Chondral Injury

- Problems generally under Δ c̄ many injuries Asx & limited abilities of xrays & MRI detect early partial thickness injury
- Difficult to treat due to poor healing
  - avascular
  - aneural
  - alymphatic

Zones of Articular Cartilage → **Superficial to deep**

- Surface (Articular)
- Sfcl tangential zone → Type II collagen, resist shear forces
- Transitional / middle zone → Proteoglycans
- Radial / deep zone → Collagen fibers are vertical into tidemark, resists compression
- Tidemark
- Calcified zone → has tidemarks (boundary btw calcified & uncalcified cartilage)
- Subchondral bone, cancellous bone

Extracellular matrix injured → Potential for healing

Subchondral bone affected → Tissue repair → Fibrin clot → Cell migration from marrow ↓ vascular ingrowth ↓ fibrocartilage (Type I) formation

Injuries

- Direct trauma
- Chr. degeneration
- Subchondral bone abn [AVN, OCD]

Classification

Modified outerbridge

Grade 0	Intact cartilage
" I	Softening chondral/blister & intact surface
" II	Soft ulceration, fibrillation/fissuring <50% depth cartilage
" III	Deep " " / " >50% " " without exposing subchondral bone
" IV	Full thickness wear & " " "

Cartilage Repair

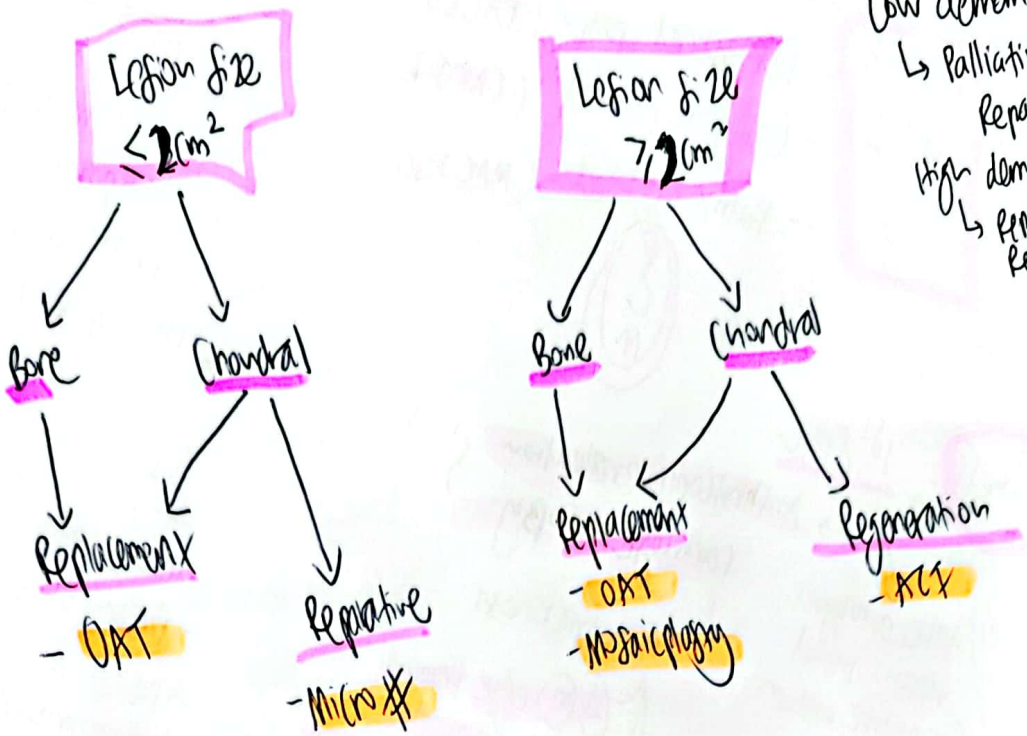
Indications

- Pain, mechanical Sx
- Isolated chondral/osteochondral lesion of knee/patella
- (N) or correctable knee alignment
- (N) " " " Lig. stability
- Functional meniscus
- Age 15-55yrs

CI

- Degen. OA knee
- RA knee
- collagen/vascular disorder
- BMI >35
- Immunosuppresive drugs

Rx → Patient specific, size & location, physical demands, Rx Hx



Low demand
↳ Palliative, Reparative
High demand
↳ Replacement, Regenerate

① Palliative
Debridement & Lavage
↓ [ ] of degenerative enzymes & cytokines

② Reparative
- marrow technique
- induce migration potential repair cells
1) subchondral drilling (Pridie)
2) Irrigation arthroplasty
3) Micro ## - use awl
↓
4mm depth & apart
↳ 'bridework' layer
↓
Superclot & MSC
↓
Heal by fibrocartilage (type I)

③ Replacement
OATS (osteochondral autograft transplantation system)
↳ Harvest from non wt bearing area
Mosaicplasty
Osteochondral Plug
- small defects
- larger plugs
- 1-2 "
- Large defects
- multiple plugs
- mosaic appearance
↓
Healing by hyaline cartilage

4 Regenerative - Autologous Chondrocyte Implantation (ACI)

- 1st gen - Periosteal patch (PACI)
- 2nd gen - Collagen covered (CACI)
- 3rd gen - Matrix induced (MACI)

P C M

Indⁿ
- Post lig. injury after stable knee
- Sx
- Full thickness defect
- Unipolar
- Well contained defect
- 1st line Rx defect > 2cm

CI
- Severe OA
- > 55 years
- obese
- Presence of kissing lesion
- Active RA
- Autoimmune d/s
- Malignancy

Process: 1st stage
- Arthroscopic evaluation
- Cartilage biopsy
  - Full thickness
    - (S) (M) edge femoral condyle
    - (L) intercondylar notch
    - (S) (L) edge fem. condyle
- take autologous venous blood for culture medium

after 6/52 1st stage

2nd stage
- Defect debridement
  - (M) (L) parapatellar incision
  - thorough debridement c̄ scapel vertically down
  - Ring curette the base of fibrocartilage
  - Stop bleeding c̄ adrenaline gauze
  - Measure defect c̄ aluminium foil
- Periosteal harvesting
  - @ prx (M) tibia
  - outer layer marked to know inner layer cambium
- Suturing periosteal membrane
  - (osteogenic layer) Cambium inner layer face outward
  - Suture from periosteum to cartilage c̄ interrupted vicryl
  - test for water tightness
  - Secure edges c̄ fibrin glue
- Cell implantation
  - Through small opening c̄ catheter & gently withdraw
  - Suture small opening & secure c̄ fibrin
  - Close arthrotomy, No drain inside jt

PACI

- graft hypertrophy
- donor site morbidity

CACI

- Porcine collagen membrane
- No donor site morbidity & graft HT

MACI

- Chondrocytes cultured in 3D-matrices / scaffold
- Cultured cells seeded onto type I/III collagen matrix
- Matrix membrane
  - Rough side
    - Chondrocytes attached
    - faced down
  - Smooth side
- even cell distribution without graining effect
- Scaffold covered & fibrin glue & implanted arthroscopically

- Require cell suspension injection
  - Can't ensure even cell distn
  - graft need to be sutured
  - Can't fix unconfined defect

[Flap can't be sutured to cartilage wall]

Stem cells

- Self renewing cell population undergo multilineage differentiation

- Embryonic — ethical issue
  - Proliferate in vitro & maintain its pluripotent potential
- mesenchymal
  - from mesoderm
  - give rise to Chondrocytes, osteoblasts