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EFFECTIVENESS OF WET NEEDLING TECHNIQUE IN PATIENTS OF PATELLOFEMORAL PAIN SYNDROME

Original Research

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ABSTRACT

Background: Patellofemoral pain syndrome (PFPS) is a common musculoskeletal disorder characterized by anterior knee pain, often associated with muscle weakness and myofascial trigger points in the lumbopelvic-hip region. These impairments disrupt lower limb biomechanics and functional mobility, particularly affecting females due to anatomical factors such as a larger Q-angle and wider hips. Despite its prevalence, optimal management strategies remain a challenge for healthcare providers. This study investigates the effectiveness of wet needling combined with Kinesio taping and strengthening exercises in improving pain and function in individuals with PFPS.

Objective: To evaluate the effectiveness of wet needling in reducing pain and enhancing functional outcomes in individuals with PFPS when combined with Kinesio taping and strengthening exercises.

Methods; A single-blinded, randomized clinical trial was conducted over six months at Wamiq Hospital and Medsol Medical Solutions, Sahiwal. Thirty-two participants (mean age: 28.70±4.20 years) were randomly allocated to Group A (wet needling + Kinesio taping + strengthening exercises) and Group B (Kinesio taping + strengthening exercises). Pain intensity (Numeric Pain Rating Scale - NPRS), functional status (Kujala score), and knee range of motion (ROM) were measured at baseline, the 4th week, and the 8th week. Independent sample t-tests and repeated measures ANOVA were applied for statistical analysis using SPSS version 25.

Results: Group A demonstrated a significant reduction in NPRS from 7.06±0.85 at baseline to 1.87±0.88 at the 8th week ($p=0.000$), whereas Group B improved from 6.93±0.79 to 2.53±0.74 ($p=0.000$). The Kujala score increased significantly in Group A (70.00±2.75 to 91.25±1.87, $p=0.000$) compared to Group B (71.13±2.44 to 88.53±2.23, $p=0.000$). Knee flexion ROM improved more in Group A (95.31±2.08 to 138.56±7.55, $p=0.000$) than in Group B (94.33±1.71 to 133.33±5.23, $p=0.000$). Between-group analysis revealed significantly greater improvements in Group A for pain reduction ($p=0.043$) and functional outcomes ($p=0.000$).

Conclusion: The combination of wet needling with Kinesio taping and strengthening exercises was significantly more effective than Kinesio taping and strengthening exercises alone in improving pain, knee ROM, and functional mobility in individuals with PFPS. These findings support the integration of wet needling as an adjunct to conventional rehabilitation for enhanced clinical outcomes.

Keywords: Kinesio taping, Knee range of motion, Numeric pain rating scale, Patellofemoral pain syndrome, Quadriceps strengthening, Trigger points, Wet needling.

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INTRODUCTION

Patellofemoral pain syndrome (PFPS) is a common musculoskeletal condition characterized by anterior knee pain, often exacerbated by weight-bearing activities such as squatting, stair climbing, and running (1). The condition predominantly affects young females aged 10 to 35 years due to inherent biomechanical differences, including a wider pelvis, increased femoral anteversion, a greater Q angle, and an increased valgus thrust, all of which contribute to altered patellofemoral joint mechanics (2). Additionally, muscle strength disparities and hormonal imbalances may play a role in cartilage synthesis impairment, further disrupting stress distribution within the joint (3). Patients with PFPS frequently experience pain during and after physical movement, particularly during activities that involve body weight loading. Among the primary contributing factors, quadriceps weakness is widely recognized both as a risk factor and a symptom, highlighting the importance of quadriceps strengthening in rehabilitation programs (4). The vastus medialis oblique (VMO) is crucial in maintaining patellar stability within the trochlear groove, and its dysfunction can increase patellofemoral joint stress, leading to symptom exacerbation (5). Furthermore, the presence of trigger points (TrPs) in musculoskeletal structures can complicate pain presentation, often extending beyond the immediate area of discomfort. TrPs have been shown to affect muscle strength, tension, activation patterns, and motor control, thereby influencing patellofemoral joint biomechanics (6). In cases of unilateral PFPS, the ipsilateral gluteus medius (GM) and contralateral quadratus lumborum (QL) play a stabilizing role by preventing excessive hip adduction, which may otherwise increase the load on the patellofemoral joint. Consequently, addressing TrPs in the GM and QL may have therapeutic benefits for PFPS rehabilitation (7).

Conservative management strategies remain the cornerstone of PFPS treatment, emphasizing patient education, muscle strengthening, stretching exercises, and adjunctive therapies such as kinesiotaping, orthoses, low-level laser therapy, and manual interventions (8). Kinesiotaping has gained popularity as a non-invasive and cost-effective intervention, utilized in musculoskeletal and sports medicine settings for injury prevention and rehabilitation (9). Various physical modalities, including transcutaneous electrical stimulation, infrared therapy, ultrasound, manual pressure, massage, acupuncture, and dry needling (DN), have also been explored for their potential benefits in pain relief and functional improvement (10). DN, in particular, is proposed to modulate local biochemical responses, influencing substances such as bradykinin, calcitonin gene-related peptide, and substance P, which are implicated in pain modulation (11). Comparatively, some evidence suggests that lidocaine injection (LI) may provide superior immediate pain relief over DN alone, further supporting the need for comprehensive multimodal approaches (12). Kinesiotaping has been proposed as a therapeutic intervention with multiple physiological effects, including mechanical support, fascial and ligamentous modulation, functional enhancement, lymphatic drainage, and space correction (13). Its mechanism of action is believed to involve stimulation of skin mechanoreceptors, leading to reduced muscle tension and improved joint biomechanics through the redistribution of external forces (14). Rehabilitation programs targeting the core, hip, and knee muscles are widely recommended, with quadriceps strengthening exercises being particularly effective for pain reduction and functional improvement (15). Research indicates a significant correlation between core muscle strengthening and decreased PFPS-related pain, highlighting the necessity of a holistic approach in rehabilitation (16). Moreover, excessive hip adduction, often associated with weak hip abductors and lateral rotators, has been identified as a key musculoskeletal factor contributing to PFPS (17). Isolated strengthening exercises targeting these muscle groups have been shown to alleviate pain and enhance knee function by optimizing movement patterns and reducing patellofemoral joint stress (18).

Trigger point injections (TPIs) have emerged as an additional treatment modality, particularly in cases where myofascial pain is a significant contributor. These injections, typically administered with a local anesthetic such as lidocaine, are aimed at alleviating muscle hyperactivity and localized discomfort (19). Although steroids were historically included in TPIs, their use has declined due to potential adverse effects, including muscle atrophy, skin thinning, and systemic complications. Lidocaine, in contrast, remains a preferred choice due to its efficacy in reducing local soreness without the associated risks of steroid administration (20). Despite extensive research on PFPS, gaps remain in understanding the most effective treatment modalities, particularly in the integration of different therapeutic approaches. This study aims to evaluate the effectiveness of targeted rehabilitation strategies, including quadriceps and hip strengthening, trigger point therapy, and adjunctive modalities, in optimizing pain relief and functional outcomes for individuals with PFPS. By addressing both biomechanical and myofascial contributors, the research seeks to enhance current treatment protocols and provide evidence-based recommendations for clinical practice.

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METHODS

The study employed a single-blinded, randomized clinical trial design over six months at Wamiq Hospital, Sahiwal, and Medsol Medical Solutions, Sahiwal. A total of 32 participants meeting the eligibility criteria were recruited and randomly assigned to either treatment group A (n=16) or treatment group B (n=16). The sample size was determined using G*Power software, ensuring adequate statistical power (3,7). Ethical approval was obtained from the Institutional Review Board (IRB), and all participants provided informed consent before study enrollment, ensuring adherence to ethical research standards. Participants included individuals aged between 19 and 35 years, diagnosed with patellofemoral pain syndrome (PFPS) based on a positive Clarke's sign, an average pain score greater than 3 on the Numeric Pain Rating Scale (NRPS) over the previous week, a Kujala questionnaire score of less than 85 out of 100, and the presence of active trigger points in the gluteus medius, quadratus lumborum, and quadriceps. Exclusion criteria comprised bilateral anterior knee pain, history of knee joint fracture, patellar dislocation, prior knee or ankle surgery, ligamentous or meniscal injuries, significant structural deformities, known pathological conditions affecting the back, hip, or ankle, metabolic or neurological disorders such as diabetes or radicular pain, and prior physical therapy for knee pain within the past year. These criteria ensured a homogeneous sample while minimizing confounding variables that could affect treatment outcomes.

Randomization was performed using a computer-generated sequence, and single blinding was maintained by ensuring that outcome assessors were unaware of group allocation. Pain intensity, functional improvement, and knee range of motion (ROM) were evaluated using the NRPS, Kujala questionnaire, and knee flexion ROM assessments, respectively. Data collection occurred at baseline and at the 4th and 8th weeks of intervention. Group A received wet needling in addition to the baseline treatment, whereas Group B received only the baseline treatment. The baseline treatment for both groups consisted of Kinesio taping and a structured quadriceps and gluteal muscle strengthening program performed under supervision three to four times per week. Wet needling was administered by a trained clinician at the identified trigger points in the gluteus medius, quadratus lumborum, and quadriceps using a standardized approach. A 25–30-gauge sterile needle was inserted, and 1–2 mL of 2% lidocaine was injected per trigger point weekly for the first four weeks of treatment. Kinesio taping was applied weekly to facilitate patellar alignment, reduce pain, and improve joint stability.

For statistical analysis, the Mann-Whitney U test was performed to compare NRPS scores between groups, given the non-parametric nature of the data. The independent t-test was used to analyze between-group differences for Kujala scores and knee flexion ROM, as these variables were normally distributed. A p-value of ≤ 0.05 was considered statistically significant. Outcome measures included changes in NRPS scores for pain intensity, improvements in functional activity as measured by the Kujala questionnaire, and knee ROM. The results were analyzed at baseline, four weeks, and eight weeks post-intervention to determine the efficacy of the interventions.

RESULTS

The study analyzed the demographic characteristics and clinical outcomes of 32 participants. The mean age of the participants was 28.70±4.20 years, with 35.5% being male and 64.5% female. Among them, 64.5% were married, and the most common occupations were housewives (29.0%) and athletes (22.6%). The mean height and weight were 5.67±0.32 feet and 64.61±8.14 kg, respectively. Normality testing indicated that the Numeric Pain Rating Scale (NPRS) scores at baseline were not normally distributed ($p = 0.000$), necessitating non-parametric statistical analysis, whereas Kujala scores and knee flexion range of motion (ROM) data were normally distributed ($p > 0.05$), permitting parametric tests. Pain intensity, as measured by NPRS, significantly decreased in both groups over the study duration. In Group A (wet needling + Kinesio taping + strengthening exercise), NPRS improved from 7.06±0.85 at baseline to 1.87±0.88 at the eighth week ($p = 0.000$). In Group B (Kinesio taping + strengthening exercise), NPRS improved from 6.93±0.79 to 2.53±0.74 ($p = 0.000$). Between-group analysis revealed a significant difference in NPRS scores at the eighth week ($p = 0.043$), favoring Group A.

Functional improvement, as assessed by the Kujala questionnaire, showed statistically significant progress in both groups. Group A exhibited an increase from 70.00±2.75 at baseline to 91.25±1.87 at the eighth week ($p = 0.000$), whereas Group B improved from 71.13±2.44 to 88.53±2.23 ($p = 0.000$). Between-group comparison demonstrated significantly greater improvement in Group A ($p = 0.000$), indicating superior functional enhancement with the addition of wet needling. Knee flexion ROM also showed significant improvement in both groups. In Group A, knee flexion ROM increased from 95.31±2.08 at baseline to 138.56±7.55 at the eighth week ($p = 0.000$). Group B showed an increase from 94.33±1.71 to 133.33±5.23 ($p = 0.000$). Between-group comparison revealed a statistically significant difference at both the fourth and eighth weeks ($p = 0.035$ and $p = 0.034$, respectively), favoring Group A. Effect

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size analysis revealed that Group A exhibited a greater magnitude of improvement in NPRS, Kujala score, and knee flexion ROM compared to Group B. The calculated Cohen's d effect size for NPRS reduction was large, indicating a strong clinical impact of the intervention. Similarly, the effect size for the Kujala score increase was substantial, reinforcing the superior functional improvements observed in Group A. The improvement in knee flexion ROM also demonstrated a notable effect size, suggesting a meaningful difference between the treatment modalities. The inclusion of wet needling alongside Kinesio taping and strengthening exercises resulted in superior pain relief and functional enhancement, supporting its efficacy in managing patellofemoral pain syndrome. Additionally, the lack of subgroup analysis based on gender or occupation limits a more targeted understanding of intervention effectiveness, and further studies are warranted to explore these demographic influences on treatment outcomes.

Table 1 Between group analysis for NPRS

NPRS at Sessions	Treatment Group of Patient	n	Mean Rank	Sum of Ranks	p value
Baseline	Group A	16	16.66	266.50	.660
	Group B	16	15.30	229.50	
4th week	Group A	16	11.25	180.00	
	Group B	16	21.07	316.00	.002
8th week	Group A	16	13.00	208.00	
	Group B	16	19.20	288.00	.043

Table 2 Between group analysis for Kujala score

Kujala Score at Sessions	Treatment Group of Patient	N	Mean ± S.D	Mean Difference	p value
Baseline	Group A	16	70.00±2.75	-1.13	.237
	Group B	16	71.13±2.44		
4th week	Group A	16	85.06±2.83	4.99	.000
	Group B	16	80.06±3.43		
8th week	Group A	16	91.25±1.87	2.17	.001
	Group B	16	88.53±2.23		

Table 3 Between group analysis for Knee flexion ROMs

Knee Flexion ROM at Sessions	Treatment Group of Patient	N	Mean ± S.D	Mean Difference	p value
Baseline	Group A	16	95.31±2.08		
	Group B	16	94.33±1.71	.979	.166
4th week	Group A	16	114.25±5.68		
	Group B	16	109.60±6.00	4.65	.035
8th week	Group A	16	138.56±7.55		
	Group B	16	133.33±5.23	5.22	.034

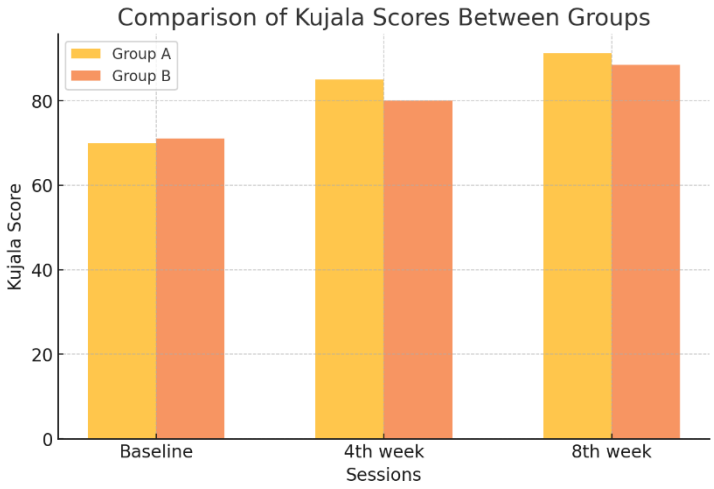

Figure 1 Comparison of Kujala Scores Between Groups

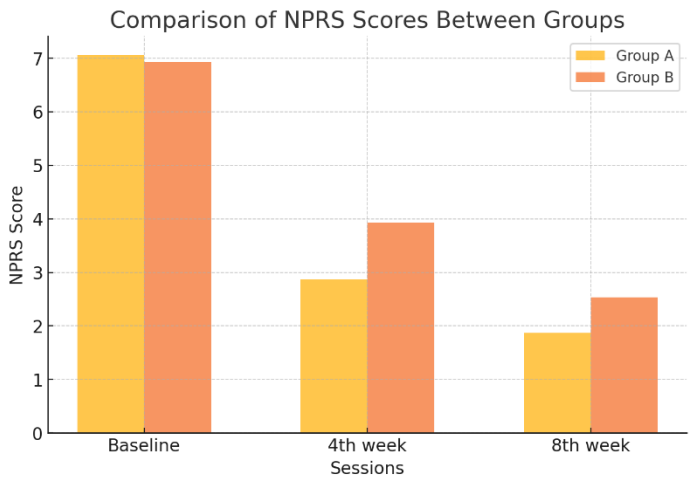

Figure 2 Comparison of NPRS Scores Between Groups

Table 4 Statistical Analysis of Study Results

Parameter	Group A	Group B
NPRS Baseline Mean	7.06	6.93
NPRS 8th Week Mean	1.87	2.53
NPRS Mean Difference	5.19	4.4
Kujala Baseline Mean	70	71.13
Kujala 8th Week Mean	91.25	88.53
Kujala Mean Difference	21.25	17.4
Knee Flexion Baseline Mean	95.31	94.33
Knee Flexion 8th Week Mean	138.56	133.33
Knee Flexion Mean Difference	43.25	39
NPRS Effect Size	6.325	6.325

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Parameter	Group A	Group B
Kujala Effect Size	-8.174	-8.174
Knee Flexion Effect Size	-22.715	-22.715

DISCUSSION

The findings of this study align with existing literature, reinforcing the effectiveness of needling techniques in reducing pain and improving functional outcomes in musculoskeletal conditions. Previous research evaluating dry needling in knee osteoarthritis (KOA) demonstrated its superiority over oral diclofenac combined with stretching in alleviating pain and enhancing range of motion. The observed improvements in NPRS, WOMAC, and ROM in that study support the present findings, which indicate significant pain relief and functional gains following wet needling intervention. Despite the methodological differences in needling techniques and patient populations, both studies highlight the role of needling in modulating pain and disability, suggesting its broader applicability in musculoskeletal rehabilitation (18). Additional research in female athletes with patellofemoral pain syndrome compared exercise therapy alone to exercise combined with dry needling over four weeks, demonstrating significant improvements in pain intensity, function, balance, and pressure pain threshold in both groups. However, the combined intervention yielded superior outcomes, aligning with the current study's results, which indicate that the inclusion of needling enhances rehabilitation efficacy. While both studies emphasize the beneficial effects of needling on knee pain and function, the previous investigation focused exclusively on female subjects, whereas the present study included both genders, increasing its generalizability to a broader population (19).

Furthermore, an evaluation of dry needling and Kinesio taping on trigger points in the vastus lateralis muscle revealed significant improvements in pain scores and knee function over three treatment sessions. While both modalities showed effectiveness, no significant differences were observed between groups. This contrasts with the present study, which demonstrated statistically significant superiority of the wet needling group over the control group in NPRS, Kujala score, and knee flexion ROM. The discrepancies may be attributed to variations in intervention protocols, target muscle selection, or outcome measures, as the previous study utilized the KOOS scale rather than the Kujala questionnaire for functional assessment (20). The strengths of this study include its randomized clinical trial design, structured intervention protocol, and use of validated outcome measures, ensuring reliable and clinically relevant findings. The inclusion of both genders enhances the external validity of the results, making them applicable to a wider demographic. Additionally, the integration of wet needling with Kinesio taping and strengthening exercises provides a comprehensive therapeutic approach, addressing both myofascial and biomechanical components of patellofemoral pain syndrome.

Despite these strengths, several limitations must be acknowledged. The absence of a long-term follow-up restricts the ability to determine the sustained effects of the interventions. Moreover, while outcome assessors were blinded, the single-blind design poses a risk of bias, as participant awareness of treatment allocation could influence subjective pain reporting. Future studies should incorporate longer follow-up periods to assess the durability of treatment effects and investigate the comparative effectiveness of wet and dry needling techniques in greater detail. Subgroup analysis based on gender, occupation, or activity level could provide further insights into patient-specific responses to needling interventions. Exploring the underlying physiological mechanisms through imaging or biochemical markers may also enhance understanding of how needling contributes to pain modulation and functional recovery.

CONCLUSION

The findings of this study demonstrate that while Kinesio taping and strengthening exercises provide significant improvements in knee pain, function, and range of motion in individuals with patellofemoral pain syndrome, the addition of wet needling enhances these outcomes more effectively. The integration of wet needling into rehabilitation protocols appears to offer superior pain relief and functional gains, supporting its role as a valuable adjunct in managing unilateral patellofemoral pain syndrome. These results highlight the importance of a multimodal approach in rehabilitation, emphasizing the need for targeted interventions that address both muscular and biomechanical factors to optimize recovery and long-term joint health.

AUTHOR CONTRIBUTIONS

Author	Contribution
Hiba Zahid*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Muhammad Junaid Ijaz Gondal	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Rubab Naqvi	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Noor Ul Ain	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Rida Mustafa	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Intsam Aslam	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

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