

ARTICULAR CARTILAGE LESIONS

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- What is articular cartilage?
- Why is it important?
- Why is it such a challenge?

WHAT IS ARTICULAR CARTILAGE?

- One of three types of cartilage?
 - Hyaline (articular)
 - Elastic (nose/ear)
 - Fibrocartilage (meniscus/pubis ramus)

ARTICULAR CARTILAGE COMPONENTS

- Cells
 - Chondrocytes
- Extracellular Matrix
 - Macromolecules (collagen)
 - Water

ARTICULAR CARTILAGE

- No Blood Vessels
- No Neural Supply

CHONDROCYTE FUNCTION

- Synthesize and maintain extracellular matrix

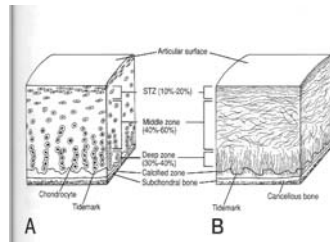
EXTRACELLULAR MATRIX

- Collagen – mainly Type II
- Embedded in gel of proteoglycans
 - Hyaluronic acid chains with links containing chondroitin and keratan sulfate
- Protects chondrocytes from loading forces

CELLULAR STRUCTURE

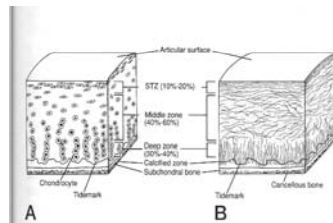
4 Zones

1. Superficial
2. Middle
3. Deep
4. Zone of calcified cartilage



COLLAGEN FIBER STRUCTURE

- Superficial – parallel fibrils
- Middle – random fibrils
- Deep – vertical fibrils
- Calcified Cartilage – fixation between bone and cartilage



FUNCTION OF ARTICULAR CARTILAGE

- Load bearing, shock absorber
- Movement
 - Low coefficient of friction
 - Slick gliding surface

CHONDRAL LESIONS

- Described by depth of the lesion
 - Superficial
 - Full Thickness

CLASSIC TISSUE REPAIR

- Depends on vascularity and cellular migration

CARTILAGE REPAIR

- Avascular
- Intrinsic Repair
 - Chondrocytes unable to migrate
 - Poor proliferation of cells in area of injury

CARTILAGE REPAIR

- Extrinsic Repair
 - Influx of inflammatory cells, mesenchymal cells, cytokines
- Repaired cartilage resembles fibrocartilage with increased Type 1 collagen

EFFECTS OF EXERCISE ON CARTILAGE

- Intermittent compression stimulates cell biosynthesis
- Immobilization causes cartilage atrophy
- Cartilage mechanically adapts to loads
- Activity levels above certain threshold may be destructive

CLASSIFICATION OF INJURIES

- Grade I – soft indentation
- Grade II – partial thickness <50%
- Grade III – defects >50%
- Grade IV – exposed subchondral bone

RESPONSE TO INJURY

- Partial thickness
 - Brief period of proliferation and matrix synthesis
 - No significant healing
 - Can remain stable

RESPONSE TO INJURY

- Full Thickness
 - With violation of subchondral bone
 - Fibrin clot with cells from marrow
 - Metaplasia to chondroid tissue
 - Type II collagen initially
 - Type I collagen later
 - Tangential fibrils fail to appear

MODULATING FACTORS

- Size of defect
- CPM – enhanced healing
- Age – greater cell proliferation in younger patients

GUIDELINES FOR TREATMENT

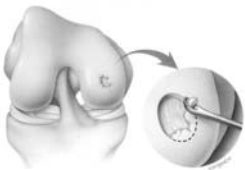
- Symptoms, goals
- Activity level
- Additional pathology
- Focal vs. diffuse

TREATMENT

- Palliative
 - Debridement and lavage
- Reparative
 - Marrow stimulation
- Restorative
 - Autograft
 - Allograft
 - ACL

OPERATIVE TREATMENT

- Shaving of fibrillated cartilage
 - Improve mechanical symptoms
 - Decrease inflammation

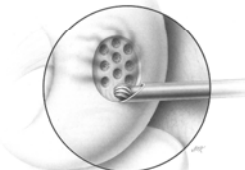


MARROW-BASED REPAIR

- Stimulate cell migration from marrow to defect
 - Fibrin clot
 - Release of growth factors
 - Mesenchymal stem cells into defect

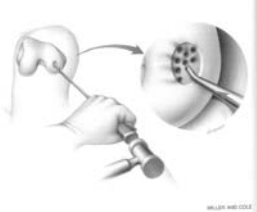
OPERATIVE TREATMENT

- Marrow-based repair
 - Abrasion arthroplasty
 - symptoms often increase



OPERATIVE TREATMENT

- Marrow-based repair
 - Microfracture – AWL creates defect in subchondral bone



TREATMENT

- Osteochondral grafts
 - Autograft
 - Allograft

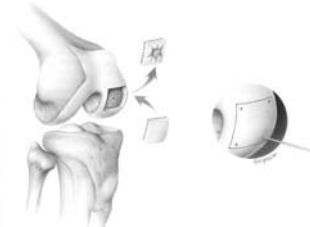
OSTEOCHONDRAL AUTOGRAFT

- Advantages
 - No immunological concerns
 - Better cell viability
- Disadvantages
 - Limited Supply
 - Morbidity of harvesting



OSTEOCHONDRAL ALLOGRAFT

- Advantages
 - Opportunity for younger donor
 - Graft from same location
 - Larger graft possible
- Disadvantages
 - Disease Transmission
 - Immunogenicity
 - Limited Availability of fresh cartilage



CHONDROCYTE TRANSFER

- ACL
 - Harvest articular cartilage
 - Culture cells in lab
 - Re-implant with periosteal cover



FUTURE TREATMENT

- Gene Therapy
 - Delivering gene-encoding growth factors into target tissues
 - In vivo – Inject vectors into joint
 - Ex vivo – Inject modified cells into joint

FUTURE TREATMENT

- Scaffolds – Biologic or synthetic
 - Combined with chondrocytes
