Inlay Resurfacing Arthroplasty

Phil Davidson, M.D.
Heiden-Davidson Orthopaedics
Park City, Utah

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OUTLINE

• Perspective on resurfacing
• Introduction of Inlay Arthroplasty Concept
  – Biomechanical Basis
• Knee CAP
  – HemiCAP, UniCAP, PF
  – Indications
  – Technique
  – Cases
Joint Resurfacing
A wide realm between.....

Arthroscopic debridement
Goals:
Cartilage Restoration & Joint Resurfacing

- Relieve pain
- Restore functional
- Improve Mechanics
- Long lasting
- Prevent or Limit Future Degenerative Changes
- Retain Options for younger or more active individuals
**Theme** of Minimally Invasive Joint Restoration

- Spectrum of Pathology
- Individualize according to the specific patient
- Wide array of treatment options
- Biologic Restoration in youth, when possible
- Appropriate Minimally Invasive Prostheses
- Continually incorporating new technologies
Cartilage Restoration and Joint Resurfacing Treatments: ...an evolving continuum of options

- Marrow stimulation
- Biological restoration
  - Biologics
  - Bio-synthetics/scaffolds
  - Modulated therapy
  - Cellular therapy
- Joint Resurfacing
  - Prosthetic resurfacing
  - Micro-invasive
  - Bio-elements
  - Inlay Arthroplasty
  - Onlay Arthroplasty
  - Total Joint
Biological Options

• Autologous Chondrocytes
  – ACI
  – MACI
• Osteochondral Grafts
  – Autogenous
  – Allogeneic
• Chondral grafts
• Biologically Active Scaffolds
Transitional thinking from biologics to prosthetics

- Age, health
- Pathology
  - Kissing lesions
  - Joint “out of round”
- Comorbidities
  - Health
  - Same joint
    - Stability, alignment, meniscus

Inverted patella 31 year old
Mandates associated with
Minimally Invasive Joint Resurfacing

• Minimize Perioperative morbidity
• Retain future options – as possible
• Maximize Outcomes
  – Equal, or better than traditional treatments
Anatomical Reconstruction

- Concave and convex geometric surfaces – complicated curvatures
- Intraoperative articular mapping involves measuring/replicating complex surface configurations
- Inlay Arthroplasty allows for ideal anatomic reconstructions
- Accounts for morphologic variability
ANATOMY - Alignment

- Must know alignment, potentially correct or accommodate with resurfacing
- Must have long leg standing films available
- Inlay **minimal** deformity
“Ideal” First Patient for CAP

- 30-60 yrs
- Nearly normal alignment
- Any comorbidity mitigating against Biological solution
- Unicompartmental disease (III b,c or IV)
- “Staging” Scope
Introduction of CAP

- Geometry based on patient’s native anatomy
- Intraoperative joint mapping
- Account for complex asymmetrical geometry
- Extension of biological resurfacing
Knee Implants

- **HemiCAP** (small unipolar knee)
  - Not currently FDA approved in US
- **UniCAP**
  - Developed Medial, used Medial and Lateral
  - Includes Tibial Inlay
- **PF HemiCAP**
  - Regular & XLT(large FTG)
Basic Science- Pressure Studies- reciprocal surface (tibial plateau)

Anterior

Posterior

untreated knee  flush HemiCAP®  1mm proud HemiCAP®
Finite Element - Analysis

Conclusion:
• No stress shielding
• Effective load transmission into underlying bone
P-F XLT “Wave” Inlay Prosthesis
PF- PROSTHETIC RESURFACING

- Trochlea alone or Bipolar
- Traditional prostheses limited success and rarely used
- Inlay device allows for concurrent re-alignment easily, as no overstuffing
- Inlay device for younger patients
Trochlear Implants

Variety of Geometry
Patellar Implants

Variety of Sizes/Shapes, Cemented
Case Report #1

- 41 year old female
- 2 prior knee surgeries
- Anterior knee pain
- Former “hard core” athlete
- Could not even walk with kids
Case #1
(healthy medial and lateral)
Surgical Exposure

$1^{st}$ - Arthroscopic Lateral Release
Surgical Exposure
Either MIS medial incision (or midline)
Technique –

• Guidewire key to cannulated system

• **Perpendicular placement**
  – Careful attention to this!!
Technique- Drill for set screw (no plunge)
Technique – Tap (undertap)
Insert set screw (not too deep!)
Height measuring cap
Articular Mapping

...if measured values NOT on chart, must consider WHY
Peripheral cutting - protect ambient cartilage
Drilling for implant

- High speed drill
- Do not use reamer
- Cooling irrigation
Device Trial
Patellar guide and wire
Starter drill over guidewire
Insert centering shaft/depth limiter

This shoulder limits drill depth in next step
Drill to depth stop
basically need patella “deep enough”
Insert Trochlea – Suction inserter with alignment

Alignment marker
Radiographs pre and post
Case # 2 – 42 year old female
Case # 3  50 year old
Patella-Trochlea alignment

**Key step** - Patella directly over FTG

*cannot* have poly on cartilage/bone
UniCAP™
aka... inlay arthroplasty, scope assisted Uni, AKR, etc..
Cement and FDA
UniCAP Advantages

- UniCAP may prevent patello-femoral complications/encroachment of conventional UKA through inlay resurfacing
- Revision to standard UKA may be possible due to shallow implant bed resurfacing technique
  - UniCAP avoids L-cut
- Ample room for ACL, osteotomy, soft tissue procedures
- Meniscal sparing technology for patients with healthy, functional meniscus
UniCAP Limitations and Concerns

• Limited/Little angular correction can be obtained with an inlay resurfacing

• Tibial surface:
  • UniCAP only for central lesions
  • More common peripheral
  • Extensive tibial loss, need other option

• Patient selection remains critical:
  • Treat all pathology in the knee – homeostasis

• Be cautious and specific about referred pain and radiating pain patterns
  • Extending tibial pain is important to note!
  • Don’t want to undertreat tibia
UniCAP case example –
medial knee resurfacing 46 year old cyclist
UniCAP – medial knee resurfacing
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Case Report –
51 year old, failed Microfracture, unable to exercise due to medial knee pain
1 year post microfracture, no pain relief
ACL graft – Medial UniCAP
Case Report
63 year old business man, hiker

• Neutral alignment
• Told he needed a TKA
• Seen 6 doctors, essentially refusing to accept TKA
• Healthy, ideal body weight
Combining Biologics with Inlay Arthroplasty

29 year old firefighter
• 6 wks post op back at work light duty
• 12 wks post op full RTW as firefighter
Technical Failure

38 yr old 9 mos post op - no pain relief from unipolar UniCAP synovitis, cartilage debris, UniCAPproud, tibial wear, FTG defect
Failure

“normal” fibrous overgrowth, asymmetric, proud
UniCAP removal - revision to UKA
Indication Failure – complex revision

53 yr old Navy MD, persistent medial/PF pain and instability
Complex revision
retained medial UKA, new lat UKA, PFA and ACL
Complex Revision
3 compartments, ACL
**Inlay Indications**

- Minimal angular deformity
- Large focal or limited degenerative lesions
- Limited, not diffuse disease
- ICRS Grade IIIB,C,D or IV
- PF- can address severe deformity

**Contraindications**

- Extensile T-F disease
- Tricompartmental
- Angular deformity
- Large or Peripheral Tibial defects
- Crystalline arthropathy
- Chondropenia - diffuse
Managing Utilization

- Staging scope
- Scope photos
- MRI – 3T Fat Suppressed Fast Spin Echo, cartilage sequences
- Have multiple options available
- Multiple cases in one day
Shoulder Series HemiCAP Osteoarthritis
Traditional Surgical Alternatives for G-H Osteoarthritis

• Total Shoulder Arthroplasty
• Hemiarthroplasty (stemmed)
• Hemiarthroplasty (non-stemmed)
  – “Copeland style”
Traditional Treatment Options

Total Shoulder

• Potential Problems:
  – Tissue balance
  – Blood loss
  – Overstuffing
  – Humeral height and version
  – Glenoid Loosening
  – Patient acceptance
  – Surgically difficult
Traditional Treatment Options-
Non-stemmed Hemiarthroplasty

- Humerus is “milled” to accommodate implant
- Problem:
  - non-native convexity/geometry
- This is counter-intuitive
Osteoarthritis – typical case
Osteoarthritis - typical case
HemiCAP for RCT and Osteoarthritis

- 73 y/o Male, Tennis player with a failed previous rotator cuff repair
- Previous surgical findings of articular disease
• Open Rev. RCR with Augmentation, HemiCap for RCT and Osteoarthritis
  – Post-op marked pain relief
  – Improved ROM
  – Marked decrease in pain
ANATOMIC INLAY RESURFACING FOR GLENOHUMERAL OSTEOARTHRITIS

Clinical Results in a Consecutive Case Series
Surgical Technique

- Anterior approach
- Subscapularis take down
- Capsular releases
- Osteophyte resection on both humerus and glenoid
- NO glenoid resurfacing or reaming
Demographic Data

• N = 48
  – Males – 29
  – Female – 19
• Mean age at surgery
  – 61 years
• Follow-up
  – Mean – 28 mos.
  – Max – 36 mos.
  – Min – 13 mos.
• Side
  – Right – 19
  – Left - 14
HemiCAP in OA

• Concurrent Procedures
  – Rotator Cuff Repair
    • 12
  – Subacromial Decompression
    • 25
  – Distal Clavicle Resection
    • 23
  – Biceps Tenodesis
    • 2
  – Biceps Tenotomy
    • 21
  – Capsulolabral Repair
    • 5
  – Hardware Removal
    • 1
Simple Shoulder Test

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<th>Time</th>
<th>Pre-Op</th>
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<td>7.5</td>
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NO reported loosening of implant in the shoulder

No signs of
- Device disengagement
- Progressive periprosthetic radiolucency
- Implant subsidence
Complications

One patient suffered a traumatic, high-energy injury 3 months postoperatively, subsequently resulting in revision surgery.
Osteoarthritis - Perhaps a prime indication for the HemiCAP

- How much pain from glenoid??
- Surprisingly little!!!
- Removal of Osteophytes critically important
- Soft tissue releases
- Treat concurrent pathologies
Expanding Indications Beyond “Focal Defects”

- Osteoarthritis
- Rheumatoid arthritis
- Post traumatic arthritis
- Rotator Cuff Tears
- Avascular Necrosis
- Hill-Sachs (some)
CONCLUSIONS
Shoulder Resurfacing with HemiCAP for Glenohumeral Osteoarthritis

• Short term (3 year) results very encouraging
• Restoration of native anatomy
• Comprehensive pathology treatment is key
• Excellent option for primary OA of Shoulder
Advantages of CAP

- Immediate, excellent pain relief
- Simple, canulated, reproducible, yet elegant surgery
- Very few soft tissue balancing challenges
- Minimally bone sacrificing
- Minimal EBL, can be outpatient
- Can easily convert to traditional or reverse arthroplasty

- Patient acceptance
- Allows concurrent soft tissue procedure
- Maintain cartilage restoration principles
- Based on patient, or ambient anatomy
Thank You
phildavidsonmd@gmail.com
www.phildavidsonmd.com