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Treatment of Knee Arthritis and Chondral Injuries

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Cartilage

- Type II collagen
- Cross linked type IX collagen
- 80% water
- 20-40% dry weight of glycosaminoglycans
- Chondrocytes and a composite gel
Time-Dependent Processes in Stem Cell-Based Tissue Engineering of Articular Cartilage, Ivana Gadjanski & Kara Spiller & Gordana Vunjak-Novakovic, Stem Cell Rev and Rep

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Dr Doron Sher
Knee & Shoulder Surgery
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Effects of aging on articular cartilage homeostasis

Martin Locke* and Richard F. Lesser*
Arthritis - Damage to the joint lining surface

2010 April; 5(2): 199–214
Joint aging and chondrocyte cell death
Shawn P Grogan and Darryl D'Lima

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Articular Cartilage

- Load bearing
- Shock absorber
- Smooth movement
- Prevention of articular damage is the key

No proven method to date can reconstitute hyaline articular cartilage
Arthritis Disease progression

• Early OA often localised to 1 area
• Long standing OA pain more diffuse
• Can have acute change in a chronic knee
OA Knee

- Begins as mono-compartment disease in 70% of cases (higher in Asians)
- Can stay in one compartment for up to 20 years
Pattern of Progression of OA

- Mono-compartment OA
- Intercondylar incarceration
- Rotatory subluxation
- Progressive ACL attenuation
- Bi and tri-compartment osteoarthritis
OA

- Increases with age
- Activity level NOT related to arthritis incidence
- 25% pts 45-64 yrs
- 85% pts >65 yrs have premature arthrosis of the knee (as seen on xray)
Outerbridge Classification

- 1- softening of cartilage
- 2- fibrillation superficial
- 3- fibrillation down to subchondral bone
- 4- exposed bone
Osteoarthritis

- What is the source of the pain?

Arthritic pain is largely due to increased stress on the unprotected bone.
Traumatic Chondral Lesions

- Very common
- Difficult to treat
- Present to physio before and often after arthroscopy because of ongoing pain

Can we stop isolated chondral lesions progressing to arthritis?
Who Gets Them?

- Anterior cruciate ligament injuries
- Direct blows
- Patella dislocation

Gradual wear and tear damage occurs with increasing age and usually not suitable for grafting
Surgical Treatment

• Arthroscopy
  – Debridement
  – Microfracture
  – Mosaicplasty
  – Fresh Allograft
  – CarGel

• Osteotomy

• Arthroplasty
  – Uni
  – Total
Debridement of OA

• 70% success rates
• Always try non-surgical first
• Success rate the same for delayed treatment
Debridement
MICROFRACTURE
Microfracture

• Hematoma fills the defect
  – Reparative fibrocartilage forms
    • joint surface contour partially restored
    • improved symptoms
    • delays need for reconstructive surgery

• Perforations promote blood clot adhesion
Microfracture - Results

- Male
- Small lesion
- Femur

{ Good

- Type of Rehab probably makes a difference
- Deteriorates after 2-5 years
Mosaicplasty

• Take cartilage from one part of the knee and put it in another
Mosaicplasty – Failure Rate

- 40% (long term conversion to TKR)
  - > 40 yrs
  - Female
  - Defects >3 cm²

- 12.5%
  - <40 yrs
  - Male
  - <3 cm²

Fresh Allograft

- Difficult to do in Australia

But what do you do when:
Loss of subchondral plate

- Structural defect
- Often large lesions
  - Too big for OATS autograft
- Often young patients
- Almost always significant symptoms with ADL’s
Osteochondral Allograft

- Must be FRESH
- Radiation destroys chondral cartilage
- Concerns about disease transmission
- No blood supply
  - Nutrients from synovial fluid
- Failure rate quite high
Prognosis

- Smaller Lesions Do Better
- Femoral Condyle
  - Better than Tibial
    - Better Than Patella
- Kissing Lesions Don’t Do As Well
- Not For Arthritis
CarGel

Microfracture
Chitosan + Blood
Gross – 6
Histo – 6
Indications For Surgery

- Young Patient
- Contained Lesion
- Stable Knee
- Not Overweight
- Motivated For Rehabilitation
- Subchondral Plate Intact
Treatment

- Conventional treatments do not restore articular cartilage to its normal state.
- Healing tissue is fibrocartilage which does not have the normal mechanical properties of articular cartilage.
CarGel

- Chitosan based scaffold
- Mixed with blood (shrimp exoskeleton)
- Placed on defect after microfracture
- Needs 15 minutes to set

- Physically stabilize the clot that forms
- Guide and enhance marrow-derived repair
Rehabilitation Variable After Chondral Surgery

- Site of lesion
  - Femoral condyle different from patella
- Size
  - Larger more conservative
- Surgery
  - Contained can be more aggressive

- Talk to the surgeon
Protection Phase (0-6 WEEKS)

• Allow incorporation of implant
• Promote chondrocyte activity
• Prevent adhesions
• Prevent loss of muscle strength
WEEK 0-3

- Brace straight 24 hours after surgery
- CPM can help for some
- NWB depending on site
- Isometric quads exercises
- Ice, local treatment modalities
WEEK 3-6

- PWB depending on site of lesion
- Exercises
  - Closed chain
  - Hydrotherapy
  - Gentle bike riding
Loading Phase (WEEK 6-12)

Controlled loading and pressure gives the knee the necessary stimulus to promote hyaline cartilage regeneration and restore normal joint function.
WEEKS 6-12

- Full ROM
- Graduated FWB
- Wean off crutches
- Exercises
  - Resisted cycling
  - Closed chain resisted quads
  - Walking
  - Hydro
  - Gentle proprioceptive exercises
3-6 MONTHS

• Strengthening exercises
• Avoid impact loading (No jogging/jumping)
• ?? Resisted exercises
• ?? Start jogging at 6 months
• ?? Sport 6-12 months
WORK

• Sedentary Work  2 Weeks With Crutches
• Standing Work  6 Weeks
• Physical Work  3-6 Months
Osteotomy
Realignment Osteotomy

- Unicompartmental arthritis
- Ligamentous deficiency
- Chondral transplantation
Realignment Osteotomy

- Tibial/femoral
- Medial/lateral
- Opening/closing wedge
- Flexion/deflexion
- Combined ligamentous reconstruction
Biomechanical Basis of Osteotomy

Transfer weight bearing forces from the arthritic portion of the knee to a healthier location in the knee joint to increase the lifespan of the knee

- Realigns the weight bearing forces
- Unloads the worn out joint surface
Goals of Realignment Osteotomy

- Pain relief
- Functional improvement
- Permit heavy demands
- Buy time before arthroplasty
Goals of Realignment Osteotomy

- Pain relief
- Functional improvement
- Permit heavy demands
- **Buy time before arthroplasty**
Osteotomy is different nowadays

- Intervene earlier
  - Smaller angular corrections
- Combined Procedures
  - ACL, PCL, Cartilage work
Contra-indications

• Diffuse knee pain
• Patellofemoral pain as primary complaint
• Moderate/severe instability
• Diffuse arthrosis
• Inflammatory disease
• Unrealistic patient expectations
Relative Contra-indications

- Age > 60 yrs
- ROM < 90°
- Obesity (1.3x)
- Severe arthrosis
- Tibiofemoral subluxation (1 cm)
Results

• 80% still good at 5 years
• 60% still good at 10 years

• The operation is expected to fail

• It buys time for the patient to be active before their TKR
Medial Opening Wedge HTO
Post-Operative Management

- Hinged brace
- Full range of motion
- Touch → protected weight-bearing
  - over 3 months
Post-Operative Management

Return to:

- ADL
  - 3 - 4 months
- Work (standing)
  - 4 - 6 months
- Sports
  - 4 - 6 months
Realignment Osteotomy

- Active population / increasing longevity
- Current indications narrow
- Patient selection
- Accurate surgical technique
- Combines well with cartilage surgery
But there are problems:

- Poor relief of symptoms?
- Technical failures are common (under correction / over correction, loss of fixation etc.
- High complication rate?
- Results unpredictable

? Poor results when revised to TKR

(wound healing, patellar contractures, altered joint line etc.)

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Arthroplasty

- Protects the bone from increased stress and therefore relieves pain
Resurfacing

The pathology is treated and the normal tissues are left alone.
Unicondylar resurfacing allows a better range of motion than TKR.
TKR

Good, but not without problems:

• Incomplete pain relief
• Loss of motion
• Loss of function
• Activity restriction
• Difficult revisions
• Wear problems
• Altered joint mechanics
TKR Complications
TKR alters joint mechanics

• De-functions cruciate ligaments
• Alters patellofemoral mechanics
• Changes retinacular tension
• Crowds flexion space
• Decreases knee stability
• Alters femoral rollback
Final Decision Making

• Patient expectations
  • gender, cosmesis
• Surgeon capabilities
• Potential complications
• Rehab & immobilization
• Durability of procedure
Summary

Arthroscopy
Debridement
Microfracture
Grafting
HTO
Arthroplasty
Uni
Total