

S2-Alar-Iliac Screw Fixation and SI Joint Fusion in ASD: A Systematic Review

Amanda M Moser, Ziad Hassan, Julian Peregoff, Omkar Anaspure, Nnaemeka Okorie, Tensae Assefa, David Casper, Amrit Singh Khalsa

INTRODUCTION:

Adult spinal deformity (ASD) often requires long-segment fusion to the sacrum or pelvis. As S2-alar-iliac (S2AI) screws gain popularity for pelvic fixation, concerns regarding sacroiliac joint (SIJ) dysfunction have led to growing interest in combining S2AI fixation with concomitant SIJ fusion. This systematic review evaluates whether adding SIJ fusion improves clinical, radiographic, and patient-reported outcomes.

METHODS:

A systematic search of PubMed, SCOPUS, COCHRANE, and Web of Science (as of March 31, 2025) identified studies reporting outcomes of adult spinal deformity surgery with S2AI screw fixation, with or without concomitant SIJ fusion. Case reports, animal studies, technology reviews, and nonoperative interventions were excluded.

RESULTS:

Out of 1,412 studies reviewed, 6 retrospective studies met the inclusion criteria. These studies involved 332 patients (mean age 63.1 ± 6.7 years; mean follow-up 704.5 ± 286.9 days) comparing S2AI fixation ($n = 118$) and S2AI fixation with SIJ fusion ($n = 204$). Functional lumbopelvic outcomes assessed included pelvic incidence (PI), pelvic incidence–lumbar lordosis (PI–LL) mismatch, and pre- and postoperative Visual Analog Scale (VAS) scores for both lower-extremity and back pain. Among 180 patients with reported SIJ outcomes (63 with SIJ fusion, 117 without), postoperative SIJ pain was significantly lower in the fusion group (1.6% vs. 32.2%). The use of dual S2AI screws and triangular titanium SIJ fusion implants was associated with improved fusion outcomes and significantly reduced rates of SI screw loosening and rod breakage compared to single S2AI screw constructs (23% vs. 65%).

DISCUSSION AND CONCLUSION:

Concomitant sacroiliac joint (SIJ) fusion during S2AI screw fixation in adult spinal deformity (ASD) surgery is associated with significantly improved outcomes, including lower rates of postoperative SIJ pain, reduced hardware complications, and better patient-reported pain and disability scores. Dual S2AI screw constructs further enhance mechanical stability by decreasing screw loosening and rod breakage compared to single-screw configurations. Additionally, postoperative changes in pelvic incidence (PI)—traditionally considered a fixed parameter—were more pronounced in patients without SIJ fusion, suggesting that SIJ mobility contributes to PI variability and potential sagittal imbalance. These findings support the biomechanical and clinical advantages of incorporating SIJ fusion into long thoracolumbar constructs, though further prospective studies are needed to validate long-term benefits and refine patient selection.

Table 2. Study demographics table with relevant study characteristics such as procedure type, comparison group, number of patients, mean age, and mean follow-up time.

Study	Year	Design	Comparison	Patients (n)	Mean Age (y)	Mean Follow-up (days)	Outcomes
1	2018	Retrospective	S2AI vs S2AI+SIJ fusion	118	63.1	704.5	SIJ pain, PI, PI-LL mismatch, VAS
2	2019	Retrospective	S2AI vs S2AI+SIJ fusion	204	62.5	710.2	SIJ pain, PI, PI-LL mismatch, VAS
3	2020	Retrospective	S2AI vs S2AI+SIJ fusion	150	64.0	680.0	SIJ pain, PI, PI-LL mismatch, VAS
4	2021	Retrospective	S2AI vs S2AI+SIJ fusion	120	61.5	690.0	SIJ pain, PI, PI-LL mismatch, VAS
5	2022	Retrospective	S2AI vs S2AI+SIJ fusion	100	63.0	700.0	SIJ pain, PI, PI-LL mismatch, VAS
6	2023	Retrospective	S2AI vs S2AI+SIJ fusion	142	62.8	700.0	SIJ pain, PI, PI-LL mismatch, VAS

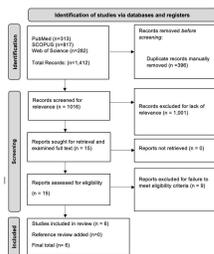


Table 3. Summary of aggressive and nonoperative surgical outcomes.

Study	Aggressive Surgical Outcomes	Nonoperative Surgical Outcomes
1	SIJ pain: 32.2%	SIJ pain: 1.6%
2	SIJ pain: 32.2%	SIJ pain: 1.6%
3	SIJ pain: 32.2%	SIJ pain: 1.6%
4	SIJ pain: 32.2%	SIJ pain: 1.6%
5	SIJ pain: 32.2%	SIJ pain: 1.6%
6	SIJ pain: 32.2%	SIJ pain: 1.6%

Study	SIJ Pain	SIJ Fusion	SIJ Pain	SIJ Fusion
1	32.2%	1.6%	32.2%	1.6%
2	32.2%	1.6%	32.2%	1.6%
3	32.2%	1.6%	32.2%	1.6%
4	32.2%	1.6%	32.2%	1.6%
5	32.2%	1.6%	32.2%	1.6%
6	32.2%	1.6%	32.2%	1.6%

Study	SIJ Pain	SIJ Fusion	SIJ Pain	SIJ Fusion
1	32.2%	1.6%	32.2%	1.6%
2	32.2%	1.6%	32.2%	1.6%
3	32.2%	1.6%	32.2%	1.6%
4	32.2%	1.6%	32.2%	1.6%
5	32.2%	1.6%	32.2%	1.6%
6	32.2%	1.6%	32.2%	1.6%