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Early mobilization versus immobilization after ankle ligament stabilization

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Functional outcome, stability at radiographic investigation and ankle joint torque after anatomical reconstruction of the lateral ankle ligaments were evaluated in patients with early postoperative mobilization versus those with cast immobilization. Thirty patients with chronic lateral ligament instability of the ankle underwent anatomical reconstruction of the ligaments. Postoperatively the patients were randomly allocated to two groups: Group A (n=15) were immobilized in a below-knee plaster for 6 weeks and Group B (n=15) underwent early controlled range of motion training using an Air-Cast® ankle brace. The funtional results were evaluated using a scoring scale and objective results using standardized stress radiographs. Also eccentric and concentric muscle torque at 60°/s was measured in plantar flexion and dorsiflexion, respectively. The functional results were satisfactory in 12/15 ankles in Group A and 14/15 in Group B (n.s.). All the patients with satisfactory results regained normal range of motion. Patients with unsatisfactory results had either residual pain or recurrent instability. In Group B, the strength measurements revealed significantly higher peak torque values after three months in plantar flexion at 60°/s. Six months postoperatively, the torque values did not differ significantly between the groups. Also, there was no group difference in the laxity of the ankle joint, including both anterior talar translation test and talar tilt test, at the two-year follow-up. One patient had a superficial wound infection. We conclude that after the reconstruction of chronic lateral ligament instability of the ankle the functional and stability results were equally good with early postoperative mobilization and 6-week immobilization. However, using early mobilization plantar flexion strength was regained earlier than with cast immonbilization, without any risk of short- or medium-term complications, such as increased ankle laxity. We recommend early mobilization after anatomical reconstruction of the lateral ankle ligaments.

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Ligament injuries to the ankle joint have repeatedly been reported to be the most frequent sports injury (1–3). The lateral ligaments, i.e. the anterior talofibular and/or the calcaneo-fibular ligaments, are involved in the majority of cases (4). Recurrent symptoms, such as ankle pain and chronic anterolateral instability, occur in approximately 10–20% of all patients who have sustained ankle ligament injuries. Chronic lateral instability of the ankle joint ligaments can lead to permanent functional impairment and reduced level of activity (5). If a well-controlled rehabilitation programme does not produce satisfactory functional results, the recommended treatment is reconstruction of the damaged ligaments to increase the mechanical and functional stability. Surgical intervention should only be considered if the rehabilitation programme is not successful (5).

Today, the most commonly used surgical procedure is anatomical reconstruction (6–11). The results after this operation have been excellent or good in 80–90% of patients (4, 5, 8, 9, 11–14). In most studies, the recommended postoperative treatment has been a below-knee plaster cast for 6 weeks (5, 8, 9). The need for this lengthy immobilization has, however, been questioned. A recent study by Karlsson et al. (15) showed that early mobilization, combined with early range of motion (ROM) training, is able to shorten the time period away from sports, as well as the sick-

leave period, without obvious negative consequences for the athlete (15). It is, however, not known how the strength of the lower limb muscles recovers after anatomical reconstruction of the lateral ligaments, followed by early mobilization.

The purpose of the present study was to evaluate the functional outcome, radiographic stability and muscle torque after anatomical reconstruction of the lateral ankle ligaments in two groups: the first group had early postoperative mobilization and controlled ROM training, while the other group was treated postoperatively with a conventional plaster cast immobilization for 6 weeks. Our hypothesis was that in both groups the functional results would be similar in terms of mobility, stability and sports activities. Furthermore, we hypothesized that patients treated with early mobilization would regain normal ankle torque more rapidly than those with prolonged immobilization.

Patients and methods

Demographics

Between 1993 and 1995, 30 patients with chronic lateral ligament instability of the ankle underwent anatomical reconstruction of the lateral ligaments. There were 12 female and 18 male patients and the median age was 27 (18–36) years. All the patients had signs of functional and mechanical instability of the ankle joint and none was treated for isolated functional instability alone. None had radiological signs of degenerative changes in the talo-crural joint. Before deciding upon surgical intervention, all the patients had undergone a well-supervised rehabilitation programme, but without regaining functional stability.

Study design

The study was prospective and randomized. Postoperatively, the patients were allocated to one of two treatment groups. The patients in Group A ($n=15$) were immobilized in a below-knee plaster cast for 6 weeks while patients in Group B ($n=15$) were treated with early mobilization using an Air-Cast® ankle brace, after an initial period of 7–10 days in plaster.

Surgical technique

One experienced surgeon (J.K.) performed all the reconstructions. A standardized technique was used. Both the anterior talo-fibular and the calcaneo-fibular ligaments were reconstructed in all patients. The ligaments were divided approximately 3–5 mm from the anterior-inferior fibular border, shortened appropriately and reinserted into the fibula using bone sutures that were tightened with the foot in the neutral position (9).

Rehabilitation

After the plaster was removed, the patients in Group B received the ankle brace and were allowed to move the ankle freely in plantar flexion and dorsal extension, but they were advised to restrict pronation-supination during the first 4 weeks. Controlled range of motion (ROM) training was conducted in weeks 3–4 and was combined with co-ordination and strength exercises in plantar flexion and dorsiflexion in weeks 5–6. The patients were instructed to train ROM for 15 min three times a day during this period. The brace was worn day and night until 6 weeks postoperatively, the time when patients in Group A had the cast removed.

During weeks 7–12, the patients in both groups underwent the same rehabilitation protocol (5), which consisted of foot exercises and closed chain training with weight-bearing. This included training different steps, walking with a rubber cord, jogging on the spot or on a soft mattress. After 6 weeks, strength training with rubber cords and weight boots was started. Co-ordination training, which included standing on one leg with the eyes closed and using a tilt board, walking along zig-zag lines and turning 90–180°, was performed after the 6th week. Increased strength training was started after the 10th week, e.g. toe lifts with shoulder weights. The athletes were allowed to return to sports activities when they had regained full functional stability and ROM (5).

Follow-up evaluation

All the patients were followed up by an observer who did not participate in the treatment and who was unaware of the group to which the patients belonged. The clinical follow-up period was a minimum of two years and consisted of subjective assessments using a scoring scale and objective assessments of ROM (16).

Torque measurements

The ankle torque measurements were performed after 3 and 6 months. We used a Kinetic Communicator (Kin-Com®) dynamometer (Chattanooga Group Inc, TN, USA) to measure the peak muscle torque during this isokinetic concentric and eccentric plantar flexion and dorsiflexion. The contraction velocity was 60°/s in every test.

Radiological evaluation

The mechanical stability of the ankle was evaluated with standardized stress radiographs, using anterior talar translation (ATT) and talar tilt (TT) tests (17–20). Mechanical instability was defined as an ATT of 10 mm or more and/or a TT of 9° or more, or a differ-

ence in ATT of 3 mm and/or TT of 3° or more between the affected and non-affected (symptom-free) ankles. These measurements were performed preoperatively and at the two-year follow-up.

Preoperative score values

All the functional assessments were done with a scoring scale. This scale is specially designed to evaluate functional impairment correlated with ankle joint ligament injury. The scale is composed of eight different items, which include a subjective feeling of stability/instability, pain, swelling, stiffness, stair climbing, running and ankle support, as well as assessment of work, sports activities and activities of daily living (16).

Statistics

Median (range) values are presented. The Mann-Whitney-U non-parametric two-tailed test and the chi^2 test were used to compare the continuous and categorical variables respectively. A P-value of <0.05 was considered statistically significant.

Results

The median preoperative score was 45 (34–72) in Group A and 42 (32–75) in Group B (n.s.). Before the injury, all the patients participated in sports activities. The preoperative median Tegner (21) activity level was 7 (4–10) in Group A and 7 (4 9) in Group B (n.s.).

The functional results were excellent or good in 12/15 patients in Group A and fair or poor in 3/15. In Group B, the functional results were excellent or good in 14/15 and poor in 1/15 (n.s.). All the patients with satisfactory results had regained normal range of motion. Patients with unsatisfactory results had residual pain ($n=2$), residual pain and instability ($n=1$) or recurrent instability alone ($n=1$). One patient in Group B had a superficial wound infection. This complication had no effect on the final result. At the final follow-up, 4/15 patients in Group A and 6/15 in Group B had a sensory disturbance on the lateral aspect of the foot (n.s.). This sensory disturbance had no correlation with other objective parameters.

There was no significant difference in the range of motion between the groups, either preoperatively or at the final follow-up. The median period for sick leave was 7 (0–12) weeks in Group A and 6 (0–10) weeks in Group B (n.s.). The median time period for a return to sports activity was 13 (10–17) weeks in Group A and 10 (7–12) weeks in Group B ($P<0.05$).

The measurements of mechanical stability showed a significant ($P<0.01$) decrease in ATT in both groups at the two-year follow-up, compared with the preoperative values. A significant decrease ($P<0.01$) in TT was also found in both groups, when the corresponding values were compared (Table 1). None of the ATT and TT values differed significantly between the two groups.

At the two-year follow-up, the median Tegner activity level was 6 (2–9) in Group A and 7 (4–10) in Group B (n.s.). Two patients in Group A and one patient in Group B had abandoned sports activities due to ankle problems.

Table 1. Mechanical stability

	ATT (mm)		TT (°)	
	Pre-op	Follow-up*	Pre-op	Follow-up*
Group A	11 (7–16)	6.5 (3–8)	10 (4–17)	4 (0–6)
Group B	10.5 (7–15)	5 (3–7)	9 (4–15)	4 (0–5)

* The radiological follow-up was performed two years after the ligament reconstruction.
The ATT and TT values did not differ significantly between the groups. The ATT and TT values decreased significantly in both groups following surgery.

Table 2. Muscle strength: plantar flexion, concentric peak torque, 60°/s, Nm

	Pre-op	3 months	6 months
Group A	60 (21–125)	57 (38–99)	64 (34–72)
Group B	62 (23–146)	74 (34–102)	74 (39–124)
	(n.s.)	($P<0.05$)	(n.s.)

The difference between the groups at three months was statistically significant.

Table 3. Muscle strength: plantar flexion, eccentric peak torque, 60°/s, Nm

	Pre-op	3 months	6 months
Group A	76 (46–134)	67 (38–156)	101 (47–135)
Group B	70 (25–146)	100 (44–121)	97 (55–155)
	(n.s.)	($P<0.05$)	(n.s.)

The difference between the groups at three months was statistically significant.

Table 4. Muscle strength: dorsiflexion, concentric peak torque, 60°/s, Nm

	Pre-op	3 months	6 months
Group A	29 (16–47)	30 (17–40)	27 (9–44)
Group B	30 (11–51)	28 (13–42)	27 (13–46)
	(n.s.)	(n.s.)	(n.s.)

There was no difference between the groups.

Table 5. Muscle strength: dorsiflexion, eccentric peak torque, 60°/s, Nm

	Pre-op	3 months	6 months
Group A	47 (20–83)	45 (19–67)	47 (18–74)
Group B	51 (19-85)	48 (17–77)	48 (25–79)
	(n.s.)	(n.s.)	(n.s.)

There was no difference between the groups.

The peak torque during concentric and eccentric plantar flexion of the ankle joint at 60°/s was significantly higher after 3 months in patients who followed the early rehabilitation programme (Group B) (Table 2, 3). No other significant differences in torque values were found (Table 4, 5). Six months postoperatively, the torque values did not differ significantly between the groups.

Discussion

Few studies describe the postoperative management after ankle ligament surgery. Most authors recommend 6 weeks of immobilization after surgery (4, 6, 8, 9, 15, 22). Weight-bearing is most frequently allowed after 2–3 weeks. We have found only one study that compares immobilization of 6 weeks with early mobilization after anatomical reconstruction of the lateral ankle ligaments (15). In that study, a different ankle brace was used as compared with the present study. The authors found that early range of motion was beneficial, as it enabled an earlier return to sports activities, shorter sick leave and had no negative effect on mechanical stability of the ankle. We have not been able to find any previous studies focusing on assessments of muscle strength after ankle ligament reconstruction and comparing immobilization to early mobilization.

The present study revealed that the functional results were satisfactory in most patients in both treatment groups. All but three (90%) patients were able to resume sports activities at a pre-injury level. Although a somewhat larger number of patients had satisfactory results in the 'early mobilization group', i.e. 14/15 as compared with 12/15, the difference was not statistically significant. Of the four patients with unsatisfactory functional results, three were treated with immobilization and one underwent early mobilization. One patient in each group complained of recurrent instability. This indicates that the early ankle mobilization had no negative effects on the final result in terms of ankle ligamentous stability. All three patients who complained of residual pain had been treated with immobilization for 6 weeks. Another important finding was that patients who underwent early mobilization were able to resume sports activities earlier and they also regained muscle strength in plantar flexion more rapidly, without signs of short- or medium-term instability. Early mobilization therefore appears to be warranted in these patients. It is possible to speculate that longer immobilization has more of a negative effect on the slow-twitch type I muscle fibres than the type II fibres. This could lead to an increase in relative atrophy of the fast-twitch type II muscle fibres. The fast-twitch fibres also recover more rapidly than the slow-twitch ones.

A strength of this study is that the study compares two rehabilitation programmes in a well-defined population of patients with chronic ankle ligament insufficiency and that the patients were followed up in a prospective manner. The follow-up examinations were performed by independent observers after 6 months (strength measurements) and 2 years (clinical and radiographic assessments), and a register of complications was updated prospectively.

Ligament injuries are frequent in athletes (4, 22–27). Adequate rehabilitation is therefore important, not least in patients in whom surgical reconstruction of the damaged ligaments is called for. In a previous study, we have shown that the time periods for a return to sports activities and sick leave were reduced by early mobilization. In the present study (smaller number of patients), no significant difference was found in terms of sick leave. However, we confirmed our previous findings of an earlier return to sports activities. This is in line with previous studies of early controlled range of motion training in the treatment of acute ligament injuries of the ankle (4, 5, 28). Zwipp et al. (29) compared early mobilization after suturing acute ruptures of the lateral ankle ligaments with 6 weeks of immobilization. They found superior results in terms of ligament healing after early mobilization.

Several previous studies have reported satisfactory results after anatomical reconstructions for chronic lateral ankle ligament insufficiency in terms of functional stability and return to sports activity. The present study confirms the results of these studies and further demonstrates the favourable evolution of the muscle strength after surgery.

We conclude that early mobilization after ankle ligament surgery for chronic ligamentous instability should be preferred to postoperative immobilization.

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