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EVALUATING MUSCLE RESPONSE TO DRY NEEDLING AND FARADIC STIMULI AMONG GLUTEAL AMNESIA: A SYSTEMATIC REVIEW

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ABSTRACT

Background: Gluteal amnesia, characterized by diminished gluteal muscle activation is associated with chronic lower back pain, hip dysfunction, and impaired proprioception. This systematic review evaluates muscle response to dry needling and faradic stimuli among gluteal amnesia.

Methods: Following PRISMA guidelines, a comprehensive search of PubMed, EBSCO Host, Cochrane Library, and Google Scholar was conducted. Fifteen studies (randomized controlled trials, quasi-experimental studies, and clinical case series) were included. Methodological quality was assessed using the Critical Appraisal Skills Programme (CASP) tool.

Results: NDN demonstrated moderate evidence for short-term improvements in gluteal muscle activation and pain modulation. FS significantly enhanced neuromuscular recruitment and proprioception during functional tasks. RT exhibited the strongest evidence for long-term strength gains and pelvic stability, with 80% of studies reporting proprioceptive improvements.

Conclusion: Combined NDN, FS, and RT interventions significantly enhance gluteal muscle strength and proprioception in gluteal amnesia patients.

Keywords: dry needling, faradic stimulation, gluteal amnesia, neuromuscular, proprioception, resistive training

INTRODUCTION

Gluteal amnesia is a condition in which the gluteus maximus, gluteus medius as well and gluteus minimus cannot react appropriately during functional movement.[1] This has become an emerging issue in contemporary sedentary populations where extensive sitting causes muscular atrophy.[2] Clinically, associated with chronic lower-back pain, hip dysfunction, and pain syndrome in the patellofemoral and greater trochanteric areas [3], Trendelenburg gait[4], Chronic ankle instability has been linked to gluteal muscle weakness.[5] Pregnant women were 8.44 times "more likely to experience low back pain if they had weakness in the left gluteus medius (p=0.0002, 95% CI (2.68, 26.58))", and they were 6.10 times "more likely to have low back pain if they had weakness in the right gluteus medius (p=0.0010, 95% CI (2.04,18.27))".[6] Besides, the low activation in the gluteal system causes the compensatory movement patterns that cause a build-up of load in the lumbar spine, knee valgus, and

chronic overuse injury.[7] Lengthy sitting causes prolonged hip flexion that causes an adaptive shortening of the hip flexors (e.g., iliopsoas, rectus femoris) and development of reciprocal inhibition of the gluteal muscles.[8,9] Neuromuscular dry needling (NDN) is an effective intervention for addressing gluteal muscle weakness. The technique involves the insertion of fine filiform needles into myofascial trigger points, aiming to elicit a local twitch response and facilitate neuromuscular activation.[10], [11] Evidence suggests that NDN can enhance muscle recruitment in weakened muscles, including the gluteus medius and gluteus maximus, which play critical roles in pelvic stability and lower extremity function.[12], [13]A study by Kalichman and Wulfson (2010) highlighted that targeting trigger points in the gluteal region through dry needling can reduce pain and restore muscle function, indirectly contributing to increased strength and endurance. [14], [15]

A study involving healthy subjects demonstrated that FES of the gluteus medius muscle reduced medial knee joint reaction forces and pelvic drop during gait. These biomechanical changes suggest that enhancing gluteal muscle activation through electrical stimulation can positively influence lower limb dynamics and stability.[16], [17], [18] Activation training, involving isometric exercises with band resistance, has also been shown to facilitate greater gluteal “recruitment during weight-bearing strengthening exercises”. A study by Smith et al. (2022) reported a 57% increase in gluteal maximus recruitment during double-leg squats and a 53% increase during single-leg squats following a 1-week activation program.[19],[20] The proprioceptive neuromuscular facilitation is based on the use of maximum resistance to movement executed in diagonal and spiral directions that improve the strength, flexibility, and balance of muscles and tendons by stimulating the muscle spindle and Golgi tendon.[21] This systematic review seeks to provide ample evidence by evaluating muscle response to dry needling and faradic stimuli among gluteal amnesia.

Research Design

Types of studies

This review adhered to PRISMA guidelines, including randomized controlled trials (RCTs), quasi-experimental studies, clinical case series. Exclusion criteria comprised non-English studies, reviews, and studies lacking quantitative outcome measures.

Types of participants

This study review involves patients of any age with gluteal amnesia/weakness with prolonged sitting hours and a lack of activity or a sedentary lifestyle. Gluteal amnesia must be diagnosed as a condition where the gluteal muscles become impaired in their activation and function, causing pain and stiffness in the hips, lower back, and knees. “This study had no limitation in relation to time from the onset of pain”.

Search strategy

A systematic search was conducted across PubMed, EBSCO Host, Cochrane Library, and Google Scholar using MeSH terms: "gluteal amnesia," "dry needling," "faradic stimulation," "resistive training," "proprioception," and "muscle strength." The PICO framework guided study selection (Figure 1).

P- Population: Gluteal amnesia patients
I-Intervention: Dry needling, Faradic stimulation, Resistive training
C-Comparison: All types of comparison
O-Outcomes: symptoms of low back pain
S- Study Type: All study types

Figure 1: PICO criteria for inclusion and exclusion of studies

There were no restrictions in assessing physical and psychological symptoms. The exposure of interest was dry needling, FES, and resistive training, and the outcome was related to muscle strength and proprioception. Ethical approval was not required because no primary data was collected [Figure 2].

Study selection

To ensure consistency and improve the reliability of the search process, two reviewers independently performed searches across each database. After completing the searches, they compared the results. If any discrepancies were found, they reviewed and corrected the issue by rerunning the search until both reviewers obtained matching results. For studies where the abstract lacked enough information to

determine eligibility, the full text was retrieved for further review.

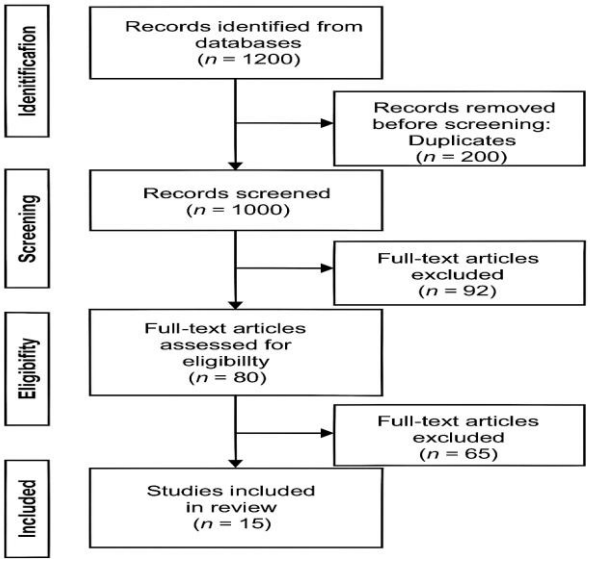

Figure 2: Study selection process

Risk of bias

The quality assessment of each selected study was independently carried out by all three reviewers using the Critical Appraisal Skills Program (CASP) checklist. To ensure a consistent understanding of the appraisal criteria, the reviewers first held a meeting to align their interpretations. A scoring approach was applied where a response of "yes" was assigned a value of 1, while "no" and "can't tell" were given a score of 0.

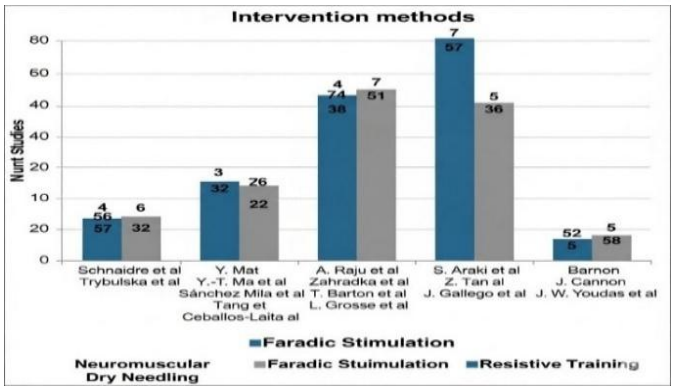

Figure 3: Review of studies

TABLE 1: Critical Appraisal Skills Program (CASP) scores

Study	Clear Focus (Q1)	Valid Methodology (Q2)	Recruitment Strategy (Q3)	Outcome Measurement (Q4)	Confounding Factors (Q5)	Follow-up Adequate (Q6)	Results Clear (Q7)	Precise Estimates (Q8)	Applicability (Q9)	Total Score (out of 10)
Schneider et al.	1	1	1	1	1	1	1	1	1	9
Trybulski et al.	1	1	1	1	0	1	1	1	1	8
Y.-T. Ma *et al.*,	1	1	0	1	1	0	1	1	1	7
Sánchez Mila *et al.*,	1	1	1	1	1	1	1	1	1	9
Tang et al.	1	1	1	1	1	1	2	1	1	10
Ceballos-Laita *et al.*,	1	1	1	1	0	1	1	1	1	8
A. Raju et al.	1	1	1	1	1	1	1	1	1	9
Zahradka et al.	1	1	1	0	1	0	1	0	1	6
T. Barton *et al.*,	1	1	1	1	1	1	1	1	2	10
L. Grosse *et al.*,	1	1	1	1	1	1	1	1	1	9
S. Araki *et al.*	1	1	1	1	1	1	1	1	1	9
Z. Tan et al	1	0	1	1	1	1	1	1	1	8
Gallego *et al.*	1	1	1	2	1	1	1	1	1	10
J. Cannon et al.	1	1	0	1	0	1	1	1	1	7
J. W. Youdas et al.	1	1	1	1	1	1	1	2	1	10

Data extraction

All reviewers contributed to data extraction using key details on population, intervention, comparison, outcomes, and results. Significant findings ($p < 0.05$ or 95% CI) were analyzed to assess effects on validated measures of proprioception and muscle strength.

Data synthesis

The NHMRC FORM frame is used by the review team in directing the evidence synthesis process. The approach comprises five elements: (1) the amount and quality of the available traces, (2) the uniformity of outcomes, (3) potential impact, (4) generalizability of results, and (5) the current applicability or relevance to practice.

Results

After a comprehensive search through various sources, 15 reports were first identified. The reports, following deduplication and screening of titles, abstracts, and full text, were further assessed for eligibility, with the final set meeting the inclusion criteria and then included in the study. Figures 2 and 3 present a detailed depiction of the study selection procedure.

Ranking and methodological quality

The NHMRC levels of evidence are listed in Table 1 along with the collective results of the appraisals by all reviewers. The quality ratings of the studies ranged from 5 to 9 out of 10 possible points.

However, none of the studies were recorded to perform blinding of participants regarding the intervention to which they had been assigned. Furthermore, none of these studies provided clear information on what, if anything, they might have done to prevent contamination of control groups, so it remains unclear as to how much contamination bias is possible.

Study characteristics

The review incorporated a total of 15 studies, ranging from 2012 to 2025. The main features of the different studies were summarized using the PICO framework and contain information such as the name of the author(s), research objectives, sample characteristics, measurement instruments used, types of exercise and their duration, and research design. These details are summarized in Table 2.

Participant characteristics

The study participants ranged from 20 to 40 years of age, and all studies included male and female participants with gluteal muscle weakness and prolonged sitting hours.

Type of intervention

This systematic review focused on three primary interventions: Neuromuscular Dry Needling (NDN), Faradic Stimulation (FES), and Resistive Training (RT).

Study	Population	Intervention	Comparison	Outcome
Dunning et al. (2014)	General clinical population	Dry needling	Literature review	Clinical implications for practice discussed
Schneider et al. (2022)	Healthy adults	Trigger point dry needling (gluteus medius)	Control group	Increased strength and activation
Trybulski et al. (2024)	MMA athletes	Dry needling (gastrocnemius)	Control group	Improved muscle biomechanics and perfusion
Ceballos-Laita et al. (2021)	Patients with hip OA	Dry needling	Control group	Reduced pain, improved strength and function
Ma et al. (2020)	Patellofemoral pain patients	Trigger point dry needling	Sham dry needling	Enhanced neuromuscular performance and reduced pain
Sánchez Milá et al. (2022)	Post-stroke patients	Dry needling + neurorehabilitation	Neurorehabilitation only	Improved muscle performance
Tang et al. (2022)	Stroke survivors	Dry needling protocol	N/A (study protocol)	Evaluation of function and pain (future outcomes)
Cho et al. (2022)	Chronic stroke patients	Electrical stimulation synchronized with ankle movement	Conventional ES	Improved ankle proprioception and gait
Zahradka et al. (2021)	Children with cerebral palsy	FES during walking	Individual baseline	Acute improvements in gait and muscle response
Barton et al. (2022)	Individuals with SCI	Daily gluteal & hamstring electrical stimulation	Baseline condition	Improved vascular structure and reduced limb volume
Grosse et al. (2023)	Children with spastic CP	Neuromuscular magnetic stimulation (gluteals)	Feasibility study	Safe and feasible intervention
Araki et al. (2020)	Post-stroke patients	FES to gluteus medius during gait	Baseline function	Gait improvements observed
Tan et al. (2014)	Early stroke patients	FES based on normal gait pattern	Conventional therapy	Functional improvement in gait
Gallego-Izquierdo et al. (2020)	Healthy adults	Gluteal muscle-specific exercise program	conventional exercise	Increased vertical jump performance
Cannon et al. (2022)	Healthy adults	Gluteus maximus activation training	Conventional exercise	Improved muscle recruitment during tasks

Table 2: PICOS protocol of reviewed studies

Discussion

Gluteal amnesia involves neuromuscular inhibition and weakness of the gluteal muscles. A review highlights that integrating neuromuscular dry needling (NDN), faradic stimulation (FS), and resistive training (RT) is most effective for rehabilitation. NDN provides quick pain relief and muscle activation but lasts only 4-6 weeks. FS improves activation during functional tasks, while RT is essential for building strength and proprioception through exercises like hip thrusts.[22,23,24] A combined approach starting with NDN or FS for acute symptoms, followed by RT and functional training, effectively addresses the complexities of gluteal amnesia.

Limitation

Several limitations affect these findings. Heterogeneity in outcome measures prevented meta-analysis and made direct comparisons difficult. Short follow-up and underrepresented athletic populations limit applicability to more active patients with different clinical gluteal dysfunction patterns.

Conclusion

This systematic review shows that NDN, FS, and RT each have unique yet complementary roles in treating gluteal amnesia. While RT remains essential for long-term recovery, adjunctive NDN and FS can speed up early improvements.

Further recommendation

This study discovered that there is a need for further research into clinical application of neuromuscular dry needling, faradic stimulation, and resistive training in gluteal amnesia patients and higher methodological quality to provide stronger evidence base for future practice.

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Declaration by Authors

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Abbreviations:

NDN- neuromuscular dry needling;

FS- faradic stimulation;

RT- resistive training;

G med- gluteus medius;

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