RECONSTRUCTION OF LATERAL LIGAMENTS OF THE ANKLE
WITH ALLOGENEIC TENDON GRAFTS

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Fresh frozen allogeneic tendon was used to reconstruct the lateral ligaments in 17 ankles. Two or more years later, 13 returned for follow-up examination. The mean age at operation was 23 years (range 15 to 39); the interval between injury and operation varied from six months to 20 years.

There were no infections and no immunological rejections, and according to Sefton's criteria, nine patients were excellent and four good. No patient complained of instability of the ankle and stress radiography confirmed this improvement.

Allograft reconstruction of the lateral ligaments of the ankle is a new method of treatment which restores stability without sacrificing normal tendons.

Injury to the lateral ligaments of the ankle is common among athletes and frequently restricts sports activities. Ligamentous reconstruction is often recommended for those with chronic symptoms of instability and numerous operative procedures have been described in which mostly autogenous tissue has been used, either the peroneous tendon (Elmslie 1934; Watson-Jones 1952; Evans 1953; Chrisman and Snook 1969) or the plantaris tendon (Anderson 1985). These procedures all sacrifice normal tissue and the reconstructed ligaments are far from anatomical, altering the kinematics and resulting in limited joint motion, which may later cause degeneration of the joint.

We have used allogeneic tendon grafts to reconstruct the ligament in an anatomical manner.

MATERIALS AND METHODS

The indications for reconstruction of the lateral ligaments of the ankle are symptomatic instability and abnormal laxity demonstrated by stress radiographs. When residual ligamentous tissues are well preserved, they may be advanced as in the Broström (1966) procedure, but when the residual ligamentous tissue was too thin for advancement, we used an allogeneic tendon graft.

The grafts. Toe flexor and/or extensor tendons were harvested from non-infected amputation specimens, within two hours of removal, under sterile conditions. The tendons were cut approximately 8 cm long. Each specimen was placed in a sterile airtight tube and stored at −80°C for at least two weeks before use.

Operative procedure. A skin incision is made along the anterior margin of the lateral malleolus and extended to the tip of the fibula. After dividing the subcutaneous tissues, the anterior talofibular (ATFL) and calcaneofibular ligaments (CFL) are exposed. When only the ATFL is to be reconstructed, two 4.5 mm diameter holes are drilled, one from the fibular attachment of the ATFL to the posterior aspect of the distal fibula, and the other from the ligament's talar attachment to the medial aspect of the talus (Fig. 1a). Should the CFL also need to be reconstructed, the hole in the fibula is drilled to half-depth from the fibular attachment of the ATFL and likewise from the fibular attachment of the CFL (Fig. 2a). An additional hole is also drilled from the calcaneal attachment of the CFL to the medial aspect of the calcaneus.

Prior to these procedures, the cryopreserved allogeneic tendon is thawed at room temperature for ten minutes in saline with added antibiotics. Three 1-0 polyester sutures are attached to each end of the allogeneic tendon. These sutures are passed through the drill holes and tied over buttons under tension (Figs 1b and 2b).

Postoperatively, the ankle is immobilised in a below-knee cast for four weeks. Full weight-bearing is not permitted for six weeks and sports activities are not allowed until five months later.

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Patients. We have operated on 17 patients, all of whom complained of pain and recurrent sprains of the ankle before operation. We reviewed 13 patients two or more years postoperatively. Their mean age at operation was 23 years (range 15 to 39); there were six men and seven women. Twelve patients had been engaged in sports before the operation. The interval between the initial injury and the operation varied from six months to 20 years. The average follow-up period was 3.1 years (2 to 5.2).

The ATFL only was reconstructed in ten patients while both the ATFL and the CFL were reconstructed in three.

At review, the patients were evaluated subjectively, objectively and radiographically. Subjectively, the grading system of Sefton et al (1979) was used (Table I). The range of ankle motion was measured and manual instability tests were performed for objective evaluation. Radiographically, the anterior drawer and talar tilt were measured using Telos stress equipment (Telos, Hungen, Germany).

RESULTS

There was no case of infection or immunological rejection. According to Sefton's criteria, the results for nine patients were excellent (69%) and for four, good (31%). These latter patients complained of mild pain around the ankle during sports or strenuous work; no patient complained of instability, nor was the anterior drawer sign positive in any case. A 10° loss of dorsiflexion was noted in one patient who had this limitation before surgery due to osteoarthritis. Four ankles had slightly limited inversion.
The average talar tilt, measured by stress radiography, was 12.3° (± 1.2) before operation and 3.3° (± 0.6) after operation. The mean talar tilt of the contralateral ankle was 5.8° (± 1.3) (Fig. 3a). The average anterior drawer improved from 8.7 mm (± 0.8) to 4.0 mm (± 0.8) postoperatively (contralateral ankle: 5.0 mm (± 0.8) (Fig. 3b). Statistical analysis showed the values for talar tilt and anterior drawer both decreased significantly after operation (paired t-test; p < 0.001). Since there was a lateral ligament injury of the contralateral ankle in some cases, the average values for the contralateral ankle were higher than those for the operated ankles.

Six months after the operation, the button used for fixation was removed in one case. The allogeneic tendon was seen to be taut and thick (Fig. 4), and a biopsy specimen of the allograft showed a crimp pattern similar to that of a normal ligament (Fig. 5).

**DISCUSSION**

Most current operations involve tenodesis of the peroneus brevis tendon (Elmslie 1934; Watson-Jones 1952; Evans 1953; Chrisman and Snook 1969), procedures which cannot result in an anatomical reconstruction. Ozeki, Yasuda and Kaneda (1990) measured changes in length of normal ligaments and of ligaments reconstructed by the Watson-Jones, the Chrisman-Snook and the Evans procedures. The average length change of the normal anterior talofibular ligament during movements from dorsal to plantar flexion was only 1.56 mm. In the reconstructed ligaments, however, the length change was more than 4 mm, and during inversion-eversion movement it was more than 15 mm. These operations must, therefore, change the normal kinematics, causing limitation of ankle motion, or stretching of the reconstructed ligaments. The procedure we describe is an anatomical reconstruction which restores normal ankle kinematics.

![Figure 3a](image1.png)

**Figure 3a** – Results of stress radiography, average values for talar tilt. **Figure 3b** – Average values for the anterior drawer test.

![Figure 4](image2.png)

**Figure 4**

Gross appearance of the allograft six months postoperatively.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Symptoms</th>
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<tbody>
<tr>
<td>Excellent</td>
<td>Full activity, including strenuous sport</td>
</tr>
<tr>
<td>Good</td>
<td>Occasional aching only after strenuous exercise</td>
</tr>
<tr>
<td></td>
<td>No giving way or feeling of apprehension</td>
</tr>
<tr>
<td>Fair</td>
<td>No giving way but some remaining apprehension especially on rough ground</td>
</tr>
<tr>
<td>Poor</td>
<td>Recurrent instability and giving way in normal activities, with episodes of pain and swelling</td>
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tendons can be obtained from one foot and so, by careful donor selection, many usable allogeneic grafts can be obtained. So far, a sterile surgical technique and cryopreservation have proved effective in the avoidance of cross infection.

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

REFERENCES


