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Imaging of the Patella

[1]Dr. Kshitij Z Badade, MBBS, MS Orthopaedics, Assistant Professor Orthopaedics Department MGM Medical College & Hospital, Navi Mumbai, Maharashtra, India.

Corresponding Author: Dr. Kshitij Z Badade, MBBS, MS Orthopaedics, Assistant Professor Orthopaedics Department MGM Medical College & Hospital, Navi Mumbai, Maharashtra, India.

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Abstract

Patellar fractures can be caused by direct, indirect, or mixed trauma and make up about 1% of all skeletal fractures. Accurate reporting and description of the fracture type are essential for proper management due to the significance of patellar integrity for knee extension and the danger of harm to the extensor mechanism associated therewith. With a brief introduction to therapeutic care, this visual essay attempts to review the patella's normal architecture, the mechanisms of injury, and several forms of patellar fractures.

Anterior knee discomfort is a typical symptom that can be brought on by a wide range of conditions, including patellofemoral diseases. Patellofemoral malt racking is a dynamic aberration of patellofemoral alignment that has been quantified using static and kinematic methods on plain film, computed tomography (CT), and magnetic resonance imaging (MRI). Although patellar dislocation is often temporary, certain MRI and conventional radiography features may show signs of previous acute or chronic dislocation. In addition, patellofemoral pain has been linked to chondromalacia patellae, osteochondritis dissecans, patellofemoral osteoarthritis, excessive lateral pressure syndrome, and bipartite patella. Reviewing the clinical and imaging characteristics of these processes, the distinctive diagnostic characteristics of each disorder are highlighted.

Teaching Points

1. Patellar fractures are divided into groups based on their morphology and degree of displacement.
2. Stellate fractures are caused by direct trauma.
3. Transverse fractures are the result of indirect trauma.
4. Displacement should raise concerns about retinacular damage.

Keywords: Computed Tomography, Patellar Fractures, Anatomical

Introduction

Patellar fractures can be caused by direct, indirect, or a combination of traumas, and they make up about 1% of all skeletal fractures. They are twice as common in men as in women and are most common in people between the ages of 20 and 50. The extensor mechanism is most frequently disrupted by patellar fractures, which occur six times more frequently than soft tissue injuries like quadriceps or patellar tendon rupture. Excessive force applied through the extensor mechanism or a direct hit can also result in fractures. Osteoarthritis in the patellofemoral joint, extension weakness and stiffness are complications. Conventional radiography typically makes diagnosis simple. For later care, it is crucial to be informed of the various morphologic kinds and mechanisms of injury. The patella plays a critical role in maximizing knee extension, hence anatomical restoration-focused treatment is favored and has been found to produce better outcomes. This visual essay examines the fundamental anatomical structure and typical biomechanics of the patella as well as various damage processes and fracture forms. A summary of both surgical and conservative therapy is also provided.

In order to reduce and fix patella injuries, intraoperative imaging is crucial. Anatomical reduction and implant placement are made easier by understanding anatomical relationships and recognizing landmarks.

Anatomy, function and Biomechanical considerations

Largest sesamoid bone in the human body is the patella. The patella is normally ovoid and flat on its anterior non-articular surface, despite wide variances in shape. The rounded inferior margin is known as the apex, while the proximal margin is known as the basis. A thick layer of articular cartilage covers the proximal three-fourths of the patella, while there is none at all on the distal pole. A longitudinal ridge separates the medial and lateral facets of the proximal articular cartilage. The medial facet's periphery, known as the odd facet, is cartilage-deficient.

A prominent cause of anterior knee pain and giving way is patellofemoral diseases. Clinical and radiological examinations can identify the anatomical characteristics of these illnesses as well as those of joint degeneration or earlier damage. While several surgical methods are utilised to treat patellofemoral problems, the relationship between anatomical or pathological findings and symptoms is not always clear, especially during long-term follow-up. This may be partially due to the fact that patellofemoral connections are typically assessed in the supine knee that is at rest, whereas failure happens in the loaded, functional joint. We'll go through some imaging techniques for the joint in both resting and active phases.

The patellofemoral joint is created when the posterior surface of the patella and the trochlear groove along the anterior surface of the femoral condyles articulate. A smaller patella exists in the back.

Standard views

- AP view
- Lateral view
- Accessory view of the Lateral facet
- Accessory view of the Medial facet
- Skyline (Laurin) view / Sunrise view

The following represent ideal imaging with the patient placed in the supine position.

1. AP view

Positioning for optimal view

To obtain the optimal AP view of the patella:

1. The leg is placed in full extension and neutral rotation.

2. The beam is placed perpendicular to the axis of the femur.

AP images obtained with the knee is in 30° flexion will not be very different from those recorded with the leg in full extension.

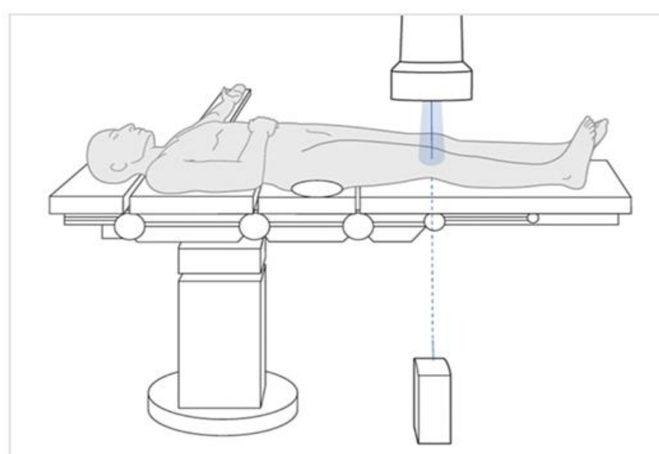

Fig 1: Positioning for optimal AP view

Verification of optimal view

The optimal AP view of the patella is obtained when:

1. The patellar apex is centred over the femoral notch and approximately 2 cm proximal to the joint line (there may be individual anatomical variations).
2. There is 1/4 to 1/3 overlap of the fibular head over the lateral edge of the tibia (there may be individual anatomical variations).
3. The lateral border of the tibia bisects the fibula head.
4. The patella is centred on the screen.

Fig 2: Verification of optimal view

Anatomical landmarks and lines

The following lines and landmarks can be observed:

1. Patellar apex
2. Patellar base
3. Patellar body

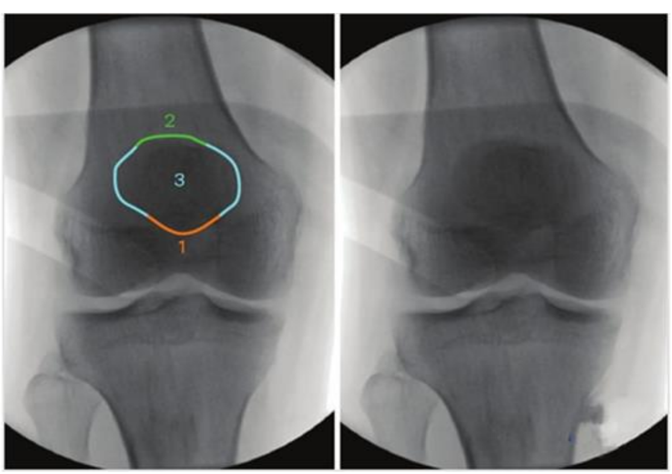

Fig 3: Imaging of the patella

What can be observed?

This view is particularly useful to identify:

1. Mal-reduction of transverse and sagittal fractures
2. Patella Baja (possible quadriceps tendon rupture)
3. Patella Alta (possible patella tendon rupture)
4. Patellar bipartite or tripartite (almost always bilateral, therefore also obtain images of the contralateral side)

Images of the contralateral side may be beneficial as reference.

2. Lateral view

Positioning for optimal view

To obtain the optimal lateral view of the distal femur:

1. The leg is flexed to elevate the knee.
2. The leg is in neutral rotation.

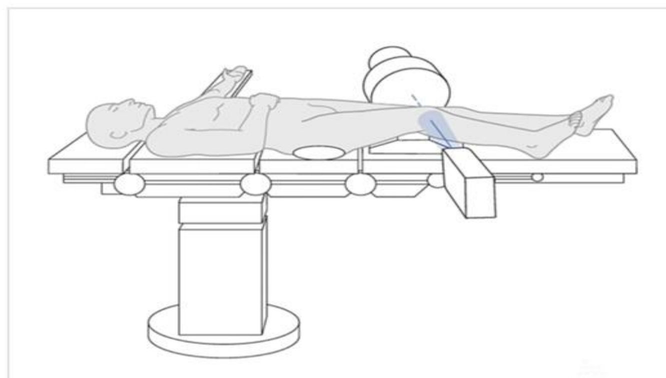

Fig 4: Imaging of the patella

1. The beam is placed parallel to the knee joint plane (this is around 79-83° to the anatomical axis of the femur) or perpendicular to the tibial axis.

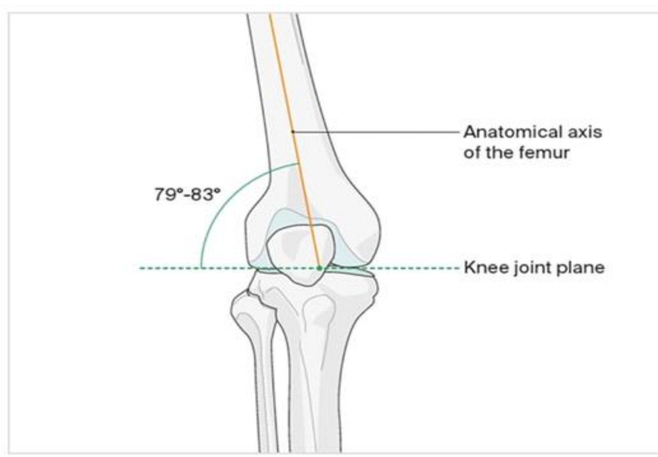

Fig 5: Imaging of the patella

Verification of optimal view

The optimal lateral view of the patella is obtained when:

1. The femoral condyles are superimposed in the anterior, distal and posterior aspects.
2. The femoral condyles are centred on the screen.

Fig 6: Optimal lateral view of patella

Anatomical landmarks and lines

The following lines and landmarks can be observed in the lateral view of the patella:

1. The articular ridge between medial and lateral facets.
2. Patellar apex
3. Patellar base

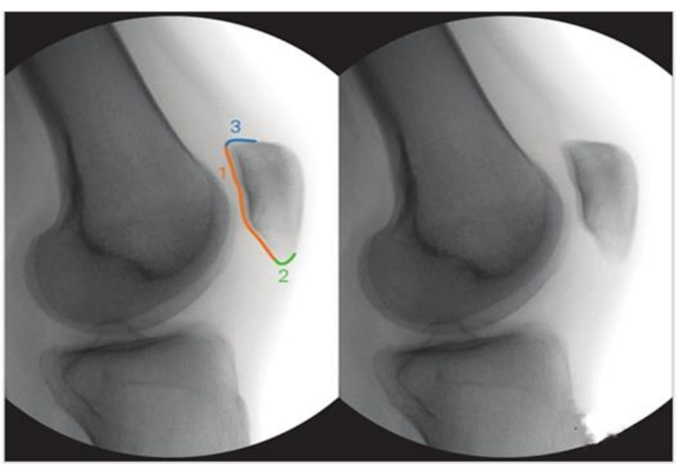

Fig 7: Imaging of the patella

What can be observed?

This view is particularly useful to identify:

1. Malreduced transverse fractures
2. Patella Baja (possible quadriceps tendon rupture)
3. Patella Alta (possible patella tendon rupture)
4. Intra-articular hardware

Images of the contralateral side is beneficial as a reference.

3. Accessory view of the lateral facet

Positioning for optimal view

Start from the Ideal lateral view of the patella, rotate the leg 20-30° externally until the optimal view of the lateral facet is obtained.

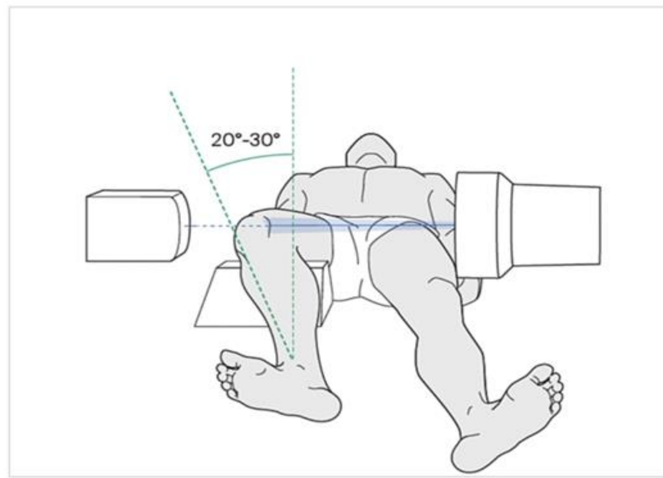

Fig 8: Positioning for optimal accessory view of the lateral facet

Verification of optimal view

The optimal view of the lateral patellar facet is obtained when the lateral facet projects as one dense line.

Fig 9: Optimal accessory view of the lateral facet

Anatomical landmarks and lines

The following lines and landmarks are seen:

1. lateral patellar facet
2. patellar apex
3. patellar base

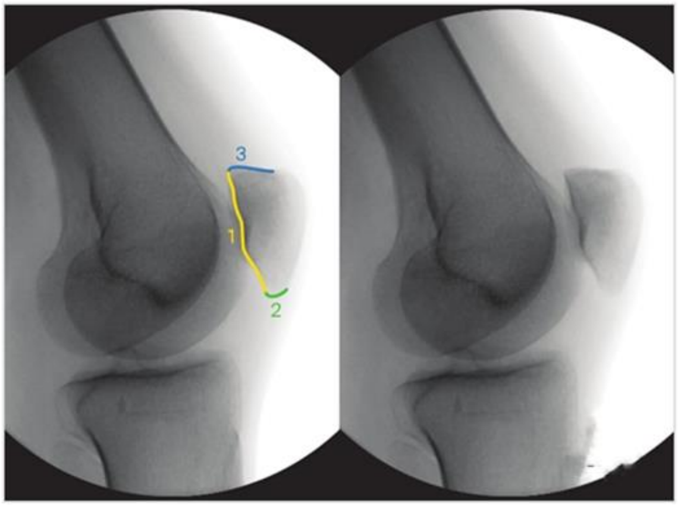

Fig 10: Imaging of the patella

What can be observed?

This view is particularly useful to assess:

1. Reduction of the lateral facet.
2. Intra-articular hardware penetrating the lateral facet.

4. Accessory view of the medial facet

Positioning for optimal view

Start from the Ideal lateral view of the patella, rotate the leg 20-30° internally until the optimal view of the medial facet is obtained.

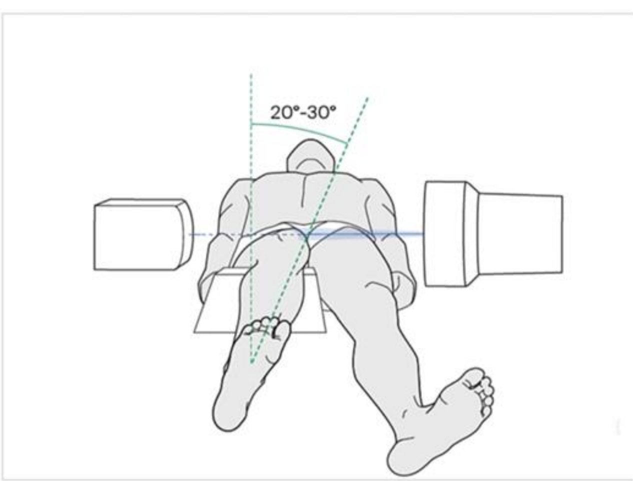

Fig 11: Imaging of the patella

Verification of optimal view

The optimal view of the medial patellar facet is obtained when the medial facet projects as one dense line.

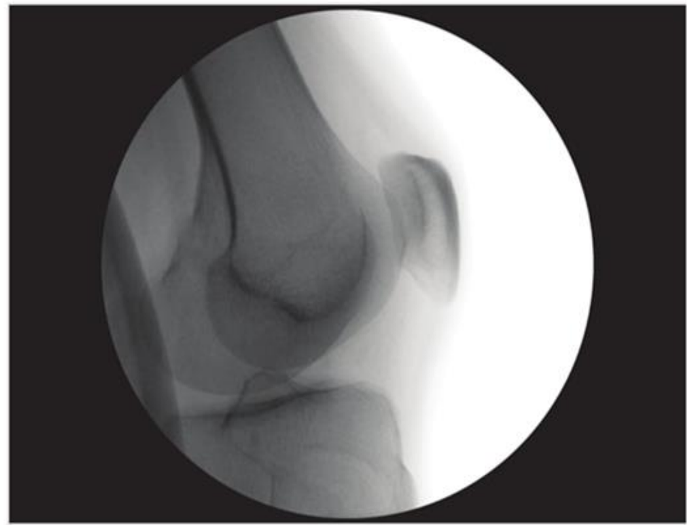

Fig 12: Verification of optimal accessory view of the medial facet

Anatomical landmarks and lines

The following lines and landmarks are seen:

1. Medial patellar facet
2. Patellar apex
3. Patellar base

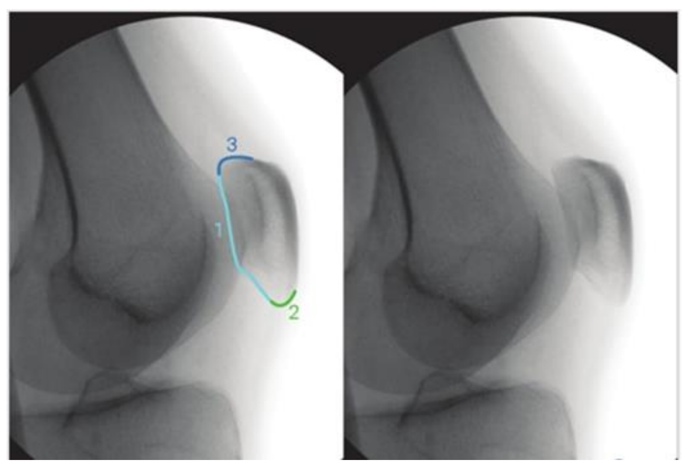

Fig 13: Imaging of the patella

What can be observed?

This view is particularly useful to assess:

1. Reduction of the medial facet.
2. Intra-articular hardware penetrating the medial facet

Skyline (Laurin) view / Sunrise view

Positioning for optimal view

1. Knee flexed 90°
2. Angle beam 30° from the horizontal axis

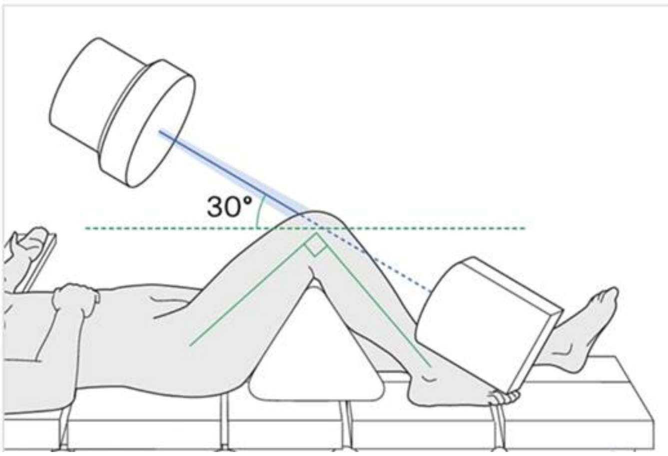

Fig 14: Positioning for optimal skyline view

The transmitter is placed either laterally or medially to the foot (thus, the beam is not entirely parallel to the axis of the tibia)

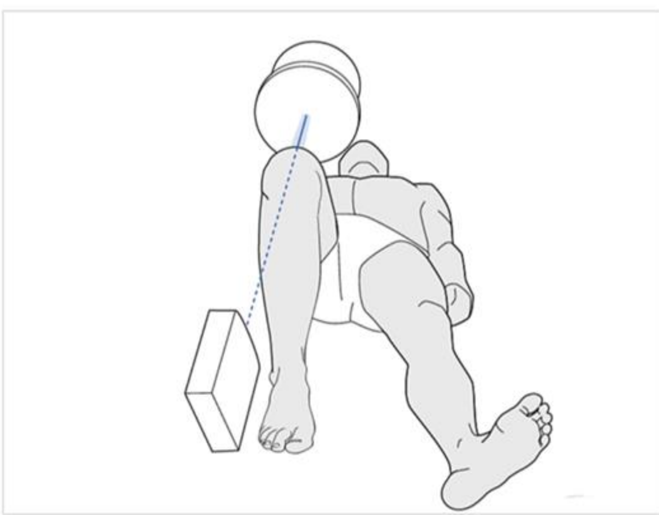

Fig 15: Positioning for optimal skyline view of the patella

Verification of optimal view

The optimal skyline view of the patella is obtained when the patella-femoral notch and the medial and lateral facets of the patella are visualized as dense lines.

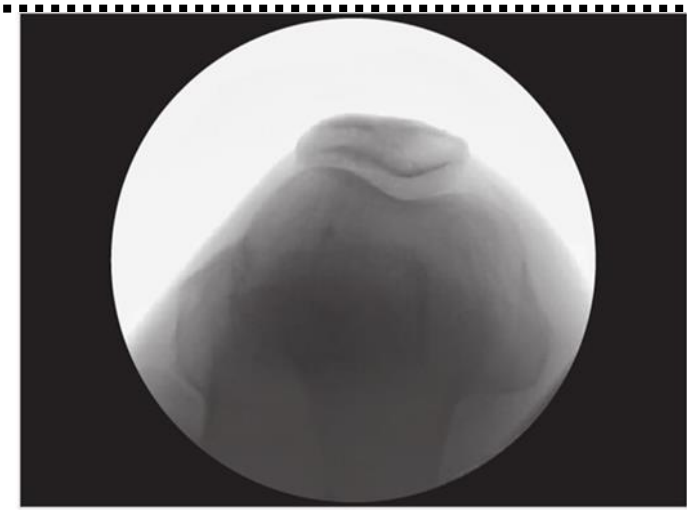

Fig 16: Verification of optimal skyline view

Anatomical landmarks and lines

The following lines and landmarks can be observed in the skyline view:

1. Patello-femoral notch
2. Medial facet
3. Lateral facet
4. The anterior part of the lateral femoral condyle

The anterior part of the medial femoral condyle

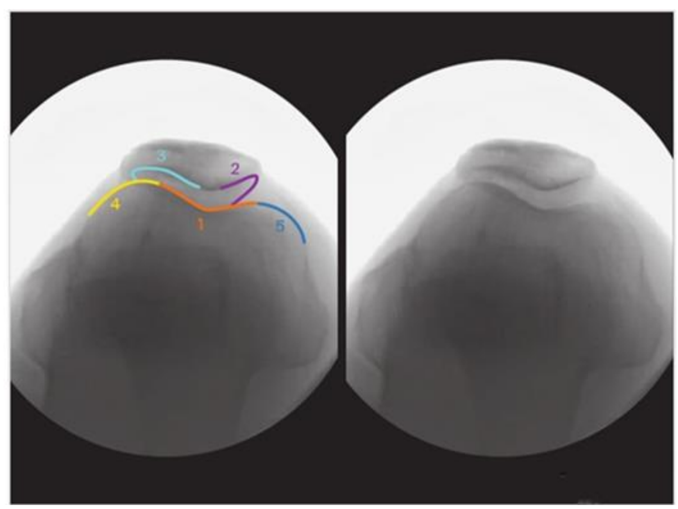

Fig 17: Anatomical landmarks and lines in the skyline view (Right side)

What can be observed?

The skyline view is particularly useful to identify:

1. Mal-reductions in the sagittal plane
2. Patella bipartite or tripartite

3. Intra-articular hardware
4. Lateralization of the patella (possible patellar subluxation)
5. Hardware in the patella-femoral notch (distal femur fixation)

On behalf of all authors, the corresponding author states that there is no conflict of interest.

Declarations

Informed consent

Informed consent was obtained for experimentation with human subjects. The privacy rights of human subjects must always be observed.

"Institutional Ethical Committee Approval"

Taken from Institutional Ethical Approval Committee, MGM Medical College & Hospital, Navi Mumbai, Maharashtra, India.

Availability of data and materials

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