Acta orthop. scand. 52, 99–102, 1981

ANTEROLATERAL ROTATIONAL INSTABILITY IN THE ANKLE JOINT

An Experimental Study of Anterolateral Rotational Instability, Talar Tilt, and Anterior Drawer Sign in Relation to Injuries to the Lateral Ligaments

OVE RASMUSSEN & IB TOVBORG-JENSEN

Orthopaedic Hospital, Århus, Denmark

In seven amputated legs the ankle region was dissected free, and anterolateral rotational instability, talar tilt, and anterior drawer sign in the talocrural joint were studied in relation to varying degrees of injury to the lateral ligaments of the ankle and in relation to various positions of the foot. This revealed a good correlation between the degree of ligamentous injury and the degree of the three different types of instability. Anterolateral rotational instability was maximal when the investigation was performed with the ankle joint in plantar flexion, whereas the talar tilt was more pronounced with the ankle joint in the neutral position and the anterior drawer sign most distinct when the ankle joint was in dorsal flexion. Compared with the other two signs, the anterior drawer sign proved to be a relatively inconstant type of instability.

Key words: ankle joint; anterior drawer sign; anterolateral rotational instability; talar tilt

Accepted 13.vii.80

Lateral instability of the ankle is generally diagnosed by demonstrating a talar tilt or an anterior drawer sign. Talar tilt is induced by forced supination of the foot (Dehne 1933, Broström 1965, Freeman 1965). Radiologically it can be measured as the distance between the tibial and talar joint surfaces at the lateral edge of the trochlea or at the angle between these articular surfaces.

The anterior drawer sign can be demonstrated by a forward directed traction on the foot, displacing the talus anteriorly in the ankle joint (Dehne 1933, Leonard 1949, Castaing & Delplace 1972, Lindstrand & Mortensson 1976). Radiologically the drawer sign is best measured by a double exposure in the sagittal plane done before and during strain (Johannsen 1978).

Abnormal internal rotation of the talar trochlea following injuries to the ankle ligaments has been reported by several authors, including Dehne (1933), Anderson et al. (1952), Cedell (1967), and Castaing & Delplace (1972). The internal rotation described by these authors indicates that in the presence of certain injuries to the lateral ligamentous apparatus the lateral part of the trochlea can slide forward in relation to its medial part. This is because in the horizontal plane it rotates on the medial malleolus using it as a kind of axis. In other words, this is a type of anterolateral ankle instability.

It was the object of the present study to investigate anterolateral rotational instability in relation to varying degrees of injury to the lateral ligamentous apparatus of the ankle and to elucidate the relationship between rotational instability, the drawer sign, and the talar tilt.

0001-6470/81/010099-04 $02.50/0

METHOD

In seven amputated legs the ankle region was freed of skin and subcutaneous tissue. All tendons, major vessels and nerves were removed. The three components of the lateral ligamentous apparatus of the ankle, i.e. the anterior talofibular ligament (ATaFL), the calcaneofibular ligament (CFL), and the posterior talofibular ligament (PTaFL) were exposed. Two Steinmann pins were inserted in the sagittal plane, one through the talar neck and the other one through the distal end of the tibia. Thereafter, the leg was fixed by two bolts, drilled through the tibia, and fastened to a special fixation apparatus.

Each ankle was then investigated for anterolateral rotational instability, talar tilt, and anterior drawer sign by forcing the foot into internal rotation, supination, and in the forward direction.

Anterolateral rotational instability was determined by radiography in the horizontal plane as the angle between the two Steinmann pins (Figure 1A). Talar tilt was determined by X-ray exposures in the frontal plane as the angle between the two articular surfaces (Figure 1B). The anterior drawer sign was induced by a 7 kg traction on the heel and determined by double exposure in the sagittal plane, with and without traction (Figure 1C).

On each ankle the studies for the three types of instability were carried out first with intact ligaments, then again after cutting the ATaFL, after cutting the ATaFL + CFL, and lastly after cutting all three ligamentous components. Moreover, all investigations were also performed with the ankle in 20° dorsal flexion, in the neutral position, and in 20° plantar flexion.

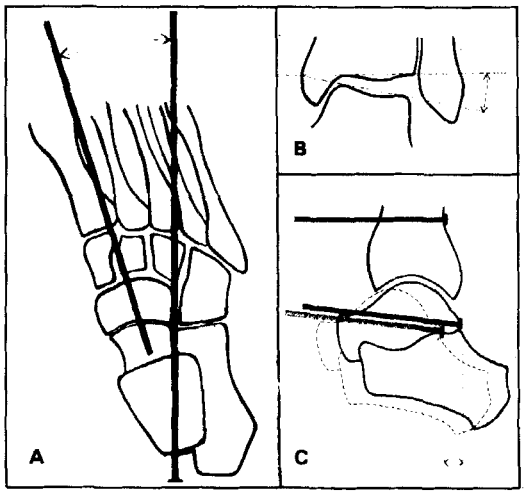

Figure 1. Demonstration of instability:
A: Anterolateral rotational instability determined as the angle between the two Steinmann pins.
B: Talar tilt as the angle between the articular surfaces.
C: Anterior drawer sign as the distance between the exposures of the head of the distal pin.

RESULTS

Anterolateral rotational instability (Figure 2) showed a definite correlation to ligament injury ($P_F = 99.9$). Regardless of the degree of the lateral ligamentous injury, this type of instability was most marked with the ankle joint in plantar flexion.

For talar tilt there was also a definite relationship to the extent of the ligamentous injury (Figure 3). After the ATaFL had been cut there was a slight talar tilt with the ankle in dorsiflexion and a more marked tilt in plantar flexion. When the CFL was cut as well, the instability increased considerably, regardless of the position in which the foot was placed. If also the PTaFL was cut, the instability again increased markedly, but was least in plantar flexion. This latter phenomenon was due to tautness in the intact part of the joint capsule.

The anterior drawer sign also showed an association, though less marked, with the degree of ligamentous injury (Figure 4). When the ligaments were intact there was a considerable drawer sign regardless of the position of the foot,

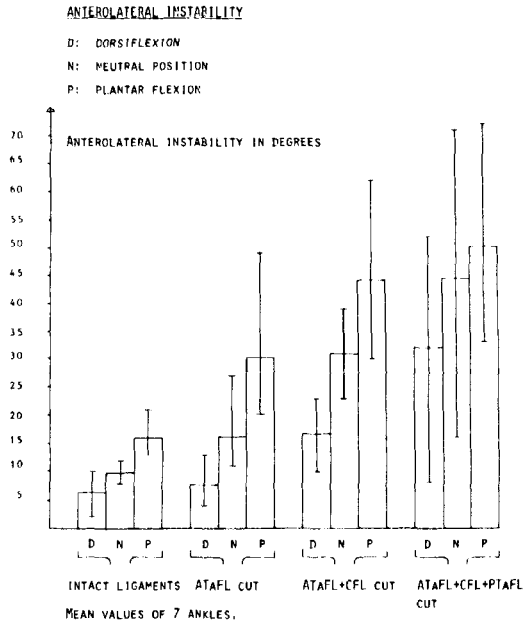

Figure 2. Anterolateral rotational instability in different positions of the foot and in relation to varying degrees of ligamentous injury.

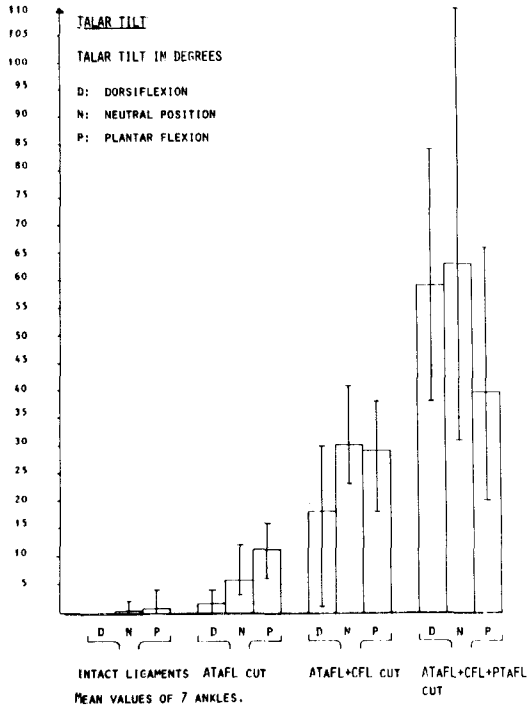

Figure 3. Talar tilt in different positions of the foot and in relation to varying degrees of ligamentous injury.

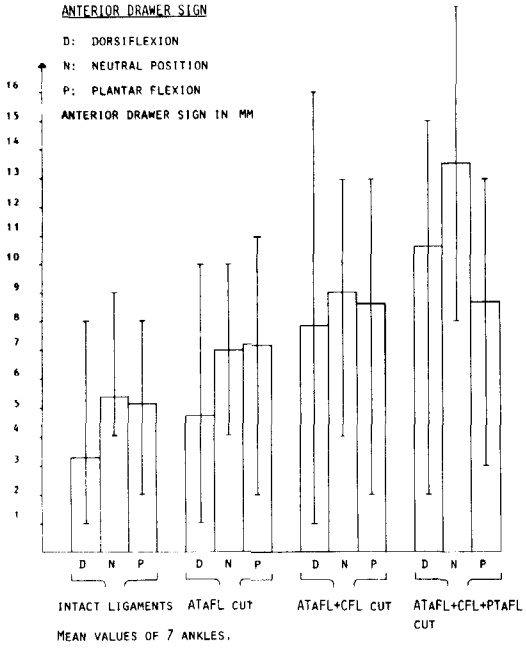

Figure 4. Anterior drawer sign in different positions of the foot and in relation to varying degrees of ligamentous injury.

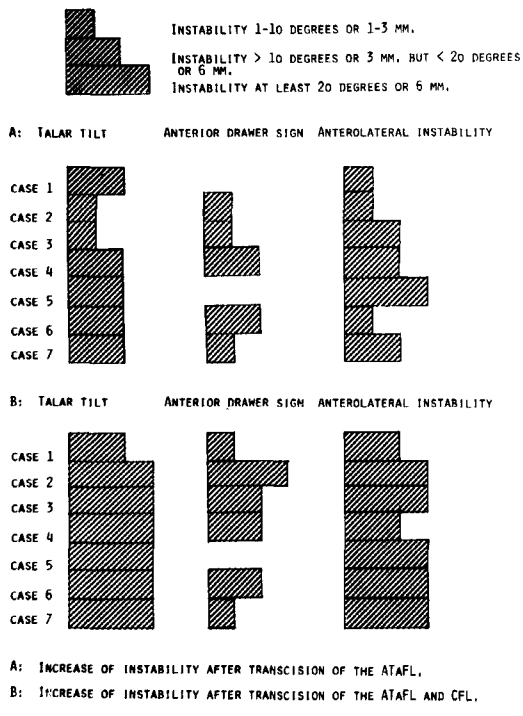

Figure 5. Correlation between anterolateral rotational instability, talar tilt, and anterior drawer sign, recorded in the optimal position of the talocrural joint for each type of instability.

but after the ATaFL had been cut only a relatively slight increase in the instability occurred.

A comparison of the three different types of ankle instability showed that after the ATaFL had been cut (Figure 5A) the anterolateral ankle instability and talar tilt were of approximately the same degree, while the anterior drawer sign was less constant. After the CFL had also been cut (Figure 5B) there occurred a marked increase in anterolateral instability and in talar tilt, while the anterior drawer sign still seemed to be fairly inconstant. After all three ligaments had been cut, there was pronounced instability in all cases.

DISCUSSION

Anterolateral rotational instability, talar tilt, and anterior drawer sign indicate ruptures in the lateral ligaments of the ankle. In clinical practice all three tests are applicable. The talar tilt and the

Figure 6. Anterolateral rotational instability can be demonstrated radiologically by anteroposterior exposure of the foot in the neutral position (A) and in forced internal rotation (B). In the presence of instability the head of the talus moves medially in relation to the medial malleolus.

anterior drawer sign are well-known, whereas anterolateral instability has not been studied in any detail. None of the three constitute simple movements in one plane. For instance, in anterolateral rotational instability the trochlea becomes distally displaced when its lateral part slides forward beneath the anterior tibial margin, and in the course of this displacement the trochlea will be tilted into a slightly varus position. In clinical examinations this instability is fairly easy to demonstrate by palpation anteriorly to the lateral malleolus while the foot is rotated inwards. In cases with instability, the lateral part of the trochlea will be felt sliding forward, out of the ankle joint. This rotation is difficult to demonstrate by radiography, but it can be done (Figure 6).

On the basis of the present findings, it would seem that investigation for anterolateral rotational instability is best done with the foot in plantar flexion, for talar tilt with the foot in the neutral position, and for the anterior drawer sign with the foot in dorsiflexion. The anterior drawer sign, however, appears to carry quite some uncertainty.

REFERENCES

Anderson, K., Lecocq, J. & Lecocq, E. (1952) Recurrent anterior subluxation of the ankle joint. A report of two cases and an experimental study. *J. Bone Jt Surg.* **34**-A, 853–860.

Brostrøm, L. (1965) Sprained ankles III. Clinical observations in recent ligament ruptures. *Acta chir. scand.* **130**, 560–569.

Castaing, J. & Delplace, J. (1972) Entorses de la cheville. Intéret de l'etude de la stabilité dans le plan sagittal pour le diagnostic de gravité. *Rev. Chir. orthop.* **58**, 51–63.

Cedell, C.-A. (1967) Supination-outward rotation injuries of the ankle. *Acta orthop. scand.*, Suppl. 110.

Dehne, E. (1933) Die klinik der frischen und habituellen Adduktionssupinationsdistorsion des Fusses. *Deutsch. Zschr.* **242**, 40–61.

Freeman, M. A. R. (1965) Instability of the foot after injuries to the lateral ligament of the ankle. *J. Bone Jt Surg.* **47**-B, 669–677.

Johannsen, A. (1978) Radiological diagnosis of the lateral ligament lesion of the ankle. *Acta orthop. scand.* **49**, 295–301.

Leonard, M. H. (1949) Injuries of the lateral ligaments of the ankle. A clinical and experimental study. *J. Bone Jt Surg.* **31**-A, 373–377.

Lindstrand, A. & Mortensson, W. (1976) A roentgenological investigation of anterior instability in the ankle joint after acute lateral sprain. Lateral lesions in sprained ankles. A. Lindstrand, Thesis, Lund.

Correspondence to: Ove Rasmussen, Korshøjen 103, 8240 Risskov, Denmark.