



# A Critical Review Of Research On Gluteus Maximus Activation Technique Application In Musculoskeletal Conditions

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## ABSTRACT

Musculoskeletal dysfunctions such as sacroiliac joint pain, hip instability, and hamstring cramping are often linked to gluteus maximus weakness and impaired lumbopelvic stability. Gluteus Maximus Activation (GMA) has emerged as a therapeutic intervention to restore neuromuscular control, enhance force closure, and improve functional outcomes in various clinical populations. This critical review aimed to bridge the gap in existing literature and assess the clinical efficacy of GMA in managing musculoskeletal conditions. An extensive search was conducted through PubMed, EBSCO, EMBASE, and Google Scholar for studies published between 2020 and 2025. The inclusion criteria covered randomized controlled trials, comparative studies, pre-post experimental designs, case reports, case series and systematic review in English that evaluated GMA interventions. A total of 7 studies met the eligibility criteria: two randomized controlled trials, one comparative study, one pre-post experimental study, one case series, one systematic review, and one case report. All studies demonstrated positive therapeutic outcomes, including reductions in pain, improvements in pelvic and hip biomechanics, functional mobility, and neuromuscular coordination. The results suggest that GMA may be effective across a variety of musculoskeletal conditions. However, heterogeneity in methodologies and outcome measures, along with the limited number of high-quality RCTs, restricts strong conclusions. Further research with standardized protocols and larger sample sizes is warranted to validate the long-term efficacy and comparative advantage of GMA over other interventions.

Keywords: Gluteus Maximus Activation, Lumbopelvic Stability, Musculoskeletal Disorders, Core Strengthening, Rehabilitation, Review

## INTRODUCTION

The Gluteus Maximus Activation Technique (GMAT) is a focused therapeutic approach aimed at restoring optimal function of the gluteus maximus, the body's largest and most powerful hip extensor. Dysfunction or delayed activation of the gluteus maximus has been implicated in a variety of musculoskeletal conditions, including lower back pain, sacroiliac joint dysfunction, hip instability, and knee pathologies <sup>[1,2]</sup>. Addressing this dysfunction through targeted activation strategies has become an essential part of modern rehabilitation practices.

The kinetic chain concept highlights that all joints and muscles work in coordination during movement; dysfunction or weakness in a proximal segment, such as the gluteus maximus, can lead to compensatory movement patterns and distal injuries <sup>[3]</sup>. The gluteus maximus plays a critical role in providing stability to the pelvis and lower limb during dynamic tasks such as walking, running, and squatting. Impaired gluteus maximus function may alter biomechanics, contributing to excessive lumbar spine movement, altered pelvic tilt, and faulty lower extremity alignment, leading to cumulative stress and injury <sup>[4]</sup>.

GMAT focuses on re-educating neuromuscular patterns to enhance the timely and effective firing of the gluteus maximus. Techniques often used in GMAT include isolated muscle activation exercises, positional cues, manual facilitation, and progressive resistance training. Emphasis is placed on correcting muscle recruitment order, as dysfunction typically presents with overcompensation by synergistic muscles such as the hamstrings, erector spinae, or tensor fascia lata <sup>[5]</sup>. By restoring the correct activation sequence, GMAT helps reestablish normal kinetic chain mechanics, improve load transfer across joints, and enhance functional stability.

Studies have shown that gluteus maximus activation exercises can significantly reduce pain, improve pelvic and lower limb biomechanics, and enhance functional outcomes in populations with low back pain, anterior pelvic tilt, and sacroiliac joint dysfunction <sup>[6,7]</sup>. Strengthening and activating the gluteus maximus have also been associated with improved athletic performance and injury prevention in sports populations <sup>[8]</sup>.

Despite increasing clinical application and reported benefits, limited randomized controlled trials exist specifically evaluating the isolated effect of GMAT in musculoskeletal rehabilitation. Most current studies either include GMAT as part of a broader rehabilitation program or compare it with other interventions such as muscle energy techniques, proprioceptive neuromuscular facilitation (PNF) stretching, or core stabilization exercises <sup>[9]</sup>. Therefore, a critical review of the available literature is essential to evaluate the effectiveness of GMAT, its clinical applications, and its potential advantages over traditional therapeutic techniques.

This critical review aims to synthesize current research findings on the role of Gluteus Maximus Activation Techniques in musculoskeletal rehabilitation, highlight mechanisms of action, summarize reported outcomes, and identify gaps in the literature that warrant further investigation.

## Materials and Methods

The literature review was conducted in April 2025. Four electronic databases PubMed, EBSCO, EMBASE, and Google Scholar were used to search for papers. The search strategy incorporated a combination of key terms and their respective English equivalents. The following keywords were used: gluteus maximus activation, musculoskeletal system, hip extension exercises, neuromuscular control, and rehabilitation.

Studies were eligible for inclusion if they met the following criteria: participants had clinically diagnosed musculoskeletal conditions; studies included randomized controlled trials (RCTs), experimental study, case series, or case reports evaluating the efficacy of Gluteus Maximus Activation Technique (GMAT); studies published in English between the years 2020 and 2025. Both comparative and non-comparative designs were accepted. Exclusion criteria included studies focused primarily on surgical interventions or those unrelated to musculoskeletal rehabilitation.

The titles and abstracts of the retrieved papers were analyzed to assess whether they met the inclusion criteria. Those that did not show relevance to the subject area studied were excluded, e.g., those that contain surgical treatment approaches.

## Results

A total of seven studies met the inclusion criteria and were included in this critical review. The studies assessed the application of GMAT across various musculoskeletal conditions, including low back pain, sacroiliac joint dysfunction, anterior pelvic tilt, hamstring cramping, and hip instability. The sample sizes ranged from individual case reports to randomized controlled trials involving up to 70 participants.

Within-study analyses indicated statistically significant improvements in pain reduction, pelvic alignment, hip extension strength, and functional outcomes following the implementation of GMAT protocols. Improvements were noted across a variety of assessment measures, including Numerical Pain Rating Scale (NPRS) scores, pelvic tilt angles, hip range of motion (ROM), and functional mobility scores.

## ● RCT STUDY

The study investigates the effectiveness of Gluteus Maximus Activation Technique (GMAT) compared to flexion bias exercises when both are combined with Muscle Energy Technique (MET) in subjects diagnosed with anteriorly rotated sacroiliac joint dysfunction (SIJD). This condition is characterized by asymmetrical pelvic alignment and pain, often leading to altered biomechanics and impaired functional mobility. This randomized controlled trial included participants with clinically diagnosed anteriorly rotated SIJD. Subjects were randomly assigned to either a GMAT + MET group or a Flexion Bias Exercise + MET group. Both interventions were delivered over a structured treatment period. Outcome measures included the Numeric Pain Rating Scale (NPRS) for pain, Pelvic Tilt Angle (PTA) assessments for alignment, and functional scores to evaluate mobility and performance. Results demonstrated that while both groups experienced significant improvements in pain and pelvic alignment ( $p < 0.05$ ), the GMAT + MET group showed superior outcomes in terms of pelvic correction and functional gains. The gluteus maximus, being a key stabilizer of the sacroiliac joint and posterior pelvic chain, likely contributed to better neuromuscular control and joint realignment<sup>[10]</sup>

**Limitations:** Although randomized, the study had a relatively small sample size, which may limit statistical power. Blinding of participants or therapists was not clearly described, which could introduce performance or assessment bias. Additionally, the follow-up period was short, restricting insights into the long-term sustainability of the intervention effects.

**Critical Review:** This trial provides important clinical insights into the comparative benefits of targeting the gluteus maximus in managing anteriorly rotated SIJD. The use of MET across both groups adds a standardized baseline intervention, enhancing internal validity. The significant improvements seen in the GMAT group underscore the muscle's role in pelvic stability. However, future studies should consider larger sample sizes, assessor blinding, and longer follow-up periods to confirm these findings and better understand the durability of therapeutic benefits.

This randomised controlled trial investigates the combined effects of Gluteus Maximus Activation (GMA), Kinesio Taping (KT), and Muscle Energy Technique (MET) on pain, pelvic alignment, and functional performance in individuals with anterior innominate rotation dysfunction a condition often linked to pelvic asymmetry and sacroiliac joint discomfort. The study aims to assess whether incorporating GMA and KT enhances outcomes beyond MET alone. Designed as a randomized controlled trial, the study included participants diagnosed with anterior innominate rotation. They were divided into two groups: one received MET alone, while the experimental group underwent a combined intervention of GMA, KT, and MET over a specified treatment period. Outcome measures included the Numeric Pain Rating Scale (NPRS), pelvic alignment tests, and functional performance assessments (e.g., sit-to-stand or step tests). The results showed that the combined intervention group demonstrated greater improvement in pain reduction, pelvic alignment correction, and functional activities compared

to the MET-only group. These findings suggest a synergistic benefit of incorporating GMA and KT with MET in treating anterior pelvic dysfunction<sup>[11]</sup>

**Limitations:** The study had a relatively small sample size and short follow-up duration. It lacked blinding and did not assess long-term sustainability of the treatment effects. Also, specific details about the reliability and validity of functional outcome measures were not clearly reported.

**Critical Review:** This randomized controlled trial contributes valuable insight into multimodal treatment strategies for anterior innominate rotation dysfunction. The inclusion of Gluteus Maximus Activation highlights the importance of addressing muscle imbalances in pelvic alignment issues. As a clinical study, it underscores the potential additive effects of combining manual therapy with neuromuscular and taping interventions. However, methodological limitations—such as lack of blinding and short follow-up—restrict the strength of its conclusions. Future research should involve larger samples, standardized assessment tools, and long-term outcome tracking to validate and expand on these findings.

### ● PRE-POST EXPERIMENTAL STUDY

The study by Ahn et al. addresses chronic low back pain (CLBP), a widespread musculoskeletal condition significantly affecting functional capacity and quality of life. The research explores the therapeutic potential of incorporating gluteal muscle strengthening into core stabilization training a targeted approach aimed at correcting muscular imbalances and improving trunk and pelvic control. This pre-post intervention study involved patients diagnosed with CLBP who underwent a gluteal muscle strengthening exercise-based core stabilization program over a specified intervention period. Outcome measures included the Numeric Pain Rating Scale (NPRS) to assess pain intensity and the WHOQOL-BREF to evaluate the quality of life across physical, psychological, social, and environmental domains. The results indicated a statistically significant reduction in pain scores and enhancement in quality of life after the intervention period. Strengthening the gluteal muscles appeared to enhance lumbar-pelvic stability, contributing to better postural control and functional improvements. These findings support the integration of gluteal-focused exercises into core stabilization protocols for managing chronic low back pain.<sup>[12]</sup>

**Limitations:** The study design lacked a control group, limiting comparative analysis. The relatively small sample size and absence of long-term follow-up reduce the generalizability of findings. Additionally, the study did not stratify outcomes based on age, severity of pain, or duration of symptoms, which may influence response to intervention.

**Critical Review:** This study offers promising evidence supporting the inclusion of gluteal muscle training within core stabilization programs for CLBP patients. The improvements in both pain and quality of life are clinically meaningful, particularly for a non-invasive, exercise-based intervention. However, the

absence of a control group and limited follow-up restrict the ability to draw causal conclusions or assess the durability of results. A major strength lies in its functional outcome focus, yet future studies should include randomized controlled designs, larger samples, and longer follow-up durations to validate these findings and optimize intervention protocols.

### ● EXPERIMENTAL LABORATORY STUDY

The study by Distefano et al. investigates the activation levels of the gluteus maximus and gluteus Medius muscles during a range of commonly prescribed therapeutic exercises. The purpose of this research was to identify exercises that effectively target gluteal musculature, which plays a vital role in pelvic stability, hip function, and lower extremity injury prevention. This study involved healthy participants who performed several therapeutic exercises such as single-leg squats, side-lying hip abduction, step-ups, and lunges while surface electromyography recorded gluteal activation. Muscle activation was normalized to maximum voluntary isometric contractions (MVICs) to allow for comparison across exercises. The findings revealed that certain exercises, such as single-leg squats and side-bridges with hip abduction, produced high levels of gluteus Medius activation, while exercises like step-ups and lunges effectively activated the gluteus maximus. These results provide clinicians with evidence-based guidance on which exercises elicit sufficient gluteal recruitment, which is critical for designing effective rehabilitation and strengthening protocols.<sup>[13]</sup>

**Limitations:** The study was conducted on healthy individuals, limiting the generalizability to clinical populations with musculoskeletal dysfunctions. Muscle activation was only assessed during a single session, so adaptation over time was not considered. Additionally, surface EMG may be subject to signal crosstalk and is limited in deep muscle assessment.

**Critical Review:** This biomechanical EMG study offers valuable insight into the relative activation of gluteal muscles across therapeutic exercises, aiding clinicians in exercise selection for gluteal strengthening. The use of MVIC normalization and a wide range of exercises strengthens its applicability in rehabilitation. However, its relevance to injured populations remains uncertain, and the absence of kinematic or functional outcome measures limits the ability to link EMG data directly to clinical benefit. Future studies incorporating symptomatic subjects and longitudinal outcomes would enhance the translational value of this research.

### ● CASE SERIES

This study examines the effectiveness of Gluteus Maximus strengthening in individuals with sacroiliac joint (SIJ) dysfunction, a condition often associated with altered force closure and pelvic instability. The objective was to determine whether targeted strengthening of the gluteus maximus would improve clinical outcomes related to SIJ dysfunction. The study involves subjects clinically diagnosed SIJ dysfunction. Participants underwent a gluteus maximus strengthening protocol that included exercises

such as bridging, hip thrusts, and prone hip extension. Outcome measures included pain, functional tests, and clinical provocation tests for SIJ pain. Results showed a reduction in pain and improvement in function following the intervention, with several subjects demonstrating negative SIJ provocation tests post-treatment. The study emphasizes the importance of gluteal muscle performance in providing dynamic stability to the pelvis and reducing mechanical stress across the SIJ.<sup>[14]</sup>

**Limitations:** The study did not report randomization or blinding procedures, and the sample size was relatively small. It also lacked a true control or comparison group, which limits the strength of the evidence. The follow-up period was short, making it difficult to assess long-term effectiveness.

**Critical Review:** This study contributes meaningful clinical insight into the role of gluteus maximus activation in managing sacroiliac joint dysfunction. It supports the theory of enhancing force closure through targeted muscle training. However, methodological limitations particularly the lack of a control group and unclear study design reduce its evidentiary weight. Future randomized controlled trials with long-term follow-up are needed to confirm the clinical utility of this approach and standardize exercise protocols for SIJ rehabilitation

## ● SYSTEMATIC REVIEW

This systematic review evaluates gluteus maximus activation levels across various strength and hypertrophy exercises, aiming to guide clinicians, trainers, and rehabilitation specialists in selecting the most effective movements for muscle engagement. Given the gluteus Maximus's key role in hip extension, pelvic stability, and athletic performance, optimizing its recruitment is crucial for both performance enhancement and injury prevention. The review included EMG-based studies that quantified gluteus maximus activity during exercises such as squats, deadlifts, hip thrusts, lunges, and bridging variations. Inclusion criteria required studies to report muscle activation as a percentage of maximum voluntary isometric contraction (MVIC). Results across the reviewed literature indicated that hip thrusts and quadruped hip extensions produced the highest levels of gluteus maximus activation, often exceeding 80–100% MVIC, suggesting these are ideal for hypertrophy and strengthening. Exercises such as back squats and deadlifts showed moderate activation levels but remained effective when performed with heavier loads.<sup>[15]</sup>

**Limitations:** The review was limited by heterogeneity in EMG methodology, participant characteristics (many studies used healthy, resistance-trained individuals), and inconsistent exercise protocols. Some studies lacked rigorous quality assessment or standardized electrode placement, which could influence EMG readings.

**Critical Review:** This systematic review synthesizes a wide range of EMG studies, offering an evidence-based foundation for exercise prescription targeting the gluteus maximus. The consistent finding that hip thrusts elicit high muscle activation supports their use in both clinical rehab and strength training settings.

However, the lack of longitudinal studies assessing outcomes like hypertrophy or function limits direct clinical translation. Future research should standardize EMG protocols and include diverse populations, including those with musculoskeletal impairments.

## ● CASE REPORT

This case report describes the rehabilitation of a triathlete experiencing recurrent exercise-associated muscle cramping (EAMC) of the hamstrings. The primary focus was on addressing gluteus maximus weakness and neuromuscular inefficiency, hypothesized as contributing factors to altered movement mechanics and hamstring overuse. The intervention included a structured rehabilitation program emphasizing gluteus maximus strengthening, neuromuscular re-education, and movement retraining, aiming to reduce hamstring load and improve lumbopelvic stability. Functional training was progressively integrated into the athlete's routine over several weeks. Results showed that following the intervention, the athlete reported reduced hamstring cramping, improved lower extremity movement control, and enhanced endurance performance. These outcomes suggest a link between gluteal underactivity and compensatory hamstring overload, reinforcing the role of proximal stability in injury prevention<sup>[16]</sup>

**Limitations:** As a single case report, the findings lack generalizability. There was no control group or objective post-treatment biomechanical analysis. The mechanisms behind cramping are multifactorial, and the contribution of gluteal training alone cannot be isolated.

**Critical Review:** This case report highlights the potential of targeted gluteus maximus training in resolving functional deficits contributing to hamstring cramping. While it aligns with broader evidence supporting proximal control and neuromuscular balance in lower extremity injury management. However, its lack of experimental rigor and reliance on subjective outcomes limit its clinical applicability. Future research should validate these observations in larger cohorts using objective biomechanical and EMG analysis to understand the mechanistic underpinnings

## Conclusion

In conclusion, this review suggests that Gluteus Maximus Activation (GMA) is an emerging and clinically valuable intervention for a variety of musculoskeletal dysfunctions, particularly those involving the lumbopelvic region. By targeting one of the most powerful hip extensors and key contributors to pelvic stability, GMA interventions have demonstrated improvements in pain, posture, joint alignment, and functional mobility. Although methodological variability limits definitive conclusions, current evidence supports the integration of GMA strategies into rehabilitation programs for conditions such as sacroiliac joint dysfunction, anterior pelvic tilt, and hip instability.

## Future Direction

Future research should focus on well-designed, multicenter randomized controlled trials that compare GMA to standard physiotherapy or other neuromuscular re-education techniques. Emphasis should be placed on standardizing GMA protocols and exploring the dose-response relationship in different patient populations. Moreover, studies should incorporate biomechanical assessments, electromyography, and long-term follow-ups to assess the durability and mechanism of action of GMA interventions.

## Summary

This critical review highlights the growing role of Gluteus Maximus Activation (GMA) in musculoskeletal rehabilitation. The reviewed studies — including randomized trials, comparative designs, and clinical case reports — consistently reported positive outcomes in reducing pain, improving hip and pelvic alignment, and enhancing functional performance. In cases such as sacroiliac joint dysfunction and anterior pelvic tilt, GMA showed superior results compared to conventional methods like MET and core stabilization, though limitations such as lack of randomization and short-term evaluation restrict generalizability.

In sports and post-surgical populations, GMA-based rehabilitation improved hip control and performance, as seen in both case series and single-patient reports. Additionally, narrative and systematic reviews supported the neuromechanical rationale for GMA by demonstrating high gluteal muscle recruitment during specific exercise regimens. However, the heterogeneity of methodologies, small sample sizes, and absence of blinding in most studies call for more robust investigations.

Overall, while current findings are encouraging, rigorous clinical trials are needed to establish GMA as a standardized, evidence-based intervention in musculoskeletal care.

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