





دانشگاه علوم پزشکی  
و خدمات بهداشتی درمانی بابل

# Osteochondral Fractures



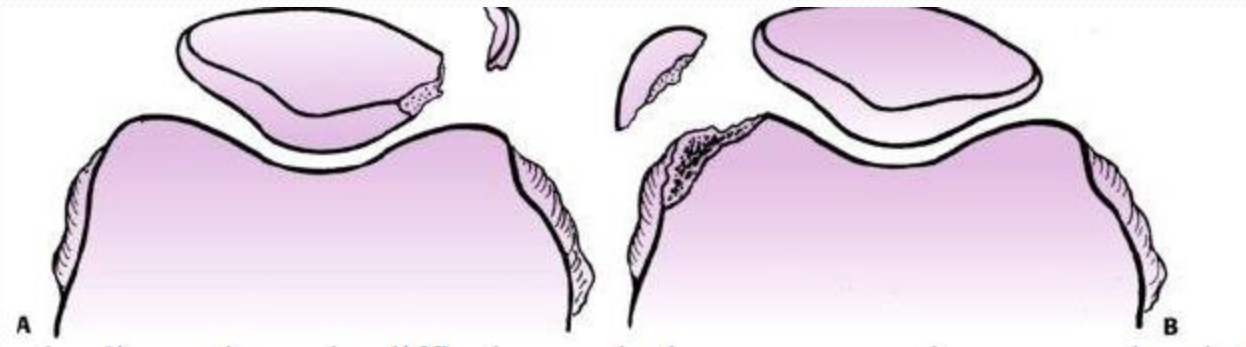
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# *Introduction to Osteochondral Fractures*

- They are typically associated with **acute lateral patellar dislocations**.
- The most common locations:
  - inferior aspect of the patellar median ridge, the inferior medial patellar facet,
  - or the lateral aspect of the LFC (Fig. 27-14).

- Figure 27-14 Osteochondral fractures associated with dislocation of the right patella.
- A: Medial facet. B: Lateral femoral condyle.



- The diagnosis can be **difficult** to make **because** even a large osteochondral fragment may contain only a small ossified portion that is visible on plain radiographs.
- **MRI** has therefore having a critical role in identifying associated osteochondral fractures or chondral-only fragments in cases of traumatic patellar dislocation.

- Acute osteochondral fractures must be differentiated from :
- **acute chondral injuries**, which do not involve subchondral bone,
- and **osteochondritis dissecans (OCD)** which is most often a repetitive overuse lesion of the subchondral bone, which may result in a nonhealing stress fracture that can progress to separation of the overlying chondral fragment.

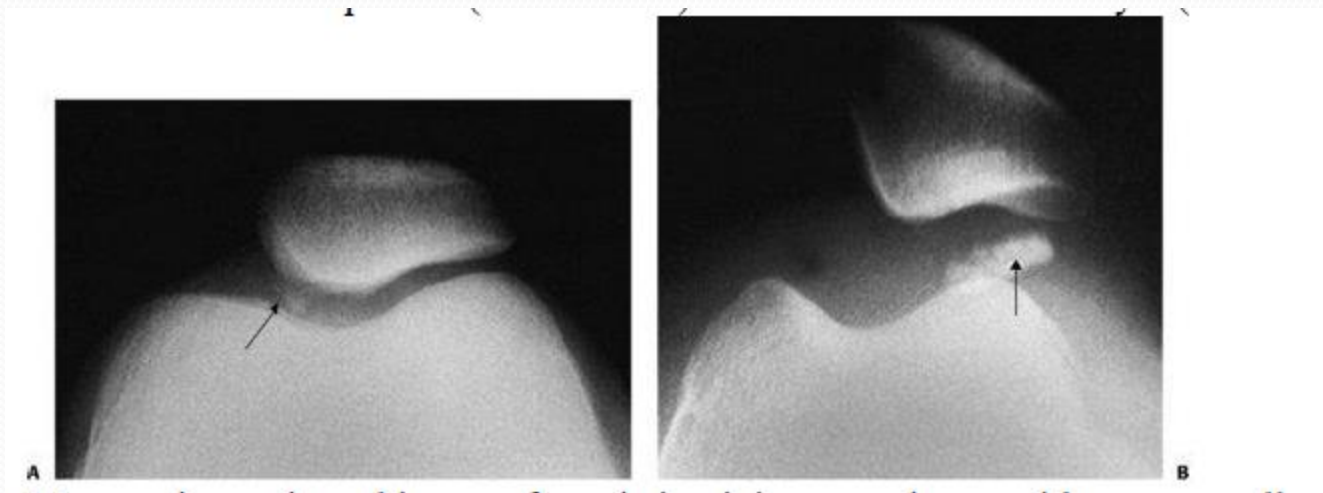
# *Assessment of Osteochondral Fractures*

## *Mechanisms of Injury for Osteochondral Fractures*

- There are two primary mechanisms :
- **First**, a direct blow to the knee with a shearing force applied to either the medial or LFC can create an osteochondral fracture.
- **The second mechanism** involves a flexion-rotation injury of the knee in which an internal rotation force is placed on a fixed foot, usually coupled with a strong quadriceps contraction.

Figure 27-15 Osteochondral fractures associated with dislocation of the patella.

A: Medial facet of patella (black arrow). B: Lateral femoral condyle (black arrow).





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- Interestingly, osteochondral fractures are relatively **uncommon** in the setting of chronic, recurrent patellar subluxations or dislocations.

- With more acute or traumatic dislocations, even if an osteochondral fracture does **not** occur, **bone bruising** is generally seen on MRI on both the patella and LFC, **and chondral injuries**, such as fissuring of the articular surface of the medial facet and median ridge, are also common.

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- The prevalence of osteochondral fractures associated with acute patella dislocation ranges from 19% to 50% in the literature.


# *Injuries Associated with Osteochondral Fractures*

- common injuries associated with acute patellar dislocation **include**:
  - ❑ MPFL tear and
  - ❑ bone bruises or impaction injuries to the LFC and medial aspect of the patella.
  - ❑ Other osteochondral fractures may occur in association with **severe cruciate** or **collateral ligament tears**, especially in the setting of a knee dislocation.

# *Signs and Symptoms of Osteochondral Fractures*

- Acutely, osteochondral fractures **present with:**
  - severe pain
  - swelling
  - difficulty in weight bearing.


- If the osteochondral fracture is associated with an acute patellar dislocation, there is **often**:
  - **tenderness** to palpation over the **medial** patella and **lateral** aspect of the LFC,


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- though **medial** femoral condylar **tenderness** may also be exhibited, **either from** a femoral-sided tear of the MPFL from the adductor tubercle region or because of a partial MCL sprain, which is **not uncommon** in association with patellar dislocation.

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- The patient will usually resist attempts to flex or extend the knee and may **hold the knee in 15 to 20 degrees of flexion for comfort.**




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- Typically there is a **large hemarthrosis** in the knee.

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- Joint aspiration may reveal fatty globules or a supernatant layer of fat if allowed to stand for **15 minutes** indicating an intra-articular fracture.
  - Similarly, **fluid–fluid levels may be seen on MRI**, from the separation of fat and blood.

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- Patients who present in a delayed fashion after injury, may complain of loose-body type symptoms such as **intermittent locking** or **catching** of the knee associated with a knee **effusion**.

# *Imaging and Other Diagnostic Studies for Osteochondral Fractures*

- Radiographic assessment should begin **with** :
  - AP
  - lateral
  - skyline plain radiographs.
  - A tunnel view may help locate a fragment in the region of the intercondylar notch.

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- Because the osteochondral fragment may be difficult to see on plain radiographs, radiographs should be **carefully assessed** for even the smallest ossified fragment (Fig. 27-16).

- Figure 27-16 Osteochondral fracture of lateral femoral condyle after patellar dislocation.
- A: Fragment seen in lateral joint space (black arrow). B: Lateral view (black arrow).



A



B


- Matelic et al. report that standard radiographs **failed** to identify the osteochondral fracture in **36%** of children who had an osteochondral fracture found during arthroscopy.
- For this reason, **MRI is recommended in most cases**, due to the importance of identifying a possible osteochondral fracture despite negative radiographs **or** a large chondral fragment.


- A **high-riding patella** may also have a **protective effect** against associated intra-articular osteochondral fractures.
- Patients with an **Insall index >1.3** have a **decreased** chance of sustaining an osteochondral fracture compared with patients who have an Insall index within normal limits.



# *Outcome Measures for Osteochondral Fractures*


- Healing of osteochondral fractures **must be followed closely with radiographs**, as healing is the most important predictor of outcome.
- For fixation of osteochondral fractures with minimal subchondral bone **or** purely chondral fractures, follow-up **MRI** may be necessary to determine healing.


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- **Traditionally**, purely chondral fragments with **no subchondral bone** attached were **previously not** considered amenable to refixation, because of concerns regarding poor healing capacity.
  - However, **new reports** have suggested that large chondral-only fragments may be able to heal in children or adolescents if early refixation is pursued.

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- **Fixation** can also be successful in the setting of a chronic osteochondral fracture fragment if done correctly and should be considered in chronic cases meeting the above criteria if tissue quality is **good**.


## *Authors' Preferred Treatment*

- In patients with an acute, traumatic patellar dislocation with a large hemarthrosis, **MRI is performed.**


- If MRI does **not** reveal any associated osteochondral fracture **or** any large chondral fragments, these patients are treated with  a brief (1 to 2 weeks) period with a **hinged knee brace** locked in extension for **ambulation with crutches** for comfort and weight bearing and **ROM** as tolerated,

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- ✓ **followed by :**
  - ✓ use of a soft, lateral-stabilizing patellofemoral **brace** and
  - ✓ physical therapy emphasizing patellar mobilization,
  - ✓ straight-leg raises,
  - ✓ progressive resistance exercises,
  - ✓ and vastus medialis obliquus (VMO) strengthening.

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- Routine diagnostic arthroscopy and MPFL repair are not performed on these patients without osteochondral fractures.

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- Patients are allowed to **return to sports** 6 to 12 weeks after dislocation depending on their progress with rehabilitation, with **use of the lateral-stabilizing brace** during sports **recommended for** those who feel it helps limit pain or apprehension.




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- **arthroscopic removal of loose bodies in** Patients with:
    - small ( $\leq 5$  mm) osteochondral fractures
    - or small chondral shear fragments,
    - damaged fragments,
    - and fractures involving non-weight-bearing areas

- Occasionally, a patient may be seen **more than 4 weeks** following the initial injury with radiologic evidence of a **small loose body** but **no symptoms**; in such instances, **arthroscopy may be deferred unless** the patient develops mechanical symptoms.

- If arthroscopy is done for a small osteochondral fracture, the **fragment's crater is debrided** to stable edges to prevent further loose bodies from developing **and the** underlying subchondral bone should be perforated with marrow stimulation techniques, such as **microfracture**, to encourage fibrocartilage formation.

- Lateral retinacular **release** with medial retinacular/patellofemoral ligament **repair** is performed adjunctively in **cases** of traumatic patellofemoral **dislocation** to decrease the risk of recurrent patellofemoral instability

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- **Primary MPFL repair** may be performed on either the patellar or femoral insertion sites if the site of the **tear** is clearly appreciated on MRI or intraoperatively.

## fragment fixation:


- Patients with **large (>5 mm)** osteochondral fractures where the :
  - chondral surface remains in good condition and
  - the osteochondral fragment can be anatomically reduced back to the native donor site,
  - **or**
- selected large purely chondral fragments with intact chondral surfaces which involve large weight-bearing areas,

- Medial patellar facet osteochondral fractures can be fixed through an **open lateral retinacular release by manually tilting the patella** or a **medial parapatellar arthrotomy**, which allows for tensioning of the medial retinacular repair during closure.


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- **LFC** osteochondral fractures typically require a **lateral parapatellar arthrotomy** for fragment fixation .





- 1) The **donor site edges** should be cleared of all fibrinous debris and tested for stability using a tiny curette.
- 2) The subchondral bone of the donor site may be **perforated** at this step to initiate bleeding prior to fragment reduction.
- 3) The fragment is then **reduced** anatomically.

- 
- At times the osteochondral fragment will have **swelled and be larger than the donor site** and may require **trimming** with a sharp knife **or** overcureting of the donor site to achieve an anatomic reduction.

- For osteochondral fragments **with large thick areas of subchondral bone**:
  - ✓ countersunk cannulated screws (3, 3.5, or 4.5 mm) **or**
  - ✓ Herbert screws are often **preferable** for fixation, **compared to** bioabsorbable tacks or screws, because of the strength of fixation which allows for fragment compression and early mobilization.

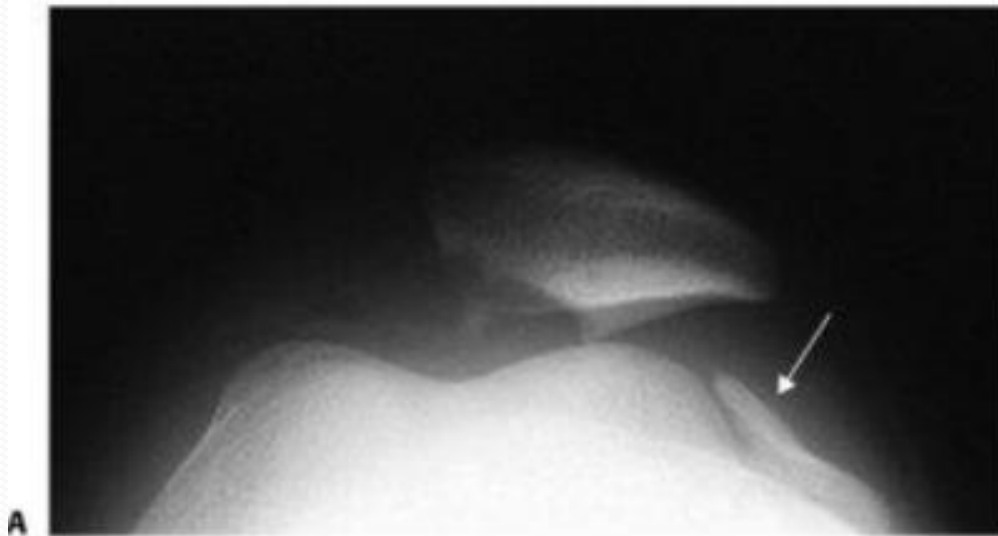
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- For osteochondral fragments **with thin layers of subchondral bone**, **bioabsorbable** tacks or screws are routinely employed for fixation which obviates the need for later implant removal .

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- Because **chondral-only** fragments will have **no subchondral bone** upon which to compress metal screws, **bioabsorbable tacks** or a **suture-based repair** are preferred techniques.

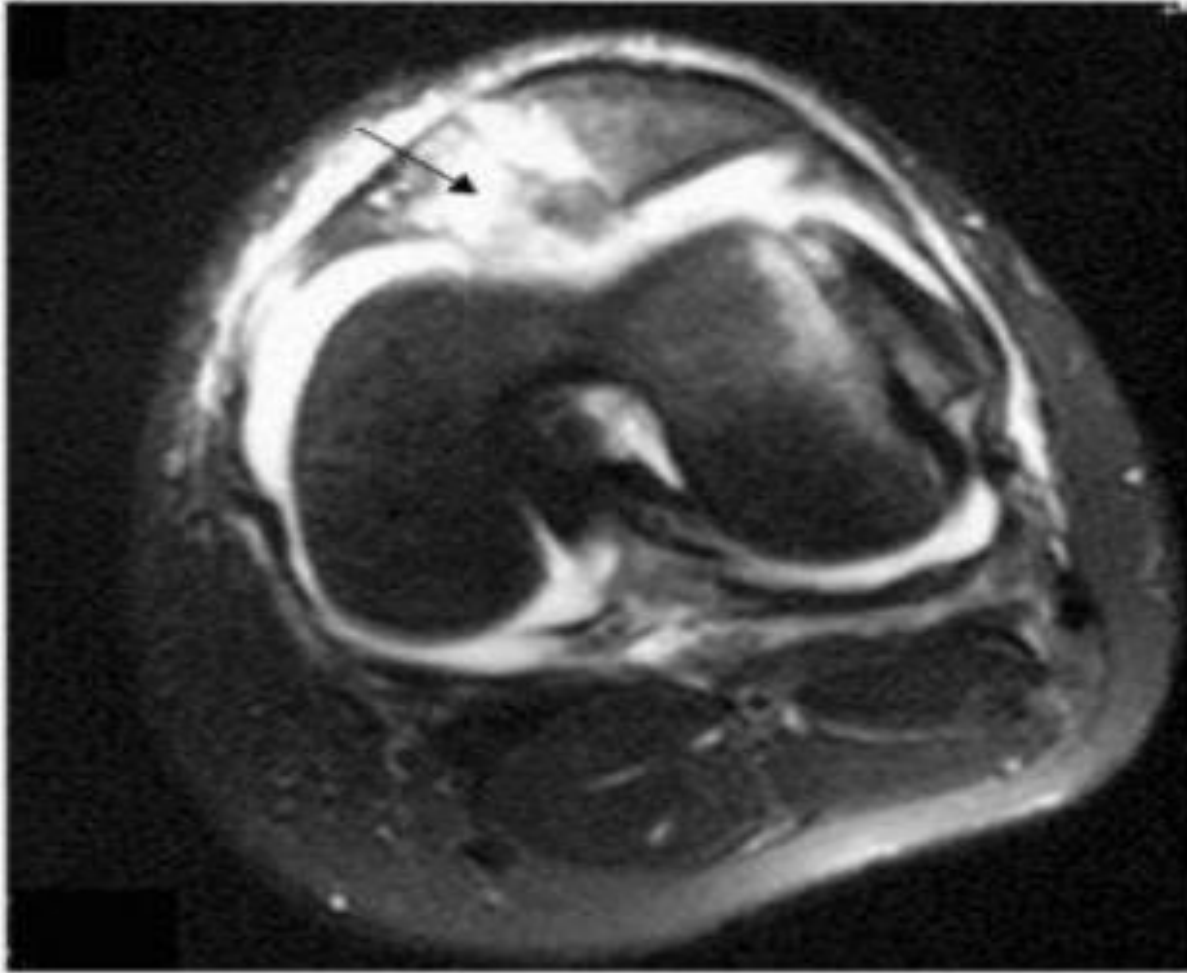
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- Lateral retinacular release with medial retinacular/patellofemoral ligament repair is often **performed adjunctively** in cases of traumatic patellofemoral dislocation to decrease the risk of recurrent patellofemoral instability.

Fixation of a **medial patellar facet** osteochondral fracture in an adolescent male athlete.

A: Skyline radiograph demonstrating a fracture of the medial patellar facet with the fragment in the lateral recess (white arrow).



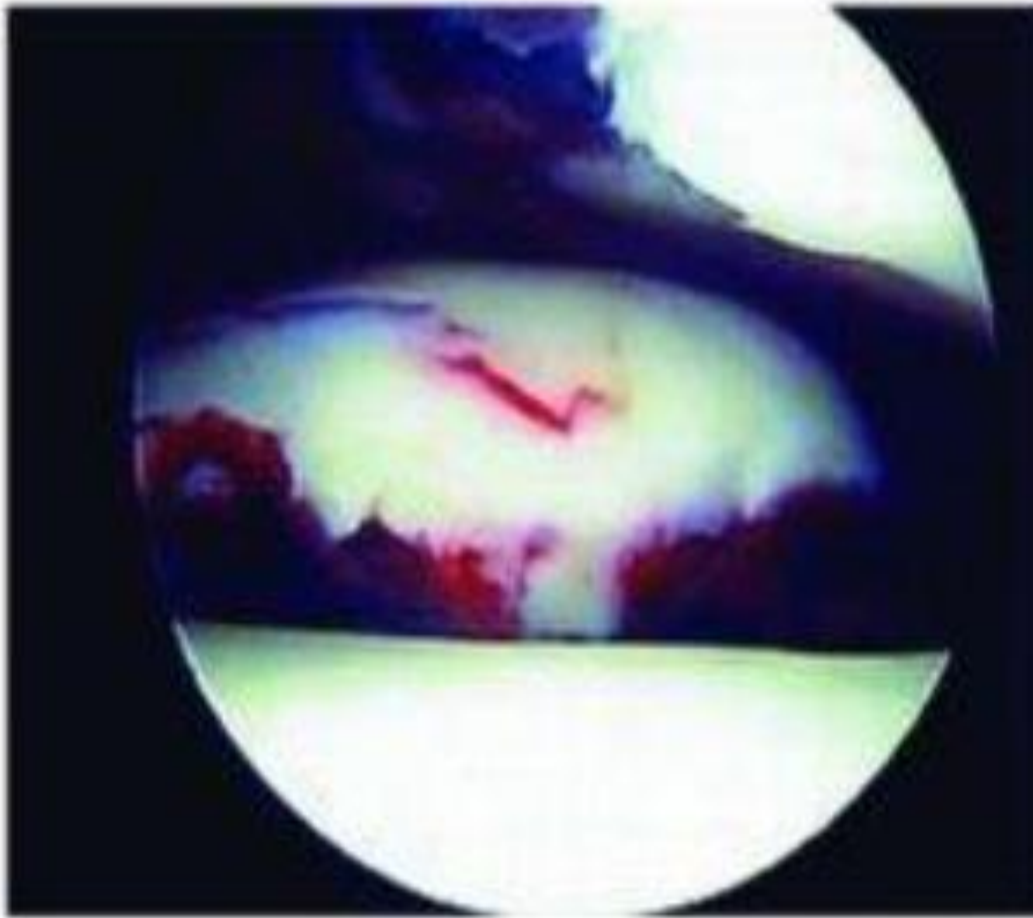
B: Axial MRI demonstrating medial facet fracture and loose fragment (black arrow).



**B**

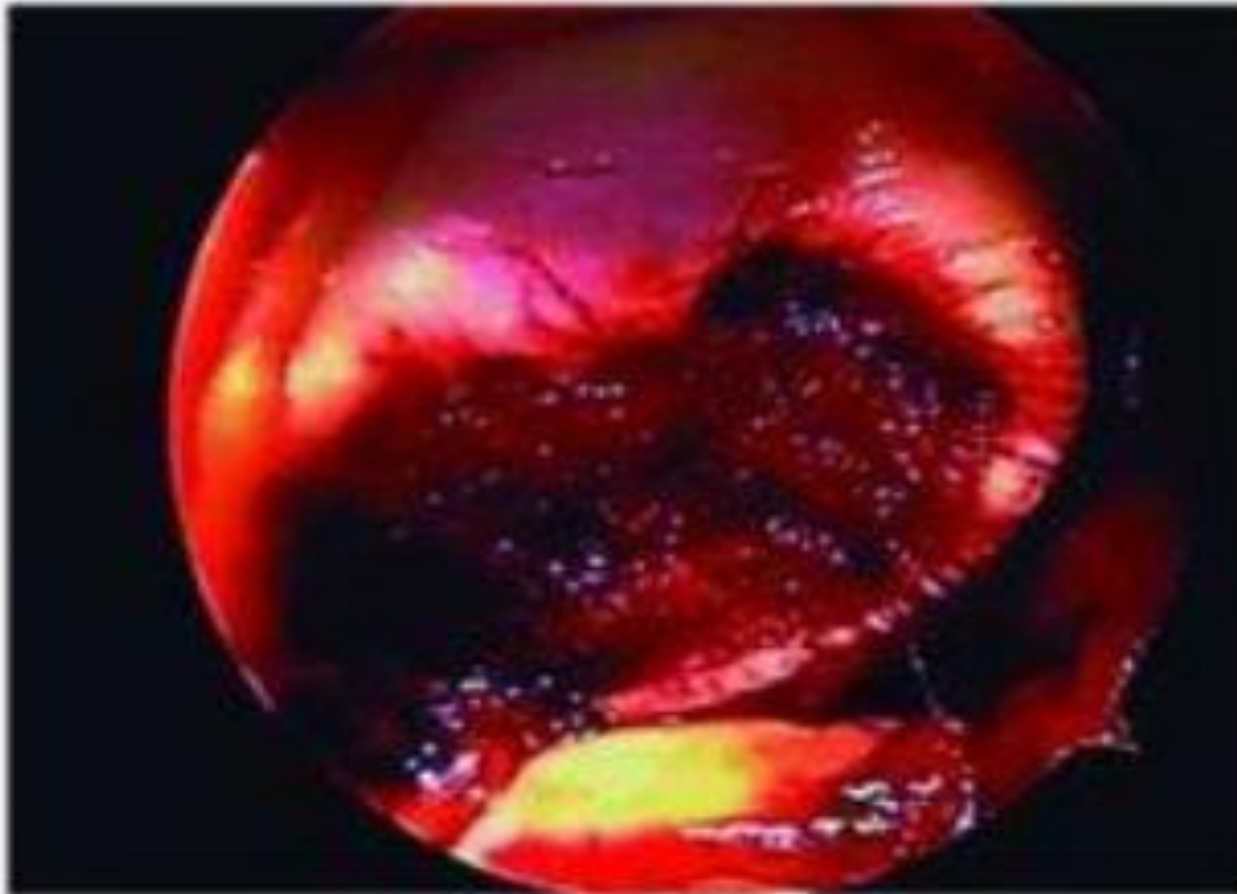


C: Arthroscopic view of osteochondral fragment  
in the lateral recess.



C

D: Open view of patella.



**D**

E: Open view of osteochondral fragment.



F: Open **view** of reduction and cannulated screw fixation of medial patellar facet.



F

G: Intraoperative lateral radiograph after fracture fixation.



**G**

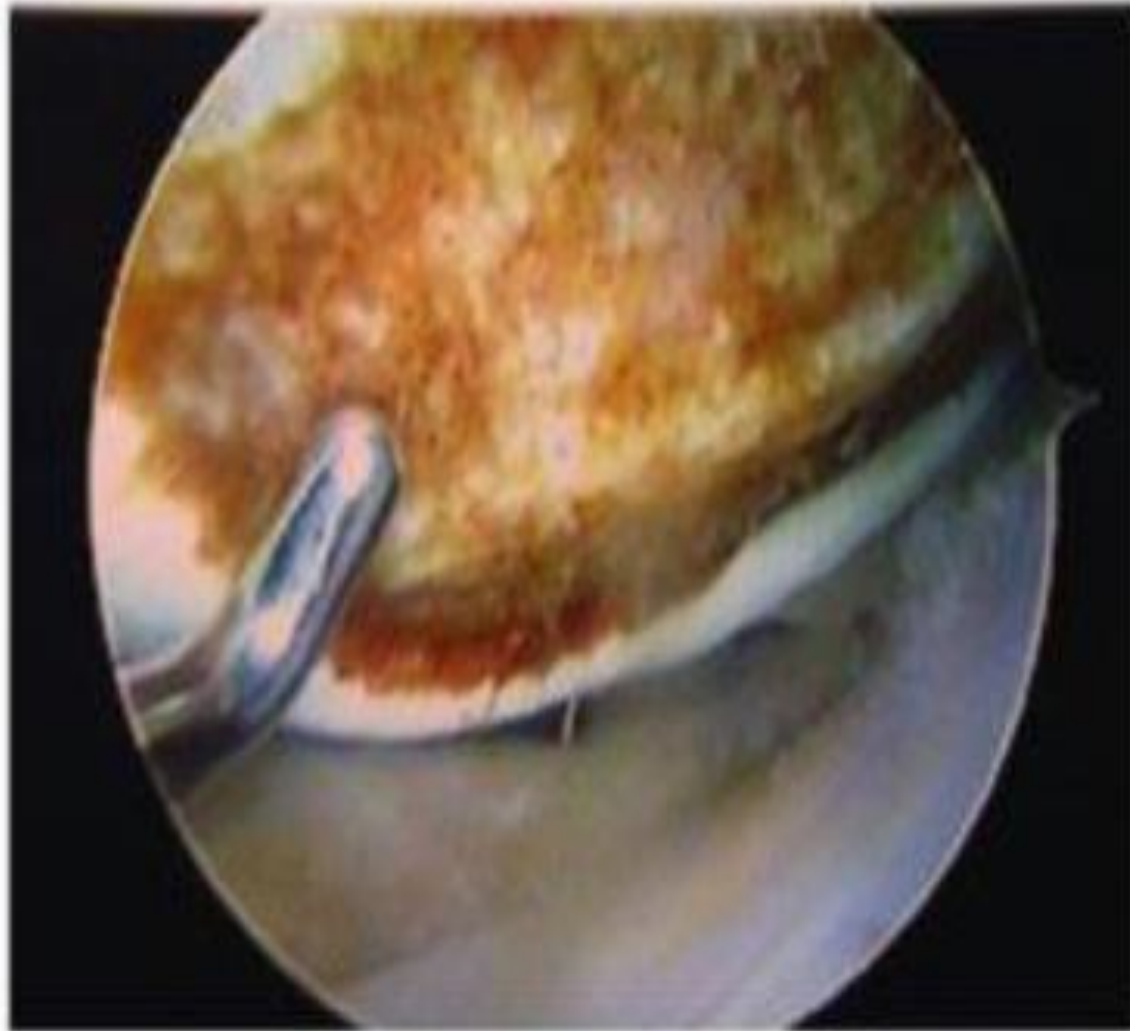
H: Lateral radiograph 3 months after fracture fixation and 6 weeks after screw removal demonstrating healing.



**H**

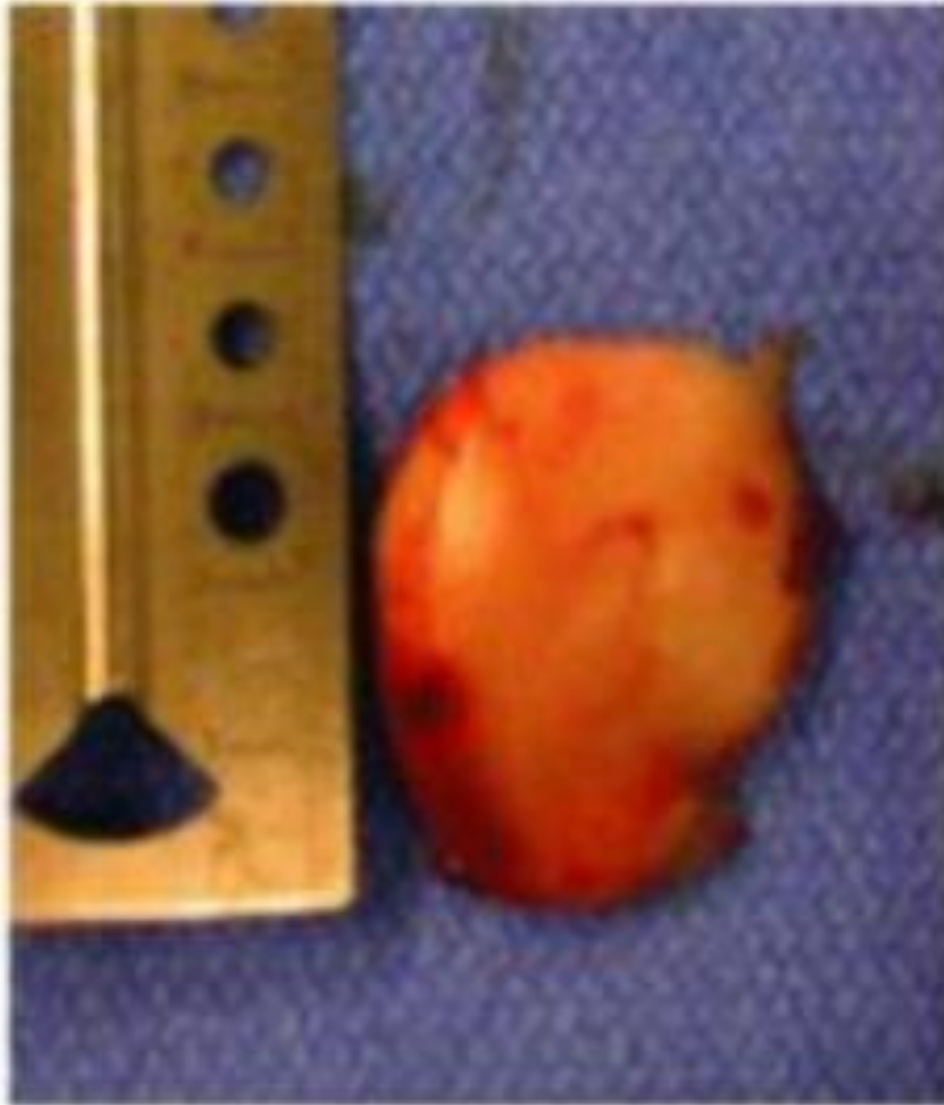
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- Fixation of a **lateral femoral condyle osteochondral** fracture in an adolescent female athlete.

- A: Arthroscopic view of the lateral femoral condyle.





B: Open view of the fracture fragment.



**B**

C: Open view of fracture fixation using **cannulated** screws through a limited lateral arthrotomy.



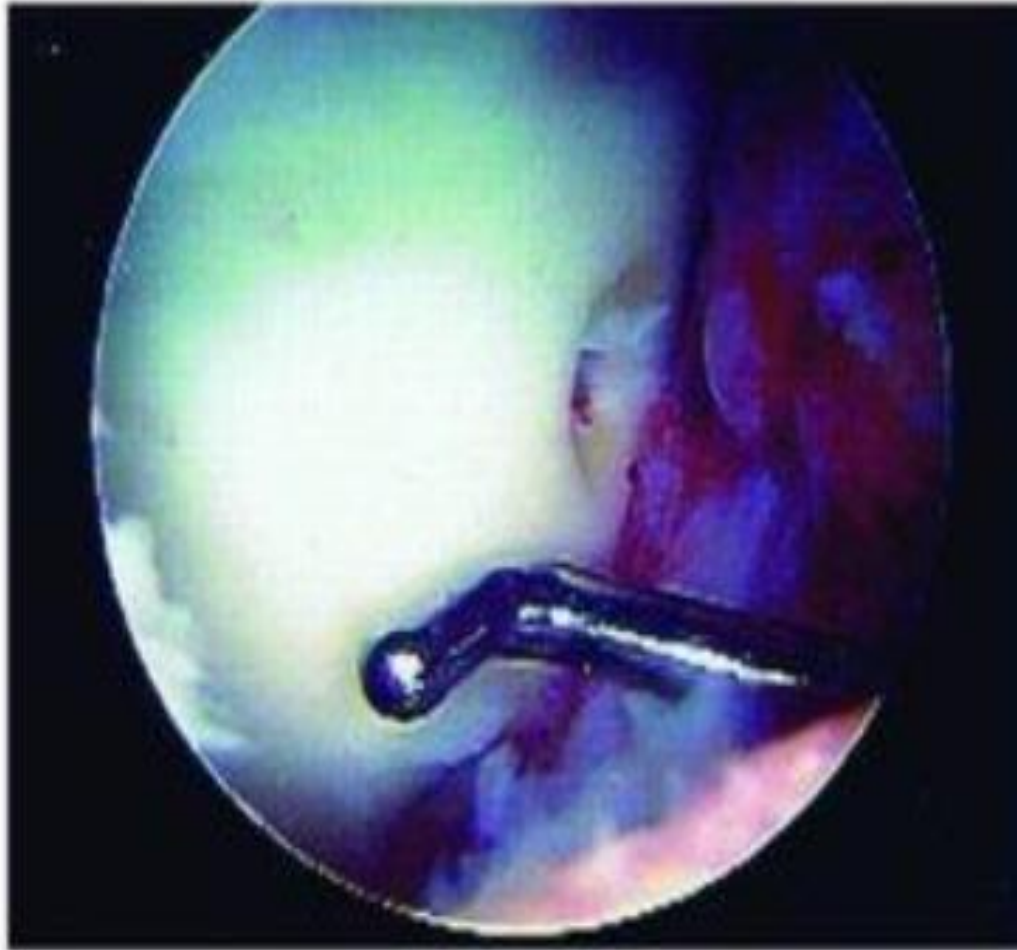
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D: Six weeks postoperative lateral radiograph demonstrating fracture healing.



**D**

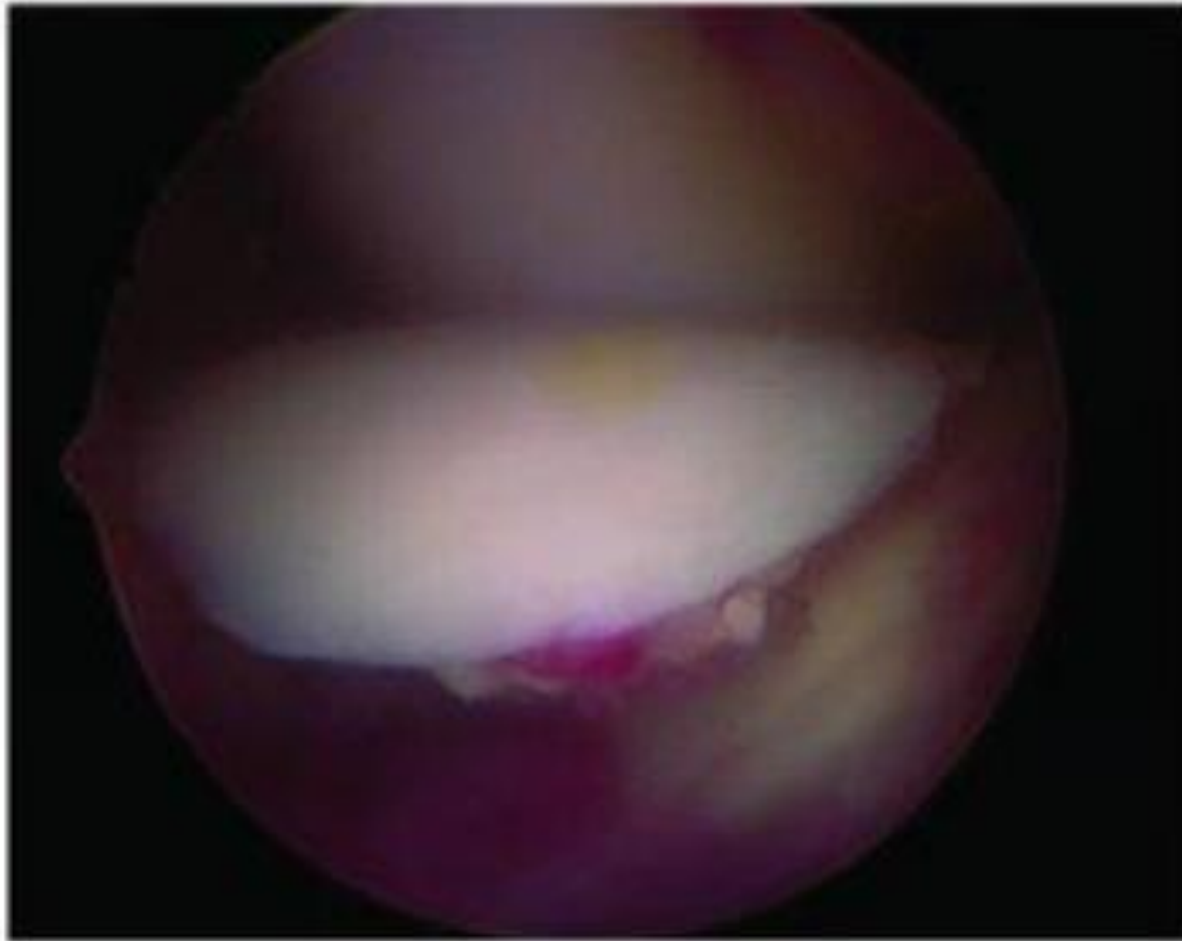
E: Arthroscopic appearance at the time of screw removal  
6 weeks postoperatively.



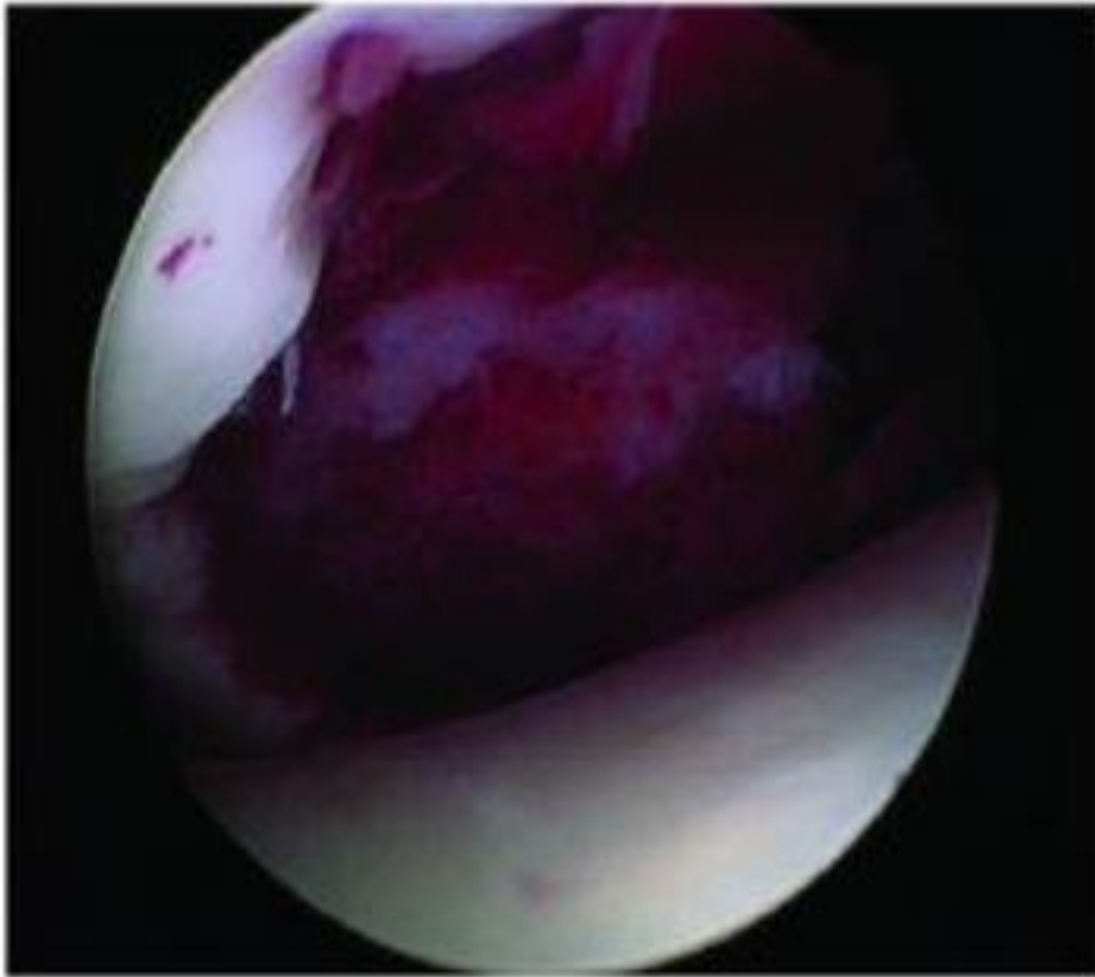
E

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- Arthroscopic knee images following a **patellar dislocation**.

A: A loose body is identified and removed (note the subchondral bone on the loose fragment).



B: The donor site on the lateral femoral condyle is identified (it is weight bearing) and prepared.



B

C: The loose **fragment** is reduced and fixed into the donor site with bioabsorbable implants.



C







- ***Postop***


- Postoperatively, patients **treated by excision of the fragment** can begin ROM exercises immediately.
- **Crutches** may be necessary in the immediate postoperative period but patients can progress to weight bearing as tolerated.

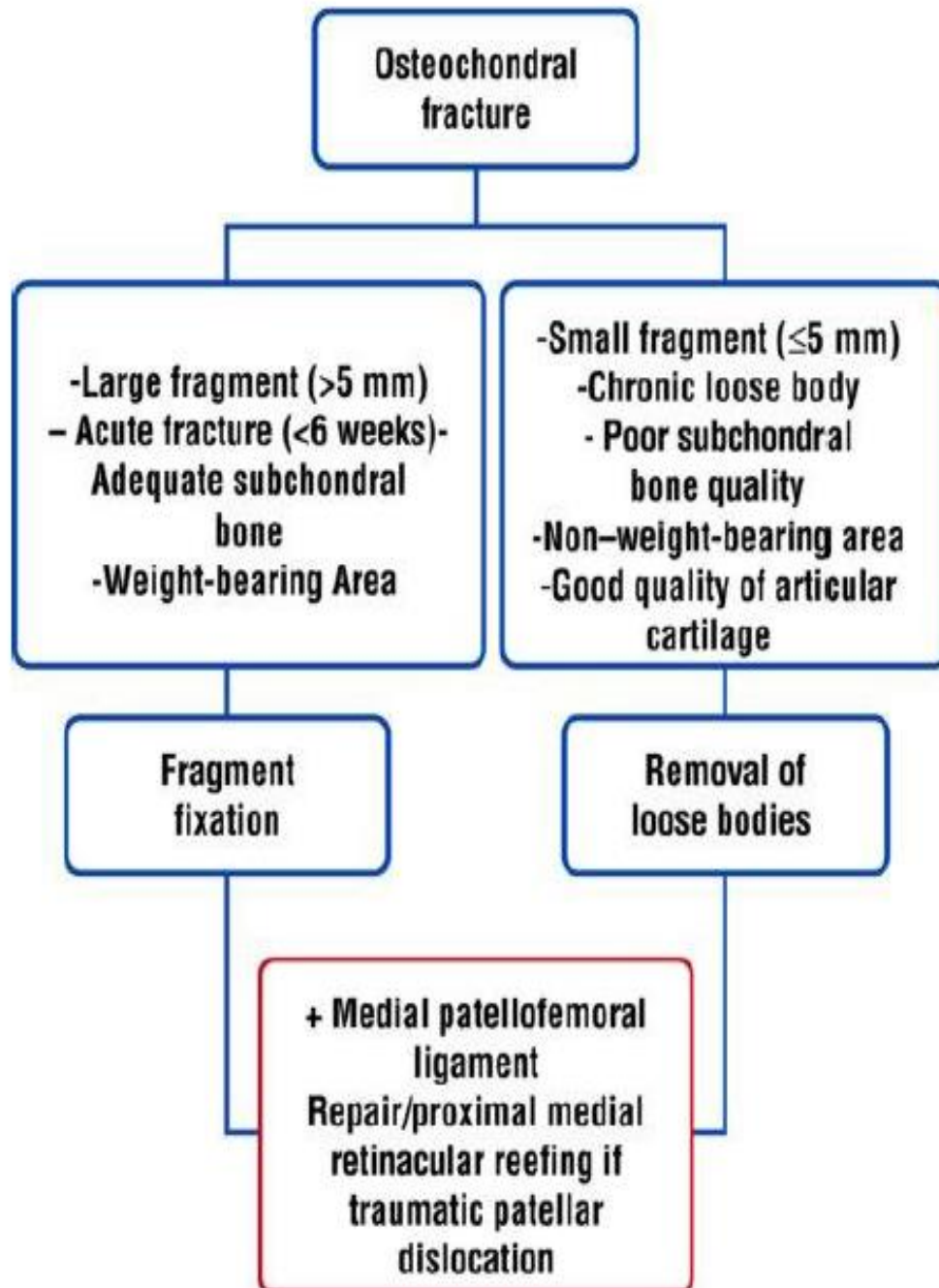
- **For** weight-bearing lesions of the femoral condyles in which a **microfracture/marrow stimulation technique** was employed, weight bearing may be **delayed** and continuous passive motion (CPM) of the knee may be employed to aid with healing of the fibrocartilage.

- Following osteochondral or chondral fragment **fixation**, patients are treated with **touch-down weight** bearing in a postoperative **brace** until fracture healing.
- ROM **when not** weight bearing is allowed from 0 to 30 degrees for the first 2 weeks, followed by 0 to 90 degrees until fracture healing.

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- Healing typically occurs **between 6 and 12 weeks** postoperatively, and confirmation with **follow-up MRI** may be utilized if necessary although is **not routinely** employed .

- 
- If metal screw **fixation** was utilized, **second look arthroscopy** is performed at a later date to :
    - confirm fragment healing,
    - remove hardware,
    - and assess the integrity of the articular surface.

- 
- Return to athletic activities is permitted when:
    - full ROM is recovered and
    - strength is symmetric.



# *Repair of Osteochondral Fractures: Potential Pitfalls and Preventions*

- ❑ Fragment does **not fit** in bed :
- Plan surgery for <7 days postinjury to prevent excessive swelling of fragment
- Trim fragment cartilage to fit bed
- Remove more bone from the donor site as needed to achieve anatomic reduction





❑ Inadequate fixation:

- When possible, achieve **at least two points** of fixation for rotational stability


❑ Growth disruption

- In skeletally immature patients, implants should be **short** enough to avoid physeal trauma during fixation

- Moreover, close postoperative clinical monitoring of *crepitus*, *swelling*, or *new pain* must be maintained, with consideration of **serial MR imaging** if necessary, because of risk of potential back out of the implants **not seen** on radiographs.

# *Outcomes*

- Osteochondral fractures with small fragments **not** involving the weight-bearing portion of the joint usually has a **good** prognosis after **loose body removal**.
- The prognosis for larger osteochondral fractures involving the weight-bearing surfaces is **more variable**.

- 
- Excision of large fragments involving the weight-bearing articular surfaces predictably leads to the **development of degenerative changes.**

# *Complications*

- Arthrofibrosis
- Loss of fixation/nonunion
- Osteoarthritis/focal chondral degeneration

- Among the most common and concerning complications after both excision of loose bodies and fracture fixation is **recurrent patellar instability**.
- Although studies have suggested that concomitant MPFL repair **decreases** the risk of recurrent instability, this concept remains **controversial**.

- **Stiffness** is also a common complication following patellofemoral dislocation, **particularly** after fracture fixation.
- Adequate internal fixation is necessary to allow for **early** motion, which **decreases** the risk of arthrofibrosis.
- Stiffness may be **treated** with aggressive therapy and dynamic splinting during the first 3 to 4 months after injury.

- **Beyond this time frame**, arthroscopic lysis of adhesions and manipulation under anesthesia is typically required, with care taken to **avoid** distal femoral physeal injury through excessive manipulation in skeletally immature patients.



- Excision of larger osteochondral fractures involving the weight-bearing articular surfaces requires associated chondral resurfacing, such as :
  - marrow stimulation procedures (microfracture),
  - osteochondral grafting (mosaicplasty), or
  - autologous chondrocyte implantation.
- All of which may be more technically challenging, with somewhat **less optimal outcomes**, when performed for the patellofemoral joint, **compared** with the tibiofemoral articular surfaces.

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