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## ORIGINAL ARTICLE

# Scarf osteotomy versus metatarsophalangeal arthrodesis in forefoot first ray disorders: Comparison of functional outcomes

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## KEYWORDS

Scarf osteotomy;  
Metatarso-phalangeal arthrodesis;  
Hallux;  
Functional result;  
Sports activity;  
Quality of life;  
First ray disorders

## Summary

**Introduction:** Scarf osteotomies of the first metatarsal and metatarsophalangeal arthrodesis are the two most frequent surgical forefoot reconstructive procedures.

**Hypothesis:** We compared functional results of isolated arthrodesis of the first metatarsophalangeal joint with an isolated Scarf osteotomy of the first metatarsal.

**Materials and methods:** This was a retrospective, observational, continuous study of patients operated between 1993 and 2008. After patients who had undergone a procedure on the lateral rays, extremely elderly patients, lost to follow-up patients and those with incomplete questionnaires had been excluded, there remained two comparable groups of 25 patients. Mean age was 60 in the arthrodesis group [41–70] and 59.8 in the Scarf group [47–71]. The Scarf group included 25 hallux valgus (100%) compared to 16 hallux valgus (64%) and nine hallux rigidus (36%) in the arthrodesis group. Complications were recorded. Evaluation of functional results was based on the most recent functional or quality of life scores (AOFAS, FFI, FAAM, SF 36) and a questionnaire on physical and athletic ability.

**Results:** There was no significant difference in the rate of complications between the two groups. There was no difference in pain according to the AOFAS score with 35.6/40 ( $\pm 6.5$ ) in the Scarf group and 34.5 ( $\pm 5.9$ ) in the arthrodesis group. Global satisfaction was also similar between the Scarf and arthrodesis groups: 91.4% and 90% of very satisfied or satisfied patients, respectively. The FFI score was higher in the Scarf group than in the arthrodesis group: 8.6 ( $\pm 20.1$ ) and 19.8 ( $\pm 17.7$ ) respectively. Functional results were better in the Scarf group than in the arthrodesis group with a FAAM Daily Activity score of 80.2 ( $\pm 12.1$ ) compared to 68 ( $\pm 7.2$ ),

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a FAAM Sports Activity score of 29.7 ( $\pm 6.7$ ) compared to 25.2 ( $\pm 7.6$ ) and a FAAM Global Function score of 94% ( $\pm 10.8$ ) compared to 87% ( $\pm 15.7$ ), respectively. The Global SF36 score was higher in the Scarf group than in the arthrodesis group: 70.9% ( $\pm 14.1$ ) and 62.3% ( $\pm 20.6$ ) respectively, which was due to a higher Mental Health score in the Scarf group: 68.7% ( $\pm 14.2$ ) and 60.4% ( $\pm 19.3$ ) respectively. In the area of sports activities the Scarf group practiced more hiking than the arthrodesis group (74% versus 42% respectively). There was no difference for other activities.

*Discussion and conclusion:* This study provides detailed information on the level of physical and sports activities that are practiced following these procedures, so that the patient can be better informed.

*Level of evidence:* Level III. Comparative retrospective.

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## Introduction

The hallux plays an essential role in foot biomechanics and for propulsion during walking. Any modification due to a surgical procedure will affect foot function and the patient's quality of life. It is therefore essential to be able to describe the extent of these changes following different surgical procedures. The metatarsophalangeal joint of the hallux can become the site of degenerative osteoarthritic conditions called hallux rigidus [1]. Moreover, the hallux can also present with an acquired deformity called hallux valgus [2]. These conditions are two frequent indications for surgery of the hallux. Hallux valgus can be corrected by an osteotomy of the first metatarsal, for which numerous techniques have been described. In case of significant deformity or especially in the case of progressive osteoarthritis, arthrodesis of the metatarsophalangeal joint can also be proposed [3].

The results of these surgical procedures have been studied in traditional retrospective studies based on an analysis of radiological images and clinical function scores such as the AOFAS [4]. As a result we know the rate of complications [5], satisfaction [6], pain [7], and walking distance [8]. Nevertheless, these studies do not compare one type of surgical procedure to another. More important, these evaluations are frequently performed by the surgeon, and not obtained directly from the patient.

Our goal was to compare the functional results of surgical procedures of the foot for hallux deformities. We performed a retrospective study in patients who were operated on by the same senior surgeon (JLB), to treat hallux valgus or hallux rigidus, either by conservative treatment associating arthrolysis with a Scarf osteotomy of the first metatarsal (M1) [9], or by arthrodesis of the first metatarsophalangeal joint (MTP1) with ball and cup reamers and osteosynthesis with titanium staples [10]. To limit study bias we excluded patients who underwent associated surgery on the lateral rays. The most recent functional and quality of life scores were used.

## Materials and methods

### Patients

This was a retrospective, observational study of a continuous series of patients who underwent surgery between

1993 and 2008. The minimum follow up was 1 year after surgery. After exclusion of patients who had undergone an associated procedure on the lateral rays, there were 110 patients with 58 metatarsophalangeal arthrodeses of the hallux and 62 Scarf osteotomies of the first metatarsal. To obtain comparable groups, patients included in the Scarf M1 group underwent surgery between 2005–2008 and those in the MTP1 arthrodesis group between 1993 and 2008. After excluding lost to follow-up patients and incomplete or incorrectly completed questionnaires, we had 65 patients with 35 MTP1 arthrodeses and 30 Scarf M1 osteotomies. Because of the difference in age between the two groups, we excluded extremely elderly patients to obtain two comparable populations. Thus, there were two groups of 25 patients.

The mean age was 60 years old in the arthrodesis group [41–70] and 59.8 years old in the Scarf group [47–71]. The Scarf group included 25 hallux valgus (100%) and the arthrodesis group included 16 hallux valgus (64%) and nine hallux rigidus (36%). Mean follow up was 66.6 months ( $\pm 28$ ) in the arthrodesis group and 41.6 months ( $\pm 17.2$ ) in the Scarf M1 osteotomy group.

### Functional evaluation and quality of life scores

We recorded short, intermediate and long term complications and surgical revisions.

Evaluation of functional results was based on the AOFAS score [11], SF 36, a general quality of life score [12] and specific scores for foot pathologies: the Foot Function Index (FFI) [13], and the Foot and Ankle Ability Measure (FAAM) [14]. We also performed an in depth evaluation of the patients' ability to perform a certain number of physical and sporting activities based on a functional questionnaire developed by Bonnin [15].

This questionnaire included general items about the patients' occupational and recreational activities as well as the degree of satisfaction with surgery. It also included functional items from the AOFAS score: pain, activity limitations, walking distance and difficulty walking on different types of ground. The practice of a sports activity was evaluated by asking the person about his/her practice of 13 sports (exercise bicycle, bicycle, gymnastics, swimming, golf, gardening, dance, yoga, sailing, hiking, cross-country skiing, downhill skiing, and jogging) and pain when practicing sports. The Foot Function Index is a score that evaluates a certain number of situations in which the patient may have

**Table 1** Rate of complications in the two groups.

Types of complications	Arthrodesis Group (%)	SCARF Group (%)	Statistical significance
Pseudarthroses	3.4	0	ns
Delayed union	6.9	0	ns
Transfer metatarsalgias	3.4	6.6	ns
Recurrent hallux valgus	0	1.6	ns
Hypercorrection or faulty position	3.4	4.9	ns
Discomfort from internal fixation	1.7	1.6	ns

trouble, difficulties or feel pain. It is noted on a score of 0 (no trouble, difficulties or pain) to 10 (constant trouble, impossible to perform an action, worst pain imaginable) on a paper scale similar to a visual analogue scale. The results were presented in the form of numerical data. The FAAM scale includes 21 items on daily activities and eight items on sports activities (Appendix A). This score was validated to measure function in patients with leg, ankle and foot pathologies. It is scored from 0 (no difficulty) to 4 (impossible). It is associated with an evaluation of overall foot function (percentage 0–100). The patient then measures his/her ability to practice a sport (from 0–100) then estimates his level of functioning (from normal to very abnormal).

The SF 36 (MOS 36 item, Short Form Health Survey) was developed from the «Medical Outcome Study», which began in 1986. This questionnaire includes 36 questions, which measure a population's state of health and quality of life. The 36 items are divided into eight categories: (physical activity [PF], limitations due to a physical condition [RP], physical pain [BP], perceived health [GH], vitality [VT], life and relationships with others [SF], limitations due to a mental condition [RE] and mental health [MH]) make it possible to calculate two scores (physical health [SP] – mental health [SM]) and a global score. This score was translated and validated in several languages and has been available in France since 1998. It is used extensively for national and regional surveys, public health research and clinical research (randomized drug trials, chronic diseases and more recently orthopedic surgery). Each of the categories is evaluated with scores from 0 to 100, with 100 representing the best state of health.

The questionnaire (including functional items from the AOFAS, FFI and FAAM scores and analysis of sports activities) and the SF 36 score were sent to each patient by mail.

## Methodology and analysis

Analysis of questionnaire results was performed with JMP 7.0 (SAS®) software. Qualitative variables were introduced into contingency tables then compared among groups using the Pearson Chi<sup>2</sup> test. For quantitative variables we first confirmed a normal distribution and equal variance: if these conditions were met we used the Student *t* test. When these conditions were not met we used the Mann Whitney non parametric test. Whatever the method used, *P* < 0.05 was considered to be significant.

## Results

### Complications and surgical revisions

The rate of complications was not significantly different between the Scarf and arthrodeses groups (Table 1). Revision surgery was necessary in nine patients in the arthrodesis group, with one pseudarthrosis treated by graft, four cases of delayed union, revised by removal of internal fixation material, two corrections for faulty positioning of the arthrodesis, one removal of painful internal fixation material and one case of transfer metatarsalgia treated by Weil osteotomy of the lateral rays. Two surgical revisions were performed in the Scarf osteotomy group, one recurrent hallux valgus treated by repeat conservative surgery, one removal of an uncomfortable screw.

### Functional results and quality of life

Global satisfaction was comparable in the two groups: 91.4% (Scarf group) and 90% (arthrodesis group) of satisfied or very satisfied patients (Table 2).

**Table 2** Comparison of functional scores.

Functional score	Arthrodesis group	Scarf group	Statistical significance
Rate of satisfied or very satisfied	90%	91.4%	ns
AOFAS pain	34.5 (± 5.9)	35.6 (± 6.5)	ns
Walking distance of more than 1 km	80%	100%	<i>P</i> < 0.05
Global SF 36	62.3 (± 20.6)	70.9 (± 14.1)	<i>P</i> < 0.05
Mental health SF36	60.4 (± 19.3)	68.7 (± 14.2)	<i>P</i> < 0.05
FFI (Foot Function Index)	19.8 (± 17.7)	8.6 (± 20.1)	<i>P</i> < 0.05
FAAM daily activities	68 (± 7.2)	80.2 (± 12.1)	<i>P</i> < 0.05
FAAM sports Activities	25.2 (± 7.6)	29.7 (± 6.7)	<i>P</i> < 0.05
FAAM estimated global function	87% (± 14.7)	94% (± 10.8)	<i>P</i> < 0.05

**Table 3** Results of the second section of the Foot Function Index (FFI).

Do you have difficulty	Arthrodesis group	Scarf group	Statistical significance
Walking around your house	0	0	ns
Walking outside on uneven ground	1.7 ( $\pm$ 3.2)	0.2 ( $\pm$ 0.7)	$P < 0.05$
Walking more than 500 m	0.6 ( $\pm$ 2.4)	0.2 ( $\pm$ 0.5)	ns
Going up stairs	0.3 ( $\pm$ 1.1)	0.1 ( $\pm$ 0.4)	ns
Going down stairs	0.5 ( $\pm$ 1.3)	0.1 ( $\pm$ 0.4)	ns
Going on tiptoe	4.5 ( $\pm$ 4.2)	1 ( $\pm$ 2.5)	$P < 0.05$
Getting up from a chair	0	0	ns
Going up or down a slope	2 ( $\pm$ 3.3)	0.6 ( $\pm$ 1.6)	$P < 0.05$
Walking fast or running	3.9 ( $\pm$ 3.9)	0.5 ( $\pm$ 1.6)	$P < 0.05$

The difficulty is graded from 0 to 10 on an analogic scale (0 corresponding to no difficulty and 10 to impossible to perform the actions).

**Table 4** Comparison of functional scores by indication (Hallux valgus versus Hallux Rigidus) in the arthrodesis group.

Functional score Metatarsophalangeal arthrodesis	Hallux rigidus	Hallux valgus	Statistical significance
Satisfied or very satisfied	89%	87.5%	ns
Walking distance of 1 km	100%	94%	ns
AOFAS pain	34.4 ( $\pm$ 7.3)	33.8 ( $\pm$ 6.2)	ns
Global SF 36	69.9 ( $\pm$ 21.3)	60 ( $\pm$ 19.2)	ns
Mental health SF 36	66.4 ( $\pm$ 23.1)	57.9 ( $\pm$ 18.1)	ns
Foot Function Index	12.2 ( $\pm$ 14.8)	13.9 ( $\pm$ 18.4)	ns
FAAM daily activities	80.9 ( $\pm$ 3.5)	75.6 ( $\pm$ 7.9)	ns
FAAM sports activities	24.1 ( $\pm$ 9.1)	22.3 ( $\pm$ 6.9)	ns
FAAM estimated global function	89% ( $\pm$ 22.3)	87% ( $\pm$ 14.7)	ns

We did not find any difference in the mean AOFAS pain score (/40 points) between the Scarf group  $35.6 \pm 6.5$  and the arthrodesis group  $34.5 \pm 5.9$ . Walking distance was greater in the Scarf osteotomy group than that in arthrodesis group with 100% and 80% of patients capable of walking more than 1 km respectively.

The patients in the Scarf group had a mean global SF 36 global that was statistically higher than patients in the arthrodesis group:  $70.9 \pm 14.1$  versus  $62.3 \pm 20.6$  respectively. The score was found to be higher due to the mean

Mental Health score  $68.7 \pm 14.2$  in the Scarf group and  $60.4 \pm 19.3$  in the arthrodesis group. The Scarf group FFI was statistically better than that in the arthrodesis group:  $8.6 \pm 20.1$  versus  $19.8 \pm 17.7$  respectively (the higher the score, the greater the pain and/or difficulty) (Table 3). Functional results were better in the Scarf group than those in the arthrodesis group based on a FMM Daily Activity score of  $80.2 \pm 12.1$  versus  $68 \pm 7.2$ ; a FAAM Athletic Activity score of  $29.7 \pm 6.7$  versus  $25.2 \pm 7.6$ ; and an estimated FAAM Global Function score of  $94\% \pm 10.8$  versus  $87\% \pm 15.7$  respectively.

**Table 5** Difficulties encountered when practicing different sports activities (sports activity items – Foot and Ankle Ability Measure [FAAM] score).

Have difficulty with the following activities	None or slight difficulty	Moderate difficulty	Extreme difficulty	Other limiting factor	Statistical significance
	Arthrodesis (%) / Scarf (%)	Arthrodesis (%) / Scarf (%)	Arthrodesis (%) / Scarf (%)	Arthrodesis (%) / Scarf (%)	
Running	40/90	26/3	14/0	20/7	$P < 0.05$
Jumping	46/83	14/7	26/0	14/10	$P < 0.05$
Sudden starting and stopping	46/80	11/10	23/0	20/10	$P < 0.05$
Side steps	77/97	11/3	6/0	6/0	$P < 0.05$
Low impact sports	74/93	9/7	6/0	11/0	$P < 0.05$
Performing usual activities normally	69/80	14/13	6/3	11/3	$P < 0.05$
Going down the stairs	97/90	3/10	0/0	0/0	ns
Practicing usual sports at the same level and for the same length of time	57/77	20/30	1/0	14/10	ns

**Table 6** Types of sports activities according to the type of surgery.

Sports practiced	Arthrodesis group (%)	Scarf group (%)	Statistical significance
Exercise bicycle	30	49	ns
Bicycle	31	37	ns
Gymnastics	34	47	ns
Swimming	40	47	ns
Golf	11	0	ns
Gardening	43	37	ns
Dance	34	30	ns
Sailing	14	3	ns
Hiking	43	73	$P < 0.05$
Tennis	14	13	ns
Cross country skiing	11	20	ns
Downhill skiing	11	23	ns
Jogging	11	14	ns

In the MTP1 arthrodesis group, the hallux rigidus and hallux valgus subgroups had identical results for satisfaction, walking distance, pain, global function FFI, FAAM and SF 36. (Table 4).

### Sports activities

The patients in the Scarf group did more hiking (74%) than those in the arthrodesis group (42%). There was no statistically significant difference in the other activities evaluated (Tables 5 and 6), but results were at the limit of significance in favor of the Scarf group for exercise bicycle, gymnastics, cross-country and downhill skiing and jogging.

### Discussion

Even if satisfaction is the same for the two types of surgery, functional results were better in patients who underwent a Scarf osteotomy of the 1st metatarsal than in those who underwent arthrodesis of the metatarsophalangeal joint of the hallux.

This is the first study to compare the results of arthrodesis of the hallux and conservative surgery with a Scarf osteotomy based on detailed functional criteria, quality of life, and sports ability. There is no interpretation bias since the patients filled out the questionnaires by themselves without the surgeon's participation. We evaluated two surgical procedures of the hallux, but there are many other conservative procedures and different arthrodesis techniques for hallux deformities. Nevertheless it would be difficult to compare all these techniques at the same time unless a multicenter study was performed.

There are certain limitations to this study. Because the two procedures were not indicated with the same frequency, the inclusion period was different for each procedure. To have a comparable mean age in each group we excluded certain questionnaires, and the small number of patients in each group decreases the statistical power of the results. This study is only based on a questionnaire, making it impossible to compare functional results with preoperative

scores. The pathologies leading to surgery were different in the two groups, which could have created an important bias. However, we did not find any difference in functional results between hallux valgus and hallux rigidus in the arthrodesis group. In the same way Van Doeselaar et al. [16] did not find any difference between the hallux valgus and hallux rigidus groups when evaluating arthrodesis for hallux pathologies by the FFI score. We can therefore consider that the surgical procedure is the only variable that affects functional results.

The rate and types of complications are comparable to those found in the literature for each type of surgery. A faulty position is reported in 3 to 20% of cases of arthrodesis [6], overloading of the interphalangeal joint in 5 [7] to 17% [8] and pseudarthrosis in 0 [7,8] to 8% [17]. Hammel et al. [18] reported surgical site infections in 0.8% of Scarf M1 osteotomies, delayed union in 5.7%, significant stiffness in 1.3% at 1 year, secondary displacement in 1.1%, broken internal fixation material in 0.4% and indications for revision surgery for recurrent hallux valgus in 0.2%.

The rate of satisfied patients was comparable for Scarf osteotomy (91.4%) and MTP1 arthrodesis (90%), and these rates are comparable to those found in all recent series [17,19–21]. Function after MTP1 arthrodesis was found to be globally satisfying and durable in a study by Groulier et al. [6]. Most series of Scarf osteotomy and MTP1 arthrodesis use the AOFAS score to evaluate functional criteria by comparing global preoperative and postoperative scores: the increase is comparable in all series with a gain of approximately 30 points [4,19,22–25]. Nevertheless, the score items are not usually listed in detail. Because our study with the questionnaire does not include a clinical evaluation, a global AOFAS score could not be provided, however the subjective items are all given in detail, so that a more detailed comparison of the results is possible. In a cohort of 49 MTP1 arthrodeses evaluated at 3, 6, and 12 months, Poggio et al. [25] showed that the global AOFAS score progressed for 1 year while pain improved for 6 months; this supports our choice to evaluate patients at least 1 year after surgery.

We did not find any difference in pain between the two populations during daily or recreational activities. Thus 94.3% (Scarf M1 group) and 96.7% (arthrodesis MTP1 group)

had no pain or occasional moderate pain, which corresponds to published results [4,8]. The AOFAS results for walking distance were better with osteotomy; 100% of the osteotomy patients had an unlimited walking distance, compared to 80% of the patients with arthrodesis. A limitation in walking distance was found in 10 to 15% patients with arthrodesis in other studies [7,8]. Moreover, patients who underwent an osteotomy had less difficulty on irregular terrain or climbing, which explains why a greater proportion practiced an activity such as hiking.

In the present study functional results following Scarf osteotomy were shown to be better than those following metatarsophalangeal arthrodesis of the hallux based on the AOFAS and FFI scores, which has never been studied in the literature. Only one study [16] has used the FFI score to evaluate patients who underwent surgery of the forefoot: Van Doeselaar did not find any difference between the hallux valgus and the hallux rigidus groups who underwent MTP1 arthrodesis. The FFI score improved by 30 points and went from 38 to 8 in both groups.

The recently published FAAM score has not yet been used to evaluate surgery of the forefoot. Our study is therefore a reference because it shows better results with Scarf osteotomy than with MTP1 arthrodesis.

Only the study by Flavin and Stephens [26] used the SF36 score and shows an improvement in the global score after arthrodesis of the first metatarsophalangeal joint.

Finally in relation to specific physical activities, although the possibility of walking on tip toe is considered to be possible in 85% of patients in both groups, our study shows FAAM and FFI scores that are better for osteotomy for this action, as well as for sudden changes in speed, taking an hill and being able to run or to crouch.

We did not find any studies in the literature which provided an in depth analysis of the sports capacities of patients after these two types of surgery. Brodsky et al. [8] is the only study to report that 86% of golfers and 92% of hikers were able to return to their leisure activities without limitation after MTP1 arthrodesis.

## Conclusion

This study clarifies the functional results that can be expected following a Scarf osteotomy of the 1st metatarsal and arthrodesis of the metatarsophalangeal joint of the hallux and provides the patient with specific information on the expected quality of life, in particular in relation to physical and sports activity, depending on the surgical procedure performed. The results suggest that conservative surgery of the hallux by Scarf osteotomy of the metatarsal is preferable in patients for whom both indications are possible or in young patients to obtain the best possible functional results. Moreover, because the validity of the AOFAS score is increasingly criticized [27], quality of life scores such as the FAAM or SF 36 can be used before foot surgery and at surgical revision to effectively evaluate the surgical procedures.

## Disclosure of interest

R. Demarchelier: no conflict.

J.-L. Besse: consultant for Biotech-International; royalties for Surgefoot.

M.-H. Ferry: no conflict.

## Appendix A. Foot and Ankle Ability Measure (FAAM) score items.

### Foot Consultation: FAMM score

#### Daily Activities

Respond to each question with a number from 0-4 (4 no problem, 0 impossible). Leave at -1 if your limitation is due to something else besides your ankle or foot

- |  |  |   |   |
|--|--|---|---|
| Stand up <input type="checkbox"/>        | Walk on flat ground <input type="checkbox"/>   | Walk on flat ground barefoot <input type="checkbox"/> | Walk on an incline <input type="checkbox"/>     |
| Go down a hill <input type="checkbox"/>  | Go up stairs <input type="checkbox"/>          | Go downstairs <input type="checkbox"/>                | Walk on an incline <input type="checkbox"/>     |
| Take a sidewalk <input type="checkbox"/> | Crouch <input type="checkbox"/>                | Go on tiptoe <input type="checkbox"/>                 |   |
| Begin walking <input type="checkbox"/>   | Walk less than 5 min. <input type="checkbox"/> | Walk 10 min. <input type="checkbox"/>                 | Walk more than 15 min. <input type="checkbox"/> |

Do you have difficulty with the following because of your foot or ankle

- |   |   |                                  |   |
|---|---|----------------------------------|---|
| House cleaning <input type="checkbox"/>   | Daily activities <input type="checkbox"/> | Washing <input type="checkbox"/> | Light work (standing or walking) <input type="checkbox"/> |
| Hard work (pushing, pulling, climbing, carrying heavy objects) <input type="checkbox"/> |   |                                  | Leisure activities <input type="checkbox"/>               |

How would you evaluate on a scale of 0-100, your level of daily activity compared to the level you had before you presented with your foot or ankle problem. 100 is your former level, 0 is if you cannot do anything.

#### Sports Activity

- |   |   |   |
|---|---|---|
| Ability to run <input type="checkbox"/>   | Ability to jump <input type="checkbox"/>            | Ability to land after jumping <input type="checkbox"/>        |
| Starting and stopping quickly <input type="checkbox"/>                          | Lateral, scissor movements <input type="checkbox"/> | Low impact activities <input type="checkbox"/>                |
| Practice a sport at the same technical level as before <input type="checkbox"/> |   | Practice a sport as long as you wish <input type="checkbox"/> |

Overall how do you evaluate your level of activity today

Total FAMM daily activity

Total FAMM overall activity

Total FAMM Sports

## References

- [1] Coughlin MJ, Shurnas PS. Hallux rigidus: demographics, etiology, and radiographic assessment. *Foot Ankle Int* 2003;24:731–43.
- [2] Valtin B. Hallux valgus: introduction. In: Leemrijse TH, Valtin B, editors. *Pathologie du pied et de la cheville*. Paris: Elsevier Masson ed; 2009. p. 100–2.
- [3] Curvale G. Traitement chirurgical de l'hallux rigidus. *Rev Chir Orthop Reparatrice Appar Mot* 1997;85:35–54.
- [4] Kristen KH, Berger C, Stelzig S, Thalhammer E, Posch M, Engel A. The Scarf osteotomy for the correction of hallux valgus deformities. *Foot Ankle Int* 2002;23:221–9.
- [5] Coetzee JC. Scarf osteotomy for hallux valgus repair: the dark side. *Foot Ankle Int* 2003;24:29–33.
- [6] Groulier P, Curvale G, Piclet-Legre B, Kelberine F. L'arthrodèse de la première métatarso-phalangienne. *Rev Chir Orthop Reparatrice Appar Mot* 1994;80:436–44.
- [7] Tourne Y, Saragaglia D, Zattara A, Maire JP, Picard F, Montbarbon E, et al. Hallux valgus in the elderly: metatarsophalangeal arthrodesis of the first ray. *Foot Ankle Int* 1997;18:195–8.
- [8] Brodsky JW, Passmore RN, Pollo FE, Shabat S. Functional outcome of arthrodesis of the first metatarsophalangeal joint using parallel screw fixation. *Foot Ankle Int* 2005;26:140–6.
- [9] Besse JL, Maestro M. Ostéotomie SCARF du 1er métatarsien (technique opératoire). *Rev Chir Orthop Reparatrice Appar Mot* 2007;93:515–23.
- [10] Besse JL, Chouteau J, Laptoiu D. Arthrodesis of the first metatarsophalangeal joint with ball and cup reamers and osteosynthesis with pure titanium staples. Radiological evaluation of a continuous series of 54 cases. *Foot Ankle Surg* 2010;16:32–7.
- [11] Kitaoka HB, Alexander IJ, Adelaar RS, Nunley JA, Myerson MS, Sanders M. Clinical rating systems for the ankle-hindfoot, midfoot, hallux, and lesser toes. *Foot Ankle Int* 1994;15:349–53.
- [12] Leplege A, Ecosse E, Verdier A, Perneger TV. The French SF-36 Health Survey: translation, cultural adaptation and preliminary psychometric evaluation. *J Clin Epidemiol* 1998;51:1013–23.
- [13] SooHoo NF, Samimi DB, Vyas RM, Botzler T. Evaluation of the validity of the Foot Function Index in measuring outcomes in patients with foot and ankle disorders. *Foot Ankle Int* 2006;27:38–42.
- [14] Martin RL, Irrgang JJ, Burdett RG, Conti SF, Van Swearingen JM. Evidence of validity for the Foot and Ankle Ability Measure (FAAM). *Foot Ankle Int* 2005;26:968–83.
- [15] Bonnin. Functional outcomes following total ankle arthroplasty. *Eur Musculoskelet Rev* 2007;2:1–4.

- [16] Van Doeselaar DJ, Heesterbeek PJ, Louwerens JW, Swierstra BA. Foot function after fusion of the first metatarsophalangeal joint. *Foot Ankle Int* 2010;31:670–5.
- [17] Goucher NR, Coughlin MJ. Hallux metatarsophalangeal joint arthrodesis using dome-shaped reamers and dorsal plate fixation: a prospective study. *Foot Ankle Int* 2006;27:869–76.
- [18] Hammel E, Abi Chala ML, Wagner T. Complications of first ray osteotomies: a consecutive series of 475 feet with first metatarsal Scarf osteotomy and first phalanx osteotomy. *Rev Chir Orthop Reparatrice Appar Mot* 2007;93:710–9.
- [19] Kerr HL, Jackson R, Kothari P. Scarf-Akin osteotomy correction for hallux valgus: short-term results from a district general hospital. *J Foot Ankle Surg* 2010;49:16–9.
- [20] Adam SP, Choung SC, Gu Y, O'Malley MJ. Outcomes after scarf osteotomy for treatment of adult hallux valgus deformity. *Clin Orthop Relat Res* 2011;469:854–9.
- [21] Kumar S, Pradhan R, Rosenfeld PF. First metatarsophalangeal arthrodesis using a dorsal plate and a compression screw. *Foot Ankle Int* 2010;31:797–801.
- [22] Jones S, Al Hussainy HA, Ali F, Betts RP, Flowers MJ. Scarf osteotomy for hallux valgus. A prospective clinical and pedobarographic study. *J Bone Joint Surg Br* 2004;86:830–6.
- [23] Aminian A, Kelikian A, Moen T. Scarf osteotomy for hallux valgus deformity: an intermediate followup of clinical and radiographic outcomes. *Foot Ankle Int* 2006;27:883–6.
- [24] Bock P, Lanz U, Kröner A, Grabmeier G, Engel A. The Scarf osteotomy: a salvage procedure for recurrent hallux valgus in selected cases. *Clin Orthop Relat Res* 2010;468:2177–87.
- [25] Poggio D, de Retana PF, Borda D, Hortua P, Asunción J, Rios J. Analysis of the clinical score progressions during the first year after first MTPJ fusion. *Foot Ankle Int* 2010;31:578–83.
- [26] Flavin R, Stephens MM. Arthrodesis of the first metatarsophalangeal joint using a dorsal titanium contoured plate. *Foot Ankle Int* 2004;25:783–7.
- [27] Pinsker E, Daniels TR. AOFAS position statement regarding the future of the AOFAS Clinical. *Foot Ankle Int* 2011;32:841–2.