

# RADIOLOGICAL AND MUSCULAR STATUS FOLLOWING INJURY TO THE LATERAL LIGAMENTS OF THE ANKLE

## *Follow-up of 144 Patients Treated Conservatively*

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An average of 4.2 years after conservative treatment of injury to the lateral ligaments of the ankle 144 patients attended a follow-up examination which included radiography and measurement of the strength of plantar flexion.

Prior to treatment all of the patients had a difference in talar tilt of 6 or more degrees between the injured and uninjured side. At follow-up there was instability in 28 patients, or 19.4 per cent, but no correlation between instability and residual symptoms. Nine patients had an anterior "drawer sign" exceeding 2 mm, but this was also without relation to residual symptoms. Radiological evidence of osteoarthrosis was found in five patients, but four of them had a stable ankle joint and only one had residual symptoms.

The mean age of the patients with osteoarthrosis was twice that for the entire material. Two patients had osteochondritis of the talus.

The strength of plantar flexion was measured in 124 patients. There was significantly less strength in the injured than in the uninjured leg, but there was no statistically significant correlation between residual symptoms and reduced strength or between radiological instability and reduced strength.

According to the results of the present study and a previous one (Hansen et al. 1979) and to the results reported in the literature, we find no reason to alter our present principles regarding the diagnosis and conservative treatment of injury to the lateral ligaments of the ankle.

*Key words:* ankle injuries; conservative treatment; ligament injuries; plantar flexion

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Injuries to the lateral ligaments of the ankle give rise to instability which can be confirmed radiologically (Freeman 1965, Olerud 1976). Recently, measurements of muscle strength have been used as a means of assessing sequelae to injuries of the lower limbs (Damholt & Zdrakovic 1972 and 1974, Gillies & Chalmers 1970).

In the present study the radiologically detectable sequelae to injuries of the lateral ligaments of the ankle were correlated with the clinical sequelae, and the possible relationship between these sequelae and the plantar flexion strength was studied.

## PATIENTS

The 144 patients, described in more detail in a previous study (Hansen et al. 1979), were treated conservatively for injury to the lateral ligaments of the ankle. The diagnosis was made when the difference in talar tilt between the injured and uninjured foot, on radiographs taken at the time of the accident, was 6 or more degrees (Freeman 1965). The follow-up period averaged 4.2 years (3.1-6.1 years).

The clinical follow-up was described in our previous study (Hansen et al. 1979). The radiological follow-up consisted of ordinary radiography of the ankle joint, an inversion stress exposure (Freeman 1965), and an exposure for anterior drawer sign (Olerud 1967).

For measuring plantar flexion strength we used a strain-gauge dynamometer with an unyielding apparatus for fixing the leg. With this arrangement the contraction of the calf muscles could be considered isometric. During the measurements the patient sat as described by Asmussen & Heebøl-Nielsen (1961). The isometric strength could be read in arbitrary units on the scale. The plantar flexion strength recorded was the maximum excursion on the scale that the subject could perform at three attempts.

## RESULTS

At follow-up 28 patients (19.4 per cent) had secondary instability when using the same criteria of instability as at the time of the accident. Table 1 gives the relationship between secondary instability and residual symptoms (pain, swelling, functional instability). Statistical analysis showed no significant correlation between secondary instability and residual symptoms.

Nine patients had an anterior drawer sign exceeding 2 mm. Table 2 shows that this sign was not significantly correlated with residual symptoms.

At follow-up five patients had radiological evidence of osteoarthritis in the injured ankle. Four out of these five patients had stable ankles. The mean follow-up period for the patients with osteoarthritis did not differ from that in the total material, but their mean age was higher, viz. 55 years as against 27 years. Only one of the five patients had complaints on account of the ankle.

Two patients, aged 29 and 27 years, had developed radiological osteochondritis of the talus during the follow-up period. Only one of them had symptoms, and neither had secondary instability or osteoarthritis of the ankle.

Plantar flexion strength was measured in 124 patients, as 20 had to be excluded from this test (17 had various diseases of the leg in question, 2 had sciatica, and 1 was pregnant). In 68 patients the uninjured leg was stronger than the injured one, in 32 the injured leg was stronger than the uninjured one, while in 24

*Table 1. Secondary talar tilt (I-U)° in relation to residual symptoms at follow-up of 144 patients treated conservatively for injury to the lateral ligaments of the ankle*

Secondary talar tilt (I-U)°	No. of pts.	Pts. having symptoms at follow-up
< 6°	116	24 (20.7 per cent)
6-9°	22	4 (18.2 per cent)
≥ 10°	6	2 (33.3 per cent)

3 × 2 chi<sup>2</sup> test  
 chi<sup>2</sup> = 0.657  
 degrees of freedom = 2  
 0.7 < P < 0.8

*Table 2. Anterior drawer sign in relation to residual symptoms at follow-up of 144 patients treated conservatively for injury to the lateral ligaments of the ankle.*

Anterior drawer sign	No. of pts	Pts. having symptoms at follow-up
Absent	135	28
Present	9	2

chi<sup>2</sup> = 0.011  
 degrees of freedom = 1  
 0.90 < P < 0.95

patients there was no difference. On the average, the uninjured leg was 6.3 per cent stronger than the injured one. The group of uninjured legs was significantly stronger than the group of injured legs (signs test,  $P < 0.01$ ).

Of the 124 patients whose plantar flexion strength was measured 28 had residual symptoms. Among the 96 patients without residual symptoms the uninjured leg was an average of 5.5 per cent stronger than the injured leg, whereas the uninjured leg was 9.3 per cent stronger than the injured leg in the 28 patients with residual symptoms. This difference in strength reduction between patients with and without residual symptoms was not statistically significant (unrepaired  $t$  test:  $t = -1.068$ , degrees of freedom: 122,  $0.10 < P < 0.15$ ).

Radiography revealed secondary instability in 26 of the 124 patients. Among the 98 patients whose ankle was stable the uninjured leg was an average of 7.6 per cent stronger than the injured leg, whereas the corresponding difference in the group with instability was 1.7 per cent. The difference in strength between the group with stable and that with unstable ankle joints was not statistically significant (unpaired *t* test:  $t = 1.578$ , degrees of freedom: 122,  $0.05 < P < 0.10$ ).

## DISCUSSION

Functional instability (F. I.) is the most common residual symptom following injury to the lateral ligaments of the ankle. According to several authors, among others Anderson & LeCocq (1954), Broström (1966), and Weber & Hupfauer (1969), F. I. is due to mechanical instability of the ankle joint, and they recommend operation as the only means of securing stability in the joint. By contrast Freeman (1965) and Freeman et al. (1965), found no association between F. I. and mechanical instability, and felt that F. I. must be due to other factors.

To assess the stability of the ankle joint previous authors (Anderson & LeCocq 1954, Broström 1966, Olerud 1967) have used partly inversion stress radiographs and partly the anterior drawer sign. In the present material we used inversion stress radiographs as well as the anterior drawer sign—both confirmed radiologically—to assess stability of the ankle joint. This did not show any correlation between F. I. and ankle stability—in accordance with the findings of Freeman (1965) and Freeman et al. (1965), but at variance with others (Andersen & LeCocq 1954, Broström 1966, Weber & Hupfauer 1969).

Freeman et al. (1965) believe that F. I. is caused by a proprioceptive defect due to capsular injury connected with the ligament rupture. In the present material no study was made of a possible proprioceptive defect at

follow-up, but like Freeman et al. (1965) we could find no association between unstable ankle joints and F. I.

The incidence of osteoarthritis was low after our follow-up period, only five patients having this affliction. Osteoarthritis occurred in an age group considerably more advanced than that of the total material and bore no correlation to unstable ankle joints.

There are no previous reports of systematic measurement of plantar strength in patients with injuries of the lateral ligaments of the ankle, but measurements of strength have previously been used as parameters of sequelae to injuries of the lower limbs (Damholt & Zdrakovic 1972 and 1974, Gillies & Chalmers 1970).

A difference of 15 per cent is usually reported as the limit of physiological variation between symmetrical muscle groups (Heebøl-Nielsen 1964). In our material the group "uninjured leg" was an average of 6.3 per cent stronger than the group "injured leg". The reduction of strength in patients with F. I. was not significantly greater than in symptom-free patients. Moreover, patients with unstable ankle joints did not show a significantly greater reduction of strength than did patients with stable ankle joints.

Injuries to the lateral ligaments entail only a slight reduction of strength in the ankle assessed by plantar flexion strength, and F. I. or mechanical instability cannot be ascribed to a reduction of plantar flexion strength.

The pathogenesis of F. I. still seems to be unelucidated, and mechanical stability does not appear to afford any guarantee against the occurrence of F. I.

## CONCLUSION

1. Out of 144 patients with injury to the lateral ligaments of the ankle 19.4 per cent still exhibited instability after conservative treatment and a mean follow-up period of 4.2 years.
2. There was no correlation between radiological instability at follow-up and residual symptoms.

3. Plantar flexion strength in the group of injured legs was significantly less than in the group of uninjured legs, but the mean difference in strength was small.
4. There was no statistically significant correlation between residual symptoms and reduced strength or between radiological instability and reduced strength.
5. According to the results of the present study and a previous one (Hansen et al. 1979) and those reported in the literature, we find no reason to change our present principles regarding the routine of the diagnosis and conservative treatment of injuries to the lateral ligaments of the ankle.

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