Proximal Row Carpectomy Using Decellularized Dermal Allograft

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Wrist arthritis is a common problem. When managed early, motion-sparing procedures can be performed with successful outcomes. Proximal row carpectomy (PRC) has demonstrated good functional results and high patient satisfaction with up to 20-year follow-up. The majority of patients with longer follow-up have, however, exhibited radiographic signs of progressive degeneration of the radiocapitate space. Although radiographic changes have not been shown to correlate with wrist pain and function, it remains a concern and questions the durability of the radiocapitate articulation with continued patient follow-up, especially those who underwent the original procedure at a younger age. Several modifications have been proposed and used to address this concern, including radiocapitate arthroplasty, with either distal radius hemiarthroplasty or tissue interposition grafts. Theoretical benefits to these adjuncts include minimizing wear and preserving the radiocapitate articulation as well as expanding the utility of a PRC even in the setting of a wrist with arthritis of the capitate head. We describe our surgical technique for managing radiocarpal arthritis with PRC and decellularized dermal allograft. Dermal matrix allografts have proved to be a safe adjunct in various orthopedic procedures, including those in the wrist and hand. This technique adds another surgical option for the treatment of radiocarpal arthritis and expands the indications for PRC to include select patients with degeneration of the capitate head. *(J Hand Surg Am. 2018;43(4):392.e1-e9. Copyright © 2018 by the American Society for Surgery of the Hand. All rights reserved.)*

Key words Proximal row carpectomy, scapholunate advanced collapse, scaphoid nonunion advanced collapse, radiocarpal arthritis.

Online Exclusive

Arthritis of the wrist is a common problem. Addressing degenerative changes of the radiocarpal joint in its early stages allows for motion-sparing surgical procedures to be performed, such as proximal row carpectomy (PRC) and intercarpal arthrodesis. The former holds several advantages including its technical ease, maintenance of functional range of motion (ROM) and grip strength, pain relief, and high patient satisfaction. Long-term follow-up data on PRC have demonstrated average wrist ROM between 61% and 78% and average grip strength between 78% and 92% of the contralateral side, respectively.[1–3] Although these are good functional results and provide high patient satisfaction, some patients with longer follow-up have exhibited radiographic signs of progressive degeneration of the radiocapitate space. Although the radiographic changes have not been shown to correlate with wrist pain and function, it certainly is a concern with continued patient follow-up, especially those who underwent the initial procedure at a younger age. More recently, after monitoring 17 wrists with a minimum of

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20 years after surgery, Wall and colleagues[3] noted 6 PRCs that failed and underwent radiocarpal arthrodesis at an average of 11 years.

The durability of the radiocapitate articulation after a PRC has been questioned. An adjunct to address this issue is the concept of radiocapitate arthroplasty following PRC, either with distal radius hemiarthroplasty[4] or tissue interposition grafts. Theoretical benefits to this adjunct include minimizing wear and preserving the radiocapitate articulation as well as extending the utility of a PRC to also manage wrists with arthritis of the capitate head. This has already been applied clinically in the presence of radiocarpal arthritis. A PRC with a capsular interposition flap between the radiocapitate articulation has been recently described with satisfactory results among 8 wrists with a mean follow up of 41 months.[5] Osteochondral resurfacing of the arthritic capitate head at the time of PRC has also demonstrated comparable results regarding pain relief, work status, ROM, and grip strength.[6]

We describe our surgical technique of managing radiocarpal arthritis with PRC and decellularized dermal allograft. Kokkalis and colleagues[7] have described the use of acellular dermal allograft for the treatment of thumb basal joint arthritis. Their technique of performing trapeziectomy with ligament reconstruction and tendon interposition using a strip of acellular dermal allograft in 82 thumbs has shown substantial pain relief as well as improvement in grip and pinch strength after a minimum 12-month follow-up. No patient experienced a clinical foreign body reaction or infection secondary to the allograft. Our approach aims to minimize wear at the radiocapitate articulation with an interposition decellularized dermal allograft, ultimately leading to an anticipated improvement in the durability of a PRC. This technique adds another surgical option for the treatment of wrist arthritis and expands the indications for PRC to include select patients with degeneration of the capitate head. We have performed this technique with satisfactory short-term results on patients even with substantial radiocarpal arthritis, both in the primary procedure and for revision surgery. Indications have included stage 3 scapholunate advanced collapse (SLAC) with mild degenerative changes of the capitate articular surface as well as failed prior surgical intervention including scaphoid excision, 4-corner fusion.

ANATOMICAL CONSIDERATIONS

Removal of the proximal row markedly alters the biomechanics and load transmission forces across the wrist joint. Incongruent stresses are created within the lunate fossa due to mismatch of the proximal capitate radius of curvature and the radius of curvature of the proximal lunate. After Hogan and colleagues[8] applied a static load of 13.7 kg to the radiocarpal joint in 7 normal cadavers following PRC, contact area and peak pressure in the lunate fossa increased substantially, independent of wrist position. The location of the contact centroid moved 5.5 mm radially, for all wrist positions tested, and changes in dorsal and volar translation of the wrist occurred with wrist flexion and extension. The authors also noted the capitate articulating over a wider area in the lunate fossa during the flexion-extension arc of the wrist, allowing for distribution of pressure over a greater area. After performing a PRC in 6 cadaver wrists, Nanavati et al[9] similarly found elevated peak pressures in the radiocapitate space during static loading as well as with flexion-extension and radioulnar deviation motions. After the authors placed an interpositional lateral meniscal allograft, there was restoration of near anatomical pressures and contact areas, a goal our technique aims to re-create as well.

INDICATIONS AND CONTRAINDICATIONS

Failure of nonsurgical management of radiocarpal arthritis is the main indication for PRC. Nonoperative modalities including orthoses, nonsteroidal anti-inflammatory medications, and/or cortisone injections are typically first tried for stage 1 SLAC. In older, less active individuals, a partial radial styloidectomy can be tried for this stage of arthritis as well. A partial styloidectomy is not enough to manage advancement of the degeneration to involve the articulation between the scaphoid fossa and the proximal pole of the scaphoid (stage 2 SLAC). In this circumstance, a PRC is preferred. Further progression of degenerative joint disease to stage 3 or stage 4 SLAC has traditionally warranted a 4-corner arthrodesis when there is presence of midcarpal arthritis and degeneration at the capitate base. The presence of mild degeneration of the capitate has not, however, precluded good to excellent results of PRC, and thus, the acceptable degree of capitate or lunate facet degeneration to achieve satisfactory results with PRC has not been clearly established. The addition of an interposition decellularized dermal allograft with our technique aims to extend the indication for PRC in select patients with capitate head and lunate facet arthritis. In select patients with stage 3 or 4 SLAC or stage 2 or 3 scaphoid nonunion advanced collapse, scaphoid excision and intercarpal fusion or total wrist