Minimal Surgical Intervention for Early OA of the Knee in Athletes:

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San Francisco
Arthur Itis

- 55 yo male
- Investment banker
- Competitive runner
- s/p partial meniscectomy
- ....Way out of his envelope
- Wants surgery so he can stay active
- What to do ????
What defines Early OA knee?
When is it too late ????

- Joint space narrowing?
- Subchondral sclerosis?
- Bony deformity (Fairbanks changes)?
- Age of patient? (what is the definition of too old?...)
- Varus alignment?
- Osteophytes?
- Bone on bone?
  - With or without weight bearing?
What are we treating?

- Bone pain?
- Synovitis?
- Loose bodies?
- Loss of motion?
- Locking, catching?
- Loss of alignment?
Who really needs a TKR?

Traditional Thinking....

- Any exposed bone on both sides of the joint
- Large extensive areas of G 4
- Associated varus
- Osteophyte formation
- Older patient
- But...are there other options ????
Baby Boomer Knee Mantra:

- “total knee… not me!”
Buying Time....

- New perspective..
- Living longer
- More active
- Want temporizing procedures that allow greater activity level!
Surgical Options

- Arthroscopy
- Biological Resurfacing
- Spacers
- Localized arthroplasty
- HTO
- Unicompartmental Arthroplasty
IT'S HIS KNEE...TAKE HIM OUT AND SHOOT HIM.

In the days before arthroscopic surgery
Arthroscopy for OA... When is it Indicated...
Well, What do we mean by Arthroscopy?

- Lavage.. Debridement
- Removal loose body
- Partial meniscectomy
  - (deg men tear with unstable fragments)
- Resection of osteophytes
- Capsule release
- Microfracture
A controlled trial of arthroscopic surgery for osteoarthritis of the knee.

Moseley JB, et al.

BACKGROUND: Many patients report symptomatic relief after undergoing arthroscopy of the knee for osteoarthritis, but it is unclear how the procedure achieves this result. We conducted a randomized, placebo-controlled trial to evaluate the efficacy of arthroscopy for osteoarthritis of the knee. METHODS: A total of 180 patients with osteoarthritis of the knee were randomly assigned to receive arthroscopic debridement, arthroscopic lavage, or placebo surgery. Patients in the placebo group received skin incisions and underwent a simulated debridement without insertion of the arthroscope. Patients and assessors of outcome were blinded to the treatment-group assignment. Outcomes were assessed at multiple points over a 24-month period with the use of five self-reported scores--three on scales for pain and two on scales for function--and one objective test of walking and stair climbing. A total of 165 patients completed the trial. RESULTS: At no point did either of the intervention groups report less pain or better function than the placebo group. For example, mean (+/-SD) scores on the Knee-Specific Pain Scale (range, 0 to 100, with higher scores indicating more severe pain) were similar in the placebo, lavage, and debridement groups: 48.9+/21.9, 54.8+/19.8, and 51.7+/22.4, respectively, at one year (P=0.14 for the comparison between placebo and lavage; P=0.51 for the comparison between placebo and debridement) and 51.6+/23.7, 53.7+/23.7, and 51.4+/23.2, respectively, at two years (P=0.64 and P=0.96, respectively). Furthermore, the 95 percent confidence intervals for the differences between the placebo group and the intervention groups exclude any clinically meaningful difference.

CONCLUSIONS: In this controlled trial involving patients with osteoarthritis of the knee, the outcomes after arthroscopic lavage or arthroscopic debridement were no better than those after a placebo procedure.
In July 2003, CMS posted a decision memorandum that outlined its coverage position on arthroscopy for the osteoarthritic knee. CMS determined "arthroscopic lavage alone is not reasonable and necessary for patients with osteoarthritis of the knee." CMS also determined "arthroscopic debridement is not reasonable and necessary for patients presenting with knee pain only or with severe osteoarthritis (Outerbridge classification III or IV)."
Critique of Mosely Article

- Unvalidated outcome measure created specifically for that study (KSPS knee specific pain score)
- Selection bias (44% refused to participate)
- VA population with issues of secondary gain/disability
- Lavage and debridement only - does not address other arthroscopic procedures…
- Included patients with bone on bone w no mechanical sx
- Did not include weight, ROM or effusion data
- 79% men
- Older group (up to age 75)
With proper selection, patients with early degenerative arthritis and mechanical symptoms of locking or catching can benefit from arthroscopic surgery.


Hunt SA, Jazrawi LM, Sherman OH.
If AVN is not present and there is not significant joint space narrowing, arthroscopic debridement can be considered.... For the treatment of patients with mechanical symptoms....
How Long Does Benefit of Scope Last?
Survivorship of Scope w OA: Effect of Age

Arthroscopic washout of the knee--a 5-year survival analysis.


Arthroscopy and washout of the knee is commonly performed for early osteoarthritis. Very little information exists regarding long-term prognosis, especially in terms of avoidance of further surgery. Using a prospectively gathered database, 100 consecutive patients having knee arthroscopy with a finding of OA between 1991 and 1993 were identified and their outcome at 5 years ascertained. Ninety-nine patients with 100 arthroscoped knees were identified. Fifty-eight had isolated medial compartment disease and six had isolated lateral compartment disease. In 36, both compartments were affected. Eighteen knees had further major surgery during follow up; 11 had total knee replacement, four had high tibial osteotomy and three had unicompartmental knee arthroplasty. Those requiring surgery were significantly older (62 cf. 53 years, P=0.008). Meniscectomy was not an important risk factor (chi2, P=0.67). The rate of knee survival without operation at 5 years was much lower in those aged over 60 years than in those younger (68% cf. 89%). (chi2, P=0.02). Only 18% of patients progress to major knee surgery within 5 years of arthroscopic washout for osteoarthritis. Age greater than 60 years worsens the prognosis considerably.
Consensus: Debridement/Lavage Works for Early OA With Mechanical Symptoms.. Especially younger patients with normal mechanical axis

- What else can be accomplished with arthroscopy for OA?
- What about other, non-lavage, arthroscopic treatments?
OA and Microfracture

Patient satisfaction and outcome after microfracture of the degenerative knee

Miller BS, Steadman JR, Briggs KK, Rodrigo JJ, Rodkey WG.

Age 40-70. F/u avg 2-5 yrs
81 pts
13 required repeat scopes at 5 years

All subjective parameters measured (pain, swelling, limping, walking, stairs, sport level, and activities of daily living) demonstrated significant improvement over preoperative status (P<.003). Lysholm score improved from 53.8 to 83.1 (P<.001), and mean Tegner Activity Scale score improved from 2.9 to 4.5 (P<.05)
Capsular Release

Arthroscopic posteromedial release for osteoarthritic knees with flexion contracture.

Moriya H, et al
Arthroscopy. 2004 Dec;20(10):1030-9

PURPOSE: To evaluate the clinical outcomes of a new arthroscopic procedure, arthroscopic posteromedial release (PMR), and its potential use as a treatment option for medial-type osteoarthritic (OA) knees. TYPE OF STUDY: Retrospective analysis of clinical outcomes of a case series. METHODS: Knees with medial-type OA and flexion contracture were treated with PMR. They were classified using the Kellgren and Lawrence (K/L) radiographic grading system and classified using magnetic resonance imaging (MRI) into smooth (S) or irregular (IR) groups, based on the subchondral contour of the medial femoral condyle. Clinical outcome was evaluated using the Japanese Orthopaedic Association knee score (JOA score), verbal rating scale (VRS), and patient satisfaction. RESULTS: Fifty-two patients with 58 OA knees were included in the study. The mean age of the patients at the time of surgery was 71.6 years, the average ROM was from 13 degrees to 129 degrees, and the average follow-up period was 3.3 years. Most of the knees were classified as K/L grade III or IV. Overall, the average JOA score improved to 71.6 points from 56.3 points preoperatively. VRS scores decreased in most patients, and 76% of patients were satisfied at their last follow-up. The JOA score of the K/L grade III knees improved to 76.9 from 60.4 points preoperatively and that of the K/L grade IV knees improved to 69.5 from 55.3 points. The improvement in JOA score was less for the IR group, from 54.5 to 66.2 points, than for the S group, from 62.3 to 79.6 points. Five knees from the IR group and 1 from the S group were converted to total knee arthroplasty.

CONCLUSIONS: Knees with relatively advanced OA, for which arthroscopic debridement has conventionally been contraindicated, can be treated with PMR if they are selected properly based on MRI findings.
Osteophytes/ Notch Stenosis

Intercondylar notch stenosis in degenerative arthritis of the knee


Purpose: To present a classification of intercondylar notch stenosis (IS) adjacent to the anterior cruciate ligament (ACL) in degenerative knee arthritis, to raise awareness of this disorder, to describe the arthroscopic findings, and to promote an organized approach to its treatment with favorable results.

Type of study: Case series. Methods: Of 362 arthroscopies in patients with gonarthrosis, we identified 122 knees in 96 patients (34%) with central knee pain and subjective instability without ACL laxity to determine the notch changes adjacent to the ACL. We followed a cohort of 69 knees in 64 patients, 47 female (73%) and 17 male (27%), excluding 53 knees in 32 patients for other symptomatic lesions, noncompliance with protocol, or loss to follow-up. The average patient age was 66 years (range, 53 to 78 years). Stenosis was classified as: type I, anterior; type II, lateral; type III, mixed; and type IV, massive. Diagnosis was determined by manipulation during arthroscopy to visualize impingement and was followed by notchplasty. Average follow-up was 26 months (range, 12 to 36 months).

Results: Type III was most common, appearing in 48% of knees. Type I was found in 29%, type II in 20%, and type IV in 3% of knees. Preoperatively, central pain occurred in all patients, being moderate in 40 knees (58%) and severe in 26 knees (38%), with diminished strength and subjective instability in all cases; only 42 (61%) had knee extension loss. Flexion contracture resolved in 81% of cases; 90% had good to excellent pain relief and 74% excellent relief of subjective instability, without significant complications.

Conclusions: Intercondylar notch stenosis in the arthritic knee may be a cause of ACL damage, symptomatic instability, and loss of extension. A structured approach to diagnosis and treatment was beneficial in restoring more normal function for our patients and may prevent disease progression. Level of evidence: Level IV.
Arthroscopic synovectomy of the knee: is it helpful?


We performed 211 arthroscopic synovectomies over a 10-year period. The results were assessed at follow-up of at least 2 years using the criteria of pain, synovitis, and effusion, range of motion and function. In rheumatoid knees (112 cases), we had good or excellent results in 80%. However, in seronegative arthritides (32 cases), only 60% were successful. Pigmented villonodular synovitis was successfully treated with an 11% recurrence rate (19 cases total). Synovial chondromatosis (17 cases) had no recurrences. In patients with nonspecific synovitis or posttraumatic synovitis, the synovitis was improved in 60% .....but only half the patients had pain relief and good function. Looking specifically at the posterior portals, there were five complications, all related to the posteromedial portal involving the saphenous nerve and vein. Overall excellent results can be achieved with due care and attention to detail.
OA: Partial Synovectomy

Localized synovial hypertrophy in the anteromedial compartment of the osteoarthritic knee.


PURPOSE: The purpose of this study was to investigate the clinical and arthroscopic findings of localized synovial hypertrophy in the anteromedial compartment and the clinical results of arthroscopic partial synovectomy. TYPE OF STUDY: Retrospective case series. METHODS: We treated 19 osteoarthritic knees with localized synovial hypertrophy in 19 patients by arthroscopic partial synovectomy under local anesthesia. All patients had complained of knee pain (mechanical type pain) and catching sensations preoperatively. Preoperative diagnosis based on physical findings and imaging studies was a medial meniscus tear with medial OA in all patients. The mean follow-up was 37 months (range, 28 to 46 months). Clinical results were assessed with the Hospital for Special Surgery (HSS) scoring scale, overall subjective estimation, and patient satisfaction. RESULTS: The catching sensation resolved immediately after surgery in all patients. The mean HSS score improved from 56.8 to 72.4 points (P < .01). Nine patients (47.4%) were rated excellent or good according to the overall subjective estimation, and 11 patients (57.9%) were satisfied with the treatment. Both HSS score and patient satisfaction were higher in patients (10 patients) who complained of intraoperative pain during synovectomy than in those (9 patients) who hardly felt the pain. CONCLUSIONS: Localized synovial hypertrophy in the anteromedial compartment of OA knees occasionally caused symptoms of pain and catching sensations that resembled meniscal symptoms. Arthroscopic partial synovectomy was effective, especially for those who complained of intraoperative pain during synovectomy under local anesthesia. LEVEL OF EVIDENCE: Level IV.
Summary
When is Arthroscopy indicated?

- **Early OA**
- Mechanical sxs (locking, catching, loose bodies)
- Best results with normal alignment, no bone/bone
- **Other**
  - Synovectomy
  - Microfracture
  - Capsular release,
  - osteophyte resection
Other Minimally Invasive Options...

- Biological Resurfacing
- Spacers
- Localized arthroplasty

“Magic wand”
Biological Resurfacing Options for Early OA

- Regrow Fibrocartilage
  - Microfracture
- Regrow Hyaline-like Cartilage
  - ACI (Genzyme)
    - Periosteum
  - Matrix
    - MACI, Neocart
  - Injectable
    - Chondrosphere
    - 3-D biosphere (co.don AG)
- Transplant articular cartilage w bone
  - OC graft (auto, allo)
- Combination:
  - HTO
  - Meniscus allograft
Biological Resurfacing for Early OA: Decisions, Decisions...

- Evaluate each case!
  - Localized?
  - Unipolar?
  - Bipolar?
  - Chondral?
  - Osteochondral?
  - Deformity?
  - Alignment?
  - Meniscectomy?
Biological Resurfacing Options for Early OA
Important to subcategorize !!

- Chondral
  - Minor/No joint space narrowing, ctlg fragmentation (G-3-4)
  - Unipolar G4 chondral defect
    - Small (< 2cm)
    - Large (>2cm)
  - Bipolar G4 lesions

- Bony:
  - OCD
  - Sclerosis
  - Osteopytes
  - Deformity (squaring of condyle)
  - Bone collapse

- Other
  - Alignment
  - Instability
Treatment Algorithm

- Chondral: stage 1
  - Minor or no joint space narrowing
  - ctlg fragmentation G3-4
  - Usually mechanical sxs
  - Best candidates for arthroscopy, debridement, lavage
Treatment Thoughts

- **Chondral Stage 2:**
  (localized unipolar defect)

- **Cartilage resurfacing**
  - Small (≤2cm)
    - Microfx
    - OCG (auto)
  - Large (>2cm)
    - Genzyme (ACI)
    - OC Allograft
    - Future
      - MACI, Neocart etc....

- +/- meniscus allograft
ACI: Case Example

**Carticel SM Treatment**

1. Healthy cartilage biopsy taken from patient
2. Biopsy sent to Genzyme Tissue Repair for processing
3. Cultured cells sent to surgeon
4. Cultured cartilage cells injected under periosteal flap

Chondrocyte Implantation (Pre-Surgery)

Chondrocyte Implantation (Post-Surgery)
Combined Procedure: ACI + Meniscal Allograft
Advanced Biological Resurfacing: Bipolar Lesions

- Chondral stage 3: (bipolar G4 lesions)
- Joint space narrowing
  - Femur
    - Genzyme, OCG, Microfx
  - Tibia
    - Microfx, retro OCG, Genzyme
- +/- meniscus allograft
- +/- HTO
Bipolar Lesion

Video
Bipolar Lesion: Follow Up
Deg OA .. Bony Involvement

- **Bony stage 1: (OCD)**
  - Bone graft + ACI
  - OC allograft

- **(sclerosis)**
  - Treat like chondral lesion...
  - expect less predictable result?
  - Add HTO
Bony Involvement: cont

- **Bony stage 2: (osteophytes)**
  - Treat as above + resect notch, rim osteophytes,

- **Bony stage 3: (deformity)**
  - Think arthroplasty… large OC allograft (shell) ? Bipolar?

- **Bony stage 4,5: (collapse, instability)**
  - Arthroplasty
Does Biological Resurfacing Stop Progression of OA?

**Improvement in Bone Homeostasis** Following Autologous Chondrocyte Implantation of the Knee

Halbrecht J. et al
Orthopedics 2004

This retrospective review and clinical follow-up demonstrates the effectiveness of autologous chondrocyte implantation of the knee. 24 patients with average follow up of 26.5 months were evaluated. The mean Lysholm score improved from 43.58 before surgery to 71.42 at most recent follow-up, the modified Cincinnati knee score for overall clinician evaluation improved from 2.96 to 6.92, and the mean modified Cincinnati knee score for overall patient evaluation improved from 3.21 to 6.13 at \( P < 0.05 \). Seventy-nine percent of patients responded that they would have the same knee surgery again and 83% rated the results of their knee surgery as good to excellent. Limited radionuclide bone scans with single photon emission computed tomography were completed in 11 of the patients to assess the physiology and homeostasis of subchondral bone adjacent to treated articular cartilage defect(s).

**A trend was identified suggesting improvement in mean subchondral bone scores at a mean of 29.6-months follow-up compared to preoperative bone scan assessment.** There was also a trend towards greatest improvement correlating with the patients with the best clinical scores. The results of this study suggest that autologous chondrocyte implantation of the knee can be successful in improving pain and function in patients with articular cartilage...
## Complex Cases

- **24 patients**
- **Avg. defect size 4.9cm**
- **12/24 had associated surgery**
  - Six Men allograft
  - Two HTO
  - Three ACL
  - One Fulkerson

<table>
<thead>
<tr>
<th>PATIENT NO</th>
<th>LOCATION OF TREATED DEFECT</th>
<th>SIZE OF DEFECT (cm²)</th>
<th>ASSOCIATED OPERATIONS²</th>
<th>GRADE OF DEFECT (PRE-OP)³</th>
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# Clinical Results of this Study

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<th>Improved (%)</th>
<th>Same (%)</th>
<th>Declined (%)</th>
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<tr>
<td>Lysholm Score</td>
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<tr>
<td>Mod. Cincinnati</td>
<td>79</td>
<td>8</td>
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**Patient Perception**

- 92% would probably or definitely have the ACI procedure repeated
- 83% rated the results of their surgery as good to excellent
Mean overall clinician and patient evaluation scores of the patient population at follow up compared to baseline at time of biopsy.

**Modified Cincinnati Knee Score**

<table>
<thead>
<tr>
<th>Overall Clinician Evaluation</th>
<th>Biopsy</th>
<th>Most Recent Follow-up</th>
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<tbody>
<tr>
<td>Overall Patient Evaluation</td>
<td></td>
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</tr>
</tbody>
</table>

- Overall Clinician Evaluation:
  - Biopsy: 2.96
  - Most Recent Follow-up: 6.92
- Overall Patient Evaluation:
  - Biopsy: 3.21
  - Most Recent Follow-up: 6.13
Mean scores of overall patient population at follow-up compared to baseline at time of biopsy.

**Lysholm Score**

- Biopsy: 43.58
- Most recent follow-up: 71.42
Scoring system for assessing limited radionuclide Bone scan with SPECT.

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<tr>
<th>Score</th>
<th>Description</th>
<th>Examples</th>
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<tr>
<td>0 – Normal (n=0,0)</td>
<td>- Unicompartmental involvement - Increased uptake relative to normal - &lt;30% of ipsilateral plateau/condyle</td>
<td><img src="Planar" alt="Image" /></td>
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<tr>
<td>1 – Minor Changes (n = 2, 3)</td>
<td>- 1-2 compartment involvement - Increased uptake relative to normal - 30-50% of ipsilateral plateau/condyle</td>
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<tr>
<td>2 – Moderate Changes (n = 3, 5)</td>
<td>- Multicompartmental involvement - Increased uptake relative to normal - &gt;50% of ipsilateral plateau/condyle</td>
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<tr>
<td>3 – Severe Changes (n = 6, 3)</td>
<td></td>
<td></td>
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</tbody>
</table>

1 Number of patients preoperatively  
2 Number of patients at most recent follow-up visit
Mean Spect Score Post op compared to Pre op

Preoperative: 2.36
Most recent follow-up visit: 2.00
Mean Spect Score By Subgroup:

- **Symptomatic**
  - Pre op: 2.25
  - Post op: 2.43

- **Asymptomatic**
  - Pre op: 1.86
  - Post op: 2.00
Case Example

Pre op

Post op
CONCLUSION

- ACI is successful in improving pain and function in patients with articular cartilage defects and may improve subchondral bone homeostasis based on bone scan evaluation.

- A larger patient population and longer follow-up are necessary to confirm statistical significance and determine the long term efficacy of this procedure in preventing progression of OA...
ACI: Comparison Results

- Most data on localized defects femoral condyle

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<tr>
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<th>Avg. Age</th>
<th>Avg. Size</th>
<th>Lysholm</th>
<th>Mod. Cin.</th>
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<td>Peterson et al</td>
<td>Preop</td>
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1 Scores from 2-year (7.5-year) follow-up
2 Scores from 2-year (4-year) follow-up
Tom Minas
Brigham & Women’s Hospital
Complex Cases

Total = 86
• FC + HTO/TTO = 42% (36)
• FC + ACL = 7% (6)
• Trochlea = 30% (26)
• Patella = 19% (16)
• Tibia = 5% (4)
• Multiple = 44% (38)

n.b. patients may appear in multiple categories

Knee Society Score

p1=0.008 (12M compared to baseline)
p2=0.038 (24M compared to baseline)
p1=0.075 (36M compared to baseline)
p1=0.105 (48M compared to baseline)
Combined Procedures: Scott Gillogly - Atlanta

75 defects/60 patients

- ACL 7
- PF (AMTT) 17
- HTO (3 staged) 5
- Meniscal Tx 1
- OC Autograft 1

No significant difference in results between isolated vs. combined procedures

(Cincinnati Scores 80-90)
Conclusion:

- Cartilage resurfacing for large chondral defects even with early OA appears effective when combined with appropriate realignment and meniscal procedures...
Spacers

- Biologic
  - meniscus

- Plastic
  - ABS... abandoned

- Metal
  - Unispacer
  - Orthoglide
  - Conformis
Meniscus “Spacer” for OA
(+ Genzyme Femur)

37 yo attorney with CD LFC, absent LM
Meniscus “Spacer” for OA: 1 year
Meniscus Spacer 9 year F/U

Playing soccer 2-3 days/wk
Meniscus Spacer: Failed
Metal Spacer

- Acts as spacer and realigns knee
- Outpatient procedure
- Easy conversion to next step procedure
- Similar recovery to HTO
- Similar pain relief (80% on average)
UniSpacer Concept: The “Internal” Osteotomy

- **Restores alignment**
  Replaces Cartilage lost from the Tibia and Femur
- **Improves stability**
  Re-Tensions the cruciate and collateral ligaments
- **Adapts to the kinematics of the individual knee**
Unispace Results

- **Hallock**
  - 71 knees 1 year:
  - 21% Reoperation rate, 6% dislocation:

- **Sisto**
  - 37 cases 26 mo.
  - 0 Exc, 10G, 15 Fair, 12 poor: 6 dislocations, only 27% improved function

- **My series:**
  - 6 patients > 3 yr fu. No dislocations. All G/E. No reops.

- **BUT**- Takes a long time to improve! >6 mo.
New Spacer Options

- Orthoglide
  - Lower profile, Stabilizing lip

- Conformis
  - Custom design
Localized Arthroplasty

- Arthrosurface

- Q’s
  - Contact surface wear
  - Loosening
The Future: Genetic Treatments?

“Augmentation of cartilage ECM biosynthesis may be possible by employing the principles of gene transfer using suitable vectors …”

- Gene-mediated restoration of cartilage matrix by combination insulin-like growth factor-I/interleukin-1 receptor antagonist therapy.

The Future: Stem Cells?

Chondrogen

Chondrogen Preclinical Data:

“Our research demonstrates that injection of adult stem cells promotes regeneration of the meniscus and protects the articular cartilage from degeneration leading to osteoarthritis.”
"Inside every older person is a younger person... wondering what the hell happened."
THANK YOU!
ACI/ HTO

- Minimal joint space narrowing
- Physiologic varus
- Single vs 2 stage
- Opening wedge
Autologous Chondrocyte Implantation
Concomitant Procedures in Complex Knees

34 y/o male irrigation repairman with MFC defect, 
medial compartment narrowing, failed microfracture
Autologous Chondrocyte Implantation
Concomitant Procedures in Complex Knees

38 y/o male fork-lift driver with MFC defect, mild varus alignment, mild medial compartment narrowing, intact medial meniscus.

TX: Medial Opening wedge HTO, Puddu plate fixation, ACI
Salvage Cases

Alignment, Stability, Meniscus for success

Results Promising
THANK YOU