Comparison of Ulnar-Shortening Osteotomy With a New Trimed Dynamic Compression System Versus the Synthes Dynamic Compression System: Clinical Study

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**Purpose** Ulnar-shortening osteotomy has become common in the treatment of symptomatic positive ulnar variance. Our goal was to evaluate prospectively a new dynamic compression plating system in comparison with a commonly used dynamic compression system. In contrast with other systems, the new system uses a slotted hole that enables fixation of the plate to the bone prior to performing the osteotomy, a fitted compression clamp, and a lag screw. Cutting guides that attach directly to plate eliminate the need for freehand osteotomies.

**Methods** Thirty-seven patients were treated with a 3.5-mm, 6-hole dynamic compression plate with distraction device (Synthes, Paoli, PA) and compared with 17 patients treated with a new dynamic compression system manufactured by Trimed (Valencia, CA). Procedure length was recorded. The patients were evaluated for amount of shortening, pain, range of motion, grip strength, time to union, and return to work as well as with validated outcome measures.

**Results** Improvement was found in all measures although no difference was found between the 2 groups other than significantly shorter length of operation with the Trimed system (a mean of 2 hours with the Synthes system vs 1 hour with the Trimed system). Ten plates were removed in the Synthes group and 4 plates were removed in the Trimed group because of symptomatic prominence of the plate. There were no infections, delayed unions, or nonunions in either group.

**Conclusions** The new Trimed plating system for ulnar shortening was found to be as effective as the Synthes system and with a shorter procedure time. This may be related to the different measuring periods, although years of practice with the Synthes technique preceded this study. We believe the shortened procedure time for the Trimed system is due to its technical advantages. (*J Hand Surg* 2008;33A:1493–1497. Copyright © 2008 by the American Society for Surgery of the Hand. All rights reserved.)

**Type of study/level of evidence** Therapeutic III.

**Key words** Compression plate, forearm fracture malunion, positive ulnar variance, triangular fibrocartilage complex, ulnar osteotomy.
sided wrist pain and degenerative processes due to the overloading that occurs between the ulnar head and the ulnar carpus. Thus, the goal of the shortening procedure is to relieve the symptoms by reestablishing a neutral or slightly negative ulnar variance.\textsuperscript{1} The typical indications for the osteotomy include ulnar impaction syndrome, nonrepairable tears of the triangular fibrocartilage complex (TFCC), attritional lunotriquetral ligament tears, radial malunions, and early posttraumatic distal radioulnar joint arthritis.\textsuperscript{2–4} Previous radial head excision and associated Essex-Lopresti lesions may be an indication as well, along with replacement of the radial head.\textsuperscript{3,4} Numerous authors have introduced methods and systems for performing, and hopefully simplifying, the osteotomy\textsuperscript{2,5–8} to prevent malrotation, angulation, or nonunion because of incomplete closure of the osteotomy gap. This study compares the results of ulnar-shortening procedures with a new plate and compression system\textsuperscript{9} to a previously described and accepted method.\textsuperscript{8}

**MATERIALS AND METHODS**

**Synthes dynamic compression system**

Thirty-seven patients had an ulnar-shortening osteotomy using a dynamic compression (DC) plate and an AO compression/distraction device (Synthes, Paoli, PA) between 1996 and 2004. The inclusion criteria for the study were ulnar-sided wrist pain with concomitant positive ulnar variance on standard radiographs (ulnar variance views\textsuperscript{10}) in patients between the ages of 18 and 65 years. Patients who were active smokers were excluded. Patients with no forearm fracture malunion were evaluated arthroscopically for possible repairable TFCC pathology prior to the osteotomy. All arthroscopies consisted of debridement and not TFCC repair. Approval by the institutional review board was obtained as well as informed consent from each patient.

The procedure was performed as described by Chen and Wolfe.\textsuperscript{8} Sixteen patients were men and 21 were women. Average patient age at the time of the shortening osteotomy was 36 years. The average ulnar positive variance was 3.8 mm (SD, 1.1). Six of the osteotomies were carried out for prior distal radius fractures that healed with shortening of the radius. Thirty-one of the osteotomies were performed for degenerative, nonrepairable tears of the TFCC confirmed in arthroscopy.

This technique implements a 3.5-mm, 6-hole DC plate (Synthes). Perfectly parallel freehand osteotomies must be made at 45° angles to the plate. This is followed by the placement of a lag screw inserted perpendicular to the approximated osteotomies. After completing the osteotomy, the Synthes distraction device is used to further reduce and compress the distal and proximal bone ends. The length of the procedure was recorded.

**Trimed ulnar-shortening osteotomy (DC) system**

Seventeen patients had an ulnar-shortening osteotomy using a new system manufactured by Trimed (Valencia, CA), between 2004 and 2006. This system has replaced the Synthes plate in the senior authors’ practice. The patients were entered into the study in the similar fashion as prior to 2004, and the inclusion criteria were not changed. Approval by the institutional review board and informed consent were obtained. Seven of the patients were men and 10 were women. Average patient age at the time of surgery was 38 years. The average ulnar positive variance was 3.9 mm (SD, 1.4). Three of the osteotomies were performed to relieve symptoms stemming from distal radius malunions that had healed with shortening of the radius. The remaining 14 osteotomies were performed for degenerative TFCC tears confirmed in arthroscopy.

This new system, designed by the senior author, implements a new plate design allowing for compression at the osteotomy site with a Bone Compression Clamp and lag screw (Fig. 1). In this system, the lag screw is placed through a guide ensuring perpendicular placement of the screw to the osteotomy. Unlike other techniques that require moving the plate prior to cutting the ulna,\textsuperscript{8} this system uses a slotted hole so that the plate is firmly affixed prior to performing the osteotomy (Fig. 2). Furthermore, the system has cutting guides that attach directly to the plate, eliminating the need for
freehand osteotomies (Fig. 3). The guides are designed to perform the cuts according to the amount of shortening necessary. The technique was performed as previously described.\(^9\) The length of the procedure was recorded.

**Postoperative protocol**

The postoperative protocol was similar in both groups. The patients were immobilized in a “sugar-tong” splint for 2 weeks followed by a removable forearm brace. Digit range of motion was encouraged immediately after surgery. After 2 weeks, motion was allowed in the brace, followed by gentle strengthening exercises after 6 weeks and maximal strengthening when bone healing was complete.

**Outcome measures**

All patients were evaluated for preoperative and postoperative range of motion and grip strength. These measures were recorded for the surgical side and then compared with the contralateral arm. Pain levels at the wrist were recorded using a visual analog scale. Patient upper-extremity function was established using the Disabilities of the Arm, Shoulder, and Hand (DASH) Outcome Measure. Ulnar variance was recorded before and after the procedure to measure the amount of shortening achieved by the osteotomy. The length of the procedure was recorded from the time of skin incision to wound closure. Time to union was evaluated both clinically and radiographically (defined as bridging of the trabecular bone and cortical margin blurring). Return to work and complications, including symptomatic hardware necessitating hardware removal were recorded.

**Statistical analysis**

Statistical analysis was performed with use of SPSS 15.0 for Windows software (SPSS Inc., Chicago, IL). The analysis of variance was calculated followed by the least significant difference using Scheffe’s method to detect statistical differences between the preoperative and postoperative measures or the Wilcoxon signed ranks test for nonparametric measures. A p value of less than or equal to .05 was considered significant.

**RESULTS**

The average procedure length differed between the groups. The procedure lasted an average of 2 hours (SD, 0.3) for the Synthes DC group and 1 hour (SD, 0.3) for the Trimed group (p < .05). All patients were followed for 12 months. Bony union was achieved at an average of 7 weeks for the Synthes DC system and 7 weeks for the Trimed system. Shortening of the ulna averaged 3.9 mm and 4.1 mm for the Synthes DC group and the Trimed group, respectively. Wrist pain scores decreased from an average of 6.0 preoperatively to 0.8 after surgery in the Synthes DC group. The patients in the Trimed group had a similar experience with their scores changing from 5.9 to 0.7. Thirty-four of the 37 patients of the Synthes DC group and 16 of the 17 patients of the Trimed group returned to their previous occupations. Three of the Synthes DC group and 1 of the Trimed group did not return to their previous work position or sports activities, although all patients returned to some form of work. Outcome measurements are detailed in Table 1.

**Complications**

In the Synthes DC group, 10 plates were removed for symptomatic prominence of the plate. Four plates were
removal in the Trimed group. There were no infections, delayed unions, or nonunions in either group. Two patients in the Synthes group and 1 in the Trimed group developed carpal tunnel syndrome during the follow-up period. We did not relate this to the procedure but to the population at risk.

**DISCUSSION**

The ulnar-shortening osteotomy has proven benefits for patients with ulnar-sided wrist symptoms (the clinical syndrome of ulnar impaction) stemming from positive ulnar variance. Presumably, wrist pain is relieved through a decompression effect provided by the correction of the radioulnar length discrepancy. Many methods for correcting this overloading of the distal ulna, lunate, and triquetrum have been proposed. In 1941, Henry Milch was the first to describe a shortening technique using nothing more than a wire and plaster immobilization. Plate and screw fixation of an osteotomy was not proposed until the early 1970s. Since that time, several plating systems have been developed to make a technically demanding procedure more facile while simultaneously decreasing complication rates.2,5–8

This study compared patient outcomes of ulnar-shortening osteotomies made with 2 different surgical systems and techniques. The Synthes DC system has been used with good results. However, this technique requires osteotomy cuts be made perfectly parallel to ensure good alignment and opposition of the cut bone ends. Furthermore, the plate must be moved during the procedure to complete the osteotomy. This adds both time and room for error. With the new system (Trimed), osteotomies are made through guides attached to the plate, thus eliminating freehand cuts, and the placement of the plate may be adjusted with the aid of sliding holes without the need for plate reapplication. In this study, we demonstrate the shorter duration of this procedure, presumably a result of these technical features. The fact that the Trimed system was used during a later period of the study may have influenced the procedure times. Improvement in the technical learning curve may possibly result in shorter operative time, not necessarily due to the ease of the technique. It should be noted that the years of experience of the senior author with ulnar osteotomies was achieved using the Synthes system, prior to the study. Yet the new Trimed system enabled us to achieve the same results with significantly less time.

Our data show that patients improved rather dramatically after having ulnar shortening with either system. Postoperative range of motion and grip strength increased to nearly 100% of the contralateral side. Furthermore, DASH scores demonstrated that patients believed they were functioning at much higher levels after surgery, and visual analog pain scores dropped to near negligible levels. This illustrates the utility of this procedure in appropriately selected patients. Importantly, the similar results for both systems demonstrate our new system works as well as the well-established Synthes DC system technique. The new Trimed system offers several technical advantages, resulting in similar success, possibly with a shorter length of operation.

**REFERENCES**