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# COMPARISION OF OPEN VERSUS CLOSED KINETIC CHAIN EXERCISE IN PATELLOFEMORAL PAIN

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***Abstract:*** One of the most common musculoskeletal problems in now a day is patellofemoral pain. Survey shows that patellofemoral pain is common about men and women are suffering with this problem causes includes overuse running or jumping sports puts repetitive stress on knee if which can cause irritation under the patella. Muscle imbalance and muscle weakness also one of the causes. Prevalence is highest in middle age with women being affected more than men. The effectiveness of closed kinetic chain exercise in minimizing the patellofemoral pain has been proven by many research workers. Very few studies exist comparing the effective of strengthening exercise in minimizing the patella femoral pain. The aim of the study is to compare the effectiveness of open and closed kinetic chain exercise in reducing pain and improving the functional activity of individual with patella femoral pain. Simple random sampling experimental design sample size 20 subjects group A=10 Patients and group B=10 patients setting done. Samples were selected into experimental group and control group with 20subjects with patella femoral pain are taken as sample for this study and divided into two groups. The subjects with patella femoral pain are confirmed through the special test for patella femoral region. After the treatment section to both groups data was analysed. Comparison of pre and post NRS using open kinetic chain exercise shows pre NRS 7.6 and post NRS reduced given t value 19.6. thus, giving significant result with P<0.001. Comparison of pre and post NRS using closed kinetic chain exercise shows pre NRS 7.4 and post NRS reduced 2.25 given t value 17.1. thus, giving significant result with P<0.001. According to this study both groups were effective in reducing pain intensity and improves the functional activity. This study predicts that group B showed better improvement when compared to group A.

***Keywords: open kinetic chain exercise, closed kinetic chain exercise, patellofemoral pain, lower extremity functional scale, numeric rating scale.***

## I. INTRODUCTION

Patellofemoral pain is a broad term used to describe pain in the front of the knee and around the patella. It is common in people who participate in sports particularly females and young adults but Patellofemoral pain can occur in non-athletes as well. The causes include overuse running or jumping sports puts repetitive stress on knee if which can cause irritation under the patella. Muscle imbalance and muscle weakness also one of the causes. Journal of orthopaedic sports physiotherapy 1998 study shows that prevalence of Patellofemoral pain is higher in young adult. Another survey shows that the incidence of PFPs is more common in female than male. However, there is law of evidence related to the long-term benefits for PFPs and exercise prescription. OKC and CKC is one of the methods to reduced musculoskeletal pain In many cases PFP is caused by vigorous physical activities that put repeated stress on the knee. Such as jogging, squatting and climbing stairs. It can also be caused by a sudden change in physical activities. Some other factor also contributes to patellofemoral pain include use of improper sports training techniques and changes in footwear. It can also be caused by normal training of the kneecap in the trochlear groove. In this condition the patella is pushed out to one side of the groove when the knee is bent. This abnormality may cause increased pressure between the base of the patella and the trochlear irritating soft tissues. In exercise and rehabilitation divided exercise into closed and open chain. Chain are links of the body parts. Such foot, ankle, knee and hip during walking. In open chains the end is free. Such as seated leg extension. Closed chain tends to involve more muscles and joints then open chain leads to better coordination around each structure. Which improve overall stability. The aim of the study is to compare the effectiveness of open and closed kinetic chain exercise to reducing pain and improving the functional activity of individual with patellofemoral pain.

## II. MATERIAL AND METHODS

Study design: Comparative study, Study Type: Experimental study, Sampling method: Convenient sampling, Study Setting: Mahatma Gandhi Medical College and Research Institute, Sri Balaji Vidyapeeth, Pondicherry, Selection Criteria: 20 subjects were taken for the study and divided into two groups namely group A and group B. each group consisting of 10 subjects. Group A was given open kinetic chain exercise and Group B was given Close kinetic chain exercise.

**Inclusion Criteria:** i. History of patellofemoral pain less than 3 month, ii. Numerical rating scale > 5\10. iii. Lower extremity functional scale >40\80. iv. Age group 30 to 50 years. v. Both genders were considered. vi. The test should be positive – Clarke's test

**Exclusion criteria:** i. other than patellofemoral pain Were excluded from the study**.** ii. History of degenerative changes. iii. uncooperative patient.

**Material used for the study:** i. Assessment chart. ii. Rx mat. iii. paper, iv. pencil, v. numerical rating scale, vi. lower extremity functional scale.

**Assessment tool:** i. Numerical Rating Scale. ii. Lower Extremity Functional Scale.

**Procedure:** The subject who satisfied the inclusion criteria were selected for the study after getting an informed consent. The 20-subject instructed were randomly assigned into two groups namely group A and group B. Each group consists of 10 subjects. The subject in group A will undergo for open Kinetic chain exercises. The subject in group B will undergo for closed Kinetic chain exercises. The pre-test score was taken before the commencement of exercise. The intensity of the pain was quantified by numerical rating scale. The functional activity was measured using lower extremity functional scale. The exercise was given for 5 days in a week for a total period of 4 week. The post-test score of NRS and LEFS were measured at the end of the fourth week. The obtained pre-test and post test score were compared analysed statistically.

Each exercise in both training group was repeated for 3 sets of 10 repetitions. The patient rested 1 minute after the conclusion of each set.

**The exercise protocol was as follows:**

**Therapeutic open kinetics chain exercise program**

- Maximal static quadriceps contraction with the knee in full extension
- SLR with the patient in the supine position
- Short Arc moment from 10° of knee flexion to terminal extension
- Leg adduction exercise in the lateral decubitus position

**Therapeutic closed Kinetic chain exercise program:**

- Seated leg press
- stationary biking
- Rowing machine exercise
- Step up and down exercise

In both training protocols with patient were instructed to perform the conventional static quadriceps, hamstring and the gastrocnemius stretching exercise after each training session. all subject were instructed to perform 3 repetitions of a 30 seconds stretch of their muscle group.

## III. RESULT ANALYSIS

The collected data were recorded and tabulated. The data was analysed using statistical package for social science to present the finding of the study. efficiency of open Kinetic chain exercises and closed Kinetic chain exercises in patellofemoral pain patient was identified through NRS and LEFS.

**Table 1: Statistical tabulation to analyses the comparison of pre and post NRS using OKC exercise (Group-A)**

| SL NO. | DETIALS | MEAN | STANDAR DEVIATION | t VALUE | SIGNIFICANCE |
|---|---|---|---|---|---|
| 1 | Pre NRS | 7.6 | 0.598 | 19.6 | P <.0001 s.s |
| 2 | Post NRS | 4 | 0.562 | | |

**Table 2: Statistical tabulation to analyses the comparison of pre and post LEFS using OKC exercise (Group-A)**

| SL NO. | DETIALS | MEAN | STANDAR DEVIATION | t VALUE | SIGNIFICANCE |
|---|---|---|---|---|---|
| 1 | Pre LEFS | 38.1 | 1.91 | 17.87 | P <.0001 s.s |
| 2 | Post LEFS | 56.9 | 3.212822 | | |

**Pain analysis:**

Comparison of pre and post Numeric Rating Scale using open Kinetic chain exercises table 1 shows pre NRS 7.6 and post NRS reduced to 4.00, gives t-value 19.6. thus, giving significant result with p<0.001.

Comparison of pre and post NRS using closed Kinetic chain exercises table 2 shows pre-test NRS 7.4 and post NRS reduced to 2.25 given t value 17.1. Thus, giving significant result with p< 0.001.

**Table 3: Statistical tabulation to analyses the comparison of pre and post NRS using CKC exercise (Group-B)**

| SL NO. | DETIALS | MEAN | STANDAR DEVIATION | t VALUE | SIGNIFICANCE |
|---|---|---|---|---|---|
| 1 | Pre NRS | 7.4 | 0.821 | 17.1 | P <.0001 s.s |
| 2 | Post NRS | 2.25 | 1.07 | | |

**Table 4: Statistical tabulation to analyses the comparison of pre and post LEFS using CKC exercise (Group-B)**

| SL NO. | DETIALS | MEAN | STANDAR DEVIATION | t VALUE | SIGNIFICANCE |
|---|---|---|---|---|---|
| 1 | Pre LEFS | 38.4 | 1.776388 | 25.3 | P <.0001 s.s |
| 2 | Post LEFS | 65.5 | 3.341656 | | |

**Disability analysis:**

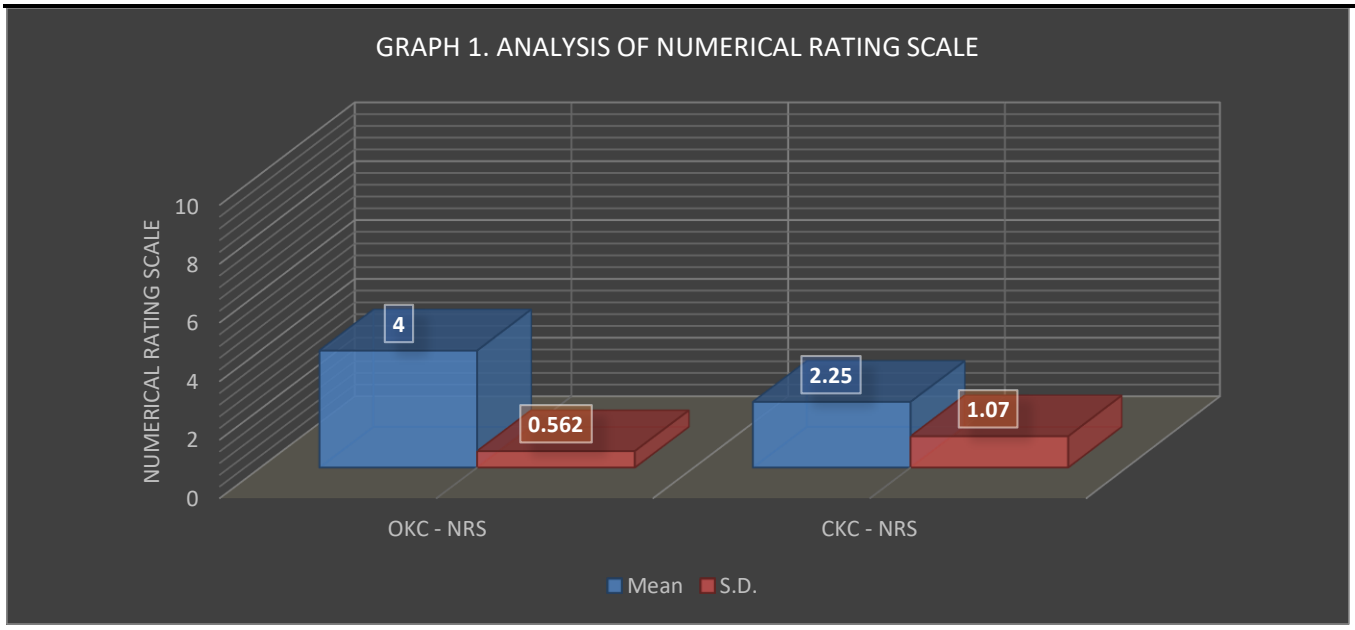
Comparison of pre and post lower extremity functional scale (LEFS) using open kinetic chain exercise shows pre LEFS value 38.1 and post LEFS functionally improved to 56.9 giving t value 17.1. Significant result p< 0.001. Comparison of pre and post LEFS using closed Kinetic chain exercises shows pre LEFS value 38.4 and post LEFS functionally improved 65.5 giving t-value 25.3. thus, giving a significant result with p<0.001.

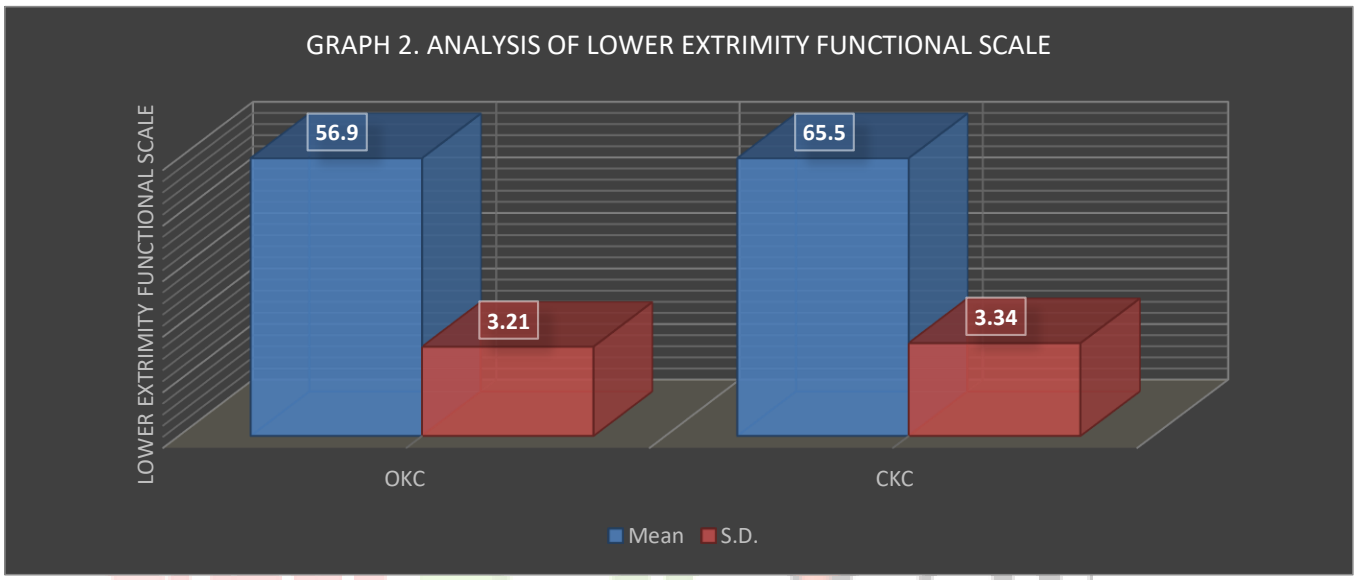
**Table 5: Statistical Tabulation to analyze the effectiveness of OKC exercise Versus CKC exercise in reduction of pain and functional disability**

| SL NO. | DETIALS | OKC | | CKC | | t VALUE | SIGNIFICANCE |
|---|---|---|---|---|---|---|---|
| | | MEAN | S.D | MEAN | S.D | | |
| 1 | NRS | 4 | 0.562 | 2.25 | 1.07 | 4.5788 | P <.0001 s.s |
| 2 | LEFS | 56.9 | 3.212822 | 65.5 | 3.341656 | 5.9163 | |

**Efficiency analysis between two groups**

Analysed the overall improvement of both parameters. this table analysed post NRS of group A with post NRS of group B with mean difference of 4 and 2.25 respectively with t value 4.5823 thus, giving a statistically Significant result p< 0.001. the table also analysed post LEFS of Group A with post LEFS of group B giving mean difference of 56.9 and 65.5 respectively with t value 6.1919. thus, giving statistically Significant result p< 0.001. closed kinetic chain exercise has benefited people with patella femoral pain. The statistical results of the study for group A open kinetic chain exercise shows that there is reduced in pain level and improvement in functional activity with p value of <0.001. the statistical result group B closed kinetic chain exercise (table 3 and 4) shows that pain is reduced with statistical significance of p value of 0.001. thus, statistical analysis shows that group B individuals who were given Closed Kinetic Chain Exercise had much relief of pain wit improved functional activity compared to group A individuals who were gives Open Kinetic Chain Exercises.




## IV. Conclusion

The comparative study using open kinetic Chain and closed Kinetic chain in Patellofemoral pain showed that both the interventions were effective in reducing pain intensity and improve the functional activity. This study predicts that group B showed better improvement when compared to group A. This study concludes that closed Kinetic chain exercises is more effective in subject with patellofemoral pain. This study will be useful for selection of intervention in patellofemoral pain subjects

## References

**[1]** American Academy of Orthopaedic Surgeons. The Clinical Measurement of Joint Motion. Greene, WB , Heckman, JD , eds. Rosemont, Ill: American Academy of Orthopaedic Surgeons; 1993. Google Scholar

**[2]** Arroll, B , Ellis-Pegler, E , Edwards, A , Sutcliffe, G. Patellofemoral pain syndrome: a critical review of the clinical trials on nonoperative therapy. Am J Sports Med. 1997;25:207–212. Google Scholar | SAGE Journals | ISI

**[3]** Augustsson, J , Esko, A , Thomeé, R. Weight training of the thigh muscles using closed vs open kinetic chain exercises: a comparison of performance enhancement. J Orthop Sports Phys Ther. 1998;27:3–8. Google Scholar | Crossref | Medline | ISI

**[4]** Cowan, SM , Bennell, KL , Hodges, PW , Crossley, KM , McConnell, J. Simultaneous feed forward recruitment of the vasti in untrained postural tasks can be restored by physical therapy. J Orthop Res.2003;21:553–558. Google Scholar | Crossref | Medline | ISI

**[5]** Crossley, K , Bennell, K , Green, S , Cowan, S , McConnell, J. Physical therapy for patellofemoral pain: a randomized, double-blinded, placebo-controlled trial. Am J Sports Med. 2002;30:857–865.
Google Scholar | SAGE Journals | ISI

**[6]** Dehaven, KE , Lintner, BG. Athletic injuries: comparison by age, sport and gender. Am J Sports Med. 1986;14:218–224.
Google Scholar | SAGE Journals | ISI

**[7]** Doucette, SA , Child, DD. The effect of open & closed chain exercise and knee joint position on patella tracking in lateral patellar compression syndrome. J Orthop Sports Phys Ther. 1996;23:104–110.
Google Scholar | Crossref | Medline | ISI

**[8]** Eng, JS , Pierrynowski, MR. Evaluation of soft foot orthotics in the treatment of patellofemoral pain syndrome. Phys Ther.1993;73:62–70.
Google Scholar | Crossref | Medline | ISI

**[9]** Escamilla, RF , Fleisig, GS , Zheng, N , Barrentine, SW , Wilk, KE , Andrews Biomechanics of the knee during closed kinetic chain and open kinetic chain exercises. Med Sci Sports Exerc. 1998;30:556–569.
Google Scholar | Crossref | Medline | ISI

**[10]** Fulkerson, J. Diagnosis and treatment of patients with patellofemoral pain. Am J Sports Med. 2002;30:447–456.
Google Scholar | SAGE Journals | ISI

**[11]** Fulkerson, JP , Kalenak, A , Rosenberg, TD , Cox, JS. Patellofemoral pain. Instruct Course Lect. 1992;41:57–71.
Google Scholar | Medline

**[12]** Gerrard, B. The PF pain syndrome: a clinical trial of the McConnell programme. Aust J Physiother. 1989;35:71–80.
Google Scholar | Crossref | Medline

**[13]** Huberti, HH , Hayes, WC. Patellofemoral contact pressures. J Bone Joint Surg Am. 1984;66:715–724.
Google Scholar | Crossref | Medline | ISI

**[14]** Hungerford, DS , Barry, M. Biomechanics of the patellofemoral joint. Clin Orthop. 1979;144:9–15.
Google Scholar

**[15]** Insall, J , Falvo, KA , Wise, DW. Chondromalacia patellae. J Bone Joint Surg Am. 1976;58:1–8.
Google Scholar | Crossref | Medline | ISI

**[16]** Jensen, KU , Strich, W , Hille, E. Dynamische Veränderungen des Patellagleitweges unter isolierter VMO Stimulation. Artroskopie.1989;2:8–15.
Google Scholar

**[17]** Kannus, P , Aho, H , Järvinen, M , et al. Computerized recording of visits to an outpatients sports clinic. Am J Sports Med. 1987;15:79–85.
Google Scholar | SAGE Journals | ISI

**[18]** Kannus, P , Natri, A , Paakkala, T , Järvinen, M. An outcome study of chronic patellofemoral pain syndrome. J Bone Joint Surg Am.1999;81:355–363.
Google Scholar | Crossref | Medline | ISI

**[19]** Karlsson, J , Thomeé, R , Swärd, L. Eleven year follow-up of patellofemoral pain syndrome. Clin J Sports Med. 1996;6:22–26.
Google Scholar | Crossref | Medline | ISI

**[20]** Kramer, PG. Patella malalignment syndrome: rationale to reduce excessive lateral pressure. J Orthop Sports Phys Ther. 1986;8:301–309.
Google Scholar | Crossref | Medline

**[21]** Kujala, UM , Jaakola, LH , Koskinen, SK , Taimela, S. Scoring of patellofemoral disorders. Arthroscopy. 1993;9:159–163.
Google Scholar | Crossref | Medline | ISI

**[22]** Maffulli, N. Anterior knee pain: an overview of management options. In: Puddu, G , Giombini, A , Selvanetti, A , eds. Rehabilitation of Sports Injuries. Berlin, Germany: Springer-Verlag; 2001:148–153.
Google Scholar | Crossref

**[23]** McConnell, J. The management of chondromalacia patellae: a long term solution. Aust J Physiother. 1986;32:215–223.
Google Scholar | Crossref | Medline

**[24]** McConnell, J. The physical therapist's approach to patellofemoral disorders. Clin Sports Med. 2002;21:363–366.
Google Scholar | Crossref | Medline | ISI

**[25]** Milgrom, C , Finestone, A , Shalam, KN. Long-term follow-up of recruits with patellofemoral pain caused by overactivity . Clin Orthop.1996;331:256–260.
Google Scholar | Crossref

**[26]** Natri, A , Kannus, P , Järvinen, M. Which factors predict the long-term outcome in chronic patellofemoral pain syndrome? A 7 year prospective follow-up study. Med Sci Sports Exerc. 1998;30:1572–1577.
Google Scholar | Crossref | Medline | ISI

**[27]** Palmiter, RA , An, KN , Scott, SG , Chao, E. Kinetic chain exercise in knee rehabilitation. Sports Med. 1991;11:402–413. Google Scholar | Crossref | Medline | ISI

**[28]** Powers, CM. Rehabilitation of patellofemoral joint disorders: a critical review. J Orthop Sports Phys Ther. 1998;28:345–354. Google Scholar | Crossref | Medline | ISI

**[29]** Powers, CM , Perry, J , Hislop, HJ. Are patellofemoral pain and quadriceps strength associated with locomotor function? Phys Ther.1997;77:1063–1074.
Google Scholar | Crossref | Medline | ISI

**[30]** Rasch, PJ , Morehouse, LE. Effect of static and dynamic exercise on muscular strength and hypertrophy. J Appl Phys. 1957;11:29–34. Google Scholar | Crossref | Medline | ISI

**[31]** Rutherford, AM. Muscular coordination and strength training: implications for injury rehabilitation . Sports Med. 1988;5:196–202.Google Scholar | Crossref | Medline | ISI

**[32]** Sandow, MJ , Goodfellow, JW. The natural history of anterior knee pain in adolescents. J Bone Joint Surg. 1985;67:36–38. Google Scholar | Crossref | ISI

**[33]** Steinkamp, LA , Dillingham, MF , Markel, MD , Hill, JA , Kaufman, GH. Biomechanical considerations in patellofemoral joint rehabilitation. Am J Sports Med. 1993;21:438–444. Google Scholar | SAGE Journals | ISI

**[34]** Stiene, HA , Brosky, T , Reinking, MF , Nyland, J , Mason, MB. A comparison of closed kinetic chain and isokinetic joint isolation exercise in patients with patellofemoral dysfunction. J Orthop Sports Phys Ther.1996;24:136–142. Google Scholar | Crossref | Medline | ISI

**[35]** Thomee, R. A comprehensive treatment approach for patellofemoral pain syndrome in young women. Phys Ther. 1997;77:1690–1703. Google Scholar | Crossref | Medline | ISI

**[36]** Werner, S. An evaluation of knee extensor and flexor torques and EMGs in patients with PFPS in comparison with matched controls. Knee Surg Sports Traumatol Arthrosc. 1995;3:89–94. Google Scholar | Crossref | Medline

**[37]** Wilk, KE. Challenging tradition in the treatment of patellofemoral disorders. J Orthop Sports Phys Ther. 1998;28:275–276. Google Scholar | Crossref | Medline | ISI

**[38]** Wilk, KE , Reinold, MM. Principles of patellofemoral rehabilitation. Sports Med Arthosc. 2001;9:325–336. Google Scholar | Crossref | ISI

**[39]** Witvrouw, E , Bellemans, J , Lysens, R , Vanderstraeten, G , Peers, K. Open versus closed kinetic chain exercises in patellofemoral pain: a prospective randomized study. Am J Sports Med. 2000;28:687–695. Google Scholar | SAGE Journals | ISI

**[40]** Witvrouw, E , Lysens, R , Bellemans, J , Cambier, D , Vanderstraeten, G. Intrinsic risk factors for the development of anterior knee pain in an athletic population: a two-year prospective study. Am J Sports Med.2000;28:480–489. Google Scholar | SAGE Journals | ISI

**[41]** Woodall, W , Welsh, J. A biomechanical basis for rehabilitation programs involving the patellofemoral joint. J Orthop Sports Phys Ther.1990;11:535–542.
Google Scholar | Crossref | Medline

**[42]** Zappala, FG , Raffek, CB , Scuderi, GR. Rehabilitation of patellofemoral joint disorders. Orthop Clinics North Am. 1992;23:555–566. Google Scholar | Crossref | Medline | ISI