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# Clinical Examination of the Patellofemoral Joint

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Sukesh Rao Sankineani, Georgios Karnatzikos,  
Sanyam Chaurasia, and Alberto Gobbi

## Contents

5.1	<b>Introduction</b> .....	23
5.2	<b>History</b> .....	23
5.3	<b>Physical Examination</b> .....	24
5.3.1	Standing Examination.....	24
5.4	<b>Q Angle</b> .....	24
5.4.1	Gait Analysis.....	24
5.4.2	Seated Position.....	24
5.4.3	Supine Position.....	25
5.5	<b>Special Tests for Patellofemoral Joint</b> .....	25
5.5.1	Passive Patellar Grind Test (Patellar Inhibition Test).....	25
5.5.2	Step-Up-Step-Down Test.....	25
5.5.3	Patellar Glide Test.....	25
5.5.4	Passive Patellar Tilt Test.....	26
5.5.5	Engagement Sign.....	26
5.5.6	Apprehension Test (Fairbanks Sign).....	26
	<b>Conclusions</b> .....	26
	<b>References</b> .....	26

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## 5.1 Introduction

The diagnosis of patellofemoral joint disorders is challenging for orthopaedic surgeons on the account of complicated pathophysiology that underlies them. The origin of patellofemoral symptoms is generally multifactorial [1], and therefore the clinical examination should take into account the patient as a whole, and meticulous attention must be drawn to the history, morphology and clinical examination to have a definitive diagnosis and address the patient's pathology. It should be remembered that a proper therapeutic approach can only be engineered with a thorough analysis of the patients' disorder.

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## 5.2 History

A thorough and proper history focusing on the patient's symptoms, duration and onset of problem and the effect of the problem in modifying his/her activities of daily living must be taken. A careful history will point to the presence of anterior knee pain with or without patellar instability. *Patellar instability* is described as episodes of giving away, subluxation or dislocation of the patella. While evaluating the history of pain, the clinician must ask for the exact location of pain, timing of pain (is it activity related?) and association of trauma with the onset of symptoms. Any referred pain must also be evaluated as sometimes a pain in the hip can radiate to the region immediately above or around the knee.

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S.R. Sankineani (✉) • G. Karnatzikos  
S. Chaurasia • A. Gobbi  
Orthopaedic Arthroscopic Surgery International  
(O.A.S.I.) Bioresearch Foundation, Gobbi N.P.O.,  
Milan, Italy  
e-mail: [sukeshrao.sankineni@gmail.com](mailto:sukeshrao.sankineni@gmail.com)

If the patient has instability, the cause of the event and confirmation that it is due to patella must be made. Often, the *feeling of giving away* of the knee may be because of quadriceps weakness, meniscal tear, ligament deficiency or other disorders around the knee. A history of previous surgery should also be taken properly to rule out the possibility of medial patellar instability after a lateral release or realignment surgery of knee. Failure to consider this possibility might lead to a misdiagnosis of persisting lateral instability and to unnecessary additional surgery, resulting in further exacerbation of the problem.

After a careful analysis of the history, a systematic clinical examination should be carried out with the patient in standing, sitting and supine position along with gait analysis.

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## 5.3 Physical Examination

### 5.3.1 Standing Examination

The patient should be asked to stand barefoot in bipodal position and asked to stand facing the examiner with both feet together and pointing ahead. From the front, the *alignment* of the knee (varus or valgus deformity), *orientation* of the patellae (squinting or outfacing patellae) and patellar *height* are noted. Patients with a valgus angulation have a more predisposition to lateral subluxation; furthermore, patients with squinting patellae have a higher incidence of patellofemoral pain, and patients with outfacing patellae are associated with habitual subluxation or dislocation of knee caps.

From the side, the inclination of the pelvis, spinal curvatures particularly hyperlordosis and the position of the body with respect to the pelvis can be assessed, and from the back, the presence or absence of a scoliotic curve, pelvic tilt or foot rotation anomalies can be assessed.

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## 5.4 Q Angle

The Q angle or quadriceps angle is a reflection of the valgus vector of the quadriceps pull acting on the patella and gives an idea of the tracking of the knee. It is usually measured in standing position

and is done by drawing the first line between the centre of the patella and the anterior-superior iliac spine and the second line between the centre of the patella and the centre of the tibial tubercle. It averages 15° in normal individuals: 14° in men and 17° in women. Anatomic variants that produce either in-facing patellae or lateral displacement of the tibial tubercle can result in an increased Q angle which increases the tendency for patellofemoral pain [2, 3].

### 5.4.1 Gait Analysis

The patient is then asked to walk while the examiner evaluates gait to see if there is evidence of *anatalgia* localized to the hip or knee joint. Moreover, it is possible to assess the *symmetry* of gait, the *length* of the stride, the *orientation* of the patellae, the *varus* or *valgus* alignment of the knee and the pelvic tilt. A *single-leg knee-bend test* is performed wherein the patient is asked to bend his/her leg bringing the knee close to the thorax. This position helps assess the quadriceps support as well as evaluate the core stability at the hip and pronation of foot and ankle. Establishing the level of lower extremity support in any patient with patellofemoral instability or pain is important to guide physical therapy appropriately in order to improve the overall function of the lower extremity [4].

### 5.4.2 Seated Position

The patient is then examined in sitting position with the legs hanging from the table. On inspection, a swelling of the tibial tuberosity or the inferior pole of the patella might suggest osteochondrosis, insertional tendinitis or a partial rupture of the patellar tendon. An overview of muscular atrophy especially vastus medialis is also evident from the inspection. In addition, an assessment of patellar height can be made in this position. In this position, the patellae should face directly forward in a normal patient. In *patella alta*, the high-riding patella faces upward towards the ceiling, and in *patella baja*, the patella is lower than the normal side and seems to be drawn

into the sulcus between the femoral condyles. The patellar tracking is then evaluated by asking the patient to flex and extend the knee while sitting. In the presence of instability, the patella undergoes subluxation near full extension constituting the so-called *J-sign* [5, 6].

In addition, an assessment of the *tubercle-sulcus angle* can be made at 90 degree flexion of the knee and is a variation of the Q angle described by Kolowich [7] to eliminate the effect of femoral rotation and to detect the abnormal displacement of the tibial tubercle. The angle is measured by drawing the first line passing through the centre of the patella and the centre of tibial tubercle and the second line drawn perpendicular to the transepicondylar axis. This angle is normally less than 8° in women and less than 5° in men. An increase in this angle reflects lateral displacement of the tibial tubercle and is associated with patellofemoral pain and instability.

### 5.4.3 Supine Position

The examiner should look for rotation of the extremities and evaluate flexion and extension of the knee to see if there is any evidence of lateral patellar tracking. *Patellar facet tenderness* [8] can be elicited in this position. To elicit it, the patella is shifted medially to expose the medial facet and then it is palpated with the other hand and observed for signs of tenderness. The procedure is repeated for the lateral facet as well. In the case of *excessive lateral pressure syndrome*, very little glide is possible and the tenderness is localized to the patellofemoral ligament. Furthermore, anteromedial knee pain can be occasionally seen due to an inflamed medial patellar plica [9] which can be palpated as a fibrous cord running between the patella and the medial femoral condyle which can be made prominent by flexing the knee.

Extensor muscles and tendons mechanism is always indicated to rule out associated soft tissue disorders. In case of quadriceps tendon rupture, a gap can be palpated along with tenderness on attempted straight-leg raise test. Similarly, palpating the patellar tendon during straight-leg raise also is a good way to check for patellar tendon rupture. In case of *jumper's knee*, tenderness

is most commonly elicited in the proximal patellar tendon just inferior to the tip of patella; in addition, a soft spongy, crepitant sensation can also be felt.

## 5.5 Special Tests for Patellofemoral Joint

### 5.5.1 Passive Patellar Grind Test (Patellar Inhibition Test)

This test is the most commonly known test for eliciting patellofemoral crepitus and is performed with the patient in supine position. The patella is pressed with the palm of one hand against the femoral groove with one hand and the knee is passively flexed with the other hand. In the presence of degeneration or irregularity of the articular surface, a distinct crunching sensation is transmitted along with pain. However, the test has a low specificity because of the fact that it is elicited even in normal individuals sometimes [10]. Pain with crepitus and recurrent effusion suggest degenerative changes; pain alone suggests articular injury [11].

### 5.5.2 Step-Up-Step-Down Test

This test is highly sensitive for patellofemoral crepitus and is used to identify distal articular lesions which are often missed on other tests. In this test, the patient is asked to stand on a small step and is asked to step down on one side and then repeated on the other side. Any evidence of pain and crepitus is felt during the test. A patient who has an intense pain on early step down may have the distal articular lesion and may benefit from an unloading operation of the distal pole such as an anterior or anteromedial tibial tubercle transfer [12].

### 5.5.3 Patellar Glide Test

This test allows us to estimate the passive patellar mobility and is performed in supine position while holding the knee at 20°–30° flexion along

with a relaxed quadriceps. The amount of translation is estimated between the centre of the patella and the medial and lateral epicondyles which are roughly equal in this position. In the presence of a tear of the medial or lateral structures, the translation is increased. Conversely, the translation is decreased in case of arthrofibrosis [7, 13].

#### 5.5.4 Passive Patellar Tilt Test

This test is used to evaluate the lateral retinaculum and is performed with the knee in full extension and the quadriceps relaxed. The normal tilt is considered to be  $0^\circ$  and it is impossible to lift the lateral edge of the patella. In case of excessive surgical release of the lateral retinaculum, the tilt is increased and the patellar plane may be rotated internally [14, 15].

#### 5.5.5 Engagement Sign

This test is used to assess the tracking and engagement of the patella over the proximal trochlea and is usually abnormal in cases of dysplastic trochlea, patella alta or knee recurvatum leading to patellofemoral pain. This test is performed in supine position with the knees placed in full extension, and a firm pressure is applied with a thumb over the tip of the patella and the knee is then flexed to  $20^\circ$ . In case of the presence of the described disorders above, pain is felt by the patient at the inferior pole of the patella when the patella engages the trochlea; furthermore, a bump can also be felt in case of dysplastic trochlea [16].

#### 5.5.6 Apprehension Test (Fairbanks Sign)

This test is pathognomonic of clinically symptomatic patellar instability and simulates an episode of patellar dislocation under controlled conditions [17]. The patient is placed supine and the limb is abducted sufficiently to allow the knee to be flexed over the side of the table by grasping the symptomatic limb at the ankle. With the other

hand, the patella is pushed laterally while the knee is flexed slowly. In patients with history of patellar subluxation or dislocation, apprehension manifesting as expressions of anxiety or quadriceps contraction to prevent knee flexion is observed. Often this test correlates with an abnormal lateral glide, a positive engagement test or patellar maltracking.

#### Conclusions

The diagnostic workup of patellofemoral pain should always start with a meticulous clinical examination including the overall morphology, static and dynamic equilibrium of the patient. Often, findings on clinical examination will pave for a clear diagnosis once supplemented with diagnostic studies. Along with a proper history taking, it should allow us to identify painful areas and patellofemoral instability in order to plan the management of the disorder. Most importantly, clinical exam is the best tool to determine the additional investigations needed to have a definitive diagnosis and lead to address the problem in the most effective manner.

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