



## UvA-DARE (Digital Academic Repository)

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

de Heus, J.A.C.; Marti, R.K.; Besselaar, P.P.; Albers, G.H.R.

#### Publication date

1997

#### Published in

The journal of bone and joint surgery. British volume

[Link to publication](#)

#### Citation for published version (APA):

de Heus, J. A. C., Marti, R. K., Besselaar, P. P., & Albers, G. H. R. (1997). The influence of subtalar and triple arthrodesis on the tibiotalar joint. A long-term follow-up study. *The journal of bone and joint surgery. British volume*, 79-B, 644-647.

#### General rights

It is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), other than for strictly personal, individual use, unless the work is under an open content license (like Creative Commons).

#### Disclaimer/Complaints regulations

If you believe that digital publication of certain material infringes any of your rights or (privacy) interests, please let the Library know, stating your reasons. In case of a legitimate complaint, the Library will make the material inaccessible and/or remove it from the website. Please Ask the Library: <https://uba.uva.nl/en/contact>, or a letter to: Library of the University of Amsterdam, Secretariat, Singel 425, 1012 WP Amsterdam, The Netherlands. You will be contacted as soon as possible.

# THE INFLUENCE OF SUBTALAR AND TRIPLE ARTHRODESIS ON THE TIBIOTALAR JOINT

## A LONG-TERM FOLLOW-UP STUDY

J. A. C. DE HEUS, R. K. MARTI, P. P. BESSELAAR, G. H. R. ALBERS

*From the Academic Medical Centre, Amsterdam, The Netherlands*

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.

*J Bone Joint Surg [Br] 1997;79-B:644-7.*

*Received 22 August 1996; Accepted after revision 24 March 1997*

---

J. A. C. de Heus, MD

R. K. Marti, PhD

P. P. Besselaar, PhD

G. H. R. Albers, PhD

Department of Orthopaedics G-4-N, Academic Medical Centre, Meibergdreef 9, 1105 AZ Amsterdam, The Netherlands.

Correspondence should be sent to Dr G. H. R. Albers.

---

©1997 British Editorial Society of Bone and Joint Surgery  
0301-620X/97/47194 \$2.00

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.<sup>1-4</sup>

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.<sup>2,5-7</sup>

## 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,<sup>8</sup> 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



Fig. 1a



Fig. 1b

Anteroposterior radiographs before (a) and seven years after (b) a subtalar arthrodesis. The ankle was incongruent at the time of the operation.



Fig. 2a



Fig. 2b



Fig. 2c

Anteroposterior radiograph (a) of an ankle before triple arthrodesis for traumatic subluxation of the midtarsal joint and fracture of the navicular, and anteroposterior (b) and lateral (c) radiographs taken 14 years later. There is no increase in the degenerative changes at the tibiotalar joint.

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<sup>9</sup> 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.

**Table I.** Grading of radiological evidence of osteoarthritis of the ankle according to Van Dijk et al<sup>9</sup>

Grade	
0	No abnormality or subchondral sclerosis
1	Signs of cartilage damage with or without osteophytes
2	Cartilage destruction, subchondral necrosis, cysts and collapse of bone
3	Cartilage destruction accompanied by a partial or complete disappearance of the joint space and bony necrosis with deformation or subluxation

**Table II.** The increase of degenerative changes in the operated and the contralateral side

Increase in degenerative changes	Operated side (n = 56)	Contralateral side (n = 42)
No increase	36	31
One grade	14	10
Two grades	3	1
Three grades	1	0

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 site 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 unoperated 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 hindfoot 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 degenerative 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.

## DISCUSSION

Triple and subtalar arthrodeses are regarded as good and reliable procedures for correcting both congenital and acquired hindfoot deformities. Although there have been many excellent reviews of subtalar and triple arthrodesis in the past,<sup>1,2,4,10,11</sup> relatively little is known about the long-term effect on the other joints of the feet, particularly the tibiotalar joint.

Degenerative changes have been reported after subtalar or triple arthrodesis in the ankle as well as in the joints of the midfoot.<sup>3,5,12-14</sup> 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;<sup>12</sup> 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 degenerative 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 changes at the time of the initial operation.

The progression of osteoarthritic changes which occurred after subtalar or triple arthrodesis appeared to be based mainly on pre-existing degeneration in the tibiotalar joint. This should be considered as a relative contraindication to performing subtalar or triple arthrodesis. Despite this, such operations remain valuable methods of treatment for problems related to the subtarsal and midfoot joints.

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

1. **Adelaar RS, Dannelly EA, Meunier PA, et al.** A long-term study of triple arthrodesis in children. *Orthop Clin North Am* 1976;7:895-908.
2. **Bernau A.** Long-term results following Lambrinudi arthrodesis. *J Bone Joint Surg [Am]* 1977;59-A:473-9.
3. **Angus PD, Cowell HR.** Triple arthrodesis: a critical long-term review. *J Bone Joint Surg [Br]* 1986;68-B:260-5.
4. **Graves SC, Mann RA, Graves KO.** Triple arthrodesis in older adults: results after long-term follow-up. *J Bone Joint Surg [Am]* 1993;75-A:355-62.
5. **Wetmore RS, Drennan JC.** Long-term results of triple arthrodesis in Charcot-Marie-Tooth disease. *J Bone Joint Surg [Am]* 1989;71-A:417-22.
6. **Vogler HW.** Triple arthrodesis as a salvage for end-stage flatfoot. *Clin Podiatr Med Surg* 1989;6:591-604.
7. **Bennett GL, Graham CE, Mauldin DM.** Triple arthrodesis in adults. *Foot Ankle* 1991;12:138-43.
8. **Mazur JM, Schwartz E, Simon SR.** Ankle arthrodesis: long-term follow-up gait with analysis. *J Bone Joint Surg [Am]* 1979;61-A:964-75.
9. **Van Dijk CN, Lim LS, Poortman A, Strübbe EH, Marti RK.** Degenerative joint disease in female ballet dancers. *Am J Sports Med* 1995;23:295-300.
10. **Howorth MB.** Triple subtalar arthrodesis. *Clin Orthop* 1974;99:175-80.
11. **Kaplan EG, Kaplan GS.** Triple arthrodesis. *J Foot Surg* 1976;15:93-8.
12. **Southwell RB, Sherman FC.** Triple arthrodesis: a long-term study with force plate analysis. *Foot Ankle* 1981;2:15-24.
13. **Tang SC, Leong JCY, Hsu LCS.** Lambrinudi triple arthrodesis for correction of severe rigid drop-foot. *J Bone Joint Surg [Br]* 1984;66-B:66-70.
14. **Clain MR, Baxter DE.** Simultaneous calcaneocuboid and talonavicular fusion: long-term follow-up study. *J Bone Joint Surg [Br]* 1994;76-B:133-6.