

Anatomic Evaluation of Sacroiliac Joint Dimensions: An Imaging Series Study to Define Safety Parameters

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Introduction:

Sacroiliac joint (SIJ) dysfunction is implicated in causing 15-30% of all non-radicular low back pain [1]. Traditional open and minimally invasive surgery involve a lateral fusion approach implanting a screw from the lateral ilium into the sacrum. This approach is associated with risks of superior gluteal artery disruption and sacral nerves injury [2, 3]. Anatomic SIJ dimensions and landmarks used for lateral fusions have not been formally studied. Understanding statistical variations of SIJ anatomy may decrease the incidence of neurovascular complications with lateral SIJ fusions. Here, we present an SIJ imaging study evaluating anatomic dimensions important for lateral SIJ fusion planning.

Methods:

101 subject pelvis computed tomography scans (evaluating 202 unique SIJ) were obtained. The level of measurement was defined as the sacral foraminal level midpoint in the lateral view. Multiplanar visualization and reorientation of the viewing planes was used to locate the anatomic margins for each measurement and account for any off-axis orientation of the anatomy. Measured parameters of each joint are defined in Table 1. Descriptive statistics and 95% confidence intervals were calculated for each parameter at the first and second sacral foramen (Figure 1). The data were further assessed by gender at the S1 foramen (Figure 2). P-values were reported for all parameters, with statistical significance set at 0.05. As all deidentified images were obtained from a publicly available database, it is exempt from University of Kansas Health System IRB requirements as per policy.

Results:

The minimal sacral length, iliac length, SIJ gap, and S1 foramen SIJ length were found to be 13.6, 6.9, 1.7 and 33.9 mm, while the maximal lengths were 32.5, 29.2, 11.3 and 59.9 mm, respectively (Tables 2 and 3). For the S2 level, minimal sacral length, iliac length, SIJ gap, and SIJ length were 8.2, 1.2, 0.0 and 17.6 mm, while maximal lengths were 27.5, 24.3, 9.8, and 47.9 mm, respectively. Sacral length and SIJ gap were greater in females, whereas iliac length was greater in males (Figure 2).

Figure 1.

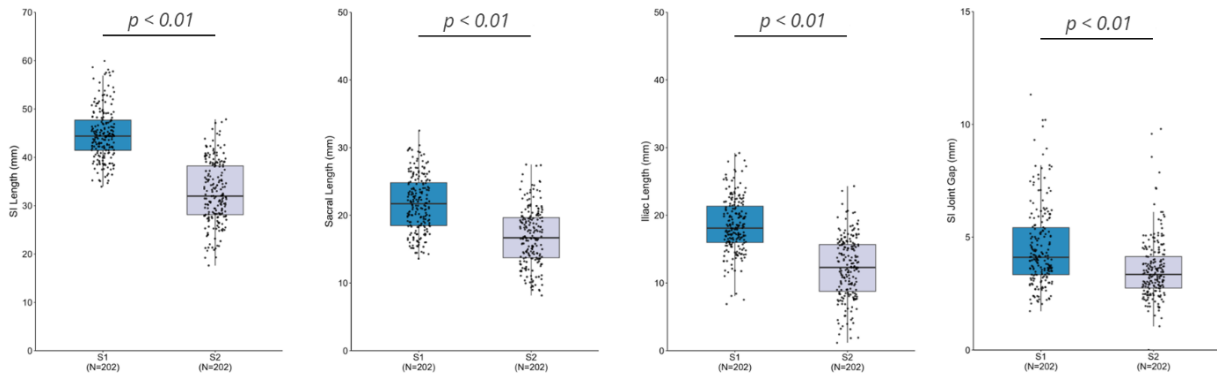


Figure 2.

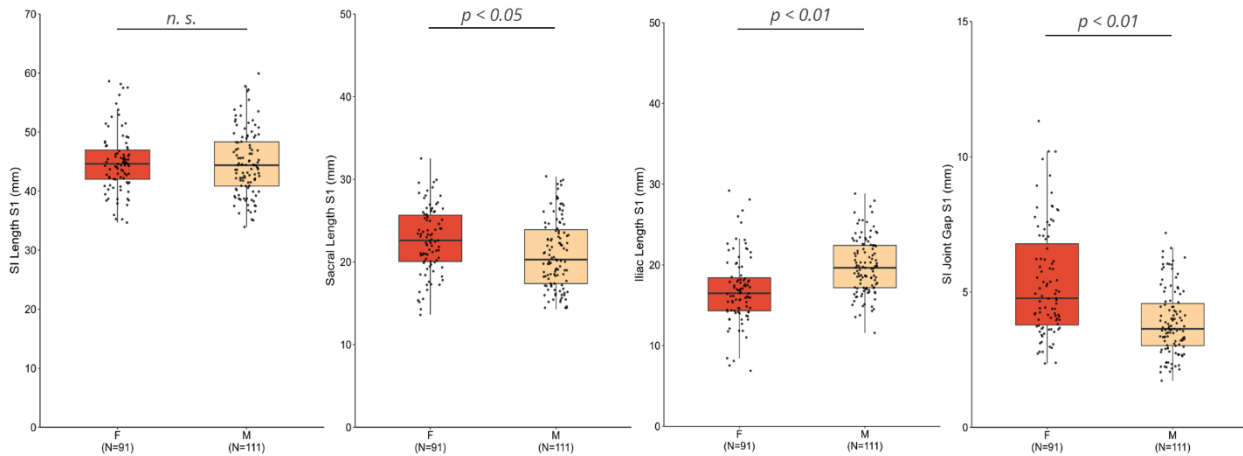


Table 1.

Parameter	Definition
Sacral Length	Distance measured from the lateral aspect of the sacrum to the lateral aspect of the foramen
SIJ Gap	Distance measured between the medial aspect of the ilium and the lateral aspect of the sacrum
Iliac Length	Distance measured from lateral aspect of the ilium to the medial aspect
SIJ Length	Distance measured from the lateral aspect of the ilium to the lateral aspect of the foramen

Table 2.

202 SI Joints	Sacral Length				Iliac Length				SI Joint Gap			
	Mean	Min	Max	95% CI	Mean	Min	Max	95% CI	Mean	Min	Max	95% CI
1st Foramen	21.8	13.6	32.5	13.7-29.9	18.5	6.9	29.2	10.7-26.3	4.5	1.7	11.3	1.1-8.0
2nd Foramen	16.9	8.2	27.5	8.7-25.0	12.2	1.2	24.3	3.4-21.0	3.6	0.0	9.8	0.9-6.2

Table 3.

Total SI Joint	Total Distance to Edge of Foramen			
	Mean	Min	Max	95% CI
1st Foramen	44.8	33.9	59.9	34.4-55.2
2nd Foramen	32.7	17.6	47.9	20.1-45.2

Prior studies demonstrate sacral anatomy is highly variable. The SIJ is formed by the S1 and S2 sacral segments with variable inclusion of S3 segment between sexes [4]. Measurements from the lateral sacral mass (LSM) to anterior sacral foramina average 29 mm (S1) and 22.8 mm (S2). The mean width from posterior LSM to posterior foramina was 24.3 mm (S1) and 18.6 mm (S2) [5].

Conclusion:

Our results are the first to delineate the statistical variations of the SIJ for the purpose of refining the lateral SIJ fusion technique. This study of 202 SIJ revealed that the minimum distance to the lateral edge of the foramen was 33.9 mm (S1 level) and 17.6 mm (S2 level). These findings may help improve the safety and efficiency of lateral SIJ implant placement.

References:

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