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Effectiveness of Integrated Neuromuscular Inhibition Technique versus Conventional Exercise on Subjects with Piriformis Syndrome

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Abstract

Background: Piriformis syndrome is a neuromuscular disorder characterized by compression or irritation of the sciatic nerve by the piriformis muscle, resulting in pain and reduced hip range of motion. Conservative physiotherapy interventions such as Integrated Neuromuscular Inhibition Technique (INIT) and conventional exercise are commonly used; however, evidence comparing their effectiveness remains limited.

Objective: To compare the effectiveness of INIT and conventional exercise in reducing pain and improving hip range of motion in subjects with piriformis syndrome.

Methods: A comparative study was conducted among 40 subjects with piriformis syndrome, who were allocated into two groups (n=20 each). Group A received INIT, while Group B received conventional exercise for 8 weeks. Pain was assessed using the Visual Analogue Scale (VAS), and hip abduction and internal rotation range of motion were measured using a goniometer before and after the intervention.

Results: Both groups demonstrated significant improvement following treatment. However, Group A showed significantly greater reduction in VAS scores and greater improvement in hip abduction and internal rotation range of motion compared with Group B ($p<0.05$).

Conclusion: INIT was more effective than conventional exercise in reducing pain and improving hip range of motion in subjects with piriformis syndrome. It may be considered an effective conservative physiotherapy intervention for the management of piriformis syndrome.

Keywords: Piriformis syndrome, Integrated Neuromuscular Inhibition Technique, Conventional exercise, Visual Analogue Scale, Goniometer.

Introduction

Piriformis syndrome (PS) is a neuromuscular disorder caused by compression or irritation of the sciatic nerve by the piriformis muscle, resulting in buttock pain, radiating leg pain, and functional limitations. It accounts for approximately 6–8% of sciatica cases and is often misdiagnosed because its symptoms resemble those of lumbar radiculopathy and other musculoskeletal conditions.[1–3] The piriformis muscle plays an important role in hip external rotation, abduction, and pelvic stability. Piriformis muscle tightness, spasm, inflammation, or hypertrophy may compress the sciatic nerve, causing pain, restricted hip motion, and difficulty with daily activities. Prolonged sitting, repetitive activities, trauma, and muscle imbalance are considered common contributing factors.[4–6] Conservative physiotherapy is the

primary treatment for PS. Integrated Neuromuscular Inhibition Technique combines ischemic compression, strain-counterstrain, and muscle energy techniques to reduce myofascial trigger points, relieve pain, and improve muscle flexibility. Conventional exercise programs focus on strengthening the hip and gluteal muscles to restore function and reduce stress on the piriformis muscle.[7–9] Pain intensity is commonly assessed using VAS, while hip abduction and internal rotation are measured using a goniometer to evaluate functional improvement. Although both treatment approaches have demonstrated beneficial effects, evidence comparing their effectiveness in individuals with PS remains limited.[10,11] Therefore, the present study was conducted to compare the effectiveness of INIT and conventional exercise in reducing pain and improving hip range of motion in subjects with PS.

Methodology

Study Design and Participants

The study was approved by the institute ethics committee, IEC- RIPT/DT/21/4502. A comparative study was conducted over a period of six months in the Outpatient Department of Revathi Medical Center, Kumar Nagar, Tirupur. A total of 40 subjects diagnosed with PS were recruited using a convenience sampling method and randomly allocated into two groups of 20 participants each.

Inclusion and Exclusion Criteria

Participants aged 18–60 years with unilateral buttock pain, positive FAIR and Beatty's tests, and symptoms lasting more than one month were included in the study. Individuals with recent hip or lumbar trauma, psychiatric disorders, limb length discrepancy, bladder or bowel dysfunction, and pelvic pathologies were excluded. Written informed consent was obtained from all participants before enrolment.

Intervention

Group A received INIT based on Chaitow's protocol, which included ischemic compression, strain-counterstrain, and muscle energy technique. Each session lasted approximately 10–15 minutes and was administered twice weekly for 8 weeks (16 sessions). Group B performed a conventional exercise program consisting of bridges, straight leg raises, side leg raises, and bird-dog exercises with progressive repetitions over the same treatment duration.

Outcome Measures

Visual analogue scale (VAS) was used to assess pain intensity in participants with PS, while a goniometer was used to assess hip abduction and internal rotation. Outcome measures were assessed before and after completion of the intervention program.

Statistical Analysis

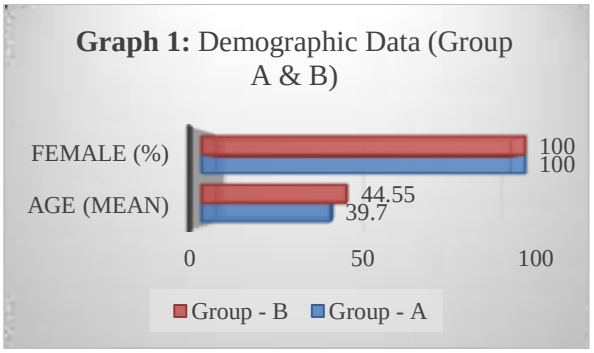
Data were analyzed using SPSS version 24. The Shapiro–Wilk test confirmed normal data distribution. Within-group comparisons were performed using the paired t-test, while between-group comparisons were analyzed using the independent t-test. Statistical significance was set at $p < 0.05$.

Demographic Variables

A total of 40 female participants diagnosed with Piriformis Syndrome were enrolled in the study and equally allocated into Group A (Integrated Neuromuscular Inhibition Technique, n = 20) and Group B (Conventional Exercise, n = 20). The overall mean age of the participants was 42.13 ± 8.37 years (range: 26–56 years). The mean age was 39.70 ± 7.44 years in Group A and 44.55 ± 8.69 years in Group B. Since all participants were female, the gender distribution was identical in both groups (100% female). The demographic variables of each group are summarized in Table 1 & Graph 1.

Table 1: Descriptive Analysis of Demographic Data (Group A and B)

Variables	Group A (n = 20)	Group B (n = 20)	Total (N = 40)
Age (years), Mean ± SD	39.70 ± 7.44	44.55 ± 8.69	42.13 ± 8.37
Gender –Female, n (%)	20 (100%)	20 (100%)	40 (100%)



Results

Twenty female participants with Piriformis Syndrome were recruited into each group: Group A (Integrated Neuromuscular Inhibition Technique) and Group B (Conventional Exercise). Pain intensity was assessed using the Visual Analogue Scale (VAS), while hip abduction and hip internal rotation range of motion (ROM) were measured using a goniometer before and after the intervention.

Baseline comparisons revealed no statistically significant differences between the two groups for VAS ($t = 0.390$), hip abduction ROM ($t = 1.59$), or hip internal rotation ROM ($t = 0.759$), indicating comparable pre-intervention characteristics. Following the intervention, both groups demonstrated significant improvements in all outcomes.

In Group A, the mean VAS score decreased from 6.90 to 2.70, with a mean difference of 4.20 (95% CI: 3.78–4.62), showing a highly significant reduction in pain ($t = 21.00$, $p < 0.0001$) and a very large effect size (Cohen's $d = 4.70$). Group B also demonstrated a significant reduction in pain, with the mean VAS score decreasing from 6.80 to 5.55, yielding a mean difference of 1.25 (95% CI: 0.95–1.55) ($t = 8.75$, $p < 0.0001$), and a large effect size (Cohen's $d = 1.96$). Similarly, hip abduction ROM improved significantly in both groups.

Group A demonstrates an increase from 26.75° to 35.50°, with a mean difference of 8.75° (95% CI: 8.45°–9.05°), ($t = 61.27$, $p < 0.0001$) and a very large effect size (Cohen's $d = 13.70$). Group B demonstrated an increase from 26.20° to 30.00°, with a mean difference of 3.80° (95% CI: 3.56°–4.04°), ($t = 32.48$, $p < 0.0001$), and a very large effect size (Cohen's $d = 7.26$). Hip internal rotation ROM also improved significantly following treatment. Group A increased from 12.85° to 21.35°, with a mean difference of 8.50° (95% CI: 8.08°–8.92°), ($t = 42.78$, $p < 0.0001$) and a very large effect size (Cohen's $d = 9.57$). Group B improved from 11.15° to 14.50°, with a mean difference of 3.35° (95% CI: 2.84°–3.86°), ($t = 13.75$, $p < 0.0001$) and a large effect size (Cohen's $d = 3.08$).

Findings indicate that INIT is more effective than conventional exercise in reducing pain and improving Hip ROM in subjects with PS. The outcome measures of the pre- and post-test of Group A are illustrated in Table 2 & Graph 2. The comparison of outcome measures of pre- and post-test values of Group B is illustrated in Table 3 & Graph 3.

Table 2: Group - A [Pre- and Post- Test Outcome Measures]

Outcome measures	Pre-test (Mean ± SD)	Post-test (Mean ± SD)	p-value
VAS	6.90 ± 0.788	2.70 ± 0.656	0.001*
Hip Abduction ROM	26.75 ± 3.27	35.50 ± 3.13	0.001*
Hip Internal Rotation ROM	11.65 ± 1.56	21.50 ± 2.25	0.001*

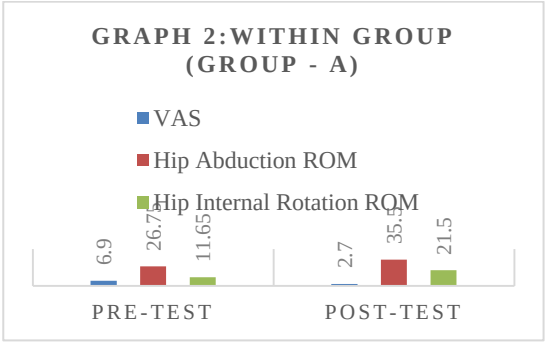
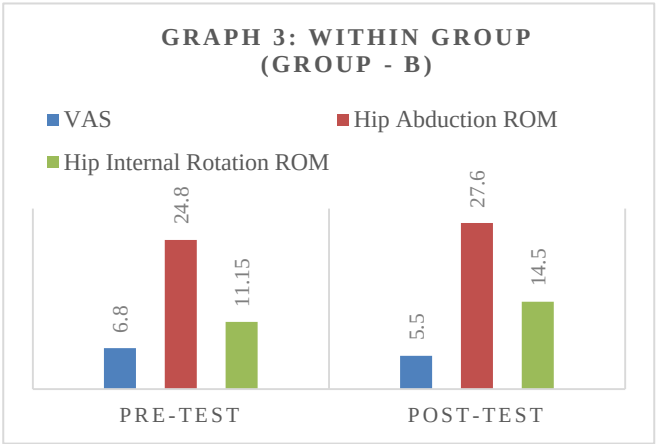


Table 3: Group - B [Pre- and Post- Test Outcome Measures]

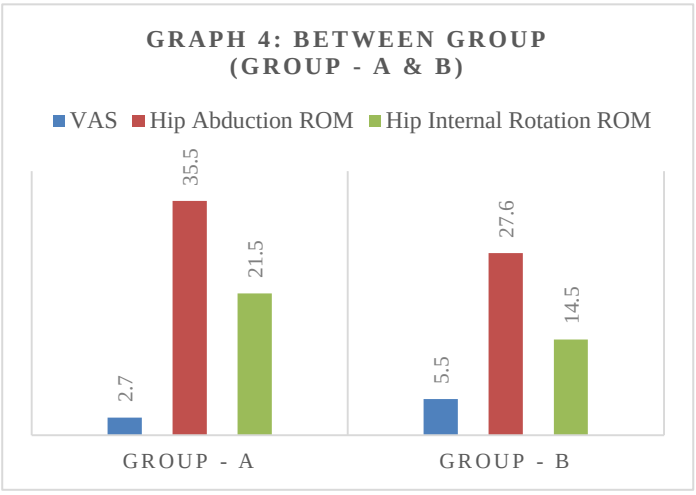
Outcome Measures	Pre-test (Mean ± SD)	Post-test (Mean ± SD	p-value
VAS	6.80 ± 0.833	5.50 ± 0.759	0.001*
Hip Abduction ROM	24.80 ± 4.37	27.60 ± 4.88	0.001*
Hip Internal Rotation ROM	11.15 ± 2.49	14.50 ± 2.48	0.001*



Between-group post-test comparisons demonstrated significantly greater improvements in Group A than Group B for pain intensity, hip abduction ROM, and hip internal rotation ROM (all $p < 0.0001$), as illustrated in Table 4 & Graph 4. These findings indicate that although both interventions were effective in reducing pain and improving hip range of motion, the Integrated Neuromuscular Inhibition Technique produced significantly greater clinical improvements than conventional exercise.

Table 4: Group – A & B [Outcome Measures]

Outcome Measures	Group - A (Mean ± SD)	Group - B (Mean ± SD	p-value
VAS	2.70 ± 0.656	5.50 ± 0.759	0.001*
Hip Abduction ROM	35.50 ± 3.13	27.60 ± 4.88	0.001*
Hip Internal Rotation ROM	21.50 ± 2.25	14.50 ± 2.48	0.001*



Discussion

The present study compared the effectiveness of INIT and conventional exercise in subjects with PS. Both interventions significantly reduced pain and improved hip ROM after 8 weeks of treatment. However, INIT produced significantly greater improvements in VAS, hip abduction ROM, and hip internal rotation ROM than conventional exercise.

The superior effect of INIT may be attributed to its combination of ischemic compression, strain-counterstrain, and muscle energy technique, which helps deactivate myofascial trigger points, reduce

muscle spasm, improve muscle flexibility, and restore normal biomechanics of the piriformis muscle. These mechanisms contribute to pain reduction and improved hip mobility.

The findings of the present study are consistent with previous studies by Thakur et al. and Gazbar et al., who reported that INIT was more effective than conventional physiotherapy interventions in reducing pain and improving functional outcomes in individuals with PS.

Although conventional exercise also resulted in significant clinical improvement by strengthening the hip and gluteal muscles and enhancing functional stability, its effectiveness was lower than that of INIT. This suggests that incorporating manual therapy techniques along with exercise may provide greater therapeutic benefits for individuals with PS. Overall, the results support the use of INIT as an effective conservative physiotherapy intervention for reducing pain and improving hip ROM in subjects with PS. Further studies with larger sample sizes and long-term follow-up are recommended to confirm these findings and evaluate their long-term clinical effectiveness.

Conclusion

INIT and conventional exercise were both effective in reducing pain and improving hip ROM in subjects with PS. However, INIT demonstrated significantly greater improvement in VAS, hip abduction ROM, and hip internal rotation ROM compared with conventional exercise. Therefore, INIT can be considered a more effective conservative physiotherapy intervention for the management of PS. Further studies with larger sample sizes and longer follow-up periods are recommended to validate these findings and establish long-term clinical outcomes.

Limitations and Recommendations

The present study had a relatively small sample size, which may limit the generalizability of the findings. The intervention period was limited to 8 weeks, and no long-term follow-up was conducted to evaluate the sustainability of treatment effects. Additionally, the study included participants from a single clinical center, which may reduce the external validity of the results. Future studies should include a larger sample size and recruit participants from multiple centers to improve the generalizability of the findings. Long-term follow-up is recommended to assess the durability of treatment outcomes. Further research may also compare INIT with other manual therapy techniques and evaluate additional outcomes such as functional disability, quality of life, and recurrence rates in subjects with PS.

Informed Consent

Written informed consent was obtained from all participants before the commencement of the study. Participation was voluntary, and confidentiality of participant information was maintained throughout the study.

Conflict of Interest

The authors declare that they have no conflict of interest regarding the publication of this study.

Author contributions

Abinaya S: Conceptualization, methodology, participant recruitment, data collection, statistical analysis, manuscript preparation, and manuscript revision.

Dr. Stanley E, Dr. S Ramkumar & Dr. Prabhuraja R: Study conception and design, supervision, methodology validation, interpretation of results, critical revision of the manuscript, and final approval of the manuscript.

Dr. P Bright Alwin Victor: Administrative support, overall academic guidance, and final approval of the manuscript.

Data availability statement

The datasets generated and analysed during the current study are available from the corresponding author upon reasonable request.

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