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Successful Arthrodesis of the First Metatarsophalangeal Joint in Patients with Inflammatory and Noninflammatory Arthritis: A Comparative Analysis

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ABSTRACT

Arthrodesis of the first metatarsophalangeal (MTP) joint has been a reliable treatment option for end-stage osteoarthritis (OA) and rheumatoid arthritis (RA). The disease process is very different between these 2 types of degeneration. It is unknown whether first MTP fusions performed for each disease process will heal the same or differently. The purpose of the present study was to compare the fusion rate and interval to fusion between patients with first MTP OA and those with RA. The present study was an institutional review board–approved retrospective radiographic and medical record review funded by a not-for-profit educational research grant. The demographic and clinical variables were collected and compared between the 2 groups. A total of 155 first MTP fusion procedures for OA and RA were analyzed. Of these, 116 (74.83%) had been performed for pain from OA and 39 (25.16%) for RA. The RA group had a statistically significantly shorter interval to fusion than did those with OA (93 and 113 days, respectively; $p = .025$). The overall incidence of fusion for those with RA was 94% and for those with OA was 89%; however, this difference was neither clinically nor statistically significantly different ($p = .36$). The incidence of first MTP arthrodesis was high for both patients with OA and those with RA, and those with RA appeared to achieve fusion more rapidly.

Arthrodesis of the first metatarsophalangeal (MTP) joint for the treatment of end-stage arthritis is a commonly performed procedure. Two common indications for first MTP arthrodesis remain end-stage osteoarthritis (OA) and rheumatoid arthritis (RA) (1). These 2 arthritic conditions have the same clinical implications for patient function and pain but have very different pathologic features. OA is an arthritic condition characterized by degenerative changes of the joint but has been considered a noninflammatory process (Fig. 1). Typically, exophytic bone spurs and bone sclerosis will be seen at the joint level. RA has been characterized by a primary inflammatory process of the joint, resulting in degeneration of the joint and, ultimately, joint erosion and destruction (Fig. 2). In these cases, the periarticular bone quality will be osteoporotic and nonsclerotic.

Arthrodesis of the first MTP joint for RA and OA is a well-documented and proven treatment. Mann and Oates (2) performed a first MTP arthrodesis on 17 patients with RA to treat hallux valgus. They reported overall fusion rates of 94% (2). In a separate study, Shereff and Baumhauer (3) considered 28 patients who had undergone 41 first MTP fusions. They found an overall fusion rate of 95%, with an average interval to fusion of 94 days (3). Taylor et al (4) reported on 55 patients with RA or OA during a 6-year period who had undergone first MTP arthrodesis with a fusion rate as greater as 96%.

The purpose of the present study was to compare the incidence and interval to first MTP fusion between patients with OA and RA after primary first MTP fusion. Our hypothesis was that a difference would be found in the healing rate or interval to healing between the 2 groups.

Patients and Methods

The OhioHealth Foundation (Columbus, OH) institutional review board approved the present investigation. It was a retrospective, comparative study of 2 groups of patients who had undergone first MTP fusion for 2 types of arthritis, OA and RA. A retrospective radiographic and medical record review was performed on those who had undergone first MTP fusion during a 5-year period from January 2006 to January 2011. Potentially eligible patients were identified by searching the electronic records for the Current Procedural Terminology (American Medical Association, Chicago, IL) code for first MTP arthrodesis; 28,705 had been performed during the 5-year observation period. To be included, the patients had to meet the following criteria: age 18 years or older and procedure performed as primary arthrodesis because of end-stage OA or RA, with end stage defined as the complete loss of the first MTP joint space. Other criteria

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Conflict of Interest: Dr. Christopher Hyer is a consultant for Wright Medical Technology, Inc. and Amniox Medical.

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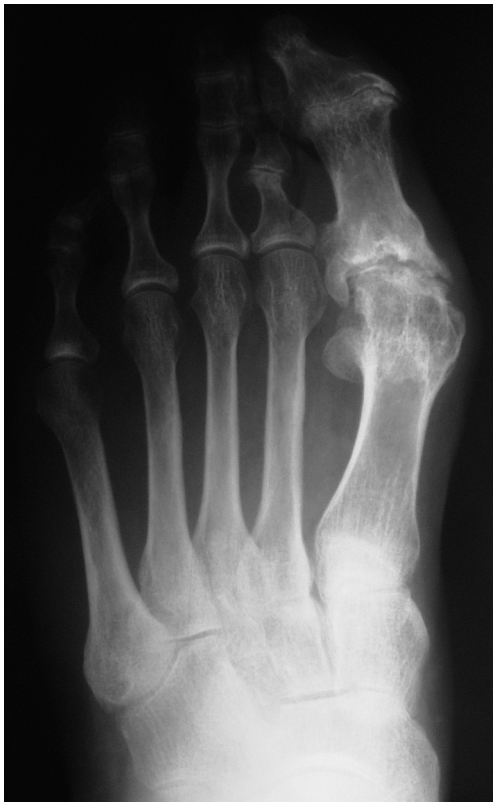

Fig. 1. Anteroposterior radiographic view of osteoarthritis destruction of the first metatarsophalangeal joint. No periarticular osteophytes and cystic changes to the first metatarsal were noted.

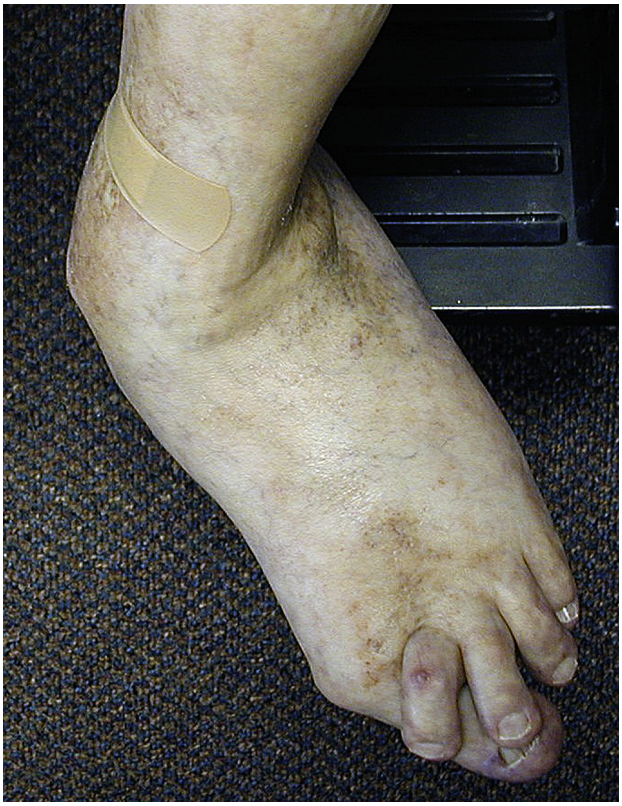

Fig. 2. Clinical appearance of rheumatoid arthritis foot. Note significant hallux valgus and other related toe deformities.

included a minimum of 1 year of follow-up data, lag screw and/or plate fixation, and postoperative non-weightbearing status for no more than 10 days. The exclusion criteria included any first MTP fusion performed for reasons other than primary OA or RA, such as a failed implant or replacement, fixation other than a plate and screws, a history of avascular necrosis or infection of bone of the first MTP, and a history of any other type of surgery performed on the first MTP joint. Fusion arthrodesis was performed by 1 of the 4 foot and ankle surgeons from the Orthopedic Foot and Ankle Center (Westerville, OH).

The medical record and radiographic data were collected and interpreted by 1 of us (S.R.M.), who was not directly involved in the surgery. The study variables analyzed included the demographic factors (i.e., age, gender, body mass index, smoking status, and presence of diabetes mellitus) and clinical and surgical factors (i.e., the side of involvement, fixation construct, adjunct use of orthobiologic agents, the incidence of fusion, and the interval to fusion; Table). Fusion was defined as radiographic cortical bridging on 2 planes. We were also interested in identifying any complications related to the surgery, and defined cellulitis as erythema in or around the incision site at the 2-week postoperative visit, delayed wound healing as superficial wound dehiscence or drainage at the 2-week postoperative visit, delayed bone union as cortical bridging in only 1 plane after 3 months, and nonunion as no cortical bridging after 3 months. A biostatistician performed the data analyses, and $p \leq .05$ was considered statistically significant. All continuous variables, which were not normally distributed, were tested using a nonparametric Wilcoxon test. All categorical variables were analyzed using a 2-sided chi-square or Fisher's exact test.

A standard dorsal surgical approach was used to expose the first MTP joint in every case. The joint surfaces were prepared using either the cup and cone reamer technique or planar resection of the joint, according to the requirements of the specific anatomy, to position the first MTP fusion in neutral to slight valgus, with the hallux interphalangeal joint elevated approximately 1 cm above the simulated, flat, weightbearing flat surface. Stabilization of the fusion was then performed using standard osteosynthesis with a plate and/or screw fixation construct. Autogenous bone marrow aspirate, procured from the calcaneus, was used in several of the procedures at the discretion of the operating surgeon. A layered closure was then performed, followed by posterior splinting.

Results

A total of 155 first MTP fusion procedures, in 142 patients, met the inclusion criteria. Of these procedures, 116 (74.8%) were performed for the treatment of end-stage OA and 39 (25.2%) for the treatment of RA. Of the 116 patients who had undergone unilateral first MTP fusion, 110 (71.0%) were female and 45 (29.0%) were male. The mean age at surgery was 60 (range 31.7 to 82.4, ± 9.07) years for the OA group and 63 (range 45.6 to 88.8, ± 11) years for the RA group. The body mass index was similar in both groups (28.73 ± 5.8 kg/m^2, range 19.3 to 49.1, in the OA group and 27.6 ± 6.1 kg/m^2, range 16.5 to 45, in the RA group). The use of nonparametric statistical tests showed that none of the independent variables, including diabetes mellitus, smoking, or

Table
Patient characteristics (n = 155 first MTP joint fusions in 142 patients)

Variable	OA (n = 116)	RA (n = 39)	*p* Value
Age (y)	60.3 ± 9.1	62.9 ± 11.0	.13
BMI (kg/m^2)	28.7 ± 5.79	27.6 ± 6.09	.67
Active smoker	14 (12.1)	4 (10.3)	.4
Diabetes mellitus	8 (6.9)	6 (15.4)	.11
Laterality			
Right	62 (53.4)	23 (59)	.29
Left	54 (46.6)	16 (41)	.36
Autogenous bone marrow aspirate used	5 (4.3)	0	.????
Fixation			
Plate	43 (37.1)	18 (46.2)	.16
Plate and screws	72 (62.1)	21 (53.8)	.19
Successful radiographic fusion	103 (88.79)	37 (94.87)	.36
Interval to fusion (d)	113.19 ± 189.77	93.63 ± 56.79	.025
Complication			
Cellulitis	2 (1.7)	0	.28
Delayed wound healing	0	3 (7.7)	.01
Asymptomatic nonunion	11 (9.5)	2 (5.1)	.22
Symptomatic nonunion	2 (1.7)	0	.28
Revision surgery	7 (6)	2 (5.1)	.44

Abbreviations: BMI, body mass index; OA, osteoarthritis; RA, rheumatoid arthritis.
Data presented as n (%) or mean ± standard deviation.