INTRODUCTION
The medical condition of softening, thinning, and degradation of cartilage underneath the patella and the inflammation of it is termed as Chondromalacia patella. It is characterized by patella femoral pain syndrome, affecting patients of all ages. In young patients the syndrome observed are mainly due to some kind of external injury which results in the damage of intraarticular cartilage which in turn results in osteoarthritis[17]. In older patients the syndrome in also seen but the action leading upto the syndrome or the causative reason for the syndrome is different from that to the younger patients. In older patients, Chondromalacia patella is commonly due to the age-related osteoarthritis. The smooth nature of the cartilage is no longer seen and thus usual movement and daily activities becomes painful. Young children who are engaged in active sports are mostly affected by it.

Chondromalacia patellae need to be distinguished from osteoarthritis of the patella femoral joint. The former is usually a self-limiting condition of adolescence, with a predilection for girls, affecting the articular cartilage of the medial patellar ridge. Few of these patients show later overt clinical and radiological osteoarthritis. Patellar pain must be separated from other causes of internal derangement of the knee by a careful history and precise examination followed by appropriate investigations. Once the cause of the pain is determined, malalignment or malposition of the patella must be sought. The Merchant view of the patellar femoral joint is recommended in this regard to demonstrate patellar incongruence. The

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ABSTRACT
Chondromalacia patella is the softening, thinning, and degradation of cartilage underneath the patella and the inflammation of it. It is most common to young adults who are very much involved with physical activities like sports and exersizing. Overuse or injury can lead to the degradation of intraarticular cartilage under the knee cap. This osteoarthritis can result from ligament injury, excess laxity, joint hypermobility, and clinical instability with osteoarthritis appearing in the synovial joint. With many clinical diagnosis present for Chondromalacia patella, this review brings in light why prolotherapy is among the best treatment for it. Following prolotherapy, patients experienced statistically significant decreases in pain at rest, during ADL, and exercise. Stiffness and crepitus decreased after prolotherapy, and ROM increased. Patients reported improved walking ability and exercise ability after prolotherapy. For daily pain level, ROM, daily stiffness, crepitus, and walking and exercise ability, sustained improvement of over 75% was reported by 85% of patients.

Keywords: Chondromalacia patella, Cartilage, Knee, Pain, Prolotherapy

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malalignment syndrome may or may not show the pathologic changes described as "chondromalacia" and respond particularly well after proximal patellar realignment. In the remaining cases, pain may be caused by overuse, trauma, the odd-facet syndrome, an abnormal femoral ridge, or degenerative arthritis. This group of cases should be managed conservatively if possible because the results of surgical treatment are often disappointing. In selected cases some improvement may occur after excision of abnormal cartilage, tibial tubercle elevation, patellar replacement, or patellectomy.

Daily activity subjects the human patella to forces often several times the individual's body weight. Healthy cartilage can adjust to these forces if they are not too excessive, concentrated, or repetitive. Such abnormal stresses most frequently occur with the disturbance of normal patellar mechanical function. Chondromalacia patellae are the result common to a wide variety of unusual traumata. Treatment must be directed primarily not toward the damaged patellar cartilage but toward a correction of the mechanical abnormality causing it. Until proven otherwise, a young female complaining of knee joint pain, particularly if bilateral, should be considered as suffering from a subluxating patella, with or without chondromalacia patellae.

The clinical diagnosis in patients complaining of pain around the patella needs, therefore, to take account of age, any history of trauma, and evidence of pain under circumstances where the patellofemoral joint is subjected to stress. Examination may elicit pain under the medial articular surface of patella on pressure or on manipulating the patella against the femoral condyles.8 Factors thought to provoke changes in the articular cartilage typical of chondromalacia are patella alta, patella malalignment, and structural abnormalities in the form of an extra patellar facet or a ridge at the proximal margin of the articular surface of the medial femoral condyle. Some, but not all, of these features can be identified clinically or radiologically to support the diagnosis. As cartilage possesses no pain fibres the pain is thought to arise in that area of bone no longer cushioned from stress by the damaged articular cartilage overlying it. Conservative, first line therapy for chondromalacia patellae includes exercise, physical therapy, non-steroidal anti-inflammatory drugs (NSAIDs) and corticosteroid injections[6]. In most cases these treatment is not helpful which leads to the degradation of the cartilage and finally the patients has to undergo knee replacement operation.

Since chondromalacia patellae is usually a self-limiting condition, palliative conservative treatment is appropriate, namely, analgesics, suitable physiotherapy, and a support for the patella. Strict avoidance of all sports and games, a serious deprivation for an adolescent, should not be necessary. Overtreatment is always possible when pain tolerance cannot be clearly assessed; adolescents frequently accept chronic or recurrent discomfort badly and with impatience. Other option for treatment of this inflammation is surgery; but doctors try and avoid surgery and diagnose the patients with conservative methods as long as possible. Other used methods of treatment are patella resurfacing procedure, patellectomy.

Structure of Patella
Patella is commonly called kneecap. The triangular shaped structured part is a sesamoid bone with its top facing down. The top portion is the lowest part of patella. It gives attachment to the patellar ligament. The base of patella is attached to the tendon of quadriceps femoris muscle and the vastus intermedius muscle. The outer lateral and medial borders are connected to the vastus lateralis and vastus medialis. The upper front of the patella is coarse, flattened and rough. Its function is helping in the connection of tendon of the quadriceps. The third lower cumilates in the apex which serves as the origin of the patellar ligament[12]. As part of a more intricate anatomy of tendons and vasculature, the patella overlies the joint consisting of the junction of the femur and the tibia. The space between these two bones is where cartilage and an extracellular matrix exist. Additionally, the
surface under the patella is covered with articular cartilage that is smooth and slippery. When the knee flexes and extends, this smooth surface allows the patella to slide easily into the groove of the femur. This cartilage becomes rough and wears away in chondromalacia patella.

During normal function the patella is subjected to heavy mechanical loading as it increases the moment-arm of the extensors of the knee. The act of climbing stairs applies a force across the patellofemoral joint of more than three times the body weight around 170 kg. One cause of early damage to the articular cartilage may be a shear stress imposed by differing stiffness zones in the underlying bone-relative osteopenia in one area permitting the bone to collapse a little relative to an adjoining region. The patella may also be damaged in falls or by contact with the facia in motor accidents: forces short of those required to fracture the bone may damage the articular cartilage, though this is likely only when the contact area between patella and femur at the time of impact is quite small (as occurs when the knee is at right-angles).

**Causes of Chondromalacia Patella**

In adolescents and active adults, chondromalacia patella can be due to sports injury with participation in athletics, such as running, soccer, cycling, skiing, and gymnastics, which are high-impact sports, involve abrupt stopping, and apply repetitive torsion, stress, and force to the joint. Overuse or injury can lead to the degradation of intraarticular cartilage under the knee cap. This osteoarthritis can result from ligament injury, excess laxity, joint hypermobility, and clinical instability with osteoarthritis appearing in the synovial joint[4]. Other sources that can lead to patella femoral pain syndrome in teens and young adults include injury due to car accidents (dislocation and fracture) and congenital flat feet. When the patella does not fit properly into the femoral groove upon movement or is dislocated to one side due to anomaly of the ligaments or musculature, chondromalacia patella can result. In older adults, the hallmark condition associated with chondromalacia patella is osteoarthritis. Although the pathogenesis of osteoarthritis involves both the degradation and synthesis of articular cartilage, cytokines cause greater breakdown than repair [9]. Chondromalacia patella is differentiated from the diagnoses of anterior cruciate ligament tear and tendon injuries, although these conditions contribute to the development of patellofemoral pain syndrome. In chondromalacia patella, the occurrence of degeneration of cartilage is hidden behind the hard bony, floating structure of the patella.

**Signs and Symptoms**

Symptoms of chondromalacia patella include acute or chronic pain, popping and cracking sounds, climbing stairs, running, kneeling, squatting, or other physical activity involving the knee can worsen these symptoms. With the negligence from patient’s part and with time the symptoms of chondromalacia patella worsen. Crepitation or dysfunction of the patella may be also being noted. Crepitation will result in palpation of the patellofemoral articulation during active and passive range of motion of the knee of the patella within the femoral trochlea. Compression of the patella against the femur at varying degrees of knee flexion may elicit articular pain. An alternative method involves manually resisting the upward movement of the patella as the patient actively contracts the quadriceps. Manipulating the patella with simultaneous compression of the patellofemoral joint may elicit pain, but, more importantly, may identify areas of significant cartilage wear on the joint surfaces. The examination is completed by thorough evaluation of the knee ligaments. This includes examination of the medial and lateral collateral ligaments as well as examination of the anterior and posterior cruciate ligaments. Joint line tenderness and crepitation of the joint may identify medial and lateral meniscus tears with provocative maneuvers such as McMurray testing.

**Treatment**

Rest and vitamin D are the primary treatment for chondromalacia patella, but these therapies have a disadvantage. They do not regenerate
cartilage, so there is no end to chondromalacia patella. Non-steroidal anti-inflammatory drugs (NSAIDs) may also be prescribed, but studies show further degradation of cartilage with this therapy in both animals and humans [7]. In addition to molecular changes in the cartilage by NSAIDs, the cartilage break down also may be due to increased joint use and load upon the knee following pain amelioration [1,11,16].

Muscle strengthening exercises may improve the relative location of the patella upon movement, but do not improve the tendons, ligaments, or cartilage. As chondromalacia patella worsens, corticosteroid injections may be provided in an attempt to relieve pain symptoms. However, a comprehensive review of the literature documents significant necrosis of cartilage from even just one injection [8]. The known effects of intraarticular corticosteroids on articular cartilage have been documented in a study by Hauser. As it worsens, arthroscopy may be recommended to remove the degraded cartilage. Finally, due to the resultant osteoarthritis, knee replacement may ultimately be recommended.

Another treatment process is lateral retinacular release/prolotherapy of the patella. A lateral release is a surgical procedure to release tight capsular structures (lateral retinuclum) on the outer aspect (lateral aspect) of the kneecap (patella). This is usually performed because of knee pain related to the kneecap being pulled over to the outer (lateral) side and not being able to run properly in the centre of the groove of the femur bone as the knee bends and straightens. The procedure is also known as a ‘lateral retinacular release’. A series of 59 knees in 58 patients were surgically treated from 1977 to 1982 for chondromalacia patellae, and were followed for an average of 1.2 to 4.6 years after the operation. The operative procedure was open lateral retinacular release in all knees. In knees with recurrent patellar subluxation, the number of poor results increased from 24% to 70% and in knees with no subluxation from 21% to 24%. The difference after 4.6 years was statistically significant. No correlation between the severity or location of the cartilage changes and the operative effect was found. Open lateral retinacular release is an acceptable treatment of chondromalacia patellae without subluxation of the patella, whereas in the presence of recurrent subluxation, the release does not correct the basic biomechanical disturbance [3].

One of the best methods for the elimination of pain of the inflammation and to reverse the process of cartilage degeneration, prolotherapy. The term prolotherapy was coined by Hacket [5] in the 1940s and 1950s to imply proliferation of normal tissue at ligamentous and tendinous entheses; the procedure has been described by other terms, such as sclerotherapy, regenerative injection therapy, and stimulated ligament repair. More recently, Reeves defined prolotherapy as injection of growth factors or growth factor production stimulants to grow normal cells or tissue [14].

Prolotherapy is an alternative medicine [13] treatment of tissue with the injection of an irritant solution into a joint space, weakened ligament, or tendon insertion to relieve pain. Prolotherapy involves the injection of an irritant solution into a joint space, weakened ligament, or tendon insertion to relieve pain. Most commonly, hyperosmolar dextrose (a sugar) is the solution used; glycerine [10], lidocaine (a commonly used local anesthetic), phenol [10], and sodium morrhuate (a derivative of cod liver oil extract) are other commonly used agents. The injection is administered at joints or at tendons where they connect to bone.

Prolotherapy treatment sessions are generally given every two to six weeks for several months in a series ranging from 3 to 6 or more treatments [10]. Many patients receive treatment at less frequent intervals until treatments are rarely required, if at all.

A case study was made to find out the success of prolotherapy. Of the 117 patients recruited for this study, 61 patients with 69 knees (8 patients with bilateral knee prolotherapy) were included in this study. Of the 69 knees, 36 (52%) were from female patients and 33 (48%) were from male patients. The average age of patients was 47.2 years with a range of 18–82 years [15].

Patients were administered a survey of 32 questions via phone to evaluate the effects of prolotherapy. A self-assessment of pain at rest was ranked on a 10-point scale, which aligns with the Visual Analog Pain Scale. 32 No pain to minimal pain was calculated as scores 0 through
3. Moderate pain was considered as 4–6 points on the questionnaire, and severe pain was scores from 7–10. The following data was reported by patients before prolotherapy [15]:

Walking ability was completely affected with an inability to ambulate in 6 knees (8.8%) in 68 responders. Before prolotherapy, walking ability was severely compromised with an inability to walk one block in 8 knees (11.8%). Four knees (5.9%) were moderately affected with an ability to walk only one to two blocks. Twenty-six knees (38.2%) were mildly affected, with an ability to walk more than three blocks, but not as far as desired. Before receiving prolotherapy 24 knees (35.3%) were not compromised. One patient was a non-responder on ability before prolotherapy. After prolotherapy 56 knees (82.3%) had no distance restrictions and were able to walk over three blocks. Eleven knees (16.2%) were mildly compromised [15] and could walk over three blocks, but not as far as desired. Only 1 patient (1.5%) stated moderate compromise with an ability to walk one to two blocks to strengthen the success of prolotherapy in treating Chondromalacia patella.
A case study was done by Bradley D. Fullerton, MD where High-Resolution Ultrasound and Magnetic Resonance Imaging to Document Tissue Repair After Prolotherapy [2]. A case was studied. In the first case a 34-year-old man with no significant medical history presented with intermittent, progressively worsening medial and anterior knee pain over the past 3 years. He had undergoing prolotherapy.

![Fig. 1: Proton density, fat saturation MRI of the knee (pre- and postprolotherapy). Top row, October 2004; bottom row, October 2005. (A and C) Sagittal views of left knee. The thin arrow (originally added by the interpreting radiologist) indicates a high signal in the deep, midportion of the patellar tendon consistent with partial tear. Note the reactive edema in the inferior pole of the patella (A) in 2004. Post-prolotherapy, the edema is resolved and a subperiosteal cyst is noted (C). Images on the right (B, D) are axial views of the left knee through the patellar tendon; the large arrow in B points to the region of the thickened abnormal tendon with high signal intensity just distal to the patellar enthesis, indicating a partial patellar tendon tear. The postprolotherapy (D) shows new tendon growth and partial repair of the tear.]

Patients were surveyed regarding the total number of pain medications as well as number of pills of each that they needed prior to prolotherapy. No pain medication was needed in 40 study knees (58.0%) before prolotherapy, but 24 knees (34.8%) needed at least 1 pain medication and 5 knees (7.2%) needed 2 pain medications. After prolotherapy, 66 knees (95.6%) of patients in the study required no pain medication and only 3 patients (4.3%) required 1 medication for pain relief [15].
DISCUSSION

In the United States, approximately one third of adults between the ages of 25 and 74 years have radiological evidence of osteoarthritis in a major joint. The knee is the most commonly affected joint in those greater than 45 years old. Chondromalacia patella, the result of osteoarthritis in the knee, can be age-related or due to trauma. Chondromalacia patella should be treated with conservative methods such as exercising, pheotherapy etc. many doctors does not approve surgery the ultimate treatment to chondromalacia patella as after surgery many complications are seen which ultimately results in knee replacement surgery over the years focus has to give to the improvement of the treatment methods and as of now the best method of treatment is prolotherapy.

Prolotherapy improved the pain and associated symptoms of chondromalacia patella in nearly all knees in this study despite the fact that patients waited an average of nearly 2 years (21.6 months) before prolotherapy. Improvements in pain range of motion, stiffness, and crepitus were sustained in over 92% of patients. Pain medication usage also was decreased following prolotherapy.

Range of motion, walking ability, and exercise ability all were improved with prolotherapy. Of 8 knees (11.6%) with a severely limited range of motion and 8 knees (11.6%) with moderate limitation, 14 knees showed improvement following prolotherapy. Before prolotherapy, 5 patients with 6 knees (8.8%) were completely unable to walk. Of these patients, 4 achieved the ability to walk with no distance restrictions and 1 patient could walk farther than 3 blocks, but not as far as desired. In the remainder of patients whose walking ability was mildly to severely affected, 82.3% (56 knees) had no distance restrictions during walking after prolotherapy.

Of 17 knees (25.8%) that could not tolerate exercise before prolotherapy, only 1 knee continued to be completely compromised. Although 18 knees (27.3%) could not tolerate exercise beyond 30 min, only 1 knee was

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affected to this extent after prolotherapy. Seventeen knees before prolotherapy with 5 patients stating moderate compromise after prolotherapy, meaning patients could not exercise the knee beyond 60 min. Initially, only 9 knees (13.6%) reported mild compromise and 6 knees (9.1%) were not affected by exercise. After prolotherapy, the condition of 23 patients (33.8%) had improved to mildly compromised, and 38 knees (55.9%) experienced no degree of compromise during exercise. Fifty-eight of 64 knees (90.6%) had sustained this improvement at rates $75\%$ of the effect achieved at their last prolotherapy session [15]. Ultrasound imaging can show tissue growth and repair. Prolotherapy does stimulate tissue growth in tendon (patellar), and that this is an organized growth with a return toward a normal appearance on ultrasound. Further clinical studies with ultrasound confirmation are recommended. The development of quantitative methods to analyze ultrasound images will be valuable in blinded efficacy studies of prolotherapy and other rehabilitative interventions.

REFERENCES