Multidisciplinary Journal of Akseprin Indonesia
Website : https://jurnal.akseprin.org/index.php/MJAI/about
e-mail : akseprin@gmail.com or mai@akseprin.org
PUBLISHER: Akademi Sertifikasi Profesi Internasional (AKSEPRIN)
ISSN 3025-0129 (online)
Pages 122-130, Vol. 3, No. 3, 2025

Received: 2024-07-29 Revised: 2025-02-19 Accepted: 2025-07-01 Published: 2025-10-28

Using Muscle Strength And Tissue Adaptation To Treat Patellofemoral Pain Syndrome Without Subjecting The Body To Strenuous Exercise

Priyanka Lizy Jeba

Hanthai Roever College of Physiotherapy, India

ABSTRACT

Patellofemoral pain syndrome (PFPS) is the collective term for pain that arises in the patellofemoral joint itself or in the surrounding soft tissues. Blood flow restriction (BFR) training has emerged as a popular and promising technique to increase muscle strength and promote tissue adaptability without subjecting the body to demanding activity. Pilates generates muscular stress through a series of basic, repetitive activities. The study's main objective is to evaluate how well Pilates-based exercises and blood flow restriction training work to improve function and lessen discomfort in people with patellofemoral pain syndrome. As observation subjects, thirty patients with a diagnosis of patellofemoral pain were chosen at random and split into two groups. The course of treatment lasted three months, with three sessions per week. The Numerical Pain Rating Scale (NRS) and the Anterior Knee Pain Scale were compared and analyzed in this study. The NRS score of the knee and the Anterior Knee Pain Scale were compared and examined in this study before and after treatment. Following treatment, Group A's functional status and health-related quality of life significantly improved in comparison to Group B, and Group A's pain intensity significantly decreased. The study's findings show that Pilates-based core strengthening exercises can help teens with PFPS in a variety of ways, including pain reduction, improved functional status, and improved quality of life.

Keywords: Pilates Workouts, Patellofemoral Pain Syndrome, And Blood Flow Restriction.

Multidisciplinary Journal of Akseprin Indonesia
Website : https://jurnal.akseprin.org/index.php/MJAI/about
e-mail : akseprin@gmail.com or mai@akseprin.org
PUBLISHER: Akademi Sertifikasi Profesi Internasional (AKSEPRIN)
ISSN 3025-0129 (online)
Pages 122-130, Vol. 3, No. 3, 2025
Received: 2024-07-29 Revised: 2025-02-19 Accepted: 2025-07-01 Published: 2025-10-28

INTRODUCTION

Runner's knee, or patellofemoral pain syndrome (PFPS), is another name for patellofemoral syndrome (PFS), a common cause of anterior knee pain (AKP). Although it is frequently seen in energetic people and teenagers, this illness affects people of all ages and activity levels. PFS, which is characterized by pain in the front of the knee, is usually made worse by activities like squatting, climbing stairs, sitting for extended periods of time, and similar motions [1]. The symptoms might last for a long time, perhaps up to two years, even though they frequently go away on their own. The reported incidence and prevalence of PFS differ, underscoring the necessity of precise epidemiological data to guide research and healthcare resource allocation. PFS accounts for a sizable percentage of cases of anterior knee pain, making it a common problem seen by physiotherapists.

The increasing prevalence of musculoskeletal illnesses, such as PFS, throughout the world highlights the conditions' mounting impact. A large percentage of the active population, especially those between the ages of 20 and 40, suffers from AKP, which can have a detrimental effect on physical activity associated with the workplace and reduce productivity. Patients' quality of life is greatly impacted by PFS, which has indirect costs related to decreased productivity and work incapacity in addition to the direct expenses of treatment [2]. PFS patients usually have widespread anterior knee discomfort that gets worse when they bend their knees, including when they run, climb stairs, or squat. Excluding further intra-articular or peripatellar disorders is frequently part of the diagnosis process. Although the precise cause of PFS is yet unknown, exercise routines and biomechanical abnormalities are probably important factors. The subchondral bone, synovium, retinaculum, skin, nerves, and muscles are among the anatomical components that could be affected [3]. In general, anterior knee discomfort is very common, impacting a large number of people each year, and it is more common in women.

Research has shown that PFP and knee pain are somewhat common, especially in younger people under 40. Some people have chronic pain, even if conservative treatment frequently alleviates PFS symptoms. It is essential to educate patients about the illness, possible causes, and accessible treatments. A home exercise program or physical therapy can help patients practice the right routines. Even with normal treatment, a significant portion of patients may continue to have symptoms, despite the generally good prognosis for PFS. Long-term

Multidisciplinary Journal of Akseprin Indonesia
Website : https://jurnal.akseprin.org/index.php/MJAI/about
e-mail : akseprin@gmail.com or mai@akseprin.org
PUBLISHER: Akademi Sertifikasi Profesi Internasional (AKSEPRIN)
ISSN 3025-0129 (online)
Pages 122-130, Vol. 3, No. 3, 2025
Received: 2024-07-29 Revised: 2025-02-19 Accepted: 2025-07-01 Published: 2025-10-28

results may be impacted by variables such as patellar hypermobility, advanced age, and dual symptoms.

RESEARCH ELABORATIONS

Patellofemoral osteoarthritis, Osgood-Schlatter disease, plica syndrome, bursitis, neuritis, tendinopathies, and referred pain are all included in the wide differential diagnosis for PFS [4]. By increasing the stress on the patellofemoral joint, quadriceps strengthening activities might worsen PFS symptoms; hence, clinicians should be cautious when recommending them. Although its exact function is disputed, patellar maltracking is frequently linked to PFS. The intricate function of the patellofemoral joint entails the dynamic interaction of both static and dynamic lower extremity components. Variations in leg length, foot shape, stiffness in the hamstrings and hips, rotational or angular abnormalities, and trochlear shape are examples of static variables. Muscle weakness, ground response forces, and foot pronation are examples of dynamic factors. Potential contributing factors have been identified as hip biomechanics, including higher hip adduction angles, and hip abductor weakness. The Numerical Rating Scale (NRS) is a valid instrument that asks patients to circle the number that best represents their level of pain, ranging from 0 to 10. The highest limit typically denotes "the worst pain ever possible," while zero typically denotes "no pain at all." Anterior knee pain scale: The 11 questions that comprise the AKPS proposed in this study are separated into discrete groups that correlate to different levels of knee function. A global index is created by adding the scores for each item's categories. A score of 0 represents the greatest conceivable deficit, whilst a score of 85 denotes "no deficit."

PFS development is also linked to overload, which is frequently linked to elevated activity levels. Pre-existing fitness levels, past exercise routines, and elevated BMI are risk factors for overload. PFS may result from direct or indirect structural injury to the patellar area. It is well acknowledged that PFS rarely results from a single cause, despite the fact that a number of risk factors have been connected to the condition [4]. NSAIDs, ice, and rest are frequently used in initial therapy. Although NSAIDs may offer some pain relief, prolonged usage is usually not advised. Other techniques, like therapeutic ultrasound and electrical stimulation, have not consistently shown improvement in symptoms. In musculoskeletal

Multidisciplinary Journal of Akseprin Indonesia
Website : https://jurnal.akseprin.org/index.php/MJAI/about
e-mail : akseprin@gmail.com or mai@akseprin.org
PUBLISHER: Akademi Sertifikasi Profesi Internasional (AKSEPRIN)
ISSN 3025-0129 (online)
Pages 122-130, Vol. 3, No. 3, 2025
Received: 2024-07-29 Revised: 2025-02-19 Accepted: 2025-07-01 Published: 2025-10-28

rehabilitation, blood flow restriction (BFR) training in conjunction with low-load exercise has shown promise in enhancing muscular strength and maybe helping to control PFS. Although there is little data on its use in teenagers with PFPS, Pilates, with its focus on core stability and controlled movements, may also have advantages. To understand PFS, one must have a solid understanding of patellofemoral joint biomechanics. An important part of knee extension is the patellofemoral joint, where the patella articulates with the femur. A number of static and dynamic factors affect patellar tracking in the femoral groove; imbalances in these forces can result in aberrant tracking, elevated stress, and perhaps PFS. Patellar maltracking can also be caused by elements such as the Q angle, which is impacted by bone alignment and other biomechanical variables. PFS has a complicated etiology that includes muscle imbalances, biomechanical variables, and possibly joint inflammation and microdamage. When making a differential diagnosis for anterior knee discomfort, patellar instability and other disorders should be taken into account.

The benefits of Pilates exercises and Blood Flow Restriction (BFR) therapy on pain and functional status in thirty patients with patellofemoral pain syndrome (PFPS) were examined in this single-blind, two-arm randomized controlled experiment. Participants were randomly assigned to either the BFR therapy group (n=15) or the Pilates exercise group (n=15), after being recruited through convenience sampling from the outpatient department of Thanthai Roever College of Physiotherapy, Perambalur. Three sessions a week were part of the three-month intervention. Male and female individuals between the ages of 18 and 35 who had anterior knee pain at rest that was aggravated by activities such as prolonged sitting, squatting, running, and stair climbing; had a sneaky onset for more than six weeks without a traumatic injury; and had not received physical therapy within the previous three months were eligible for inclusion. Meniscal tears, ligament involvement, rheumatoid arthritis, osteoarthritis in the knee, previous patellar dislocation or subluxation, knee/hip surgery, and active knee inflammation were among the exclusion criteria. The Numerical Pain Rating Scale (NPRS) and the Anterior Knee Pain Scale (AKPS) were the dependent variables, or primary outcome measures, whereas Pilates exercises and BFR training were the independent factors.

Multidisciplinary Journal of Akseprin Indonesia ISSN 3025-0129 (online)
Website : https://jurnal.akseprin.org/index.php/MJAI/about Pages 122-130, Vol. 3, No. 3, 2025
e-mail : akseprin@gmail.com or mai@akseprin.org
PUBLISHER: Akademi Sertifikasi Profesi Internasional (AKSEPRIN)
Received: 2024-07-29 Revised: 2025-02-19 Accepted: 2025-07-01 Published: 2025-10-28

RESULTS AND DISCUSSIONS

Pilates balls for core engagement and balance challenges, resistance bands (both Pilates and regular elastic bands) to provide different levels of resistance for strengthening exercises, exercise mats for participant comfort and support during exercises, a pulse oximeter to ensure participant safety during BFR training, and a specialized blood flow restriction cuff to apply controlled pressure during the BFR intervention were among the materials used in this study. The Pilates group's members participated in 30-minute sessions that included Pilates exercises. With an emphasis on appropriate form and controlled movements, these exercises were created to enhance lower extremity strength, flexibility, and core stability. To improve the exercises and offer varying degrees of difficulty, a range of equipment was used, such as mats, Pilates balls, and resistance bands (elastic and Pilates bands). Throughout the intervention period, the exercises were customized to each person's needs and pain threshold, increasing in severity as tolerated.

The 30-minute Pilates workout included a variety of movements aimed at improving flexibility, lower extremity strength, and core stability. Squats with a mat, swimming with a stabilizing ball, wall squat rolls with a Pilates ball, hip twists with a Pilates band, side kicks with an internal/external rotation with a Pilates band, the Hundred exercise, and single-leg stretches were among them. Throughout the three-month intervention, the intensity and progression of each exercise were modified according to each participant's tolerance and progress, and each exercise was performed for a predetermined number of sets and repetitions. The Blood Flow Restriction (BFR) training regimen followed the current recommendations for exercise variables found in the literature. For six weeks, members of the BFR group completed a set of exercises three times a week, averaging 15–30 repetitions. Although this may have been estimated due to practical constraints in a clinical context, the resistance load was fixed at 20–50% of 1 repetition maximum (1RM). The upper third of the thigh was fitted with a pneumatic cuff, and the inflation pressure was kept between 20 and 50 mmHg, depending on participant tolerance and clinical assessment. Side-lying hip abductions, lateral glider lunges, sitting leg extensions, and seated leg presses were among the workouts. Participants flexed and extended their knees while seated for the seated leg extension.

Multidisciplinary Journal of Akseprin Indonesia
Website : https://jurnal.akseprin.org/index.php/MJAI/about
e-mail : akseprin@gmail.com or mai@akseprin.org
PUBLISHER: Akademi Sertifikasi Profesi Internasional (AKSEPRIN)
ISSN 3025-0129 (online)
Pages 122-130, Vol. 3, No. 3, 2025
Received: 2024-07-29 Revised: 2025-02-19 Accepted: 2025-07-01 Published: 2025-10-28

In order to complete the seated leg press, participants had to lie down with their hips slightly bent. Participants executed side lunges and lateral glider lunges while standing. Lastly, the participant was placed side-lying, and the upper leg was raised away from the midline for side-lying hip abductions. Depending on each participant's response and tolerance, the precise pressure and resistance were changed as necessary, closely monitored to guarantee comfort and safety.

Table 1 Demographic Information for Groups A and B

Variables	Group A	Group B
Age	24.67 ± 6.17	24.80 ± 6.097
Height	166.40± 10.480	169.67 ± 8.381
Weight	62.60 ± 17.614	61.33 ± 10.445
BMI	24.460 ± 2.4550	21.640 ± 4.7089
Total	N=15	N=15

Table 2. Group A Pilates-Based Exercise: The Numerical Pain Rating Scale matched the "T" test

GROUP – A	MEAN	STANDARD DEVIATION	MEAN DIFFERENCE	VALUE
Pre – test	7.20	0.94	5.60	20.54
Post – test	1.60	0.51		

Table 2 compares the numerical pain rating scale values for Group A before and after the test. At the 5% level of significance, the estimated "t" value of 20.5464 is substantially higher than the tabulated "t" value of 2.145. This indicates that the numerical pain rating system for Pilates-based exercises has significantly improved.

Significant improvements in pain and function were observed with both the Pilates (Group A) and BFR (Group B) therapies. Comparisons between groups, however, indicate that Pilates may have produced more significant improvements in function (AKPS) and larger decreases in pain (NPRS). Grip strength and CAHAI scores significantly improved in Group

Multidisciplinary Journal of Akseprin Indonesia ISSN 3025-0129 (online)
Website : https://jurnal.akseprin.org/index.php/MJAI/about Pages 122-130, Vol. 3, No. 3, 2025
e-mail : akseprin@gmail.com or mai@akseprin.org
PUBLISHER: Akademi Sertifikasi Profesi Internasional (AKSEPRIN)
Received: 2024-07-29 Revised: 2025-02-19 Accepted: 2025-07-01 Published: 2025-10-28

B, while KOOS and CAHAI scores significantly improved in Group A. For both NPRS and AKPS modifications, unpaired t-tests revealed statistically significant differences between groups ($p < 0.001$), favoring Group A.

This study examined how adolescents with patellofemoral pain syndrome (PFPS) responded to a 12-week Pilates exercise program and blood flow restriction (BFR) training regimen in terms of pain and functional status. Since the knee joint is the most complex joint in the body and is essential to the mobility and stability of the lower limbs, it is prone to discomfort and damage, which raises the risk of knee-related disorders. There is evidence that excessive joint pressure and weakening in stabilizing muscles, especially the quadriceps, hip abductors, and external rotators, are linked to knee discomfort. Sports-related injuries, decreased long-term quality of life, and functional limitations in the lower extremities are all linked to PFPS, a disorder with a complicated and poorly known etiology. Knee hyperextension, restricted hip motion, altered periprosthetic muscle tension, irregular Q-angle, meniscal tears, tibial position abnormalities, and ligamentous injuries are some other factors that might cause knee discomfort.

Adolescents with PFPS, a common musculoskeletal condition, have difficulty with everyday tasks including jogging, stair climbing, kneeling, and squatting, which frequently results in them engaging in less physical activity than their peers. By activating a variety of sensory input and offering proprioceptive feedback, the use of Pilates balls and Theraband in the workout regimens may have helped to improve function by encouraging the best possible movement patterns. By lowering stress, Pilates exercise may help reduce discomfort. Pilates' breathing exercises can increase oxygenation, lung capacity, and circulation, which may encourage the release of endorphins. Adolescents with PFPS, a common musculoskeletal condition, have difficulty with everyday tasks including jogging, stair climbing, kneeling, and squatting, which frequently results in them engaging in less physical activity than their peers. By activating a variety of sensory input and offering proprioceptive feedback, the use of Pilates balls and Theraband in the workout regimens may have helped to improve function by encouraging the best possible movement patterns. By lowering stress, Pilates exercise may help reduce discomfort. Pilates' breathing exercises can increase oxygenation, lung capacity, and circulation, which may encourage the release of endorphins.

Multidisciplinary Journal of Akseprin Indonesia
Website : https://jurnal.akseprin.org/index.php/MJAI/about
e-mail : akseprin@gmail.com or mai@akseprin.org
PUBLISHER: Akademi Sertifikasi Profesi Internasional (AKSEPRIN)
ISSN 3025-0129 (online)
Pages 122-130, Vol. 3, No. 3, 2025
Received: 2024-07-29 Revised: 2025-02-19 Accepted: 2025-07-01 Published: 2025-10-28

By using pressure devices, BFR training enables high-load training effects with lower loads, which is advantageous for managing musculoskeletal pain and sports rehabilitation. For PFPS patients, strengthening the periarticular muscles can be essential since it may help reduce or eliminate discomfort, improve lower limb strength, restore knee function, and increase joint range of motion. By boosting blood flow to periarticular muscles, protecting joints, and encouraging muscle strength and recruitment, BFR training may be a useful intervention while preserving a high degree of safety and training effectiveness. Certain shortcomings are acknowledged in this study. The reliability of the results could have been impacted by random mistakes generated by the very small sample size. It is advised that future studies use bigger sample sizes. Understanding the therapies' long-term effects is hampered by the lack of long-term follow-up. Additionally, the results may not be as applicable to other populations due to the study population's bias towards athletes. Lastly, even though the 12-week intervention period was lengthy, it can be viewed as brief. To ascertain the ideal length of time for treatment results in PFPS, future research could examine the advantages and possible drawbacks of longer-term interventions.

CONCLUSIONS

The results of this study show that both the Pilates exercise group and the Blood Flow Restriction (BFR) training group experienced statistically significant improvements in their functional status and pain levels. Comparing the mean values of the two groups, however, indicates that the Pilates exercise intervention might have produced more significant increases in functional ability and less severe pain reductions than the BFR training protocol.

REFERENCES

[1] L. A. Costa, “The effects of deep leg squats on patellofemoral pain syndrome-a single subject design study,” 2011.

[2] H. Hollinger, “The Effect of Stretching and Strengthening on Patellofemoral Pain Syndrome,” 2014.

Multidisciplinary Journal of Akseprin Indonesia
Website : https://jurnal.akseprin.org/index.php/MJAI/about
e-mail : akseprin@gmail.com or mai@akseprin.org
PUBLISHER: Akademi Sertifikasi Profesi Internasional (AKSEPRIN)
ISSN 3025-0129 (online)
Pages 122-130, Vol. 3, No. 3, 2025
Received: 2024-07-29 Revised: 2025-02-19 Accepted: 2025-07-01 Published: 2025-10-28

[3] N. H. M. Priyanka and L. J. Priya, "Effectiveness of Pilates based Exercises Versus Blood Flow Restriction Training for Improving Pain and Function in Patellofemoral Pain Syndrome".

[4] A. A. Grant, M. A. Cook, and S. M. Ross, "The Impacts of i-Ready Personalized Instruction on Student Reading Achievement among Striving Learners.," *Center for Research and Reform in Education*, 2023.