MRI assessment of piriformis muscle and sciatic foramen dimensions in piriformis syndrome

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INTRODUCTION: Piriformis syndrome is the result of compression of the sciatic nerve by the piriformis muscle along the nerve's course through greater sciatic foramen in the deep gluteal region resulting in 6-8% of all sciatic nerve-related pain. Many anatomic variants of the piriformis muscle in relation to the sciatic nerve have been proposed to be associated with symptomatic piriformis syndrome, though these reports lack comparison to asymptomatic controls or direct side-to-side comparisons within the same patient. This study aims to determine whether magnetic resonance imaging (MRI) measurements of sciatic foramen and piriformis dimensions are associated with piriformis syndrome. Specifically, to 1) determine whether there are side-to-side differences in patients with piriformis syndrome, and 2) determine whether there are differences in piriformis or sciatic foramen dimensions between piriformis syndrome patients and age, sex, and height matched femoroacetabular impingement syndrome (FAIS) controls.

METHODS: After institutional review board approval, patients diagnosed with piriformis syndrome who subsequently underwent piriformis tenotomy by a single surgeon between 2023-2024 were retrospectively identified and matched 1:1 with FAIS controls by sex, age (within 10 years), and height (within 10 cm). MRI measurements of piriformis diameter and sciatic foramen width were obtained in coronal and axial planes with blinding to the symptomatic side. MRI sequences were reviewed and measured by two independent reviewers. Symptomatic-asymptomatic side-to-side differences among piriformis cases and between-group comparisons between cases and FAIS controls were analyzed with statistical analysis performed using JMP® Pro 17.2.0. Paired t-tests were used to compare symptomatic and asymptomatic sides. Intra-rater and inter-rater reliability for MRI measurements were assessed using intraclass correlation coefficients (ICCs), which were interpreted according to standard guidelines: poor (<0.50), moderate (0.50–0.75), good (0.75–0.90), and excellent (>0.90).

RESULTS: 31 patients with piriformis syndrome (mean 51.9 ± 14.8 years, 83.9% female) and 31 matched FAIS controls (mean 47.1 ± 12.7 years, 83.9% female) were included. No significant side-to-side differences were observed within the piriformis syndrome group for piriformis muscle diameter, sciatic foramen width, or the piriformis-to-foramen diameter ratio in either the coronal or axial planes (Table 1). In the coronal plane, FAIS controls demonstrated significantly larger piriformis diameters (23.2 ± 5.6 mm versus 21.7 ± 6.0 mm, $p = 0.04$) and ratio of piriformis diameter-to-foramen width (0.50 ± 0.14 versus 0.47 ± 0.14. $p = 0.03$) on the symptomatic versus asymptomatic side. Piriformis patients had smaller coronal plane piriformis diameters (20.5 ± 4.1 mm versus 23.2 ± 5.6 mm, $p = 0.03$) and foramen widths (43.3 ± 5.2 mm versus 46.6 ± 6.2 mm, $p = 0.04$) compared to the symptomatic side of FAIS controls. Axial measurements showed no significant differences between groups.

DISCUSSION: Piriformis syndrome patients did not exhibit side-to-side asymmetry in piriformis muscle or sciatic foramen dimensions, challenging the assumption that asymmetry on MRI is a diagnostic marker of piriformis syndrome. In contrast, FAIS patients demonstrated symptomatic side piriformis hypertrophy, suggesting that muscular asymmetry is more likely compensatory to hip pathology rather than specific to piriformis syndrome. Piriformis patients did show a relatively narrower sciatic foramen which may indicate that absolute anatomic constraints may contribute to susceptibility. Although patients with piriformis syndrome demonstrated smaller piriformis muscle diameters compared to FAIS controls, this difference likely lacks clinical utility as there are no established normative values for piriformis size, and substantial overlap in measurements existed between groups. These results highlight the importance of integrating MRI findings with clinical evaluation. Overall, this study found that Piriformis syndrome is not associated with side-to-side asymmetry in piriformis muscle bulk or sciatic foramen dimensions. In contrast, FAIS is associated with piriformis hypertrophy of the symptomatic hip. Limitations of this study include variability in imaging sequences, potential progression from unilateral to bilateral symptoms, and incomplete blinding of image reviewers.

SIGNIFICANCE/CLINICAL RELEVANCE: Piriformis syndrome is not associated with MRI detectable asymmetry in piriformis muscle or sciatic foramen dimensions, whereas FAIS shows piriformis hypertrophy of the symptomatic side. These findings highlight the limited diagnostic utility of MRI asymmetry alone and emphasize the need for clinical correlation when evaluating suspected piriformis syndrome.

Table 1. Comparison of Symptomatic and Asymptomatic Sides in Patients with Piriformis Syndrome

Plane	Measurement	Symptomatic Side (mm) (Mean ± SD)	Asymptomatic Side (mm) (Mean ± SD)	Mean Difference	N	95% CI of Difference	p-value
Coronal	Piriformis Diameter	20.5 ± 4.1	20.4 ± 4.7	0.1	31	[-1.3, 1.5]	0.86
Coronal	Foramen Diameter	43.3 ± 5.2	43.7 ± 5.9	-0.4	31	[-2.1, 1.2]	0.61
Coronal	Piriformis-to-Foramen Ratio	0.48 ± 0.092	0.47 ± 0.11	0.01	31	[-0.042, 0.042]	0.68
Axial	Piriformis Diameter	17.5 ± 4.3	17.0 ± 3.7	0.6	23	[-0.5, 1.6]	0.27
Axial	Foramen Diameter	58.3 ± 6.9	57.8 ± 5.5	0.5	23	[-0.9, 1.9]	0.48
Axial	Piriformis-to-Foramen Ratio	0.31 ± 0.097	0.30 ± 0.084	0.0093	23	[-0.011, 0.030]	0.36

SD, standard deviation, **CI**, confidence interval, **mm,** millimeters.
Note: Piriformis-to-Foramen Ratio is defined as piriformis diameter divided by sciatic foramen diameter.