Smooth Sailing

Overuse injuries in sailing and windsurfing

By Tamara Mitchell

Sailing is one of the oldest forms of transportation.[1] The oldest representation of a sailing ship is on a painted disc found in Kuwait dated 5000 to 5500 BC.[2] As a sport, yachting appears to have originated in Holland in the 17th century.[3] The Dutch yacht was a small, fast, and good for making short voyages.[3] Competitive sailing started in England in the late 1800s with the America's Cup yacht racing.[1] As a hobby, if you live near a body of water, sailing can be a wonderful sport for relaxation, excitement, mentally challenging, and good for fitness.[4] It doesn't have to be expensive as boats can be rented, lessons and clubs abound, and maintenance costs are not outrageously expensive.[4] Windsurfing, is a very new sport estimated to have started in 1964.[5] Windsurfing takes a bit of attitude and skills from both surfing and from sailing.[5] It is an easy sport to get into, yet has plenty of depth to continue mastering the advanced skills and into competition, if so desired.[6] Although the sport has died out significantly after a huge boom in the 1980's, it may see a resurgence and an online search brings up plenty of places that still sell equipment and classes.

There is minimal research on overuse injuries in these sports. Part of this is due to the diversity in sailing that makes comparison of data very difficult. There are hundreds of boat classes, competitions vary from dinghy racing to global circumnavigations, there are various crew positions, and water/weather conditions greatly affect the number and type of injuries.[7,8] This article gives an overview of traumatic and overuse injuries in sailing and windsurfing along with prevention and treatment options.

There is no cure for Cumulative Trauma Disorder (CTD), known as overuse injury in sports medicine. It makes sailing and windsurfing very painful and sometimes impossible, but it can be prevented. Risk factors include a lack of general fitness, overuse, overtraining, and/or macro traumatic accidents.[8] Many actions in sailing are sudden and sporadic, requiring muscles to perform with explosive, powerful moves when they are not warmed up.[8] Awkward postures such as rotation, hyperextension, and locking or twisting joints cause musculoskeletal problems.[8]

Taken collectively, it can be said that many traumatic and overuse injuries in all types of sailing or windsurfing occur because of:[9]

- Lack of general fitness and strength, muscle imbalances, overuse, overtraining, or macrotraumatic accidents.
- Lack of warming up and cooldown.
- Muscles are placed at high risk when performing explosive, powerful moves, such as those frequently required when sailing.
- Poor sailing or lifting technique.
- Postural problems leading to musculoskeletal problems often caused by the design of the boat often resulting in rotating, hyperextending, locking, or twisting of joints.

Traumatic Injuries

Injuries in novice and recreational sailing are generally traumatic in nature and result from collisions with the boom or other equipment resulting in abrasions or contusions.[7] In elite Olympic-class sailing, the most common injuries are to the upper and lower spine and the knee resulting in about 0.2 injuries/sailor/year.[7] Injuries to the knee are thought to be a result of poor hiking technique and inadequate leg strength.[7] In professional ocean yacht racing, 33% of the injuries occur below deck, largely because of the amount of time spent below and the violent and sudden movements of the yachts.[10] In shorter distance races and sailing, most injuries occur from impact with boat hardware on or above deck.[10]

Small boats traumatic injury

In an online questionnaire survey of dinghy and keel boat sailors, primarily consisting of intermediate to experienced level respondents, the types of injuries reported were similar.[11] Contusions (bruising), lacerations, and sprains were the most common injuries to the upper and lower extremities. In keelboats, trunk injuries were the third most injured area while in dinghies, head/neck injuries were the third most injured area.[11] Although respondents would have been free to report overuse or repetitive strain injuries, none were reported perhaps because they felt that the survey was only seeking responses about traumatic injuries.

During the 1984-87 Kiel week regatta, hospital care was twice as likely due to injuries from dinghy sailing rather than keelboats.[8] These injuries included open wounds (31.3%), hand injuries (31.3%), head injuries (22.1%), contusions/bruising (19.7%), and various fractures (15.1%).[8] Another source reports that the most common injuries are strains, sprains, and contusions.[1] The three most common areas of injury are the lumbar spine (lower back), the knees, and the shoulders.

Big boats/yachts traumatic injuries

In one study observing participants in the 2003 America's Cup yacht race, the incidence of injury was 5.7 injuries/1000 hours during preparation for and participation in the Challenge.[10] Amateur ocean yacht racing has an injury rate of 1/1000 hours.[10] Comparatively, professional cricket, also a non-contact sport, has an injury rate of 7/1000 hours. Professional sports involving contact and collision (e.g., rugby and soccer) have injury rates of 114/1000 hours and 81/1000 hours, respectively.[10] So injury rates for yacht sailing, as well as small boats and windsurfing, are comparatively low.

In the 2003 America's Cup study, 67% of the injuries were acute and 33% were overuse injuries.[10] The overuse injuries were relatively more disabling that the acute injuries. However, there was no significant difference in the total number of days absent from training between acute and overuse injuries (acute: 1210 days; overuse: 1142 days) or the total number of days absent from sailing (acute: 507 days; overuse: 437 days).[10] 40% of the injuries affected the shoulder, 25% affected the lower limb, 20% affected the trunk, and 14% affected the head and neck.[10]

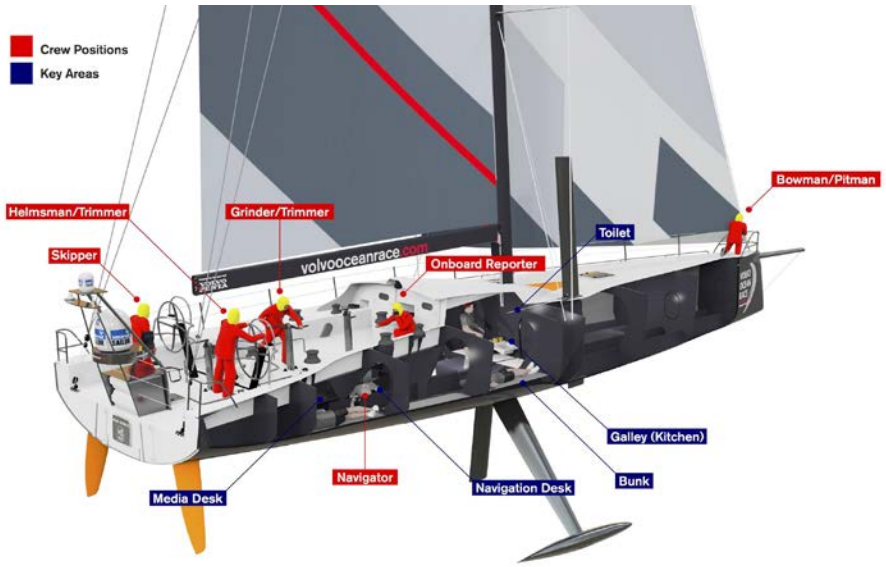


Illustration courtesy of VolvoOceanRace.com

The most common traumatic injuries that occurred while sailing in the 2003 race were contusions (bruises) and sprains from contact with boat hardware (e.g., Spinnaker poles, winch handles, foot chocks, ropes, sails, and winches).[10] Similarly, the amateur sailors participating in 1996-1997 British Telecom Global Challenge experienced mainly abrasions and contusions (36%).[12] Bowmen reported the highest incidence of injury due to the high intensity of their activities performed in the very small, unstable area of the bow.[10] These findings confirm the data from a study of all of the 2000 America's Cup teams that identified bowmen and jib winch grinders as the most frequently injured.[8] 76% of these injuries were soft tissue injuries: 16% in the lumbar spine, 16% in the shoulder, 10% in the knee, 8% in the cervical spine, and 7% in the hand.[8]

Incidence of injury, illness, and all incidents as a function of crew position

Crew position	Number	Injury				
		Sailing	Training	All	Illness	All incidents
Grinder	12	33 (3.1)	33 (11.2)	101 (7.7)	51 (3.9)	152 (11.5)
Pitman	3	5 (2.0)	9 (12.2)	24 (7.3)	10 (3.0)	34 (10.3)
Utility	4	5 (1.5)	12 (12.2)	28 (6.4)	16 (3.6)	44 (10.0)
Bowman	4	11 (3.2)	1 (1.0)	22 (5.0)	11 (2.5)	33 (7.5)
Navigator	2	1 (0.6)	4 (8.1)	6 (2.7)	8 (3.6)	14 (6.4)
Trimmer	7	10 (1.7)	13 (7.6)	33 (4.3)	19 (2.5)	52 (6.8)
Helmsman	3	1 (0.4)	2 (2.7)	6 (1.8)	4 (1.2)	10 (3.0)
All	35	66 (2.2)	74 (8.6)	220 (5.7)	119 (3.1)	339 (8.8)

Values are number with incidence/1000 hours in parentheses.

Table courtesy of Reference 10

The 2001-2002 Volvo Ocean Race also reported that bowmen and helmsmen were the most likely to be injured, with the highest reports of lower back pain, shoulder pain, neck pain, and skin lesions.[8] Due to the lack of specific injury descriptions, it is not possible to determine whether some of these injuries were overuse or traumatic injuries.

In addition to abrasions and contusions, the 1996-1997 British Telecom Global Challenge experienced burns (15.7%) including thermal, rope, and sunburns, fractures (11%), lacerations (11%), damage to cartilage, ligaments, and tendons (9%), and head injuries (6.7%).[12] The site of injuries were predictable: foredeck, galley, winches, and helm. Injuries increased with wind strength and sea conditions.[12]

Stress-related disorders including hypertension, insomnia, and upper respiratory tract infections (URTIs) are a significant problem in lengthy races and understudied in research.[12] These disorders were likely worsened by living in hotels away from home, intense training and sailing demands, working and sailing in excess of 12 hours a day, little time off, cold and wet weather conditions, and routine monotony .[10,12] All of these conditions increase the risk for cumulative trauma to the musculoskeletal system and are likely to increase the likelihood of traumatic injuries due to fatigue and exhaustion. Recreational non-competitive yacht sailing is less likely to present these extreme conditions and stresses, though storms and inclement weather can still place extraordinary demons on a crew.

Windsurfing/Boardsailing traumatic injuries

Boardsailing injury rates appear to be quite low at 0.22 per 1000 hours of participation and an incidence of 1 per 1000 sailing days.[1,7,8] Almost all traumatic injuries involve various scrapes, sprains, contusions, and fractures resulting from impact with equipment.[1,7,8]

Another study in 2006 grouped windsurfers according to type of participation: [13]

RB: competitive national/international raceboarders
REC: recreational windsurfers
WS: competitive national/international wave slalom surfers

The first two groups were similar in ability levels, but the WS surfers were ranked higher, reflecting their involvement in aerial maneuvers.[13] The average number of injuries suffered by the WS surfers was approximately double that of the other two groups (i.e., approximately 2 incidences per person per year).[13] In all groups, the most common injury was muscle strain, which represented 35% of all injuries (to be discussed in the Overuse Injuries section). [13] In another article, ligament strain came in first at 29%, cuts and fractures 12%, contusions 8%, and hamstring strain at 7.8%.[14]

The chest ribs were at highest risk of fracturing.[13] Collision with equipment when overpowered by wind and waves was the major cause of traumatic injuries identified in the WS group. It was also a factor in 34% of the injuries in the REC group.[13] In addition, equipment faults such as ineffective foot strap release and harness release were identified as causes of injury.[13]

Women experience more injuries than men and they mostly get hurt on the trunk rather than other parts of the body.[14] Over half of the injuries to all windsurfers is to the lower limbs. Upper limbs, trunk, and head are injured in less than lower limbs in that order.[14] Windsurfers who weigh 175 lbs. or more get hurt less than lighter windsurfers..[14] Windsurfers aged 33 are hurt less than those who are 28 years old.[14A] 83% of injuries occur during training when much more daring moves are attempted.[14]

Overuse Injuries

Unlike traumatic injuries that are associated with a particular incident, overuse injuries develop slowly over time. There are multiple, complicated factors that increase a sailor's risk for CTD. Often it is difficult to identify an exact cause. However, enough sailors have reported soft tissue disorders that can be associated with activity on and off the boat.

The 2003 America's Cup study found that most injuries occurred during weight training on land.[10] This may indicate one of several things:

1) intensity of training is a bigger factor in injury than is the volume of activity,
2) there is a decrease in training during the racing period, or
3) there is a reluctance of the crew to confess injuries for fear of jeopardizing their position on the race boat.[10]

Another reference also found that training too hard in the gym can result in the overuse or strain of muscles needed during sailing. Weight training injuries have largely been found to be strains, tendinopathies, and muscle strains, so even though strength training is valuable, working out to maximal or near maximal loads is definitely not advised.[10]

Small boat sailing and racing

In any type of sailing, when the wind fills the sails, the boat "heels" to one side.[1] In small boat sailing, the sailor counterbalances the heeling to keep the boat flat on the water by "hiking"out over the side of the boat.[1] Hiking is done in medium to heavy air conditions (over 8 knots).[1] In small boat sailing and board sailing, most injuries are to the knee and lumbar spine due to extensive forces applied during "hiking".[1,10] This activity is uncommon in yacht sailing or racing.[10] Hiking can be done either with bent legs or with straight legs.[8]

Bent-knee hiking

Straight-leg hiking

In bent-knee hiking, the knees, hips and trunk are bent with the posterior dragging in the water.[1] In straight-leg hiking, the knees are extended and the hip and trunk are in various degrees of extension.[1] Straight-leg hiking allows the sailor to respond to changes in wind velocity by swinging the upper body in and out.[1] Overarching the lower back due to weak abdominal muscles, or abnormal spinal stresses and overuse during sailing may be causes of back injuries.[8]

Hiking involves an isometric contraction of the upper leg muscles, which can impede or even halt blood flow to muscles and soft tissues.[15] Exhaustion can happen within a few minutes if the muscles are not in good condition.[15] With the help of friction from the back of your pants on the side of the boat and with all four knee ligaments taking up the knee reaction forces, a person can hang on the side of the boat for much longer, but the knee cartilage takes a lot of beating, especially over waves.[15] In general, hiking increases stresses on the knees and spine, and it can result in overdevelopment of the quadriceps muscles resulting in an imbalance in the hamstring/quadricep ratio.[7]

Rapid and powerful movements of the upper extremities are involved in both steering the boat and trimming the sails.[1] Muscles needed while sailing during medium to heavy breezes include the rotator cuff, pectoralis major and minor, deltoid, triceps, bicep, brachioradialis, coracobrachialis, and wrist flexors and extensors.[1]

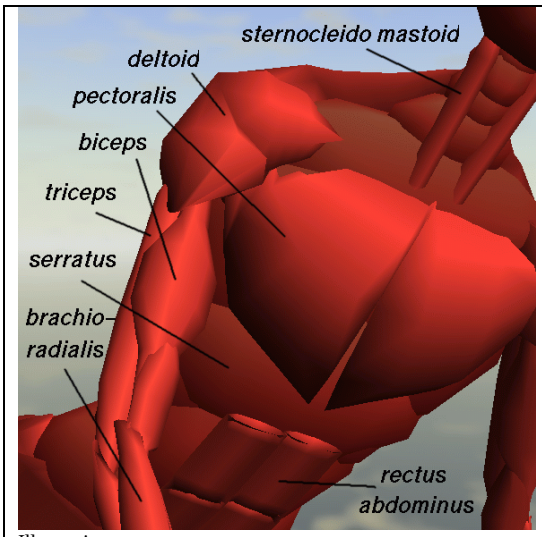
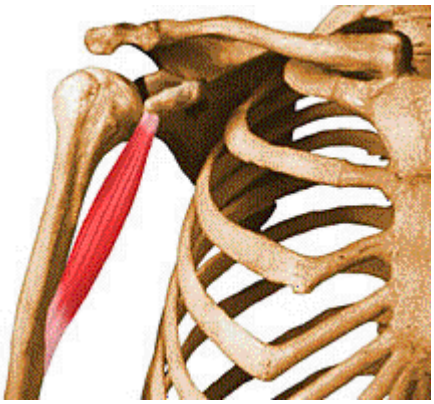


Illustration source:
http://www.soe.ucsc.edu/~wilhelms/fauna/Snaps/r_arm_bent.m.gif



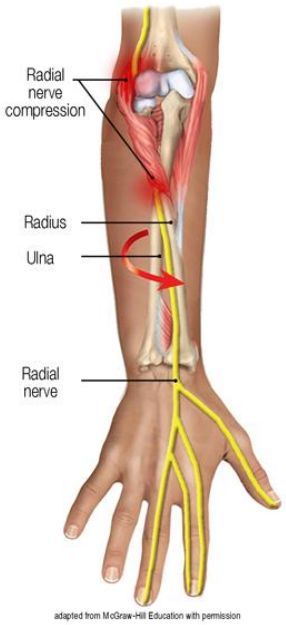
Coracobrachialis muscle

Illustration source:
http://www.abcbodybuilding.com/anatomy/shouldersanatomy1_files/image008.gif

Anecdotal reports of Carpal Tunnel Syndrome are unverified, but reports are fairly common among small boat sailors where fingers go numb during sailing and at rest, resulting from gripping the ropes tightly. It occurs whenever isometric gripping with the hands is required, especially with small diameter objects.

Windsurfing/Boardsailing

Recreational windsurfing requires a lot of repetitive motions and there are reportedly a lot of muscle imbalances and overuse injuries. Competitive national/international raceboarders, recreational windsurfers, and competitive national/international wave slalom surfers groups reported recurrent and ongoing injuries in the lower back potentially related to the chronic lordosis of the spine while pumping the sail.[7,13] Competitive wave slalom surfers reported about 250% more recurrent muscular strains to the body than competitive raceboarders, in addition to ongoing ligament injuries, especially to the knee.[13] Competitive wave slalom surfers reported injury to the lower back twice as often as to the upper back. All windsurfers reported recurrent muscular and tendon strains in the neck through elbow regions.[13] Muscle and tendon strains combined accounted for 55% of the injuries in competitive raceboarders, 43% in recreational windsurfers, and 42% in competitive wave slalom surfers.[13]



Windsurfers are at risk for various neuropathies, specifically radial tunnel syndrome among novice windsurfers.[7] The constant grip, prolonged pronation of the forearm, infrequent rest, heavy winds, rough seas, large sail, and heavy or large booms are likely to blame.[7]

Yacht sailing and racing

In the study of the 2003 America's Cup yacht crew, nonspecific overuse injuries affected the tendons in the elbows to biceps, as well as the cervical spine and hands. There were lateral/medial elbow tendinosis, biceps tendinopathy, cervicothoracic junction pathology, and intersection syndrome.[10] The illustrations below show the location of intersection syndrome in the wrist and how it differs from deQuervain's, another CTD.

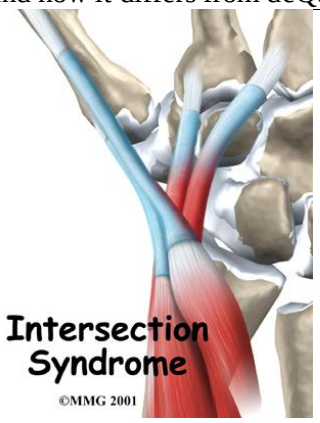


Image source: http://www.eorthopod.com/images/ContentImages/wrist/wrist_intersection_syndrome/wrist_intersection_syndrome_intro01.jpg

Image source: http://www.handuniversity.com/images/illustrations/wrist_dequervains_diag01.jpg

Nonspecific overuse injuries causing the greatest number of days absent from sailing were cervical spine degeneration, inguinal hernia, posterior interosseous nerve entrapment (PINE), and intersection syndrome.[10] PINE appears to have been reported previously as "grinder's elbow" and described as a "combination of tendonitis, fasciitis, and epicondylitis causing local tenderness near the elbow and forearm."[10] All of these CTDs were caused by muscle tension that aggravated the tendons, inducing inflammation.

The severity of overuse injuries in the 2003 America's Cup race, primarily tendinopathies, was significantly greater than the severity of acute injuries, perhaps because of the demands of highly repetitive activities such as grinding, top handle winching, sail trimming, and steering.[10] Helmsmen have been found to be at a greater risk of overuse injuries to the upper extremities including carpal tunnel syndrome during ocean racing because of gripping the wheel and the high demands of steering in heavy weather conditions.[8,10]

Overuse/repetitive strain injuries in yacht sailing is quite specific to crew position. Lumbar and cervical spine injuries are likely a result of the forward flexed and rotated position of the spine during the repetitive activities of grinding, pulling ropes, trimming sails, and lifting poles and heavy sails.[10] [8] Cervical spine injuries were likely related to the sustained extended and protracted postures of the neck of trimmers while looking up at the sails and helmsmen while

steering.[8,10] It appears that sustained postures and highly repetitive activities involved may contribute to degeneration of these joints over time.[10] Clearly the postures of the grinder and trimmer are very stressful to the back and neck and strain on the hands and forearms while operating the winches can be quite damaging. The amount of strain while operating the winches depends on the gearing. Pontos (http://pontos-americas.com) winches quickly and easily shift from a 2-gear winch to a 4-gear winch. It was shown that the 771 lb. typical of a 370 sq. ft. sail in a 22 knot wind can be reduced to just 9 lb. load on the winch in low gear.[16] Most winches are 2-gear or at most 3-gear. Power winches are another option, but they are expensive.

Pre-existing injuries accounted for only 8% of all injuries reported on the 2003 America's Cup crew; however, they were of greater severity than both new and recurrent injuries.[10] Cervical spine degeneration, PINE, long head of biceps, tendinopathy, and lumbar spine pathologies caused the greatest absence from sailing and training.[10]

Injury Prevention

For all types of sailing/windsurfing, appropriate fitness training and proper care of previous injuries is the best method of preventing future problems.[8] In addition, agility exercises may improve hand-eye coordination and the efficiency of movement on a sailboat.[8]

As with almost any physically demanding activity, the four fitness cornerstones for injury prevention in any type of sailing are:[8,9]

- Cardiovascular (aerobic) fitness training
- Strength training
- Flexibility training
- Core strength/stability training

In addition, agility exercises may improve hand-eye coordination and the efficiency of movement on a sailboat or surfboard.[8] Using sailing to get in shape rather than getting in shape to sail increases the likelihood of injury.

Warm up

Proper warm up and cool down, and performing warm up moves mimicking the activities to be performed while sailing can optimize balance and mobility while decreasing muscle tension.[8] The aim of warm up is to increase body temperature, pulse rate, and circulation which can be accomplished on land prior to sailing by walking, jogging, skipping rope, or cycling.[1] Since there is often a long period of time on the water prior to sailing, muscles often cool down and stiffen up again, so 3-5 minutes of warm-up on the boat (e.g., arm circles, leg pedaling, and sit-ups) as well as the on-water drills (e.g., tacking and jibing) will raise the heart rate to reduce risk of CTD.[1]

Aerobic fitness

Research has shown that aerobic training and fitness is directly related to an improved reaction speed to wind shifts, as well as enhanced endurance, decision making, and concentration, particularly in the later stages of races.[8] Recovery, both mentally and physically, is faster for those who are fit.[8] Suggested types of aerobic exercise that are most appropriate for sailors are rowing, cycling, swimming, stair climbing, or running. [1,8] Aerobic fitness also reduces the risk of CTD. Suggested types of aerobic exercise that are most appropriate for sailors are rowing, cycling, swimming, stair climbing, or running.[9]

Balance and Core Traning

Body strength starts with your core. It is the central link connecting the upper and lower body, so it is critical to develop and maintain a strong core to have power to do everyday tasks as well as sports, sailing, and other activities.[17] It doesn't matter how strong your arms are if you have no core strength. And core strength helps with balance and stability as well as fall and injury prevention.[17] An excellent core workout can be done with no equipment using pilates training such as this one with Kristin McGee, https://youtu.be/oiTlHkUezPE .

Balance can also be learned. Training definitely improves your ability to maintain balance in both stationary and dynamic situations by developing your proprioceptive abilities which are definitely needed when you are moving on a rocking boat or board. This video has five really good balance training routines: https://youtu.be/wTn_zG5PDew . This is another great dynamic balance exercise that would be even more challenging on a bosu ball or wobble board: https://youtu.be/0blnmxtoqVY .

Strength Training

Weightlifting routines should involve commonly used muscle groups and their antagonists to maintain proper balance of strength, as well as developing optimum core stability and physical endurance.[8]

Specific training depends on the type of sailing as well as the crew member position. For example:

1) Sailors who hike require strength in the thighs, abdominals, hips, and arms.
2) Those who trapeze should focus more on upper body strength and endurance, aerobic endurance, and agility.[8]
3) Grinders who "man" the sails of big boats require aerobic endurance, muscular strength, power and endurance, especially in the upper body. [8]
4) Sailors regularly involved with sail trimming need highly trained arms, shoulders, and upper back muscles.[8]
5) It was observed in the British Telecom Global Challenge amateur race that the high incidence of shoulder and cervical (neck) pain common in helmsmen could have been remedied partly by retraining.[12] Professional yacht races report lower rates of these types of injuries which may be a result of better balance, physical fitness, and sharper instinctive reflexes.[12]

Small boat sailing

An excellent program for training is outlined in Reference 18 feveloped for the University of Iowa Laser Team.

1. Strengthening the leg muscles is imperative in order to avoid injury to the knees during hiking.[15] The outer quadriceps muscles can quickly become the dominant muscle, which will pull the kneecap to the outer side, eventually causing chronic pain due to uneven tracking of the kneecap and the wearing of the cartilage.[10] To keep the kneecap tracking properly and to support the body while hiking, all of the muscles supporting the knee need to be strengthened during training, especially the smaller muscle on the inside of the kneecap .[10,15] This video is a good discussion of the problems with knee pain, proper straight leg hiking, and the knee muscles involved: https://youtu.be/yDGYMVGU2j0. The use of a rigid, padded harness from the shoulder to the buttock, and also hiking pads/leg straps, which support the upper leg beyond the bench and give much greater leverage, is encouraged to spare strain on the knee.[8] Finding a proper fit for this equipment is key to its effectiveness.[8]

2. Work on all of the major muscle groups: quads, hamstrings, gastrocnemius and soleus (ankle), glutes, tibialis anterior (front of shin), back and stomach.[15] Exercises should include squats, leg press, lunges, and wall sits.
3. Use a hiking bench to increase hiking endurance.[1]

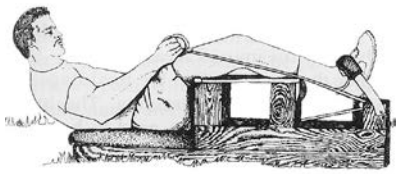


Illustration courtesy of Reference 1

4. Strength training the upper body should target the elbow flexor and extensor muscles. Exercises include dumbbell curls, hammer curls, cable curls, triceps presses, triceps cable presses and triceps dumbbell presses.[1] For the anterior chest wall and pectoralis major and minor, use both the flat and inclined bench press for flies.[1]

Windsurfing

Good aerobic fitness is critical in injury prevention with windsurfing along with muscular strength and endurance.[19] Modifying training techniques has been found to be the most effective way of minimizing or preventing injury while windsurfing.[13]

1. Warm up
2. Lower body strength is really important because windsurfers are in a half-squat position most of the time.[13,19]
3. Sufficient upper body strength will help the windsurfer cope with the demands of pumping in light winds and uphauling.[13] (Note: Pumping is the movement of a sail by pulling in or releasing the sail to increase the speed of the boat in light winds.[19])
4. Strength, endurance, and flexibility in the shoulders is needed since boardsailing requires sustained isometric action of the pectoralis major, deltoid, and scapular stabilizers.[8]
5. The high incidence of lower back muscle strain indicates a need for specific muscular training and flexibility exercises focused on the trunk and back muscles, especially the muscles at the hip and shoulder joints.[13]

To stay in shape off-season the following sports and exercises can help you maintain the strength, cardiovascular fitness, and endurance necessary to windsurf with reduced risk of injury:[19]

- Bicycling uses quadriceps, hamstrings, and arms similar to windsurfing and keeps them strong.
- Rowing uses the same pushing leg and pulling arm motions as windsurfing and is an excellent cardiovascular workout.
- Swimming is non-weight bearing, but is an excellent full-body cardiovascular workout.
- Weights and exercises that use opposite arm and leg simultaneously to improve balance, lateral pulls, planks, and single leg squats are good.

<u>Periodization and timing</u>

Periodization of training creates peak fitness when it is most needed. For sailors and windsurfers who participate in competition, training starts six months before the target date.[8] Maintaining fitness in the off-season and reducing heavy training loads before regattas is important for injury prevention.[8] For those who participate in sailing and windsurfing for sport, it is also important to maintain fitness in the off-season. Rest is sometimes more important than more training in the gym if a sailor has used a certain body part extensively on the boat. Overtraining must be avoided to reduce risk of CTD and other injuries.

Nutrition, hydration, stress and fatigue

Whether sailing for a day or for long distances, proper nutrition is important to sustain blood glucose levels throughout the event which improves concentration and coordination.[8] In addition, hydration is very important. [8] Dehydration and inadequate caloric intake can hamper performance, cause early onset of fatigue, and increase risk of heat related injuries.[8] Therefore, it is crucial to drink water prior to and throughout events.[8] Rather than drinking sugary artificially colored and flavored sports drinks, mix up a big batch of one of these drinks to stay hydrated.[20,21]

Honey Citrus Sports Drink 3 cups filtered water ¼ raw unfiltered local honey ¼ tsp unrefined sea salt 1/3 cup mixed lemon and lime juice (or any other fruit juice)	**Pomegranite-Cranberry Sports Drink** 2 cups Cranberry-pomegranite sports drink 1.5 packets Stevia powder ¼ tsp unrefined sea salt 2 qts. water

Monitoring fatigue, eliminating overtraining and consuming a correct balance of carbohydrate, protein, and micronutrients will reduce risk for upper respiratory tract infections and overuse injuries.[10] You can read up on proper nutrition and its role in injury prevention and healing in our article: http://working-well.org/articles/pdf/NutritionNew.pdf .

Staying warm.

Staying warm can be difficult if crew members are wet and it is windy. Waterproof attire that protects against the wind is important. It was observed on the British Telecom Global Challenge amateur race that Gore-tex offshore foul weather gear consisting of a jacket and pants probably provided considerable protection from the elements, but was insufficient in maintaining dryness in heavy weather, especially on the foredeck.[12] Neoprene wetsuits and drysuits are also available for sailing which may be more effective, especially if used in conjunction with Gor-tex clothing.

Injuries of all types are more likely to occur when people are fatigued and cold since circulation is restricted. Cold muscles are less flexible and much more susceptible to injury and strain from overuse.[22]

Sailing gloves afford protection, but those designed to give maximum dexterity do not protect adequately against cold.[12]

Ergonomics

Eliminating the overuse of muscles, tendons and ligaments requires concentration on technique and positioning. Maintaining a neutral posture whenever possible reduces the stress on soft tissues that eventually causes pain, numbness and tingling. For example,

1. Problems with the wrist and hand are usually a result of gripping too hard and too long. Take breaks, add padding to increase the diameter of wheels and other instruments, and be conscious of not gripping harder than required. Be aware of the angle of your wrist, arm and hand. The hands and wrists should be in a straight line. Alternate positions and grips to relieve forearm strain that causes wrist and elbow pain.
2. It may be safest to keep the back straight during hiking.
3. Relax the quadriceps muscles while hiking every so often to allow for blood flow to prevent quadriceps exhaustion while hiking.[15]

Injury Treatment

Get medical attention **as soon as** you start feeling pain. Pain associated with overuse might go away, but the cause of the pain does not. It pain is left untreated, it will result in permanent damage.

Return to sailing after injury should be done gradually, following the direction of a physical therapist or other qualified practitioner.[1] For example, sail in light air conditions (i.e., under 8 knots) for 15 to 30 minutes during the first week and slowly progress to medium and heavy air if you do not experience any symptoms such as achiness, soreness, stiffness and burning.[1] Stop immediately if you experience pain, numbness and/or tingling.

Updated 4/30/2018

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This article and all of our articles are intended for your information and education. We are not experts in the diagnosis and treatment of specific medical or mental problems. When dealing with a severe problem, please consult with a healthcare or mental health professional and research the alternatives available for your particular diagnosis prior to embarking on a treatment plan. You are ultimately responsible for your own health and treatment!

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