



Scarf of the First Métatarsal for Bunionectomy

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Review article

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Summary

Authors described surgical technique of the scarf osteotomy for hallux valgus correction.

Key words: Hallux valgus, scarf osteotomy, bunionectomy

INTRODUCTION

This article takes stock of the scarf procedure in the hallux valgus treatment, emphasizing the *technical main points*, which are critical for be successful when performing this procedure, and for decreasing the time of the learning curve.

The scarf remains a must in the forefoot surgery.

DEFINITION, HISTORIC ASPECTS, GENERALITIES

The Jupiter's cut exits from several centuries: it is a double chevron cut, first used in carpentry: this cut, combined with a long osteotomy, is the definition of Scarf.

In 1984, Ch. Gudas made a drawing of scarf to LS Weil. who adopts this procedure, then shows it to Samuel Barouk in 1991. In 1992, first meeting on scarf in Bordeaux, then progressive adoption by orthopedic surgeons of this osteotomy which revealed to be extremely effective, accurate and reliable.

From this period, numerous studies, (complete references in 3 and 8) allowed to precise and improve this osteotomy.

The main points of scarf: versatility, stability, long term reliability, and as observed by Toullec, the scarf is the only osteotomy which restitutes a normal X Ray one year after the Osteotomy, that proves the respect of anatomy, which is described (Fig. 2).

Surgical Anatomy

It is described (Fig. 3) the Scarf Osteotomy preserves and takes into account the first metatarsal anatomy as well as its blood supply.

The scarf osteotomy is only one - but the main one - of the 4 steps required for bunionectomy (Fig. 1), and which has to be included in a global management of the forefoot surgery

Fig. 1. The scarf, carpentry term, *double chevron, long osteotomy*

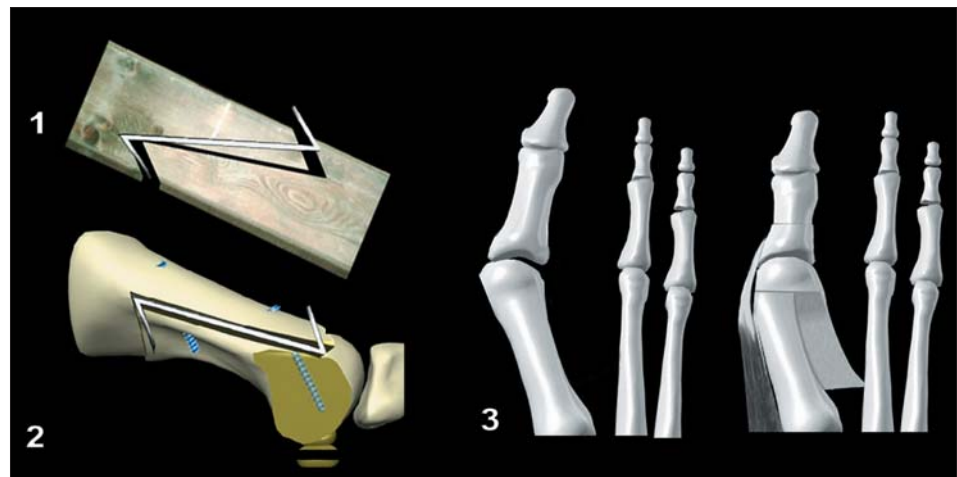
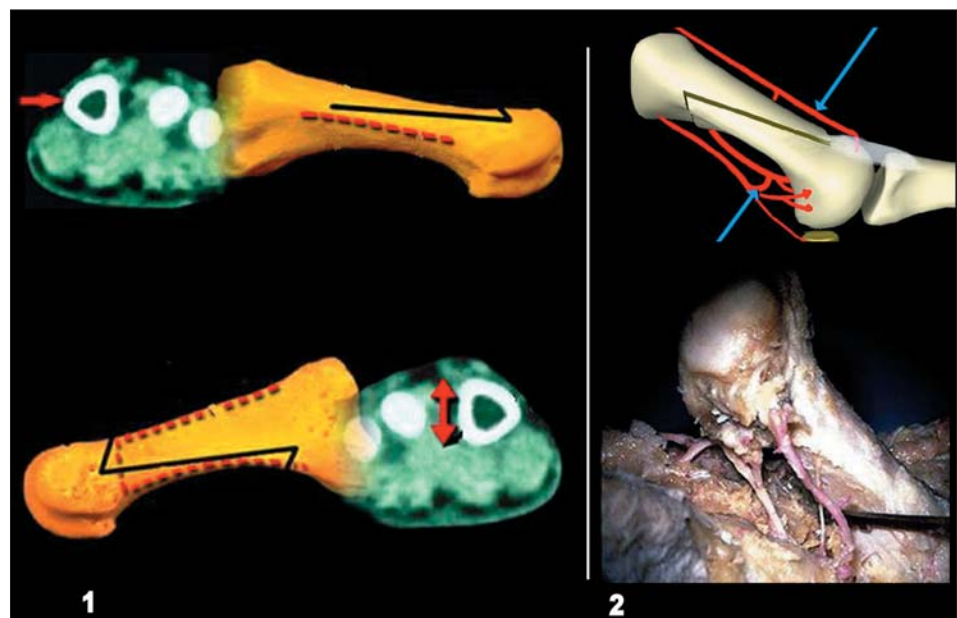


Fig. 2. First metatarsal surgical anatomy

-on the left: **bone** anatomy metatarsal: note the lateral obliquity of the plantar surface on the cross section, and the position of the scarf cuts.

- on the right: metatarsal head **blood supply** the scarf preserves the head blood supply, both dorsally and plantarly (note the important plantar vascular bundle)



Lateral release of the MTP 1 (Fig. 4)

It is the one step of bunionectomy.

The *suspensory ligament* must to be cutted in all cases, to leave the place to the metatarsal head when it will be displaced laterally

The *adductor tendon* is cutted as far as required to have a passive correction of hallux valgus without over correction

The *lateral ligament* has to be preserved in all cases

We perform usually the lateral release by an intermetatarsal approach, but recently, Pierre Barouk and Andrew Robinson made a *dorsomedial approach* which avoids a separated incision. (ref. in our web site)

Approach (Fig. 5)

It is strictly medial, proximally from the vascular planar band, we find the Proximal Plantar Exposure (PPE)

which allows to make easily, accurately and harmlessly the cuts, displacements and fixation.

Osteotomy Cuts (Fig. 6)

Chronologically:

We first perform the *longitudinal cut*, first on the medial face, then crossing the metatarsal, while being close to the plantar oblique surface, this allowing to preserve the lateral surface, which acts like a strong beam, allowing large lateral shift and preventing proximal fracture

Then we perform the two *transversal cuts*: they are chevron shaped, the *distal cut* one beginning in the epiphysis, this avoids the throughing and ensures the healing; the *proximal cut* is performed easily thanks to the PPE. To provide a longitudinal decompression, these two cuts are proximally directed, resulting in a small

Fig. 3. The 4 Steps for bunionectomy

Upper line, the 4 successive steps: 1. lateral release. 2. metatarsal osteotomy. 3. medial soft tissue tightening in many cases. 4. proximal phalanx osteotomy in 90% of cases

Bottom line, radiological and clinical aspect of a case showing that the only 1st metatarsal osteotomy is insufficient for reach the hallux valgus correction: the 4 steps are necessary.

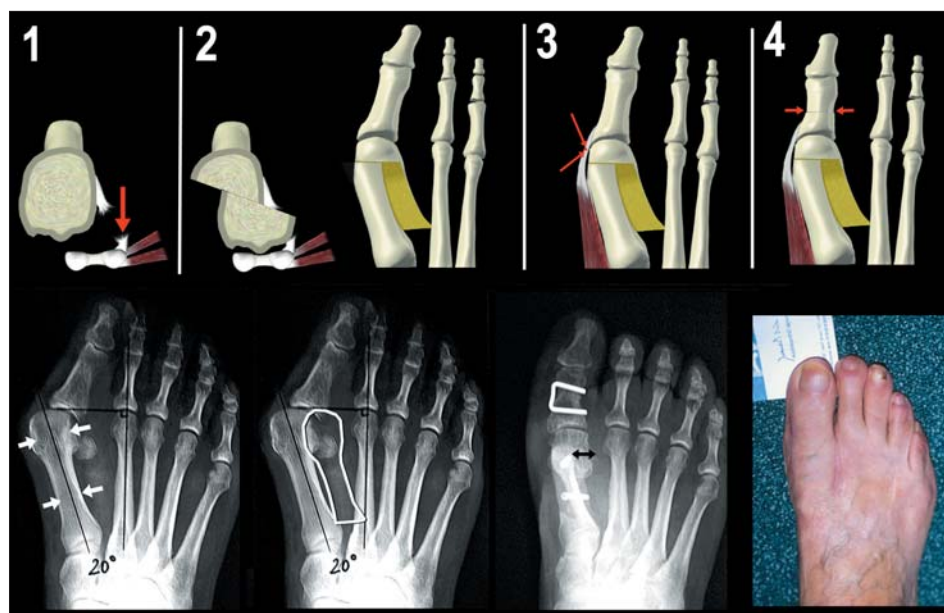
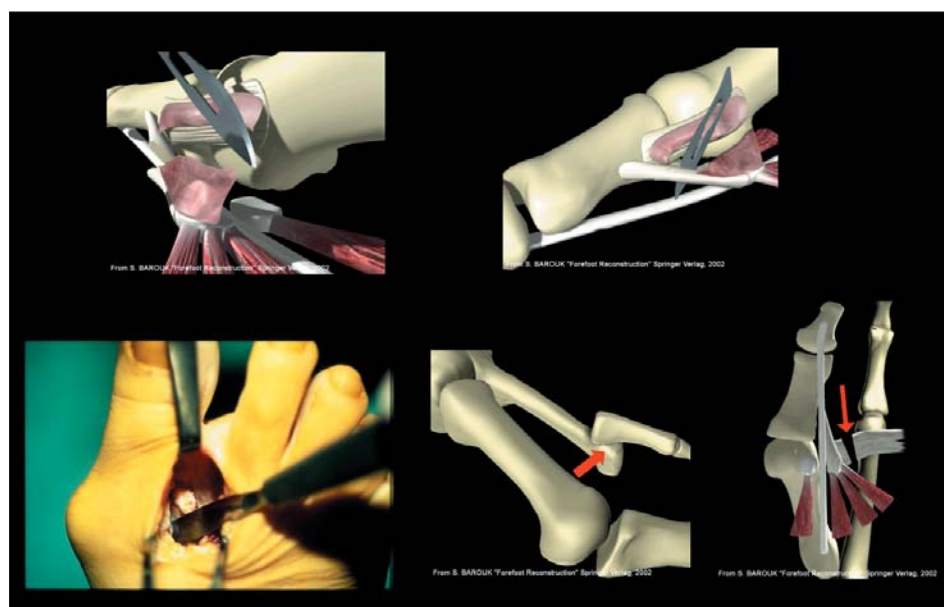


Fig. 4. Lateral release

Upper line: in each case section of the suspensory ligament, and section as far as required of the adductor tendon

Bottom: intermetatarsal approach is accurate, and allows when required in one hand to cut the intermetatarsal ligament, in a other hand to approach the 2nd metatarsal



shortening, which is compensated by the combined lowering

The Maestro cuts are required to have an accurate shortening while to preserve the collateral ligament displacements (Fig. 7 to 11)

The first interest of Scarf is the great versatility of large and accurate displacements, as well as the easy **combination** of each displacement.

- The **Latéral Shift** (Fig. 7) may be pushed to the 2/3 of the surface, thanks in one hand to the respect of the lateral surface, in the other hand to the longitudinal coaptation applied on the distal inter fragmental contact.
- The **DMAA Correction** (Fig. 8) as far as 20°, which is enough: the true assessment is intra operative
- In a **sagittal plane** (Fig. 9), we can have a large **lowering**, but it is preferable not to lower too much, and,

in case of a pre-operative 2nd ray metatarsalgia as the main symptom, it is better to combine the 2nd metatarsal elevation osteotomy (BRT)

Elevation is also possible but may fragilize the metatarsal

- **Axial rotation** is also possible. (Fig. 10)
- We emphasize the **M1 Shortening by Scarf**, which is accurate and very useful for severe forefoot disorders. We bring precisions about its necessity (Fig. 11a), then its assessment, from the **ms point** (Fig. 11b): this point is located on the basis of the phalanx of the most impaired ray, assessed on the pre operative X-ray: its projection on the corresponding metatarsal indicates the required shortening to get a good result. The shortening technique follows the cuts of Maestro. The metatarsal shortening results in the **MTP Joint longitudinal decompression** which explain the good results observed.

Fig. 5. Medial Approach Proximal Plantar Exposure (PPE): 3 interests: 1 proximal cut performed under soft tissue protection, 2. accurate proximal fixation, 3. proximal resection :easy pull out of the plantar fragment (shortening)

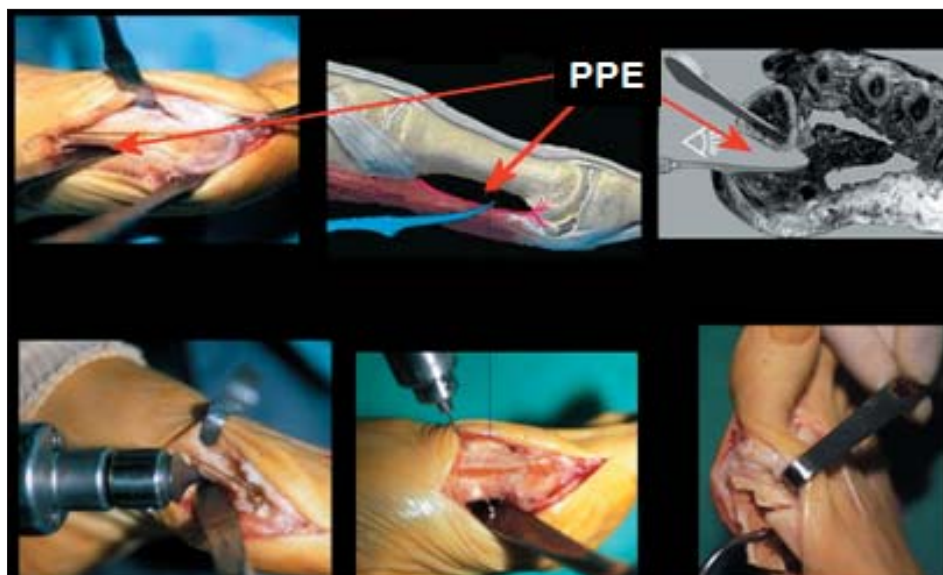


Fig. 6. Osteotomy Cuts
Longitudinal Cut : Upper line : this cut is first performed on the medial face (1, 2, 3), then (middle line) crossing the metatarsal close of the plantar surface (4), it preserves the lateral surface (strong beam).
 Bottom: **Transversal cuts**, (5, 6): The two cuts are proximally directed ,to provide a longitudinal decompression. the distal one is proximal from the dorsal capsula and sufficiently distal for reaching better bone and avoiding throughing (Valtin). The Proximal more proximally directed to emphasize the distal coaptation Maestro cuts, for Shortening. (7)

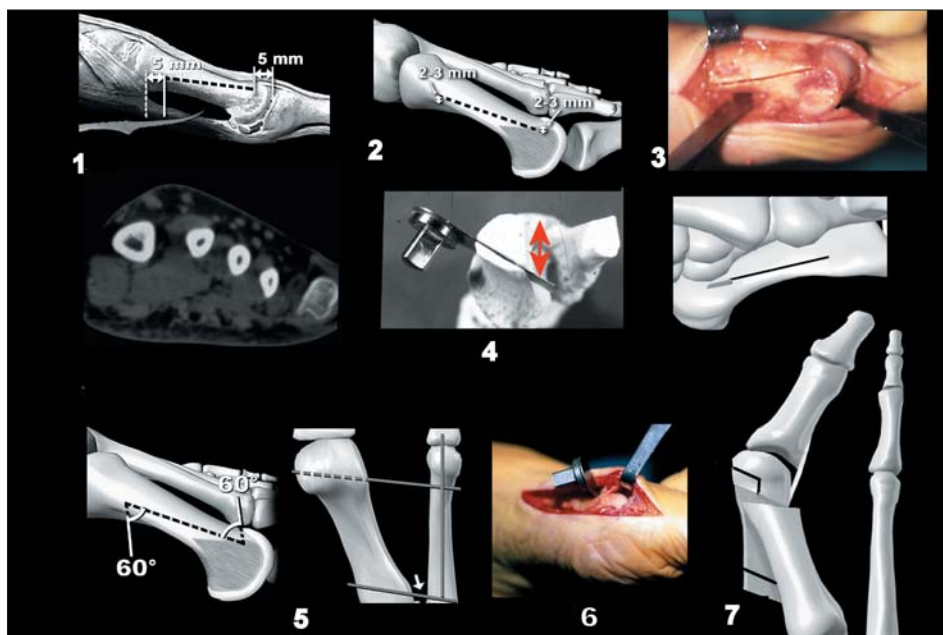


Fig. 7. Displacements: 1. *Lateral translation*

Lateral shift of more 2/3 of surface is allowed thanks to the preservation of the lateral face (1,2,3) as well as the distal inter fragmental contact combined with the longitudinal impaction

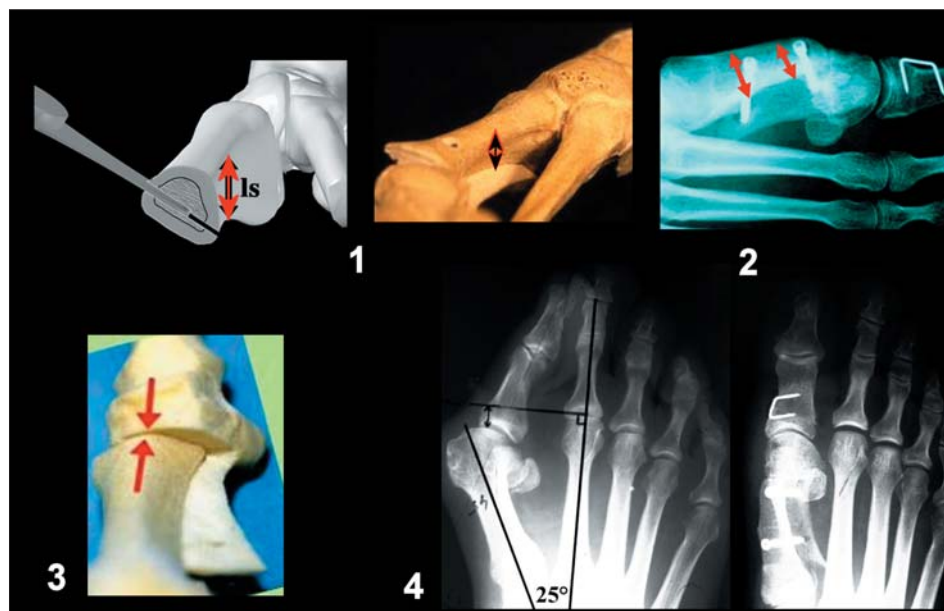


Fig. 8. Displacements: 2. *DMAA correction*

Upper line: indications :1. Juvenile hallux valgus (HV). 2. Iatrogenic HV

3. Arthritic HV. 4. same case than 3 : in fact the true assessment of the position of the cartilage is intra operative.

Bottom Line: 5 .6. Correction up to 20° thanks to the distal coaptation and contact 7 ex: Iatrogenic HV

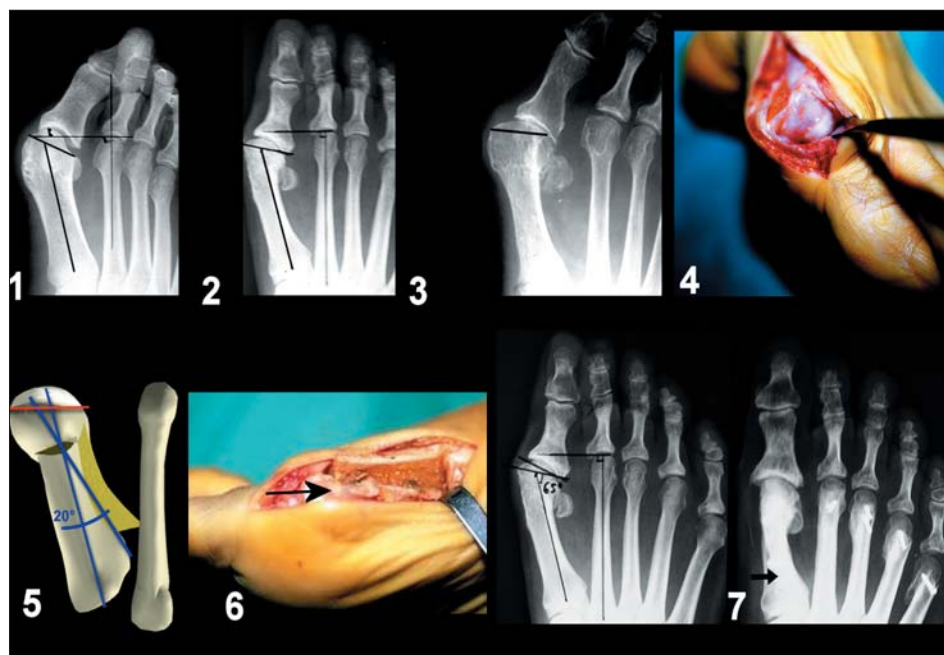
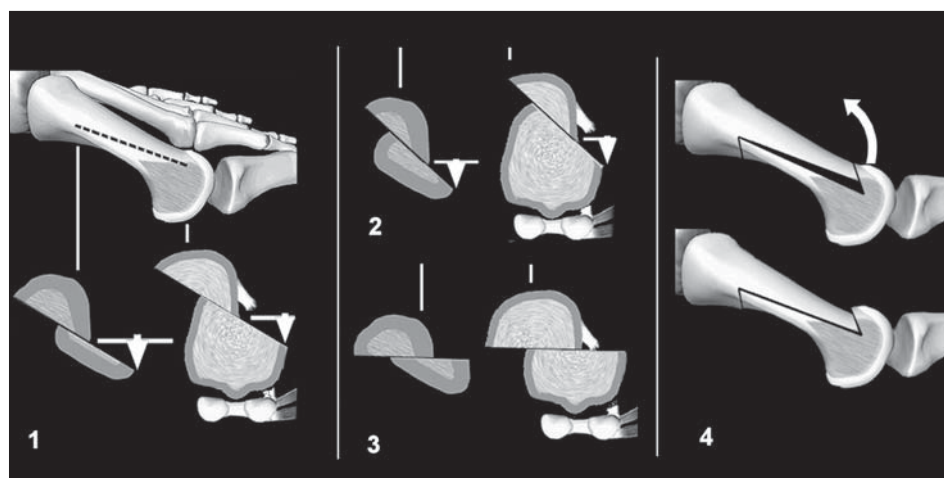


Fig. 9. Displacements : 3. *in a Sagittal plane*

As required , usual lowering (1), less or more lowering (2,3). Elévation (4)



Fixation (Fig. 12)

The scarf primary stability is such that some authors do not fix the osteotomy. We think that it is a risk, so that we recommend to fix.

The *distal fixation* is always required : screw oblique distally, which reinforces the distal impaction, and reach solid distal cancellous bone.

Proximal fixation: often necessary. it requires a low profile screw, and has to preserve the lateral beam.

Fig. 10. Displacements : 4. *Axial rotation*: Distally, medial resection; proximally, the throughing is favourable

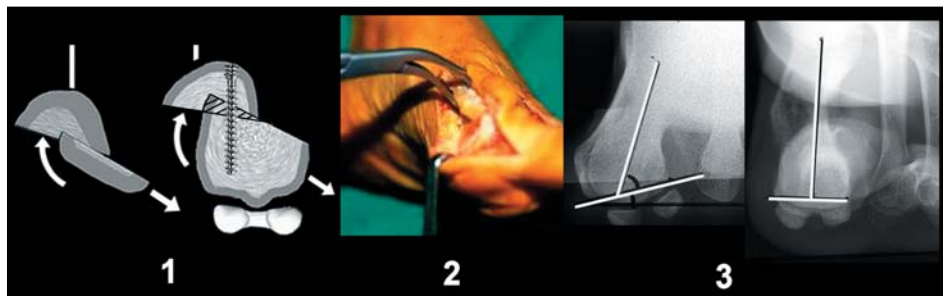


Fig. 11a. Displacements : 5.

Shortening : its need

Problems resulting from a first metatarsal too long: **1** over or under correction, **2** over load on the first metatarsal head, **3** decreased range on the side where the first metatarsal is too long

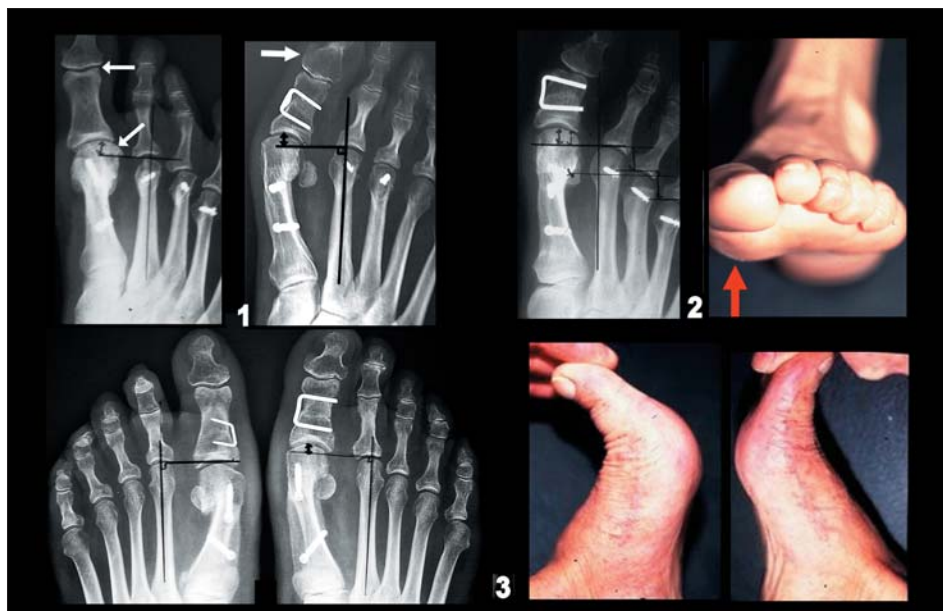


Fig. 11b. Displacements : 5.

Shortening : Assessment

Upper line. **1.** pre-operatively, loss of dorsal flexion while we attempt to correct the deformity, and, above all (**2**), localisation of *point ms* (see text), it is the most accurate land mark to assess the M1 shortening. Sometimes need to intraoperative ajustment: we have to reach minimum 50° of dorsal MTP flexion.

Bottom line. *ms* assessment in 3 usual indications: **3.** excess of M1 lenght; **4.** advanced hallux valgus. **5.** Adaptation to M2 shortening for MTP luxation

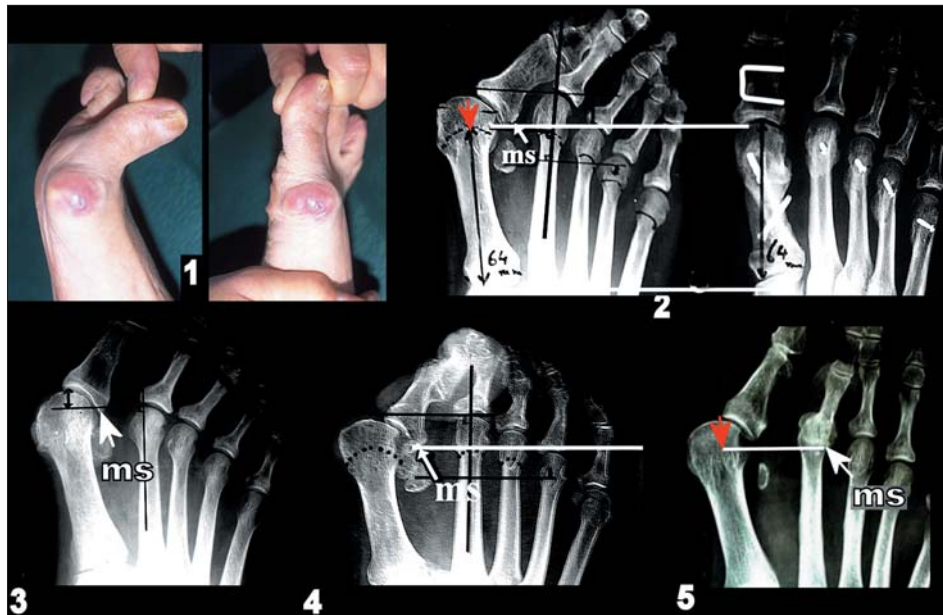


Fig. 11c. Displacements : 5. Shortening : Technique (Maestro cuts)

Upper line: this technique preserves the lateral ligament and increases the inter fragmentar surface. **3** : aspect at one year. *Bottom line:* Lateral displacements combined with shortening. **4** : small medial resection = large lateral displacement. **5** : Large medial resection = small lateral displacement

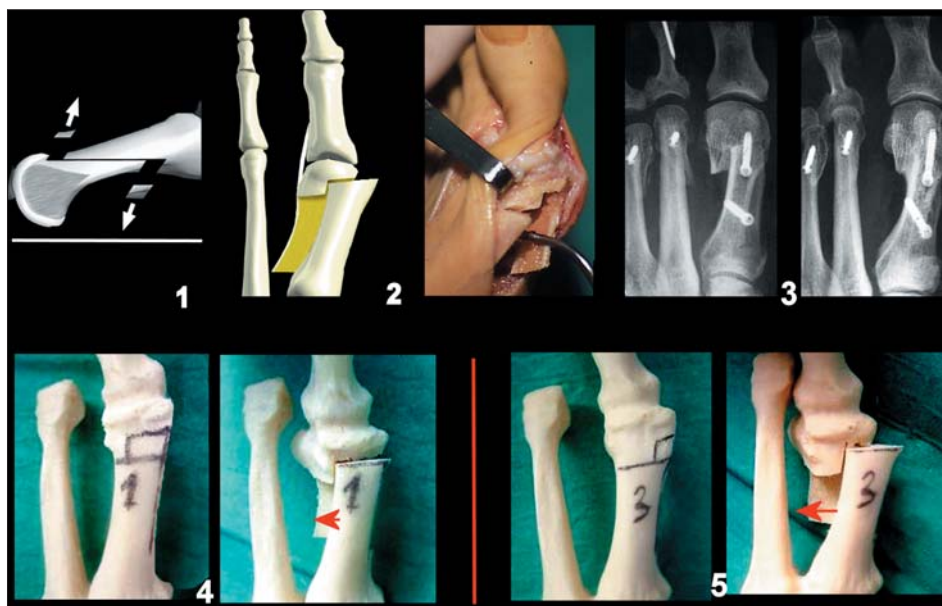


Fig. 11d. Displacements : 5. Shortening : effects, indications. **1,2.** Increasing of dorsal flexion, and longitudinal decompression by flexor brevis relaxing **3, 4.** This decompression allows a stable correction in severe deformities: (see also Figures 10b, 13b and c)

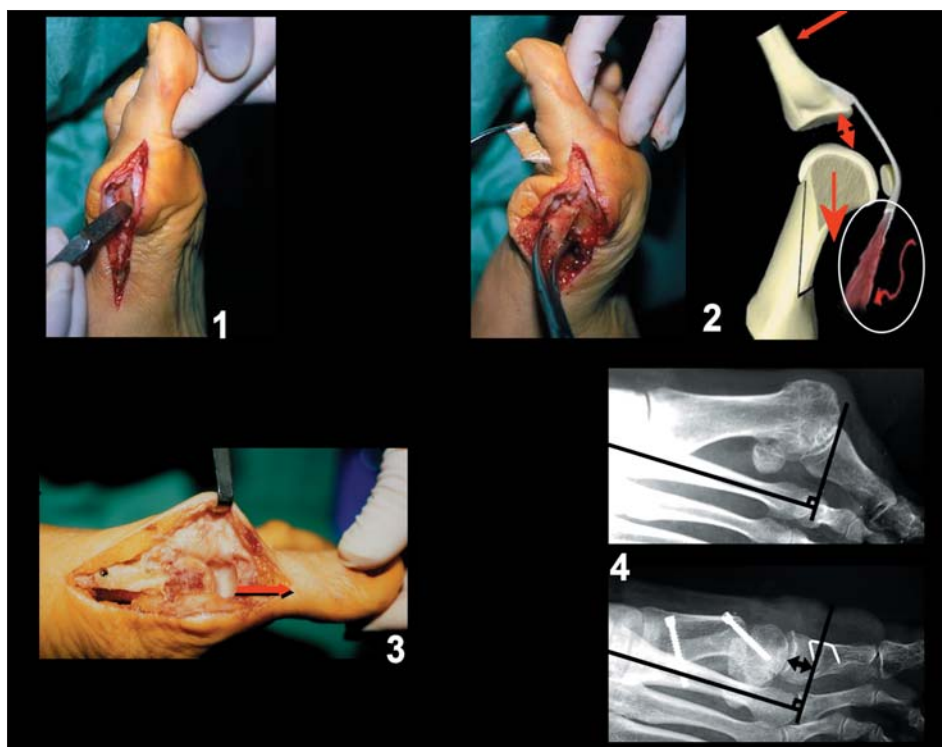


Fig. 11e. Displacements : 5. Isolated 1st metatarsal shortening .

A question often asked by surgeons. In fact, the isolated shortening is possible with 2 conditions: M1 shorter than M2 not more than 5 mm, and no pre operative problems on the lesser rays



The screws we use are the Barouk or the new FRS screw (Depuy)

Medial soft tissue tightening (Fig. 13)

This tightening may be a simple capsula closure in mild deformities, or a true tightening, which includes the distal part of the Abductor tendon

Proximal phalanx osteotomy (Fig. 14)

This osteotomy has to be performed in more than 90% of cases.

We have given an accurate description in previous articles, notably in Foot and Ankle Clinics (4), our book and Web site (3,9).

Post operative period (Fig. 15)

It is painless and we observe an early functional recovery. During the first post operative month, patients wear the heel support heel shoe, for security and early walking, then variable volume shoe type II.

On the third month, usually complete functional recovery, and high heel shoes after 6 months

Fig. 12a. Fixation the specific clamp is required, after manual longitudinal impaction of the fragments. Fixation by the Barouk screw (B), may be improved thanks to the new FRS screw (Depuy) with low profile size

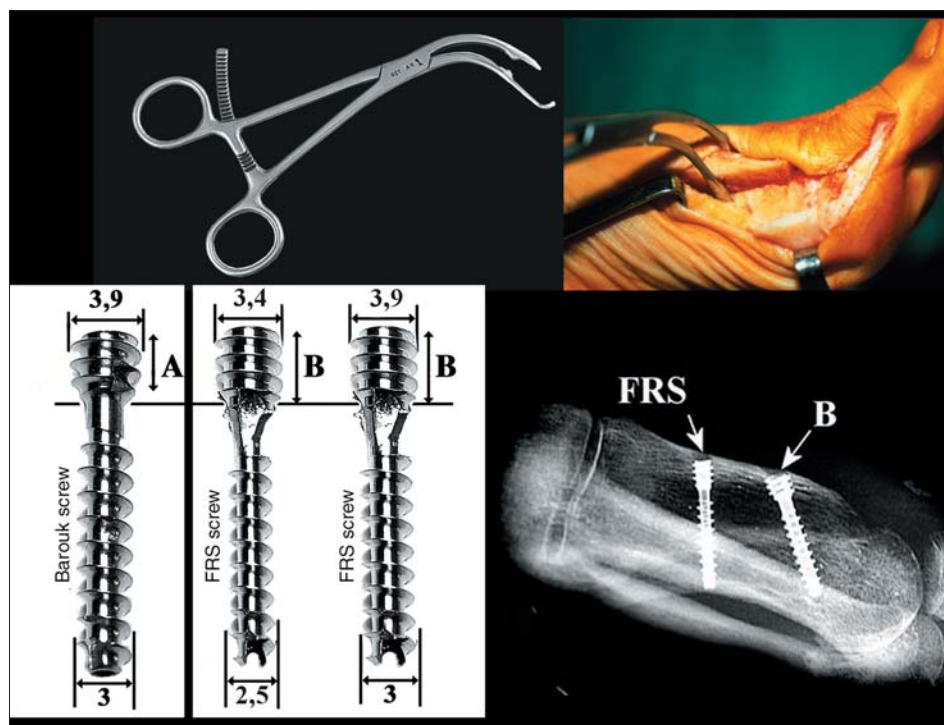
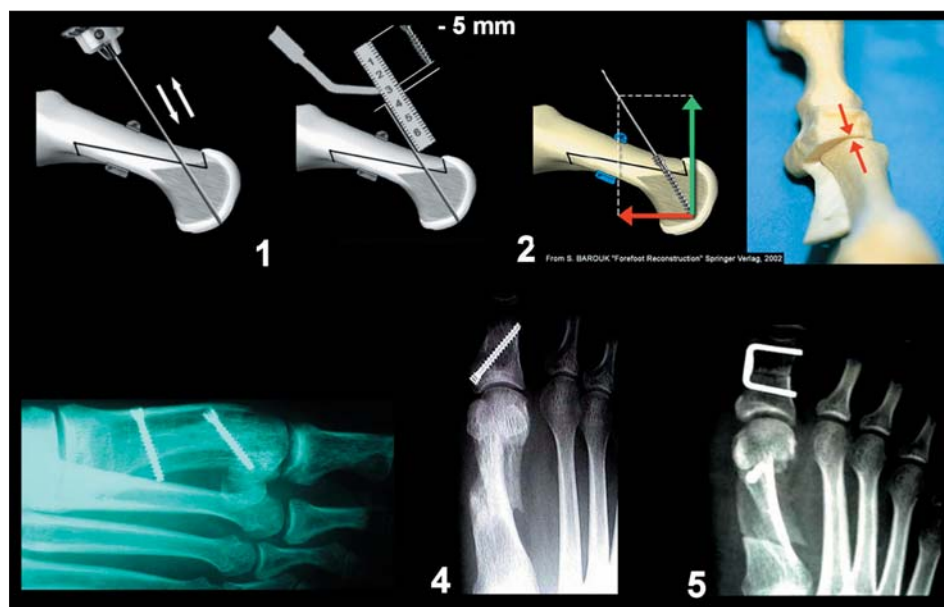


Fig. 12b. Fixation
Upper line: the distal screw must be oblique distally to reinforce the longitudinal coaptation
Bottom line : left. usual fixation in Bordeaux, 4. no screw (Maestro, Leemrijse), thanks to the primary stability of the Scarf osteotomy. 5. an intermediary solution seems more reliable : it is to always fix distally, and proximally if required (P. Barouk)



Complications (Fig. 16)

Preferably we speak of drawbacks which occurs during the learning curve period but this period may be shortened, thanks to the technical articles and videos, notably (3,8), or a workshop on saw bones.

One example is given by two successive articles of Coetze (5, 6), the second, written 4 years after the first one, changes the results observed in the first one which was written in the author's early experience.

Fig. 13. Medial soft tissue tightening
In mild deformity, just close the medial capsula
At the contrary, as shown here, in severe hallux valgus deformity, the medial soft tissue tightening is required

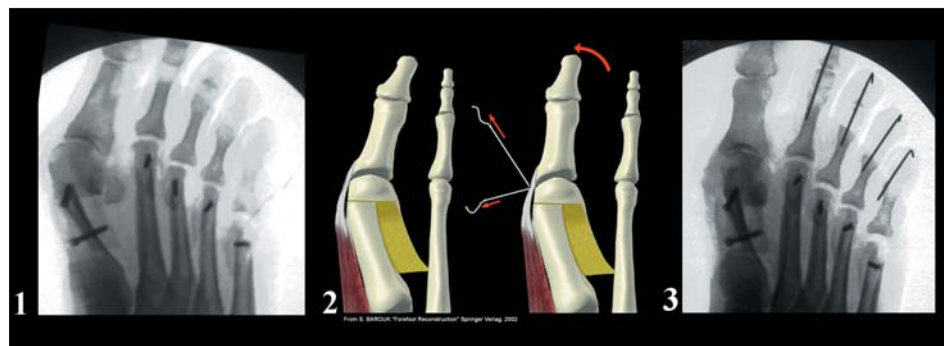


Fig. 14. Proximal phalanx osteotomy
Once performed the medial soft tissue tightening, we may asses the correction with the load simulation test. Proximal phalanx osteotomy is above all a varisation, combined or not with derotation, as showed here: fixation by oblique staple or by the dedicated "12" memory staple (Depuy)

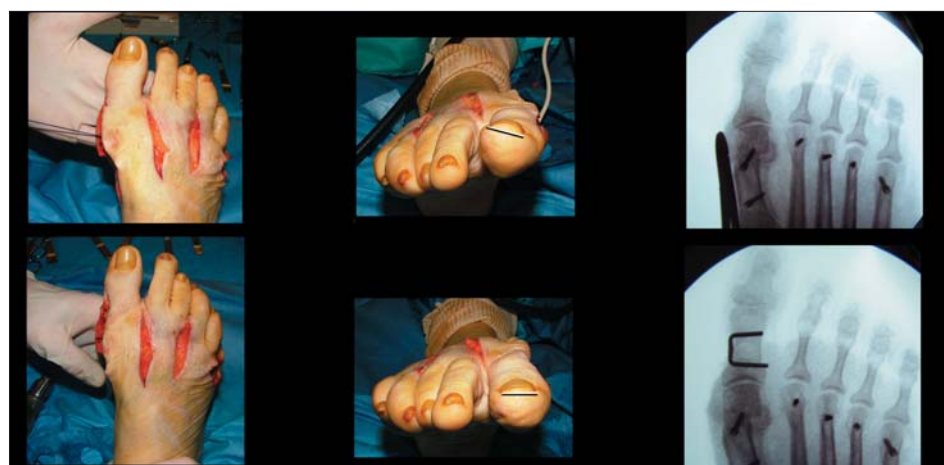


Fig. 15. Post operative aspects
The relative long incision is not a problem to the functional recovery 2. The type I heel support shoe for the 3 to 4 post op. weeks, then (3) a shoe type II with variable volume and medially deported tip. 4. Type III shoes, for severe disorders. (All Shoes from Romans Industrie). 5. Clinical aspect 5 months after usual bunionectomy



RESULTS, INDICATIONS (Fig. 17a, b)

Results. The different studies show similar good results of the scarf osteotomy (see references). In our experience, with more than 4.500 scarf performed with a follow up of 17 years for the early cases, we observe that these results are long lasting. However, these results require an accurate technique, and a learning curve.

In fact, the scarf provides the most versatility as well as the most reliability than any procedure

Indications (Fig. 17a, b)

Since to the great versatility of the displacements, the scarf has a wide range of indications : adaptation to any hallux valgus, whatever the degree of the deformity or the impairment of the MTP joint.

Particularly, the scarf appears as the most reliable technique in advanced hallux valgus, revision surgery, impairment of the first MTP joint, including the rheumatoid forefoot, this above all due to the shortening of the first metatarsal

Fig. 16. Main Drawbacks during the learning curve

1 : Longitudinal cut too planar and horizontal : weakness of the lateral beam: transfer metatarsagia, fracture around the proximal screw introduced too laterally and too big 2 : Remaining DMAA. 3 : Insufficient lateral displacement. 4 : M1 too long remaining

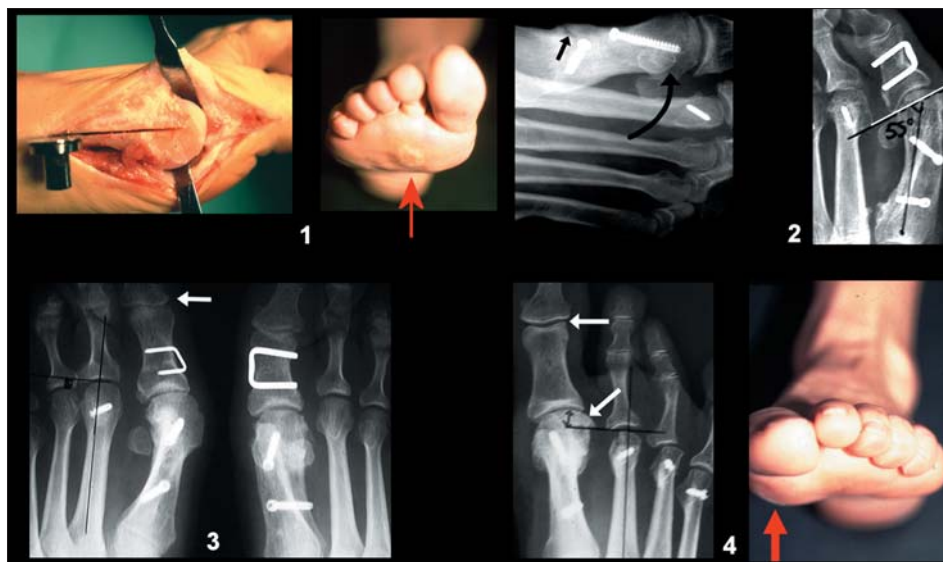
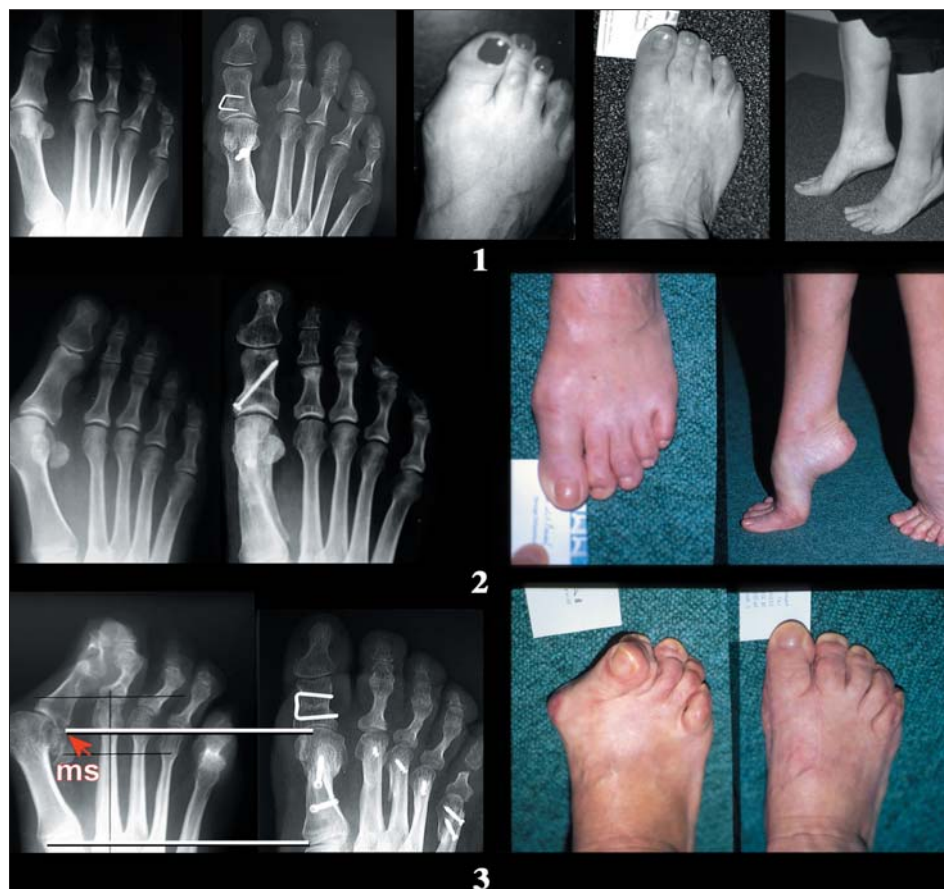


Fig. 17a. Main indications and results

Upper line. 1. Acquired hallux valgus 2. Juvenile hallux valgus
Middle line: 3.4. Iatrogenic hallux valgus, here a case of scarf on scarf
Bottom line. Rheumatoid forefoot : the M1 shortening by scarf allows to preserve the joints (this case, 4 years follow up)



Fig. 17b. Long follow up results
1. 11 years follow up. **2.** 8 years follow up. **3.** Severe deformity 7 years follow up: the shortening focused on the **ms** point has a large contribution to the long lasting result



- Nevertheless there are indications where other techniques may be competitive
- Hallux valgus where we have only to correct the DMAA –i.e. with a normal intra-metatarsal angle- in this case, the percutaneous osteotomy may be used.
- Hallux valgus with mild deformity, where the distal chevron is also competitive
- The other techniques, particularly the basal osteotomies, do not provide the same reliability than the scarf procedure.

CONCLUSION

This long and double chevron osteotomy which is the Scarf asserts itself as a gold standard among the different procedures for bunionectomy.

The scarf is not technically demanding, but needs a learning curve, which may now be short.

It has to be integrated in a whole overview on fore-foot surgery.

All along the 17 years of practice in Europe, the scarf proved its **versatility**, with its adaptation to almost all cases of hallux valgus, its **solidity**, and its **reliability**, with good results remaining in a **long term follow up** (Fig. 17b).

This article is focused on the technique, which has to be accurate in order to ensure the results. Other techniques have currently their place in bunionectomy, but the scarf remains a must, at least for severe deformities, revisions, and MTP impairment, including even rheumatoid hallux valgus.

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