reduce frothing and bubbling in your gut. If you're the type who always seems to get the squirts, test any antispasmodic out at home to see how long it takes, how much you need, and how long it lasts. Bring some along with you. If you are literally pissing out your ass, hydrate with **electrolytes and sugar water**. If it remains you probably are sick or have a food or water borne illness. **Peppermint oil with enteric coating** has been suggested as an effective OTC medication for IBS related GI symptoms.

On the flip side, constipation can make you feel like a ton of bricks. Get your **fiber** in your normal diet and by eating some extra dried fruit. Don't hold it in at night or on the approach. Backed up bowels can create diarrhea later. **Laxatives** work well, but of-

ten too well and you may regret taking them later. **Suppository tool softeners** are a bit gentler than laxatives. Constipation and also sitting around in the cold can create hemorrhoids. **Hemorrhoid creams, suppositories, and wipes** will help reduce the pain and inflammation but surgery is necessary to totally rid yourself of these nasty buggers if the get out of control.

If you suffer from GERD or chronic heartburn, or watch TV, you should be all too familiar with the OTC drugs like **Pepcid**, **Pepto-Bismol**, **Zantac**, **Tagamet**, and **Roloids/Tums**. Sneak something that works for you in your med kit. **Vinegar** is a lesser-known but very successful remedy for excessive acid. A small shot tells your stomach that it doesn't need to produce anymore acid.

SLEEP AND STRESS

Suggestions for getting good sleep are under the Programming chapter under Rest. For the love of god please try the following drugs out at home before on a climb! **Melatonin** is produced naturally, is quite effective, but most doses are way too high. 1-2 mg should be sufficient. Take it thirty minutes to an hour before you want to fall asleep helps to reset your body clock. It can make you groggy if you take too much (start with ½ mg) and can give you nightmares. Used in conjunction with a **full spectrum light**, like the Philips GoLight, in morning can really help you reset your body's clock. **Valerian root** is an excellent natural sleep aid, but it smells terrible. **Kava kava** and **chamomile tea** are popular herbal remedies, but there is not great evidence for either. Chamomile tea needs to be strong (3 tea bags) to work. Kava has better evidence for helping with anxiety, which may be why it is suggested to aid in sleep. **Tryptophan** (the amino acid in turkey and milk that make you sleepy), **hops**, and **passionflower** are all supplements that can make you sleepy, but dosage and efficacy are lacking.

Diphenhydramine (**Benadryl**) and dimenhydrinate (**Dramamine**) are OTC pills used as sleep aids. Climbers have been using these for years, probably because they are cheap. The sleepiness is really a side effect since Benadryl is an antihistamine and Dramamine is for motion sickness. Morning grog can be fully expected if you take too much (more than ½ to one pill). **Huperzine-A** is a supplement used for memory enhancement, and has been anecdotally suggested to increase your total REM sleep. I'd avoid it. **L-theanine** is an amino acid found in green tea that is able to cross the blood brain barrier. It has been successfully shown in studies to help your body cope with stress both physical and mental and to improve mood and cognition by increasing alpha brain waves and helping to regulate dopamine and serotonin levels in your brain. Alcohol is often used to fall asleep, but is a terrible sleep aid. It reduces mental and physical regeneration associated with sleep (especially reducing HGH), and obviously makes you feel like crap the next day. It also acts as a diuretic, dehydrating you for the climb.

Next up on the list are **prescription sleeping pills**. These can cause big trouble, even if taken at proper doses. Don't even think about trying these out the night before a climb or combining them with alcohol. All of these can make you do some very strange things under their influence. I really don't recommend prescription sleeping pills before a big day. Remember, you may need to jolt out of bed in the middle of the night and need to be on your game. If you have chronic insomnia, see a doctor instead of medicating yourself. Melatonin and most of the herbals shouldn't become addictive, but anything can become a habit or dependence – especially when it comes to sleep. **Sonata** works quickly, is least likely to cause hangover (short half-life) but won't keep you asleep. It can still mess you up. **Lunesta** has the second least chance of a hangover,

but it still can make you groggy. **Ambien** can make you the groggiest. Everyone reacts differently to each of these prescriptions, so you may have to try a few out. Do this in a safe sleep environment!

UNHEALTHY VICES

Misuse of legal drugs, use of illegal drugs, smoking and tobacco use, and alcohol abuse are obviously negative to health and climbing performance. But climbing is a stressful activity, and sometimes vices can get us through some tough times. This is not a lecture, but just suggestions for those who want to stop or cut back. Climbing can be a self-destructive act, but sometimes that self-destruction avoids other demons faced in the real world. After all is said and done, whatever gets you through the day and up the pitch – your motivations and problems are your own.

Smoking / Tobacco

Quitting smoking can be the most difficult thing a person can ever accomplish. For your partner's sake, don't quit cold turkey on a climbing trip. It may be a tempting time if you plan on being in the backcountry and won't be able to get a fix, but it's a terrible idea for obvious reasons. People have about equal success by going cold turkey, or gradually quitting. The one thing to remember is that it can take many attempts. So don't quit quitting. Immediately get back on the horse (or wagon). Avoid contact with tobacco at all costs. Movies with smokers are the worst. Use a temporary replacement with another, healthier substance to help with the ritualistic habits of having a smoke: **gum, tea, toothpicks**, or whatever. If you're used to going outside, bring a cup of tea outside instead. Chew gum in the car. Also, as described in the mental training chapter, make deals with yourself and follow through.

One alternative to tobacco use that your health care provider may not suggest are

electronic cigarettes. The FDA has not approved these for a smoking cessation device so they are not regulated...yet. That means you don't know what you are getting or the possible side effects. You could not be getting any nicotine, getting a lethal dose, or inhaling a dirty factory worker's tuberculosis. I haven't heard of anyone getting hurt, but I wanted to warn smokers out there. Now that I've covered my butt, I believe they are one of the best tobacco replacement devices out there. You can even get cartridges that gradually reduce the nicotine delivered. FDA approved nicotine replacement therapies are **patches, gum, lozenges, and inhalers**. Patches will probably fall off when climbing and exercising.

A couple anti-depressants are available to help with smoking cessation: **Wellbutrin** and **Zyban**. Another drug, **Chantix**, helps with reducing hard-hitting cravings. My advice is to arm yourself with as many physical and psychological replacements as possible, and keep quitting over and over and over. If you fall off the wagon, forgive yourself and immediately quit again. Don't give yourself a "break" from quitting. If you find yourself buying a pack, don't plan on finishing it. Run it under water, and throw it out. It can take many many attempts to quit, but you must try to quit immediately after falling off the wagon.

Alcohol

Alcohol is definitely part of the climbing culture, and there is a lot of climbing peer pressure to drink. No one should care if you drink in moderation and aren't driving, but just know that alcohol is detrimental to strength and skill training, and interferes with your rest and regeneration. It's also expensive. Unfortunately many climbers use climbing as an excuse for their alcoholism. Climbers who think they may be alcoholics should consult a doctor for blood tests because many nutrient deficiencies are possible.

Marijuana

Now that pot is legal in some states and legal with a prescription in many more, I can recommend it for those who already partake for a relaxant, sleep-aid, pain reliever, and entertainment. That said, like alcohol, pot can be very unhealthy for your lungs, dull your senses, interfere with performance, and get you or your partner hurt if used in dangerous situations. I do not recommend anyone start, and not using it is probably a good thing (unless you have a physical or mental conditions that a doctor recommends it for).

AGE RELATED CONDITIONS

Many seemingly impossible climbs have been done by people who are bling, missing limbs, paralyzed, are three years old, and 90 years old. Unfortunately this leaves you without many excuses.

KIDS

Climbing is the greatest thing in the world for kids, but training is not. Kids and adolescents can stunt their growth and development by the type of training involved in this book by altering their growth plates, and causing hormonal changes. What kids and adolescents need is skill development, and muscle and cardio training via real world activities and organized sports. In other words kids get exercise through playing and skill development, not by running and weight training. Focus on eating healthy and play – not diets. Kids need to eat plenty, but they can learn to eat too much. If you make them clean their plate, make sure the portions aren't well over their caloric needs. Kids do have a higher caloric need than adults do pound for pound. Under nourishing kids can actually make them obese because their developing bodies won't become as metabolically active. Kids also need plenty of water. They sweat less and don't dissipate heat as well as adults, putting them at higher risk for dehydration and overheating.

Keep the science experiments to yourself and avoid giving kids questionable supplements that screw with metabolism or hormones. Children's' vitamins and milk are safe if standardized and free of additives. A normal ratio of carbs, protein and fats should be supplemented with plenty of fruits and vegetables. Treat sweets like a cheat day – as a positive reward for eating well.

Congenital Malformations and End Plate Injuries

Most NMS problems kids and young adults get (besides broken bones) are due to congenital malformations, or injuries to the growing endplates on their bones. Injury to the growing endplate can cause permanent growth retardation to that bone, or cause AVN if the endplate is avulsed. Be a cheap-skate with yourself, but not with your kids. Get them checked after any moderate to major trauma, especially if there is any swelling, intense pain, or reduction in range of motion or function with trauma or if the symptoms seems to come out of nowhere.

Some malformations, like scoliosis, can be managed and possibly reduced by specialists. Treatments involving combinations of bracing, counter weight exercises, proprioceptive exercises, and muscle stimulation have been shown very effective in progressive cases. Scoliosis can be progressive (gets worse) or can be self-limiting and resolve with maturity. Get your kid checked and monitor the progression. Scoliosis in a front to back direction usually resulting in a hyperkyphosis of the thoracic spine is usually caused by Scheuermann's disease, a disorder in calcification of the vertebral endplates.

Kids and young adults (11-20) are susceptible to osteochondrosis, a slow separation of subchondral bone and cartilage in their knee, foot, and elbow from repetitive activities. AVN can occur in both femoral

heads, called Legg-Calve-Perthes in children 4-8 years old. Congenital hip dislocation, diagnosed at birth, can lead to problems down the road if not treated properly. Temporary inflammation can occur in the hip joint for no apparent reason, called transient hip synovitis, in children 3-10 years old and can mimic an infection of the joint. The growth plate can avulse or start to slide off the top of the femur at the hip in slipped capital femoral epiphysis for adolescents 10-16 years old. Kids generally grow out of knock-knees, aka genu valgum, but it could be caused by injuries or malformations in the foot, knee, or hip. Coxa vara and coxa valga, decreased or increased femoral angle at the head respectively, can contribute to problems at the knee or hip. Conservative management of symptoms is usually recommended for this. Also the femoral head can be retroverted or anteverted, facing out or in too much at the hip joint. The can lead to anatomic over toeing-in or toeing-out, and a predisposition to instability at the hip. Avulsion of the tibial tuberosity, called Osgood Schlatter's, is common in kids and early teens (8-15), and responds well to conservative care. A similar condition where the calcaneal tuberosity avulses on the heel, called Sever's disease, has a similar self-limiting prognosis. Young children can have their radius dislocate in their elbow and rupture the annular ligament, simply called pulled elbow. Be careful tugging them through the grocery store, and on dynamic climbs. This usually self-resolves.

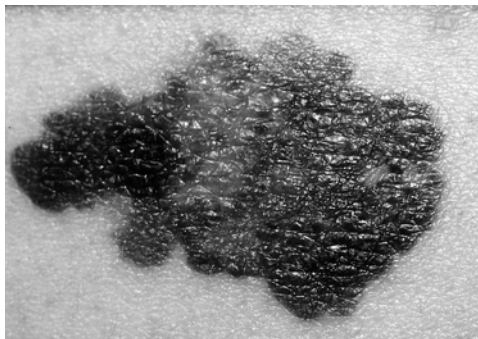
GETTING OLD

Skin Cancer

I would say this is the most serious concern for climbers who have had chronic sun exposure. Regular exams by a dermatologist can be lifesaving. The most worrisome and lethal skin cancer is malignant melanoma because it can metastasize and is difficult to detect and occur in non-obvious places. Look for irregular shaped moles, new moles,

moles that have undergone any changes in color or size, and moles with dark spots and irregular or jagged edges. Unfortunately some common spots for melanoma are on the soles of the feet and under the nails. The upper back and lower legs are the most common spots, as are any areas that have been sunburned (like the upper back and lower leg). Most basal cell carcinomas, another type of skin cancer, occur on the head and neck and sun exposed areas like the ears and nose.

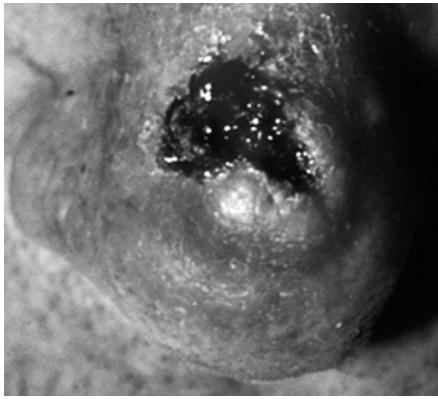
Basal cell carcinoma can be serious and result in significant damage to the immediate area. It is the most common type of skin cancer and is found mostly on the head and neck. Squamous cell carcinoma is the second most common form of skin cancer and also occurs in sun-exposed areas of the head and neck, but its appearance can be highly variable. It is serious and can metastasize like melanoma. Get any new or growing skin lesion checked out.



Malignant melanoma



Basal cell carcinoma



Squamous cell carcinoma. Courtesy NIH/CDC

Genetic Disease

Getting old can mean turning 30 for some health and genetic conditions. Once you turn 30, start to pay attention to odd changes. Some genetic diseases start showing signs now. Besides starting to actually put money in the bank for retirement, also put prevention in the health bank.

50's and Older

Not much happens generally speaking until your start hitting your late 50's to mid-60's. Now you must deal with the increased threat of osteoporosis, cancer, cardiovascular disease, diabetes, and weight gain. Hormone levels like testosterone and estrogen fall, metabolism slows, healing time increases, and things generally start to fall apart. Be sure and eat enough calcium, protein, and healthy foods. Crackers and tomato soup aren't enough! This is the age where most people start taking preventative measures. Do some more research and find out what you can do to prevent cancer, diabetes, and cardiovascular disease – the main killers. Also focus on diets or supplements that aid in recovery, and improving the effects of insulin and spare protein metabolism.

Once you hit your 60's you need heavy resistance weight training if you haven't already. Weight training keeps muscles strong and bones solid for when they really start to get old and things begin to waste. Heavy

resistance weight training for seniors is money in the bank. Since tissues are less forgiving, stretching is necessary as well, but the focus is on light stretching, and active range of motion. Heart rates are lower, so cardio can be as simple as going for a thirty-minute walk every day

We are living longer, but as we age longer the burden of disease grows. As we age, arthritis and degenerative joint disease becomes more and more prevalent. Beware of AVN in the hip if you've had trauma to the area or bad arthritis. Connective tissues weaken. Bone weakens, and can develop osteoporosis in some. Spinal stenosis (narrowing of the spinal canal) can cause neurological problem, as can the increased risk of stroke and TIA. Metabolism slows and hormone levels change, making you more predisposed to NMS injuries. Muscles lose strength and endurance.

The list of things to prevent growing old in poor health is simple, and we've heard it all before. Keep an eye on your blood pressure, cholesterol, body fat, and nutrient intake for your heart. Get regular gynecologic exams, mammograms, prostate exams, colonoscopies, skin checks to nip future cancers in the bud, and once a year physicals. Stay active in both cardio and strength building exercises. Avoid stress, injury, and inflammation. Eat well, don't drink too much, or smoke. Keep climbing. The more you move the healthier you stay. Pretty simple advice. I can only hope this is all condescending information to those of you who stayed fit and are crushing it in your 70's, or later!

PREGNANCY



Pregnancy harness courtesy Mountain Momma

Women who are menstruating heavily should supplement with more **iron** than the RDA for women due to the loss in blood, but consult with your doctor for specific amounts. **Folic acid** supplementation is very important before becoming pregnant to aid in neural tube development of the fetus. Supplementation is required before conception. You can also take **prenatal vitamins** for you and your child.

While pregnant, women need to eat slightly more, around 300 extra calories. This is not a good time to diet. Worry about your child over your own self-image issues. Some chemicals pass easily into the child's bloodstream, while others are blocked. Do a thorough amount of research if you put anything in your body besides a regular diet. Avoid seafood high in mercury, undercooked animal products, or unpasteurized dairy.

Your goals will obviously have to change due to your body and new responsibilities. That doesn't mean you need to put your training on hold. Invest in a full-body harness designed for pregnant women that avoids the waist belt, and stick to top roping if you want to be extra safe. This can be an

excellent opportunity to re-visit skills, and get a natural way to train with some extra weight! You could also carefully follow pitches, alpine scramble, or boulder low to the ground depending on your ability to not fall far or onto your stomach. Avoid jerky, bouncy, high impact movements, and anything that would cause you to fall or get hit in the abdominal area. Assess risks for your baby, not just for you. Some contraindications to avoid all but light exercise are: pregnancy induced hypertension, history of spontaneous abortion, vaginal bleeding, or pre-term labor.

During the first trimester it's important to not overheat, and armpit temperature should be below 101° F. Also, it's important to keep your heart rate below 140 bpm (can't comfortably carry on a conversation). The 140 bpm is an area of debate for extremely active women, however. Some maintain that if you are extremely fit, staying below that heart rate will lead to too much de-training. It's up to you, but I suggest at least using a perceived exertion scale and try to stay below anything that leaves you totally exhausted. Pregnant women can actually increase their aerobic capacity compared to being non-pregnant if they exercise while pregnant and up to a year after pregnancy!

In the second trimester, weight lifting should be avoided while standing up if you feel dizzy or lightheaded. Avoid lying on your stomach in the second (and obviously 3rd) trimester, and after 20 weeks avoid exercising on your back as well. Avoiding exercising in the supine position is another area of contention for active women. If you must do exercises on your back, keep your knees bent and feet on the floor. Try lying on your side instead. In your third trimester, be careful on trails or terrain that can put you off balance. Finally, unless you already live at high altitude, avoid prolonged activity about 8,000'.

The hormone relaxin loosens joints and tissues, and combined with added weight, injuries to shoulders, elbows and fingers can occur more easily. Sacroiliac joint problems are common because of the looser joints – see a chiropractor or physical therapist to deal with the symptoms and work heavily on the core after you deliver. Swimming and yoga are excellent alternative forms of exercise you can do while pregnant. In fact, because you are going to get looser, now and just after pregnancy are both great times to work on flexibility! The hip flexors, low back, and chest area may get tighter,

and the upper back, gluts, abs, and possibly hamstrings may get a little weaker from the change in posture.

Every woman experiences pregnancy in a different way. I've seen women outperform plenty of men well into their 3rd trimester. Listen to your body and coordinate your exercise plans with your doctor or birth councilor. Find one that is experienced treating active, pregnant women. Check out the book, "[Exercising through Your Pregnancy](#)" for more information.