# TARSOMETATARSAL DEGENERATIVE JOINT DISEASE

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The tarsometatarsal or LisFranc's joint is fairly susceptible to degenerative arthritis. Situated at the interface of rearfoot and forefoot motion the tarsometatarsal joint is subjected to a tremendous amount of force during ambulation. Slight biomechanical abnormality may result in degenerative changes within the joint. Injuries involving the tarsometatarsal joint are frequently misdiagnosed leading to a rapid degeneration of the joint. A thorough understanding of the tarsometatarsal articulation is necessary to adequately manage the arthritic process.

## ANATOMICAL CONSIDERATIONS

The tarsometatarsal joint consists of a complex interrelationship between bones, ligaments, and muscles. The skeletal framework includes bases of the five metatarsals as they articulate with one another, the three cuneiforms and the cuboid. The second and third metatarsal bases and corresponding cuneiforms are wedged-shaped with their bases directed dorsally (Fig. 1). These bones unite to form an asymmetrical arcade creating a transverse arch. The *keystone* of this arch is the second metatarsal and cuneiform. The second cuneiform is smaller than the first and third cuneiforms producing a recess for the second metatarsal. The second metatarsal is firmly keyed into tight articulations with five adjacent bones (Fig. 2). This locking of the second metatarsal enables it to be the primary stabilizer in the area (1).

The transverse arch is supported by dorsal, plantar, and interosseous ligaments. Ligaments bond all metatarsal and cuneiform/cuboid articulations except for the first and second metatarsal bases (Fig. 3). There is no ligamentous attachment between the bases of these two metatarsals. However, the second metatarsal is stabilized by an extremely strong ligament which extends from the medial cuneiform. This ligament is commonly called LisFranc's ligament.

The transverse arch is reinforced plantarly by the expansions from the tibialis posterior tendon and the peroneus longus. The peroneus longus inserts into the first metatarsal base and acts as a primary stabilizer of the first ray. Additional stabilization of the tarsometatarsal joint comes from intrinsic muscles and plantar fascia.

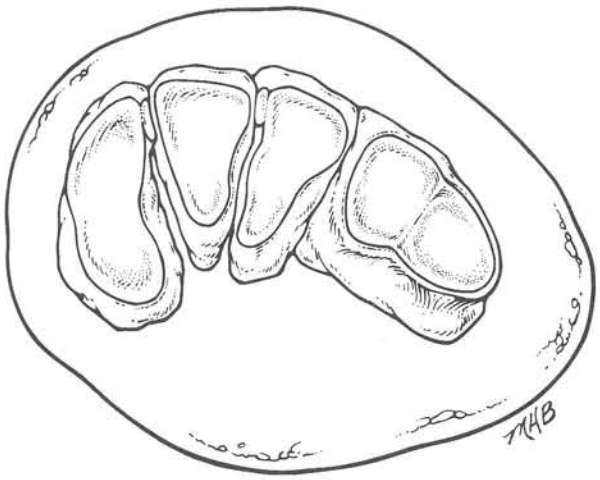

**Fig. 1.** Cross section through tarsometatarsal joint showing asymmetrical arcade formed by three cuneiforms and cuboid. Keystone of this arch is second metatarsal and cuneiform.

**Fig. 2.** Second metatarsal is locked in position between first and third metatarsals and three cuneiforms.

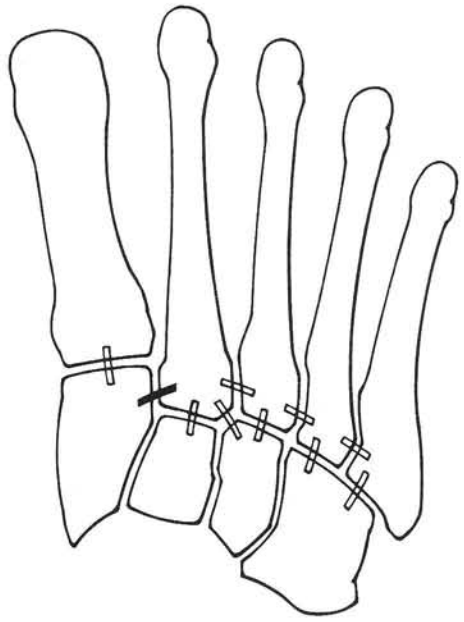

**Fig. 3.** Diagram showing ligamentous attachments of tarsometatarsal joints. Note absence of ligamentous attachment between bases of first and second metatarsals. Second metatarsal is stabilized medially by ligament extending from medial cuneiform (LisFranc's ligament).

Functionally, the tarsometatarsal joint participates in forefoot motion and stability. The metatarsals extend from LisFranc's joint and are the functional units of motion in the forefoot. The tarsometatarsal joint is the interface between the rearfoot motion (subtalar and midtarsal joints) and forefoot motion (metatarsals and digits).

The first and fifth rays have a considerable range of motion in the sagittal and frontal planes. The third and fourth metatarsals have a range of motion basically limited to the sagittal plane (dorsiflexion and plantarflexion). The second metatarsal is essentially locked in the mortise and is immobile. The ratio of metatarsal range of motion from the first through the fifth is 2:0:1:2:3 (2).

Hicks described a forefoot twisting around a stable third metatarsal axis (3). The direction of motion was in pronation or supination. The pronatory twist of the forefoot involves plantarflexion eversion of the first metatarsal while the fifth metatarsal dorsiflexes and everts. The supinatory twist includes first metatarsal dorsiflexion inversion with plantarflexion inversion of the fifth metatarsal. The forefoot supinatory twist occurs with subtalar joint pronation while the pronatory twist is found with subtalar joint supination.

## ETIOLOGY

Degenerative joint disease does not always involve every articulation of LisFranc's joint. Joint destruction most typically develops over a long period secondary to biomechanical abnormalities.

Subtalar joint supination during gait results in a rigid lesser tarsus with stability across the tarsometatarsal joint. Furthermore a rigid lateral column allows the peroneus longus to function more effectively plantarflexing the first ray. This stability is necessary during the late midstance and propulsive phase of gate. During the early stance phase of gate the foot needs to be a mobile adaptor. The subtalar joint then pronates resulting in a loosely packed lesser tarsus.

Excessive subtalar joint pronation results in prolonged unlocking of the midtarsal joint. Unlocking causes the development of distal hypermobility of the lesser tarsus and metatarsals. Hypermobility diminishes the keystone effect. Additionally, the stabilizing effect of the peroneus longus on first metatarsal plantarflexion is reduced. The stability of the lateral column that the peroneus longus requires is lost. The excessive motion results in articular subluxation and osseous jamming. After a period of time degeneration of the tarsometatarsal joint is observed.

Biomechanical abnormalities associated with excessive subtalar and mid tarsal joint pronation are the most frequent causes of total or partial LisFranc's joint breakdown. Common causes include compensated forefoot varus, compensated equinus, or tibialis posterior rupture.

Tarsometatarsal degenerative joint disease can be secondary to cavus deformity. Excessive first ray or forefoot equinus can lead to a jamming at the tarsometatarsal joint . Retrograde jamming results in a gradual degeneration of the joint. Examples of cavus deformities resulting in tarsometatarsal joint breakdown include congenital plantarflexed first ray, forefoot valgus, anterior cavus (pseudo equinus) and overpowering function of the peroneus longus muscle causing excessive plantarflexion of the first ray.

Painful degenerative joint disease of the tarsometatarsal joint can follow fracture dislocation of that joint.The reported incidence of symptomatic degenerative arthritis of this joint is 0-58% following injury (4). According to the literature as many as 20% of these injuries are either misdiagnosed or overlooked altogether (5). Patients not receiving treatment for this injury are assured of developing degenerative joint disease. Although controversy surrounds the proper therapy of this injury, the complications significantly decrease when open reduction with internal fixation is carried out. Patients receiving closed reduction of the deformity had an extremely high rate of degenerative joint disease (Fig. 4).

Occasionally patients with major rearfoot fusion, such as triple arthrodesis and pantalar arthrodesis may proceed to breakdown LisFranc's joint. Absorption of additional stresses previously compensated by the rearfoot joints are now directed through this joint.

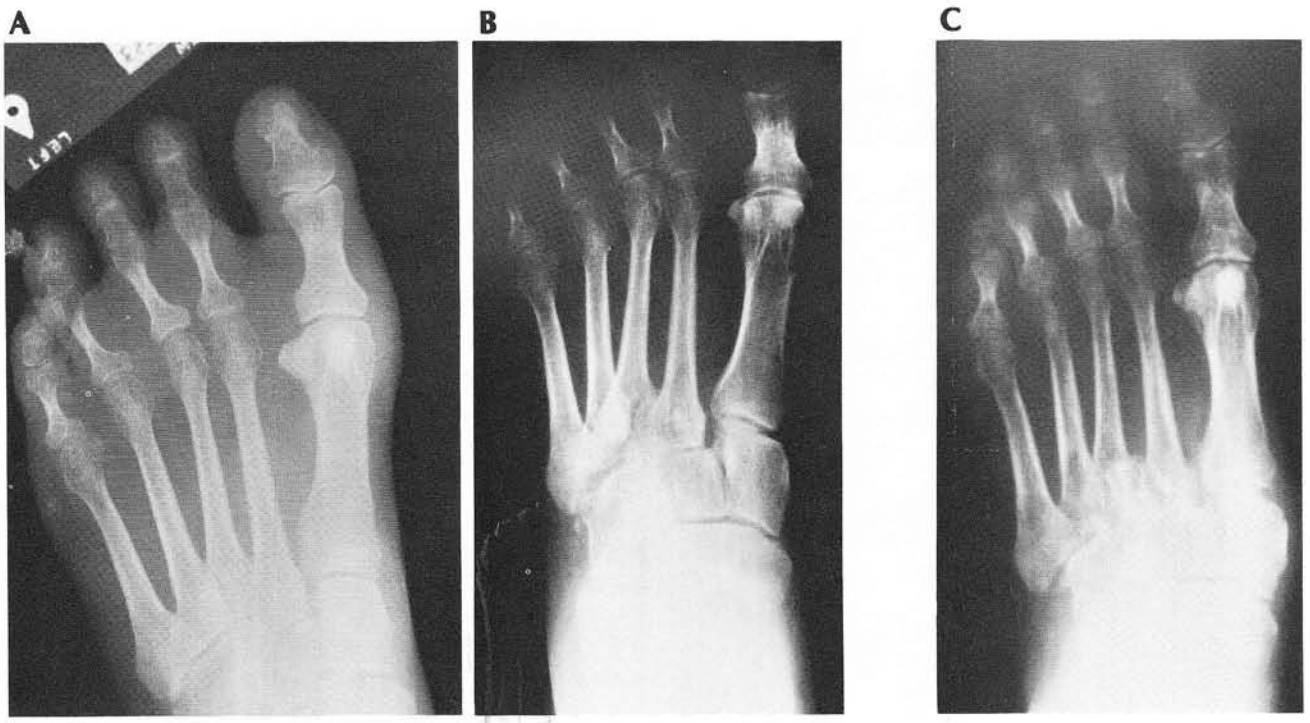


**Fig. 4.** A. Radiographs of 52 year old white female before injury to tarsometatarsal joint. B. Following dislocation of LisFranc's joint. C. One year after closed reduction of that injury. Note significant amount of destruction to tarsometatarsal joint.

## DIAGNOSIS

The chief complaint is usually a progressive midfoot fatigue and dull aching pain. The foot is usually collapsed and severely pronated. The forefoot is commonly abducted on the rearfoot creating a concave lateral border. Medially the talar head can be seen protruding secondary to subtalar joint pronation (Fig. 5).

Pain is elicited on palpation of the affected joints. Osteophytic proliferation can be observed and palpated on clinical exam. Additional biomechanical deformities are noted resulting in excessive forefoot hypermobility. There is usually a primary or secondary equinus present in these patients. The gait is usually apropulsive with a prolonged stance phase.

Standard radiographic findings reinforce the clinical assessment. Joint destruction can range from slight irregularities to total obliteration of the joints. Subluxations and dislocations are common findings. Multiple osteophytes can be appreciated around the joints. If severe destruction is present, tomography or CT scans may be necessary to completely evaluate the articular surfaces (Fig. 6).

## TREATMENT

Conservative therapy should be directed to the underlying cause of degenerative joint disease. Obviously the degenerative joint disease is usually a result of biomechanical abnormalities. Conservative treatment is usually effective when the disease is recognized early. Once adaptive change and joint subluxation become apparent surgical intervention is often necessary. Biomechanical control is the primary goal of conservative therapy. In the acute stage the joint should be rested with the use of non-steroidal anti-inflammatory agents and physical therapy.

Surgical correction should be considered if conservative methods appear inadequate. The surgical goal is to reduce painful motion and increase the stability of the foot. This goal can be obtained through partial or total

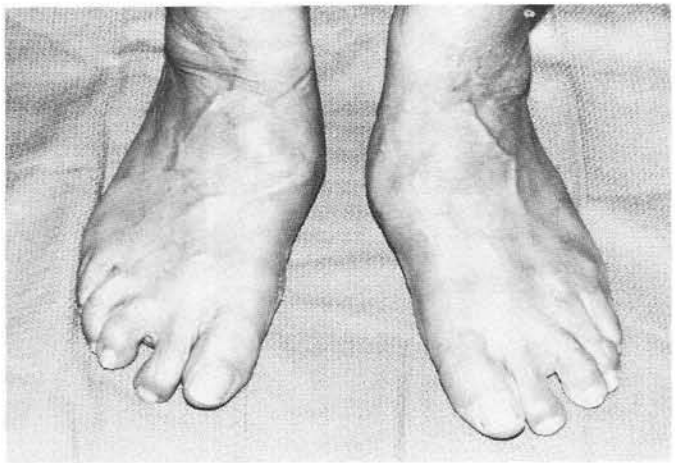

**Fig. 5.** Patient with degenerative joint disease of tarsometatarsal joint. Note abducted forefoot on rearfoot and medial talar head protrusion.

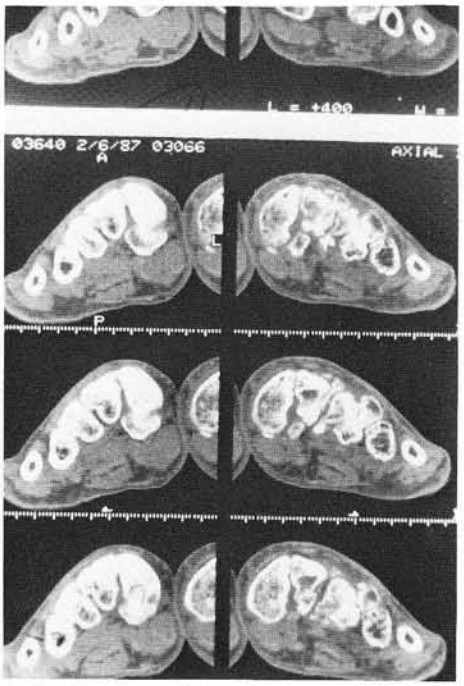


**Fig. 6.** CT scan showing severe destruction at LisFranc's joint one year following injury.

fusion of the tarsometatarsal joints. Correction of the deformity is a secondary concern. Arthrodesis can be restricted to one joint or include multiple joints. The most common joint requiring stabilization is the first metatarsocuneiform articulation.

Johnson advocates primary arthrodesis for dislocations of tarsometatarsal joint that require open reduction for stabilization (4). The most common joints to be fused in this study were the second and third metatarsocuneiform joints. Primary arthrodesis should not be attempted in the majority of the cases. Open reduction with internal fixation of LisFranc's fracture-dislocations has produced satisfactory results (6, 7).

Incisional approaches vary depending on the specific joints to be fused. Most cases require first metatarsocuneiform arthrodesis. Exposure is obtained through a dorsomedial approach. If total LisFranc joint fusion is required a central linear or lazy *S* incision can be placed over the third metatarsal to expose the central three metatarsals. Access to the fifth metatarsocuboid articulation can be obtained through a dorsolateral incision. Anatomic dissection will permit accurate visualization of the joint complexes while avoiding neuro-vascular structures.

The joints are then entered and evaluated. Joint surfaces are resected. Intermetatarsal joint surfaces may also be resected for additional stability. Improved fit of the arthrodesis site is obtained through reciprocal planing. If significant transverse plane deformity is present the

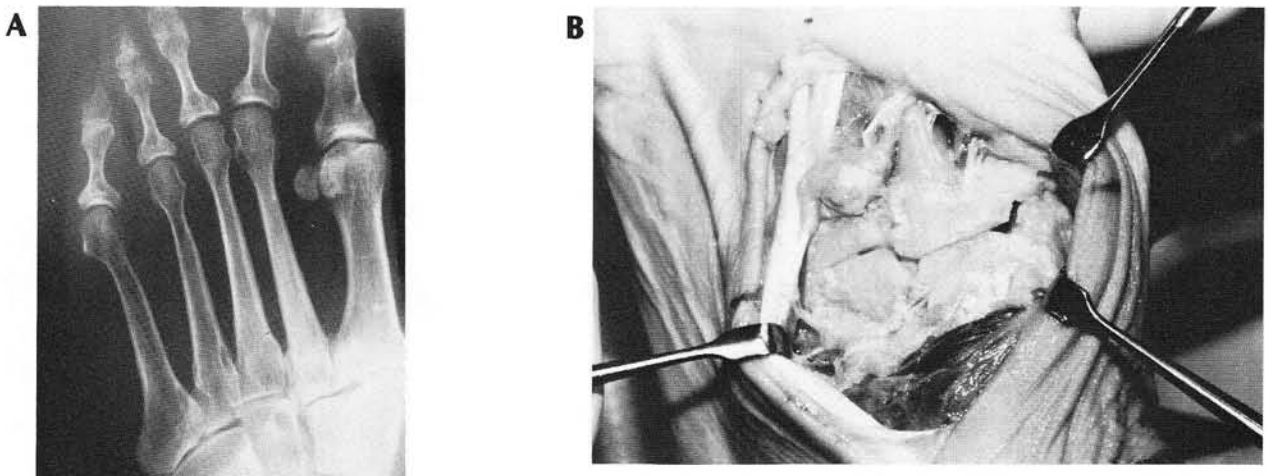


**Fig. 7.** A. Preoperative radiograph of 61 year old patient presenting with breakdown at tarsometatarsal joint secondary to collapsing pes valgo planus. B. Intraoperative clinical view showing arthrodesis site follow-

forefoot can be held in correct position during reciprocal planing (8). Once the position that is desired is achieved temporary fixation is placed.

Final fixation should be initiated at the first metatarsocuneiform joint. Due to the tremendous stress placed on this arthrodesis it should be rigidly fixated to insure proper bone healing. This can be achieved with a medially placed ASIF plate and screws. A dorsal interfragmental compression screw can further secure this arthrodesis site. The remainder of the arthrodesis sites can be fixated with screws, Kirshner wires or staples. The fifth metatarsal can also be stabilized with a plate (Fig. 7).

A closed suction drainage system is placed prior to closure of the wounds. The limb is placed in a Jones compression cast at the time of surgery. Three to five days postoperatively, the patient is placed in a below-knee synthetic cast. The patient is maintained in a cast for up to 3 months. The foot is non weightbearing until healing is apparent radiographically.

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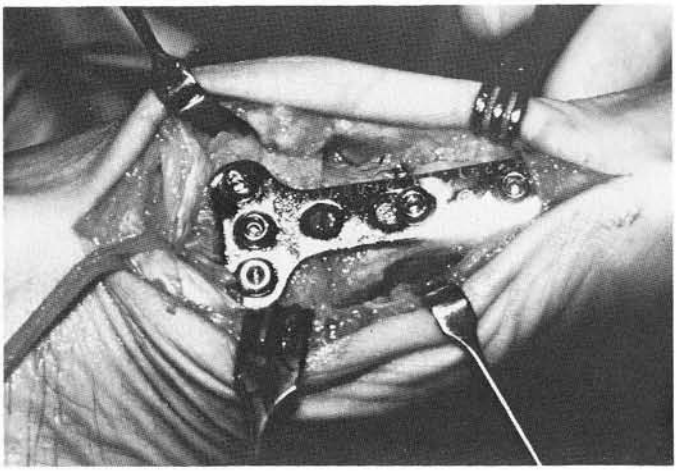

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ing resection. C. First metatarsocuneiform arthrodesis with ASIF *T* plate and interfragmental screw. D. Postoperative radiographs of first, second, and third metatarsocuneiform arthrodesis.