



MedStar Health

The Effect of Scaphoid Overstuffing on Radiocarpal Contact Pressures

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Introduction

The Medial femoral trochlea (MFT) flap is a motion preserving option for treating scaphoid proximal pole nonunion. Although this technique requires resecting a substantial portion of the scapholunate interosseous ligament, the intercarpal angular relationships are preserved. Studies have demonstrated that this is due to the reconstruction with a flap that is larger than the resected nonunited proximal scaphoid. The technique of purposeful expansion of the scaphoid height has been termed *scaphoid overstuffing*. This study was to characterize the effect of overstuffing on force transmission across the scaphoid and lunate facers of the radius.

Methods

- 11 fresh, frozen cadaveric specimens; no evidence of injury or wrist disease
- Exposure was via a dorsal approach
- Pressure analyzed by electronic pressure sensors
- Wrists were evaluated in three different states
 - Native
 - Scapholunate dissociation (SLD)
 - Overstuffed (OD)
- Pressures were taken in 30 degrees of flexions, full wrist extension, 30 degrees of extension and fist clenched
- Pressure measured in kPa
- Contact areas measured in mm²
- One-way ANOVA for comparison of groups

Results

In all functional positions the overstuffed state had higher peak pressures across the scaphoid facet than the native state.

- 30 degrees flexion (OS 383±221 kPa, P=0.033),
- Full wrist extension (OS 1068±767 kPa, P=0.022)
- 30 degrees wrist extension (OS 880±518 kPa, P<0.001)
- Clenched fist (OS 1040±736 kPa, P=0.02)

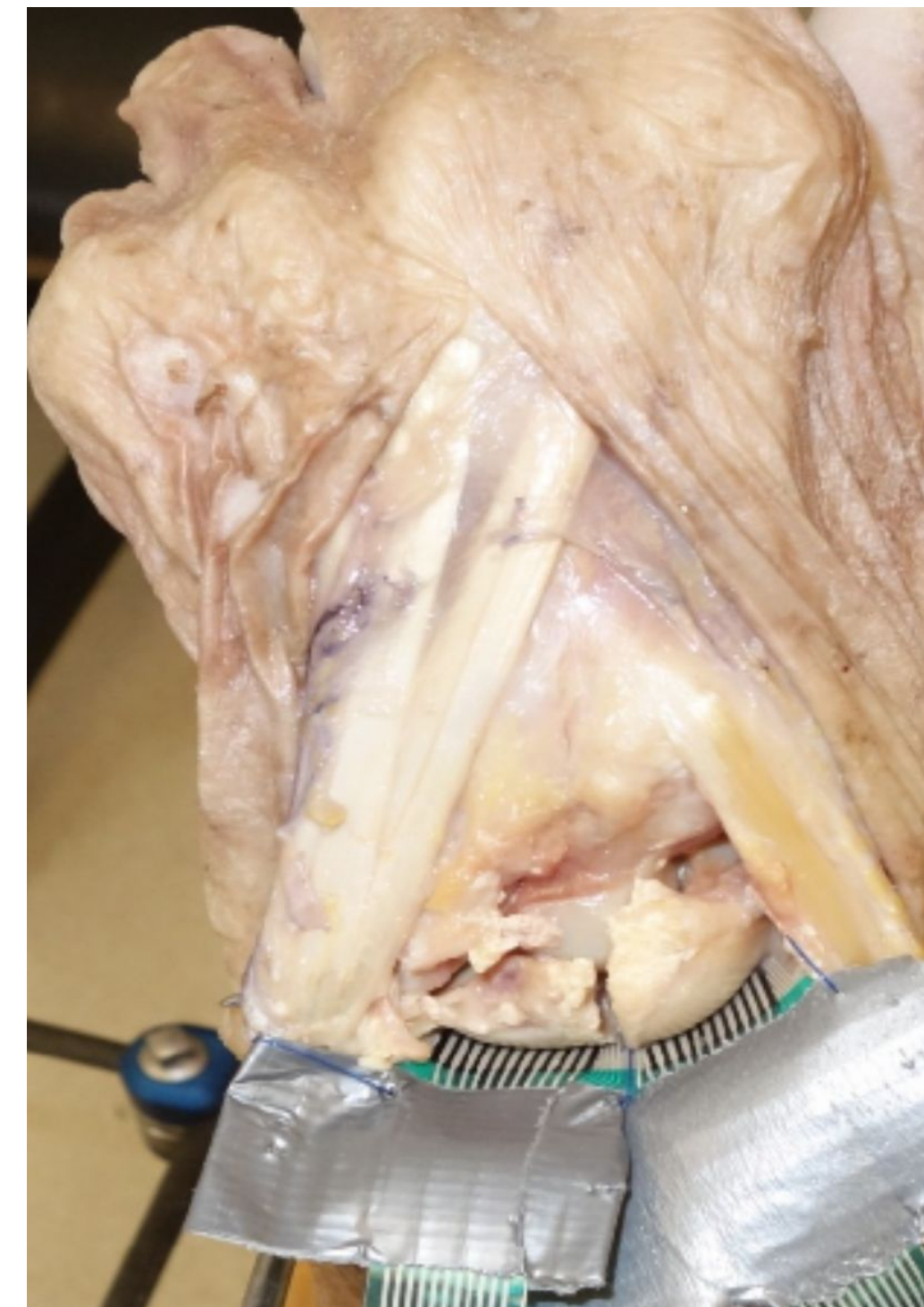


Figure 1
Experimental cadaveric upper extremity with sensors, dorsal view.

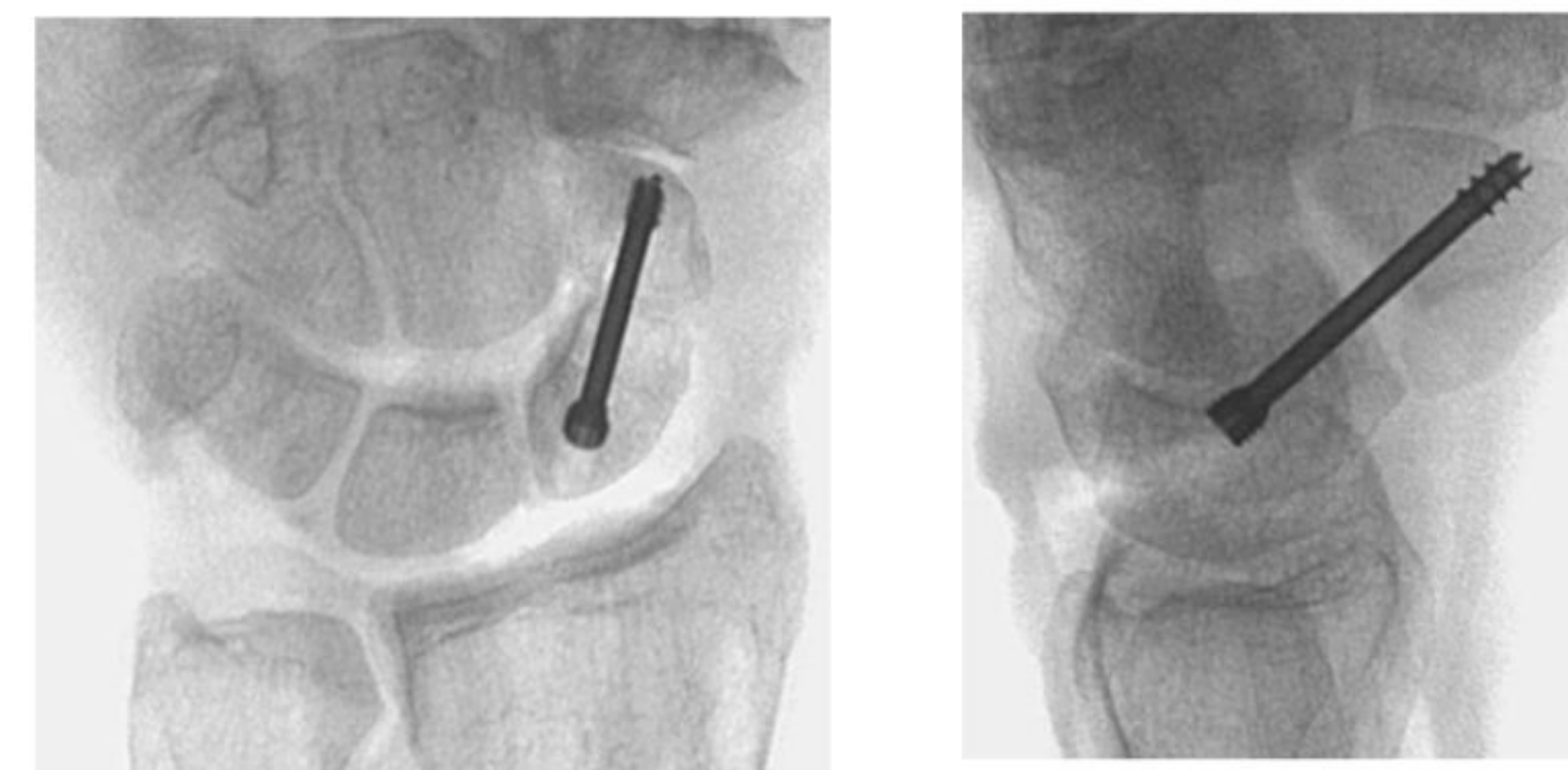
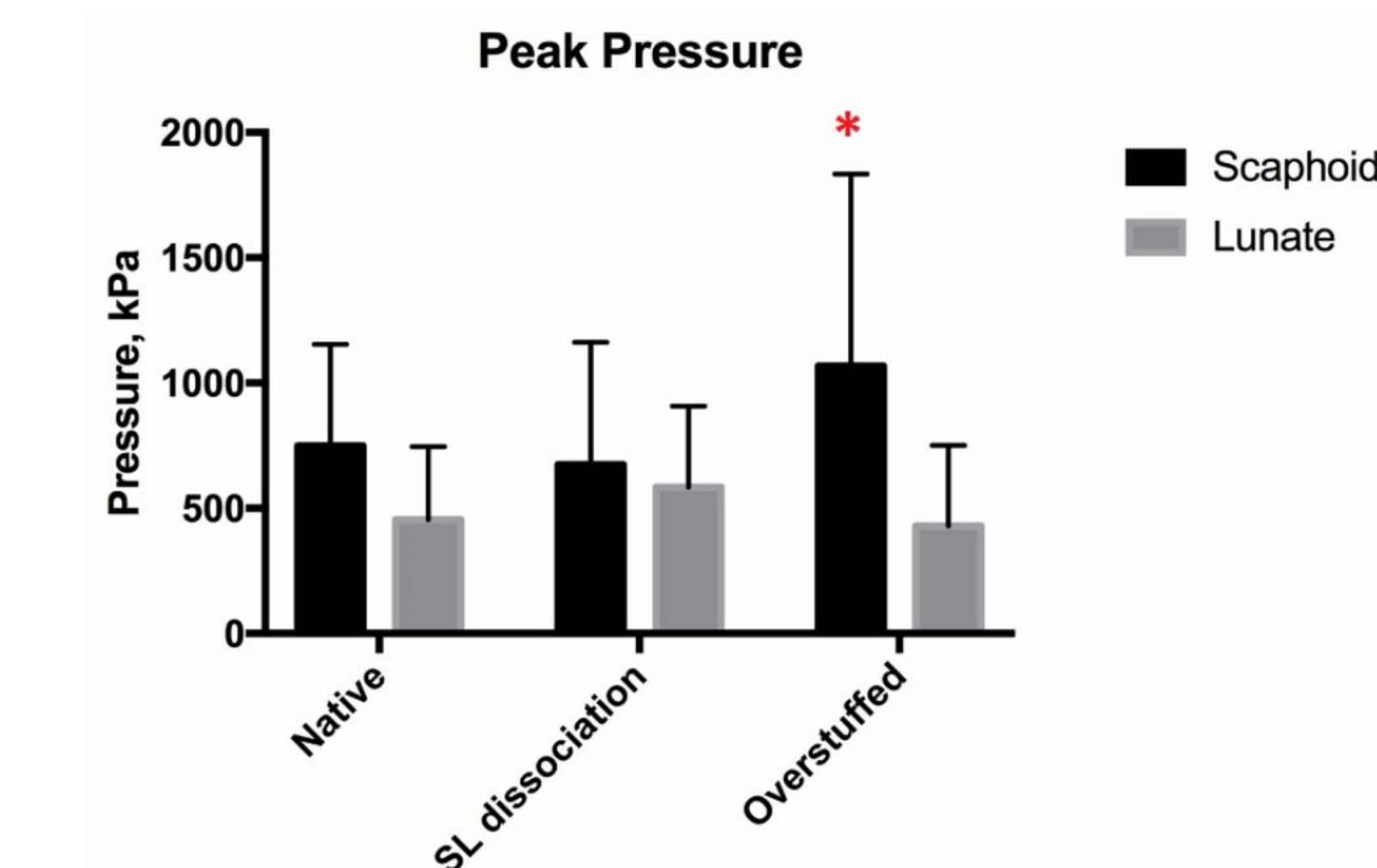
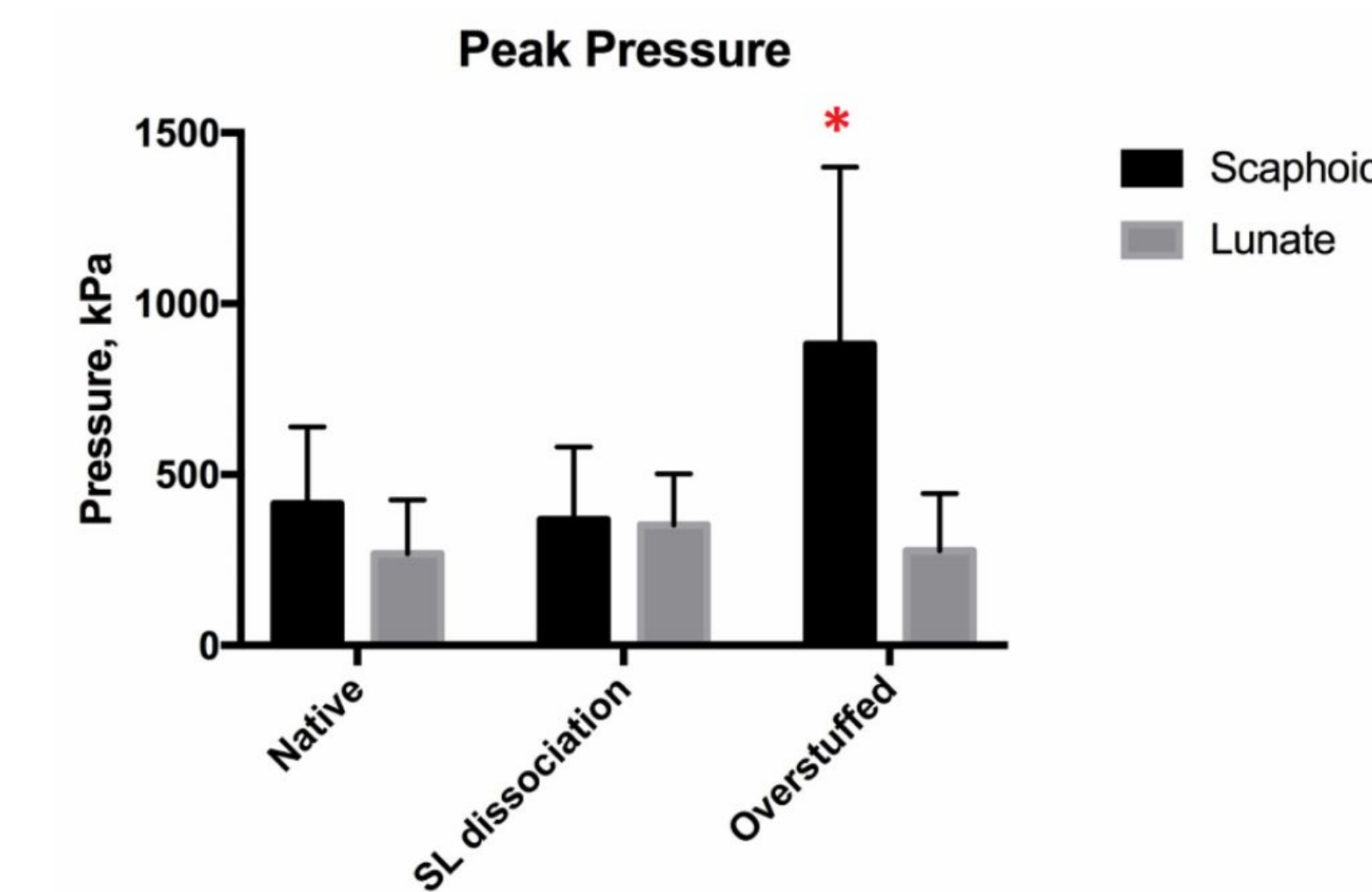
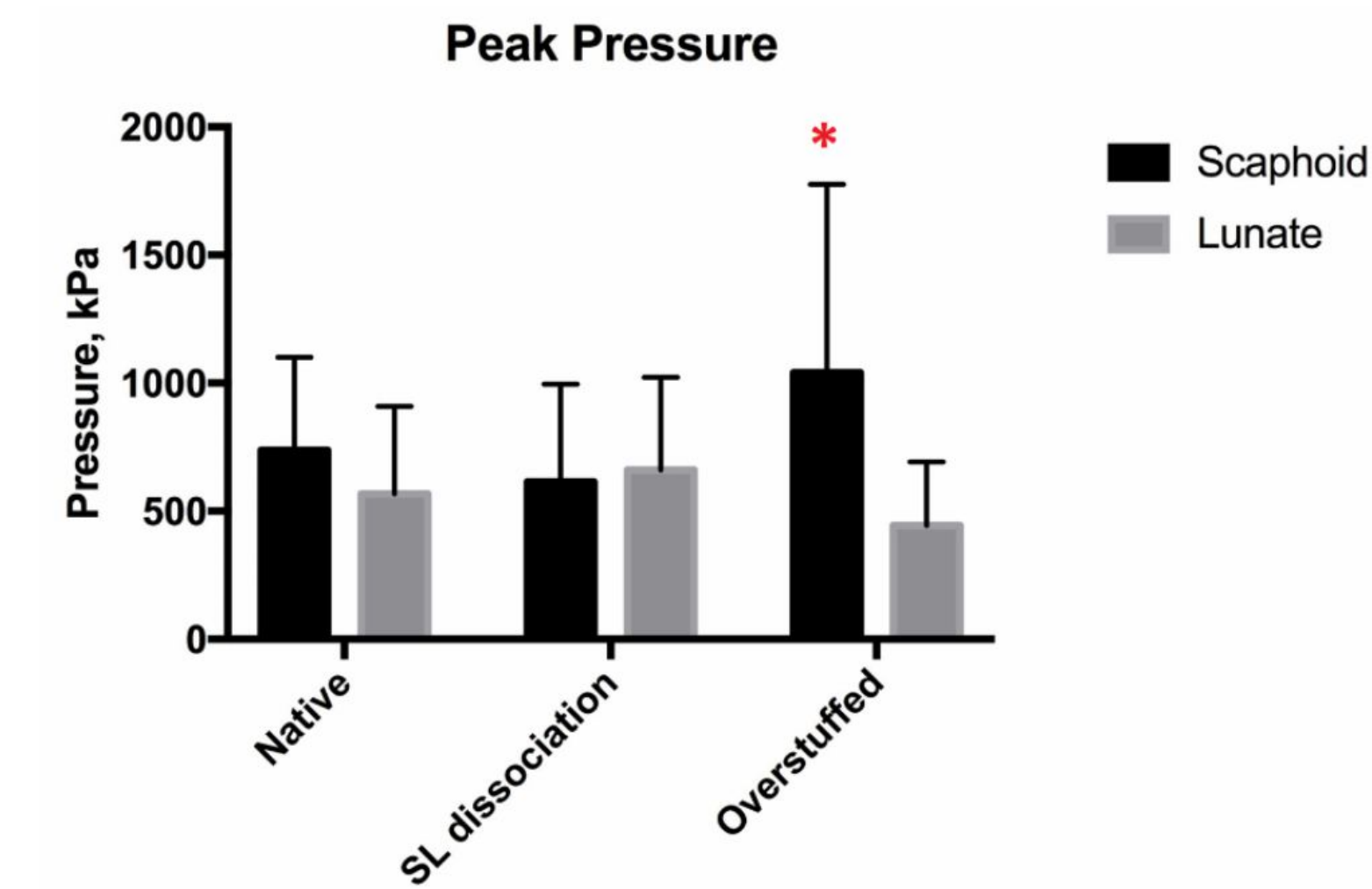
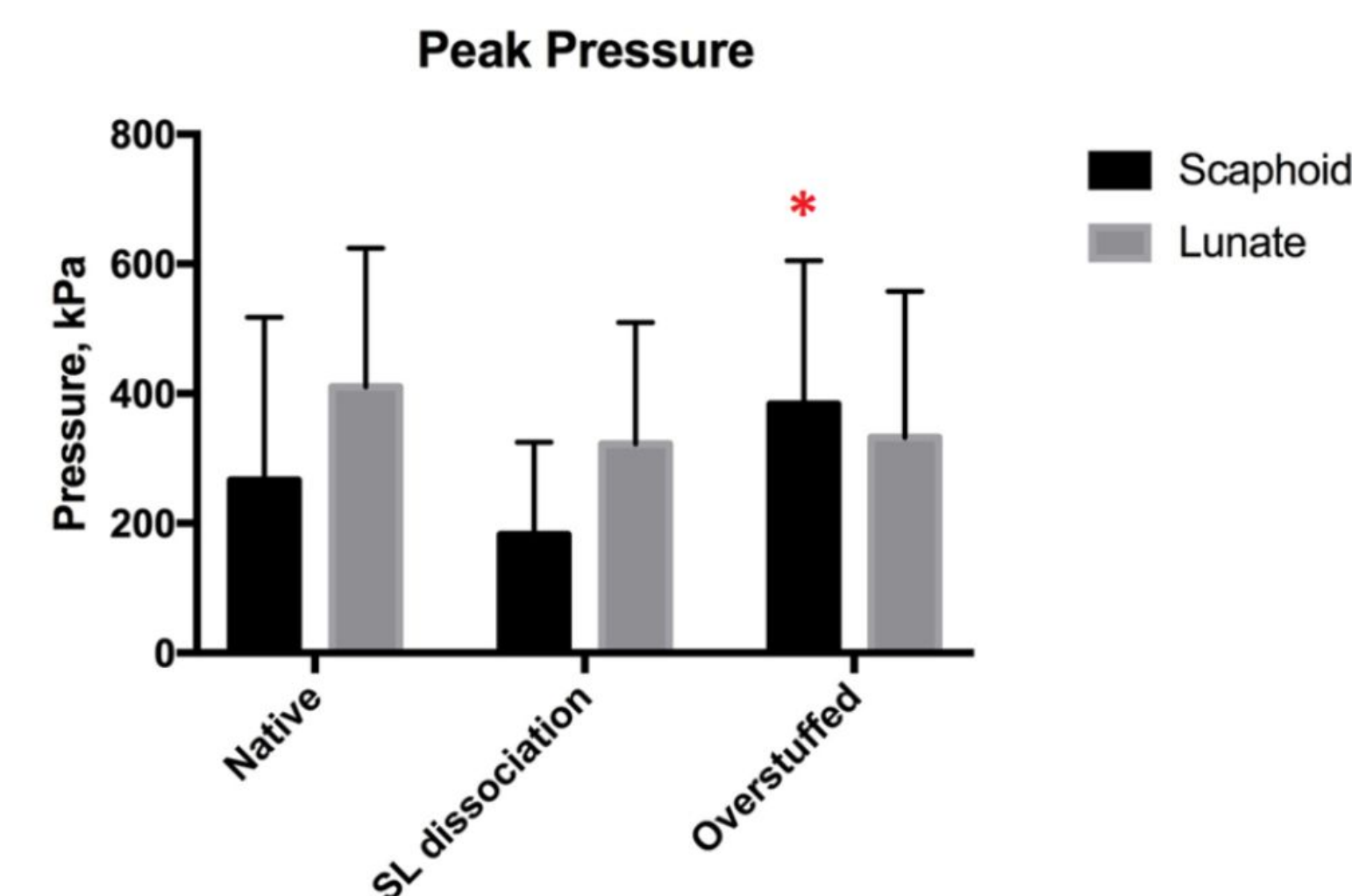


Figure 2
AP and lateral radiographs demonstrating fixation of scaphoid with the spacer inserted at the waist level to increase scaphoid height, mimicking the overstuffed state.



Figures 3-6

(3) Peak pressure for 30 degrees wrist flexion in three states; (4) Peak pressure for clenched fist position in three states; (5) Peak pressure for 30 degrees wrist extension in three states; (6) Peak pressure for full extension in three states. Asterisks indicates scaphoid facet peak pressures were statistically significant in the overstuffed state with each.

Limitations

- Cadaveric study; unclear if different results and contact pressures would occur in clinical practice
- Unable to assess changes that may occur with cyclic loading
- Sensors are 0.2mm thick which may alter the expected force transmission across the radiocarpal joint
- Single load, limited position measurements

Conclusion

This study is the first to assess how radiocarpal kinetics are impacted by scaphoid overstuffing. Overstuffing can occur with performing MFT or MFC vascularized autografts. While overstuffing provides sustained carpal alignment and improved fracture healing, it is unclear the effect the increased pressures seen in this study will have clinically long term on the cartilage degeneration.

Take Home Message

In functional wrist positions overstuffing increases scaphoid facet peak contact pressures. While the shift in force likely explains why the carpals alignment is corrected and maintained with overstuffing, there is a potential clinical downside with the potential for accelerated cartilage degeneration with increased pressures.

References

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