On the surgical treatment of chronic anterolateral ankle instability

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Citation for published version (APA):
Chapter VII

ANATOMICAL RECONSTRUCTION FOR CHRONIC ANTEROLATERAL ANKLE INSTABILITY DOES NOT PREVENT THE DEVELOPMENT OF DEGENERATIVE CHANGES.

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Chronic Ankle Instability. 138-149, 2000

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Abstract

We reviewed 185 patients at 2 to 30 years after anatomical reconstruction for chronic anterolateral ankle instability. Results were analysed for three follow-up groups: 2-10 years (n=106), 10-20 years (n=55) and 20-30 years (n=24). The question was whether functional, clinical and radiological results deteriorated with the passage of time.

Recurrent sprains occurred in 7.5% of patients in the 2-10 years follow-up group, in 17% in the 10-20 years follow-up group and in 12.5% in the 20-30 years follow-up group. After 2-10 years, 5% of patients were reoperated on due to residual complaints. After 10-20 years this percentage was 9% and after 20-30 years 17%. At physical examination, the anterior drawer test was positive in 18% of patients in the 2-10 years follow-up group, 20% of patients in the 10-20 years follow-up group and 17% of patients in the 20-30 years follow-up group. The development of degenerative changes in the ankle joint as seen on standard radiographs were detected in 29% of patients 2-10 years after the operation. After 10 years this percentage increased to 56%. Assessment of ankle joint function using the Karlsson scoring scale revealed a mean (SD) value of 92 (10.3) points after 2-10 years, and 87 (8.2) and 81 (11.9) points after 10-20 and 20-30 years, respectively. The Good score showed that approximately 85% of patients had good or excellent results until 20 years after the operation. After more than 20 years, approximately 70% of patients had good or excellent results. The stress radiographs revealed a decrease of the mean value of talar tilt from 4.5° (2.7) in the 2-10 years follow-up group to 2.7° (3.7) in the 20-30 years follow-up group. The mean value for anterior talar translation increased over time; 2.9 mm (2.2) in the 2-10 years follow-up group to 3.8 mm (2.3) in the 20-30 years follow-up group.

Anatomical reconstruction leads to a high percentage of good and excellent results at short-, mid- and long-term follow-ups. This survey demonstrates that the procedure preserves mechanical stability at a long-term. Anatomical reconstruction, however, does not reduce the risk for the development of degenerative changes of the ankle joint and subsequent reoperations. Despite the fact that ligament laxity is well restored, the development of degenerative changes of the ankle joint caused functional results to deteriorate, 20-30 years after the initial treatment.
Introduction

A sprain of the lateral ankle ligaments is the most common sports-related injury of the lower extremity. Concerning stability non-operative treatment has a success rate of approximately 80-90 percent. For patients who experience persisting instability after non-operative treatment, a wide variety of reconstructive methods have been advocated. Most of these involve tenodesis between the distal fibula on one side and the calcaneus, neck of the talus, and/or base of the fifth metatarsal on the other. Peroneal tenodesis has several disadvantages, including failure to recreate the normal anatomy, extensive surgical exposure, peroneal weakness, persistent pain and stiffness, and failure to return to previous sports activity. In 1966, Broström described a technique, later modified by Gould et al. and Karlsson et al., in which the lateral ankle ligaments are anatomically restored. Broström reported satisfactory results after late anatomic repair of the lateral ankle ligaments in about 85 percent of patients. Other, more recent short- to mid-term follow-up studies report similar percentages of satisfactory results after anatomical reconstruction. The long-term outcome after tenodesis has a tendency to deteriorate over time. To the best of our knowledge, there are no long-term follow-up studies after anatomical reconstruction.

The aim of the present study was to assess the short-, mid- and long-term follow-up results after anatomical reconstruction in order to determine whether functional, clinical and radiological results deteriorated with the passage of time.
Patients and Methods

Five European centres participated in this retrospective study. Twelve different surgeons were involved. Between 1970 and 1995, a total of 206 patients underwent an anatomical reconstruction for chronic anterolateral instability of the ankle. All patients had experienced complaints for at least six months and had undergone rehabilitation with range of motion and proprioceptive training before the surgery. Preoperatively, ligament laxity was assessed by stress radiographic examination in both the frontal plane; talar tilt (TT), and sagittal plane; anterior talar translation (ATT) according to the criteria of Lindstrand and Mortensson. TT was regarded as positive if the tibio-talar angle was more than 10° or when the difference between ankles was more than 6°. ATT was regarded as positive when the anterior displacement of the talus relative to the tibia was more than 4 mm or the difference between the ankles was more than 3 mm. The standard load of 150 Newton was applied, using the Telos® apparatus. The indication to perform an anatomical reconstruction rather than a tenodesis was independent of the type of instability or other patient characteristics.

The following inclusion criteria were employed: 1) age at operation between 16 and 40 years; 2) an uninjured contralateral ankle; 3) no history of previous fracture of the affected ankle; 4) no prior surgery other than an anatomical reconstruction of the affected ankle; 5) no prior surgery of the contralateral ankle; 6) no history of bilateral hyperlaxity; 7) no history of subtalar instability; 8) no generalized neuromuscular disorder.

At follow-up, 2-30 years after the operation, the following demographic data were recorded: age, sex, profession, affected side and the preinjury Tegner activity level. For the long-term follow-up (i.e. 20-30 years) the Tegner activity level was felt to be an inappropriate outcome measure after such a long period and was subsequently not recorded.

The review protocol consisted of the registration of postoperative complications, reoperations and assessment of the Tegner activity level. Functional outcome was assessed using two ankle scores; the Karlsson score and the rating system developed by Good et al. Absence of symptoms was considered to be an excellent result. At physical examination, the range of ankle motion was determined by measuring dorsiflexion and plantar flexion to the nearest five degrees using a goniometer. A reduction of more than five degrees in comparison with the contralateral ankle was considered to represent a restriction in range of ankle motion. Also the presence of swelling and pain on palpation were determined. Ligament laxity was tested using the anterior drawer test with the ankle in 15 degrees of plantar flexion. This test was regarded
as positive if there was a difference of more than 5 mm compared with the contralateral ankle.

At all centres, a standardized radiographic examination consisting of antero-posterior (AP) and lateral radiographs of both ankles, as well as stress radiographs, including measurements of both talar tilt (TT) and anterior talar translation (ATT), was performed at the follow-up.

The development of degenerative changes was graded according to the scale of van Dijk et al. 
41. All standard and stress radiographs were scored by an independent observer (RK).

The baseline characteristics and final results of three follow-up groups, 2-10 years, 10-20 years and 20-30 years were considered.
Results

Of the original 206 patients, 21 were lost to follow-up. Seventeen patients had moved to another place and could not be traced, three patients refused to return for follow-up examination and one patient had died. There were no significant differences in age at operation, male/female ratio, left/right ratio, preinjury Tegner activity level and direct postoperative complications between the lost cases (n=21) and the group of patients that returned for the follow-up examination (n=185). There were no significant differences in baseline characteristics and final results between the patient series that were operated by the different surgeons.

Of the 185 patients analysed, 72 patients underwent periosteal flap plasty according to Reichelt and Weyrauch, 59 patients underwent a Broström procedure and 54 patients underwent anatomical reconstruction with shortening and reinsertion of the lateral ankle ligaments according to Karlsson et al.2,18,31. There were no significant differences in the final results between the three different procedures used for anatomical reconstruction.

The baseline characteristics are shown in Table I. One hundred and six patients attended for follow-up 2-10 years after the operation. The mean duration of follow-up (SD) was 5.5 years (2.8) and the mean age at operation was 24.3 years (8.4). Fifty-five patients attended for follow-up 10-20 years after the operation. The mean duration of follow-up was 15.1 years (2.9) and the mean age at operation was 23.8 years (5.2). Twenty-four patients attended for follow-up 20-30 years after the operation. The mean duration of follow-up in this group was 24.2 years (2.4) and the mean age at operation was 26.2 years (4.0).

The final results are shown in table II. The percentage of patients who sustained a recurrent sprain after the operation was 7.5% in the 2-10 years follow-up group, 17% in the 10-20 years follow-up group and 12.5% in the 20-30 years follow-up group. After 2-10 years postoperatively, five patients (5%) were reoperated on, all in order to release an overly tight reconstruction. In the second follow-up group nine percent of patients underwent a reoperation; four patients underwent arthroscopy in order to remove osteophytes of the anterior tibia. One patient underwent a new anatomical reconstruction, twelve years after the original procedure. After 20-30 years, four out of 24 patients (17%) had been reoperated on. Two patients underwent arthroscopy for an anterior impingement syndrome, one patient was
operated on for a posterior tibial tendon injury and one patient underwent a new anatomical reconstruction of the lateral ankle ligaments, 25 years after the primary operation.

At the follow-up physical examination, 10% of patients in the 2-10 year follow-up group had a limited range of ankle motion. This was the case for four percent after 10-20 years and 12.5% after 20-30 years. The anterior drawer test was positive in 23% of patients in the 2-10 year follow-up group, in 26% of patients in the 10-20 years follow-up group and 17% in the 20-30 years follow-up group.

The percentage of patients who had degenerative changes as seen on standard AP and lateral radiographs was 29% in the 2-10 years follow-up group; 21% had osteophytes without joint space narrowing and eight percent with joint space narrowing. In the 10-20 years follow-up group, 56% of the patients showed degenerative changes on the radiographs; 38% had osteophytes, 11% osteophytes with joint space narrowing and seven percent of patients had developed severe osteoarthrosis. The values of the 20-30 year follow-up group were similar to the 10-20 year follow-up group.

The mean (SD) Karlsson score was 92 (10.3) points in the 2-10 years follow-up group, 87 (8.2) points in the 10-20 years follow-up group and 81 (11.9) points in the 20-30 years follow-up group. According to the rating system of Good et al.10, 83% of patients had a good or excellent result in the 2-10 years follow-up group. In the 10-20 years follow-up group, 85% of patients had a good or excellent result and in the 20-30 years follow-up group, 71% of patients had good or excellent results.

The results of stress radiographic examination are shown in table III. According to the criteria of Lindstrand and Mortensson 21 in each follow-up group approximately 12% of patients had positive stress radiographs. In the 2-10 years follow-up group the mean talar tilt angle (SD) was 4.5° (2.7). In the 10-20 years follow-up group, the mean talar tilt angle was 3.4° (3.8). In the 20-30 years follow-up group, the mean talar tilt angle was 2.7° (3.7). The mean anterior talar translation (SD) was 2.9 mm (2.2) in the 2-10 years follow-up group, 3.0 mm (2.2) in the 10-20 years follow-up group and 3.8 mm (2.3) in the 20-30 years follow-up group.
Discussion

The aim of the present study was to assess the short-, mid- and long-term follow-up results after anatomical reconstruction, in order to determine whether functional, clinical and radiological results deteriorated with the passage of time. The results of the present study show that anatomical reconstruction leads to a high percentage of good or excellent results in the short-, mid- and long-term. However, after 20 years follow-up, the functional and radiological results deteriorate. Despite the fact that a high percentage of the operated ankles remain stable, a considerable number of patients suffer from chronic ankle pain. Furthermore, with the passage of time, a relatively high number of patients are reoperated on for residual ankle pain.

Chronic anterolateral instability of the ankle leads to limitations in daily and sporting activities. The goal of treatment in chronic anterolateral ankle instability is the restoration of stability without a deficit in the functional result. Biomechanical studies suggest that an anatomical reconstruction provides adequate stability and does not cause a limitation in the range of motion $^{1,15,20,24,38,45}$. Broström was the first to recommend a reconstruction of the anterior talo-fibular ligament $^2$. The anterior talo-fibular ligament was repaired directly by sutureing the ligament to the lateral malleolus. He reported a success rate of 85% with this technique. A limitation of this procedure is that some patients lack the necessary strength of the local ligamentous tissue. Gould et al. described a modification of the Broström technique using a repair of the lateral talo-calcaneal ligament and reefing of the lateral ankle retinaculum to the fibula in addition to the repair of the anterior talo-fibular ligament and calcaneo-fibular ligament $^{11}$. The problem of attenuated ligamentous tissue could thus be overcome. A similar modification has been described by Liu et al. with 92% satisfactory results at a mean of five years after the operation $^{24}$. Karlsson et al. noted that the anterior talo-fibular ligament and calcaneo-fibular ligament were usually elongated and scarred rather than disrupted and recommended shortening the ligaments and reattaching them to the fibula at their anatomic origins $^{17}$. These authors reported a success rate of 88% two to 12 years after the operation.

In the present study, the overall functional results were satisfactory in 85% of patients even after more than 10 years. This is comparable with the results of the previously mentioned studies, all, however, with a much shorter duration of follow-up. We are not aware of studies that report on the outcome of anatomical reconstruction after more than 10 years.
After 20 years of follow-up, the results of the present study revealed a deterioration of functional results. However, the number of patients with a positive anterior drawer test and the mean values for talar tilt and anterior talar translation at stress radiographic examination, did not increase over time. This suggests that ligament laxity is not the cause of the deterioration in functional results after anatomical reconstruction. The results reveal that in the long-term follow-up groups the number of patients with degenerative changes in the ankle joint is relatively higher than at short- and mid-term follow-up. Degenerative changes lead to pain and stiffness of the ankle and subsequent the deterioration of functional results. At the long-term follow-up a relatively large number of patients develop symptomatic arthritis. In these cases an arthroscopic removal of osteophytes from the anteromedial rim of the distal tibia can be necessary. A relatively high percentage of patients (17%) underwent such a procedure approximately 10 years after the original reconstructive procedure.

It has been demonstrated that an inversion trauma leads to macroscopic cartilage damage in the majority of cases \(^{41}\). Any inversion injury is associated with distraction forces on the lateral side and compression forces on the medial side of the ankle joint. In 20% of such cases flakes of cartilage can be found in the joint after a lateral ankle ligament rupture \(^{40}\). This cartilage damage can be regarded to be the onset of joint degeneration. Persistent ligament laxity increases the risk for a recurrent sprain with associated cartilage damage on the medial side of the joint and subsequently accelerated joint degeneration \(^{14,41}\). A study of Krips et al. showed that increased laxity is associated with the development of degenerative changes on the medial side of the ankle joint \(^{21}\).

The goal of an anatomical reconstruction is to restore the ligamentous laxity of the ankle joint. The results of our study show that anatomical reconstruction provides excellent long lasting ligament function and the risk for increased laxity with time is low. Despite the high percentage of mechanically stable ankles, our study demonstrates joint degeneration over time. Since the indication for anatomical reconstruction was recurrent inversion trauma, it is evident that many patients had cartilage damage at the time of the reconstructive procedure. Our results show that anatomical reconstruction is not capable of stopping the process of degeneration once it has started. We, therefore, recommend to shorten the interval between the onset of symptomatic instability and reconstruction.
<table>
<thead>
<tr>
<th>Item</th>
<th>2-10 yrs FU</th>
<th>10-20 yrs FU</th>
<th>20-30 yrs FU</th>
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<tr>
<td></td>
<td>n=106</td>
<td>n=55</td>
<td>n=24</td>
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<tr>
<td>Age (yrs)</td>
<td>24.3 (8.4)</td>
<td>23.8 (5.2)</td>
<td>26.2 (4.0)</td>
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<td>Male/female (%)</td>
<td>53/47</td>
<td>60/40</td>
<td>58/42</td>
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<td>Left/right (%)</td>
<td>43/57</td>
<td>46/54</td>
<td>38/62</td>
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<td>Tegner preinjury (med)</td>
<td>6 (1-10)</td>
<td>6 (1-9)</td>
<td>-</td>
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<td>FU (mean)</td>
<td>5.5 (2.8)</td>
<td>15.1 (2.9)</td>
<td>24.2 (2.4)</td>
</tr>
<tr>
<td>Item</td>
<td>2-10 yrs FU</td>
<td>10-20 yrs FU</td>
<td>20-30 yrs FU</td>
</tr>
<tr>
<td>-----------------------------</td>
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<td>-------------</td>
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<tr>
<td>Recurrent sprain (%)</td>
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<td>17</td>
<td>12.5</td>
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<td>Reoperations (%)</td>
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<td>Follow-up</td>
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<td>Difference</td>
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<td>Limited ROM (%)</td>
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<td>12.5</td>
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<tr>
<td>Positive ADT (%)</td>
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<td>Arthrosis (%)</td>
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<td>Grade 0</td>
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<td>44</td>
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<td>Grade I</td>
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<tr>
<td>Grade II</td>
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<tr>
<td>Grade III</td>
<td>0</td>
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<td>6</td>
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<tr>
<td>Karlsson score (points)</td>
<td>92 (10.3)</td>
<td>87 (8.2)</td>
<td>81 (11.9)</td>
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<tr>
<td>Good score (%)</td>
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<tr>
<td>Excellent</td>
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<td>36</td>
<td>29</td>
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<tr>
<td>Good</td>
<td>25</td>
<td>49</td>
<td>42</td>
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<tr>
<td>Fair</td>
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<td>13</td>
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</tr>
<tr>
<td>Poor</td>
<td>5</td>
<td>2</td>
<td>4</td>
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ROM = range of ankle motion
ADT = anterior drawer test
Table III. Results of stress radiographic examination.

<table>
<thead>
<tr>
<th>Item</th>
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<th>10-20 yrs FU</th>
<th>20-30 yrs FU</th>
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<tbody>
<tr>
<td>Pos stress radiographs (%)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>TT(a)</td>
<td>4.5 (2.7)</td>
<td>3.4 (3.8)</td>
<td>2.7 (3.7)</td>
</tr>
<tr>
<td>TT(u)</td>
<td>4.0 (3.1)</td>
<td>2.7 (3.5)</td>
<td>2.4 (2.8)</td>
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<tr>
<td>TT(diff)</td>
<td>0.61 (2.6)</td>
<td>0.72 (3.6)</td>
<td>0.29 (4.0)</td>
</tr>
<tr>
<td>ATT(a)</td>
<td>2.9 (2.2)</td>
<td>3.0 (2.2)</td>
<td>3.8 (2.3)</td>
</tr>
<tr>
<td>ATT(u)</td>
<td>3.0 (1.2)</td>
<td>2.9 (2.0)</td>
<td>3.6 (1.9)</td>
</tr>
<tr>
<td>ATT(diff)</td>
<td>-0.14 (2.1)</td>
<td>0.10 (2.7)</td>
<td>0.14 (2.2)</td>
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</tbody>
</table>

TT: talar tilt (°)
ATT: anterior talar translation (mm)
a: affected ankle
u: unaffected ankle
diff: difference between unaffected and affected ankle
References


