

## **Podiatry Today**

### **Point-Counterpoint: Hallux Rigidus Surgery In Active Adults: Implant Arthroplasty Or First MPJ Arthrodesis?**

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Arthroplasty.

This author notes positive results with metatarsal head resurfacing and points out that many active patients reject the first MPJ arthrodesis option due to concern about loss of joint mobility.

By Brian Carpenter, DPM, FACFAS

The hallux is the most common area for arthritis in the foot and hallux rigidus affects one out of 40 patients older than age 50.<sup>1</sup> There is controversy about the treatment of advanced stages of hallux rigidus. Despite inherent disadvantages associated with the procedure, many authors have advocated arthrodesis. While joint fusion is only accepted as a salvage procedure in other joints, physicians have touted metatarsophalangeal joint (MPJ) arthrodesis partly due to the mixed results of surgical alternatives such as total joint replacement or phalangeal based hemi-arthroplasty.<sup>2-5</sup>

Although one can achieve reproducible pain control with arthrodesis, many patients do not accept the loss of mobility, which is especially true of patients with an active lifestyle or profession. When active patients are confronted with treatment options for advanced stages of hallux rigidus, many reject surgical treatment via arthrodesis.

Patient education is crucial, given that some patients do not understand terms like “fusion” or “arthrodesis.” This misunderstanding can result in a postoperative surprise when the joint is “permanently stiff.” Accordingly, one needs to convey to patients that fusion of the joint is an end stage procedure, which has been associated with many other complications including non-union, progressive degeneration of adjoining joints, restrictions in shoe wear, hardware failure and an extended postoperative recovery time.<sup>6-8</sup>

#### **What The Research Reveals About Implant Arthroplasty And Metatarsal Head Resurfacing**

In a meta-analysis, Cook and colleagues noted high patient satisfaction in over 3,000 first MPJ implant arthroplasty procedures with a mean 61.48 month follow-up.<sup>9</sup> The authors noted that 85.7 percent of patients were satisfied with the procedure. When adjusting for lower quality studies with less than five years’ follow-up, this satisfaction rate increased to 94.5 percent.

A majority of patients presenting with hallux rigidus have numerous degrees of cartilage defects that primarily involve the metatarsal head. In 2004, surgeons started using metatarsal head resurfacing in order to preserve the joint, address pain and improve the limitations in range of motion associated with the pathology.<sup>10</sup>

The HemiCAP Metatarsal Head Resurfacing system (Arthrosurface) features a titanium tapered cannulated screw and a cobalt chrome articular component. Hasselman and

Shields discussed the results of metatarsal head resurfacing from the first series of patients.<sup>11,12</sup> After a mean follow-up of 20 months, the range of motion of the joint in 25 patients increased postoperatively by 42 degrees. The patients' mean American Orthopedic Foot and Ankle (AOFAS) score was 82.1 while the SF-36 questionnaire score was 96.1. All patients were satisfied with the results and indicated they would have the surgery again.

Hasselmann and colleagues contacted patients from the initial series of 30 implants (26 patients, four bilateral) and used a questionnaire to assess patients' current symptoms and satisfaction five years after the procedure.<sup>13</sup> All patients reported continued excellent satisfaction, with none indicating that they were "limited daily" or had "severe limitations" in their daily and recreational activities. The implant survivorship was 88 percent at five years.

Out of the initial patient series of 30 implants, there were four revision procedures (including a patient who had bilateral procedures).<sup>13</sup> All four revisions were indicated due to phalangeal pathology and occurred at the three-year mark. All metatarsal head implants were well incorporated without any signs of loosening.

SanGiovanni and co-workers studied 36 patients who had undergone metatarsal head resurfacing.<sup>14</sup> A 45-month follow-up revealed good to excellent results in 76 percent of patients and a satisfaction rate of 80 percent. In a larger group of 56 patients, there was no significant evidence of loosening, according to radiographic assessment. Researchers concluded that the implant appeared to show superior radiographic results in comparison to results from other metallic implants that utilize a stemmed design.

In 2010, a study by Carpenter and colleagues focused on a series of 30 patients (32 procedures) with an average age of 62.8 years who received the HemiCAP implant for grade II and grade III hallux rigidus.<sup>15</sup> The mean change from baseline for the AOFAS score was 236.8 percent, according to midterm results measured at 27.3 months. All patients indicated satisfaction with the results and said they would undergo the procedure again if necessary.

At two to five years' follow-up, clinical results show a high rate of patient acceptance and satisfaction.<sup>15</sup> Pain relief and patient activity ratings support the concept of a resurfacing treatment that preserves mobility. The implant screw fixation is a key benefit of the implant system, given the previous reports on the loosening associated with other arthroplasty procedures.

### **Final Notes**

With two to five years of follow-up, clinical and radiographic results of the metatarsal head resurfacing system have been encouraging. Researchers have reported high patient satisfaction as well as promising functional improvement and pain relief. The arthroplasty procedure permits preservation of joint mobility in the advanced stages of hallux rigidus and is a viable alternative to arthrodesis, which continues to provide an effective clinical exit strategy as a salvage procedure.

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Editor's note: For related articles, see "A Guide To First MPJ Head Resurfacing" in the August 2008 issue of *Podiatry Today* or "Metatarsal Head Resurfacing: Does It Have A Place In Treating Hallux Limitus/ Rigidus?" in the January 2008 issue.

## **Arthrodesis.**

This author says arthroplasty is “not ready for prime time,” arguing that arthrodesis is a more reliable method of addressing hallux rigidus in active patients and athletes with fewer complications.

By Richard Bouché, DPM, FACFAS

Advanced stage hallux rigidus is a difficult problem to treat. It is especially challenging in an active and athletic patient population as demands on the lower extremity are significant and expectations for an excellent result are high. As the grade of hallux rigidus becomes more advanced, conservative measures become less effective and in a predictable fashion, the problem will advance to the point that performance of athletic activities become impossible.

When patients cannot live with their pain and dysfunction, and conservative treatment has been exhausted, surgery becomes a viable option for many patients who seek to remain active and pursue their athletic endeavors. Using a modified Regnault classification, an advanced stage of hallux rigidus is defined as radiographic grades 3 and 4 on a 4 grade scale with 0 being normal. Generally, these patients have significant pain with activity especially bothersome at push-off. Due to a variable amount of limited great toe joint motion in addition to the pain, patients will tend to compensate by supinating their foot during midstance and they will be propulsive to avoid painful push-off. Many times, patients can run better than they can walk with this problem as walking typically requires approximately 40 degrees of great toe joint motion and running requires approximately 25 degrees of motion.<sup>1</sup> Based on my initial observations of barefoot and “minimalist” runners, it is noteworthy to mention that barefoot running and certain alternative running techniques (“chi” and “good form” running) that advocate initial midfoot contact may demand even less great toe joint motion than conventional heel-to-toe running.

Essentially, patients with advanced hallux rigidus end up with a “functional fusion” as they function in whatever way they can to limit motion at their first metatarsophalangeal joint (MPJ). The less the joint moves, the less it will hurt. Due to a lack of first MPJ function, the patient’s “high-gear axis” (pushing off through the first MPJ), which is important for sports activities, becomes disabled. As a result, patients function in their “low-gear axis” (pushing off through lesser MPJs), which is less desirable for sports activities and results in more load distributed through the lesser MPJs. This situation commonly results in lateral forefoot overload symptoms and lesser MPJ instabilities.

Although many surgical techniques are available, conventional joint preservation procedures have limited application for most grade 3 and especially grade 4 hallux rigidus due to poor predictability and a low chance of success. In my experience, one can consider joint preservation procedures in these advanced cases but expected results are fair at best with a likely need for revision surgery. The logical surgical option for advanced stage hallux rigidus involves some form of joint destructive procedure. Though there are various procedures available in this category, there are two options that top the list: first MPJ arthrodesis and implant arthroplasty.

In addition to a thorough review of the literature, my opinions on these two procedures are based on the following: 28 years of experience in specifically performing surgical procedures on athletes (amateur to professional) in a multidisciplinary sports medicine clinic setting; and extensive surgical experience with early generation implants in sedentary patients, active patients and athletes. (See “Where The Literature Falls Short: Clarifying The Activity Level Of Patients” below.) In addition, I have had a large number of revision cases dealing with failed implants (from all generations of implants) in active and athletic patients, and an average of 10 cases per year of performing first MPJ arthrodesis on active and athletic patients for the last 15 years.

### **Why Arthroplasty Is Not The Best Option For Athletic Patients**

I realize that first MPJ implant arthroplasty is a procedure which is here to stay. Historically, it has been and will probably continue to be a very popular and attractive option for patients who are desperately trying to maintain function of their joints and for foot surgeons who are trying to fulfill their patients’ wishes. It is this level of enthusiasm/optimism that must be tempered in patients and surgeons given the reality of implant arthroplasty and how it holds up to unbiased scientific scrutiny and evidence-based medicine.

My experience tells me that implant arthroplasty is a procedure that is improving but it is not ready for prime time, especially when it comes to active and athletic patients. One needs to consider issues with technique, implant loosening and biocompatibility, and persistent complications.

Many of the various types of implants available today are heavily marketed before they are adequately tested and this is unfortunate. Most of my experience with implant arthroplasty as a primary procedure has been with the use of first- and second-generation implants (total and hemi-silicone implants with and without metal grommets respectively). I have had minimal personal experience with third- and fourth-generation implants (two component total and hemi-metal implants with press fit and threaded stems respectively).<sup>2</sup> Although I think some of the new third- and fourth-generation designs are interesting and have merit, like earlier implant generations, they are not ready to be routinely used for active and athletic patient populations. As with the early implants, results are not predictable enough. Complications can be significant and should be expected.

When discussing complications with implants in active and athletic individuals, especially preoperatively, a good philosophy is to think about “when” the implant will fail, not “if” it will fail. When the procedure indeed fails, does the surgeon who performed the procedure have a plan with the knowledge and experience to revise the failed implant?

Unfortunately, in my experience in dealing with many failed implant arthroplasties in athletes, surgeons are generally not prepared for a difficult revisional procedure. Revisional procedures can be more challenging than the index procedure and a predictable result can be even more elusive, especially in a disgruntled athlete who cannot function. After talking with many of these surgically crippled athletes, one common theme is inadequate patient education about common complications. All that patients hear is that arthroplasty will give them “normal hallux position, motion and function, and a fast return to sports activities.”

Key Insights On The Benefits Of First MPJ Arthrodesis

In contrast to implant arthroplasty, first MPJ arthrodesis has never been a popular procedure with patients or podiatric surgeons despite a long track record of good to excellent results. In my opinion, the reason is because there have been many myths and misconceptions propagated about arthrodesis, especially in podiatric medical school and residency training. These myths include an inability to wear heeled shoes, an inability to walk normally or run, and an inability to play sports.

In addition, I find that there are some critical technique issues when performing this procedure that are paramount to consider, specifically when it comes to active and athletic patients. One major issue in my opinion is the position of fusion. In my opinion, one should fuse the hallux on the ground as its mission in life is to bear weight and aid in unloading the metatarsal heads.<sup>3</sup> When the surgeon fuses the hallux in a significantly dorsiflexed position off the ground, there are undesirable structural and functional effects (i.e., hallux hammertoe, increased load on the first metatarsal head, decreased step length, decreased ankle plantarflexion motion and strength at toe off, lateral overload, etc.).

When one performs this procedure appropriately, it has proven to be a predictable and reliable solution for a difficult problem with rarely a need to perform revision surgery. After undergoing a first MPJ arthrodesis, patients can typically wear up to a 1½-inch heel, can participate in many sports including running and jumping, and can walk well with no perceptible gait aberrations. In addition, the procedure is durable and maintains a predictable high level of function over a long period of time.

When considering these two surgical options in an athletic population, it is important to realize the goals of surgical intervention in this unique setting. Common goals for these procedures would be to: eliminate pain; achieve hallux purchase; normalize gait aberrations; allow varied sport activities including running and jumping; allow normal shoe wear; and achieve a cosmetically acceptable result. A unique goal of arthrodesis would be to stabilize the medial column and a unique goal of implant arthroplasty would be to re-establish a normal range of first MPJ motion.

The first MPJ arthrodesis predictably fulfills most of the common surgical goals for these procedures in addition to stabilizing the first ray. When these patients walk, they can wear normal flat footwear. When these patients run, a rigid sole shoe with an adequate rocker is recommended as there is no motion available at the first MPJ. (Running shoes usually have adequate rockers but are flexible at the “toe break,” which is not desirable. A helpful solution for this is placing a thin/light Carboplast plate in both shoes.) Heel height in shoes is limited to 1½ inches. If one does not fuse the hallux on the ground, some degree of extensus and/or hammering can result. This will negatively affect cosmesis and can also result in gait abnormalities.

When it comes to implant arthroplasty, there are many concerns. Arthroplasty typically relieves pain in the first MPJ but pain is common in the lateral forefoot. Hallux purchase is typically compromised — based on static and dynamic evaluation — anytime one resects the base of the proximal phalanx. Lateral overload occurs during gait as compensation for compromised first MPJ function. Sustained running and jumping over an extended period of time is not achievable with implant arthroplasty. Gait aberrations are expected due to the aforementioned problems and cosmesis can be an issue if the hallux is in an extended/hammered position with lack of toe purchase. Motion of the first MPJ is typically excellent early on but it consistently decreases over time.

Surveying The Research On Arthrodesis Versus Arthroplasty

In reviewing the literature, I recommend eight key studies for readers to review. I feel these references give a good overview of the present state of the implant arthroplasty versus first MPJ arthrodesis controversy.

Raikin, Gibson and their respective colleagues present a side-by-side comparison of these procedures, one using a hemi-metallic implant and the other using a two-component metallic implant.<sup>4,5</sup> Brewster discusses results of a systematic review of the literature looking at both hemi and total metallic implants with exclusion of silicone implants.<sup>6</sup>

Daniilidis conducted the only study that specifically discusses implant arthroplasty in an active patient population.<sup>7</sup> Cook and co-workers summarize the results of a meta-analysis on all implant arthroplasty articles since 1990.<sup>2</sup> Brodsky and co-workers provide an excellent article looking at functional outcome in a group of active/athletic patients post-arthrodesis procedure.<sup>8</sup>

Finally, Defrino, Brodsky and their respective colleagues look at the effect of first MPJ arthrodesis on walking gait.<sup>9,10</sup> One retrospective study compares arthrodesis to an age and sex matched control group, and the other is a prospective study looking at gait changes before and after first MPJ arthrodesis.

After reviewing these articles, it becomes evident that arthrodesis is the favored procedure for advanced stage hallux rigidus. It is a more predictable procedure with fewer complications. In regard to the active and athletic patient populations, if running, jumping and significant lower extremity loading are the expectations, then arthrodesis is the best choice as implant arthroplasty is not conducive to these activities. Despite the fact that arthrodesis appears to be the better procedure and many complications can result from implant arthroplasty, patient interest in implant arthroplasty is still favorable so demand for a viable implant design will continue.

### **What Does The Future Hold?**

Here are some suggestions and comments on what to look forward to concerning these procedures.

- Premarket implant testing should include simulation of running and jumping loads as this would be the expectation for active and athletic patients.
- Studies on running gait need to occur with these procedures.
- Anytime the proximal phalanx base is violated, one should consider a flexor hallucis brevis tendon repair to re-establish first MPJ stability. Redirecting the flexor hallucis longus to the proximal phalanx base may not be enough.
- Research, development and scientific scrutiny will continue until a viable implant design and procedure are established to address the needs of sedentary patients, active patients and athletes.

### **Where The Literature Falls Short: Clarifying The Activity Level Of Patients**

Unfortunately, in reviewing the literature or just having a discussion on any surgical procedure involving the foot and/or ankle, I find it rare that patient population types are differentiated. This is problematic as each patient type will have different goals, demands and expectations concerning their surgical procedure. There may be surgeries that would be appropriate for a sedentary person but not be appropriate for a high level athlete.

There are three patient types to consider: sedentary, active and athlete. Sedentary patients are defined as patients whose daily routine is characterized by inactivity with minimal walking. Active patients do not exercise or train per se, but their daily routine is characterized by vigorous activity including moderate to high levels of walking and



occasional exercise. Athletes are generally defined as individuals who consistently exercise or train in one or more sports or art forms to attain a specific goal.

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