

# Volar Radioscapholunate Arthrodesis and Distal Scaphoidectomy After Malunited Distal Radius Fractures

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**Purpose** The purpose of this study was to assess range of motion (ROM), pain, and incidence of radiographic degenerative joint disease (DJD) after volar radioscapholunate (RSL) arthrodesis and distal scaphoidectomy (DSE) following malunited distal radius fractures (DRF).

**Methods** Fourteen patients with malunited DRF and DJD limited to the radiocarpal joint underwent RSL arthrodesis and DSE between 2006 and 2014. These were retrospectively analyzed both clinically and radiologically. Eleven patients with a mean follow-up of 63 months (range, 30–97 months) were included in the final analysis because 1 was unavailable and 2 had died. The outcome was evaluated using parameters of pain, ROM, grip strength, nonunion rate, and DJD of the adjacent joints. In addition, self-assessment by patients was registered on the Disability of the Arm, Shoulder and Hand score, Patient-Rated Wrist Evaluation score, and Michigan Hand Outcomes Questionnaire. To investigate DJD and union, a computed tomography (CT) scan at the final follow-up visit was performed.

**Results** All patients showed union and no midcarpal DJD in the CT scans at final follow-up. The mean ROM in extension was 53°, flexion 42°, supination 81°, pronation 85°, radial deviation 10° and ulnar deviation 25°. The ROM in extension, extension/flexion arc, and supination improved significantly after surgery. Patients achieved a mean of 80% of grip strength compared with the other hand.

**Conclusions** Volar angular stable plate RSL arthrodesis with resection of the distal scaphoid pole is a safe and effective method for treating malunited DRF. This leads to an improved ROM and low pain level. (*J Hand Surg Am.* 2017; ■(■):1.e1-e8. Copyright © 2017 by the American Society for Surgery of the Hand. All rights reserved.)

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

**Key words** Distal radius fracture, malunion, partial wrist fusion, radioscapholunate arthrodesis, scaphoidectomy.



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**T**HE GOAL OF SURGICAL TREATMENT of distal radius fractures (DRF) is anatomical reconstruction of the articular surface and early mobilization.<sup>1–3</sup> Several clinical studies have shown that early mobilization following surgery leads to an improved functional outcome without increased risk of secondary loss of reduction.<sup>4–7</sup> Restoration of the articular surface can represent a technical challenge in some cases and, sometimes, especially in comminuted DRF, articular deformity remains.<sup>8</sup>

In cases in which reduction is lost, or in comminuted fractures of the articular surface, an articular malunion may occur.<sup>9</sup> Knirk and Jupiter<sup>10</sup> have shown that a step-off greater than 2 mm in the radiocarpal joint have a higher risk for posttraumatic radiographic degenerative arthritis, leading to pain and functional impairment. In addition, in young patients, 91% of the DRF healed with incongruity in the radiocarpal joint, leading to degenerative arthritis.<sup>10</sup> In these cases, in which nonsurgical treatment fails and does not lead to an improvement in pain and range of motion (ROM), and corrective osteotomies are also not an option, salvage procedures can be useful. Various surgical interventions like wrist denervation, total wrist fusion, and radio-scapholunate (RSL) arthrodesis are available. An RSL arthrodesis is typically performed when the degenerative joint disease (DJD) involves the radiocarpal joint and the midcarpal joint is normal.<sup>11–14</sup>

Many studies report successful RSL arthrodesis for DJD in rheumatoid arthritis, but only a few after a malunited DRF.<sup>11,15</sup> Typically, RSL arthrodesis is carried out from a dorsal approach. The advantage of a volar approach is that previously placed hardware can be removed without an additional dorsal incision.<sup>16</sup> Distal scaphoidectomy (DSE) in RSL arthrodesis was first reported by Garcia-Elias et al in 2001<sup>17</sup> and 2005<sup>18</sup> and resulted in improved pain relief, better flexion, and radial deviation in comparison with previously published studies without DSE. They also showed a union rate of 100% of the RSL arthrodesis carried out with additional DSE.<sup>17,18</sup>

The purpose of this study was to assess the results in ROM, pain, and incidence of DJD after volar RSL arthrodesis and DSE, using a volar locking plate, following a malunited DRF.

## MATERIAL AND METHODS

Institutional review board approval was obtained for this retrospective study. All patients with RSL arthrodesis performed to treat an intra-articular malunion incurred after a surgically treated DRF were

included in the study. All patients had DJD in the radiocarpal joint with persisting pain despite nonsurgical treatment (nonsteroidal anti-inflammatory drugs, infiltrations, individual hand occupational therapy, and orthosis fabrication). Contraindication to this procedure was DJD at the midcarpal joint. Between 2006 and 2014, RSL arthrodesis was performed on 14 patients. All patients were invited to attend the follow-up evaluation at our hospital. Two patients had died and 1 had moved abroad; therefore, 11 patients were included in the final clinical and radiological analysis.

A total of 7 men and 4 women with a mean age of 55 years (range, 35–86 years) were included. The follow-up was a mean of 63 months (range, 30–97 months). The DRF was primarily treated in 8 patients by a volar angular stable plate, in 1 by a volar and dorsal plate, and in 2 by an external fixator and K-wires. The mean interval between surgery for the DRF and RSL arthrodesis was 6 months (range, 3–9 months). Demographic details are shown in [Table 1](#).

## Surgical procedure

The surgery is performed using the preexisting volar approach for both hardware removal and RSL arthrodesis. The incision is extended distally to the radial side, which exposes the scaphoid sufficiently. The previous hardware is removed and a capsulotomy is performed, the carpus is exposed and the radiocarpal articulation is inspected ([Fig. 1A](#)). The complete palmar rim of the radius is planed using a chisel to ensure no tendon irritation from the incoming hardware ([Fig. 1B, C](#)).

The distal quarter of the scaphoid is resected. This unlocks the scaphotrapezium-trapezoid joint ([Fig. 1D](#)).<sup>18</sup> Maximal extension of the wrist enhances visualization and exposes the proximal articular surfaces of the scaphoid, lunate, and distal radius. To denude the cartilage surface, we use a rongeur or a bur until cancellous bone is exposed. If the scapholunate ligament is intact and stable, decortication of this area is not necessary. In cases of instability or malalignment between the scaphoid and the lunate, the scapholunate area must be denuded and filled with a cancellous bone graft. During this procedure, care must be taken to avoid damage of the midcarpal joint.

If the scapholunate joint is malaligned, correction of the alignment is performed. This is achieved with the use of joysticks to reduce the scapholunate gap and malrotation of the scaphoid and lunate. A K-wire is temporarily inserted to connect the scaphoid and

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