INTERNATIONAL JOURNAL OF ADVANCE RESEARCH AND DEVELOPMENT

(Volume2, Issue6)
Available online at www.ijarnd.com

Association of lower extremity Biomechanical factors with pain severity in individuals with patello-femoral pain syndrome

Girish Lavjibhai Baldha
Madhav University
girish8884@gmail.com

ACKNOWLEDGEMENT

We are deeply indebted to our guide Dr. ANKUR VERMA, Madhav University; for his guidance and constant supervision as well as for providing necessary information regarding the project. We are also grateful to our principle of madhav physiotherapy viswa vidhyalaya, Madhav University whose guidance and support made this project work possible. We would like to thank all the participants without whose co-operation this task would have been impossible. At last, I would also like to thank my parents, friends & classmates who have supported us throughout this project.

INDEX

SUMMARY OF LITERATURE REVIEW

There is a significant risk of pain when undertaking physical activities. Abnormal biomechanics of the lower limb has been implicated as a causative factor for pain. Although there have been a large number of studies in this field, many lack consistency of definitions and methodology. A large number of these studies have been retrospective, and it is often impossible to identify the baseline population.

The evidence suggests that limitation of range of ankle dorsiflexion, limitation of range of hip eversion, excessive joint laxity, leg length discrepancy, an excessively supinated or pronated foot, excessively high or low arches of the foot and a large Q-angle are risk factors for pain. On the other hand, there is little convincing evidence that an abnormal range of ankle plantar flexion, genu varum or valgum or undue muscle tightness may be potential risk factors.

All of these biomechanical abnormalities need further evaluation as potential risk factors for pain. Any trials undertaken must endeavor to define and describe their methods fully, and ensure that their results are reproducible.

INTRODUCTION

Patellofemoral pain syndrome (PFPS) is a syndrome characterized by knee pain ranging from severe to mild discomfort seemingly originating from the contact of the posterior surface of the patella (back of the kneecap) with the femur (thigh bone). "Anterior knee pain involving the patella and retinaculum that excludes other intraarticular and peri-patellar pathology".

Patellofemoral pain syndrome (PFPS) is a syndrome characterized by knee pain ranging from severe to mild discomfort seemingly originating from the contact of the posterior surface of the patella (back of the kneecap) with the femur (thigh bone). It is "anterior knee pain involving the patella and retinaculum that excludes other intraarticular and peri-patellar pathology".

Patellofemoral pain syndrome is a pain in the front of the knee. It frequently occurs in teenagers, manual laborers, and athletes. It sometimes is caused by wearing down, roughening, or softening of the cartilage under the kneecap. The population most at risk from PFPS are runners, cyclists, basketball players and other sports participants. Onset can be gradual or the result of a single incident and is often caused by a change in a training regime that includes dramatic increases in training time, distance or intensity, it can be compounded by worn or the wrong type of footwear. Symptoms include discomfort while sitting with bent knees or descending stairs and generalized knee pain. Treatment involves resting and physical therapy that includes stretching and strengthening exercises for the legs.

Signs and symptoms

The onset of the condition is usually gradual, although some cases may appear suddenly following trauma.

Knee pain - the most common symptom is a diffuse peripatellar pain (vague pain around the kneecap) and localized retro patellar pain (pain focused behind the kneecap).

Affected individuals typically have difficulty describing the location of the pain, and may place their hands over the anterior patella or describe a circle around the patella (the "circle sign"). Pain is usually initiated when the load is put on the knee extensor mechanism,

e.g. ascending or descending stairs or slopes, squatting, kneeling, cycling, running or prolonged sitting with flexed (bent) knees. The latter feature is sometimes termed the "movie sign" or "theater sign" because individuals might experience pain while sitting to watch a film or similar activity. The pain is typically aching with occasional sharp pains.

Crepitus (joint noises) may be present

Causes

1. Increased levels of physical activity
2. Malalignment of the patella as it moves through the femoral groove
3. Quadriceps muscle imbalance
4. Tight anatomical structures, e.g. retinaculum or iliotibial band.

The diagnosis of patellofemoral pain syndrome is made by ruling out,

- patellar tendinitis,
- prepatellar bursitis,
- plica syndrome,
- Sinding-Larsen
- Johansson syndrome, and
- Osgood–Schlatter disease.

As patellofemoral pain syndrome is the most common cause of anterior knee pain in the outpatient, a variety of treatments for patellofemoral pain syndrome are implemented. Most patients with patellofemoral pain syndrome respond well to conservative therapy.

Boramchoi et al March (2015) conducted a study to determine the vastusmedialis oblique to vastuslateralis ratio in two pelvic tilt positions while performing the sit-to-stand task. Activation of the vastusmedialis oblique and the vastuslateralis muscles of 46 healthy subjects were recorded by surface electromyography during the STS task with anterior pelvic tilt and neutral pelvic tilt positions. Vastusmedialis oblique and vastuslateralis muscle activation significantly increased in neutral pelvic tilt position, but the vastusmedialis oblique/vastuslateralis ratio was not statistically different. The authors concluded that the sit-to-stand procedure with neutral pelvic tilt position increased activation of the vastusmedialis oblique and vastuslateralis, usefully strengthening the quadriceps, but did not selectively activate the vastusmedialis oblique muscle.

Ohjeoung Kwon et al Jan (2014) Purpose of this study was to evaluate the correlation between intrinsic patella-femoral pain syndrome in young adults and lower extremity biomechanics. This experiment was carried out with sixty subjects (24 men and 32 women), who were normal university students. All subjects underwent 3 clinical evaluations. For distinguishing the intrinsic PFPS from controls, they used the Modified Functional Index Questionnaire (MFIQ), Clarke's test and the Eccentric step test. Based on the results of the tests, subjects who were classified as positive for 2/ more tests were allocated to the bilateral or unilateral intrinsic PFPS group (n=14), and the others were allocated to the control group (n=42). These two groups were tested for hamstring tightness, foot over-pronation, and static Q-angle and dynamic Q-angle which are the four lower extremity biomechanical factors cited as risk factors for patella-femoral pain syndrome. The results showed over pronation, static Q-angle and the dynamic Q-angle were not significantly different between the two groups. However, the hamstring tightness of the PFPS group was significantly greater than that of the controls. The authors concluded that they found a strong correlation between intrinsic PFPS and hamstring tightness.
M. Boling et al October (2010) conducted a study to determine gender differences in the incidence and prevalence of patello-femoral pain syndrome. A total of 1319 participants were included in the Poisson regression model for incidence. Females were 2.23 times more likely to develop PFPS compared with males. While not statistically significant, the prevalence of PFPS at study enrollment tended to be higher in females (15%) than in males (12%).Females were significantly more likely to develop PFPS than males.
Gregory R Waryasz, et al June (2008) conducted a systematic review to find out possible risk factors for patella-femoral pain syndrome. Positive potential risk factors which were identified are weakness in functional testing; gastrocnemius, hamstring, quadriceps or iliotibial band tightness; generalized ligamentous laxity; deficient hamstring or quadriceps strength; hip musculature weakness; an excessive quadriceps (Q) angle; patellar compression or tilting; and an abnormal VMO/VL reflex timing and they concluded that there will be reduced likelihood of developing PFPS especially in those with positive potential risk factors if they perform the proposed pre-habilitation program in the study.

Sara R Piva et al March (2006) conducted a study to determine the Reliability of measures of impairments associated with patello-femoral pain syndrome. Several of the impairments associated with PFPS had good reliability like hamstrings length, quadriceps length, plantar flexors length, ITB/TFL complex length, hip abductors strength, and foot pronation, which ensured valid interpretation of these tests results in clinical practice. Moderate values of reliability were found in Q-angle, tibial torsion, hip external rotation strength, lateral reticular tightness, and test of the quality of movement. Measurement of femoral anteversion resulted in fair reliability, suggesting that interpretation of this test may not be consistent. The authors concluded that several of the impairments associated with PFPS had sufficient reliability and low measurement error and further investigation is needed to test if these impairment measurements are related to physical function and whether or not they are useful for decision-making.

Propps M et al March (2005) conducted a study to determine the test-retest reliability and responsiveness of the Anterior Knee Pain Scale and the Lower Extremity Functional Scale in patients with anterior knee pain. Test-retest reliability was high for both questionnaires. A significant correlation was found between the criterion measures of both questionnaires. Both questionnaires were found to be moderately responsive. The authors concluded that the LEFS and the AKPS both demonstrated high test-retest reliability and appear to be moderately responsive to a clinical change in patients with anterior knee pain.

Kay M Crossley, et al. May (2004) conducted a study to determine the test-retest reliability, validity, and responsiveness of several outcome measures in the treatment of patello-femoral pain. Three 10-cm visual analog scales for usual pain, worst pain, and pain on 6 aggravating activities (walking, running, squatting, sitting, ascending and descending stairs); the Functional Index Questionnaire; the Anterior Knee Pain Scale; and the global rating of change. The authors concluded the reliability, validity, and responsiveness of several outcome measures. The results of these tests indicate that the VAS for usual or worst pain and AKPS are the most valid and responsive outcome measures of treatment for patella-femoral pain. A change in these measures of 10 points (out of100) on the AKPS and 2cm on a 10-cm VAS reflects a real change in patient symptoms.

Judi Laprade et al Nov (2002) conducted a study to develop a scale for estimating the severity of patella-femoral pain syndrome (PFPS) and to determine its reliability and validity. Reliability was determined by comparing the scores obtained on two test days and Convergent validity of the PSS was determined by comparing data from the PSS with two established knee scales: WOMAC (Western Ontario and McMaster Universities) Osteoarthritis Index and the Hughston Foundation subjective knee scale. The PSS was found to be reliable and valid, making it a useful tool for monitoring rehabilitative or surgical outcomes in individuals with PFPS.

OBJECTIVES OF LITERATURE REVIEW

To find out the association of biomechanical factors with pain severity in individuals with patella-femoral pain syndrome.

CONCLUSION

By evaluating several different study designs looking at knee injuries during high-risk man oeuvres, we were able to obtain a holistic perspective of biomechanics associated with PFPS. Looking at different biomechanical research approaches allowed us to assess not only the mechanism of pain but also to look for commonalities in biomechanics (in particular, altered frontal plane mechanic at the knee and altered sagittal plane mechanic at the knee and hip) between pain and without pain participants pre-pain, at the time of pain, and following pain, to better understand potential causes of PFPS. Development of pain prevention programs should focus on correcting these mechanics observed across the three-time points during high-risk manoeuvres as this may help decrease the prevalence of PFPS. Programs focusing not only on neuromuscular training but also skill-specific training focused on correcting mechanics during these high-risk manoeuvres may be of greatest benefit regarding prevention. Future research should consider the impact of cumulative loading on knee pain risk. Additionally, better techniques for assessing mechanics in-game are needed in order to facilitate pain prevention and screening strategies

FUTURE RECOMMENDATION

More research should be done about the association of biomechanical factors with pain severity.

REFERENCES

1. Boramchoi. Activation of the vastus-medialis oblique and vastus-lateralis muscles in asymptomatic subjects during the sit-to-stand procedure Journal of physical therapy and science. March;2015: 27(3):893-895
2. Smith TO, Clark AB, Drew BT, Meek TH. Knee orthoses for treating patella-femoral pain syndrome. Cochrane Database of Systematic review 2013, (5), Art no. :CD010513
3. Kwon O, Yun M,Lee W. Correlation between Intrinsic Patello-femoral Pain Syndrome in Young Adults and Lower Extremity Biomechanics journals of physiotherapy in society. Journal of physical therapy science. July 2014;26(7): 961-964
4. Roush J, Bay R. Prevalence of anterior knee pain in 18-35-year-old females. The International Journal of Sports Physical Therapy. August 2012;26(7): 396-401
5. Foss K, Myer G, Chen S, Hewett TE. Expected Prevalence From the Differential Diagnosis of Anterior Knee Pain in Adolescent Female Athletes During Pre-participation Screening. Journal of Athletic Training. Sept-oct 2012;47(5):519–524
6. Selfe J et al.Targeted interventions for patello-femoral pain syndrome (TIPPS): classification of clinical subgroups. British medical journal. September 2013; 3(9).
7. Halabchi F, Mazaheri F and Seif-barghi T, Patello-femoral Pain Syndrome and Modifiable Intrinsic Risk Factors. Asian Journal of Sports Medicine. 2013 June;4(2): 85–100
8. Waryasz G, McDermott M. Patello-femoral pain syndrome (PFPS): a systematic review of anatomy and potential risk factors. Dynamic Medicine. 2008 June;**7**:9
9. Petersen W et al. Patello-femoral pain syndrome. Knee Surgery Sports Traumatology Arthroscopy. 2014 Oct; 22(10):2264-74.
10. Crossley M, Bennell K, Cowan S, and Green **S.** Analysis of outcome measures for persons with patella-femoral pain: which are reliable and valid? American Congress of Rehabilitation Medicine and the American Academy of Physical Medicine and Rehabilitation May 2004,85(5):815-822
11. Propps C, Ratner J, Zeigler D, Horton P, Smith S. Reliability and Responsiveness of the Lower Extremity Functional Scale and the Anterior Knee Pain Scale in Patients With Anterior Knee Pain.Journal of Orthopedic &Sports Physical Therapy. 2005;35(3):136–146
12. Greenn A, Liles C, Rushton A, Kyte K. Measurement properties of patient-reported outcome measures (PROMS) in Patello-femoral Pain Syndrome: A systematic review. Manual therapy.2014 Dec;19(6):517-26
13. Papadopoulos K, Stasinopoulos D and Ganchev D. A Systematic Review of Reviews in Patello-femoral Pain Syndrome: Exploring the risk factors, diagnostic tests, outcome measurements and exercise treatment. The Open Sports Medicine Journal2015, 9:7-17
14. Laprade J, Culham E.A self-administered pain severity scale for patello-femoral pain syndrome. Clinical Rehabilitation2002; 16:780–788
15. Piva S, Fitzgerald Z, Irrgang J, Jones S, Hando B, Browder D and Childs J. Reliability of measures of impairments associated with patello-femoral pain syndrome. BMC Musculoskeletal Disorders. March 2006; 7(33):1471-2474

16. Boling M, Padua D, Marshall S, GuskiewiczK, Pyne S, and Beutler J, Gender differences in the incidence and prevalence of patella-femoral pain syndrome. Scandinavian Journal of Medicine & Science in sports.October2010; 20(5): 725–730.
17. T Frances, et al. Q-angle and J-sign Indicative of Mal-tracking Subgroups in Patello-femoral Pain. Clinical Orthopedics. 2010January; 468(1):266–275.
18. Magee D: Orthopedic Physical Assessment6th edition. Philadelphia, PA, W.B. Saunders Company; 2014