SUBCHONDROPLASTY REPAIR OF BONE MARROW LESIONS AND CURRENT LITERATURE

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SPECIAL THANKS TO FRED KING & JORY BARONE

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SEARCH DATE(S): JANUARY 7- FEBRUARY 1ST 2017
SEARCH STRATEGIES

- (subchondral or subchondroplasty).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading] (7344)
  2 bone marrow lesion$.mp. (1026)
  3 1 and 2 (233)
  4 limit 3 to (conference abstract or conference paper or conference proceeding) (124)
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- # Searches Results
  1 subchondroplasty.mp. 21 2 limit 1 to yr="2010 -Current" 21 3 remove duplicates from 2 10 4 (bone? adj2 marrow).mp. 602131 5 lesion?.mp. 1631982 6 4 and 5 30452 7 (bone? adj2 marrow adj4 lesion?).mp. 3465 8 (bone? adj1 marrow adj3 lesion?).mp. 2991 9 (bone? adj1 marrow adj3 lesion? adj3 repair$).mp. 4 10 remove duplicates from 9 3
SUBCHONDROPLASTY (SCP)

- SCP procedure is a repair (ORIF) of a MRI identified subchondral fractures (Bone Marrow Lesion) associated with osteoarthritis

- Calcium phosphate bone substitutes (CPBS) are commonly used to augment and repair bone voids and defects after fracture

- “Subchondroplasty” is a marketing tradename, and is not recognized as standard diagnosis or generic procedure terminology
WHY TREAT BONE MARROW LESIONS?

Your patient presents for ankle pain....

- Articular Cartilage has no associated pain fibers
- Ligaments have proprioceptive fibers
- Synovium has some associated pain fibers
- **BONE HAS PAIN FIBERS**
SUBCHONDROPLASTY: REPAIR OF BONE MARROW LESIONS

- Bone Marrow Lesions essentially act as chronic insufficiency stress fractures

- Repair of a fracture requires Open Reduction Internal Fixation
  - ‘SCP’ Procedure
  - Decompressional Osteotomy w/ backfill
SCP PROCEDURE

- MRI T2 fat suppressed image to plan

- Fluoroscopy in OR to correlate w/ MRI
  - (I put up the MRI on big screen TV’s in the OR)

- Drill to the lesion
  - Various companies make simple one pass kits/drills

- Fill the defect w/ a very porous calcium phosphate
  - (I mix Calc Phos w/ patients Bone Marrow Aspirate)
Histopathologically:

- fibrosis, necrosis, trabecular abnormalities, vascular ingrowth
Vascular breaching of the osteochondral junction is associated with subchondral marrow replacement by fibrovascular tissues.

- Characteristic of some BML’s observed by MRI.

Angiogenesis (edema) is thought to be a marker for other pathological processes associated with pain.

SCP LITERATURE = KNEE LITERATURE

- Only a handful of papers available...
FLATTENING OF ARTICULAR SURFACE AND BML’S

- The MOST study – 1025 knees

- Flattening or depression of the osseous articular surface is defined as ‘subchondral bone attrition’
  - Cause unknown, but reflected on MRI as Bone Marrow Lesions

- One explanation for the presence and development of SBA is subchondral remodeling due to increased stress, which is reflected as BMLs on MRI.

Subchondral bone marrow lesions are highly associated with, and predict subchondral bone attrition longitudinally: the MOST study
Frank W. Roemer, M.D., Tuhiing Neoai, M.D., Ph.D., Michael C. Nevitt, Ph.D., David Felson, M.D., M.P.H., Yanyan Zhu, Ph.D., Yuging Zhang, M.Sc., John A. Lynch, Ph.D., M. Kassim Javaid, M.D., Michael D. Cremg, M.D., James Torner, Ph.D., Cora E. Lewis, M.D., and Ali Guermazi, M.D.
THINGS TO KNOW:

- Ultimately Subchondral remodeling fails in joints
  - Due to increased focalization of stress.

- Subchondral bone has reduced healing capacity
  - Increased vascularization
  - Increased inflammation
  - Subchondral bone attrition (flattening/compression)
    - FURTHER CARTILAGE LOSS
BONE MARROW LESIONS MRI

T2/STRI:
Hyperintensity on fat-suppressed, T2 weighted, and STIR sequences

T1:
Intermediate or low intensity on T1 weighted sequences in comparison with normal subchondral bone
SHORT TERM OUTCOME OF SCP IN KNEE:

- SCP is an effective treatment modality in the management of patients with knee OA and BME lesions.
- The goal of the procedure is to provide enduring pain relief caused by BME

- 50 patients demonstrated an average 4.7 point improvement in pain on a 10 point visual analog scale
  - (pre-SCP 8.3, post-SCP 3.6)
  - (average f/u 14.6 months, average age 55)
- 4/50 pts went on to TKA
- Need for long term f/u
**KNEE: 2 YEAR F/U POST**

- **Inclusion:** Moderate to severe joint disease confined to the same compartment as the BML for greater than 2 months and pain min 4/10.

- **Mean improvement** 4.2-4.5 on VAS scale
  - 27.2 months average

- **2 year survivorship** 42/60 (70%)
  - 18 went on to TKA
    - Mean age 58 yo for TKA
    - Mean age 55 yo for survivorship

- **Rejected null hypothesis** that function not improved after SCP
  - Meaning patients experienced durable functional/symptomatic improvement for 2 years

Subchondroplasty for Treating Bone Marrow Lesions Steven Brad Cohen, MD1 Peter F. Sharkey, MD1 1Department of Orthopedic Surgery, Rothman Institute, Thomas Jefferson University, Philadelphia, Pennsylvania J Knee Surg 2016;29:555–563.
KNEE ARTHROPLASTY AFTER SCP

Does application of CBPS for repair of MRI identified subchondral fractures associated w/ arthritis adversely affect performance of subsequent TKA?

-Good question for those who perform TAR’s

22 pt’s w/ periaritulcar fx combine w/ use of SCP later had TKA.

-F/U 23.5 months.

No difference in surgical complexity or complication from prior SCP.


*Knee Arthroplasty After Subchondroplasty: Early Results, Complications, and Technical Challenges.*

Yoo JY, O’Malley MJ, Matsen Ko LJ, Cohen SB, Sharkey PF
SCP INEFFECTIVE FOR BML’S IN ADULTS W/ ADVANCED OSTEOARTHRITIS

- Does percutaneous calcium phosphate injection improve validated patient-reported outcome measures?

- 33 patients with Grade III or IV cartilage loss in knee with BML on MRI

- 22 patients had poor clinical outcomes as assessed by the Tegner Lysholm Knee Scoring.
  - 3 had fair results
  - 5 had good results
  - 7 had excellent results

- No relation between age, sex, or BMI

Subchondral Calcium Phosphate is Ineffective for Bone Marrow Edema Lesions in Adults With Advanced Osteoarthritis
SCP INEFFECTIVE?: LETTER TO THE EDITOR

- Small Sample Size: 20 of 22 failures did show improvement
- KOOS scores improperly represented
- Tegner-Lysholm Score is used to grade ACL recon success, not BML's
- Grade IV patients: Weak R2 value (poorly represented)

Conflict of Interest?:
- Author of letter to editor or family member received payment from med device co. (<10k)
WHICH CALCIUM PHOSPHATE PRODUCT IS THE ‘BEST’?

- We want something w/ similar strength and size/porosity as cancellous bone.

- To keep branding out of this, I will let you look this up.
  - Happy to answer your questions aside
CALCIUM PHOSPHATE VS BONE

- Porosity 75-85% cancellous vs 5-10% cortical
  - Want a high porosity material to extravate into cancellous bone

- Cancellous Bone compressive strength 2-6 MPa
  - Want to inject a slightly stronger material
    - but not too strong (cortical bone 110-150 Mpa)

- Poor size 300-600 µm
  - Want to inject slightly smaller poor size to extravate extensively
    - (in thought anyways)
There are small case reports in the foot & ankle, but no substantive literature.

We could use foot/ankle literature out of the larger institutions...
  - I’ve had good results, but who am I???