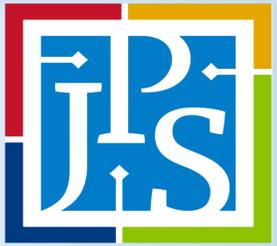


Total Metatarsophalangeal Joint Implant Arthroplasty For Hallux Rigidus, a Short Term Follow Up



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Statement of Purpose

Treatment options for late stage degenerative joint disease of the first metatarsophalangeal joint (MPJ) remain controversial. The purpose of this study was to investigate the short-term outcomes of patients who had undergone total first MPJ arthroplasty.

Methodology And Hypothesis

Summary:

This retrospective study was conducted evaluating patients who underwent first MPJ total arthroplasty. 14 consecutive implantations were performed by a single senior author A.G. at our institution between 2014-2017. The American Orthopedic Foot and Ankle Society (AOFAS) metatarsophalangeal clinical rating system was utilized to quantify our patient's pre- and postoperative assessment, along with a satisfaction questionnaire.¹

Follow-up was conducted by 2 authors B.B and B.R. via telephone interview. AOFAS scores and satisfaction information was obtained. Questions comprised of: "Based on your experience, would you have the surgery again?", "Would you recommend this surgery to a friend?", "How often do you need medication for toe pain?", "Have you required repeat surgery to the affected toe?"

Inclusion Criteria:

- Hallux Rigidus Grade II or Grade III:
 - Grade II: moderate osteophytes with joint space narrowing and subchondral sclerosis.²
 - Grade III: marked osteophytes, loss of joint space, and possible subchondral cysts.²
- Osteoarthritis noted to base of proximal phalanx and metatarsal head.
- Previous first MPJ surgery, history of trauma

Exclusion Criteria:

- Lack of response via phone call or by mail.
- Patients with osteoporosis, history of septic arthritis or osteomyelitis to first MPJ.

Hypothesis:

We hypothesize that first MPJ total implant arthroplasty will yield favorable short term results.



Figure 2. Post-operative radiographic images with total MPJ implant

Procedures

Total First MPJ Prosthesis:

- Cobalt-chromium metatarsal articular component with a titanium taper post and a titanium phalangeal component with ultra high molecular weight polyethylene (Figure 2).

Surgical Technique:

- Dorsomedial incision was performed along the first MPJ extending from the interphalangeal joint to three cm proximal to the MPJ. Extensor tendon was retracted laterally with a linear capsulotomy. An elevator was used to free up adhesions between the sesamoids and metatarsal head.
- Metatarsal Component (Figure 1A): Guide pin was placed in the central region of the metatarsal head, 1 to 2 mm plantarly in the sagittal plane. A step drill was used and advanced flush with the articular surface. This was drilled at full speed before contract with the metatarsal to avoid shattering the bone or articular surface followed by a manual tap. Taper post was advanced over the guidewire. All joints were decompressed 1-3 mm by advancement of the post. After reaming the metatarsal head, the sizing trial was fit into the post. Periarticular osteophytes were debrided.
- Phalangeal Component: Guide pin was placed centrally within the base of proximal phalanx, area was reamed flush to the articular surface followed by a manual tap. Place fixation post, use insert trails for appropriate sizing. Place phalangeal insert and perform final range of motion evaluation (Figure 1B,C and Figure 2).

Postoperative Protocol:

- Protected weight bearing in a post-operative shoe immediately. Passive range of motion exercises.
- Weight bearing, normal gait without a shoe at 48 hours.
- Active range of motion exercises, return to normal shoe gear and normal activity once the skin was healed.

Literature Review

Hallux rigidus describes osteoarthritis that progressively affects the great toe at the metatarsophalangeal joint (MPJ) causing reduced range of motion (ROM) and decreased function.³⁻⁵ Surgery is indicated if conservative methods fail to relieve pain.⁴

Treatments for symptomatic hallux rigidus vary depending on the severity of the arthritis, patient age and physical depends on the patient. Treatments include cheilectomy, excisional arthroplasty, interposition arthroplasty, phalangeal osteotomy and first metatarsal osteotomy for early to intermediate staged hallux rigidus. Implant arthroplasty, and arthrodesis are reserved for advanced stages of the condition.⁵

Literature Review

According to current published literature, there is not a gold standard for treatment of advanced hallux rigidus, although controversy exists among arthrodesis versus implant arthroplasty. Arthrodesis of the first MPJ has been the reference standard due to its consistency, and durability.⁶⁻⁷ Alternatively, total first MPJ implant arthroplasty has been described as a viable option with minimal bone resection and preservation of MPJ mobility⁷⁻⁸.

Several studies have investigated total first MPJ implant arthroplasty with various systems exemplifying an effective treatment option for severe hallux rigidus.⁸⁻¹⁵

- Daniilidis et al reported a significant improvement in a mean AOFAS score of 82.5 at 18 months for 23 patients who received a total MPJ arthroplasty. This study concluded that total arthroplasty for the treatment of hallux rigidus in an active patient population revealed good clinical and functional results.⁸
- Fuhrmann et al found significant improvements among both hemiarthroplasty and total MPJ replacement evident in the AOFAS scores, and the VAS scores. No significant difference was evident between the two groups.¹²
- Hilario et al evaluated hemi-arthroplasty 10 years postoperatively for a total of 32 patients and a mean AOFAS score of 93.7.¹³
- Erdil et al compared total joint arthroplasty, arthrodesis, and MPJ resurfacing arthroplasty. Their results showed improvements in AOFAS scores and visual analog scale (VAS) scores in all 3 categories. The arthrodesis group had lower AOFAS scores due to lack of motion; however, it also had a significant increase in the VAS scores.¹⁴

Results

Total first MPJ implant arthroplasty was performed on 14 patients between 2014-2017. Of the 14 surgeries, 3 were lost to follow-up, for a 78.6% short term follow-up rate at a mean of 18 months. 100% of the patients were female with an average age of 59.7 years old (range 46-74 years).

The mean pre- and postoperative AOFAS scores respectively were 44.18 ± 15.92 and 80.09 ± 15.14. The most common reduction in scores was due to decreased MPJ range of motion (ROM). 100% of patients reported optimum MPJ stability post-operatively.

Two out of the 11 patients were originally converted from a hemiarthroplasty to a total first MPJ implant. One of the 11 patients underwent a revisional surgery to the same joint, converting the total first MPJ implant to an arthrodesis. This patient had a previous first metatarsal osteotomy non-union prior to implant placement, with a history of chronic pain.

Of the total patient population, 72% would recommend the surgery to a friend and 82% would have the procedure again. Additionally, 82% of patients deny requiring pain medication for their surgical site. The one patient requiring additional surgery requested a pain management referral. Results are summarized in Table 1.

Table 1	Mean		SD	
	Pre- Op	Post- Op	Pre-Op	Post-Op
Pain (40)	10.9	33.6	10.4	8.1
Function (45)	25.5	35.3	16.2	11.7
- Activity (10)	5.0	8.5	3.2	2.5
- Footwear (10)	5.9	7.3	2.0	2.6
- MPJ Range of Motion (10)	4.1	5.5	3.8	3.5
- IPJ Range of Motion (5)	3.6	4.5	2.3	1.5
- Stability (5)	3.2	5.0	2.5	0.0
- Callous Present (5)	3.6	4.5	2.3	1.5
Alignment	7.6	11.0	6.7	6.1
Total	44.18	80.09	15.92	15.14

Table 1. Mean and Standard Deviation (SD) of short term AOFAS scores.

Analysis and Discussion

Surgical management of late stage hallux rigidus remains controversial. Our results support total implant arthroplasty as a viable treatment option. Previous publications investigating alternative surgical treatment options for hallux rigidus, such as hemi-implantation and arthrodesis, concluded similar post-operative AOFAS scores.^{8, 12-14} Our patients showed a high mean AOFAS score after 18 month follow up with a very low re-operation rate and no serious complications. In comparison to arthrodesis, implant arthroplasty allows preserved MPJ mobility (Figure 3B), increased options for shoe gear, for example the ability to wear high heels (Figure 3A), and return to activities or an occupation that require kneeling/squatting.

Our study displays that patients with arthritis affecting the base of the proximal phalanx of the first MPJ, can achieve similar results compared to those who receive a hemi-implant or arthrodesis for localized first metatarsal head arthritis. In conclusion, total first MPJ implant arthroplasty is a viable alternative for surgical treatment of moderate to severe hallux rigidus with preservation of joint motion and the ability to advance to salvage arthrodesis if revisional surgery is indicated.

- Limitations: Short term follow-up, 78.6% follow-up rate, final interview was conducted over the phone only.

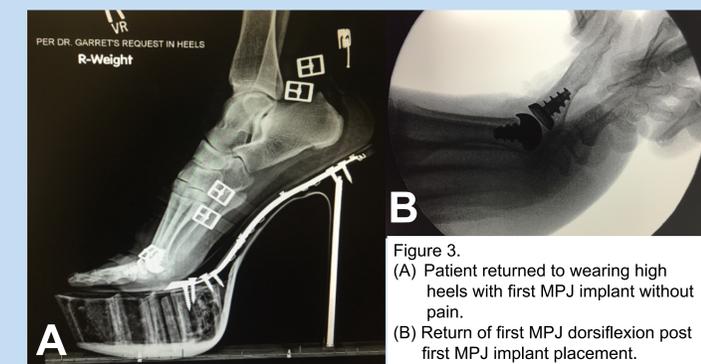


Figure 3. (A) Patient returned to wearing high heels with first MPJ implant without pain. (B) Return of first MPJ dorsiflexion post first MPJ implant placement.

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Figure 1. (A) Intra-operative first metatarsal head preparation for implant. (B) Total first MPJ replacement (C) First MPJ increased dorsiflexion range of motion with total implant arthroplasty.