Geometrical and Sizing Considerations for Biologic Resurfacing of the PFJ

focus on Osteochondral Allografts

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Outline

• Geometric/Morphologic Variability
• Defining Goals
• Geometric Challenges
• Donor Issues
• Clinical scenarios
• Recommendations for Sizing OCA
Geometric Variability

- Wide array of both “normal” and “pathologic”
- “Normals”
  - Both patella and FTG manifest variable curvatures, convexities and concavities
  - Concavity of FTG generally in the 4 and 5 mm range of height, with 4 being “shallow” and 5 “deeper”
  - Patella generally ovoid or cylindrical, variable height of ridge or radius of curvature
Morphologic Variability

• Pathologic – Traumatic or Atraumatic
  – Traumatic- much simpler as usually has relatively “normal” morphology
  – Atraumatic- more common in PFJ practice.
    • Relative degree of FTG hypoplasia, aplasia and malalignment/malrotation
    • Patella frequently has lateral facet dominance from chronic subluxation/lateralization
Defining Surgical Goals – biological restoration of PFJ

- Congruous, concentric restoration of hyaline cartilage
- Secure and stable with minimal fixation
- Simple and reproducible
- Allow early ROM and Weight Bearing
- Predictably good/excellent results with few complications or revisions needed
- Long lasting
Broad Consideration for Geometry of Cartilage Restoration

- Cellular/semirigid scaffold based therapies
  - NO size matching challenges for supple biomaterial, minimal contour challenges
  - Rigid scaffolds, easy to use, flat, no radius of curvature
  - Efficacy, durability, rehab and healing challenges

- Osteochondral Allograft
  - Transplanting healthy hyaline cartilage with intact subchondral bone
  - Long lasting, outstanding pain relief
  - Relatively easy surgery, predictable recovery, excellent outcomes
  - Limited availability and high cost
  - Geometrically challenging to match
Geometric Challenges- OCA

- Variable concavity/depth of Trochlea
- Radius of curvature, concave and convex, 3D both Trochlea and Patella
- Size of patellar facets
- Convergence of cylinders (OCA) in patella
- Height of patellar ridge
- Thickness of cartilage
Donor Issues - OCA

- Grafts are fresh stored
- Maintained hypothermically in nutrient solution for 3-6 weeks while donor and graft microbial screening and testing takes place.
- Limited processing of Patellae takes place because of economic pressure to generate BTB grafts for ACL reconstruction. Each Patella could potentially yield 2 or 3 BTB grafts.
Donor Issues - OCA

- Donors typically from young accident victims or tragic deaths
- Limited geometrical data available about donor
- No MRI or CT
- Digital photo
- Linear dimensions of graft
- Scaling- Tibial width
Current Graft Data Sheet

TW= Max. width 7.4 cm

No visual imperfections

COMMENTS: *Fixed w/loop*

(Indicate imperfections)

Initial: [Signature]
Date: [Date]

Clearly a paucity of data....
OCA Donor

• What we currently know
  – Age, sex, date of death, Tibial Width

• What we would really like to know:
  – FTG: inter-eminence distance, depth of groove
  – Patellar geometry:
    • Prox-Distal length
    • Med-Lat length
    • Medial facet length
    • Lateral facet length
    • Thickness data could yield indicator of radius of curvature, or height of ridge
Scenarios for OCA of PFJ

- **Small Isolated Patella Defect**
  - Easiest scenario with simplest geometry
  - Facets relatively flat, easy match for size

- **Large Isolated Patella**
  - Cylinder graft, usually single plug
  - Dual Consideration-
    - Size of plug
    - Morphology or Topography if facet involved
  - Key: Is donor big enough?
  - Matching: Know defect size, then...
    - Donor AP and ML measurements of total patella and facet data can yield appropriate match
Scenarios for OCA of PFJ

*Isolated FTG defect*

- **Small defect:**
  - Can usually match easily as typical defect is central in FTG and small plugs with any concavity usually suffice

- **Large defect:**
  - Want to match size and morphology, bigger challenge.
Scenarios for OCA of PFJ

*Bipolar, including shell grafts*

- These are supplanting for the ambient anatomy
- Sizing consideration merely to scale, not really topographic challenge
- Scale within 5mm+/- on Tw should suffice
- Essentially, just need to relatively close on size/scale
Recommendations for OCA Sizing of PFJ

• Patient/recipient
  – Scope measurements of defect
  – Scaling – Tw
    • Easily gotten from any MRI
  – CT or MRI
    • Patella dimensions
      – AP-ML of patella
      – Facet- height(thickness) and dimensions
Recommendations for OCA Sizing of PFJ

• Donor
  – Patella
    • Width, height, thickness
    • Scaling, Tw
    • Facet dimensions to ridge
  – FTG
    • Intercondylar distance
    • Depth of groove
    • Scaling, Tw
Cartilage case for later discussion
29 year old firefighter
• 6 wks post op back at work light duty
• 12 wks post op full RTW as firefighter
• 2 yrs post op
Biologic or Prosthetic Resurfacing ????

*Key decision making point*

- Multifactorial decision
  - Lesion/Cartilage nearby
  - Patient Factors
  - Age (biological)
  - Comorbidities
  - Joint Status
  - Resources

32 year old mom and former ski racer
Thank you
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