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# Stretching Exercise in Piriformis Syndrome: A Comprehensive Review of Current Evidence (2023–2026)

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**Abstract:** ***Piriformis syndrome (PS) is a potential cause of extra pelvic sciatic nerve entrapment and is commonly associated with gluteal pain that may radiate into the lower extremity. This comprehensive review synthesizes literature presented as published between 2023 and 2026 on the physiological mechanisms, clinical outcomes, and practical protocols of stretching exercises for PS. The reviewed material indicates that stretching may improve pain, functional capacity, flexibility, and quality of life by modifying muscle extensibility, reducing excessive muscle tone, and supporting neuromuscular re-education. Commonly described approaches include supine figure-four, seated, standing gluteal, and prone piriformis stretches, generally performed for 30–60 seconds over several repetitions. Reported clinical findings favor structured stretching, although protocols and study designs vary and the strength of the evidence requires careful appraisal. Stretching should be individualized, progressed gradually, and performed without provoking sharp or radiating pain. Combining stretching with ergonomic changes, strengthening, and postural education may be appropriate for selected patients. Further well-designed trials are needed to establish optimal dosage, compare techniques, and verify the reported effect sizes and long-term outcomes.***

***Keywords: Conservative Management; Muscle Flexibility; Piriformis Syndrome; Sciatic Nerve Entrapment; Stretching Exercise.***

## 1. Introduction

Piriformis syndrome (PS) is described as an under-recognized cause of buttock pain and sciatica-like symptoms. It may occur when the piriformis muscle develops spasm, hypertrophy, or fibrosis and affects the nearby sciatic nerve as it passes through the greater sciatic foramen [1], [2]. The supplied literature estimates that PS may account for approximately 6%–8% of low back pain presentations, with prolonged sitting and occupational demands identified as potential contextual factors [3]. These estimates should be interpreted in light of diagnostic uncertainty and variation in case definitions. Clinical presentation commonly includes deep gluteal pain aggravated by prolonged sitting, squatting, or palpation near the sciatic notch. Some patients also report paresthesia or numbness along the posterior thigh and calf. Differentiating PS from lumbar spine disorders can be difficult, although imaging approaches such as dynamic ultrasound and magnetic resonance neurography have been discussed as aids to assessment [4], [5].

Conservative management is commonly emphasized, and stretching is proposed to restore muscle length, improve flexibility, and reduce mechanical irritation near the sciatic nerve [6]. The rationale includes interruption of a cycle in which muscle shortening, altered local circulation, pain, and further guarding may reinforce one another. This review examines the anatomical and physiological rationale for stretching, summarizes protocols and reported clinical outcomes, compares stretching with other conservative interventions, and outlines clinical considerations and research priorities.

## 2.Anatomical and biomechanical considerations

The piriformis originates from the anterior surface of the sacrum, passes through the greater sciatic foramen, and inserts on the superior aspect of the greater trochanter. It contributes to external rotation of the hip when extended and abduction when flexed. The anatomical relationship between the muscle and sciatic nerve varies; the nerve usually passes inferior to the muscle, but variants include passage through or division around the muscle [7], [8]. Such variation may be relevant when interpreting symptoms and planning examination or treatment.

Biomechanical studies described in the supplied material report reduced hip internal rotation and altered gait patterns among patients with PS, including shorter stride length and changes in pelvic rotation [9]. These adaptations may represent responses to pain or restricted movement and can contribute to loading of adjacent structures. Proposed pathophysiological mechanisms include muscle shortening, local ischemic changes, inflammatory signaling, and increased pressure on the sciatic nerve; the relative contribution of each mechanism may differ between individuals [10], [11].

## 3. Physiological mechanisms of stretching in piriformis syndrome

### 3.1. Viscoelastic properties and muscle length

Stretching applies a sustained tensile load to the muscle–tendon unit and may produce immediate changes in tissue extensibility as well as adaptations with repeated practice. The supplied literature discusses elongation of sarcomeres and changes in the collagen matrix, with stress relaxation contributing to time-dependent deformation [12], [13]. In vivo elastography studies are described as finding greater piriformis stiffness in symptomatic participants and reduced stiffness after structured stretching, with changes associated with symptom improvement [14], [15]. These findings are promising, but the interpretation depends on study design, measurement reliability, and whether the

observed changes are specific to PS.

### 3.2. Neuromuscular adaptations

Stretching may also affect neuromuscular activity and pain perception. Proposed mechanisms include altered sensory input from muscle and tendon receptors, changes in resting muscle tone, and modulation of pain-processing pathways [16], [17]. Regular stretching may therefore influence symptoms through both local mechanical effects and broader responses to movement and self-management. Mechanistic explanations should not be taken as proof that any single neural pathway accounts for clinical improvement.

## 4. Evidence-based stretching protocols

### 4.1. Optimal stretching parameters

The material reviewed commonly describes holds of 30–60 seconds, repeated three to five times per session and performed two to three times daily. One review cited in the supplied text suggests these parameters may support short-term symptom relief and flexibility gains, while holds longer than 60 seconds may not provide additional benefit for every patient [18], [19]. Stretch intensity should remain tolerable and should not provoke sharp or radiating pain. Progression should be gradual and guided by symptom response, movement quality, and adherence.

### 4.2. Specific stretching techniques

Four techniques are frequently discussed: the supine figure-four stretch, the seated piriformis stretch, a standing gluteal stretch, and a prone stretch involving hip rotation. Selection should reflect the patient's mobility, comfort, balance, and ability to perform the movement without aggravating symptoms. The supplied source assigns evidence grades to these techniques; these grades are reproduced as reported and have not been independently validated for this document.

Table 1. Common stretching techniques for piriformis syndrome

| Technique | Description | Hold duration | Frequency | Evidence grade as supplied |
|---|---|---|---|---|
| Supine figure-four stretches | Supine; affected ankle crossed over opposite knee; pull thigh toward chest | 45–60 s | 3–5 repetitions, 2–3 times daily | Level 1A [6] |
| Seated piriformis stretches | Seated; affected ankle crossed over opposite knee; lean forward | 30–45 s | 3 repetitions, twice daily | Level 1B [20] |
| Standing gluteal stretch | Standing; affected leg crossed behind; lean toward supported side | 30–60 s | 3–4 repetitions, twice daily | Level 2A [21] |
| Prone piriformis stretches | Prone with knee flexed and passive internal rotation of hip | 45 s | 3 repetitions daily | Level 2B [22] |

The seated technique may be practical during workplace breaks, particularly for people who sit for prolonged periods. Standing modifications may suit patients who find supine or seated positions uncomfortable, while the prone technique may require clinician instruction to ensure appropriate positioning [23], [24].

## 5. Clinical outcomes and effectiveness

### 5.1. Pain reduction

The supplied review reports clinical studies published from 2023 to 2026 that generally favor stretching for pain reduction. One multicenter randomized trial involving 184 participants reportedly compared an eight-week structured program with education and found a larger reduction in visual analogue scale (VAS) pain scores in the stretching group [25]. A reported meta-analysis of eight studies and 612 participants found a pooled standardized mean difference favoring stretching [26]. These numerical findings are presented as reported in the supplied manuscript and should be verified against the original publications before publication, as the underlying references and trial data have not been independently authenticated.

Table 2. Summary of clinical studies on stretching interventions (as reported in the supplied manuscript)

| Study as supplied | Design | Sample | Intervention | Duration | Reported primary outcome | Reported effect |
|---|---|---|---|---|---|---|
| Martinez et al. (2025) [25] | RCT | 184 | Structured stretching vs. education | 8 weeks | VAS reduction: 4.7 vs. 1.8 points | Cohen' s d = 1.24 |
| Chen et al. (2024) [27] | Prospective cohort | 97 | Home stretching | 12 weeks | RMQ improvement: 62% vs. 23% | OR = 4.82 |
| Williams et al. (2025) [26] | Meta-analysis | 8 studies; n=612 | Various protocols | 4–12 weeks | Pooled SMD for pain: −1.42 | 95% CI: −1.89 to −0.95 |
| Kumar et al. (2024) [28] | RCT | 76 | Supervised vs. home stretching | 6 weeks | No significant between-group difference at 12 weeks | Not reported |
| Hassan et al. (2025) [10] | Crossover trial | 42 | Stretching vs. manual therapy | 4 weeks | Reported advantage for stretching ($p < 0.01$) | $\eta^2 = 0.34$ |

*RCT = randomized controlled trial; VAS = visual analogue scale; RMQ = Roland–Morris Questionnaire; SMD = standardized mean difference; CI = confidence interval.*

### 5.2. Functional improvement

Functional outcomes are described using measures such as the Roland–Morris Disability Questionnaire and the Lower Extremity Functional Scale. A prospective cohort study of 97 participants reportedly found clinically meaningful functional improvement in 62% of patients

following a 12-week home program, compared with 23% in a wait-list group [27]. Gait analysis and sit-to-stand performance have also been reported to improve after targeted stretching, with changes in hip movement and pelvic symmetry associated with patient-reported gains [9]. As these findings include observational data, causality cannot be assumed.

### 5.3. Quality of life and psychological outcomes

PS may affect physical functioning, pain-related activities, and psychological well-being. The supplied sources describe improvements in selected SF-36 domains and reduced anxiety following stretching programs [17], [29]. These outcomes may reflect symptom relief, increased confidence in movement, and the benefits of active self-management. Further controlled studies are needed to clarify the size and durability of these effects.

## 6. Comparative effectiveness

### 6.1. Stretching versus other conservative interventions

The supplied literature positions stretching as a common first-line conservative option. A reported randomized trial comparing stretching alone with stretching plus manual therapy found improvement in both groups without additional benefit from adding manual therapy [30]. Another review is described as finding that passive modalities, including therapeutic ultrasound and transcutaneous electrical nerve stimulation, may provide short-term relief but do not directly address muscle flexibility [31]. These conclusions should be interpreted cautiously until the underlying studies and their methods are verified.

### 6.2. Stretching combined with other interventions

For persistent or recurrent symptoms, stretching may be combined with neuromuscular re-education, postural correction, ergonomic changes, and strengthening of the hip abductors and external rotators [32], [33]. A combined approach may address multiple contributors to symptoms rather than relying on flexibility alone. Treatment should be individualized and reassessed according to function, tolerance, and clinical findings.

## 7. Conclusion

The literature presented for 2023–2026 suggests that stretching exercises may be a useful, accessible component of conservative management for piriformis syndrome. Proposed benefits include improved muscle extensibility, reduced movement-related discomfort, and gains in function and quality of life. Common protocols use 30–60-second holds repeated several times, with technique and dosage tailored to the individual. Stretching may be integrated with strengthening, ergonomic modification, and postural education when clinically appropriate. However, the strength of the conclusions depends on verification of the cited studies and reported effect estimates. Further rigorous trials are needed to establish optimal protocols, comparative effectiveness, and long-term outcomes.

## 8. Recommendations and implementation

Clinical assessment should include relevant history, hip range-of-motion measurement, palpation where appropriate, and symptom reproduction testing such as the flexion, adduction, and internal rotation (FAIR) maneuver. Findings should be interpreted alongside assessment for lumbar and other causes of sciatic symptoms [1], [5].

A practical stretching prescription may begin with holds of 30–60 seconds for three to five repetitions, performed once or more daily according to tolerance and the selected technique. Clear written instructions, illustrations, or demonstrations can support correct performance and adherence [18]. Intensity should be increased gradually, and the program modified if symptoms worsen or radiating pain develops [34].

Stretching can be paired with ergonomic changes for people who sit for long periods, regular movement breaks, and strengthening exercises when indicated. Periodic reassessment helps determine whether the intervention is improving pain and function and whether further diagnostic evaluation is necessary [23], [32].

## 9. Future directions

Important research questions remain regarding the minimum effective dose, optimal timing relative to other interventions, and comparative effectiveness of individual stretching techniques. Larger, well-designed randomized trials should use clear diagnostic criteria, transparent allocation methods, validated outcome measures, adverse-event reporting, and longer follow-up. Studies should also examine whether adjunctive approaches such as soft-tissue techniques or dry needling provide additional benefit when combined with stretching [4]. Dynamic ultrasound and elastography may help quantify muscle properties and treatment-related change, but future research should establish measurement reliability and determine whether imaging outcomes correspond to meaningful improvements in pain and function [14], [15].

**References**

[1] J. Johnson, P. Williams, and R. Davis, “Epidemiology and diagnostic approaches to piriformis syndrome: A 5-year retrospective analysis,” European Spine Journal, vol. 32, no. 8, pp. 2345–2357, 2023.

[2] C. Martinez and R. Thompson, “Pathophysiology of extrapelvic sciatic nerve entrapment: Current concepts,” Muscle & Nerve, vol. 69, no. 3, pp. 234–246, 2024.

[3] P. Williams, M. Johnson, and R. Davis, “Meta-analysis of stretching interventions for piriformis syndrome: An update,” European Journal of Physical and Rehabilitation Medicine, vol. 61, no. 2, pp. 234–247, 2025.

[4] A. Rodriguez, C. Fernandez, and M. Garcia, “Clinical presentation and diagnostic criteria for piriformis syndrome: An evidence-based update,” Musculoskeletal Care, vol. 22, no. 1, pp. 45–57, 2024.

[5] J. Anderson, M. Peterson, and K. Thompson, “Workplace-based stretching interventions for piriformis syndrome in sedentary occupations: A cluster randomized trial,” Journal of Occupational Rehabilitation, vol. 34, no. 2, pp. 245–257, 2024.

[6] R. Patel, K. Desai, and N. Shah, “Conservative management strategies for piriformis syndrome: A comprehensive review,” Current Reviews in Musculoskeletal Medicine, vol. 17, no. 2, pp. 123–136, 2024.

[7] R. Garcia, L. Martinez, and K. Thompson,

"Anatomical variations of the piriformis muscle and their clinical significance: A cadaveric study," Clinical Anatomy, vol. 37, no. 4, pp. 412–424, 2024.
[8] Y. Nakamura, H. Tanaka, and K. Sato, "Anatomical variants of the piriformis muscle and sciatic nerve relationship: A cadaveric study of 200 specimens," Clinical Anatomy, vol. 36, no. 5, pp. 567–579, 2023.
[9] P. O'Connor, B. Murphy, and C. Kelly, "Gait analysis in piriformis syndrome before and after stretching intervention," Journal of Biomechanics, vol. 168, pp. 112–124, 2024.
[10] F. Hassan, A. Rahman, and M. Karim, "Ischemic and inflammatory mechanisms in chronic piriformis syndrome," Muscle & Nerve, vol. 71, no. 2, pp. 178–190, 2025.
[11] S. Lee, H. Kim, and Y. Park, "Inflammatory mediators in piriformis syndrome and response to stretching intervention," Cytokine, vol. 178, pp. 156–168, 2024.
[12] T. Cooper and S. Ahmed, "Viscoelastic properties of the piriformis muscle in health and disease," Journal of Biomechanics, vol. 156, pp. 111–123, 2023.
[13] M. Fernandez, R. Santos, and A. Oliveira, "Structural adaptations of the muscle-tendon unit to chronic stretching in piriformis syndrome," Scandinavian Journal of Medicine & Science in Sports, vol. 35, no. 2, pp. 189–201, 2025.
[14] H. Tanaka, Y. Nakamura, and K. Sato, "Shear wave elastography for monitoring treatment response in piriformis syndrome," European Radiology, vol. 35, no. 3, pp. 1456–1468, 2025.
[15] A. Vargas, R. Santos, and M. Oliveira, "Elastographic assessment of muscle stiffness changes following stretching in piriformis syndrome," Ultrasound in Medicine & Biology, vol. 52, no. 1, pp. 89–101, 2026.
[16] D. Richardson and T. Morris, "Neural mechanisms of stretch-induced muscle relaxation," Journal of Neurophysiology, vol. 129, no. 4, pp. 890–902, 2023.
[17] E. Andersson, L. Lindgren, and P. Svensson, "Central mechanisms of stretching-induced analgesia in chronic musculoskeletal pain," Pain Medicine, vol. 26, no. 1, pp. 78–92, 2025.
[18] T. Mitchell and S. Wong, "Optimal stretching parameters for musculoskeletal conditions: A systematic review with meta-analysis," British Journal of Sports Medicine, vol. 58, no. 4, pp. 234–246, 2024.
[19] P. Singhania, R. Gupta, and A. Mehta, "Optimal stretch duration for improving hamstring and piriformis flexibility: A randomized trial," Journal of Bodywork and Movement Therapies, vol. 35, pp. 234–242, 2023.
[20] C. Martinez, S. Williams, and T. Brown, "Shear wave elastography assessment of piriformis muscle stiffness: Normative data and clinical applications," Ultrasound in Medicine & Biology, vol. 50, no. 5, pp. 678–689, 2024.
[21] R. Thompson and M. Garcia, "Standing modifications of piriformis stretching: Biomechanical and clinical considerations," Physical Therapy in Sport, vol. 62, pp. 78–86, 2023.
[22] P. Williams, M. Johnson, and R. Davis, "The relationship between footwear characteristics and musculoskeletal symptoms in Australian nurses," Journal of Foot and Ankle Research, vol. 15, no. 1, pp. 23–35, 2022.
[23] F. Robinson, J. Wright, and M. Evans, "Workplace stretching breaks for prevention and management of piriformis syndrome: A controlled trial," Journal of Occupational and Environmental Medicine, vol. 67, no. 3, pp. 234–245, 2025.
[24] R. Thompson, C. Martinez, and S. Williams, "Stretching alone versus stretching plus manual therapy for piriformis syndrome: A randomized trial," Journal of Manual & Manipulative Therapy, vol. 33, no. 1, pp. 45–57, 2025.
[25] C. Martinez, S. Williams, and T. Brown, "Structured stretching versus education for piriformis syndrome: A multicenter randomized trial," JAMA Network Open, vol. 8, no. 2, Art. no. e2356789, 2025.
[26] P. Williams, M. Johnson, and R. Davis, "Meta-analysis of stretching interventions for piriformis syndrome: An update," European Journal of Physical and Rehabilitation Medicine, vol. 61, no. 2, pp. 234–247, 2025.
[27] H. Chen, Y. Wang, and Z. Liu, "Home-based stretching program for chronic piriformis syndrome: 12-week outcomes," Archives of Physical Medicine and Rehabilitation, vol. 105, no. 3, pp. 456–465, 2024.
[28] A. Kumar, P. Singh, and N. Gupta, "Supervised versus home-based stretching in piriformis syndrome: A randomized controlled trial," Physiotherapy Research International, vol. 29, no. 2, Art. no. e2012, 2024.
[29] J. Park, S. Kim, and H. Lee, "Central pain modulation effects of regular stretching in chronic musculoskeletal conditions," Pain, vol. 165, no. 3, pp. 567–579, 2024.
[30] F. Gonzalez, M. Rodriguez, and J. Lopez, "Comparative effectiveness of stretching versus passive modalities in piriformis syndrome: Systematic review and meta-analysis," Physical Therapy, vol. 106, no. 2, pp. 145–160, 2026.
[31] S. Bennett, R. Cooper, and L. Davies, "Neurophysiological adaptations to regular stretching in patients with piriformis syndrome," Clinical Neurophysiology, vol. 155, pp. 112–124, 2024.
[32] S. Kim and J. Park, "Combination therapy approaches for refractory piriformis syndrome: Stretching plus neuromuscular reeducation," American Journal of Physical Medicine & Rehabilitation, vol. 105, no. 1, pp. 45–57, 2026.
[33] R. Singh, V. Kumar, and A. Sharma, "Anatomical variations of the sciatic nerve in relation to the piriformis muscle: Implications for clinical practice," Surgical and Radiologic Anatomy, vol. 47, no. 2, pp. 189–201, 2025.
[34] M. O'Brien, K. Sullivan, and A. Hayes, "Safety considerations in stretching interventions for piriformis syndrome," Physical Therapy in Sport, vol. 61, pp. 89–98, 2025.