

The Weil osteotomy for correction of the severe rheumatoid forefoot

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Abstract

Purpose In rheumatoid arthritis the metatarsophalangeal (MTP) joints are predominantly affected with resultant metatarsalgia and dislocation. Therapy options include many different surgical procedures with results that are not always satisfying. We present the oblique Weil metatarsal osteotomy as a treatment option for the rheumatic forefoot.

Methods A total of 216 osteotomies in 63 consecutive patients (72 feet) with a mean age at the time of surgery of 59.3 years and long-standing rheumatoid arthritis were observed prospectively for an average of 57.4 months (minimum 36 months). All patients received a Weil osteotomy of the lesser metatarsals with at least one additional procedure of the forefoot. Patients were evaluated prospectively for clinical outcome by the American Orthopaedic Foot and Ankle Society (AOFAS) lesser MTP-interphalangeal scale and subjective satisfaction. In the radiological evaluation weight-bearing X-rays were analysed for alignment, shortening and union.

Results American Orthopaedic Foot and Ankle Society score increased significantly from 21.9 ± 6.7 to 63.3 ± 9.8 ($p < 0.05$). The increase was significant for all subgroups regarding pain, function and alignment. All joints were dorsally dislocated preoperatively; a subluxation was present in 13.6 % at follow-up. There was a significant decrease of callositas in 82 %, a decrease in need for orthopaedic shoes in 61 %, a decrease of MTP joint stiffness in 96 % and a relief of severe pain in 97 % of all patients. No metatarsal head

dislocation or necrosis, pseudoarthrosis or screw perforation was observed. Of 63 patients, 55 (88 %) subjectively reported excellent or good results.

Conclusions We conclude that the Weil procedure for lesser metatarsals is a satisfactory method for correcting the rheumatic forefoot and can be recommended as an approach for the future.

Introduction

Rheumatoid arthritis is an autoimmune-mediated, systemic, inflammatory disease that is chronic and progressive in nature. The foot is most commonly affected early with a prevalence of up to 90 % for the metatarsophalangeal (MTP) joints and in 15 % the forefoot is the first manifestation of the disease. Usually the disease involves both feet, although the resulting deformities may not be symmetrical because of differences in weight-bearing and inflammation [1–4].

The typical rheumatic forefoot shows a hallux valgus deformity and a subluxation or luxation of the proximal phalanges dorsally on the metatarsal heads. Correction of the forefoot should achieve a stable realignment, improve the patient's ambulation and allow better shoe fit. A number of procedures have been described for rheumatoid forefoot reconstruction. Resection arthroplasties of the metatarsal heads have been described, including partial metatarsal head resection, resection of the base of the proximal phalanx or combined metatarsal head and proximal phalanx resection. Over time deterioration of results have been reported including recurrences and lost function [5–7]. As alternative methods metatarsal shortening osteotomies have been described for the metatarsal neck or midshaft. Preservation of the MTP joint may be one of the advantages to preserve a stable forefoot. Although good patient satisfaction is described, the problem of recurrent metatarsalgia and

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relaxation may remain. Another osteotomy, the Weil osteotomy, was originally described for treatment of metatarsalgia. The Weil osteotomy is an oblique osteotomy of the metatarsal head and neck with controlled shortening and fixation with a twist-off screw [4]. A recent review makes it clear that further studies are needed for this surgical intervention [8]. Therefore this prospective report presents the results of a large series of Weil osteotomies for treatment of the rheumatoid forefoot.

Patients and methods

We report the prospective midterm results of 216 metatarsal osteotomies in 63 consecutive patients (72 feet; 51 female, 12 male) with long-standing (minimum five years) rheumatoid arthritis. The mean age of the patients at the time of surgery was 59.3 ± 8.7 years (range 32–74 years). All patients had a minimum follow-up of 36 months (range 36–65 months; the mean follow-up was 57.4 ± 3.2 months). There were 34 left and 38 right feet. Four patients were not included in this series because they died within 24 months after surgery (two cardiac failures, one stroke, one cancer). Inclusion criteria for this study were long-standing rheumatoid arthritis for at least five years and dislocation of the lesser MTP joints in combination with rheumatoid forefoot deformity. All clinical and radiological data were collected prospectively; patients with resection of one of the metatarsal heads three to four were not included.

All osteotomies were performed on the metatarsals two to four; any involvement of the fifth metatarsal was treated differently. All patients had at least one additional forefoot procedure either for the hallux (treated with an arthrodesis with a plate or crossed screws) or the claw toe (trochlear resection of the proximal phalanx) or the fifth metatarsal head (head resection, cheilectomy, synovectomy) or a combination of these.

The operative technique consisted of two longitudinal skin incisions over the second MTP joint and between the third and fourth MTP joints. The extensor tendon was split in a z-shape for later lengthening, the joint capsule was incised longitudinally and the collateral ligaments were cut. The toe was plantarflexed to reduce luxation and to expose the metatarsal head. The Weil osteotomy was performed as an oblique osteotomy parallel to the ground from the dorsal quarter end of the cartilage proximally towards the plantar surface. The plantar fragment was then shifted proximally according to the adjacent metatarsals and the grade of luxation. Then the shortened metatarsal was fixed with a twist-off screw (11–14 mm long, DePuy, Johnson & Johnson, Warsaw, IN, USA). The resulting protuberance was removed and a synovectomy of the MTP joint was done and the extensor tendon reconstructed.

For clinical assessment all patients had lateral and weight-bearing dorsoplantar radiographs of the forefoot for evaluation of the alignment, luxation and evidence of nonunion, malunion and position of screws.

Clinical assessment was done before surgery and at the time of final follow-up with a thorough clinical evaluation in which toe position, callosities, range of motion, stiffness and foot deformities were noted. Patients were interviewed with regard to satisfaction with surgery, pain, activity and type of shoes worn. Additionally the forefoot score on the American Orthopaedic Foot and Ankle Society (AOFAS) lesser MTP-interphalangeal (IP) scale according to Kitaoka et al. [9] was documented for all patients. Satisfaction was rated by asking the patients at follow-up how satisfied they were with the outcome of the forefoot surgery (excellent, good, fair, poor).

Statistics

All continuous data are given as mean and standard deviation (SD) unless stated otherwise and were analysed by SPSS® software. The Wilcoxon signed-rank test and Mann–Whitney U test were performed to analyse differences between the groups, and a p value of <0.05 was considered statistically significant.

Results

All patients had long-lasting rheumatoid arthritis (minimum five years) affecting multiple joints. The mean preoperative score on the AOFAS lesser MTP-IP scale was 21.9 (SD 6.7) points. The respective preoperative scores were 14.4 points for pain, 4.7 points for function and 1.8 points for alignment (Fig. 1). A score of 0 points was observed for MTP stability because in all patients the lesser MTP joints were dislocated. For callus the preoperative score was 0 because it was present in all patients (Table 1).

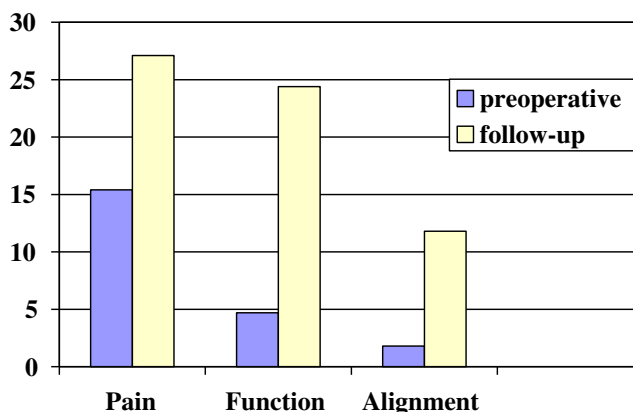


Fig. 1 Mean scores on the AOFAS lesser MTP-IP scale for pain, function and alignment

A significant increase to 63.3 (SD 9.8) points at follow-up could be observed ($p < 0.001$). This applied to all sub-items; the score at follow-up was 27.1 points for pain, 25 points for function and 11.8 points for alignment. Comparing the subjective rating by the patients a significantly higher subjective satisfaction was reported ($p < 0.05$). Only two patients were dissatisfied (3.2 %); both had bilateral surgery and complained of pain as the reason (Fig. 2). Subjective patient satisfaction was excellent ($n = 25$) or good ($n = 30$) in 88 % and fair ($n = 6$) or poor ($n = 2$) in 12 % of the patients.

There was no correlation between AOFAS score and satisfaction, which may be a sign of the multimorbidity of these patients. There was a significant decrease of callosities of 82 %, a decrease in need for orthopaedic shoes in 61 %, a decrease in MTP joint mobility impairment in 96 % and a relief of severe pain in 97 % of the patients. Not all problems could be resolved by surgery; there was a recurrence of painful callosity in 12.5 %, all of which could be treated conservatively by an insole or shoe modification. At least some residual pain or activity limitation was observed in half of the patients in spite of significant improvement.

The radiographic results showed no metatarsal head necrosis, no malunion, pseudoarthrosis or fracture of the metatarsal bones, no exuberant bone growth and no screw perforation. While all feet presented with dorsal dislocation of the metatarsal joints preoperatively, a dorsal subluxation was seen in 13.8 % at follow-up; there was no indication for a revision. There was no revision surgery, and delayed wound healing was observed in six feet (8.3 %), all of which healed on conservative treatment after three to five weeks.

Discussion

Treatment of patients with rheumatoid arthritis is always challenging because of the multifocal nature of the disease.

Table 1 Mean scores on the AOFAS lesser MTP-IP scale presenting all sub-items

	Preoperatively	Follow-up
Pain	15.4±7.1	27.1±9.2
Function	4.7±0.3	25
Activity limitations	0.7±0.4	3.2±0.5
Footwear requirements	3.1±0.2	4.5±0.3
MTP joint motion	0.3±0.1	4.4±0.8
IP joint motion	0.6±0.1	3.9±0.6
MTP-IP stability	0±0	4.5±0.7
Callus related to lesser MTP-IP	0±0	3.9±0.8
Alignment	1.8±0.3	11.8±1.4

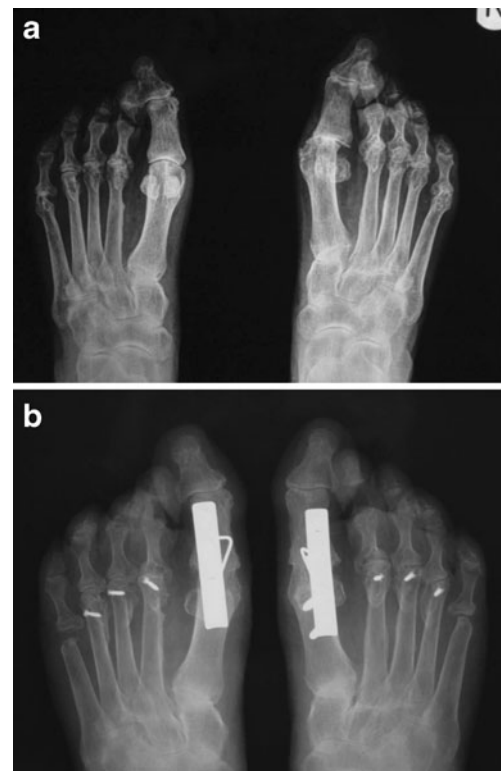


Fig. 2 **a** Severe rheumatic forefoot deformity in a female patient with long-standing rheumatoid arthritis. **b** Post-operative radiograph after arthrodesis of the first ray and oblique shortening osteotomy of the lesser metatarsals and resection of the fifth metatarsal head in combination with trochlear resection of lesser toes

For treatment of the rheumatoid forefoot different approaches have been developed and described. The classical approach combines a first MTP fusion and resection of the lesser metatarsal heads or resection of all heads by a plantar approach. The disadvantage is the loss of joints and a pedobarographic loss of pressure distribution in the forefoot; therefore joint-preserving surgery for the lesser metatarsals is an alternative for the rheumatic foot. So far reports on this approach are scanty; a summary is given in Table 2. A recent review makes it clear that further studies on joint-preserving surgery in arthritis are needed [8].

Our scores are lower both preoperatively and at follow-up compared to other reports. This might be caused by long-standing rheumatoid arthritis in all patients with dislocated MTP joints and painful callosities in all patients. The AOFAS lesser MTP-IP scale score increased by 41.4 points (from 21.9 points preoperatively to 63.3 points at follow-up) which is in the range reported by other studies including non-arthritic patients and is statistically significant. Of the four studies presented on rheumatoid arthritis patients only two include the complete AOFAS score [10–13]. The increase of the AOFAS lesser MTP-IP scale score is 37 points in one study [10] and 49 in the other [11]. The latter reports on 49 patients with 66 joint-preserving procedures with Scarf

Table 2 Clinical results for the metatarsal osteotomy for rheumatoid arthritis (RA)

	First author (reference)	Patients/feet (<i>n</i>)	Diagnosis	Follow-up (months)	AOFAS LMIS preoperative	AOFAS LMIS follow-up
	Niki [10]	30/39	RA	36	52.2	89.6
	Bhavikatti [11]	49/66	RA	51	39.8	88.7
<i>LMIS</i> lesser metatarsophalangeal-interphalangeal scale, <i>NA</i> not available	Barouk [12]	34/60	RA	75	NA	NA
	Hanyu [13]	47/75	RA	72	NA	NA
	Trieb (this study)	63/72	RA	59	21.9	63.3

osteotomy on the first and Weil osteotomy on the lesser metatarsals. The AOFAS score improved from 39.8 points preoperatively to 88.7 at follow-up after 51 months. The other study reports results of 30 patients (39 feet) with fusion of the first and Weil osteotomy of the lesser metatarsal joints after a 36-month follow-up. The foot score improved from 52.2 to 89.6 points including further surgery in four patients. Another study reports on the possibility of joint-preserving surgery of the lesser metatarsals in 86 %, but gives no scores or further detailed information [12]. Patient satisfaction rated as good or excellent regarding results was stated to be from 83 to 90 % and was therefore in the range of our study [12, 13]. The latter study describes an oblique shortening osteotomy without screw fixation and uses a temporary K-wire fixation for stabilisation [13].

Weil osteotomy is widely used for treatment of metatarsalgia and recommended as a safe and reproducible approach for correction of the lesser ray [14]. One of the results might be floating or stiff toes in some patients with little effect on patient satisfaction [15]. Comparing Weil and Helal osteotomies in metatarsalgia (15 patients in each group) the authors concluded that Weil osteotomy is superior with regard to outcome and complication rate [16].

The joint-preserving approach to the rheumatoid forefoot reveals some advantages. Due to shortening of the metatarsals the condition of the rheumatoid joint is changed, a synovectomy is included and pathological pressure on the joint is relieved. Excellent satisfying results can be observed over a long time without surgical limitation even in dislocated joints as shown in this series of cases. Only completely destroyed or mutilated metatarsal heads should be considered for classical resection. In our experience metatarsal heads with inflammatory damage less than a third of the cartilage surface should be preserved. In summary, preserving lesser metatarsal joints results in similar or better results than resection arthroplasty and yields high satisfaction and improvement. According to our data, the Weil osteotomy can be seen as a reliable procedure for surgical treatment of dislocated MTP joints in rheumatoid arthritis and should be considered as an alternative to classical resection of metatarsal heads in the future.

References

- Mann RA, Coughlin MJ (1979) The rheumatoid foot: review of literature and method of treatment. *Orthop Rev* 8:105–112
- Clayton ML (1960) Surgery of the forefoot in rheumatoid arthritis. *Clin Orthop Rel Res* 349:6–8
- Vanio K (1956) The rheumatoid foot. A clinical study with pathological and rheumatological comments. *Ann Chir Gynaecol Fenn* 45:101–107
- Trieb K (2005) Management of the foot in rheumatoid arthritis. *J Bone Joint Surg Br* 87:1171–1177
- Helal B (1975) Metatarsal osteotomy for metatarsalgia. *J Bone Joint Surg Br* 57:187–192
- Giannestras N (1958) Shortening of the metatarsal shaft in the treatment of plantar keratosis: an end-result study. *J Bone Joint Surg Am* 40-A:61–71
- Schuh R, Trmka HJ (2011) Metatarsalgia: distal metatarsal osteotomies. *Foot Ankle Clin* 16:583–595
- Roukis TS (2010) Scarf and Weil metatarsal osteotomies of the lateral rays for correction of rheumatoid forefoot deformities: a systematic review. *J Foot Ankle Surg* 49:390–394
- Kitaoka HB, Alexander LJ, Adelaar RS, Nunley JA, Myerson MS, Sanders M (1994) Clinical rating systems for ankle-hindfoot, midfoot, hallux, and lesser toes. *Foot Ankle* 15:349–353
- Niki H, Hirano T, Okada H, Beppu M (2010) Combination joint-preserving surgery for forefoot deformity in patients with rheumatoid arthritis. *J Bone Joint Surg Br* 92:380–386
- Bhavikatti M, Sewell MD, Al-Hadithy N, Awan S, Bawarish MA (2012) Joint preserving surgery for rheumatoid forefoot deformities improves pain and corrects deformity at midterm follow-up. *Foot (Edinb)* 22:81–84
- Barouk LS, Barouk P (2007) Joint-preserving surgery in rheumatoid forefoot: preliminary study with more-than-two-year follow-up. *Foot Ankle Clin* 12:435–454
- Hanyu T, Yamazaki H, Murasawa A, Tohyama C (1997) Arthroplasty for rheumatoid forefoot deformities by a shortening oblique osteotomy. *Clin Orthop Relat Res* 338:131–138
- Pérez-Muñoz I, Escobar-Antón D, Sanz-Gómez TA (2012) The role of Weil and triple Weil osteotomies in the treatment of propulsive metatarsalgia. *Foot Ankle* 33:501–506
- Hofstaetter SG, Hofstaetter JG, Petroutsas JA, Gruber F, Ritschl P, Trmka HJ (2005) The Weil osteotomy: a seven-year follow-up. *J Bone Joint Surg Br* 87:1507–1511
- Trmka HJ, Mühlbauer M, Zettl R, Myerson MS, Ritschl P (1999) Comparison of the results of the Weil and Helal osteotomies for the treatment of metatarsalgia secondary to dislocation of the lesser metatarsophalangeal joints. *Foot Ankle Int* 20:72–79