



ROLE OF MAGNETIC RESONANCE THERAPY IN REDUCING PAIN AND IMPROVING FUNCTION IN CHONDROMALACIA PATELLA: A CASE STUDY

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ABSTRACT

Chondromalacia is an affliction of the hyaline cartilage coating of the articular surfaces of the bone. It results in the softening and subsequent tearing, fissuring, and erosion of hyaline cartilage. Most commonly, it is recognized as involving the extensor mechanism of the knee. In chondromalacia patella the cartilage of articular surface of patella particularly the medial facet is roughened and fibrillated. It is summarised that friction between the damaged area and corresponding femoral condyle is responsible for pain. The condition is distinct from osteoarthritis but osteoarthritis may be superimposed upon it in later years. In this present study magnetic resonance therapy was given to patient who was suffering from chondromalacia patella, who achieved a good result.

KEYWORDS: Magnetic Resonance Therapy, Chondromalacia patella.

INTRODUCTION

Chondromalacia is an affliction of the hyaline cartilage coating of the articular surfaces of the bone. It results in the softening and subsequent tearing, fissuring, and erosion of hyaline cartilage. Most commonly, it is recognized as involving the extensor mechanism of the knee.^[1] In chondromalacia patella the cartilage of articular surface of patella particularly the medial facet is roughened and fibrillated. It is summarised that friction between the damaged area and corresponding femoral condyle is responsible for pain. The condition is distinct from osteoarthritis but osteoarthritis may be superimposed upon it in later years.^[2] In 1906, for the first time, pathological changes in the patellar cartilage were reported by Budinger et al. Then, Kelly et al. described these pathological changes as chondromalacia patellar (CMP).^[3] Originally, the word "chondromalacia" stemmed from Greek words. Chondros means cartilage, and malakia means softening.^[4] In general, chondromalacia (sick cartilage) is an affliction of the hyaline cartilage coating of the articular surfaces of the bone. Chondromalacia patella (CMP) is when the posterior articular surface of the

patella starts losing its density when in a healthy state and becomes softer with subsequent tearing, fissuring, and erosion of the hyaline cartilage. It is commonly recognized as involving the extensor mechanism of the knee and, accordingly, is often referred to as chondromalacia of the patella, patellofemoral syndrome, or runner's knee. The undersurface of the patella is covered with hyaline cartilage that articulates with the hyaline cartilage-covered femoral groove (trochlear groove). Post-traumatic injuries, microtrauma wear and tear, and iatrogenic medication injections can lead to chondromalacia development. Chondromalacia occurs in any joint and is especially common in joints with trauma and deformities.^[5]

Aetiology

There are 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.^[6]

Epidemiology

Due to increased Q angles women are affected more than men. 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.^[8,9]

CASE REPORT

A 36-year-old female patient presented to Svasthi Orthopaedic and Respiratory Health Care Centre, Bengaluru, with complaints of bilateral anterior knee pain, more pronounced in the right knee than the left, for approximately 2–3 years. The pain had an insidious onset and progressively increased in severity over time. The patient reported aggravation of symptoms during activities involving increased patellofemoral joint loading such as trekking, running, stair climbing, prolonged sitting with crossed legs, squatting, and kneeling. Pain was partially relieved by rest and oral analgesic medications.

During the preceding 2–3 months, the patient experienced significant worsening of symptoms, resulting in difficulty performing routine daily activities and recreational activities. She had previously consulted an orthopaedic surgeon who advised radiological evaluation including X-ray and Magnetic Resonance Imaging (MRI) of the knee. MRI findings revealed chondromalacia patella involving the right knee, and arthroscopic chondroplasty was suggested as the treatment option.

The patient sought a second opinion at our centre due to concerns regarding surgical intervention and expressed a preference for conservative management.

Baseline Clinical Assessment

Before initiation of treatment.

Parameter	Baseline Value
VAS Pain Score	9/10
Walking Tolerance	Severely restricted
Stair Climbing	Painful
Squatting	Unable
Running/Trekking	Unable
Joint Creptitation	Severe
Functional Status	Markedly impaired

TREATMENT PROTOCOL

A comprehensive multimodal regenerative rehabilitation protocol was planned with the objective of reducing inflammation, promoting cartilage repair, improving joint biomechanics, and restoring functional mobility.

Clinical Examination

General Examination

The patient was conscious, cooperative, and well-oriented. Vital signs were within normal limits. No systemic abnormalities were detected during cardiovascular, respiratory, abdominal, or neurological examination.

Local Examination

Right Knee

- Medial joint line tenderness present
- Lateral joint line tenderness present
- Patellofemoral crepitus present during active and passive movements
- Painful terminal range of flexion
- Mild discomfort during patellar compression test
- No ligamentous instability

Left Knee

- Medial joint line tenderness present
- Mild patellofemoral crepitus
- Full range of motion with occasional discomfort
- No instability noted

Radiological Assessment

Plain Radiography

Skyline (Merchant) view radiographs demonstrated reduction in patellofemoral joint space, more pronounced in the right knee, suggestive of cartilage degeneration.

Magnetic Resonance Imaging

MRI of the right knee demonstrated features consistent with chondromalacia patella characterized by:

- Irregularity of the patellar articular cartilage
- Cartilage thinning over the patellofemoral compartment
- Early degenerative changes without significant osteoarthritic involvement
- No evidence of major meniscal or ligamentous pathology.

Phase I: Patient Education and Counselling

The patient was thoroughly educated regarding:

- Nature and progression of chondromalacia patella
- Patellofemoral biomechanics
- Importance of weight management

- Activity modification strategies
- Role of regenerative therapies
- Need for structured rehabilitation

The patient elected to undergo conservative management after understanding the potential risks and benefits of both surgical and non-surgical options.

Phase II: Regenerative Injection Therapy

Platelet Rich Plasma (PRP) and Autologous Conditioned Plasma (ACP)

PRP and ACP injections were administered using the Artex Double Syringe Method under strict aseptic precautions.

Procedure Details

- Approximately 15 mL of autologous venous blood was collected.
- Blood processing was performed using the Artex Double Syringe System.
- Platelet-rich plasma and conditioned plasma fractions were isolated.
- C-arm-guided intra-articular administration was performed into the right knee joint.

Injection Schedule

Session	Time
1st Sitting	Day 1
2nd Sitting	3 Months
3rd Sitting	6 Months

Biological Rationale

PRP and ACP contain concentrated growth factors including:

- Platelet-Derived Growth Factor (PDGF)
- Transforming Growth Factor- β (TGF- β)
- Insulin-Like Growth Factor (IGF-1)
- Vascular Endothelial Growth Factor (VEGF)
- Fibroblast Growth Factor (FGF)

These factors promote

- Chondrocyte proliferation
- Extracellular matrix synthesis
- Collagen production
- Reduction of inflammatory cytokines
- Cartilage tissue repair

Phase III: Magnetic Resonance Therapy (MRT)

Following the PRP injection, the patient completed three weeks of rest and basic knee exercises, after which **Magnetic Resonance Therapy** was advised.

Treatment Parameters

- Device: QRST Device
- Applicator: Double Knee RFID Card
- Treatment Duration: 9 consecutive days
- Sessions: One session per day
- Treatment Area: Bilateral knee joints

Proposed Mechanism of Action

MRT utilizes low-energy electromagnetic resonance frequencies to stimulate cellular metabolism.

Potential biological effects include.

- Enhanced chondrocyte activity
- Increased proteoglycan synthesis
- Improved extracellular matrix organization
- Enhanced nutrient diffusion within cartilage
- Modulation of inflammatory pathways
- Promotion of cartilage regeneration

Phase IV: Physiotherapy and Rehabilitation

A structured rehabilitation program was initiated immediately following MRT.

Weeks 1–4

Goals

- Pain reduction
- Restoration of range of motion

Exercises

- Quadriceps isometrics
- Straight leg raises
- Hamstring stretching
- Ankle pumping exercises
- Patellar mobilization

Weeks 5–8

Goals

- Improve muscular strength

Exercises

- Closed-chain kinetic exercises
- Mini squats
- Step-up exercises
- Resistance band strengthening
- Core stabilization training

Weeks 9–12

Goals

- Functional recovery

Exercises

- Dynamic balance training
- Proprioceptive exercises
- Functional stair training
- Controlled aerobic conditioning

Phase V: Lifestyle Modification

The patient was advised:

- Avoid prolonged squatting
- Avoid sitting cross-legged
- Avoid excessive stair climbing
- Maintain ideal body weight
- Continue quadriceps strengthening
- Follow a joint-protective exercise program

FOLLOW-UP AND OUTCOMES

Three-Month Follow-Up

The patient reported substantial reduction in pain and improved functional capacity.

Parameter	Baseline	3 Months
VAS Score	9/10	2/10
Walking	Restricted	Improved
Stair Climbing	Painful	Mild discomfort
Crepitation	Severe	Minimal

One-Year Follow-Up

At one year, the patient reported complete symptomatic relief and unrestricted participation in routine activities.

Parameter	Baseline	1 Year
VAS Score	9/10	0/10
Daily Activities	Severely Limited	Normal
Crepitation	Severe	Nearly Absent
Functional Capacity	Poor	Excellent

Radiological Outcome

Repeat MRI performed at one-year follow-up demonstrated:

- Improved cartilage morphology
- Reduction in cartilage surface irregularity
- Approximately 1 mm increase in cartilage thickness
- Improved overall patellofemoral joint health

These findings correlated well with the patient's clinical improvement and complete resolution of symptoms.

Final Outcome

The patient achieved

- Complete pain relief
- Restoration of normal functional activities
- Significant reduction in patellofemoral crepitation
- Improved cartilage thickness on MRI
- Avoidance of surgical intervention

The combined regenerative approach consisting of PRP, ACP, MRT, physiotherapy, and lifestyle modification produced sustained clinical and radiological improvement over a one-year follow-up period.

DISCUSSION

Chondromalacia patella is a degenerative condition characterized by progressive softening, fibrillation, and deterioration of the articular cartilage on the posterior surface of the patella, leading to anterior knee pain, crepitus, and functional impairment. The condition is frequently encountered in young and middle-aged adults and is commonly associated with abnormal patellofemoral biomechanics, repetitive microtrauma, malalignment of the extensor mechanism, quadriceps weakness, and increased patellofemoral joint stress. Progressive cartilage degeneration may ultimately predispose the patient to early osteoarthritic changes if not appropriately managed.

The present case demonstrated substantial clinical and radiological improvement following a multimodal conservative treatment strategy consisting of Platelet-Rich Plasma (PRP), Autologous Conditioned Plasma (ACP), Magnetic Resonance Therapy (MRT),

physiotherapy, and lifestyle modification. The patient initially presented with severe pain (VAS 9/10), functional limitation, and radiological evidence of chondromalacia patella. Following treatment, pain progressively reduced to VAS 2/10 at three months and reached complete resolution (VAS 0/10) at one-year follow-up, accompanied by restoration of functional activities and significant reduction in joint crepitation. Furthermore, repeat MRI demonstrated improvement in cartilage morphology with approximately 1 mm increase in cartilage thickness, suggesting a favourable biological response.

The therapeutic benefits observed in this case may be attributed partly to the regenerative potential of PRP and ACP. Platelet concentrates contain numerous bioactive growth factors including platelet-derived growth factor (PDGF), transforming growth factor-beta (TGF- β), vascular endothelial growth factor (VEGF), insulin-like growth factor (IGF-1), and fibroblast growth factor (FGF). These factors stimulate chondrocyte proliferation, extracellular matrix synthesis, collagen production, and tissue repair while suppressing inflammatory mediators responsible for cartilage degradation. Several studies have reported that PRP injections can reduce pain and improve knee function in patients with patellofemoral cartilage lesions and early degenerative changes by creating a favorable biological environment for cartilage healing.

An additional notable component of the treatment protocol was Magnetic Resonance Therapy. MRT is a non-invasive biophysical intervention that utilizes low-energy electromagnetic fields and specific resonance frequencies to influence cellular metabolism and tissue regeneration. Experimental studies have suggested that MRT may enhance chondrocyte activity, stimulate proteoglycan synthesis, improve extracellular matrix organization, and promote cartilage repair processes. The mechanism is believed to involve modulation of cellular signaling pathways and enhancement of molecular transport within damaged cartilage tissue. Although the exact biological mechanisms continue to be investigated,

emerging evidence suggests that MRT may have a positive influence on cartilage regeneration and symptom reduction in degenerative musculoskeletal disorders.

The MRI findings observed in the present case are particularly noteworthy. Articular cartilage possesses limited intrinsic healing capacity due to its avascular nature and low cellular density. Therefore, any measurable increase in cartilage thickness on follow-up imaging may indicate an improvement in cartilage metabolism and matrix restoration. The observed increase in cartilage height, together with complete symptom resolution, supports the possibility that regenerative interventions combined with biomechanical correction may contribute to structural recovery in selected patients with chondromalacia patella.

Physiotherapy and rehabilitation likely played a crucial role in sustaining clinical improvement. Strengthening of the quadriceps, particularly the vastus medialis obliquus, along with core stabilization exercises, can improve patellar tracking, reduce abnormal patellofemoral loading, and minimize recurrent cartilage stress. Lifestyle modifications aimed at reducing repetitive knee overloading further contribute to long-term symptom control and prevention of disease progression.

The findings from this case support the concept that a comprehensive conservative management strategy can be a viable alternative for patients who are reluctant to undergo surgical intervention. While surgical procedures such as arthroscopic chondroplasty may be indicated in selected cases, non-operative regenerative approaches may offer meaningful symptom relief, functional recovery, and potential structural improvement without the risks associated with surgery.

However, the interpretation of this case should be approached with caution. As a single-patient case study, the results cannot be generalized to the wider population. The combined use of PRP, ACP, MRT, physiotherapy, and lifestyle modification makes it difficult to determine the individual contribution of each intervention to the observed outcomes. Larger prospective studies, randomized controlled trials, and long-term imaging-based evaluations are required to establish the efficacy, safety, and mechanisms of MRT in cartilage regeneration and chondromalacia patella management.

CONCLUSION

This case study demonstrates that a multimodal conservative treatment approach comprising PRP, ACP, Magnetic Resonance Therapy (MRT), structured physiotherapy, and lifestyle modification resulted in remarkable clinical and radiological improvement in a patient with chondromalacia patella. The patient achieved complete pain relief, restoration of daily functional activities, substantial reduction in joint crepitation, and measurable improvement in cartilage thickness on MRI during one-year follow-up.

The findings suggest that MRT, when integrated with biologic regenerative therapies and rehabilitation protocols, may represent a promising non-surgical treatment option for patients with symptomatic chondromalacia patella. The observed structural and functional improvements indicate the potential role of this therapy in promoting cartilage repair and improving joint health.

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