Role of Osteotomy in Cartilage Repair

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Knee Osteotomy

- Established track record
  - Literature replete with guidance for OA
  - Less abundant in pts undergoing cartilage repair
    - Lack of high quality evidence
    - Case series - lack statistical power to establish CPGs
    - Heterogeneous patient populations

- Clear role in select patient population

- Goals
  - Who they are
  - How to plan
  - Pearls to execute
Current Trends

• Current trends reveal annual incidence growth of 5% for cartilage repair procedures (McCormick et al, Arthroscopy 2014)

• Multifactorial
  • Wider adoption with technical advancements
  • Improved understanding of cartilage biology and advantages/limitations of procedures
  • More available resources, “off-the-shelf” solutions

• Similar trends in osteotomy?
  • Respect comorbidities
Venn-Diagram of Cartilage Surgery

- Treatment Considerations
  - The Lesion
  - The Patient
  - The Knee
  - The Clinical Evidence for Each Surgical Strategy
- Role of osteotomy - favorable mechanical environment
  - Aid in biologic healing
  - Potentially improve long term survival of repair tissue
Surgical Indications

• “Physiologically” young, active patient
• Lower extremity coronal malalignment
  • Deviation of >5 (3) degrees from neutral mechanical axis
  • “outside tibial spines”
• Symptomatic, unicompartmental defect(s)
Surgical Contra-Indications

- Limited knee ROM
  - Flexion <90°
  - Flexion contracture >15°
- Tibial subluxation >10mm
- Inflammatory arthritis
- Smokers
- Morbid obesity
- Contralateral degenerative disease
  - High quality MRI with necessary sequences
  - Consider diagnostic arthroscopy
    - MRI underestimates zone of cartilage injury - avg 65% larger using arthroscopy (Gomoll et al, Cartilage 2011)
Preoperative Planning

• Long-leg alignment films
  • Weightbearing views
  • Draw weightbearing mechanical axis
  • Determine the amount of postoperative correction based on clinical data

• Weightbearing line method
  • Lateral tibial plateau divided from 0-100% (M→L)
  • Line drawn from center of the femoral head and center of the talus intersect at the desired point of correction
  • Angle formed by the two lines determines angle of correction
Preoperative Planning

- Planned angle of correction is transposed to the medial proximal tibia at the level of the desired correction.

- Calculated angulation creates a triangle with height in mm at medial cortex representing required amount of correction:
  - Geometric triangle method
  - Radiograph must be size calibrated.
Preoperative Planning

• Amount of correction determined by pathology
  • Osteoarthritis
    • Apex of lateral plateau (62%)
  • Cartilage Restoration
    • Focal defect, meniscus intact
      • Correct to neutral
    • Mild degenerative changes on opposite surface, loss of meniscal volume
      • Slightly overcorrect - opposite tibial spine
Surgical Technique

• Opening Wedge HTO
  • Advantages
    • Does not violate the proximal tibiofibular joint - peroneal nerve
    • Does not alter length of LCL
    • Incision extended for access to medial compartment
    • Precise intraoperative correction - open and close as necessary
  • Disadvantages
    • Lengthen the patellar tendon, with distal translation of patella (baja)
    • Increased tension of MCL
    • Slower healing, Protected WB
Surgical Technique

• Opening Wedge HTO
  • Pearls
    • Use radiolucent retractor posteriorly - identify pin/osteotome w/out removing retractor
    • Stack osteotomes (no wedge) - take advantage of stress relaxation to prevent fracture
    • Cortical wedge allograft placed even w/ native cortex to avoid loss of correction
      • Posterior gap 2x larger than anterior
      • Every 1mm off is ~ 1° in PTS
    • Bend plate if necessary, place posterior
  • Pitfalls
    • 1.5cm of bone between proximal osteotomy and cartilage surface (intra-articular)
    • 1cm bone bridge laterally (extra-articular)
Surgical Technique

• Opening Wedge DFO
  • Advantages
    • Easy/familiar surgical approach
    • Precise intraoperative correction
    • Extended peripatellar approach to lateral knee for concomitant cartilage restoration
  • Disadvantages
    • Hardware complications - small women & IT band
    • Slower healing, Protected WB
    • Risk of nonunion
Surgical Technique

• Opening Wedge DFO
  • Pearls
    • For combined cartilage repair, extend incision into lateral peripatellar approach
    • Flex knee during osteotomy to minimize NV injury
      • Radiolucent triangle - tibial nail
    • Perforate medial cortex w/ drill to facilitate larger corrections (10-12°)
    • Bend plate - flush to cortex
  • Pitfalls
    • For larger corrections, consider medial closing wedge
Why do Cartilage Repair?

- OA studies - excellent clinical results and survival at short- and mid-term follow-up
- Decreasing rate of success at ~15 years
  - HTO - 46-65% at 15 yrs
  - DFO - 45-78% at 15 yrs
- In setting of cartilage repair, the additive effect may improve these results compared to those observed in isolation
 Biological Knee Reconstruction for Combined Malalignment, Meniscal Deficiency, and Articular Cartilage Disease


- Level IV case series
- 18 patients (mean 34 yrs)
  - 66.6% medial compartment disease
    - 7.5° ± 2.0° varus corrected to 1.2° ± 1.5°
  - 33.3% lateral compartment disease
    - 6.1° ± 1.0° valgus corrected to 0.7° ± 0.5°
- 12 OC allografts (OATs, ACI, MFX 2 each)
- Mean 6.5 yr follow-up
- 13 reoperations in 10 pts
  - 1 → TKA, 1 → revision cartilage repair
  - Most common complication - arthrofibrosis
Analysis of Outcomes for High Tibial Osteotomies Performed With Cartilage Restoration Techniques

Cynthia A. Kahlenberg, M.D., Benedict U. Nwachukwu, M.D., Kamran S. Hamid, M.D., M.P.H., Michael E. Steinhaus, M.D., and Riley J. Williams III, M.D.

• Systematic Review
• 839 patients (mean 50.2 yrs)
  • ~38% Marrow stim
• Mean 5.1 yr follow-up
  • Lysholm 40-65.7 preop → 67-94.6
• Survivorship
  • 6.8% of pts converted to TKA at mean 6.2 yrs

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HTO, high tibial osteotomy; OATS, osteoarticular transfer system.
Successful Return to Sport Following Distal Femoral Varus Osteotomy

Pramod B. Voleti¹, Isabella T. Wu², Ryan M. Degen¹, Danielle M. Tetreault¹, Aaron J. Krych², and Riley J. Williams III¹

- 13 patients (8 males, 5 females)
  - Mean 24 yrs (range 17-35 yrs)
  - 6 medial closing wedge, 7 lateral opening wedge
    - Mean correction 8°
  - 6/13 (46%) LFC OC allograft
- Mean follow-up 43 months
  - All returned to sports - mean 11 months
  - Improvements in Marx activity scale and IKDC
Summary

• Isolated cartilage repair for isolated problem - neutral alignment

• Cartilage repair + osteotomy for malalignment
  • Choose degree of correction based on clinical evaluation

• Isolated osteotomy for patients with significant isolated compartment disease with significant joint space narrowing

• Literature is mixed with small heterogeneous patient populations
  • Osteotomy - established procedure
  • Long term survivorship (>15yrs) of osteotomy - additive effect to improve outcomes when damaged cartilage is addressed
Thank You