

Calf Muscle Strain ('Tennis Leg')

Diagnosis

'Tennis leg' is an incomplete rupture of the inside of the calf muscle (*figure 1*). It is a typical tennis injury that often occurs in players in the 35 to 50 age group. This muscle injury may occur as a result of a sudden contraction of the calf muscles, for instance during a sprint. Symptoms are a sudden, sharp or burning pain in the leg, sometimes accompanied by an audible sound. In most cases, the player is unable to continue play because of the severe pain. Depending on the severity of the injury, recovery may take between a few days and six weeks.



figure 1. Calf muscle strain ('tennis leg')

First Aid

The following action should be taken as quickly as possible, certainly within 48 hours.

- Rest (immobilisation). Stop playing tennis and do not lean on the foot.
- Cool the painful area directly with ice, a cold pack, or cold running water for 10 to 15 minutes and repeat this several times a day. Do not place ice on the bare skin. Place a towel between the skin and the ice pack to avoid injury from the ice pack.
- Apply a compression bandage. This is important, as it compresses the small vessels in the calf and limits the bleeding.
- Elevate the lower leg.

Fast and adequate first aid is of major importance for a quick recovery. In severe cases, or if in doubt, the injury should be evaluated by a physician, who may make a referral for physiotherapy.

How to Ensure the Best Recovery

When the worst pain and swelling have subsided (after 1 to 2 days), start to build-up the training load. During this period, pain is a signal to rest. Do not to cross the pain threshold, as this will slow down the healing process. The training load is built up in three steps. These are described below, with several tips.

Stage 1. Improvement of Normal Function

- If the pain allows it, you may put weight on the foot, if necessary using elbow crutches during the first week. The foot should be used in a normal fashion.
- A heel lift (with shock absorption) in both shoes for one to two weeks may help to ease the load on the calf muscles during walking. 'Viscoheels' are very useful for this purpose.
- Swimming or cycling for 30 minutes every day increases the blood flow to the calf muscles and enhances recovery.
- Stretching the long calf muscles (*figure 2*). Step forward with the unaffected leg, keeping the heel of the back leg on the floor. The knee of the affected leg is kept straight. Shift the weight of the back leg to the front leg and press the heel of the back leg firmly into the floor. Rest with your hands on a stationary object. The stretch is felt high up in the calf. Hold the stretch for 15 to 20 seconds without bouncing, followed by a rest period of 10 to 20 seconds. Repeat 3 times.
- Stretching the short calf muscles (*figure 3*). Start from the same position as described above, but now bend the knee of the hind leg, while keeping the heel on the floor. The stretch is felt low in the calf. Again, hold the stretch for 15 to 20 seconds (no bouncing), followed by 10 to 20 seconds rest, and repeat 3 times.
- Strengthening the foot muscles. Sit on a chair. Write the alphabet in the air with the foot of the injured leg. Fold a towel by grasping it with the toes of the injured leg. Perform this for 15 to 20 seconds, followed by 10 to 20 seconds rest, and repeat 10 to 20 times.

Stage 2. Build-up

- As soon as all the above exercises can be performed and walking is possible without pain, a return to tennis and other sports can be considered.
- Start by strengthening the calf muscles (*figure 4*). Slowly rise onto your toes and hold this position for 10 to 20 seconds. Then return to the starting position. Perform this exercise with both feet at the same time, then when leaning on the injured leg only. If using body weight is too painful or difficult, elastic tubing may be used to work the plantar flexors (i.e. push the toes and forefoot down against the resistance of the elastic tubing).
- Take small, quick steps on the spot, alternating the left and the right leg.
- If this goes well, you can begin jogging. Start with an easy jog, then include some sprints and straight running, followed by quick turns, starts, and stops.
- Finally, you can include jumping exercises.

Stage 3. Return to Play

- A return to the tennis court should now be possible. Start against the practice wall or with mini-tennis and gradually increase the distance to the wall or your opponent on the court. Make sure you position yourself well for the ball by taking small steps.
- In this phase you can also include volley exercises.
- Gradually (in the course of one to two weeks) include more exercises that involve moving longer distances towards the ball.
- Next, include low volleys, followed by overheads and services.
- As soon as you can hit a smash with footwork without problems, you are ready to start playing points, games and a practice match.
- Once you have played practice matches for two weeks in succession without problems, you can start playing matches again.



figure 2. Stretching of the long calf muscles

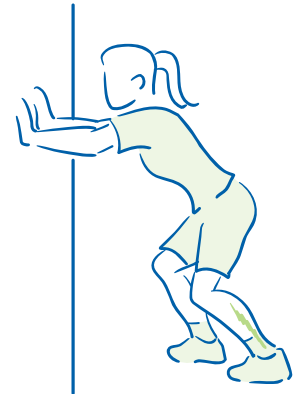


figure 3. Stretching of the short calf muscles

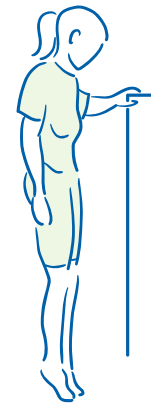


figure 4. Strengthening of the calf muscles

Preventing Re-injury

- It is not always possible to prevent tennis leg, but the risk can be reduced by paying attention to the following points:
- Perform a complete warm-up before play and a cool down afterwards, for approximately 10 to 15 minutes each. Pay close attention to correct stretching exercises. Stretching exercises for the calf muscles are particularly important.
- Build up training gradually, so that the body can slowly adapt to the increased load.
- Adapt clothing to the weather conditions. Particularly at the start of the season or if there is a biting wind, it may be wise to keep the track suit or running tights on during the warm up. Well-warmed muscles and tendons are better able to withstand pulling and traction forces than cold muscles.
- Wear properly fitting tennis shoes with good shock absorption, sideways stability, feeling with the playing surface (grip) and optimal comfort.
- Massage calf muscles if they feel stiff and tense.
- Maintain strong calf muscles, with adequate rest in your training programme. Steps, cycling and running are ideal exercises for calves.

Diagnosis

A sprained or twisted ankle is the most common tennis injury. In most cases, the injury is caused by landing on the outside of the foot, with the foot turning too far inwards. The relatively weak lateral ankle ligaments are then injured (*figure 1*). An injury of the much stronger ligament on the inside of the ankle (medial ankle ligament) is far less common (5-10% of cases). Depending on the severity of the injury, the ligaments may be overstretched or torn, resulting in instability of the ankle. The symptoms are pain and swelling around the ankle, mainly on the outside, later followed by discoloration of the skin.



figure 1. Ankle sprain

First aid

- Perform the following as quickly as possible, during the first 48 hours:
- Rest (immobilisation). Do not play tennis and do not lean on the ankle.
- Cool the painful area directly with ice, a cold pack or cold running water for 10 to 15 minutes. Repeat this several times a day (aim for 20 minutes every 2 hours). Do not place the ice directly on the bare skin, but cover the ice or cold pack with a towel.
- Apply a compressive bandage immediately. This is even more important than cooling with ice, as it will stop the bleeding and prevent severe swelling of the ankle due to an accumulation of blood. The ankle cannot be taped until the swelling subsides.
- Elevate the lower leg and the ankle above the heart whenever possible (i.e. lie on the floor and place the entire leg on several pillows to decrease swelling).

Immediate and adequate first aid is important to ensure fast healing. In more serious cases, a visit to the doctor is recommended to rule out a fracture and to determine whether crutches or a boot are necessary. The doctor may refer the patient for physiotherapy.

How to Ensure the Best Recovery

Rehabilitation can begin when most of the pain and swelling have disappeared (after 2 to 5 days). During the build-up phase, pain is a signal to rest. Do not cross the pain threshold, as this will slow down the healing process.

The build-up of the training load takes place in three stages, as described below, together with some practical tips.

Stage 1. Improvement of Normal Function

- As much as the pain allows, you may stand on the foot. Crutches can be used to support the ankle/foot during the first week, but try to walk normally, from heel to toe.
- Sit down in a chair. Lift the injured foot and circle the ankle 10 to 20 times. Make the circles slow and wide, first with a clockwise set, then an anti-clockwise set.
- Sit on a smooth surface. Lay a towel on the floor in front of you. Put the injured foot on the towel, with both the heel and the toes touching it (*figure 2*). Move the feet with the towel alternately forwards (extend the knees) and back (bend the knees). Both the heels and the toes should stay in touch with the ground.
- Stand straight and walk on your heels. The forefoot and mid-foot must not touch the ground. Take small steps. Then walk on your toes. Finally, walk on the inside of your feet, pressing the big toe firmly into the ground.
- Stand on the injured foot, with arms spread to keep your balance (*figure 3*). Shut your eyes and try to still keep your balance.
- Sit on a chair with your feet on the floor (*figure 4*). Tie one end of an elastic tube to the chair. Wrap the other end of the tube under the middle of the injured foot. Bend the knees 90 degrees. Move the foot against the resistance of the elastic tubing outwards and try to keep the outer side of the foot facing up. Repeat 10 to 20 times. Try to hold the knee and upper leg stable.
- Swim or cycle for 15-30 minutes each day to preserve overall physical fitness.

Stage 2. Build-up

As soon as the player can perform the above exercises well and can walk without pain, he/she can start building up strength for a return to sport.

- Slowly rise onto your toes and hold this position for 10 to 20 seconds. Return to the starting position. Perform this exercise with first with both feet together, then using the injured leg only.
- Stand on the injured leg. Bounce a tennis ball against a wall or on the floor and catch it again without losing your balance. Try to vary the point of the bounce as much as possible. A variation on this exercise is to stand on one leg and try to juggle with one, two, three or even more balls.
- Take quick, small steps, alternating the injured and uninjured legs.
- A very good exercise for the muscles around the ankle and foot is skipping. This should be done with care, however. It is important to build up this exercise gradually, from one minute a day to 10-15 minutes daily. Use a soft surface, such as grass or carpet, and wear either tennis or running shoes.
- If this goes well, you can start jogging. Start with an easy warm up, then progress to straight running, followed by the introduction of starts and stops into your running exercises.
- Finally, include sprints and jumping exercises.

Stage 3. Return to Play

- Now you are ready to go back on court again. Initially, the ankle should be taped or lace-up brace should be used, to help prevent re-injury of the ankle ligaments.
- Start against the practise wall or with mini-tennis (playing within the service lines). Gradually increase the area of play and move back towards the baseline. Make sure you use small steps to position yourself correctly for the ball.
- This can be followed by volley exercises.
- After 1-2 weeks, you can start including exercises in which you run longer distances to the ball (tennis drills, from side to side).
- Include low volleys, followed by the serve and overhead.
- As soon as you can hit a jump smash without problems, you can start playing practice matches.
- Take care with explosive or unexpected movements, or strokes in which your foot is perpendicular to the running direction, such as wide backhands.
- In this phase, it is important to increase the loading capacity of the ankle, to regain your rhythm and to win confidence.
- Once you have been able to play practice matches for two successive weeks without problems, you will be ready for match play again.

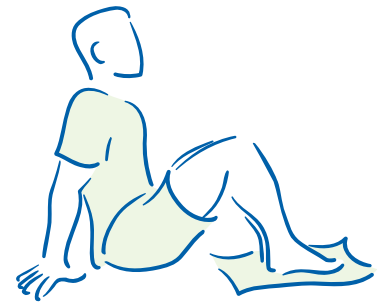


figure 2. Mobilising the ankle



figure 3. Balance exercises are very useful

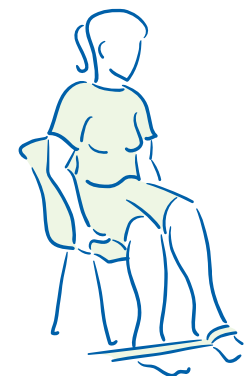


figure 4. Strengthening the muscles around the ankle

Preventing Re-injury

It is not always possible to prevent an ankle sprain, but the risk can be reduced by paying attention to the following:

- Perform a complete warm-up before each practice or match, and a cool-down afterwards, both lasting 10-15 minutes. Pay attention to the correct performance of stretching exercises. Stretching exercises for the calf muscles are especially important.
- Ensure a gradual build-up of training, so the body can get used to the extra load.
- Wear firm, stable, well-fitting tennis shoes and pay attention to how the shoelaces should be tied. An ideal tennis shoe should have good shock absorption, sideways stability, feeling with the surface (grip) and optimal comfort.
- Remove all the balls from the tennis courts, to avoid tripping over them.
- Improve your physical condition with regular jogging or cycling. Most injuries tend to occur towards the end of the match or at the end of the day, when you are getting tired. The better your physical condition, the lower the risk of injury.
- Improve proprioception and strength of the muscles around the ankle with co-ordination and balance exercises. Standing on one leg is a particularly useful exercise. The exercises can be made more difficult by using a wobble board
- A tape, brace or high shoe will help protect the ankle ligaments, especially during the first three months after the injury, and have been shown to reduce the risk of re-injury. Contrary to common belief, this does not weaken the ankle.

Diagnosis

Tennis elbow is the best-known and also the most painful elbow injury in tennis players. An estimated 50% of all tennis players will suffer from tennis elbow in the course of their career. Players aged over 35 are particularly at risk. Tennis elbow is an overuse injury of the extensor muscles of the wrist, in which pain and tenderness are felt at the attachment of these muscles at the outer side of the elbow (*figure 1*). The pain may radiate into the arm, wrist and fingers. The injury usually develops gradually, as a result of multiple micro ruptures and scar tissue at the muscle attachment. The injury may also occur suddenly, for instance as a result of miss-hitting the ball, so that a larger tear develops. Lifting, gripping, twisting the wrist, shaking hands, washing dishes or opening a door may all be very painful. During tennis, hitting backhands usually provokes the pain.



figure 1. Tennis elbow

First Aid

Tennis elbow is a common complaint, but as yet, there is no consensus on the optimal treatment strategy. There are various therapies, all based on rest, cooling with ice and stretching techniques. In some cases, rest will mean complete withdrawal from play. In others, the complaints can be controlled by training modification and discontinuation of match play. Physiotherapy (friction massage, ultrasound, and a standardised exercise programme aimed at the mobility of the elbow and wrist, stretching exercises and strengthening of the muscles of the forearm, upper arm and hand) and manual therapy often have good effects, if necessary in combination with a brace. A corticosteroid injection may have a positive effect in the short term, but the long-term results are less positive than those of physiotherapy or rest. One negative side effect of corticosteroids is that they weaken the tendon tissue. A more conservative approach is therefore taken with this therapy today than in the past, especially with competitive tennis players. Surgery is generally advised if the complaints persist, despite long-term intense therapy for more than a year.

How to Ensure the Best Recovery

Stage 1. Improvement of Normal Function

In this phase, attention focuses on improving flexibility and strengthening the forearm muscles.

- Daily stretching of the forearm extensor muscles. Extend the arm forward from the shoulders with the palm down and the elbow straight. The fingers point to the floor. Grasp the wrist and fingers with the other hand and bend the wrist down, until tension is felt at the outside of the forearm (*figure 2*).
- Increase grip strength. This is a general exercise, which can be performed by squeezing a stress ball or low-pressure tennis ball.
- Strengthening the forearm flexor muscles. Sit on a chair and lean forward. Rest the forearm with the elbow slightly bent on the knees. Turn the hand so the palm is facing up. Holding a weight, curl the hand towards the ceiling. Return to the starting position and repeat 10-15 times (*figure 3*).
- Strengthening the forearm extensor muscles. Turn the palm of the hand towards the floor and rest the forearm with the elbow slightly bent on the knees. Holding a weight, curl the hand towards the ceiling and return to the starting position. Gradually build up to three series of 10 to 20 repetitions (*figure 4*).
- To maintain general fitness, running (20-30 minutes) or cycling (30-60 minutes) three times per week is recommended. Swimming is also acceptable, but should be restricted to kick-board work to limit stress on the arm/wrist.

Stage 2. Return to Play

- In this phase, attention focuses on building up the specific tennis load. The increase of the load could take place as follows:
 - Mini-tennis (within the service-lines), both forehands and backhands.
 - Baseline tennis, hitting only forehands and (double-handed) backhands. It is preferable to start on a slow court (clay), because on fast courts there is less time available to perform the strokes well.
 - Baseline tennis, hitting flat or double-handed backhands only and gradually introducing slice backhands (no topspin!).
- Volleys.
- Baseline tennis with all types of backhands.
- Smash and service.
- Practice match.
- Match play.

During Stage 2, it is important to pay close attention to timing and technique. The sense of timing ensures that renewed mastery and improvement of the techniques occurs with minimal use of strength. This is important, because it allows the player to keep the wrist straight and to hit the stroke fluently.

A few tips for the gradual build-up of the tennis-specific load, especially the backhand:

- Try to hit the ball in front of the body, so it is easier to fully use the shoulder and trunk and to stabilise the wrist.
- When the ball impacts the racket, the wrist should be straight. The forearm extensor muscles are better able to handle the shock when the wrist is straight than when it is flexed.
- Try to use the forearm for control instead of strength. The application of strength should come mainly from the shoulder and trunk muscles, which are much stronger than the forearm muscles.
- Try to use the other arm for balance when hitting a one-handed backhand. The function of the balance arm is to ensure a smooth stroke (supporting the racket in the starting position, enabling a change of grip, improving the shoulder turn etc).
- If the player cannot develop sufficient strength or co-ordination during the one-handed backhand stroke, hitting a double-handed backhand may be considered. The advantages and disadvantages of double-handed backhands should be discussed with the coach.
- In addition to the backhand, the service and overhead may also provoke pain in the elbow. Try to build up these strokes gradually too.



figure 2. Stretching of the forearm extensor muscles



figure 3. Strengthening the forearm flexor muscles



figure 4. Strengthening the forearm extensor muscles

Preventing Re-injury

It is not always possible to prevent tennis elbow. However, risk can be reduced by measures such as a gradual build-up of the training programme, warm-up and stretching exercises, suitable equipment (see below) and the correct technique (hit the ball in front of the body with a straight, firm wrist).

Tips for Choosing Correct Equipment:

- The racket. To prevent tennis elbow, it is best to choose a flexible racket with a large sweet spot, such as a mid-size or oversize racket. Even though a stiff racket gives the player more power and control, a flexible racket is gentler on the arm with off-centre hits, because the flexion will absorb some of the shock and spread it over a longer period.
- Strings. Relatively low string tension is better for the arm, because it increases the dwell time of the ball on the strings. The longer contact time means that the shock of the ball impact is spread over a longer period of time. Thinner strings are more elastic and have better shock-absorbing capacities, and are therefore better for the arm than thicker strings.
- The ball. Choose new, pressurised tennis balls. Avoid, old, wet, and pressure-less tennis balls.
- The grip. A grip that is too small or too large may cause problems. In both cases, the player may have to grip the racket too tightly to prevent it from twisting, and high grip force may increase the risk of elbow injury. An easy way to determine the correct grip is by measuring the distance from the long crease in the palm (the second one down from the fingers) to the tip of the ring finger.

Diagnosis

An injury of the Achilles tendon is a degenerative condition of the tendon, not an inflammatory process. It is therefore incorrect to describe this as tendinitis. Tendinopathy is a better term. The injury is caused by chronic repetitive movements during running and jumping. It occurs mainly in recreational tennis players aged between 35 and 45. The symptoms are a gradual increase of pain, initially only in the morning and at the start of the training. In later stages, the pain may be continually present during exercise and even at rest. The pain is felt in the Achilles tendon, 5-7 cm above the heel (*figure 1*). Continued exercise carries the risk of a gradual worsening of the injury, which makes recovery more difficult.

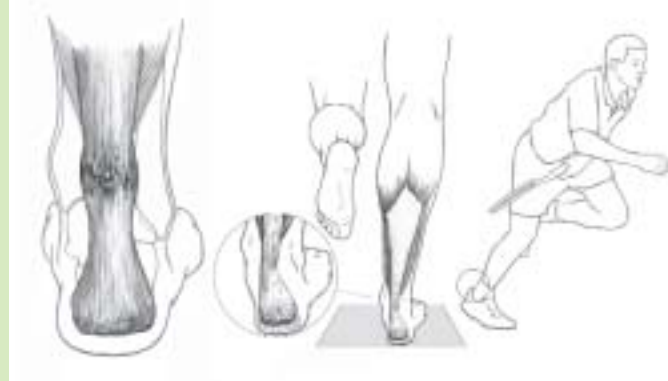


figure 1. The Achilles Tendon Injury

First aid

- As a rule of thumb, first aid involves modification of activity (less tennis and running)
- Cooling with ice, stretching exercises and wearing firm, good shoes are also important measures
- When there is swelling and pain, ice massage may alleviate symptoms. Use a melting ice cube or a paper cup with ice. Massage the painful spot. In general, 5 to 8 minutes will be sufficient. Repeat this several times a day.
- Use special (visco-elastic) inlays or an Achilles tendon bandage. These provide good shock absorption and because of the increase in height, they artificially 'lengthen' the tendon, reducing the stress on it.
- Replace running exercises with cycling or swimming.

How to Ensure the Best Recovery

Exercises can start when the worst pain and swelling have disappeared. During these exercises, pain is a signal to reduce the training load. Do not surpass the pain threshold, as this will impair recovery. The build-up of the training load takes place in three stages, as described below, together with some practical tips.

Stage 1. Improving Normal Function

- Stretching the long calf muscles (*figure 2*). Take a step forward with the unaffected leg, keeping the heel of the back leg on the floor. The knee of the affected leg is kept straight. Shift the weight of the back leg to the front leg and press the heel of the back leg firmly into the floor. Rest the hands on a stationary object (no bouncing). The stretch should be felt high in the calf. Hold the stretch for 15 to 20 seconds, followed by a rest period of 10 to 20 seconds, and repeat three times.
- Stretching of the short calf muscles (*figure 3*). Start from the same position as above, but now bend the knee of the back leg, while keeping the heel on the floor. The stretch is felt low in the calf. Hold the stretch for 15 to 20 seconds, followed by 10 to 20 seconds rest, and repeat three times.
- Strengthening the foot muscles. Sit on a chair. Write the alphabet in the air with the foot of the injured leg. Fold a towel by grasping it with the toes of the injured leg. Perform this for 15 to 20 seconds, followed by 10 to 20 seconds rest, and repeat 10 to 20 times.
- Strengthening the calf muscles (*figure 4*). Stand on your toes on a stair or bench and move up and down. It is best to use both legs while going up, and to lean on the injured leg only when going down. This exercise needs to be repeated seven days a week, twice a day for five minutes, for twelve weeks. The exercise should be performed both with an extended knee as with a slightly bent knee. You should continue the exercise, even if you feel pain and stop only if the pain becomes really severe. The exercise can be made harder by carrying a filled knapsack.
- Cycling or swimming for 15-30 minutes every day to preserve general fitness.

Stage 2. Build-up

As soon as the Stage 1 exercises can be performed well and the patient can walk without pain, work can start on a return to sport.

- Take small, quick steps on the spot, alternating the left and the right leg
- If this goes well, start with easy jogging. Take small steps and use the entire foot
- Now you are ready for some easy running
- The next step is to include some sprinting exercises, starts, stops and turns in the training
- This can be followed by jumping exercises

Step 3. Return to play

- A return to the tennis court should now be possible. Start against the practice wall or with mini-tennis and gradually increase the distance to the wall, or use a full court. Make sure you position yourself well for the ball by taking small steps.
- A start can now be made with volley exercises
- The next step is some easy hitting from the baseline
- In the course of the next two weeks, gradually incorporate exercises that require running longer distances to the ball (tennis drills from side to side).
- Next, include low volleys and overheads
- Start playing points, then games, and then a full practice match. Once practice matches have been completed for two successive weeks without problems, the player is ready for match play.



figure 2. Stretching the long calf muscles

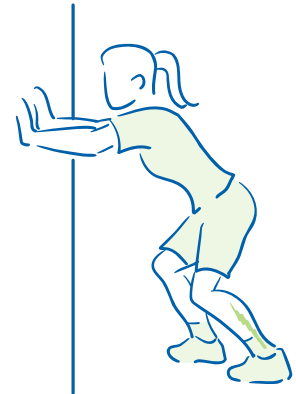


figure 3. Stretching the short calf muscles

Preventing Re-injury

It is not always possible to prevent a reoccurrence of an Achilles tendon injury, but the risk can be reduced by paying attention to the following:

- Perform a complete warm-up before play and cool down afterwards, for approximately 10 to 15 minutes each.
- Improper footwear is one of the main causes of an overuse injury of the Achilles tendon. Stability around the ankle joint is essential. Make sure the shoe fits well around the heel and that the base of the heel is wide enough. The heel cap should be stable. You can test this by pressing the heel cap with your thumb. It should be very difficult to compress. The sole of the shoe should be supple, with a normal unrolling from the ball of the foot to the toes. The flex point of the shoe should be located under the ball of the foot and not under the middle of the foot. Do not throw old shoes immediately away, but gradually break in shoes of another type of brand. A good tip is to walk around in new shoes before wearing them when playing.
- During the unrolling of the foot a certain amount of pronation is necessary. Excessive pronation, however, can be found with a flat foot, cavus foot, and a leg length discrepancy. When misalignments are present, have customised inlays or a heel lift made by a podiatrist.
- After a heavy practice or match a massage may help to relax the calf muscles and to relieve the tension of the Achilles tendon. In addition, blood flow of the tissues is increased, which will reduce muscle cramp and enhance recovery.
- Do not increase the frequency or duration of the practice too quickly. If there are any drastic changes, such as new shoes or a change of playing surface, the body must be given enough time to become accustomed to the change.
- During the recovery period after an ankle injury there may be temporary Achilles tendon problems. This may be caused by the fluid around the Achilles tendon and increased instability of the ankle, which increases the load on the Achilles tendon. These complaints can be overcome by temporary use of an ankle brace.

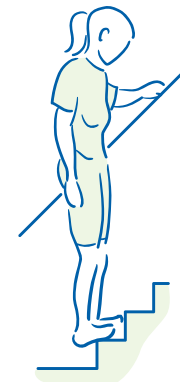


figure 4. Strengthening the calf muscles

The plantar fascia is the strong tissue under the foot that connects the toes to the heel. In conjunction with the muscles and bones, it forms the arch of the foot.

Diagnosis

Plantar fasciitis is an overuse injury at the point where the plantar fascia anteromedial attaches to the heel (*figure 1*). Degenerative changes of the plantar fascia occur at the attachment site to the bone, as a result of repetitive micro ruptures. A heel spur is calcification caused by repeated pulling away of the periosteum from the calcaneus. This can be demonstrated by X-rays. However, heel spur itself is not the cause of the pain. Plantar fasciitis is common among players who perform a great deal of jumping and sprinting. Common symptoms are a localised, sharp pain and/or swelling at the inside of the heel, deep under the fat pad of the calcaneus, as well as pain during exercise. Rest gives immediate pain relief, although there may be some nagging pain after exercises or at night. There is generally pain and stiffness in the morning and at the start of exercise, when the area around the heel is cold and contracted.

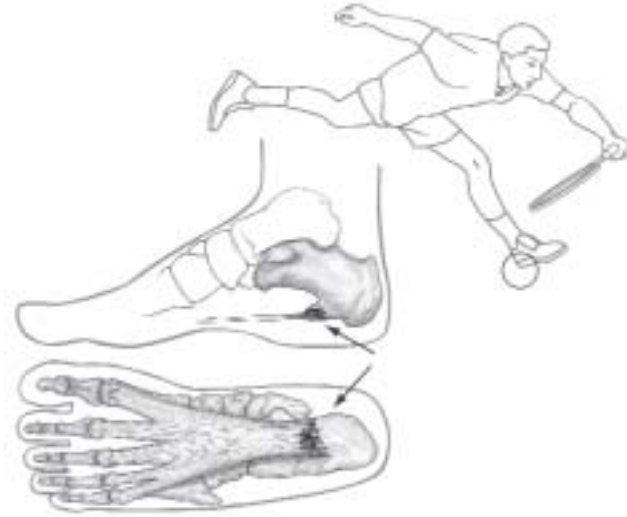


figure 1. Heel pain: plantar fasciitis and heel spur

First Aid

Fast and adequate first aid treatment is very important to ensure a speedy recovery. In serious cases or when in doubt, the injury should be evaluated by a physician. He/she may refer the patient to a physiotherapist for further treatment.

- The following general measures can be taken to ease the pain: activity modification, unloaded exercise, cooling with ice, stretching and wearing firm, well-cushioned, orthotically-designed, shoes.
- When there is pain and swelling, ice massage can be helpful. Use a melting ice cube or a polystyrene cup filled with ice. Massage the painful spot. Five to eight minutes of massage will generally be sufficient. Repeat this several times a day.
- Massaging the soles of the feet by rolling the feet over a can or bottle will also help to relax the fascia and the muscles.
- In feet with a collapsed arch (flat feet) or excessive pronation, the plantar fascia may become overloaded during running and tennis. When the plantar fascia is very tight, as in cavus feet, there may also be considerable pressure at the attachment to the heel bone. Make sure the feet receive adequate support by using an inlay, shoes with sturdy soles or tape.
- Temporary use of a shock absorbing heel lift can be useful. The advantage of a heel lift is that there is less tension on the plantar fascia, because the calf muscles are more relaxed. Is there not some disadvantages associated here or is this only with prolonged use?

How to Ensure the Best Recovery

When the initial pain and swelling have disappeared, the player can start to build up the volume and/or intensity of training. However, the onset of pain during this period is a signal to take some rest. If players go beyond their pain threshold, this is likely to slow the healing process.

Training load should be increased in three stages, as follows:

Stage 1. Improvement of Normal Function

- Stretching the foot muscles. Kneel on one knee, with the toes on the floor (*figure 2*). A stronger stretch can be felt by grabbing the toes of the foot with one hand and pulling the toes and feet as far backwards as possible (*figure 3*).
- Stretching of the long calf muscle. Take one step forward with the uninjured leg. The knee of the injured leg is kept straight. Shift the weight of the back leg to the front leg and press the heel of the back leg firmly into the floor. Rest with the hands on a stationary object (no bouncing). The stretch is felt high in the calf. Hold the stretch for 15 to 20 seconds and follow this with a rest period of 10 to 20 seconds. Repeat three times.

- Stretching the short calf muscles. Start from the same position as described above, but now bend the knee of the back leg, while keeping the heel on the floor. The stretch is felt low in the calf. Hold the stretch for 15 to 20 seconds, then rest for 10 to 20 seconds. Repeat three times.
- Strengthening the foot muscles. Sit on a chair. Write the alphabet in the air with the injured foot. Fold a towel by grasping it with the toes of the injured leg. Perform this for 15 to 20 seconds, then rest for 10 to 20 seconds. Repeat 10 to 20 times.
- A night splint with the ankle in a neutral position and the toes maximally bent backwards/upwards reduces the healing time. The night splint is applied with an elastic band.
- Cycling or swimming for 15 to 30 minutes every day preserves general fitness.

Stage 2. Build-up

As soon as the player can perform the above exercises well and can walk without pain, he/she can start building up strength for a return to tennis.

- Slowly rise to your toes and hold for 10 to 20 seconds, then return to the starting position. First perform the exercise with both feet at the same time, then with the injured leg only.
- Walk on your toes, then on your heels.
- Take small, quick steps on the spot, alternating the left and the right leg.
- If this goes well, introduce easy jogging. Take small steps and use the entire foot.
- This can be followed by some easy running.
- The next step is to include sprinting exercises, starts, stops and turns in the training.
- Jumping exercises are the final step in the build-up stage.

Stage 3. Return to Play

- A return to the tennis court should now be possible. Start against the practice wall or with mini-tennis and gradually increase the distance to the wall, or use a full court. Make sure you position yourself well for the ball by taking small steps.
- A start can now be made with volleys.
- In the course of the next two weeks, gradually incorporate exercises that require running longer distances to the ball (tennis drills from side to side).
- Next, include low volleys and overheads the smash – is this a drill?
- Start playing points, then games, and then a full practice match. Once practice matches have been completed for two successive weeks without problems, the player is ready for serious tournament play.



figure 2. Stretching the foot muscles



figure 3. Stretching the foot muscles slightly further

Preventing Re-injury

It is not always possible to prevent the recurrence of an injury to the heel, but the risk can be reduced by paying attention to the following:

- Perform a complete warm-up before play and cool down afterwards, for approximately 10 to 15 minutes each.
- Use correct form when stretching. Stretching exercises for the foot and calf muscles are of particular importance.
- Ensure a gradual build-up of the training programme, so that the body can slowly adapt to the extra training load. Many players suffer injuries when they switch from a clay court to a hard court or during the transition from outdoor to indoor play. After a holiday, illness or when practising on a hard court, gradually increase the training load over the course of one to two weeks.
- Wear well-fitting tennis shoes with a firm heel cap and adequate arch support.
- Use proper shoes during off-court (conditioning) training. In casual settings, firm walking shoes are more comfortable than unstable, light shoes or high heels. A sudden decrease in heel height can increase the potential for heel injury if a player's tendons and muscles lack flexibility.
- Do not throw out old shoes immediately. Break in new shoes gradually and walk around in them for a day or two first, to help 'wear them in'.
- Improve the co-ordination (proprioception) and strength of the muscles around the ankle. Performing exercises on one leg is an effective way to do this. Additional complexity (difficulty) can be added to these exercises if the player stands on a wobble board.

Diagnosis

Osgood Schlatter's disease is an overuse injury of the knee that occurs in junior players. The affliction is most commonly observed in adolescence, particularly in 10 to 15-year-old boys and 8 to 13-year-old girls. It is seen more often in boys than in girls. The powerful quadriceps group of muscles converge to a single patellar tendon attached to a vulnerable area of the lower leg (*tibial tubercle, figure 1*). Continuous pulling of the patellar tendon on the developing tibial tubercle leads to pain, tenderness and swelling at the point of repeated stress. Sometimes, both knees can be affected. The symptoms are a warm, swollen and painful bump below the knee. Cycling, stair climbing, starts, stops, sprints, deep knee bends and kneeling are usually painful. In tennis, low volleys, court drills involving sudden changes in direction and serving may provoke pain. The symptoms may appear suddenly or develop gradually, and may be intermittent. The injury takes six months to heal on average, with a range from two months to more than two years. Occasionally, a player will have symptoms during adulthood. This is caused by bone fragments, which must be removed surgically.



figure 1. The Osgood Schlatter knee injury

First Aid

- Cool the painful area with ice cubes or with a cold pack for 10 to 15 minutes, repeating this process several times a day. Do not place ice directly on the skin, but wrap it in a towel.
- If the knee hurts, stop play or reduce the intensity of the training. The injury usually heals well if the load on the knee is reduced.
- Do not treat the painful area with ultrasound, since this may affect the growth plate.

Fast and adequate first aid is of major importance for a rapid recovery. Serious injuries should be evaluated by a physician. Occasionally, patients will be referred for further evaluation (ultrasound scan or X-rays of the knee).

How to Ensure the Best Recovery

Pain is a signal to rest the knee. Do not to cross the pain threshold, as this will slow the healing process. The increase of the training load occurs in two stages. This program is described below, including several tips.

Stage 1. Improvement of Normal Function

- Regular stretching of the muscles at the front and back of the thigh (quadriceps and hamstrings) decreases the tension of the muscles and the pulling forces on the patellar tendon. Stretching should not hurt, so do not stretch too much in the acute phase of the injury.
- Quadriceps. Stand up straight, with support for one hand. Bend one leg, hold the ankle of the other leg and pull the heel towards the buttocks until you feel the stretch in the thigh. The stretch can be increased by extending the thigh backwards (*figure 2*). Stretch for 10 to 15 seconds, followed by a break of 10 to 20 seconds. Repeat three times.
- Hamstrings. Place one leg horizontally on a bench or step. Bend forwards while keeping the back straight and extend the toes towards your body. Keep both legs straight. Hold for 10 to 15 seconds, followed by 10 to 20 seconds rest. Repeat three times (*figure 3*).
- Co-ordination exercises. Stand on the injured leg, with the arms spread for balance. Close your eyes and try to keep your balance. Count to 20. Now try to perform 10 to 20 small knee bends.
- Use a patellar tendon strap (*figure 4*) or brace during play. This ensures that the load on the insertion point of the patellar tendon at the tibial tubercle is spread out over a larger area, decreasing the point pressure.
- Use a bike with gears. Use the lightest gear, which results in a high pedal frequency. This is easiest on the knees. Try to avoid cycling uphill or against the wind.
- Avoid prolonged sitting in the same position or with the knees pulled up.

Stage 2. Return to Play

It is not necessary to stop playing tennis completely if the complaints are minor. However, training programmes should be adapted. Even with serious complaints, most players can resume play after three to six months.

- Try to play on clay or sandy surfaces that allow gliding and avoid playing on hard courts as much as possible. Because of the longer braking phase, the peak load on the knee is lower on a clay court than on a hard court.
- Ask your coach to adapt your training load so that you do not have to run so much, but can hit the ball from an area of 2 square meters. This will still enable you to do the footwork well (take small steps, position yourself well for the ball) without putting excessive load on the knee.
- If the adapted training sessions go well, you can introduce exercises with longer distances to reach the ball (tennis drills from corner to corner).

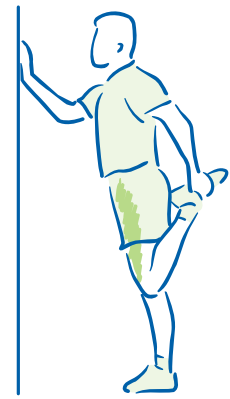


figure 2. Stretching the quadriceps muscles



figure 3. Stretching the hamstring muscles

Preventing Re-injury

It is not always possible to prevent an Osgood Schlatter knee injury, but paying attention to the following can reduce the risk:

- Perform a complete warm-up each practice or match, and a cool-down afterwards, of 10-15 minutes each practice. Pay attention to correct performance of stretching exercises.
- Ensure a gradual build-up of the training load, so your body can adapt to the extra load.
- Sprinting and jumping exercises should be introduced gradually. The day after intense sprint training, the training load should be reduced.
- Do not do too many jumping exercises during the growth spurt.
- Make sure to wear well-fitting tennis shoes, e.g. shoes with adequate shock absorption, sideways stability, feeling with the surface (grip) and optimal comfort.
- When there are leg length discrepancies (valgus or bow knees, flat or cavus feet), inlays should be worn in firm shoes with sturdy soles.



figure 4. Patellar tendon strap

Diagnosis

A wrist tendinopathy is an overuse injury of one of the tendons around the wrist. Usually it involves the extensor tendon, which is located at the ulnar side of the wrist (*figure 1*). Often, the injury occurs in the non-dominant wrist in players who use a double-handed backhand. The flexor tendon is also located lower down on the ulnar side of the wrist. This injury leads to complaints during serving and when hitting forehands and forehand volleys. The cause of the injury is the high loads that the tendons around the wrist have to deal with when the ball impacts with the racket. This results in overstretching and micro-tearing of these tendons. Women are more commonly affected than men, because they have looser and weaker wrists. The injury is characterised by pain, swelling, heat and redness at the insertion point of the tendon in the wrist. Usually, extension and flexion of the wrist against resistance is painful. Tendon injuries are slow to heal and may take six weeks or more.

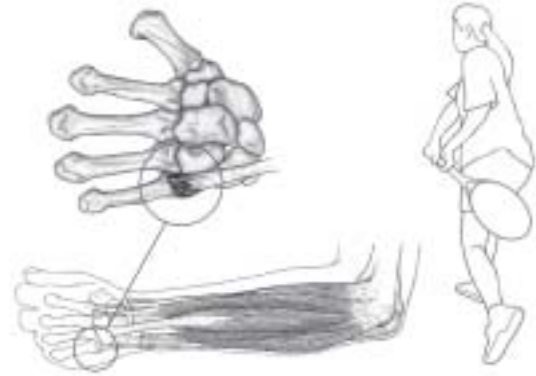


figure 1. Wrist tendinopathy

First Aid

- Activity modification (if you do not stop playing completely while the injury heals, hit mainly shots that do not hurt, such as double-handed backhands or only forehands and serves depending on the location of the injury).
- Cool the wrist with ice.
- Stabilise the wrist with a wristband or tape, so the ligaments and tendons can heal.

Fast and adequate first aid is very important to ensure good recovery. In severe cases, or when in doubt, the player should have the injury evaluated by a physician, who may make a referral for more detailed diagnosis and prescribe physiotherapy.

How to Ensure the Best Recovery

The recovery process takes place in three stages, using exercises to enhance strength. These are described below, with several tips.

Stage 1. Improvement of Normal Function

At this stage, special attention is paid to enhancing the strength of the muscles that are responsible for stabilising the wrist. Players with a double-handed forehand or a double-handed backhand need to make sure they strengthen both wrists.

- Wrist flexor muscles (*figure 2*). Start with a light weight (max. 1 kg) or elastic tubing. Support the forearm with a slightly flexed elbow on the knee, palm of the hand facing up. Move the wrist up and down, from a neutral position (2-3 sets of 10-20 repetitions).
- Wrist extensor muscles (*figure 3*). This exercise is the opposite of the exercise for the wrist flexor muscles. Support the forearm with a slightly bent elbow on the knee, but now with the palm of the hand facing down. Move the wrist up and down from a neutral position. This can be built up to 2-3 sets of 10-20 repetitions. When starting these exercises, it is sufficient to simply hold the weight, without moving the wrist.
- Once the wrist flexion/extension exercise is tolerated, progress to ulnar/radial deviation and pro/supination to further build strength in the wrist region.
 - Ulnar/radial deviation. Support the elbow on the knee, palm facing down and light weight in the hand. Move the hand to the left and right.
 - Pro/supination. From the same starting position, rotate the hand clockwise and counter clockwise.
- Improve grip strength. This is a general exercise that strengthens all the muscles of the forearm and hand. Use an older, softer ball (3 sets of 10-20 repetitions).

Stage 2. Return to Play

In this phase it is important to build up the tennis-specific load. The increase of the load could take place in the following way.

- Mini tennis (i.e. half court within the service lines), both forehands and backhands
- Baseline tennis, with only forehands, slice backhands, or a single-handed backhand. Be careful of your technique if you use a double-handed backhand.
- A slow court (clay court) is preferable at first, since fast courts afford less time for a good stroke performance.
- Gradually introduce volleys. Do not practice these for too long. Stabilise the wrist well at the point of impact.
- Baseline tennis with all types of backhands. Limit the use of the short cross-court backhand, because this puts a high strain on the wrist.
- Service and overhead.
- Practice match
- Match play.

During stage 2 it is important to pay attention to timing and technique. The feel for the timing ensures that improvements in technique occur with a minimum use of strength. This is very important for the maintenance of a correct position of the wrist and a fluent stroke.

Some Tips for the Backhand

- Try to hit the ball in front of the body, so it is easier to fully use the shoulder and trunk and to stabilise the wrist.
- Try to use the forearm for racket control only, and not for strength. Strength should be exerted mainly via the shoulder and trunk muscles instead of the forearm muscles.
- When hitting a backhand, try to use the other arm for balance. The function of the balancing arm is very important for a fluent stroke. It supports the racket in the starting position and enables an easy grip change when preparing for the backhand.
- If the injury is the non-dominant hand and persists during the double-handed backhand, the player could consider switching to a one-handed backhand. Since there are both advantages and disadvantages to the use of a single-handed backhand, the player should discuss this with his/her coach first before making the change.
- Since volleys may also provoke the pain, these should be gradually introduced into the training programme.



figure 2. Strengthening the wrist flexor muscles



figure 3. Strengthening the wrist extensor muscles

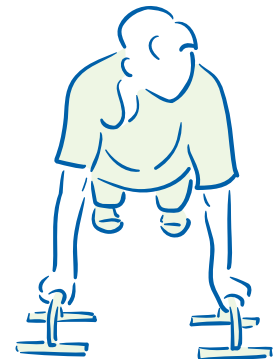


figure 4. Push ups using handle bars

Preventing Re-injury

- Perform a complete warm-up before play and a cool-down afterwards, for approximately 15 minutes each. This should be followed by mini-tennis.
- Make sure the build-up of the tennis training is gradual, so your body can adapt to the increased load.
- Alternate volley exercises with other strokes, so your wrists have enough time to recover.
- Avoid push-ups with a bent wrist, because this may worsen a wrist injury. If you do want to perform push-ups, use handlebars or support yourself on your knuckles (this straightens the wrists) (figure 4).
- Make sure to use the correct grip. If the grip is either too thick or too thin, you have to squeeze the racket to prevent it from twisting in the hand. The correct grip can be determined as follows: grip the racket lightly, as if you were shaking hands. The little finger should fit between the base of the thumb and the fingertips. Consult your coach for further details regarding the correct grip size.
- Continue to work on wrist strength to stabilise the wrist using the exercises and a low-resistance, high-repetition format.