Correction of Metatarsus Primus Varus with an Opening Wedge Plate: A Review of 18 Procedures

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The opening base wedge osteotomy is a safe and useful surgical alternative for correction of moderate to severe hallux valgus deformities with substantial metatarsus primus varus. The authors combine the modified McBride bunionectomy with a proximal first metatarsal opening base wedge osteotomy. Osteotomy stabilization was achieved without bone grafting with a titanium fixation plate specifically designed for opening proximal osteotomies. To assess outcomes achieved by the use of this fixation device, we reviewed the records of 18 procedures (16 patients). Preoperative and postoperative weight-bearing radiographs were measured to compare changes in the following radiographic variables: intermetatarsal angle 1-2, hallux valgus angle, the first metatarsal protrusion distance, and the Seiberg Index. The mean follow-up duration was 11 months (range, 6-17 months). The median intermetatarsal angle decreased by 9° (range, 2°-15°), the hallux valgus angle decreased by 13.5° (range, 0°-56°), and the change in first metatarsal protrusion distance was +2.6 mm (range, –0.8 to 6.6 mm), and all of these changes were statistically significant ($P \leq .001$). The preoperative to postoperative change in the Seiberg Index was not statistically significant ($P = .17$). In regard to the American Orthopaedic Foot and Ankle Society Hallux Metatarsophalangeal-Interphalangeal score, the postoperative scores were statistically significantly higher than the preoperative scores ($P < .001$). Complications included 2 (11.11%) recurrences, and 1 (5.56%) case of deep vein thrombosis. Fourteen patients (16/18 feet, 88.89%) reported satisfaction with the surgical results. Level of Clinical Evidence: 4 (The Journal of Foot & Ankle Surgery 48(4):420–426, 2009)

Key Words: base osteotomy, bunionectomy, first metatarsal, hallux valgus, osteotomy, outcome

Over the past century, more than 130 procedures for the correction hallux valgus have been described in the biomedical literature (1). When the deformity is combined with a first intermetatarsal angle (IMA 1-2) >14°, or metatarsus primus varus (MPV) deformity, a diaphyseal or proximal osteotomy is often indicated (1–6). Numerous proximal first metatarsal base procedures have been described for the correction of moderate to severe hallux valgus with metatarsus primus varus (1, 2, 4, 6–8), and the opening base wedge osteotomy of the first metatarsal is a technically demanding procedure. Dorsiflexion of the first metatarsal can result in metatarsalgia and/or hallux rigidus, whereas overcorrection of metatarsus primus varus can lead to hallux varus (1, 6, 9, 10). Furthermore, inadequate fixation can result in fracture of the osteotomy, and delayed union or nonunion (1, 4).

We undertook a prospective case series investigation of consecutive cases in which a hallux valgus deformity with metatarsus primus varus was treated by means of proximal first metatarsal opening base wedge osteotomy with a titanium fixation plate designed specifically for this procedure. In regard to outcomes of interest, we considered radiographic angles, complications, and foot-related quality of life as important variables to measure.

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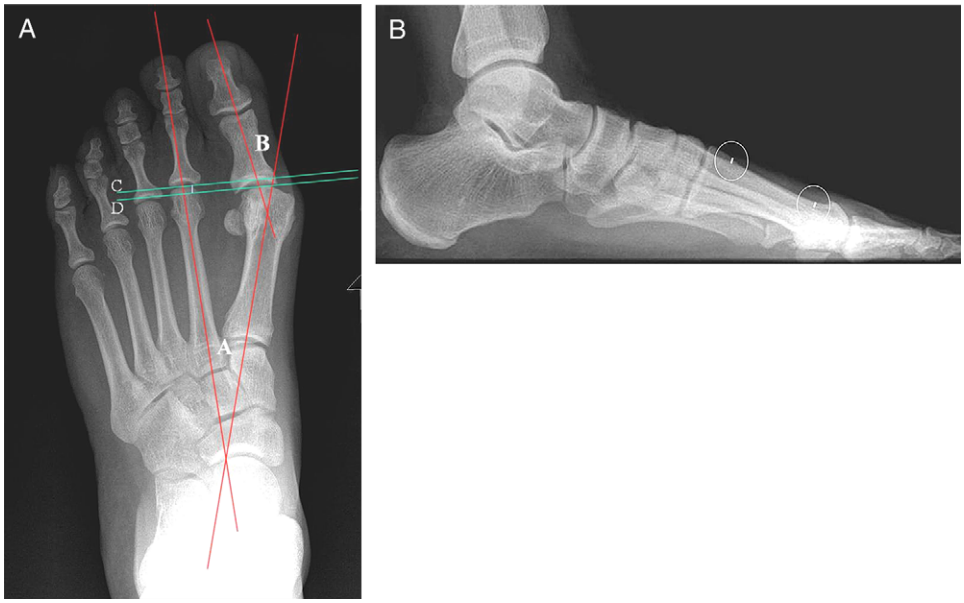

FIGURE 1 **A,** Preoperative weight-bearing AP radiograph. The white *A* designates the intermetatarsal angle 1-2 of 17°. The white *B* designates the hallux valgus angle of 24°. The white *C* and *D* designate the lines used to measure the first metatarsal protrusion distance of –2.8 mm. **B,** Preoperative weight-bearing lateral radiograph. The lines (within the circles) represent the distance between the dorsal cortex of the first metatarsal and dorsal cortex of the second metatarsal, at proximal and distal levels. Subtracting the proximal value from the distal value yields the Seiberg index (12).

Patients and Methods

The University of Pittsburgh Medical Center Institutional Review Board approved the research protocol. We reviewed the records of consecutive patients seen and treated by the senior author (DW) between April 2005 and November 2006, after previously collecting data related to outcomes of interest. We measured changes in preoperative and postoperative radiographic angles and changes in the American Orthopaedic Foot and Ankle Society Hallux Metatarsophalangeal-Interphalangeal Scale (AOFAS-HMI) scores to assess structural and patient satisfaction outcomes after the operation (11). Radiographic analyses included measurement of the following angles with weight-bearing preoperative and postoperative films:

- **Intermetatarsal angle (IMA) 1-2**: the angle created by the intersection of perpendicular lines bisecting the proximal and distal articular surfaces of the first and second metatarsals on the anteroposterior (AP) radiograph (Fig 1, *A*).
- **Hallux valgus angle (HVA)**: the angle created by the intersection of perpendicular lines bisecting the proximal and distal articular surfaces of the first metatarsal and the proximal phalanx of the hallux on the AP radiograph (Fig 1, *A*).
- **First Metatarsal Protrusion Distance (MPD)**: the distance between parallel lines tangential to the distal most aspect of the first and second metatarsals, perpendicular to the second metatarsal bisector on the AP radiograph; a positive value indicated that the first metatarsal was longer than the second metatarsal, and a negative value indicated that the second metatarsal was longer than the first (Fig 1, *A*).
- **Seiberg Index (SI):** The SI was measured using the perpendicular distance in millimeters from the dorsal aspect of the second metatarsal shaft to the dorsal aspect of the first metatarsal shaft, at the level of the first metatarsal neck and at the point 1.5 cm distal to the first metatarsal base. The proximal measurement was then subtracted from the distal measurement to get the SI (12). A negative SI indicated plantar declination of the first metatarsal, and a positive value indicated dorsal angulation of the first metatarsal (Fig 1, *B*).

To be included in the case series, the preoperative radiographs had to reveal the following: osseous maturity as determined by the absence of any open pedal growth plates, an IMA 1-2 of ≥14°, an HVA of ≥20°, a negative MPD, and radiographic evidence of the absence of degenerative first metatarsophalangeal joint (MTPJ) joint disease. Moreover, it was required that preoperative and postoperative AOFAS-HMI scale scores also be available for the inclusion, and that the patient displayed normal first MTPJ range of motion (ROM) before the operation, with normal being defined as at least 35° of dorsiflexion during the propulsion phase of gait. Patients demonstrating radiographic evidence of first tarsometatarsal joint (TMTJ) instability were excluded from this study, and instability was defined as plantar gapping (widening of the plantar aspect of the first TMTJ) visualized on the lateral weight-bearing radiograph. The authors routinely use radiographic plantar gapping in evaluating hypermobility and have found this parameter to be consistent and reproducible. Additionally, patients who