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Biomechanical Evaluation and Surface Analysis of Glenoid Reconstruction Using the Subtalar Joint Allograft for Significant Glenoid Bone Loss in Recurrent Shoulder Instability:

A Novel Alternative Graft Option

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Faculty Disclosure Information

- **Presenter: Phob Ganokroj, MD** reported nothing to disclose
- **Co-author:**
  - Justin Hollenbeck, MSc reported nothing to disclose
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Matthew T Provencher, MD, MBA, FAAOS has something to disclose: Submitted on: 08/25/2022

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Background

- Glenoid and humeral head bone defects are common in chronic shoulder instability.
- The talus, and more specifically, the subtalar joint, has been proposed as a unique allograft from which bipolar bone loss can be addressed.
- However, there are few biomechanical data or joint reconstruction analyses of the glenoid using the posterior facet of a subtalar joint allograft (STA)

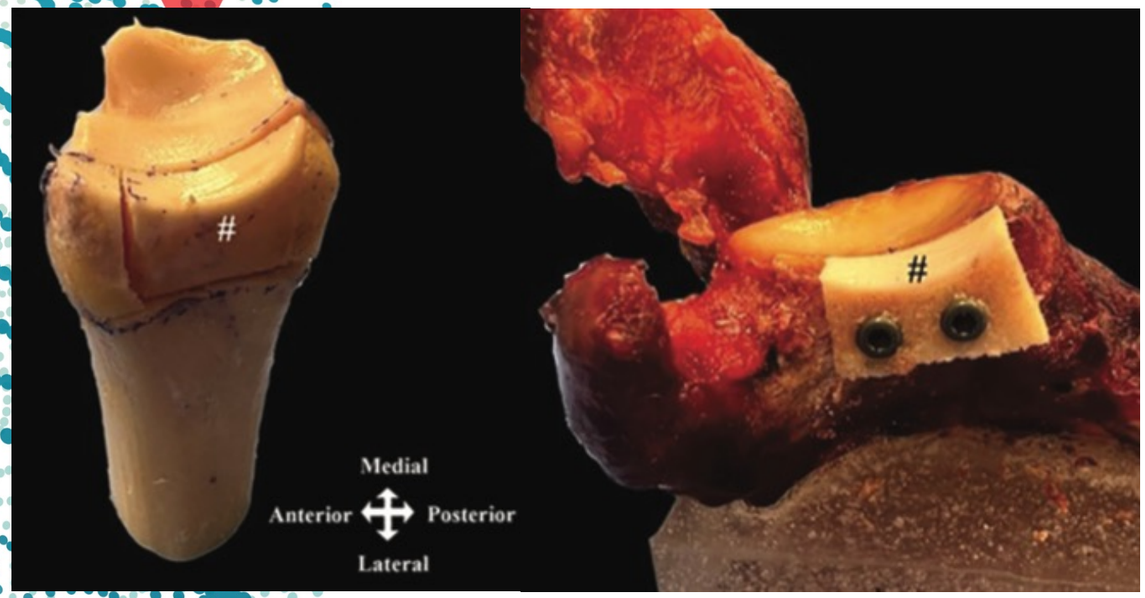
Objective

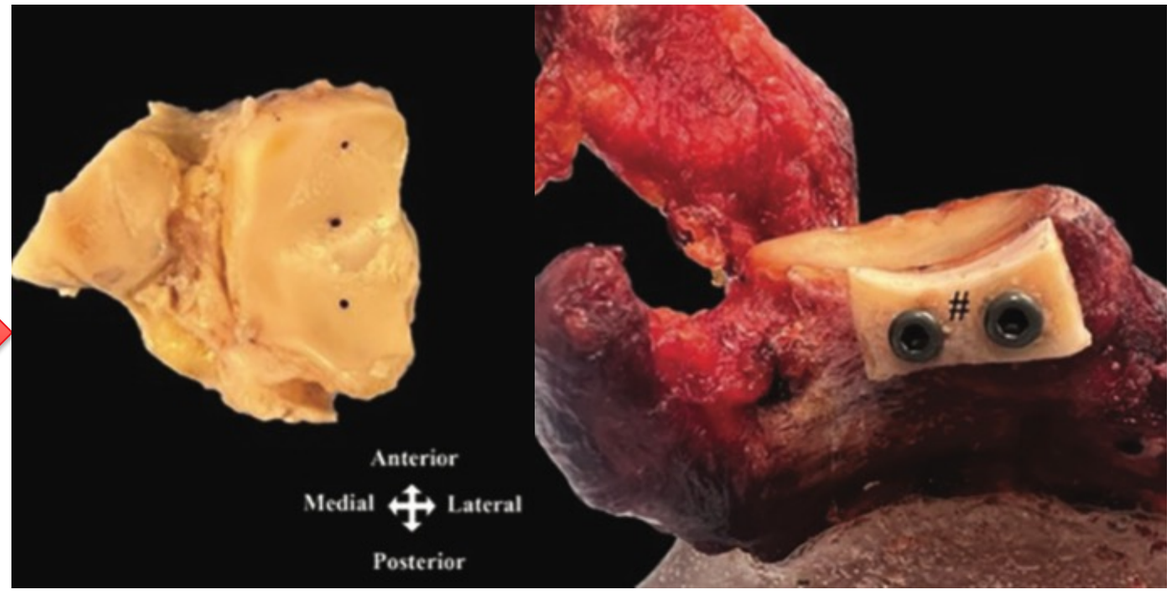
- To compare the contact mechanics of a subtalar joint allograft (STA) versus a coracoid graft (Latarjet procedure) versus a distal tibial allograft (DTA) for anatomic glenoid reconstruction.

Methods

- A Controlled laboratory study.
- A total of 8 fresh-frozen, unpaired cadaveric specimens
- The repeated-measures biomechanical testing in 5 stages: native (intact) state, bone loss (30% glenoid bone defect), Latarjet procedure, glenoid reconstruction using a DTA, and glenoid reconstruction using an STA

Anatomic glenoid reconstruction





DTA reconstruction

STA reconstruction

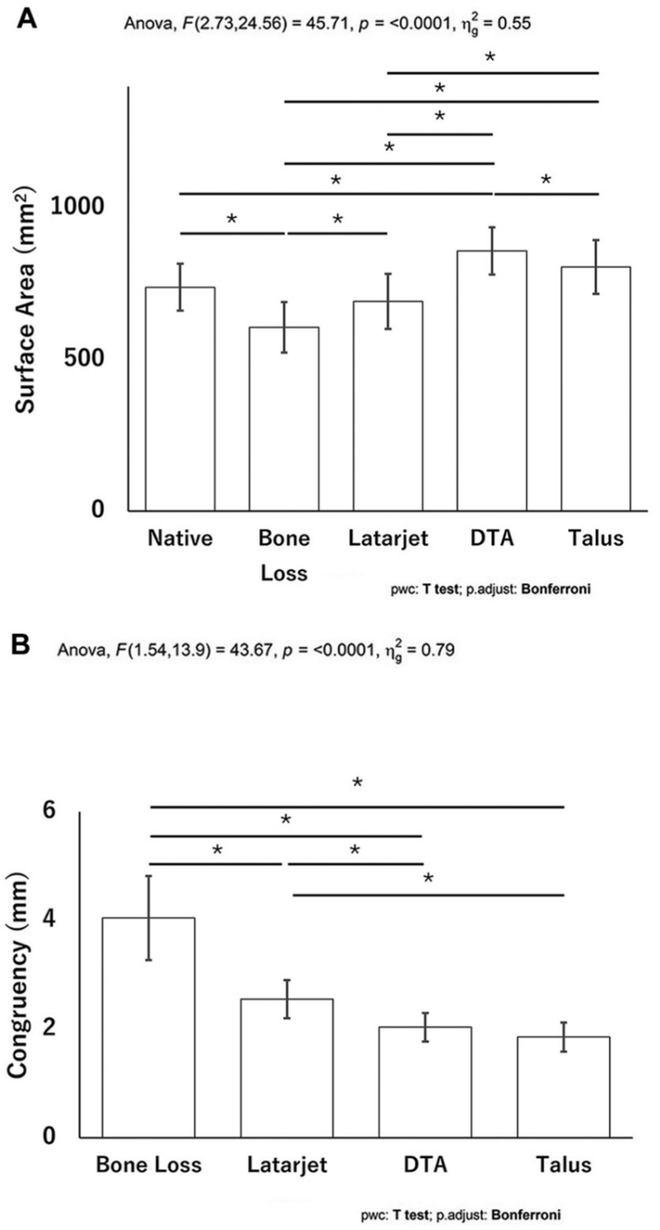
Methods

- A compressive load of 440 N was
- A dynamic tensile testing machine in 3 shoulder positions: 30° of abduction, 60° of abduction, and 60° of abduction with 90° of external rotation
- Average contact pressure, contact area, and peak contact pressure were measured
- Surface area and surface congruency were calculated using a custom script.
- Data were analyzed using analysis of variance.

Result

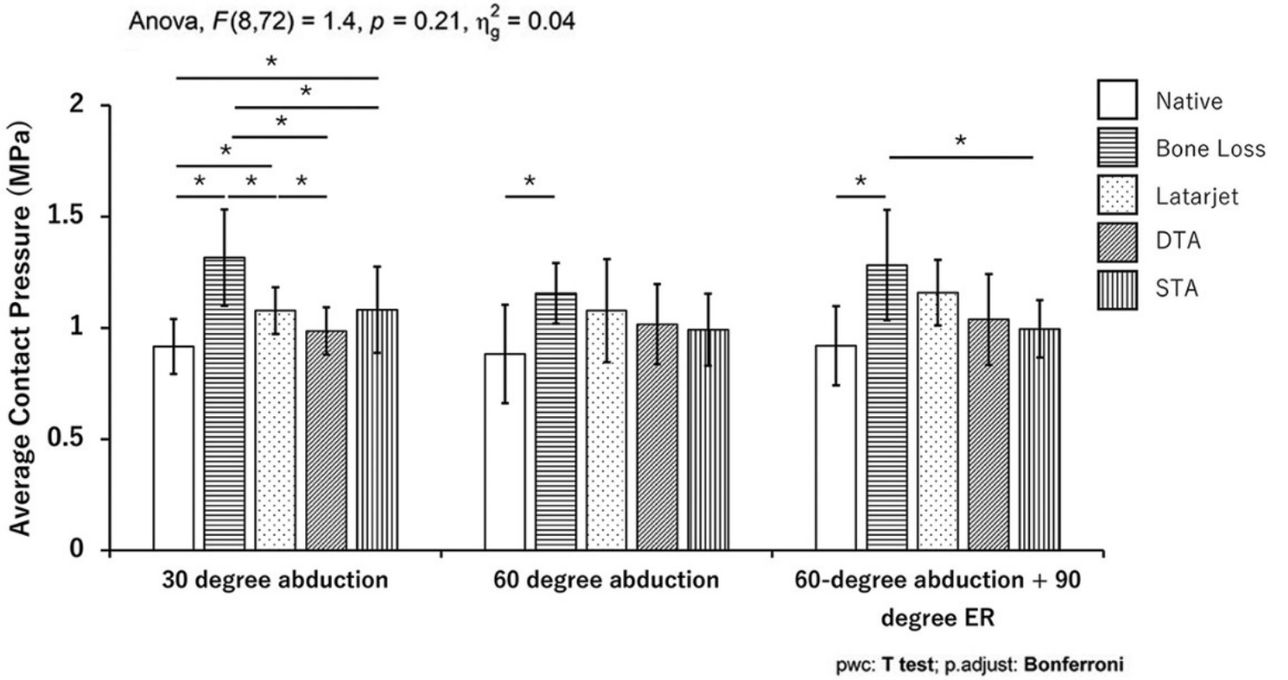
- There was a significantly higher surface area with glenoid reconstruction using the DTA (859 ± 78 mm2; *P* = .005) than with glenoid reconstruction using the STA (806±88 mm2; *P* < .001) and the Latarjet procedure (692±91 mm2).

- Surface congruency was significantly better with reconstruction using the DTA (2.0 ± 0.3 mm; *P* = .003) or the STA (1.9 ± 0.3 mm; *P* = .004) than with the Latarjet procedure (2.6 ± 0.4 mm).



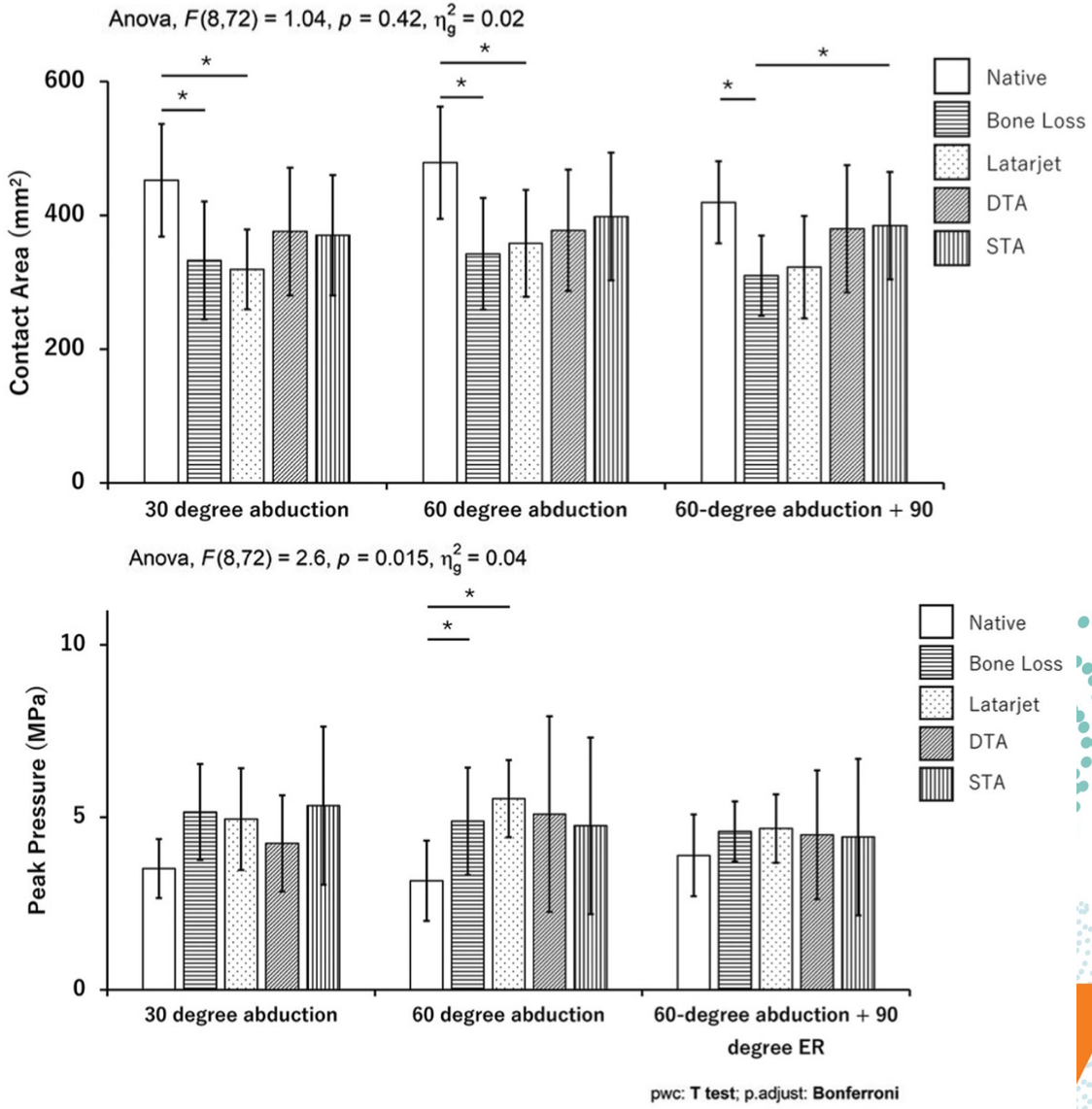
Result

- The average contact pressure in the bone loss state was significantly higher than that in the native state (*P* <.05) in all positions.
- All repair states restored average contact pressure to the native state at 60° of abduction and 60° of abduction with 90° of ER.



Result

- There was less contact area after the Latarjet procedure than in the native state at 30° and 60° of abduction (*P* = .009 and *P* = .040, respectively).
- There was no significant difference in contact area and peak contact pressure after reconstruction with the DTA or STA compared with the native state.



Discussion

- The study's most important findings were that the Latarjet procedure and anatomic glenoid reconstruction using an STA restored the physiological surface area.
- Furthermore, reconstruction with a DTA and STA improved surface congruency over the Latarjet procedure. DTA and STA preserved the contact area, similar to the native state, better than the Latarjet procedure
- Finally, the Latarjet procedure induced a higher peak contact pressure at 60° of abduction than the native state. This finding may be because of the poor congruency of the coracoid graft to the native humeral head

Conclusion

- Anatomic glenoid reconstruction using a DTA or STA restored average contact pressure, peak contact pressure, and contact area at 60° of abduction and 60° of abduction with 90° of ER in a cadaveric model.
- In addition, surface congruency and surface area improved over the traditional Latarjet procedure.
- The STA showed comparable contact mechanics and surface geometry to the DTA.
- Further research is needed to determine the in vivo clinical outcomes of this new alternative graft.

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