Subchondroplasty: A New Option for Arthritis

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Subchondroplasty

• Minimally invasive, fluoroscopically assisted procedure
• Targets and treats subchondral defects associated with bone marrow lesions (BML’s)
• Delivers tricalcium phosphate crystal bone substitute matrix
Theory, Rationale, and Evidence

• Osteoarthritis and Young Patients
  – 20 million Americans Diagnosed with OA every yr
    • By 2016 greater than 50% of TKA’s will be less than 65 yo
    • Fastest growth in 45-54 yo’s
    • By 2030 there will be a 673% increase in patients who are TKA candidates (3.4 million)
Patients Present because of Pain

• What we know:
  – Articular cartilage has NO pain fibers
  – Synovium has SOME pain fibers
  – Ligaments have more proprioceptors
  – BONE HAS PAIN FIBERS
  – Lidocaine injections into joint with painful OA only relieves 60% of the pain
The Knee Contradiction

• XRAYS don’t always tell the story
• XRAYS and symptoms may not align

• MRI breakthrough’s have shown us more information on bone in OA
PAIN in OA

- The presence or absence of joint space narrowing was not significantly associated with knee pain \((OA&Cartilage, 1996)\)
- Pain with BML’s is felt to be secondary to irritation or disruption of sensory nerves on bone marrow while “irritation” has been suggested to be related to intraosseous pressure increase. \((Starr et al., 2005)\)
- A systematic Review of OA Biomarkers found that pain is:
  - Strongly related to BML’s
  - Moderately related to synovitis and effusion
  - Weakly associated with cartilage volume/thickness

emoryhealthcare.org/ortho
Knee Bone Marrow Lesions

• Chronic BML’s
  – Associated with progressing OA
  – Enlarging BME/BML’s is associated with increasing cartilage loss (*Hunter et al, Arthritis Rheum 2006*)
  – Presence of BML’s in OA 9X more likely to progress to TKA than without (*Scher et al, 2009*)
  – OA without BML’s = decreased risk for progressive cartilage loss on MRI (*MOST study 2007*)
HOW?

• Physiologic subchondral remodeling fails
• Increased focalization of stress
• Reduces healing capacity of subchondral bone
  – Causes Inflammation
  – Causes increased subchondral vascularization
  – Causes high bone turnover
  – Causes subchondral bone attrition
  – Causes progression of cartilage loss

Summarizing Knee BML’s

• 1: ~9X more likely to rapidly progress to TKA
• 2: Increase patient risk of TKA by 57%
• 3: Presence of medial BML is one of strongest predictors of TKA
• 4: Large medial BML is ~2.5X and worsening BML is 3.5X more likely to get a TKA
Big Ortho Change

• Somers et al, JBJS 2011
  – Confirmed 10-20 yrs of data
  – “Large Bone Marrow Lesions in presence of OA associated with substantial increased odds of pain”
  – “BML’s in medial compartment are associated with marked decrease in walking and stair climbing performance”
  – Showed BML’s associated with pain and decreased function
OA Treatments

- Early: NSAIDS, bracing, injections, PT
- Middle: arthroscopic debridement
- End: TKA

Where does subchondroplasty fit?
- 80-90% of patients ignore doctors' advice for TKA
  - Orthopaedics Today 2007
Subchondroplasty

• 1: Pre-operative planning MRI T2 fat suppressed image
• 2: Target BML- Flouroscopy
• 3: Access the Lesion- Drill with cannulated pin
• 4: Fill the bony defect- macroporous injectable calcium phosphate
CaP bone filler

• Several commercially available
• Flowable, synthetic calcium phosphate
• Goal:
  – Improve the structural integrity of damaged subchondral bone
  – Create the potential for subchondral bone remodeling
• Requires curing time in bone
  – Endothermic reaction (KEY!)
Cohen/Rothman SCP Study

- 1st 66 patients with procedure
- All failed conservative treatment and were candidates for TKA
- 96% Outerbridge 3 or 4 in treated compartment
- Pre-op VAS-pain score avg 7.5/10
- At 2 yr postop VAS-pain score 3/10
- Mean fxnl/symptom improvement of IKDC 17.8 pts
- 70% Kaplan Meyer survivorship of native knees at 2 yrs
When do I do Subchondroplasty?

• Failed standard arthritis treatments
  – OTC meds/PT
  – Injections....

• Normal ROM of the joint

• Fat Suppressed MRI sequence confirming BML
My Experience

• Patients all love an easy option compared to TKA
• It’s not a fix for the arthritis, but another treatment
• By 9 months, patients will convert to TKA if they need one
  – Otherwise good short to mid term survival that mirrors the Rothman study of 70% at 2 yrs....
• Still need more long term follow up and studies
  – Early results are better than Mosley, Kirkland and Thorlund studies on arthroscopy alone....
Case Presentation

- 63 yo Male with MFC/tibial plateau subchondroplasty
- 76 yo Male MFC subchondroplasty
- 73 yo Female MFC subchondroplasty
- 53 yo Female MTP subchondroplasty
- 40 yo Male MFC OCD/subchondroplasty
- 38 yo Male Medial tibial plafond fx
KW

• 63 yo presents with R knee pain
• Intermittent mild pain for years
• Pain and swelling increased over last month
• No prior injury or surgery

• PMH/PSH: neg
KW

- **PE:**
  - Moderate Effusion
  - Lacks ~5 deg from full extension, flexion full
  - mJLT with pain with flexion
  - Ligamentous and patellofemoral exams nml

- **XR:** 30 deg PA flexion WB, 30 deg flexion lateral, and merchant. From OSH
  - Advanced medial compartment DJD and moderate PF arthritis with benign cyst it lateral tibia plateau
KW

• Plan:
  – Steroid injection and PT

• 6 wk follow up:
  – No improvement long term, but had relief for about 1 wk.
  – Recommended viscosupplementation

• 6 wk follow up:
  – No significant gains with visco.
  – “Not Ready” for TKA
  – Recommended MRI to evaluate for subchondral edema
KW

• Plan:
  – Conservative vs Subchondroplasty vs TKA
  – Patient not ready for TKA, but not happy with current activity level and pain
  – Desired to proceed with R knee scope with subchondroplasty.
KW

- 2 year follow up he is still gaining benefit and only notes occasional PF sx with going down inclines.
WB

- 76 yo with h/o L knee DJD managed with CSI/PT who presents with 3mo h/o worsening R knee pain.
- c/o pain with walking and inability to sleep
- No history of surgery or injury to knee
- Has failed CSI and PT to his R knee 2 months earlier

- PMH/PSH: Negative
WB

• PE:
  – Small effusion
  – mJLT with painful squat test and flexion McMurrays
  – Ligamentous exam intact
  – Mild PF crepitatance

• XR:
WB

• Plan:
  – Viscosupplementation versus MRI to evaluate subchondral edema and/or possible MMT
  – Has maintained joint space on R knee so feeling was he could do well arthroscopically if indicated
  – Failed CSI and PT

• MRI:
WB

• DX: Complex MMT with inferior flap in meniscotibial recess of posterior horn. Medial compartment chondromalacia and large MFC subchondral fracture.

• Plan: R knee scope/MMX with MFC subchondroplasty
WB

• Post Op Course:
  – Has done well, small extravasation no problem
  – Currently 12 months out from surgery and pain/ADL’s are much improved.
  – Happy he had the procedure thusfar.
VR

• 73 yo female with 4 mo history of L knee pain
• Pain began after running with dog and worsened in her agility training class
• Had knee aspirate, CSI, and PT by one of my primary care sports medicine partners 3 months prior.
• 6 weeks ago had a visco injection with minimal relief
• Presents with MRI

• PMH/PSH: Anemia, h/o breast CA, HTN,
VR

• PE:
  – Moderate effusion with pain
  – PF crepitation
  – Moderate mJLT and pain with squat testing
  – Ligamentous exam nml

• XR/MRI:
VR

- Plan: Dx with impaction fx with subchondral fracture and edema MFC
  - Discussed unloader brace and further conservative measures vs subchondroplasty
VR

• Post Op Course:
  – Did PT for 1mo.
  – Released to full activity at 6 wk visit
  – Seen at 18 months with minimal symptoms other than occasional overuse soreness. Very pleased
AE

- 53 yo WF with 2yr hx L knee pain
- Denies injury
- Pain is intermittent and worse with transitioning from seated to standing and prolonged sitting
- Had MRI 1 yr ago with outside physician

- PMH/PSH: negative
AE

• PE: mild effusion
  – TTP at MJL with pain with flexion
  – FROM
  – Neg ligamentous exam
  – Neg PF exam

• XR:
AE

- MRI: complex tear of MM body with extrusion. MTP subchondral edema with a moderate effusion. G2-3 chondromalacia MC and central ridge of patella
AE

• Plan: given steroid injection at initial visit as returning to Brazil for 2 months

• 2 mo follow up: denies new injury, but pain returning at MC. Discussed options and elected for L knee arthroscopy and MTP subchondroplasty
AE

• Operative:
  – L knee scope/MMX
  – L knee abrasion chondroplasty MTP/Patella
  – L knee MTP subchondroplasty
AE

• 6 months post op follow up:
  – Back doing non-impact activity
  – No pain
  – Pleased with results and released to resume activity

• 3 year post op
  – Seen for shoulder injury
  – Knee doing well with no complaints
DD

• 40 yo male with 4 wk h/o R knee pain that occurred after a workout
• Pain is medially located. No history of prior injury
• Pain has improved but still affects ADL’s
• Unable to workout

• PMH/PSH: Syncope only
DD

• PE: minimal effusion
  – mJLT with positive pain on McMurrys. Positive squat test/hyperflexion.
  – No lig abnormalities
  – No patellofemoral abnormalities

• XR
DD

• Plan: Given significant mJLT and sx with no DJD on XR. MRI ordered to eval MC for ? MMT
DD

• MRI: MFC subchondral fracture with edema and central chondral defect of MFC
DD

• Plan: conservative vs operative
• Patient elected to proceed with R knee scope with subchondroplasty and chondral debridement vs microfracture.
DD

• 12 months follow up:
  – Doing great with no complaints
  – Back to exercising without difficulty
  – F/U MRI shows good fibrocartilage over microfracture and intact bone substitute with no edema.
JW

- 38 yo WM who injured R ankle while running 1 month ago. Runs 3-4 x/wk and ankle “just hasn’t felt right” and has been painful.
- History of R ankle sprain 10 yrs ago in soccer
- c/o swelling, stiffness and inability to run

- PMH/PSH: Hypothyroid, Reflux
JW

• PE:
  – Moderate ankle effusion. No instability.
  – Pain with extreme dorsiflexion and plantarflexion.
  – No tendinopathy
  – FROM with excellent strength
  – NVI

• XR: from OSH and are negative
• Plan: Ankle overuse injury with possible chondromalacia. Tx plan: Rest, activity modification, NSAIDs. Follow up in 4-6 wks

• 6 wk follow up: Still painful and had improved, but pain and effusion returned with running. Plan is to eval chondral defect or stress fx with MRI
JW

- MRI: medial malleolar stress rxn/subchondral fracture

- Plan: Continued rest vs ankle arthroscopy and medial malleolar subchondroplasty.
JW

• At 6 mo POV doing well. Pain free and had been returned to running and activities for 2 months. F/U prn

• Currently 2.5 years post op.
  – Last seen 2 yrs post op for hip strain but ankle doing well
Thank You