



THE UNIVERSITY OF TOLEDO MEDICAL CENTER

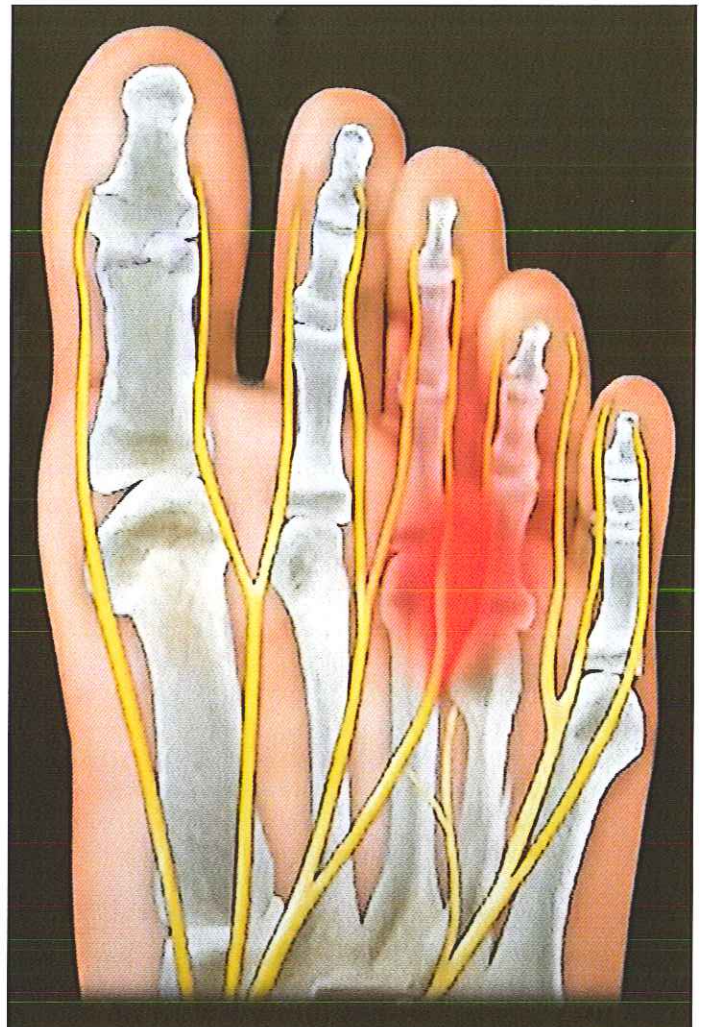
ORTHOPAEDIC MONTHLY

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Interdigital Neuroma Morton's Neuroma

Morton's neuroma is a compressive neuropathy of the interdigital nerve. It occurs most commonly in the third web space. Perineural fibrosis and entrapment of the interdigital nerve may be the cause of this problem. The patient usually describes a forefoot pain on the plantar aspect of the foot, especially during standing and walking. This is usually associated with radiation of tingling and burning into the toes that are affected. The pain is usually localized to a specific area, and it does not involve the entire forefoot. The pain is radiating distally in about 60% of the time and numbness occurs about 40% of the time. When you examine the patient, the area of focal and localized tenderness is in the plantar webspace and not over the joints. The interdigital neuroma (Morton's neuroma) occurs in middle aged females with forefoot pain that is worse with shoe wear. The pain is worse with weight bearing or wearing tight shoes with high heels. The weight transfer to the metatarsal heads will aggravate the condition. Dorsiflexion of the toes will also aggravate the condition. The symptoms are relieved by removing the shoes and massaging the foot. The paresthesia is most commonly on the plantar aspect of the web space. The patient will have chronic pain in the interdigital space between the 3rd and 4th toes that occasionally radiates down distally into the toes, and the foot exam is normal. Compression test of the web space may be positive. Compression of the metatarsals medially and laterally (squeezing the metatarsals) while pushing on the plantar tissue dorsally. The bursal tissue may create a "click", and if this happens it is the classic test. Ultrasound and MRI are helpful, but it is usually not as good as the history and physical examination. MRI has a very limited role in the diagnosis of Morton's Neuroma. EMG and nerve studies are of little benefit. The history and physical exam is the gold standard for the diagnosis of interdigital neuroma. You can add diagnostic injection to see the result. Injection of local anesthesia into the area of the interdigital nerve can be diagnostic for Morton's neuroma. Differential diagnoses include metatarsalgia, stress fractures, MTP synovitis, complex regional pain syndrome, arthritis, osteonecrosis of the metatarsal head, neoplasm, and lumbar radiculopathy. X-rays are helpful in excluding metatarsal stress fractures. Consider MTP synovitis especially after digital nerve block. Treatment can be conservative or surgical. To treat conservatively, start with shoe wear



modification (no high heels or tight shoes). Conservative treatment also includes injection of steroids. This will give relief of symptoms in 1/3 of the patients with multiple injections. Injection is usually done dorsally, and it may be more diagnostic than therapeutic.

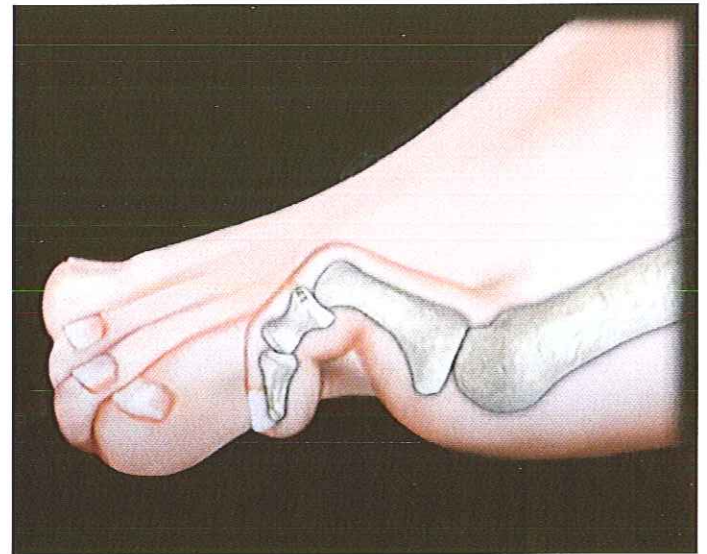
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Surgery can be neurectomy, done after failure of nonoperative treatment (approach the neuroma through dorsal or plantar approach). Dorsal approach is most commonly used. Incise the transverse metatarsal ligament. Resect the nerve 3 cm proximal to the metatarsal heads. Bury the proximal stump within the intrinsic muscles. If the neuroma is recurrent, then there may be a retained neuroma distal to the metatarsal heads. In this case, you may want to do surgery through the plantar approach, and you may want to do the research of the nerve and transpose it to muscle on the plantar foot (there might be about 70% success rate). The most likely cause

of recurrent symptoms following excision of a 3rd web space neuroma is a traumatic neuroma tethered by plantar neural branches. When a recurrent neuroma occurs at the end of the resected nerve, it does not retract far enough because the transection may not be far proximal enough or it may be tethered by the plantar neural branches. Stump neuroma can also occur due to inadequate resection. Causes of surgical failure include resection of the common plantar nerve is too distal, there may be a coexisting tarsal tunnel syndrome, wrong diagnosis, or wrong interdigital space.

Claw Toe and More

Claw toes have PIP flexion and MTP hyperextension (irreducible). You may also find DIP flexion. The claw toe deformity is usually associated with an underlying neurologic condition such as diabetic peripheral neuropathy and Charcot-Marie-tooth disease. Claw toes deformity of the lesser toes can follow severe closed calcaneal fracture as a result of contracture of the intrinsic flexor muscles of the foot. Excision of the lateral and medial sesamoids may lead to claw toes. In claw toes, there is a muscle imbalance where the extrinsic muscle overpowers the weaker intrinsic muscle and can cause claw toes. The claw toe and hammer toe deformities are associated with dorsal subluxation of the interossei, which can no longer serve to flex the metatarsophalangeal joint. Once the MTP joint extends, the tendon imbalance becomes a vicious cycle. It is important to recognize if these deformities are rigid (fixed) or flexible. Claw toes is different from mallet toe, hammer toe, curly toe, and crossover second toe. The isolated hammer toe and the mallet toe usually result from an acute injury or from chronic pressure from shoes. Hammer toe rarely occurs by itself, and you may have a disorder of the plantar plate. The hammer toe and the claw toe differ by the position of the DIP joint. In the hammer toes, you will find flexion of the PIP and extension of the MTP joint, but it is reducible. Hammer toe can occur by itself, and there might be an associated dorsal PIP callus. You may also find second toe metatarsalgia. The condition of hammer toe can be flexible or rigid. In mallet toe, there is a DIP flexion deformity. You can find nail pain and end bearing callus. In mallet toe, the extensor digitorum longus will lose its tenodesis effect on the proximal interphalangeal and distal interphalangeal joints. Curly toe is associated with contracture of the flexor tendons and usually occurs in children. Curly toe is usually bilateral and usually affects the third or the fourth toe. The affected toe is usually flexed and curved medially, so that toe lies underneath the neighboring



medial toe. The curly toe is usually asymptomatic, and it may improve by itself. The nail of the curly toe may cut the plantar surface of the overlying toe. The condition of curly toes is usually caused by tight flexors of the toe. The condition usually does not need treatment, and you may need to stretch the toe. If stretching of the toe fails, then you may need to do release of the flexor tendon (flexor tenotomy). Crossover second toe usually occurs due to attenuation or rupture of the plantar plate and the lateral collateral ligament. They are associated with a varying degree of instability. With crossover second toe, there will be progressive migration of the digit towards the big toe (usually the second one) with dislocation or subluxation of the MTP joint.

Congenital Trigger Thumb

Congenital trigger thumb is a pediatric condition which results in flexion deformity of the thumb at the IP joint. There will be triggering and flexion deformity of the IP joint of the thumb and a nodule can be felt at the base of the thumb over the MCP joint of the thumb. The condition can be developmental or congenital. Congenital trigger thumb is bilateral in 25% of cases. The flexor pollicis longus tendon is thickened and its diameter is increased

compared to the A1 pulley. Thickening of the tendon will interfere with normal gliding of the tendon and will cause some triggering which can lead to fixed contracture of the thumb. Spontaneous resolution of the symptoms is unlikely after the age of 2 years. It is a flexion deformity at the thumb IP joint. The flexor tendon may have a nodule called "Nota's Node".

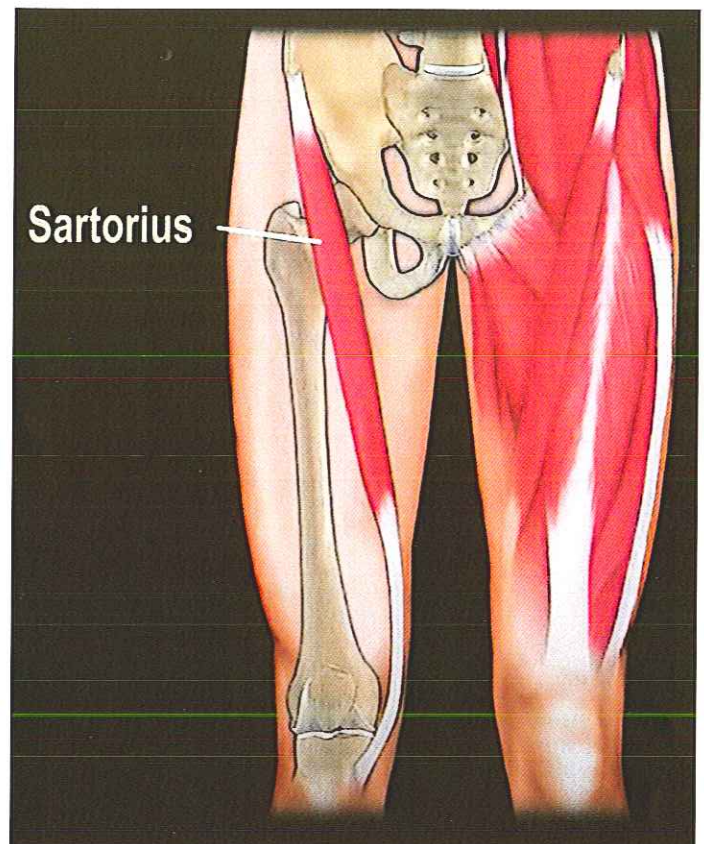
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The patient may not be able to extend the IP joint due to fixed flexion deformity. X-rays are usually normal. Treatment is extension splinting in the first year. If the patient is less than one year of age, the treatment is observation, stretching, and splinting. Do passive extension exercises with intermittent extension splinting. There will be about 50% resolution of symptoms. Surgery is done if there is failure of conservative treatment or if there is fixed deformity after 1 year of age. If there is no spontaneous correction of the deformity by

1 year, do release of the A1 pulley. During the A1 pulley release surgery, you must protect the radial digital nerve which may cross the field. Avoid release of the oblique pulley because this may lead to bowstringing of the flexor tendon. Usually multiple fingers are affected. There will be distal triggering as the flexor digitorum profundus passes through the sublimus decussation at the level of the A2 pulley (not the A1 pulley). Treatment is usually excision of one sublimus slip to allow for smooth gliding of the FDP tendon.

Anatomy of the Sartorius Muscle

The sartorius muscle arises from the anterior superior iliac spine (ASIS) of the pelvic bone. The sartorius muscle crosses the upper third of the thigh obliquely, downwards medially and then descends vertically towards its insertion. It is a superficial muscle, the longest muscle, and its fibers are parallel. The sartorius muscle is inserted into the anteromedial surface of the upper tibia. Other tendons are inserted into the same location. These tendons are called the Pes Anserine tendons. Surgical approach to the Pes Anserine insertion for harvesting of the semitendinosus and gracilis tendons puts the terminal branch of the saphenous nerve at risk as it emerges between the sartorius and the gracilis tendons. The sartorius muscle is innervated by the femoral nerve. The sartorius muscle flexes, abducts, and rotates the hip laterally as well as flexes the knee. It is sometimes referred to as the "tailor's muscle" in reference to the cross-legged position in which tailors once sat. The "tailor" position helps to understand the function of the sartorius muscle. The upper third of the sartorius muscle forms the lateral border of the femoral triangle, and its middle third forms the roof of the adductor (subsartorial) canal which contains the femoral vessels and the saphenous nerve. The femoral triangle is a superficial triangular space located on the anterior aspect of the thigh just inferior to the inguinal ligament. The boundaries of the femoral triangle include the lateral border (formed by the medial border of the sartorius muscle), the medial border (formed by the medial border of the adductor longus muscle), and the base (formed by the inguinal ligament). The femoral triangle contains three important structures: femoral nerve, femoral artery, and femoral vein (from lateral to medial), and it also contains the deep inguinal lymph nodes. The lateral cutaneous nerve of the thigh crosses the lateral corner of the triangle and supplies the skin on the lateral part of the thigh. It appears that the neurovascular bundle is medial to the sartorius muscle. Therefore, in the anterior approach to the hip, it is always safe to go lateral to the sartorius muscle in order to avoid the important structures within the femoral triangle. It is important to remember when performing this approach to avoid injury to the lateral cutaneous nerve of the thigh. For the Hip Anterior Approach (Smith-Petersen) the internervous plane superficially between the sartorius (supplied by the femoral nerve) and the tensor fascia lata (supplied by the superior gluteal nerve). Bony avulsion of the sartorius tendon occurs from a strong sudden pull of the sartorius with the hip in extension and the knee in flexion. Avulsion of the sartorius from its attachment site most commonly occurs in sprinters



and other running athletes. The avulsion can also occur after anterior iliac crest bone graft. It is advisable to start harvesting the bone graft approximately 3 cm from the anterior superior iliac spine to avoid weakening of the bone and avulsion fracture. Harvesting bone less than 3 cm of the ASIS may cause an avulsion fracture of the sartorius muscle. If there is a persistent hip pain after anterior iliac crest bone graft, get an x-ray of the pelvis to check for an avulsion fracture. The adductor canal (subsartorial canal) is an aponeurotic tunnel in the middle third of the thigh, extending from the apex of the femoral triangle to the opening in the adductor magnus, which is called the adductor hiatus. The canal contains the femoral artery, femoral vein, and the saphenous nerve, which is a branch of the femoral nerve. It is important to recognize the relationship of the saphenous nerve to the sartorius muscle and tendon.

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The saphenous nerve is posterior to the sartorius tendon. The pes anserine bursa is a small fluid filled sac located between the tibia and three tendons of the sartorius, gracilis, and the semitendinosus. The pes anserine is the common area of insertion for the three tendons along the proximal medial aspect of the tibia. The sartorius is innervated by the femoral nerve. The gracilis is innervated by the obturator nerve. The semitendinosus is innervated by the tibial branch of the sciatic nerve. Pes anserine bursitis, or “breaststroke knee”, is an inflammatory condition of the medial knee at the pes anserine bursa that is common in swimmers. Pes anserine bursitis is usually seen as causing pain, tenderness, and localized swelling after trauma or total knee replacement. The pain is seen below the joint line on the medial part of the proximal tibia with the bursa deep to the tendons. Pain at the joint line is probably a meniscal tear. Pain below the joint line is probably bursitis.

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