The Effect of Humeral and Ulnar Tunnel Placement on Achieving UCL Graft Isometry

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Background

- Acute and attritional injury to the UCL occurs most often in overhead athletes, especially baseball pitchers, due to valgus overload during the throwing motion.
- UCL reconstruction has been mainstay of treatment since its first description by Dr. Frank Jobe in 1974.
- Limited literature available on the assessment of UCL graft isometry in the setting of single point fixation methods.

Purpose

- Assess changes in UCL graft effective tension between multiple humeral and ulnar bone tunnels combinations

Methods

- 10 fresh-frozen cadaveric elbows were dissected to expose the native UCL
- 3 humeral and 3 ulnar tunnels created using 0.86-mm guide wires and 1.7-mm cannulated drill bit
- 2.0-mm cannulated screws were placed in 6 total tunnels (Fig. 1)

- Anteriorepi = anterior med epicondyle
- Centralepi = central med epicondyle
- Posteriorepi = posterior med epicondyle
- Anteriortub = anterior sublime tubercle
- Centraltub = central sublime tubercle
- Posteriortub = posterior sublime tubercle

- Suture passed between each cannulated screw combination (9 total combinations)
- At the medial epicondyle, suture was secured with hemostat clamp
- At the sublime tubercle, suture was fixed within a cannulated isometric positioner (Fig. 2)

Testing Protocol

- Preconditioning: each elbow cycled twice through a 120-degree arc of motion to eliminate creep in system prior to data collection
- Data collection: changes in system tension measured by the isometric positioner were recorded at 0, 30, 60, 90, and 120 degrees of flexion
  - Positive values (increased tension) = spring compression
  - Negative values (decreased tension) = spring relaxation
- Statistics: values between the 9 tunnel combinations were analyzed using one-way analysis of variance with Tukey's Honest Significant Difference for pairwise comparisons. Significance was set at p≤0.05.

Results

- Significant effect (p<0.0001) of tunnel placement at all degrees of flexion

- No significant differences between ulnar tunnel locations when paired with any single humeral tunnel

- Anterior or posterior humeral tunnel positioning caused diminished isometry during all range of motion testing (Fig. 3)
  - Anteriorepi tunnel placement caused graft loosening at 120 degrees
  - Posteriorepi resulted in graft tightening

- Greatest displacement occurred with Posteriorepi – Posteriortub pairing (Fig. 4)

- Central(epl) (central medial epicondyle) tunnel placement resulted in the most isometric findings

Conclusion

- UCL graft isometry is dependent upon optimal bone tunnel placement.
- Deviation, anterior or posterior, from the centroid of the UCL footprint on the medial epicondyle significantly affects isometry to a greater extent than sublime tubercle tunnel deviation.

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