

The Superior Tibiofibular Joint: The Forgotten Joint

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Clinicians and anatomists have ignored the superior tibiofibular joint too long. As Dr. Arthur Helfet⁵ states: "The superior tibiofibular joint has suffered clinical and literary neglect." Although pathology of this joint is relatively uncommon, it must be considered as a differential diagnosis. Persistent, vague symptoms of the lateral aspect of the knee may include pathology to the superior tibiofibular joint as well as the more common problems (lateral meniscus, lateral capsule, lateral musculature, lateral compartment pathology, etc.). A careful, thorough, systematic evaluation must be performed if appropriate care is to be rendered.

The first portion of this paper deals with the anatomy, biomechanics, and mechanisms of injury of the superior tibiofibular joint. The second portion of the paper includes the evaluation and treatment of injuries to this joint, while the final portion includes illustrative case studies.

The fibula is described as a long, slender, bone located in the lateral aspect of the leg. Evans³ found the middle and proximal thirds of the fibula have great ability to withstand tensile forces. The tensile strength of these areas was calculated to be greater than any other osseous component in the skeleton. The distal and proximal portions of the fibula are expanded and articulate with the talus and tibia, respectively. The distal expansion is referred to as the lateral malleolus while the proximal expansion is termed the fibular head. The inferior tibiofibular articulation is of a syndesmonic (nonsynovial) nature, while the superior joint is synovial.

The head of the fibula articulates on the posterolateral and inferior aspect of the lateral tibial condyle. A single facet of the fibular head articulates with the tibia. Ogden⁸ has revealed that there are essentially two types of superior tibio-

fibular joints. This is due to anatomical variations he describes as horizontal and oblique. An arbitrary figure of 20° is used in determining a joint's nature. The joint surface area decreases as the joint obliquity increases. While the horizontal joint averages approximately 26 square millimeters of joint surface, the oblique joints average only 17 square millimeters. The horizontal joint also demonstrates greater capacity for rotary mobility than does the joint surface of the oblique type⁸ (Fig. 1).

The importance of the superior tibiofibular joint in lower extremity function is clearly described by Helfet.⁵ It is known that the knee joint is a helicoid structure and that the tibia internally and externally rotates upon the femur in a controlled, synchronous pattern. Hence, flexion and extension of the knee do not occur without tibial rotation. Ankle flexion and extension do not occur as isolated motions but rather require a component of tibial rotation as well. When considering the weight-bearing extremity, it is obvious that rotation of the tibia is quite restricted. To accommodate internal and external rotatory movements of the tibia, the superior tibiofibular joint provides a compensatory motion. At this joint, three movements occur in the relationship between the tibia and fibula: 1) anterior-posterior, 2) superior and inferior, and 3) rotation. It is obvious these motions occur synchronously and are dependent upon knee position as well as foot position. Ogden⁸ determined the following primary functions of the superior tibiofibular joint: 1) the dissipation of torsional stresses applied at the ankle joint, 2) the dissipation of lateral tibial bending movements, and 3) tensile rather than compressive weight bearing.

Examination of the talus reveals the medial facet to be oriented in a vertical fashion. The lateral aspect of the talus flares and travels in an inferior and lateral direction. Since the fibula rides upon this nonvertical surface, it must be subjected to stress upon dorsiflexion of the ankle. Barnett and Napier¹ describe this resultant

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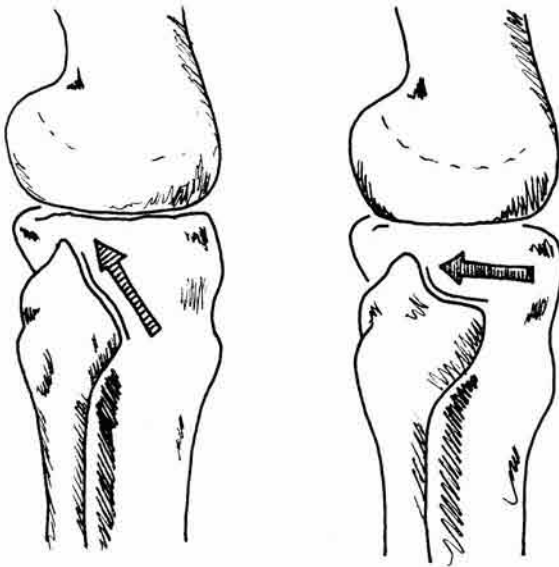


Fig. 1. The two types of superior tibiofibular joints: the oblique (left) and horizontal (right).

movement of the fibula as an external rotation about its longitudinal axis. It is apparent that the transmission of this movement superiorly must be accompanied by similar movement at the proximal tibiofibular joint. The correlation between the type of superior tibiofibular joint and the inclination of the dorsiflexion axis has been found by Barnett and Napier.¹ A horizontal joint allows greater rotatory mobility and thus more easily dissipates the torsional stresses than does an oblique joint. Thus the oblique joint is more susceptible to injury by torsional stress.

The transverse width of the dome of the talus may be slightly wider anteriorly than posteriorly in some individuals.^{1, 6} Upon dorsiflexion of the ankle, the malleoli may slightly separate to accommodate the difference in the width of the talus. Close and Inman² calculated this separation to range from 0.13–1.8 millimeters. This movement thus occurs through the distal fibula as it swings outward and upward on the interosseous membrane. It is clear that, in some fashion, this motion is transmitted superiorly through the fibula and is dissipated at the superior tibiofibular joint.

The functions of dissipation of lateral tibial bending movements and tensile weight bearing are highly related as well as controversial. Through the use of biostatic specimens, Lambert⁷ calculated that the proximal tibiofibular joint accepts one-sixth of the static load applied to the leg. Lambert⁷ came to the conclusion that the weight-bearing force applied through the

fibula is transmitted to the superior tibiofibular joint through the tibia. This was determined through the examination and testing of lower limbs before and after the resection of the proximal fibula (Fig. 2).

Preuschoff suggests that the superior tibiofibular joint functions primarily to dissipate lateral tibial bending. Thus, rather than functioning to dissipate compressive forces, this joint functions in a tensile fashion. This is supported by Evans³ who determined the fibula to possess great tensile strength. It is thus logical to assume that the superior tibiofibular joint is involved in both functions.

MECHANISMS OF INJURY

The superior tibiofibular joint is susceptible to indirect trauma. This trauma is usually the result of severe ankle stress sustained by the weight-bearing extremity. The normal rotatory movements of the tibia are blocked by the weight bearing. Thus the extreme forces must be dissipated through the fibula and its superior joint.

Direct trauma to the superior tibiofibular joint may result in dislocation, subluxation, or sprain. The normal mechanism for direct trauma is a violent lateral blow while weight bearing on a flexed knee.

One reported mechanism of dislocation involves parachutists. This mechanism occurs during landing when the parachutist sustains an inversion injury to the ankle with the knee flexed and the extremity weight bearing.⁴

EVALUATION

Rational patient management may only be provided through systematic evaluation of the knee. Differential diagnosis is the key when examining

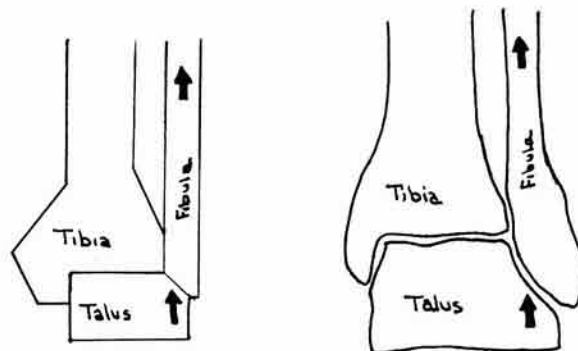


Fig. 2. The weight-bearing status of the fibula is confirmed by the oblique articulation of the fibula and talus.

the superior tibiofibular joint. Although dislocations are easily diagnosed, sprains of this joint are easily overlooked.

Pathology of this joint usually is not disabling. The patient will complain of pain in the lateral aspect of the knee or pain in the posterolateral calf. The patient usually presents with a normal range of motion and only complaining of "nagging" problems. Palpation of the superior tibiofibular joint may or may not elicit pain. Tenderness may be present in the area of the biceps femoris and may be exacerbated by resisted flexion of the knee. "Rocking" the head of the fibula may also elicit pain. Abnormal motion may be present as well as a prominent fibular head.

Activities such as toe walking, hopping on a flexed knee, full dorsiflexion of the ankle, and resisted contraction of the biceps femoris may reproduce symptoms. Helfet⁵ includes a flexed knee weight-bearing test as part of a differential diagnosis for the superior tibiofibular joint (Fig. 3). This test requires the patient to flex the knee without stabilization from the other extremity. A positive test is indicated when the individual further stabilizes or "gives way" while attempting the test.

TREATMENT

Treatment of the superior tibiofibular joint pathologies is dictated by the severity of symptoms. Treatment will range from judicious neglect through surgical intervention. Trial use of antiinflammatory drugs with a compressive dressing may give gratifying relief. Further conservative treatment includes the application of ice and partial weight bearing to reduce further trauma and minimize secondary insult. Prolonged ambulation and weight bearing is to be discouraged as the vertical displacement of the fibula may further inflame the involved structures. Intraarticular injections of Xylocaine and cortical steroids may be quite effective.

Dislocations of this joint are normally reduced spontaneously by the patient. If a joint remains dislocated, closed reduction should be attempted. To accomplish this, the knee is passively flexed to approximately 90° and an appropriate force directed to the fibular head. This normally results in an audible pop and a successful reduction.⁹ Postreduction management includes antiinflammatory drugs as well as immobilization. Immobilization is usually in the form of a short leg cast and is maintained for approx-

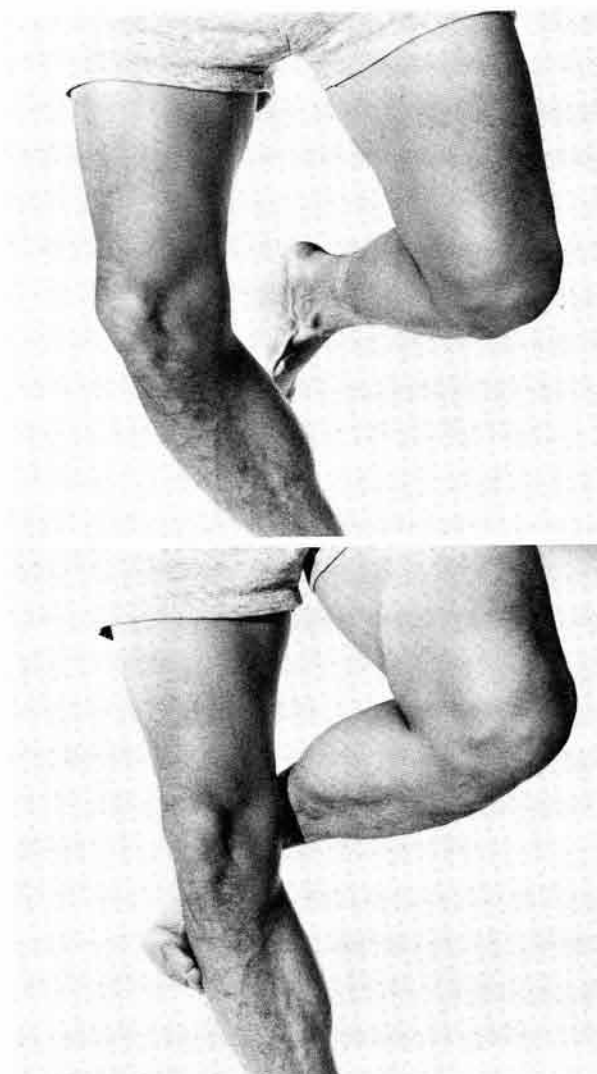


Fig. 3. The individual who has superior tibiofibular joint pathology will be forced to stabilize the weight-bearing extremity with the uninvolved limb in an effort to prevent giving way. Top, normal; bottom, superior tibiofibular joint pathology.

imately 3 weeks. The patient is instructed in non-weight-bearing ambulation during this period of time.

Surgical intervention is considered as a last resort. It is normally used only in chronically subluxed joints or in individuals presenting with peroneal nerve involvement.

Surgical procedures which have been used include joint reconstruction, arthrodesis, resection of the proximal fibula, and temporary joint fixation. The procedure of choice by most authors involves resection of the proximal fibula. This procedure preserves normal distal tibiofibular joint function while eliminating the proximal

symptoms. Parkes and Zelko⁹ have suggested temporary fixation of the superior tibiofibular joint. Repair of the joint capsule and surrounding tissues is included during this procedure followed by the application of a short leg cast. The ankle is maintained in the neutral position thus immobilizing the superior tibiofibular joint. The internal fixation is maintained for 6 weeks. Mobilization occurs at 6 weeks and is progressive in nature. If problems continue, fibular resection is recommended.⁹

CASE STUDY

A 21-year-old male soccer player was referred to the clinic for evaluation and treatment. This individual had sustained a dorsiflexion inversion stress to the right ankle while attempting to change directions. The individual was attempting to rotate to his left while weight bearing on the right extremity. This individual complained of ankle pain as well as tenderness about the lateral aspect of the knee. The clinical examination revealed the area of the fibular head to be quite tender to palpation. Dorsiflexion (active and passive) of the ankle was possible but elicited pain at the superior tibiofibular joint. Passive rocking of the fibular head also elicited pain. The ankle was stable and relatively painless throughout the range of motion. This individual was diagnosed as having sustained a sprain of the tibiofibular joint.

As the joint was not unstable, a trial of antiinflammatory drugs (Indocin), rest, and compressive wrapping was used. This athlete improved rapidly and was asymptomatic after 2 weeks and returned to competition.

CASE STUDY

A 27-year-old white male was referred to the clinic for evaluation and treatment. This individual had sustained an injury upon landing while parachuting. The individual described the injury as occurring when his foot turned inward while all his weight was on it. He stated that he was unable to straighten the knee until he twisted his foot and heard a loud pop attributed to the outside of his knee.

Examination revealed the fibular head to be tender to palpation. The superior tibiofibular joint appeared to be mildly unstable to anterior and posterior stress. Resisted knee flexion elicited pain as did passive rocking of the fibular head. Dorsiflexion of the ankle also elicited pain. This

individual was unable to bear weight without pain. It was determined that this individual had sustained an acute dislocation of the superior tibiofibular joint.

As the joint was mildly unstable, immobilization was in order. The individual was placed in a short leg cast with the ankle in the neutral position. The individual was allowed to begin weight bearing as pain permitted. A 3-week course of salicylates was initiated. Cast immobilization was maintained for 6 weeks. Two weeks post-cast removal, the individual returned to full activities. He has remained completely asymptomatic.

CONCLUSION

Injury to the superior tibiofibular joint is a relatively uncommon occurrence resulting from direct or indirect trauma. Severity of injury may range from a simple sprain to a complete dislocation. Differential diagnosis is vital in order to rule out other lateral knee pathology if one is to provide adequate treatment. Sprains of this joint are normally treated by antiinflammatory drugs and compressive dressings. Subluxation of the joint is nearly always successfully treated by closed reduction and immobilization. Surgical intervention is only undertaken when chronic problems or neurological symptoms exist.

Although the functions of the superior tibiofibular joint are somewhat in question, it appears to be involved in the dissipation of torsional, compressive, and tensile forces applied to the fibula. These forces are transmitted through the tibia as well as through the fibula during ankle motion and weight bearing. The clinical importance of this joint is that it must be included as a differential diagnosis of lateral knee pain.

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