Topographic Analysis Of The Glenoid And Proximal Medial Tibial Articular Surfaces – A Search For The Ideal Match For Glenoid Resurfacing

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Background

- **Glenohumeral Arthritis**
  - Predictable pain relief with TSA $^{1,5,7,8}$
- **What to do with young, active patients?**
  - Idiopathic arthritis
  - Chronic steroid-induced
  - Post-surgical arthritis – Anchors, pain pumps
  - Prior infection
  - Post-traumatic
- **Humeral Side**
  - Osteochondral Allograft
  - Resurfacing
  - Hemiarthroplasty
- **What about the glenoid?**
Background

- Glenoid resurfacing options:
  - Soft tissue resurfacing
    - Achilles allograft, lateral meniscus allograft, tissue matrices
    - Limited efficacy due to failure to restore anatomy and provide adequate pain relief \(^4,6,9,13,15,\)
    - Difficulty in situations of glenoid bone loss \(^6,18,20,\)
  - Alternative: osteochondral allografting \(^10,12\)
    - Limited availability of scapulae
    - Immunogenicity
Purpose

• Quantify the articular surface topography of the glenoid and medial tibial plateau via 3-dimensional (3D) modeling
• To determine if the medial tibial articular surface provides an anatomic topographic match to the articular surface of the glenoid
Hypothesis

• Medial tibial plateau articular surface will provide a suitable osteochondral harvest site due to its concavity and anatomic similarity to the glenoid
Methods

- Fresh-frozen human cadavers
  - 4 Glenoids
  - 4 Proximal Tibiae
  - All Male, <60yo
  - No evidence of arthritis
- CT- Coronal and sagittal 0.625mm slices
- 3D reconstructions
Methods

• Images exported into point-cloud models (Mimics, Belgium)

• Coordinate map created
  • Glenoid and medial tibial plateau articular surfaces

• Glenoid articular surface
  • Defined as best-fit circle of the glenoid articular surface with a 2mm bony rim
Methods

- Two zones of the medial tibial articular surface (anterior and posterior) quantified

- Glenoid superimposition assumed two-thirds of AP dimension of plateau
Methods

- Glenoid surface virtually placed on tibial articular surface
- Glenoid surface reoriented so that direction of glenoid surface eigenvector matched that of tibial surface
Methods

- Glenoid surface rotated 360 degrees in 1° increments
- Mean distance difference calculated at each rotating angle
Methods

- Statistical Analysis
  - Non-parametric Wilcoxon signed rank test
  - P-value of less than 0.05 was considered statistically significant
Results

- Mean distance difference in articular congruity of all surface points of all 16 combinations
  - 0.74 mm (Std. Dev. ± 0.13 mm)
Results

- Mean distance difference of anterior and posterior two-thirds of the medial tibial articular surface
  - Anterior
    - 0.72 mm (± 0.13 mm)
  - Posterior
    - 0.76 mm (± 0.16 mm) (p=0.187)
Conclusions

• Medial tibial articular surface may provide an appropriate anatomic match to the glenoid articular surface

• Both anterior and posterior two-thirds of the medial tibial plateau may serve as potential sites for osteochondral graft harvest

• Methodology can be applied to future studies evaluating the ideal sites of graft harvest to treat zonal glenoid bone wear and/or loss
Strengths/ Limitations

• **Strengths**
  - 3D topographic quantification analysis
  - Novel concept
  - Validated methodology

• **Limitations**
  - Limited number of specimens
  - Specimens without osteoarthritis
  - Does not account for cartilage thickness
  - Future studies with more specimens, Isovue
References


