The influence of subtalar and triple arthrodesis on the tibiotalar joint. A long-term follow-up study

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THE INFLUENCE OF SUBTALAR AND TRIPLE ARTHRODESIS ON THE TIBIOTALAR JOINT

A LONG-TERM FOLLOW-UP STUDY

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From 1975 to 1990 we performed subtalar or triple arthrodesis on 54 patients; 48 of them were reviewed after a mean follow-up of 10 years (6 to 15). There were 17 subtalar fusions in 14 patients and 37 triple arthrodeses in 28 patients. We assessed tibiotalar ankle function using the criteria of Mazur which gives a points score of a maximum of 100. Radiological evidence of degenerative change was graded on a scale of 0 to 4.

The mean Mazur score was 85 for the subtalar fusions and 78 for the triple arthrodeses. The radiological score showed no degenerative changes in 36 feet (24 triple and 12 subtalar arthrodeses) and an increase of one grade in 14 feet (10 triple and 4 subtalar), of two grades in three feet (all triple arthrodeses) and of three grades in one foot after a subtalar arthrodesis.

We found no statistically significant difference in the radiological score in unilateral fusions between feet with subtalar and triple arthrodeses and the contralateral foot. In all four feet which showed an increase in degenerative changes of two or more grades, there was an abnormality of the tibiotalar joint before the fusion operation. Of the 14 feet which showed an increase of one grade, there was a similar increase on the contralateral side in nine.

Our findings show that subtalar or triple arthrodesis has little adverse influence on the function of the tibiotalar joint, even after many years.

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Subtalar or triple arthrodesis is used to correct deformity, relieve pain and achieve a plantigrade foot, but there is little information regarding the outcome of either operation. Secondary osteoarthritis of the tibiotalar joint is a possibly severe adverse effect of such arthrodeses, but there are no conclusive long-term reports which address the outcomes.1-4

We investigated the long-term influence of subtalar or triple arthrodesis on the tibiotalar joint in patients with deformities of the hindfoot or post-traumatic degenerative changes in the subtalar or Chopart joints.2,5-7

PATIENTS AND METHODS

From 1975 to 1990, 54 consecutive patients had a subtalar or triple arthrodesis in our department; 48 were available for review at a mean follow-up of 10 years (6 to 15). Of the other six, three could not be traced, one refused to be reviewed and two patients had a later arthrodesis of the tibiotalar joint for persistent pain due to severe pre-existing degenerative changes which had deteriorated within two and three years after the initial operation. None of the patients had nonunion after their fusion, probably because of very careful after-care.

Of the 48 reviewed patients (54 feet) 14 had a subtalar arthrodesis (3 bilateral) and 34 a triple arthrodesis (3 bilateral), giving a total of 17 subtalar and 37 triple arthrodeses (Figs 1 and 2). There were 20 men and 28 women, with one man and five women having bilateral procedures. The mean age at operation was 25 years (12 to 74). There were 28 left and 26 right feet.

Neurological problems such as club foot, poliomyelitis or spina bifida were the reason for one of the subtalar and 14 of the triple arthrodeses, and bony abnormalities such as club foot, tarsal coalition and post-traumatic degenerative changes of the subtalar joint for the remaining 16 subtalar and 23 triple arthrodeses.

All patients were assessed according to the ankle score of Mazur, Schwartz and Simon,8 which includes a subjective score for pain, function, support, walking distance, walking up and downstairs, ability to rise on toes and running. This gives a maximum of 90 points. The objective score, with a maximum of 10 points, includes the range of
movement of the ankle. The maximum score is 100; a score of 80 to 100 points is excellent, 70 to 79 good, 60 to 69 fair and less than 60 a poor result.

We assessed the radiological changes according to Van Dijk et al.\(^9\) into four grades (Table I) using standard standing anteroposterior (AP) and lateral views of the foot and ankle on both sides. We also studied degenerative joint changes in the midfoot, instability in the ankle, and valgus and varus in the hindfoot. We tried to determine the relationship between residual deformity in the hindfoot and degenerative changes in the tibiotalar joint.

**RESULTS**

All the patients reviewed had a solid fusion and had no complications from their operation.
osteoarthritis which did not deteriorate after operation. In
ative changes, although nine had preoperative evidence of
Chopart joints. In 36 feet there was no increase in degener-
for evidence of degenerative changes in the tibiotalar and
were reviewed by two examiners, excluding the surgeon,
the foot and AP and lateral radiographs of the ankle. All
bearing. AP, lateral, and oblique radiographs were taken of
standard techniques with the patient standing and weight-
varus (0 to 5°).

Most of the ankles which showed an increase in degener-
ative changes were abnormal before the operation. Those
which appeared normal before the hindfoot fusion had only
mild changes, which were usually symmetrical. The two
ankles which required arthrodesis had severe, grade-2 chan-

DISCUSSION

Degenerative changes have been reported after subtalar
or triple arthrodesis in the ankle as well as in the joints of
the midfoot.\(^{3,5,12-14}\) Elimination of major shock-absorbing
joints in the subtarsal and midtarsal regions will place
abnormal stress on the ankle and midfoot and possibly lead
to increased wear in these joints. We have observed this in
our series, but not to the extent seen by others;\(^{12}\) our results
show that 36 of our patients (66%) showed no increase in
degenerative changes of the ankle or Chopart joint after a
mean period of ten years.

Most of the ankles which showed an increase in degener-
ative changes, although nine had preoperative evidence of
osteoarthritis which did not deteriorate after operation. In
14 feet (four subtalar and ten triple arthrodeses) there was
an increase in degenerative changes of one grade, but the
opposite foot had a similar increase in nine cases. The
severity of changes had increased by two grades in three
feet (three triple arthrodeses) and by three grades in one
foot (subtalar arthrodesis in a patient with old juvenile
rheumatoid arthritis). In all four patients the ankle had not
been congruent at the time of operation (Table II). The
Mann-Whitney U test showed no significant difference
between the operated and the contralateral side in regard to
degenerative changes.

Degenerative changes were seen in the joints of the
midfoot in eight feet, and were severe in three. No patient
complained of instability of the ankle, but on clinical
examination three had severe and six had mild instability.
We found no correlation between valgus/varus deformity or
instability and the presence or an increase in degenerative
changes of the ankle, nor was there any correlation between
degenerative changes at the ankle and those in the midfoot
joints.

As assessed by the Mazur score 45 feet (83%) were rated
good or excellent, two (4%) as fair and seven (13%) as
poor. Of the 17 subtalar fusions the Mazur score was good
or excellent in 16 feet (94%) and poor in one (6%). Of the
37 feet with a triple arthrodesis, 29 had a good or excellent
score (79%) two fair (5%) and six a poor score (16%) after
a mean follow-up of 10 years (6 to 15). The mean Mazur
score for the whole series was 79, being 85 for subtalar
fusion and 78 for triple arthrodesis.

Active dorsiflexion and plantar flexion were measured by
the same examiner in all 48 patients using a goniometer and
two reference lines, one along the long axis of the tibia and
the other along the lateral border of the sole of the foot. We
compared the range of movement on the operated side with
the opposite joint, excluding the six patients who had
bilateral procedures.

In the 42 patients with unilateral operations the average
dorsiflexion on the fused side was 5° (–5 to +12) and the
average plantar flexion 30° (+5 to –45). On the unoper-
ated side the average dorsiflexion was 7° (0 to 18) and
plantar flexion 36° (0 to 45). No patient had pain on
attempted subtalar movement. Examination of the hind-
foot showed that 38 feet lay in a neutral position (0 to 6°
of valgus), ten in mild valgus (6 to 10°) and six in minimal
varus (0 to 5°).

All radiographs taken before and after the operation used
standard techniques with the patient standing and weight-
bearing. AP, lateral, and oblique radiographs were taken of
the foot and AP and lateral radiographs of the ankle. All
were reviewed by two examiners, excluding the surgeon,
for evidence of degenerative changes in the tibiotalar and
Chopart joints. In 36 feet there was no increase in degener-
avative changes, although nine had preoperative evidence of
osteoarthritis which did not deteriorate after operation. In

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No abnormality or subchondral sclerosis</td>
</tr>
<tr>
<td>1</td>
<td>Signs of cartilage damage with or without osteophytes</td>
</tr>
<tr>
<td>2</td>
<td>Cartilage destruction, subchondral necrosis, cysts and collapse of bone</td>
</tr>
</tbody>
</table>
| 3     | Cartilage destruction accompanied by a partial or complete dis-
appearance of the joint space and bony necrosis with deforma-
tion or subluxation |

<table>
<thead>
<tr>
<th>Increase in degenerative changes</th>
<th>Operated side (n = 56)</th>
<th>Contralateral side (n = 42)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No increase</td>
<td>36</td>
<td>31</td>
</tr>
<tr>
<td>One grade</td>
<td>14</td>
<td>10</td>
</tr>
<tr>
<td>Two grades</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Three grades</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

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REFERENCES