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Dr. Kaushik Guha PT
17/1, N. C. Mitra Road, Dum Dum Cantonment, Kolkata, West Bengal, India

Corresponding Author:
Dr. Kaushik Guha PT
17/1, N. C. Mitra Road, Dum Dum Cantonment, Kolkata, West Bengal, India

Chondromalacia patellae: A case study

Kaushik Guha PT

Abstract
Chondromalacia is a softening of the cartilage of the patella. Many predisposing factors have been named, including: an increased Q angle, foot pronation, trauma, improper patellar tracking, vastus medialis obliquus deficiency, and patella alta. However, chondromalacia is often idiopathic in nature. The conservative treatment of chondromalacia is directed at correcting any predisposing factors and rendering the patient asymptomatic. Most approaches to this problem include rest, ice, anti-inflammatory agents and controlled exercise. Isometric progressive resistive exercises for the quadriceps done in extension or isotonic quadriceps strengthening in the last 30' of extension have long been advocated. This is a case study of a 23 year old non-athlete female diagnosed with Chondromalacia patellae of right knee, also having bilateral genu valgum, pes planus. She consulted local orthopaeditian, who referred her for physiotherapy. The patient was initially treated with L.L.L.T, faradic stimulation of quadriceps femoris especially right side V.M.O with strengthening exercises for quadriceps & hamstrings for 21 sittings. She was also advice for doing stretching, exercises for strengthening of small muscles of both feet, bare foot walking on sands or mud, use of corrective soft shoe insoles.

Keywords: Chondromalacia patellae, case study, physiotherapy, Laser, K. Guha

1. Introduction
Chondromalacia patellae (CMP) is referred to as anterior knee pain due to the physical and biomechanical changes [2]. The articular cartilage of the posterior surface of the patella is going though degenerative changes [3] which manifest as a softening, swelling, fraying, and erosion of the hyaline cartilage underlying the patella and sclerosis of the underlying bone [4]. Chondromalacia patellae is one of the most frequently encountered causes of anterior knee pain among young people. It's the number one cause in the United States with an incidence as high as one in four people [5]. The word chondromalacia is derived from the Greek words - chrondros, meaning cartilage, and malakia, meaning softening. Hence chondromalacia patellae is a softening of the articular cartilage on the posterior surface of the patella which may eventually lead to fibrillation, fissuring, and erosion [6]. The differential diagnosis of chondromalacia includes patellofemoral pain syndrome and patellar tendinopathy.
Chondromalacia of patella (CMP) or patellofemoral syndrome is a condition wherein cartilages under patella and underlying surface soften and tear [7]. This causes acute anterior knee pain especially while flexing and climbing stairs. In addition, the pain also increases after sitting for a long time or during kneeling and squatting. CMP is very common and can be due to plenty of reasons such as intense sports, patella misalignment, weak muscles in thighs or calves, trauma, progressing age, poor dietary, malnutrition and obesity or sometimes idiopathic [8].

1.1 Grades
Chondromalacia can be divided into four grades by MRI, typically using fat saturated proton density sequences. This grading system is the modified Outer bridge grading system, which was devised for arthroscopy initially for assessment of chondromalacia patella, but then modified and extended for all chondral surfaces.

1.2 Grade I
It is found in focal areas of hyper intensity with normal contour arthroscopically: softening or swelling of cartilage.

1.3 Grade II
It is blister-like swelling/fraying of articular cartilage extending to surface arthroscopically: fragmentation and fissuring within soft areas of articular cartilage.

1.4 Grade III
It causes partial thickness cartilage loss with focal ulceration arthroscopically: partial thickness cartilage loss with fibrillation (crab-meat appearance).

1.5 Grade IV
It causes cartilage loss with underlying bone reactive changes arthroscopically: cartilage destruction with exposed subchondral bone.

According to the statistics there are many risk factors for developing chondromalacia i.e Age, sex, flat feet, previous injury, and activity level, arthritis. Patients with chondromalacia patellae usually present with anterior knee pain on walking up or down stairs. Additionally there may be knee pain when kneeling or squatting or after sitting for long periods of time. Knee stiffness, crepitus and effusions may also be present. In some cases, a history of patellar dislocation may be present.

2. Causes
The patella (kneecap) is normally pulled over the end of the femur in a straight line by the quadriceps (thigh) muscle is known as chondromalacia patella. Patients with this infection frequently have abnormal patellar "tracking" toward the lateral (outer) side of the femur [9]. The undersurface of the patella to grate along the femur causes chronic inflammation and pain. Certain individuals are predisposed to develop chondromalacia patella: females, knock-kneed or flat-footed runners, or those with an unusually shaped patella undersurface.

3. Etiology
Several ways lead to the development of chondromalacia. Intra-articular injections of bupivacaine at high doses or frequent intra-articular injections of corticosteroid lead to softening and dysfunction of articular cartilage. Iatrogenic injection of chondrotoxic medication into a joint is one that patients can avoid. Chondromalacia is associated with abnormal (microtrauma) wear and tear of the hyaline cartilage of the patellofemoral joint. Lateral positioning of the patella in the patella-femoral joint is a frequent cause of chondromalacia. The abnormal Q angle causes tight lateral retinaculum or a lateral synovial plica may be implicated as the cause of this positioning,

The Q angle is the measurement of the pull of the quadriceps muscle relative to the pull of the patella tendon on the patella [10]. A normal angle is 14 degrees in men and 17 degrees in women. This variance is created anatomically because normally for female have wider pelvis than males. The Q angle is measured by drawing a line from the centre of the anterior iliac spine to the centre of the patella (quadriceps pull) and a second line from the mid portion of the patella to the tibia tubercle (Patella tendon pull). An abnormally high Q angle indicates lateral pull of the patella in the trochlear groove of the femur and a mechanism of articular cartilage.

The alignment of the patella in the vertical plane can be also abnormal. Patella alta, high riding, and low riding in both the conditions it have been implicated as a cause of chondromalacia. Chondromalacia is also seen complication of injuries, immobilization and surgical procedures that lead to quadriceps atrophy [11]. This cause the micro-trauma created by the decreased pull of the quadriceps muscle on the patella.

Foot and ankle anatomic variances (pes planus) that cause an increased valgus orientation of the knee cause increased lateral wear of the patellofemoral joint. For example, high-heel shoes, which create increased stress on the patellofemoral joint also, can be a cause of chondromalacia.

4. Symptoms
The symptoms of chondromalacia patella are generally a vague discomfort of the inner front of the knee, aggravated by activity (running, jumping, climbing or descending stairs) or by prolonged sitting knees in a moderately bent position (pain arises from a desk or theatre seat). Some patients may also have a vague sense of "tightness" or "fullness" in the knee area. Occasionally, chronic symptoms cause loss of quadriceps (thigh) muscle strength may lead leg to "give out. Besides an obvious reduction in quadriceps muscle mass, mild swelling of the knee area may occur [12].

5. Epidemiology
Due to increased Q angles women are affected more than men. Not a hormonal cause of variation. Active young adults who participate in running sports or workers who increase stress in their patellofemoral joint by repeated stair climbing or kneeling have a higher incidence of chondromalacia patella.

6. Pathophysiology
The matrix consists of type II collagen, which are proteoglycans, and water. The chondrocyte which produce the collagen called proteoglycan.[12] which are then secreted into the extracellular matrix. Hyaline cartilage is avascular. Hyaline cartilage is composed of chondrocytes that are dispersed throughout an extracellular matrix. Its nutrients diffuse into the matrix from synovial fluid. It does not repair well because of the lack of blood supply [13]. Hyaline cartilage also devoid of lymphatic and neural tissue.

Patella luxations may be congential or developmental, and there may be a genetic component. The cause of patella luxations is related to the complex function of the hip joint femur, patella, stifle joint and tibia. There is wearing of the trochlear ridge and flattening of the groove, which leads to abnormal articular cartilage in the groove. The cartilage reacts to both in the environment as well as physical loads.

Destruction of hyaline cartilage may occur in response to chondrotoxic substances injected into a joint. It can also occur through exposure to cytokinins and proteolytic enzymes produced in response to the intra-articular bacterial infections [12]. Hyaline cartilage degeneration also occurs in response to microtrauma wear and tear. Repeated activities that create compressive stress on the patella femoral joint or increased loads cause chondromalacia patella.

Aging also has an effect on hyaline cartilage. Loss of elastic properties of the cartilage develops because of the cross linking of collagen fibrils that also occurs with aging. The superficial zone of hyaline cartilage is the first zone to degenerate in the aging. The number of chondrocytes in the cartilage decrease and this correlates with a reduction in the number of proteoglycans produced. This reduction leads to a decrease in the water content of the cartilage.

7. Case history: A twenty three years female came to the clinic with diagnosis of Chondromalacia Patellae of right knee. Her complaints were pain in the anterior part of right knee for last few months. Her pain increases with knee flexion while sitting & stair climbing. There was burning sensation, mild crepitus, swelling & difficulty in walking. Her symptoms were developed after she started work out in a local gym, where she did few workouts of legs with resistance. Later she consulted orthopaedician, M.R.I was done. It was diagnosed that she is suffering from Chondromalacia patellae (grade IV) with bilateral genu valgus & pes planus. She was advised to take few medicines & referred for physiotherapy.

Fig 1: Genu Valgus in hip abduction

Fig 2: Genu Valgus in hip adduction

Fig 3: Pes planus - Right foot

Fig 4: Pes planus - Left foot

8. Examination

On examination there was tenderness over the medial aspect of right patella. Pain was elicited upon compression of patella, which increases with stair case climbing & during prolong sitting or rising from sitting. Clarke's test or Patellar grind test was positive. Pain was measured using V.A.S & score was 9. Crepitus was present during right knee movement. The R.O.M of flexion of right knee was restricted to 90^0. Mild swelling was noted around right knee around patella. The patient was having difficulty in walking. She was having bilateral genu valgum & pes planus. There was right side quadriceps atrophy, especially V.M.O. Girth measurements showed a two centimeter deficit on the right side compared to left.

M.R.I reports shows focal thinning in lateral patellar articular cartilage with subchondral small depression of lateral patellar facet & surrounding bone marrow oedema - grade IV Chondromalacia patellae.

Table 1: Clinical Comparison of Right and Left Knee Joint Examination Findings

Examination Parameters	Right Knee Joint	Left Knee Joint
Tenderness	Present (around patella)	Absent
Pain	Present (V.A.S score 9)	Absent
Crepitus	Present	Absent
Swelling	Present	Absent
Temperature	Normal	Normal
Color	Normal	Normal
R.O.M	Restricted in flexion (0-90º)	Normal
Muscle atrophy	Present - Quadriceps (2 cm)	Not present

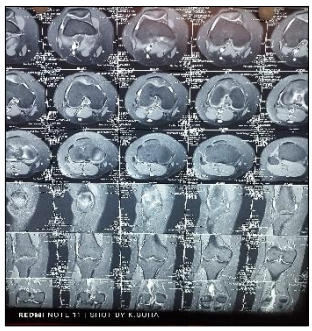

Fig 5: M.R.I - Right knee

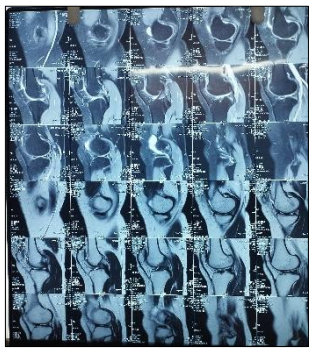

Fig 6: M.R.I - Right knee

9. Treatment

The patient was given twenty sittings of faradic stimulation to right quadriceps muscle & laser (Freq- 5000 hz, energy density - 4.49 J/cm^2, time - 5 minutes/ point) to the right knee. She was also advised to carry out exercises (static quadriceps, toe crawling, S.L.R, V.M.O strengthening exercises) twenty times twice daily which were demonstrated to her. Initially she was unable to carry out S.L.R because of inhibition of quadriceps especially V.M.O [14].

Fig 7: Faradic stimulation - Right knee

Fig 8: Laser treatment - Right knee

After twenty sittings of treatment the patent was able to walk in better way. The level of pain was measured using V.A.S & it was 1. The R.O.M of flexion of the right knee was also measured & there was significant improvement in R.O.M (0^0-120^0). The outcome of the treatment is given below,

Table 2: Post-Treatment Clinical Outcome and Resolution of Symptoms in the Right Knee Joint

Outcome of the treatment	Right Knee Joint
Pain	*Absent*
Swelling	*Absent*
Temperature	*Absent*
Crepitus	*Absent*
Restricted ROM (Flexion)	*Improved*
Tenderness	*Absent*
Color	*Normal*
Grab sign	*Negative*
Muscle atrophy	*Not present*

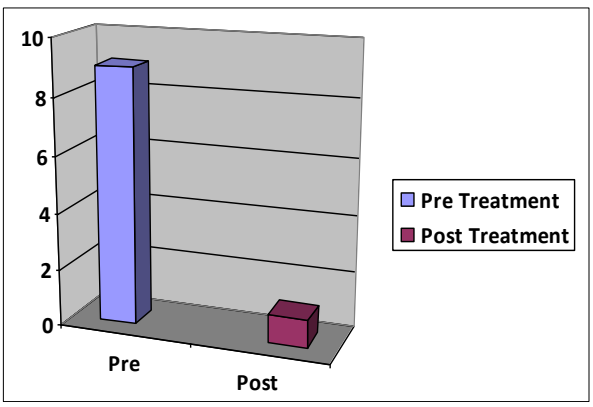

Fig 9: V.A.S: Graphs for comparison (Pre & post treatment)

10. Discussion

Chondromalacia patella is a painful condition of knee where physiotherapy plays an important role as a treatment. Proper assessment is needed before intervention to rule out other pathological, traumatic or degenerative conditions of knee, because there are several causes of C.M.P & signs, symptoms may defer from patient to patient. This case study discusses the role of L.L.L.T, exercises & faradic stimulation in C.M.P as treatment. However more studies are needed with more number of patients with different physiotherapy interventions to prove the importance of physiotherapy as a conservative treatment in Chondromalacia patella.

11. Conclusion

Chondromalacia of patella is a painful condition of knee joint, in which physiotherapy can delay or prevent the need of surgical interventions in some cases. The present study on a single case demonstrated that chondromalacia of patella respond well to physiotherapy with L.L.L.T or laser therapy, therapeutic exercises and faradic stimulation to the quadriceps muscle helped to improve the strength of muscle. However, after the improved therapeutic conditions, regular exercises should be done on a regular basis in order to preserve knee function and knee joint flexibility.

12. Conflicts of interest

Author declares no conflicts of interest.

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