

# Dermal Allograft Interposition with Proximal Row Carpectomy Decreases Radiocarpal Contact Pressure

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## INTRODUCTION:

Proximal row carpectomy (PRC) is a procedure in which the proximal three carpal bones (scaphoid, lunate and triquetrum) are removed, after which the capitate directly articulates with the lunate fossa of the distal radius. PRC is a valuable surgical option for those with wrist arthritis, but a common contraindication is pre-existing degeneration at the capitate head or lunate fossa. Additionally, long term studies have shown that even in those without pre-existing capitate or distal radius degeneration, a significant portion of patients exhibit radiographic progression of radiocapitate degeneration. In light of these limitations of performing PRC, the use of decellularized dermal allograft as an adjunct to PRC was recently described and has shown promising preliminary clinical results. The purpose of this study was to evaluate whether dermal allograft interposition restores the contact characteristics of the radiocarpal joint to more closely approximate those of a normal (pre-PRC) radiocarpal joint.

## METHODS:

Eight cadaveric wrists were mounted on a custom testing system that allowed for loading of the wrist tendons (Figure 1). A Tekscan pressor sensor was inserted into the radiocarpal joint in the intact wrist, post-PRC wrist and post-PRC with dermal allograft augmentation both as a single layer (SL) and double layer (DL) (Figure 2). The sensor was used to collect contact area, contact pressure, and peak pressure at 13 static positions of radial-ulnar deviation and flexion-extension. Statistical analysis was performed using a repeated measures linear mixed-effect model and Tukey's honest post hoc test to compare across all conditions with significance set at  $P < 0.05$  (RStudio).

## RESULTS:

PRC significantly decreased contact area compared to the intact state at 10° and 30° of flexion and 10°, 20°, and 30° of extension. PRC augmented with both SL and DL dermal allograft had significantly higher contact area than PRC alone at neutral, 5°, 10°, 15° of ulnar deviation and 5° of radial deviation. PRC augmented with DL dermal allograft had significantly higher contact area compared to PRC at all flexion/extension positions; PRC augmented with SL dermal allograft had significantly larger contact area at all flexion/extension positions except for 20° and 30° of flexion when compared to PRC alone (Figure 3).

PRC alone had significantly higher contact pressure than the intact wrist across all positions except for 10° of radial deviation. PRC with single layer augmentation was unable to restore contact pressure to intact levels at neutral and 5° of ulnar deviation and from 30° of flexion to 10° of extension. PRC with double layer augmentation restored contact pressure to intact in all positions except for 30° of flexion (Figure 4).

PRC alone had significantly higher peak pressure compared to the intact at all positions. PRC with DL and SL augmentation significantly decreased peak pressure compared to PRC alone across all positions except for 10° radial deviation for SL. PRC with SL augmentation was unable to restore peak pressure at 15° of ulnar deviation and from 0° to 30° of flexion. PRC with DL dermal allograft augmentation was able to restore peak pressure at all positions (Figure 5).

## DISCUSSION AND CONCLUSION:

PRC decreases contact area and increases both the contact pressure and peak pressure within the radiocarpal joint compared to the intact wrist. The addition of dermal allograft increased the contact area to more than that of the intact joint for both single and double layer grafts. Dermal allograft interposition also decreased the contact pressures and peak pressures within the joint, with double layer allograft more closely restoring pressures of the intact joint. This demonstrates a potentially beneficial role in dermal allograft as an augmentation to PRC to expand indications to patients with pre-existing capitate or lunate fossa arthritis or the prevention of progression of radiocapitate degeneration after PRC.

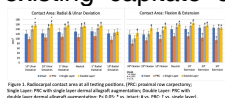


Figure 1. Radiocarpal contact area at various positions. PRC decreased contact area; single layer and double layer dermal allograft significantly increased contact area compared to PRC alone.