



## Comparison of Arthrodesis, Resurfacing Hemiarthroplasty, and Total Joint Replacement in the Treatment of Advanced Hallux Rigidus

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### ABSTRACT

The purpose of the present study was to compare the functional results of arthrodesis, resurfacing hemiarthroplasty, and total joint replacement in hallux rigidus. The data from patients treated from 2006 to 2010 for advanced stage hallux rigidus were retrospectively reviewed. A total of 38 patients who had at least 2 years (range 24 to 66 months, mean 31.1) of follow-up were included in the present study. Of the 38 patients, 12 were included in the total joint replacement group (group A), 14 in the resurfacing hemiarthroplasty group (group B), and 12 in the arthrodesis group (group C). At the last follow-up visit, the functional outcomes were evaluated using the American Orthopaedic Foot and Ankle Society-Hallux Metatarsophalangeal Interphalangeal (AOFAS-HMI) scale, visual analog scale (VAS), and metatarsophalangeal range of motion. Significant improvements were seen in the AOFAS-HMI score, with a decrease in the VAS score in all 3 groups. According to the AOFAS-HMI score, no significant difference was found between groups A and B. However, in group C, the AOFAS-HMI scores were significantly lower than in the other groups owing to the lack of motion. According to the final VAS scores, no significant difference was found between groups A and B; however, the VAS score had decreased significantly more in group C than in the other groups. No major complications occurred in any of the 3 groups. After 2 years of follow-up, all the groups had good functional outcomes. Although arthrodesis is still the most reliable procedure, implant arthroplasty is also a good alternative for advanced stage hallux rigidus.

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Hallux rigidus (HR) is a common degenerative foot disease characterized by pain and decreased range of motion (ROM) in the first metatarsophalangeal (MTP) joint (1,2). HR was firstly described by Davies-Colley (3) in 1887; later, the term was coined by Cotterill (4). The pathogenesis of HR has not been clearly defined; however, trauma, repetitive microtrauma, a long first metatarsus, and inappropriate shoe wear have been proposed as causative factors. The main physical findings include pain in the lift-off phase of gait, MTP swelling, and restriction of dorsiflexion (5). Radiographic examination with weightbearing anteroposterior and lateral radiographs are useful in observing the narrowing of the joint space, dorsal osteophyte formation, and flattening of the metatarsal head (5).

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The Coughlin and Shurnas grading system is the most commonly used (5). The disease is graded from 0 to 4 according to the MTP joint ROM and clinical and radiologic findings (5) (Table 1).

In the treatment of early-stage HR, conservative methods such as shoe modification, oral anti-inflammatory drugs, and intra-articular injections can be effective. In those for whom conservative treatment has failed, plantar fascia release, cheilectomy, and decompressive osteotomy can be effective (6). However, management of advanced stage disease (stage 3 and 4) remains controversial. For these patients, resection interposition arthroplasty, proximal phalanx or metatarsal head resurfacing hemiarthroplasty, total joint replacement (TJR), and arthrodesis have been used (7–13). In the treatment choice, the patient's age, activity level, expectations, previous treatment, and radiographic and clinical findings should be considered (14).

Resection interposition arthroplasty could be the treatment of choice for low functional capacity older patients who do not wish to undergo arthrodesis (10,15).

**Table 1**  
Coughlin and Shurnas (5) classification

Grade	Narrowing	Pain	Restriction
0	Normal	None	Stiffness or slight loss
1	Minor narrowing of MTP joint space	Intermittent	Mild restriction
2	Moderate joint space narrowing, osteophyte formation	More constant	Moderate restriction
3	Severe joint space narrowing, extensive osteophyte formation	Constant (no pain at midrange of MTP joint motion)	Moderately severe restriction (<20° total motion)
4	Same as grade 3	Pain at midrange of passive MTP joint motion	Same as grade 3

Abbreviation: MTP, metatarsophalangeal.

In advanced stage HR, arthrodesis has been accepted as the reference standard treatment (12,16,17). The diseased cartilage and spurs are removed from the joint, and a stable osteosynthesis provides union with a less than 5% complication rate (5,18). Although this procedure has a high success rate in pain relief and restoration of function, it has some disadvantages, including the loss of joint motion, shoe wearing problems, a long recovery period, and metatarsalgia due to inappropriate alignment (12,16,17). Although the function and pain levels improve, patients could be concerned about the potential limitations in sports participation and physical activity.

Implant arthroplasty is another alternative for patients with advanced stage HR (19,20). Although TJR remains the ultimate solution for the hip and knee, replacement of the MTP joint has not been established as a standard of care for HR. Implant arthroplasty of this joint has been used in orthopedic surgery for the past 60 years; however, good postoperative outcomes have been achieved only in the past 10 years. Early on, the flexible hinged silicone prosthesis had early success in relieving symptoms. However, the high failure rates have limited the use of these Silastic first-generation implants because of the high shear forces on the prosthetic hinge (21). To solve these problems, double-stem silicone implants with titanium grommets were designed (22). Despite these improvements, the potential effects of silicone debris leading to foreign body reactions, synovitis, and bone erosion in the hallux persisted (17). Vanore et al (23) announced the first TJR systems that have 2-component, nonconstrained articulations in 2003. Subsequently, better results were obtained with the new implants (17). However, problems such as subluxation, infection, and early loosening still exist (24).

With the evolution of new designs and biomaterials, resurfacing has become a good alternative for the treatment of HR (13,19,20,25). The encouraging clinical outcomes with resurfacing implants in the

other joints have led to the use of phalangeal and metatarsal resurfacing arthroplasty. In patients with advanced stage HR, for whom conservative methods have failed, resurfacing arthroplasty can also be a good surgical option with painless and stable MTP motion. Moreover, this procedure provides deformity correction without changing the length of the first metatarsus.

Recently TJR, metatarsal resurfacing hemiarthroplasty, and arthrodesis have become prominent in the treatment of HR. To the best of our knowledge, no study has compared all 3 methods. The purpose of the present study was to compare the mid-term functional results of 3 different surgical treatment methods for patients with grade 3 to 4 HR.

#### Patients and Methods

From 2006 to 2010, the data from patients who underwent surgery for grade 3 to 4 HR were retrospectively reviewed, and 38 patients with at least 2 years of follow-up (range 24 to 66 months, mean 31.1) were included in the present study. Of the 38 patients, 12 underwent TJR (group A), 14 underwent metatarsal head resurfacing hemiarthroplasty (group B), and 12 underwent MTP arthrodesis (group C).

The patients were treated by 4 surgeons (1 professor and 3 assistant professors) at 2 different hospitals (M.E., 13 patients; O.F.E., 12 patients; K.B., 3 patients; and C.S., 10 patients). The follow-up data were obtained by 3 of the surgeons (M.E., O.F.E., K.B.). The operation reports from the computerized database and charts were reviewed for the exclusion and inclusion criteria for the study by the 4 surgeons (M.E., O.F.E., K.B., G.P.). The procedure was chosen by the 4 surgeons in accordance with their experience and patient choice. The patients underwent the final follow-up examination, the mean follow-up duration and the patients' functional assessment, visual analog scale (VAS) scores, and MTP ROM were recorded. No statistically significant differences were present among the 3 groups in age, gender or clinical and radiographic findings (Table 2).

All patients were informed in detail about the surgical intervention, and all patients signed an informed consent form concerning the operative technique to be performed.

The functional outcomes were evaluated using the AOFAS-HMI scale, VAS score, and MTP ROM (26).

**Table 2**  
Overall results for patients who underwent surgery for grade 3 to 4 hallux rigidus (N = 38 patients)

Variable	Total	Group A (TJR)	Group B (metatarsal head resurfacing hemiarthroplasty)	Group C (arthrodesis)
Patients (n)	38	12	14	12
Gender				
Female	27	8	9	8
Male	11	4	5	4
Mean age ± SD (y)	59.18	61.42 ± 7.45	58.14 ± 6.13	58.17 ± 8.45
Side				
Right	20	8	7	5
Left	18	4	7	7
Grade*				
III	5	2	2	1
IV	33	10	12	11
Tourniquet time (min)				
Mean	48.44	58.16	38.42	50.41
Range	30–71	50–71	30–60	43–66
Follow-up (mo)				
Mean	31.10	27.91	30.21	35.33
Range	24–66	24–41	24–42	24–66

Abbreviations: SD, standard deviation; TJR, total joint replacement.

\* Coughlin and Shurnas (5) classification.

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