Bioabsorbable Fixation for Mitchell's Bunionectomy Osteotomy

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Although bioabsorbable pins have been used to successfully stabilize a wide range of osteotomies, to date there have been not published studies describing the results of their use for fixation of first metatarsal osteotomies in Mitchell's bunionectomy. The purpose of this retrospective investigation of 78 first metatarsal osteotomies was to evaluate the effectiveness of polydioxanone bioabsorbable pin fixation of the first metatarsal osteotomy in Mitchell's bunionectomy. The mean length of the first metatarsal preoperatively was 6.65 ± 0.42 cm, and postoperatively it was 6.31 ± 0.57 cm (P < .0001). The mean first IMA preoperatively was 17.59° ± 3.51°, and postoperatively it was 9.91° ± 2.58° (P < .0001). The mean HVA preoperatively was 29.74° ± 4.70°, and postoperatively it was 12.89° ± 4.26° (P < .0001). The average time to bony union was 6.01 ± 0.61 weeks. There were 5 (6.41%) superficial wound infections that resolved with oral antibiotics, 1 (1.28%) deep-seated infection requiring surgical debridement, and 2 (2.56%) patients complained of transfer metatarsalgia. Five (6.41%) patients displayed persistent localized translucency at some portion of the osteotomy site on postoperative radiographs, and there were no cases of progressive osteolysis. In this series there were no complications related to pin fracture or failure of osteotomy fixation. Based on the results observed in this study, it appears that the use of polydioxanone bioabsorbable pins provides satisfactory stabilization of the first metatarsal osteotomy in Mitchell's bunionectomy, and was not associated with any serious complications. Level of Clinical Evidence: 2 (The Journal of Foot & Ankle Surgery 48(1):9–14, 2009)

Key Words: bioabsorbable fixation, bunionectomy, hallux valgus, Mitchell's osteotomy

First metatarsal osteotomy for the repair of the deformity of hallux valgus is one of the most commonly performed procedures in elective reconstructive foot surgery. Despite its prevalence, deformity correction by means of first metatarsal osteotomy can be challenging, and requires thorough preoperative evaluation of the patient and detailed operative planning for each case. A recent review of the biomedical literature revealed more than 130 soft tissue and bony procedures described for the correction of the deformity of hallux valgus, suggesting that there is considerable disagreement among surgeons as to the optimal way to manage patients with this common deformity (1–3).

The use of bioabsorbable pins for bone fixation was first described in 1984 for the management of ankle fractures (4). Although OrthoSorb Resorbable Pins (DePuy Orthopaedics, Inc. [a Johnson & Johnson Company], Warsaw, IN), which are made of poly-p-dioxanone (PDS), and Biofix pins (Biofix-Bioscience LTD., Tampera, Finland), made of polyglycolic acid (PGA), have been widely used for fracture and osteotomy fixation, a number of complications have been associated with these materials, including osteolysis, sterile sinus formation, foreign body reaction, fluid collection, and implant extrusion (5–9). However, it seems that there are fewer complications associated with the use of PDS pins compared with polyglycolide pins. Lavery et al (10) compared these 2 types of pins in regard to distal first metatarsal osteotomy stabilization in 45 feet, and found a higher overall complication rate using polyglycolide as compared with PDS pins (55% versus 3%, respectively, $P < .001$). One of the most common complications associated with the use of bioabsorbable pins is that of foreign body reaction; this complication is less commonly seen when using PDS pins. There are only 2 case reports describing foreign body reactions in association with PDS pin fixation of first metatarsal osteotomies (8, 9), whereas the rate of foreign body reaction with the use of polyglycolide rods for fracture fixation has

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Financial Disclosure: None reported.

Conflict of Interest: None reported.

1067-2516/09/4801-0003$36.00/0

doi:10.1053/j.jfas.2008.09.008

been reported to be 8% (11). Furthermore, Parks and Nelson (12) reported that 5 of 49 patients (10.2%) developed a foreign body reaction in association with polyglycolide fixation of first metatarsal osteotomies.

Another practical bioabsorbable material used in foot and ankle surgery is poly L-lactide (PLL). PLL, in comparison with PDS and polyglycolide, has a longer degradation time that can take up to several years (13–16). It is possible to copolymerize bioabsorbable polymers in different proportions in order to create biomaterials with different physical and chemical characteristics (17). LactoSorb (Biomet, Inc, Warsaw, IN) is such a material, and it consists of 82% PLL and 18% polyglycolide. This material retains its strength at 6 to 8 weeks and is fully absorbed by 1 year following implantation. PDS and polyglycolide lose their strength in 4 to 6 weeks, whereas pure PLL loses its strength over several months (18–20).

The primary aim of this investigation was to evaluate the use of PDS bioabsorbable pin fixation used to stabilize the first metatarsal osteotomy in patients undergoing Mitchell bunionectomy, with the outcomes of interest being radiographic alignment and time to bony union at the osteotomy site.

Patients and Methods

We undertook a retrospective cohort study of consecutive patients who had undergone Mitchell's bunionectomy with distal first metatarsal osteotomy for repair of the deformity of hallux valgus, between October 2002 and August 2006. All of the patients were referred to the surgical consultant service, where they were assessed preoperatively by means of a thorough historical interview and physical examination, as well as radiographic inspection. The consulting surgeon analyzed the clinical findings, as well as the plain film radiographs. Based on the consulting surgeon's recommendation, the patients were scheduled for surgical repair of their bunion deformity.

All of the operative procedures were carried out with the use of a general anesthetic and a thigh tourniquet. Prophylactic antibiotic therapy was not used in any of the cases. The surgeon who listed the patient initially measured and recorded the first intermetatarsal angle (IMA) and hallux abductus angle (HAA), as well as the first metatarsal length, although this surgeon did not necessarily perform the operative procedure. Surgery was performed with the patient in the supine position, and a dorsomedial longitudinal incision, beginning over the first metatarsophalangeal joint (MTPJ), was used to approach the underlying metatarsal head. The incision was deepened between the most medial branch of the medial plantar nerve and the most medial branch of the superficial peroneal nerve (proper digital branch of the medial dorsal cutaneous nerve). Care was taken to avoid

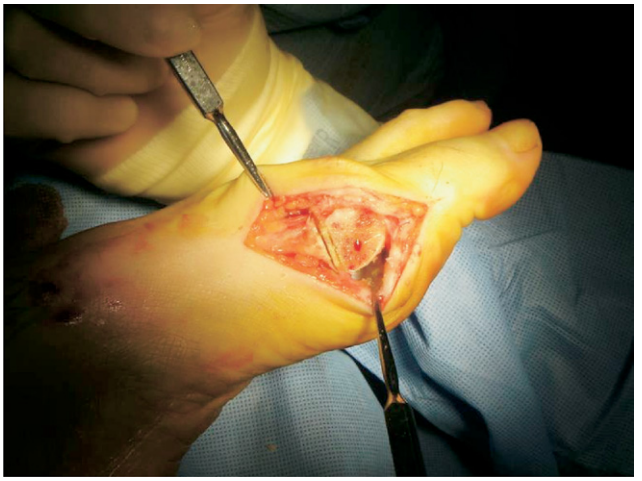

FIGURE 1 Skin incision and the osteotomies.

detaching the periosteum and capsular attachments along the lateral aspect of the metatarsal head, in an effort to minimize the risk of developing postoperative avascular necrosis of the head.

After adequately exposing the structures of the first MTPJ and the distal metaphysis of the first metatarsal, a metatarsal osteotomy was performed in accordance with the technique described by Mitchell et al (21) (Figure 1). Using a periosteal elevator, the soft tissues were reflected on the lateral side of the osteotomy in order to facilitate lateral displacement of the metatarsal head. After translocating the capital fragment of the first metatarsal into the corrected alignment, and ensuring sufficient bone-to-bone apposition between the proximal and distal segments of the metatarsal, the reduction was temporarily held with the guide wire provided with the PDS bioabsorbable pin set (OrthoSorb Resorbable Pins, DePuy Orthopaedics, Inc., Warsaw, IN). The wire was inserted from the medial aspect of the metatarsal, and directed from proximal to distal (Figure 2). Leaving this guide wire in situ to hold the reduction, a second guide wire was placed convergent to the first one and removed to create a tract for the bioabsorbable pin. The guide wire was run through the near cortex (first metatarsal metaphysis) only, so as to prevent penetration into the joint cavity. To place the second bioabsorbable pin, the original guide wire was removed and replaced with the second pin. Both pins were then cut flush to the proximal cortex (Figure 3). The distal-medial edge of the proximal segment of the metatarsal was resected to reduce its prominence, and this excess bone was used as an autograft on the lateral side of the osteotomy in all cases. Finally, the joint capsule and the skin were closed in anatomical layers prior to wound infiltration with local anesthetic and the foot dressed with wool and crepe.

When clinically indicated, adjunct lesser digital procedures were undertaken, including (1) interphalangeal joint fusions for fixed hammer toe deformities, and (2) Stainsby's