Imaging Analysis of Arthroscopic Shoulder Stabilization: A Cadaveric Comparison of Repair in the Beach Chair versus the Lateral Decubitus Position

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Disclosures

- Alex Lencioni, MD:
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- Steven Jones, MD:
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- Adam Seidl, MD:
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- Todd Baldini, MS:
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Introduction

- Shoulder instability → common in athletes, workers, "weekend warriors"
- Instability events → result in pain, dysfunction, and disability
- >90% Recurrent Instability Rates in young athletes
- *Despite a more evolved understanding of shoulder instability, **failure rates** after primary open and arthroscopic surgery are noted to be **as high as 20-30%***

Surgical Goals:

To create an anatomic, secure capsulolabral repair
Improve function
Reduce pain
Return to sport/work

Multiple Factors

- Bone Loss
- # Anchors
- Age, Sex, Sport
- Capsule redundancy
- Missed HAGL
- **POSITIONING**

Study Purpose and Hypothesis

- Purpose: to perform an imaging analysis of anchor positioning and trajectory to determine preferable patient positioning for arthroscopic anterior shoulder stabilization

- Hypothesis: LD position offers improved inferior anchor position (between 5-6 o’clock) and trajectory compared to the BC position

Methods

- Procedures were performed by experts trained in beach chair and lateral decubitus
- N=9 fresh frozen, matched pairs of human cadaver shoulder specimens → 18 total shoulders
    - 5 male pairs (10 shoulders) Average age 41.4 years, BMI 19.5
    - 4 female pairs (8 shoulders) Average age 48.7 years, BMI 28.8
- Specimens were examined arthroscopically for any pre-existing lesions or glenoid dysmorphia
- An iatrogenic anterior inferior labral tear was then created from 3'oclock to 6'oclock
- Specimens were potted to simulate LD and BC positioning as a surgeon would experience in the OR

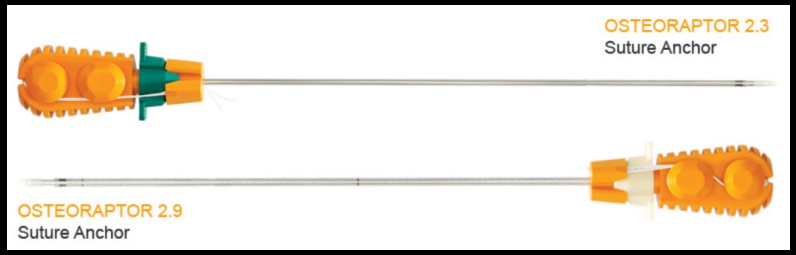
Beach Chair

Lateral Decubitus

Methods

- Tears were then repaired using 3 bioabsorbable, hydroxyapatite suture anchors
- Experts were instructed to place anchors at the theoretical 3:30, 4:30, and 5:30 positions
- Three standard portals were used for access and repair:
  - A posterior portal viewing portal
  - An anterior interval working portal
  - And an anterior-inferior accessory portal
- The specimens then underwent CT scan analysis

Anchors: 2.9mm OSTEORAPTOR◊



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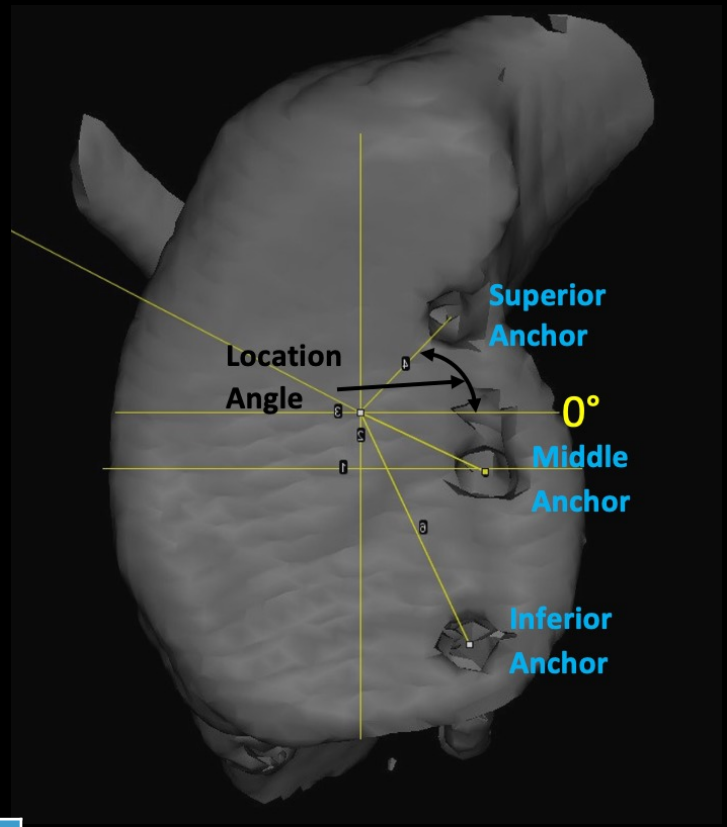
Results: Anchor Position

- Three-dimensional CT scans were obtained, and a model was built in ImageJ
- The anchor location angle is the angle between the center of the clock face and the center of the anchor.
- The 3 o'clock position is 0 degrees:
  - Above 3:00 = positive angle
  - Below 3:00 = negative angle
- For ideal anchor positions of 3:30, 4:30, and 5:30, the anchor location angles should be -15°, -45°, and -75° respectively
- Each angle was measured 3 times and averaged
- Deviation from these ideals was used in statistical analysis

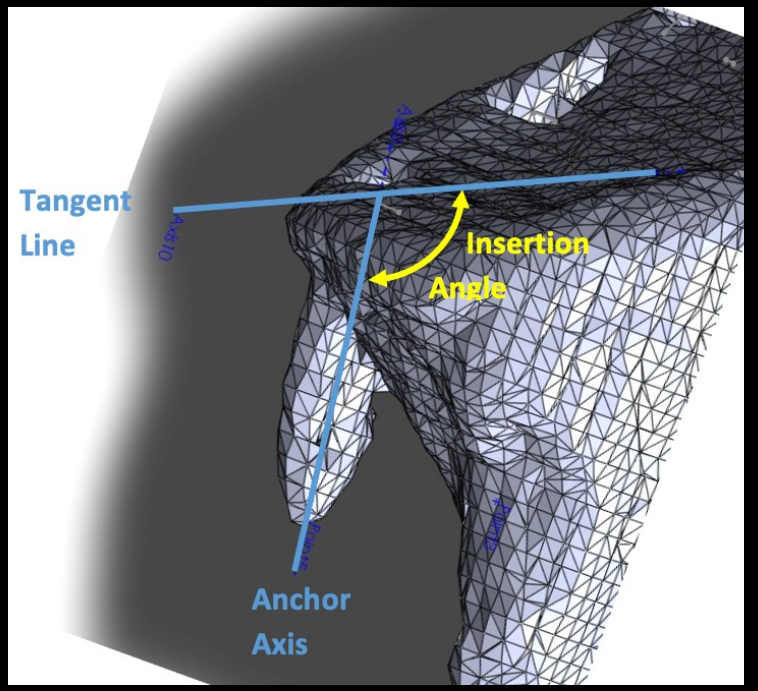


	Superior (3:30)		Middle (4:30)		Inferior (5:30)	
	Technique LD	Technique BC	Technique LD	Technique BC	Technique LD	Technique BC
Average	19.2°	-22.9°	-33.7°	-64.1°	-74.3°	-101.3°
St. Dev.	32.3°	25.1°	16.4°	16.0°	15.9°	13.5°

Table: Descriptive statistics of anchor location for the three anchor positions for each technique.

Results: Anchor Trajectory

- ImageJ 3D models were used
- A line was drawn along the axis of the anchor (anchor axis)
- A second line was drawn parallel to the glenoid face to the center point of the anchor insertion (tangent line)
- The angle between these two lines is the insertion angle
- For ideal anchor trajectories, the insertion angle should be as close to 90° as possible
- Descriptive statistics were recorded and reported



	Superior (3:30)		Middle (4:30)		Inferior (5:30)	
	Technique LD	Technique BC	Technique LD	Technique BC	Technique LD	Technique BC
Average	70.6°	83.1°	86.1°	88.9°	93.1°	106.3°
Upper CI	78.5°	97.4°	95.8°	106.9°	104.2°	130.0°
Lower CI	62.7°	68.8°	76.4°	70.9°	82.1°	82.7°

Table: Insertion Angle with 95% CI

Discussion

- BC may offer improved superior anchor placement, while LD may offer improved inferior anchor placement
- Middle anchor placement did not vary significantly
- BC positioning offered a more accurate anchor placement in the superior anchor location
- LD positioning offered a more accurate anchor placement in the inferior anchor location
- While the pathology and surgeon preference should dictate the positioning of a patient for arthroscopic repair of shoulder instability, we offer data that supports that LD may allow for a more accurate inferior anchor location for the repair and capsular shift.

Discussion

- BC may offer improved superior anchor trajectory, while LD may offer improved inferior anchor trajectory
- Middle anchor trajectory did not vary significantly
- BC positioning offered a more accurate anchor trajectory in the superior anchor location
- LD positioning offered a more accurate anchor trajectory in the inferior anchor location
- Our data shows that both the anchor trajectory and location on the glenoid face follow the same trends
- The superior anchor more accurate and accessible using a BC positioning while the inferior anchor location is best approached with the LD positioning

Limitations

- Limitations: cadaveric study, small sample size, equipment limitations, measurement/observer bias (single measurer)
- IN our study while designed to limit direct comparison of the two surgeons we recognize there is some component of direct comparison of the preforming surgeons.
- Additionally, when repairing artificially generated tears there may be a difference in the normal anatomical landmarks the surgeons will use to best individualize the anchor location and spread for each patient
- Another limitation to this study is the observation of surgeons preforming the repair in attempt to place anchors at specific locations on the glenoid and not in relation to the tear may have altered the final anchor position.
- In this cadaveric model, differences are noted between LD and BC positioning, but further analysis is needed

Conclusions

- Choice of positioning for arthroscopic stabilization remains controversial
- Both positioning techniques demonstrate their own pros and cons
- Currently, both positions are considered safe and accepted techniques
- Future utility for this study will include posterior instability models and biomechanical testing

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