Synovitis in chronically unstable ankles

Eilif Larsen[1] and Antonio Aru[2]

Histopathologic synovial changes were studied prospectively in 69 patients with 75 ankles operated on for radiographically verified chronic lateral instability. The median duration of instability was 2 (0.5–20) years. Before the operation, 73 ankles were painful. After a peroneus brevis tenodesis, all but 1 patient felt improved. Twenty-eight of 75 ankles had moderate or extreme degrees of synovitis. The degree of ankle instability did not influence the severity of changes. Factors that influenced the degree of synovitis were duration of instability of more than 4 years, degenerative changes – such as old bony avulsions, chondral fibrillations and clefts – and high activity level of the patient.

To improve stability, alleviate pain, and perhaps to prevent the development of arthrosis, we recommend ligamentous repair in painful active patients with long-standing lateral instability of the ankle with degenerative changes in or around the ankle joint.

To what extent chronic instability of the ankle disposes to degenerative arthrosis is a disputed matter (Bonnin 1944, Harrington 1979, Rubin and Witten 1964). Do osteophytes, ligamentous bony avulsions and/or dissecting osteochondral lesions induce synovial changes with the risk of secondary degenerative arthrosis?

We have studied the possible influence of the instability, accompanying lesions, and other factors on the occurrence of synovial changes in patients with chronic lateral ankle instability.

Material and methods

The prospective material comprised 75 ankles operated on for lateral instability in 69 patients, 33 women and 36 men, with a median age of 26 (16–61) years. The duration of instability was 2 (0.5–20) years. None of the patients had had serious sprains within the last 3 weeks before the planned operation. Forty-seven of 62 patients had had to curtail their sports activities. The circumstances of the last trauma were soccer in 23 ankles, handball in 9, badminton in 5, jumping and running in 8, other sports in 12, and other causes in 18 ankles.

All the patients complained of repeated giving way of the ankle. In all of them, anterior drawer sign and/or talar tilting could be demonstrated manually. Pain was present in 73 ankles, mostly after exercise, and 51 ankles had permanent or intermittent swelling in the anterior and outer aspects.

Before the operation, all the patients were examined for talar tilting and anterorotational displacement of both ankle joints using standardized radiographic provocation methods (Lindstrand and Mortensson 1977, Larsen 1986). The apparatuses secured the ankle joint in the position of 10° of plantar flexion and 25° of inward rotation to give a free ankle mortise in the anteroposterior plane and concentric arches of the tibial and talar joint surfaces in the side projection. Articular and periarticular changes were recorded. The following values were considered pathologic and warranting operation: A talar tilt of 6° or more (Cox and Hewes 1979) and/or a displacement index of 93 or more (Lindstrand and Mortensson 1977) and/or an anterorotational displacement of 3 mm or more (Jason and Henderson 1973, Johanssen 1978, Larsen 1976). The median values in 31 opposite nondistorted ankles were

Copenhagen University, Departments of Orthopedics[1] and Pathology[2], Gentofte Hospital, Copenhagen, Denmark

Correspondence: Dr. Eilif Larsen, Lyngvigvej 14, DK-2720 Vanløse, Denmark

a talar tilt of 3° (0– 5°), an index of 27 (0–86), and an anterorotational displacement of 1 (0–2) mm. Major instability was arbitrarily fixed to a talar tilt more than 10°, an index above 150, and an anterorotational displacement more than 5 mm.

All the patients were operated on with a peroneus brevis tenodesis (Gianella and Huggler 1976, Larsen 1988). During the operation the ankle joint was exposed through a skin incision behind and below the lateral malleolus. The joint was visualized except for the articular facets between the medial malleolus and the talus. The state of the cartilage and any periarticular changes were recorded. Osteochondral lesions were removed and the base of the defect curretted. Synovial biopsies were obtained from the anterior joint, away from the injured ligaments. Synovectomy was never performed.

Pathology

The macroscopic changes were evaluated by the first author and were not reported to the pathologist. The degree of macroscopic synovitis was classified as follows: 1) absent, all the synovial membrane normal white, no excess synovial fluid; 2) slight, some localized redness and/or increased amount of synovial fluid (1–2 mL); 3) moderate, diffuse redness and aspiration of more than 1 mL of synovial fluid; and 4) extreme, diffuse major redness of the synovial membrane with edema and thickening of the synovial membrane, and with an increased amount of synovial fluid. All the biopsies were studied blindly by the second author. The specimens were stained in hematoxylin and eosin. The following histopathologic findings were recorded: 1) presence of inflammatory cells (neutrophil granulocytes, lymphocytes, and plasma cells); 2) fibrosis or scar tissue; 3) hypertrophy and/or hyperplasia of the synovial lining cells, with the presence of villous formation on the surface; 4) iron and fibrin deposits. These findings were evaluated on a semiquantitative scale.

Finally, a general evaluation of the inflammatory state was made (Figure 1): normal; slight changes (few cells and/or a very thin layer of fibrotic tissue), moderate changes (some inflammatory cells and/or a thick layer of fibrotic tissue or scar tissue), extreme changes (large amount of cells and/or fibrosis, fibrin and eventually iron deposits).

For statistical calculations the degrees of microscopic synovitis were used. The changes were divided into two groups including normal and slight changes in one and moderate and extreme in the other group. A significance level of $P < 0.05$ was used.

Results

Microscopic (and macroscopic) synovitis was absent in 13 (23) ankles, slight in 34 (37), moderate in 25 (10), and extreme in 3 (5) ankles, (Spearman's correlation test, RHO = 0.58, $P = 0.0001$).

The synovitis in men did not differ from the findings in women. Neither did the age of the patients influence the degree of synovitis.

The duration of instability affected the degree of synovitis. Thus, 18 of 29 ankles with instability of more than 4 years duration had moderate or extreme degrees of synovitis compared with the rest of the material, where 10 of 57 ankles had synovitis (chi-square test, $P = 0.001$).

Major or minor ankle instability did not correlate with the degrees of synovitis. Accompanying periarticular and/or intraarticular degenerative changes correlated with the degrees of synovitis (Table 1). More severe degrees of synovitis were found in the ankles with degenerative changes (chi-square test, $P = 0.01$). However, osteochondral lesions of the talus in 9 of 20 ankles did not affect the degree of synovitis.

Twenty-six of 57 ankles in patients who had sustained sports injuries had moderate or extreme synovitis in contrast to 2 of 18 patients without a sports injury. Clinical symptoms such as pain or swelling were without positive correlation with the synovial changes. However, 3 patients with extreme degrees of synovitis included a 22-year-old active male volleyball player, a 22-year-old man active in motocross, and a 18-year-old obese sedentary girl. All 3 patients had minor bony avulsions at the sites of the origin of one or more ligaments, 2 had osteochondral lesions of the talus, and 2 had calcifications at the capsular insertion on the talus.

At the follow-up, median 2 (1.5–3) years after surgery, 65 ankles were painless, in nine ankles some minor pain after sports activity persisted, and 1 patient had given up sports because of pain and loss of interest. Except for the last-mentioned patient, who had had moderate synovitis, all the patients were pleased with

Table 1. Periarticular or intraarticular degenerative changes correlated with the degrees of microscopic synovitis

Degenerative changes	Synovitis				
	Absent	Slight	Moderate	Extreme	Total
Present	10	25	25	3	63
Absent	3	9	0	0	12
Total	13	34	25	3	75

Table 2. Data for 69 patients operated on for chronic lateral instability

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	1	19	2	49	1	1	3	1	6.5	6.5	91	76	2.5	3	3	2	2	1	2	4	2	14	38
2	2	45	2	32	3	2	3	1	5.5	8	29	44	0.5	2	2	2	2	2	1	4	2	3	34
3	2	18/18	3	120/120	1/1	2/2	3/3	1/1	10	9.5	117	100	4	3	1/1	1/1	1/2	1/2	1	3/4	2	*16	29/25
4	2	23	2	26	1	2	2	2	3	18	233	266	1	5	2	2	2	1	1	4	2	13	30
5	2	20	2	20	1	1	3	2	3.5	7	81	31	3	3	2	2	1	1	1	4	2	12	29
6	2	21	1	50	1	1	3	1	6	2	244	125	8.5	4.5	1	2	2	2	1	4	2	16	28
7	1	24	1	72	1	1	2	2	11	6	124	37	4	1	2	3	2	1	2	4	2	12	28
8	2	29	1	22	3	2	2	1	7	9.5	164	167	4	7	2	2	2	1	1	4	2	3	29/16
9	2	23	2	72	1	1	3	1	1	3	36	379	2	10.5	2	2	2	2	2	4	2	16	29
10	1	35	1	22	1	2	3	1	4.5	3.5	50	27	8.25	0.5	1	1	2	1	2	4	2	14	24
11	1	24	2	25	1	1	3	1	3	14	31	78	1.5	2	2	2	2	1	2	4	2	12	32
12	1	32	2	14	1	1	2	2	4	12	50	63	0.5	0.5	3	3	2	1	2	4	2	12	24
13	1	19	2	12	1	1	3	2	0.5	6.5	15	174	0	1.25	3	3	2	1	2	4	2	12	25
14	2	20	2	12	2	2	3	1	0.5	4.5	100	150	3	5	1	1	2	2	1	4	2	20	28
15	2	17	2	16	2	1	2	2	5.5	9	48	81	1.5	2	1	2	2	2	2	4	2	16	24
16	2	52	2	108	2	2	3	1	0.5	6	21	73	1	3	1	2	2	1	2	4	2	40	24
17	1	28	1	99	1	1	2	1	7	4	93	43	2.5	0.5	2	2	1	1	2	4	2	13	23
18	1	19	1	10	1	1	2	1	7	0.5	66	25	3.5	0.25	1	3	2	1	2	4	2	14	23
19	2	16	1	14	1	2	2	1	7	5	145	32	4.5	1	1	2	2	1	2	3	2	28	23
20	1	17	1	18	1	2	2	2	7	4	54	26	3	2	1	1	2	2	2	4	2	13	23
21	1	36	2	72	2	1	3	2	3	6	12	44	2	3	3	3	2	1	2	4	2	16	22
22	2	30/29	3	108/120	1/1	1/1	3/3	1/1	19	11.5	181	224	4.5	4	1/2	1/3	2/2	1/1	2	4/4	2	*14	18/21
23	1	27	2	66	1	1	2	2	4	11	114	121	2	2.5	1	2	2	1	1	4	2	14	23
24	1	28	1	7	1	1	2	1	10.5	4	69	63	2.75	0.5	2	3	2	1	2	4	2	12	23
25	1	31	1	120	1	1	2	1	6.5	3	186	22	2.5	0.5	2	2	2	1	2	4	2	10	23
26	2	24	1	58	1	1	2	1	6.5	2	67	17	3.25	2.25	2	3	2	1	2	4	2	16	21
27	1	23	2	19	2	1	2	1	0.5	8	50	64	0.5	2.25	2	2	2	1	2	4	2	12	31
28	1	29	1	12	1	1	3	1	7	3.75	250	47	7.25	1.25	4	2	1	1	2	4	2	14	24
29	2	39	1	72	1	1	2	1	11.5	11.5	89	73	0.5	2.25	3	3	1	1	2	4	2	16	26
30	1	26/26	3	17/9	2/2	1/1	2/2	1/1	12	10.25	75	50	4	1.25	3/2	3/2	2/2	1/1	2	4/4	2	16/12	21/29
31	1	26	2	96	1	1	3	1	3.5	7.25	138	13	3.25	0.5	2	3	2	1	2	4	2	12	26
32	1	41	2	140	1	2	2	2	7.25	7.25	88	51	1.25	4.25	4	2	1	1	2	4	2	13	25
33	1	24	2	60	1	1	2	2	0.5	7	36	50	0.25	2.25	1	1	1	1	2	4	2	12	26
34	1	33	1	144	2	1	3	1	5	15	13	13	0.5	0.75	4	3	1	1	2	4	2	14	25
35	2	24	1	48	3	2	2	1	17.5	10	125	67	5	4.75	2	3	1	1	1	4	2	3	25
36	1	27	1	46	1	2	2	2	14.25	5	88	37	2.25	0.25	2	2	2	1	2	4	2	16	25
37	1	23/24	3	48/56	1/1	1/1	2/2	2/2	10	6.5	164	33	6	2	1/2	2/2	2	1	1	4/4	2	16/12	25/18
38	1	23	1	9	1	1	2	1	7	2.75	107	14	2.75	0.75	1	1	1	1	2	4	2	12	26
39	1	44	1	204	1	1	2	2	7.25	6.75	81	59	3	0.5	1	2	2	1	2	4	2	14	24
40	1	22	1	35	2	1	2	2	6.25	0	86	71	2	0.25	2	3	2	1	2	4	2	12	24
41	1	23	1	48	2	1	3	1	8	2	42	0	3.25	0.5	2	2	2	1	2	4	2	12	24
42	1	49	2	240	3	2	2	1	5.5	4	33	20	2.5	1.75	2	2	1	1	2	4	2	3	24
43	2	32	1	25	2	1	2	1	11.25	6	100	40	5	1	1	1	2	1	1	4	2	12	23
44	2	21	2	13	2	1	2	1	1.5	7	38	136	1.75	3	1	2	1	1	2	4	2	14	25
45	2	21	2	48	1	1	2	1	4	6.75	58	156	1	4	1	2	2	2	2	4	2	14	22
46	2	53	2	162	1	2	2	1	7	8	129	106	3	5.5	3	3	1	1	2	3	2	2	21
47	2	19	2	54	1	1	2	1	10.25	8	112	148	6	6.5	2	1	2	1	1	3	2	10	18
48	2	45	2	7	1	2	2	1	2	3	48	81	0.5	3.5	2	1	2	1	1	4	2	52	21
49	1	20	1	72	1	1	2	1	6	5	92	23	4	0.5	2	2	2	1	2	4	2	18	21
50	1	31/32	3	12/22	1/1	1/1	2/2	1/1	9	1	74	132	3	4	4/2	3/2	1/2	1/2	2	3/4	1/2	12/13	25/18
51	1	41	1	48	1	1	2	1	7.25	4	105	13	2	1	2	3	1	1	2	3	1	15	21
52	2	24	1	144	3	2	2	1	3.75	1	81	32	4	1	2	2	1	1	2	4	2	3	28
53	2	38	1	13	3	2	2	1	6.5	3	23	23	1.5	0.5	1	1	2	2	2	2	2	3	22
54	1	22/22	3	108/90	1/1	1/1	2/2	1/1	12	10	118	108	4.75	4.5	4/3	4/3	2	1	2	4/4	2	14/12	22/18
55	2	18	2	15	1	1	2	1	3.25	6	17	42	1.75	0.5	2	4	1	1	2	3	2	16	22
56	1	22	1	15	2	1	2	1	2	1.25	97	76	3.5	2	2	4	1	1	2	3	2	12	22
57	2	19	2	11	2	1	2	1	5	9	29	22	0.5	0.5	2	2	1	1	2	4	2	12	22
58	2	61	2	184	3	1	2	1	11.75	13	94	203	4	8.5	2	3	2	1	2	4	2	3	21
59	2	17	2	22	1	1	2	1	4.25	13	181	231	3	7	1	1	2	1	1	4	2	16	21
60	2	18	2	10	1	1	2	1	3	6.25	21	83	0.25	1.75	2	3	2	1	2	4	2	14	22
61	2	17	1	14	2	1	4	2	9.25	4.5	145	48	5.5	2	2	3	2	1	2	4	2	12	20
62	1	22	2	16	1	1	4	1	6	8	79	92	1	2.25	3	3	1	1	2	4	2	12	20
63	1	26	2	25	1	1	2	1	2	8	14	71	0	1	2	2	2	1	2	4	2	16	20
64	2	16	1	28	1	1	2	2	9.5	8	156	145	9	9	2	2	2	1	1	4	2	20	18
65	1	21	1	48	1	1	2	2	6.5	0.5	61	30	3	1	3	3	2	1	2	4	2	14	19
66	2	20	2	19	1	1	2	2	4	4.5	50	150	1	5	2	2	2	2	1	4	2	21	18
67	1	19	2	20	2	1	2	1	1	7.25	7	20	0.25	0.75	1	3	2	1	2	4	2	12	19
68	2	29	2	9	1	1	2	1	4.5	6.5	29	91	1	3	2	2	2	2	1	4	2	20	18
69	2	16	1	19	1	1	2	1	9	4	158	33	5	3	1	3	2	1	1	3	2	14	18

Key to the data in Table 2. (If both ankles were operated on, the data are given as right ankle/left ankle).

1. Case number.
2. Sex: 1 male, 2 female.
3. Age in years at operation.
4. Operated on ankle: 1 right, 2 left, 3 both.
5. Duration of instability in months.
6. Stopped sports activity before operation: 1 yes, 2 no, 3 never sported.
7. Circumstances of the last trauma: 1 sports, 2 other.
8. Pain before operation: 4 none, 3 slight, 2 moderate, 1 extreme.
9. Swelling before operation: 1 yes, 2 none.
10. Talar tilt in degrees, right ankle before operation.
11. Talar tilt in degrees, left ankle before operation.
12. Anterior talar displacement index, right ankle before operation.
13. Anterior talar displacement index, left ankle before operation.
14. Anterior drawer sign, right ankle before operation.
15. Anterior drawer sign, left ankle before operation.
16. Macroscopic synovitis: 1 normal, 2 slight, 3 moderate, 4 extreme.
17. Microscopic synovitis: 1 normal, 2 slight, 3 moderate, 4 extreme.
18. Osteochondral lesions: 1 yes, 2 none.
19. Bony avulsions and/or projections and/or calcifications: 1 yes, 2 none.
20. Hypermobile joints: 1 yes, 2 no.
21. Pain at follow-up: 4 none, 3 slight, 2 moderate, 1 extreme.
22. Swelling at follow-up: 1 yes, 2 none.
23. Resumed sport(s) after operation: no. of weeks, 2 stopped, 3 never sport, * mean weeks after last operation.
24. Follow-up time in months.

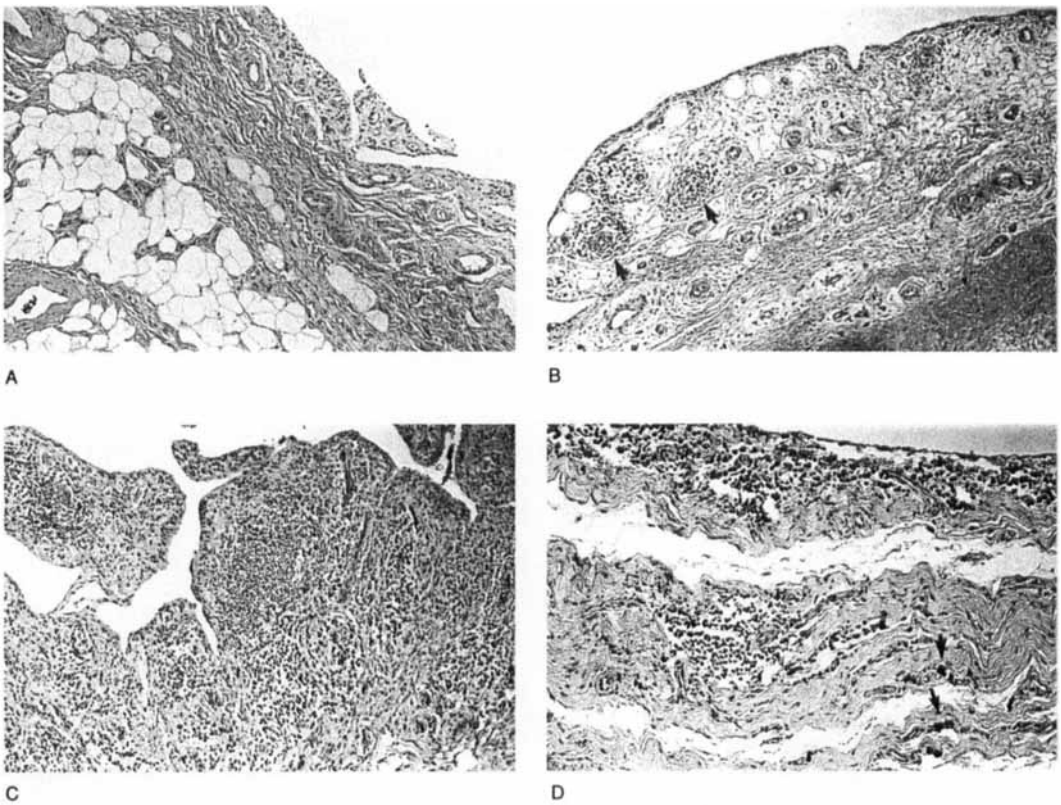

Figure 1. Variable degrees of histopathologic changes in the synovial membrane.
A. Slight changes with few inflammatory cells and a thin layer of fibrosis, x125.
B. Moderate changes with villous proliferation on the surface, covered with hypertrophic synovial lining cells, proliferation of vessels, some inflammatory cells (arrows), and fibrosis, x200.
C. Severe changes with a villous surface, hypertrophy and hyperplasia of synovial lining cells with multinucleated cells, large number of inflammatory cells – mostly lymphocytes and plasma cells – and fibrosis, x125.
D. Large amounts of iron deposits (arrows), as seen in posttraumatic hemarthrosis, x200.

the stabilizing operation, and only 2 patients, who had had moderate synovitis, had a swelling tendency at the outer aspect of the ankle.

Discussion

Despite the relatively good correlation between the macroscopic and microscopic findings in our patients, there were discrepancies that may be explained by the fact that the biopsies were always taken from the anterior part of the ankle joint, whereas the macroscopic changes were more generalized in the entire visible part of the joint. The site of the biopsy was chosen in an attempt not to overestimate influence of adjacent ligamentous or capsular scar formation. In patients with rheumatoid arthritis, synovial biopsies have been shown to correlate well with the activity of the disease including possible destruction of the cartilage (Jason and Henderson 1973, Yates and Scott 1975). Such a correlation has not been reported in patients with chronic ankle instability.

In 44 chronically unstable ankles, Broström (1966) described the periarticular tissue on the lateral aspect of the ankle as greatly thickened and fibrotic, but the histologic examination of the ligaments was in most cases without degenerative changes except for fibrosis. Harrington (1979) examined 36 patients with chronic ankle instability that had lasted for at least 10 years. Five of the patients suffered clinically and radiographically from arthrosis, and 24 ankles had synovial thickening at the preoperative examination. Arthroscopy was performed in 12 ankles, and different degrees of destruction of the cartilage were seen in all the cases, mostly on the medial side of the ankle. After ligament reconstruction, the majority of patients improved both clinically and radiographically. These studies accord with the suggestion that the synovial pathology in patients with unstable ankles may progress, but also suggest that intraarticular biopsies after operation may be needed to clarify the problem.

The duration, but not the degree of instability, influenced the degree of synovial changes. We had expected a correlation between increased talocrural mobility, implying daily increased stress to the ankle joint, and the degree of synovial changes. This was not confirmed, indicating that in chronic ankle instability the synovitis is associated with the degenerative joint pathology.

We conclude that most of the degenerative changes are caused by trauma and that ligamentous instability increases the risk of contracting synovitis with time. Clinically, it seemed that stabilizing the ankle reduced the synovitis problem; but a final conclusion could only have been made if the patients had had a biopsy after treatment. We did not find this ethically justifiable. Still, our results shows that physically active patients with degenerative periarticular and/or intraarticular changes and patients with a history of instability for more than 4 years are most disposed to serious synovitis. If no improvement is achieved by coordination exercises and/or external support, it seems reasonable to consider a ligamentous reconstruction.

References

Bonnin J G. The hypermobile ankle. Proc Roy Soc Med 1944;37:282–6.

Broström L. Sprained ankles. VI. Surgical treatment of "chronic" ligament ruptures. Acta Chir Scand 1966; 132(5):551–65.

Cox J S, Hewes T F. "Normal" talar tilt angle. Clin Orthop 1979;(140):37–41.

Gianella F V, Huggler A H. Muskelaktivierte dynamische Bandplastik bei chronischer fibularer Seitenbandinsuffizienz. Z Orthop 1976;114(5):805–12.

Harrington K D. Degenerative arthritis of the ankle secondary to long standing lateral ligament instability. J Bone Joint Surg (Am) 1979;61(3):354–61.

Jason M I V, Henderson D R F. Arthroscopy in the diagnosis of inflammatory joint disease. Rheumatol and Rehab 1973;12:195–7.

Johannsen A. Radiological diagnosis of lateral ligament lesion of the ankle. A comparison between talar tilt and anterior drawer sign. Acta Orthop Scand 1978;49(3):295–301.

Larsen E. The unstable ankle joint. Clinical and radiological assessment with particular attention to the significance of the "drawer symptom". Ugeskr Laeger 1976;138(33): 1989–93.

Larsen E. Experimental instability of the ankle. A radiographic investigation. Clin Orthop 1986;(204):193–200.

Larsen E. Tendon transfer for lateral ankle and subtalar joint instability. Acta Orthop Scand 1988;59(2):168–72.

Lindstrand A, Mortensson W. Anterior instability in the ankle joint following acute lateral sprain. Acta Radiol (Diagn) (Stockh) 1977;18(5):529–39.

Rubin G, Witten M. The unstable ankle. Bull Hosp Joint Dis 1964;25:179–90.

Yates D B, Scott J T. Rheumatoid synovitis and joint disease. Relationship between arthroscopic and histological changes. Ann Rheum Dis 1975;34(1):1–6.

Acknowledgement

Supported by a grant from the Else and Svend Madsen Foundation.