

Evaluation of Bony Union after Two Types of Arthrodesis for Osteoarthritis of the Thumb Carpometacarpal Joint

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INTRODUCTION:

Arthrodesis using two headless compression screws (the previous method) has routinely been performed in our department as treatment of osteoarthritis of the thumb carpometacarpal joint; however, this approach was associated with delayed union and low rates of bony union. Reportedly, the rate of nonunion after arthrodesis using two headless compression screws was approximately 10.0–20.0%. Therefore, we modified the surgical method and used one headless compression screw, followed by placement of a locking plate (the current method) since 2020 to improve the rate of bony union. In this study, we compared the previous and current methods with regard to the time required for and the rate of bony union.

METHODS:

This study included 34 patients (2 men and 32 women, median age 59.1 [range 45.0–86.0] years), who were treated using the previous method and 16 patients (5 men and 11 women, median age 61.0 [range 54.0–74.0] years), who underwent treatment using the current method. The previous method involved the use of two headless compression screws, whereas the current method included the use of one headless compression screw, followed by additional fixation using a locking plate.

After creation of a Wagner's skin incision, the carpometacarpal joint was exposed between the abductor pollicis longus and extensor pollicis brevis tendons. The remaining articular cartilage was curetted, and the dorsal aspect of the metacarpal base was shaved using a steel bur. Autologous bone was obtained from the radius or ilium and half of the bone was grafted into the joint, followed by insertion of a headless compression screw from the trapezium into the metacarpal to maintain the thumb in 20–30° of radial abduction and 30–40° of palmar abduction. A second headless compression screw was subsequently inserted from the metacarpal into the trapezium using the previous method. In the current method, followed by fixation with a locking plate. The remaining autologous bone was grafted into the joint, the periosteum and articular capsule were repaired, and the wound was closed. All patients were immobilized using a rigid brace postoperatively, regardless of the method used. The brace was worn throughout the day over 1 month postoperatively and was subsequently used only when performing light work until 2 months postoperatively.

We recorded operative time, time to bony union, and rate of bony union, which were analyzed using the Mann-Whitney U test and Fisher's exact test at a significance level set to 5%. Patients underwent radiography and computed tomography of the thumb carpometacarpal joint (frontal and lateral views) to evaluate bony union.

RESULTS:

The median operative time was 90 (range 60–143) min in the previous- and 119.5 (range 80–144) min in the current-method group; we observed that the previous method required significantly lesser time ($p < 0.001$). The median time to bony union was 3.7 (range 1.4–11.2) months in the previous- and 2.3 (range 1.9–3.7) months in the current-method group; we observed that the current method required significantly lesser time until bony union ($p < 0.01$). The rate of bony union was 82.4% in the previous- and 100.0% in the current-method group; however, the difference was statistically nonsignificant ($p = 0.159$). We observed nonunion in six of 34 patients from the previous-method group; four of these patients were symptomatic, and one of these four patients subsequently required reoperation.

DISCUSSION AND CONCLUSION:

Our study highlights that the rate of bony union was higher and bony union occurred earlier in patients who underwent arthrodesis using a headless compression screw, followed by placement of a locking plate than in patients who underwent arthrodesis using two headless compression screws.

Two previous studies have reported arthrodesis using locking plates and screws similar to our technique. Pflibsen performed arthrodesis using a locking plate and 2.0 mm screws in 22 patients and reported a bony union rate of 100.0%. Similarly, Save performed arthrodesis using a locking plate and 3.0 mm screws in 10 patients and reported a bony union rate of 100.0%. However, both authors inserted simple screws from the metacarpal into the trapezium. In our view, a headless compression screw should be inserted from the trapezium into the metacarpal because this approach is not associated with a risk of screw protrusion into the scaphotrapeziotrapezoidal joint.

Recent studies have reported the usefulness of arthrodesis using two headless compression screws. Zhang observed that arthroscopic curettage of the joint surface, followed by insertion of two headless compression screws and an autologous bone graft achieved successful bony union over a mean period of nine weeks in all 11 patients included in the study. Sehjal performed mechanical tests using pig metatarsal joints for arthrodesis using five different types of implants and reported that two headless compression screws were associated with the best bending rigidity and fracture strength.

Notably, all patients in the study performed by Zhang were young men (mean age 48 years), and the pigs used in the study reported by Sehjal were also young (<6 months of age); therefore, these results may be applicable only to patients with good bone quality.

The results of our study showed that the rate of bony union was 100.0% in the current-method group, and the time until bony union was shorter than that in the previous-method group, which suggests that attraction of bone fragments using headless compression screws and strong fixation provided by the locking plate are potentially useful to achieve bony union earlier than that observed using the previous method. An important limitation of this study was that we could not perform exclusive comparison of fixation methods because of minor modifications in surgical techniques and differences in postoperative treatment.