



Revision sacroiliac joint fusion: mid-term patient-reported outcomes

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Background: Sacroiliac joint (SIJ) fusion is an accepted management strategy of SIJ dysfunction. However, revision SIJ fusion (RSIJF) may be required in up to 12 percent of cases, and data are limited regarding patient outcomes following RSIJF. This study analyzes the clinical, radiographic, and patient-reported outcomes (PROs) after RSIJF.

Methods: A retrospective review was conducted of patients who underwent RSIJF from 2017 to 2024. All RSIJF utilized a principles-based approach: joint decortication, bone grafting, compression, and rigid stability. PROs at preoperative, 6-month, 1-year, and 2-year follow-up timepoints were recorded for Numeric Pain Rating Scale (NPRS), Oswestry Disability Index (ODI), Single Assessment Numeric Evaluation (SANE), Patient-Reported Outcomes Measurement Information System Pain Interference (PROMIS PI), and PROMIS Physical Function (PF). Fusion was assessed by computed tomography (CT) after ≥ 1 year.

Results: A total of 62 RSIJF were performed in 48 patients. SANE scores demonstrated sustained improvement across 6-month to 2-year timepoints (64.6% vs. 69.2%, $P=0.74$). ODI score improvement was significant at all timepoints ($P<0.001$). Postoperative PF and PI scores demonstrated improvement at the 1- and 2-year timepoints ($P\leq 0.03$). NPRS scores dropped significantly at all timepoints ($P\leq 0.004$). Five SI joints (8%) underwent reoperation for implant removal ($n=2$), antirotation screw removal ($n=2$), and continued pain ($n=1$). Available CT imaging demonstrated definitive bridging bone observed in 92% of cases. There were no occurrences of radiolucency or implant migration.

Conclusions: RSIJF offers sustained moderate improvements in pain and function, as evidenced by PROs at extended follow-up. Improvements were moderate, highlighting a difficult diagnosis and patient population commonly endorsing multiple pain generators.

Keywords: Revision; sacroiliac joint fusion (SIJF); arthrodesis; low back pain

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Introduction

The sacroiliac joint (SIJ) is an important but less commonly recognized pain generator in the low back. It is estimated in some studies to be a contributor to symptoms in up to 30% of all patients with low back pain, particularly in those patients with a prior history of lumbar fusion or extensive spinal fusion constructs (1-5). An increasing number of patients are undergoing SIJ fusion (SIJF) (6), which has been shown to be an effective management strategy for sacroiliac (SI)-related pain (7,8), especially with the emergence of minimally invasive techniques (9-12). Reported rates of revision SIJF (RSIJF) range from 2% to 4% based on the degree of follow-up in various studies (13-15). While indications for individual patients are variable, revision may be beneficial in cases of implant malpositioning, loosening, pseudoarthrosis, or continued pain (16).

There is a paucity of literature on the outcomes of RSIJF. Current literature reports variable outcomes of

RSIJF, dependent on factors such as chronic opioid use and patient sex (17). While Thompson *et al.* reported significant improvements in numerous patient-reported outcomes (PROs) following revision surgery, other studies, such as Brown *et al.*, suggest unchanged PROs following RSIJF at the 1-year mark postoperatively (16,17). However, given the infrequent nature of revision surgery, studies on RSIJF are limited by both sample size and follow-up. These limitations are particularly important in these patients given that primary SI fusion may take more than 1 year in many patients (18).

This study assessed the clinical, radiographic, and PROs of patients who underwent RSIJF at extended follow-up of 2 years post-revision. We present this article in accordance with the STROBE reporting checklist (available at <https://jss.amegroups.com/article/view/10.21037/jss-2026-1-0036/rc>).

Methods

Ethics statement

The study was conducted in accordance with the Declaration of Helsinki and its subsequent amendments. The study was approved by the institutional review board of Mayo Clinic (IRB No. 24-011137) and individual consent for this retrospective analysis was waived. All research activities were performed in line with the approved protocol.

Patient population and data collection

A retrospective review was conducted of all patients who underwent RSIJF between January 2017 and September 2024 with a single surgeon at a large academic institution. Patients were included if they had previously undergone SI arthrodesis in the same joint. Patients were excluded if they did not meet the minimum postoperative follow-up of 12 months or if they had a concurrent spinal operation at the time of RSIJF, with the exception of minor hardware removal. Patient medical and surgical histories were reviewed for medical comorbidities including diabetes, tobacco use, and osteoporosis, as well as prior lumbar spine surgery (PLSS), and prior RSIJF. Complications included infection, nerve injury, implant loosening, and reoperations of any type, including subsequent revision or hardware removal. Routine postoperative computed tomography (CT) imaging was obtained at ≥ 12 months postoperatively.

PROs were collected and analyzed preoperatively, as

Highlight box

Key findings

- Revision sacroiliac joint fusion (RSIJF) using a minimally invasive principles-based approach was associated with a low complication rate, including a 2.1% rate of further revision surgery, and osseous bridging was observed in over 90% of cases.
- Significant yet modest improvements in all patient-reported outcome (PRO) measures were observed following RSIJF, and these improvements were sustained at the 2-year follow-up timepoint.

What is known and what is new?

- Two prior studies have reported clinical outcomes of RSIJF which are limited to just 1 year after surgery. PROs data are similarly limited to 1-year data.
- This study contributes the first published data through the 2-year follow-up timepoint. It also covers a greater range of PROs measures (Single Assessment Numeric Evaluation, Oswestry Disability Index, Numeric Pain Rating Scale, and Patient-Reported Outcomes Measurement Information System scores) compared to other studies on RSIJF or sacroiliac joint fusion in general.

What is the implication, and what should change now?

- This study is the first to report midterm outcomes data following RSIJF and found that not only was RSIJF associated with moderate improvements in pain and function, but these benefits appear to be sustained at more extended follow-up of 2 years. Patients who present for RSIJF evaluation frequently seek guidance on expectations for postoperative function. This study reports the first extended 2-year outcomes data which can aid both the surgeon and patient in decision-making regarding revision surgery.

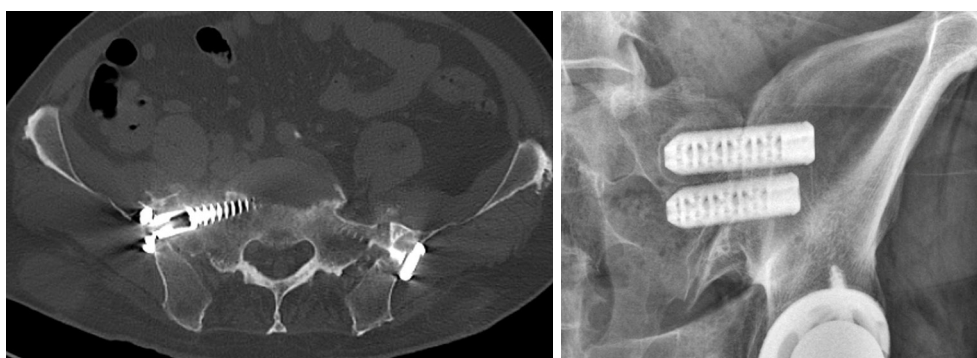


Figure 1 Preoperative imaging of implant malpositioning (left) and implant loosening (right) in patients presenting for revision sacroiliac joint fusion.

well as at the 6-month, 1-year and 2-year postoperative timepoints, including Numeric Pain Rating Scale (NPRS), Oswestry Disability Index (ODI), Single Assessment Numeric Evaluation (SANE), Patient-Reported Outcomes Measurement Information System Pain Interference (PROMIS PI), and PROMIS Physical Function (PF). The SANE score is a non-specific measure of patient satisfaction utilizing a single number representing the patient's interpretation of clinical success. We utilized this PRO in our study given the relative lack of specificity of any current widely accepted SI-specific scoring tool evaluating SIJF surgical success. We assessed this PRO by asking patients to compare their current outcomes only as they pertain to their preoperative SIJ pain. This metric is important given the multifactorial pain generators that many of these patients have. The minimal clinically important differences (MCID) used to evaluate postoperative changes in ODI and NPRS scores were 15 and 2, respectively, derived from previously reported values in patients with spinal pathologies (19-21). MCID utilized for PI and PF were 5.9 and 5.3, respectively (22).

Preoperative evaluation for revision surgery

To be considered for RSIJF, patients must meet specific clinical and radiographic criteria. At least three physical examination maneuvers such as the Mayo SIJ test (PSIS distraction + FABER), Gaenslen test, flexion abduction external rotation test (FABER), or thigh thrust must be positive in these patients, localizing the source of pain to the SIJ (23-26). Patients who present for potential revision may have varied etiologies of SI pain, some of which may be visualized on radiograph.

It is standard practice to obtain anteroposterior, inlet, and outlet pelvic radiographs and CT of the pelvis to assess for implant malposition or loosening (*Figure 1*). Key hallmarks for failed SIJF include radiolucent halos around existing implants or complete lack of bridging bone between the ilium and sacrum. The presence or absence of bridging bone through the implants themselves should be closely evaluated. Indications that present more challenging decision-making include “pseudoarthrosis” radiographs demonstrating no discernible bridging bone across the SIJ, as well as “vacuum phenomenon” in the SIJ, which may represent abnormal motion. There is currently, however, no way to accurately assess motion of the SIJ in this patient population, either pre- or intraoperatively. No patients were noted to have SIJ widening prior to RSIJF. Lastly, all patients undergo an image-guided SIJ injection with anesthetic agent for diagnostic purposes. In patients with history of SIJF, this diagnostic injection provides important information to distinguish recurrent or persistent SIJ pain from other regional pain generators. A documented positive response of 50-75% identifying the SIJ as the source of pain. Corticosteroids are not utilized in the injection secondary to the slight risk of infection given existing implants (27).

Surgical technique

All patients underwent RSIJF using a minimally invasive system (Integrity SIJ Fusion, OsteoCentric Technologies, Austin, TX, USA) and a lateral approach. The device design enables for an SIJF approach consistent with the principles taught by the AO Foundation (28), including joint decortication, bone grafting, compression, and rigid



Figure 2 The surgeon preparing to inject local anesthetic at the conclusion of the revision. Two incisions are typically utilized during revision sacroiliac joint fusion: one for implant removal and a second for the revision fusion approach. The more posterior incision allows compression orthogonal to the oblique joint (patient is positioned prone, and patient head is to the left. The lines are for incision planning and circle is on the posterior superior iliac spine).

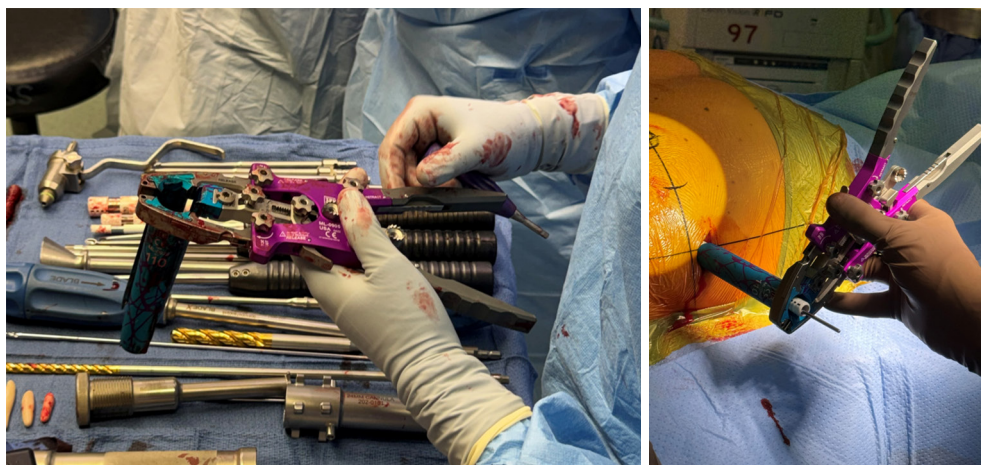


Figure 3 Lateral spine retractor system with long blades (left), in place over implant requiring removal (right).

stability. Guide wires were placed to identify the pre-existing implant(s), which were recannulated utilizing intraoperative fluoroscopy. The guidewires were oscillated through the entire implant to remove any bone or tissue from inside them. Minimally-invasive spine retractors (Phantom XL3, TeDan Surgical Innovations, Sugar Land, TX, USA) were then used to dilate around the existing guidepin. Using a headlamp, the devices were located under direct visualization. In cases with bone grown over the implant, a 12 mm cannulated drill from the Integrity SI System was used to drill over the bone to expose the implant. Extended length cautery and pituitary rongeurs were also used. Once the implants were exposed, system-

specific removal instruments were used (*Figures 2,3*). Most often, a back-and-forth twisting motion worked for screw-style implants, whereas a triangular chisel system worked for triangular implants. In scenarios where these systems failed, large trephines were used (Zimmer Biomet, Warsaw, IN, USA). In the later half of this surgical series, voids were grafted using Abryx Montage bioabsorbable putty (Acumed, Hillsboro, OR, USA). The handling properties of this bone graft substitute allow the surgeon to apply the putty to voids and drill through it after it hardens. Prior to using Montage, voids were not addressed and allowed to fill in with fibrous tissue. At this point, with all implants removed, the revision fusion ensued following the previously described technique

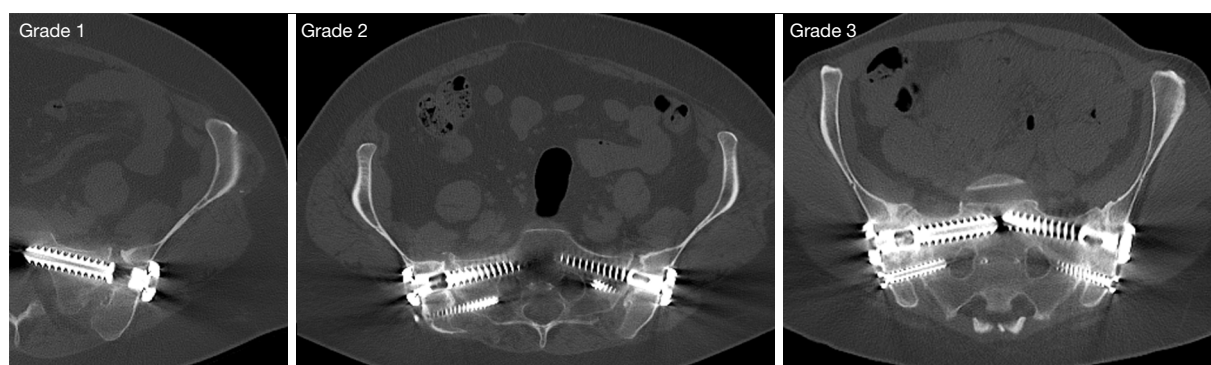


Figure 4 Radiographic fusion grading system, with scale from 1 to 3, where grade 1 is assigned in cases of no bone growth, grade 2 is assigned where bone growth present with no bridging bone observed, and grade 3 is assigned in cases of definitive bridging bone observed across the sacroiliac joint.

for primary SI fusion (29). At surgeon discretion, an anti-rotation screw can be added for additional stabilization. Oftentimes, the previous implants made this secondary screw difficult to place safely, such that it was omitted. The minimally invasive approach described above is also advantageous in cases of significant bone loss, as this approach bypasses alar bone loss, engaging bone in the S1 or S2 vertebral bodies.

Radiologic evaluation of fusion

Postoperative CT imaging was obtained ≥ 12 months following RSIJF. Fusion was independently graded by a senior fellowship-trained musculoskeletal radiologist according to the scale referenced in a previous publication, denoting grade 1 as lack of bone growth, grade 2 as bone growth without bony bridging across the SIJ, and grade 3 as definitive bridging bone across the SIJ (*Figure 4*) (30).

Statistical analysis

Descriptive statistics were reported using mean and standard deviation, or count and frequency, as appropriate. Comparisons of each PRO mean score across pre- and postoperative timepoints were performed using paired *t*-tests or Wilcoxon signed-rank tests, depending on normality, assessed using the Shapiro-Wilk test. Subgroup PRO analyses were calculated for patients based on prior surgery and indications for revision using Kruskal-Wallis tests. Changes in PROs by preoperative indication were assessed utilizing linear mixed-effects models for ODI and NPRS scores, while Wilcoxon rank-sum tests were utilized

for SANE due to limited subgroup sample sizes. Two-year data was excluded from analysis due to missing data for patients with indication continued pain with partial fusion. Multivariable linear regression was performed to evaluate the association of patient and surgical factors with final ODI scores. Statistical analysis was performed using BlueSky (BlueSky Statistics, Chicago, Illinois, USA). A $P < 0.05$ was considered significant.

Results

Sixty-two RSIJFs were performed in 48 patients, of whom 36 (74%) were female with a mean age of 53 ± 14 years and mean body mass index (BMI) of 28 ± 5 kg/m² (*Table 1*). The mean follow-up for this cohort was 2.4 ± 1.7 years. The most common indications for revision were pseudoarthrosis (58%, $n=36$) and implant loosening (31%, $n=19$). Amongst the 28 (58%) patients who had PLSS, the most common spinal operations were spinal fusions (16 patients) and discectomies (9 patients), and 5 (18%) patients with PLSS had undergone multiple types of spinal procedures. A higher proportion of patients with PLSS were female ($P=0.003$). Eight (13%) hips had undergone prior hip surgery (PHS) on the same side as SIJF, including total hip arthroplasty in 3 hips, hip arthroscopy in 2 hips, pelvis and sacral open reduction and internal fixation in 1 hip, labral repair in 1 hip, and bone grafting of the SIJ in 1 patient. Patient characteristics, including age, BMI, sex, and comorbidities did not differ significantly by PLSS or PHS status.

The mean time from index SIJF to RSIJF was 38.1 months (range 0.8 to 159.3 months). Prior to presenting to our institution for RSIJF, 10 (21%) patients had previously

Table 1 Revision sacroiliac fusion patient demographics

Characteristics	Value (n=48)
Sex	
Female	36 (74.0)
Male	12 (26.0)
Age (years)	
All	53±14
Female	52±14
Male	56±14
BMI (kg/m ²)	
All	28±5
Female	27±5
Male	28±4
Medical comorbidities	
Tobacco use	14 (29.0)
Osteoporosis	5 (10.0)
Diabetes mellitus	4 (8.0)
Surgical history	
Previous lumbar spine surgery	28 (58.0)
Prior hip surgery (n=62 hips)	8 (13.0)
Indications for revision (n=62 hips) [†]	
Pseudoarthrosis	36 (58.0)
Implant loosening	19 (31.0)
Continued pain with partial fusion	10 (16.0)
Implant malpositioning	6 (10.0)

Data are presented as n (%) or mean ± SD. [†], some patients may have had more than one indication for revision. BMI, body mass index; SD, standard deviation.

undergone revision with another surgeon. These outside revisions were typically adding additional implants to the existing implants in an effort to increase stability.

PROMIS

NPRS scores were improved or maintained at all postoperative timepoints, with an overall mean improvement of 4 points (*Table 2*). This improvement reached statistical significance at all postoperative timepoints ($P \leq 0.004$). Thirty-four (71%) patients had NPRS scores documented at final follow-up. Of these patients, 20 (59%) reached MCID for NPRS, and 25 (74%)

had improved NPRS scores compared to preoperatively.

PROMIS PF and PI scores also demonstrated significant improvement at the 1- and 2-year postoperative timepoints (*Figure 5*). PROMIS PF scores improved from 31.5 (7.2) preoperatively to 38.3 (7.4) at 2-year follow-up ($P=0.005$), while PROMIS PI scores improved from 69.3 (6.4) preoperatively to 57.5 (18.1) at 2-year follow-up ($P=0.02$). Cohort means for PF and PI met MCID by the 2-year postoperative timepoint.

Compared to a mean preoperative ODI score of 56.4 (19.1), postoperative ODI scores were significantly reduced at all postoperative timepoints (all $P < 0.001$). Preoperatively, 2 (4%) patients' SIJ were classified according to criteria by

Table 2 Patient-reported outcomes following revision sacroiliac joint fusion

Outcomes, stratified by timepoint	n	Mean (SD)	P value
NPRS			
Preoperative	59	7.2 (1.6)	–
6-month follow-up	24	4.7 (2.5)	<0.001
1-year follow-up	31	4.1 (2.5)	<0.001
2-year follow-up	5	3.2 (3.1)	0.004
PROMIS PF			
Preoperative	37	31.5 (7.2)	–
6-month follow-up	19	34.5 (6.9)	0.28
1-year follow-up	32	35.6 (10.7)	0.02
2-year follow-up	12	38.3 (7.4)	0.005
PROMIS PI			
Preoperative	37	69.3 (6.4)	–
6-month follow-up	19	65.9 (5.1)	0.053
1-year follow-up	32	65.6 (9.3)	0.03
2-year follow-up	13	57.5 (18.1)	0.02
ODI			
Preoperative	52	56.4 (19.1)	–
6-month follow-up	40	46.0 (20.8)	<0.001
1-year follow-up	40	44.3 (21.4)	<0.001
2-year follow-up	18	44.6 (20.8)	<0.001
SANE, %			
6-month follow-up	33	64.6 (32.3)	–
1-year follow-up	31	69.6 (28.9)	–
2-year follow-up	12	69.2 (34.0)	–

NPRS, Numeric Pain Rating Scale; ODI, Oswestry Disability Index; PF, Physical Function; PI, Pain Interference; PROMIS, Patient-Reported Outcomes Measurement Information System; SANE, Single Assessment Numeric Evaluation; SD, standard deviation.

Fairbank *et al.* as having mild disability (ODI <20), 7 (13%) as having moderate disability (ODI between 20 and 40) and 43 (83%) as having severe disability (ODI >40) (31). Forty-five (73%) SIJ had both pre- and postoperative ODI scores available. ODI improved in 38 cases (84%), and MCID was met in 18 cases (40%). Sixteen (36%) SIJ demonstrated ODI score improvement of at least 1 category of disability. Overall, the proportion of patients with severe disability decreased significantly from 43/52 to 23/45 ($P<0.001$).

Early postoperative SANE scores reached a mean of 64.6% at 6-month follow-up, and the mean 1-year SANE score was 69.6% (Figure 6). Postoperative SANE scores

demonstrated sustained improvement through 2-year follow-up at 69.2%, with no significant differences observed between any timepoints ($P=0.74$).

Stratifying PROs by PLSS status, there were no significant differences in any PRO measure aside from inferior 1-year PROMIS PF scores for patients with PLSS (32.6 ± 8.0 *vs.* 42.3 ± 13.1 without PLSS; $P=0.02$). Patients with PHS had baseline inferior ODI (66.0 ± 20.5 *vs.* 54.1 ± 18.3 ; $P=0.04$) and PROMIS PF scores (27.3 ± 6.7 *vs.* 33.1 ± 6.9 ; $P=0.03$).

Stratifying by indications for revision, preoperative PROs did not differ by indication. Postoperatively, NPRS

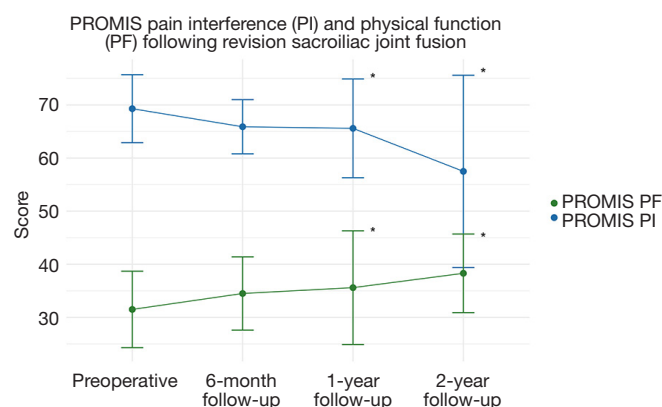


Figure 5 PROMIS PI and PF scores in patients undergoing revision sacroiliac joint fusion at preoperative and postoperative timepoints. Mean and standard deviation are shown for the cohort. Timepoints that are statistically significant ($P<0.05$) from preoperative scores are denoted with an asterisk. PF, Physical Function; PI, Pain Interference; PROMIS, Patient-Reported Outcomes Measurement Information System.

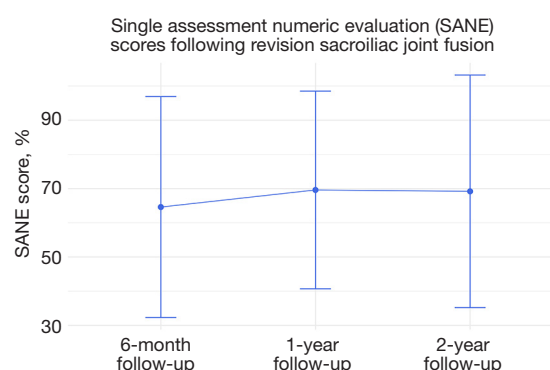


Figure 6 SANE scores following revision sacroiliac joint fusion, displayed as mean and standard deviation. SANE, Single Assessment Numeric Evaluation.

scores were significantly reduced at the 1-year timepoint for patients who underwent RSIJF secondary to implant malpositioning (1.6 ± 2.5 vs. 5.6 ± 2.3 ; $P=0.03$), though this finding was not sustained at 2 years. NPRS, SANE, and ODI scores did not otherwise differ by revision indication for 1- and 2-year postoperative timepoints.

Multivariable linear regression modeling was performed to further assess the relationship between final ODI scores and patient demographics, surgical history characteristics, and preoperative PROs (Table 3). Higher preoperative NPRS and ODI scores were associated with higher postoperative scores for both metrics ($P\leq0.01$). Patient factors and prior surgical history were not significantly associated with differences in ODI at final follow-up.

PROs following revision surgery were also stratified by preoperative indication (Table 4). SANE scores

demonstrated durable results irrespective of indication, with no significant changes for any groups between the 6-month, 1-year, and 2-year follow-up timepoints. Pseudoarthrosis, implant loosening, and implant malpositioning were all associated with statistically significant improvements at all postoperative timepoints, although these improvements were not observed for patients undergoing revision for continued pain with partial fusion. NPRS scores were significantly reduced for all groups at 1-year follow-up, and this was the only significant timepoint for patients revised due to implant malpositioning.

Clinical and radiologic outcomes

The reoperation rate following RSIJF was 8.1% and included implant removal in 2 patients, antirotation screw

Table 3 Multivariable analysis of final ODI scores following revision sacroiliac joint fusion

Variables	ODI, a β (95% CI)	P value
Demographics		
Age	−0.18 (−0.62 to 0.26)	0.41
Male sex	3.85 (−7.04 to 14.73)	0.48
BMI	0.64 (−0.41 to 1.69)	0.22
Surgical history		
Previous lumbar spine surgery	−2.88 (−11.92 to 6.15)	0.52
Previous hip surgery	−5.49 (−16.93 to 5.94)	0.34
Prior RSIJF	1.40 (−9.84 to 12.65)	0.80
Preoperative PROs		
NPRS	4.06 (1.03 to 7.09)	0.01
ODI	0.80 (0.51 to 1.08)	<0.001

a β , adjusted beta coefficient; BMI, body mass index; CI, confidence interval; NPRS, Numeric Pain Rating Scale; ODI, Oswestry Disability Index; PROs, patient-reported outcomes; RSIJF, revision sacroiliac joint fusion.

Table 4 Patient-reported outcomes following revision SIJF by preoperative indication

PROs	Indication	Preoperative	6-month follow-up		1-year follow-up		2-year follow-up	
			Mean $\pm$ SD	P value	Mean $\pm$ SD	P value	Mean $\pm$ SD	P value
SANE, %	Pseudoarthrosis	–	61.5 $\pm$ 33.6	–	69.7 $\pm$ 30.1	0.47	66.1 $\pm$ 37.1	0.59
	Implant loosening	–	74.4 $\pm$ 22.7	–	77.9 $\pm$ 20.6	0.70	78.0 $\pm$ 33.3	0.46
	Continued pain with partial fusion	–	62.5 $\pm$ 47.9	–	82.5 $\pm$ 10.6	0.48	–	–
	Implant malpositioning	–	65.0 $\pm$ 25.7	–	63.8 $\pm$ 42.7	0.59	78.3 $\pm$ 25.7	0.44
ODI	Pseudoarthrosis	58.2 $\pm$ 18.5	44.1 $\pm$ 21.7	<0.001	43.3 $\pm$ 19.7	<0.001	43.8 $\pm$ 18.5	<0.001
	Implant loosening	60.0 $\pm$ 12.9	44.8 $\pm$ 18.9	<0.001	45.4 $\pm$ 23.3	<0.001	37.4 $\pm$ 24.0	<0.001
	Continued pain with partial fusion	45.1 $\pm$ 21.7	44.4 $\pm$ 21.1	0.99	40.0 $\pm$ 30.7	0.55	–	–
	Implant malpositioning	53.5 $\pm$ 27.5	44.0 $\pm$ 27.3	0.019	46.8 $\pm$ 27.9	0.04	37.3 $\pm$ 26.6	0.03
NPRS	Pseudoarthrosis	7.0 $\pm$ 1.8	4.6 $\pm$ 2.4	<0.001	4.2 $\pm$ 2.7	0.004	2.3 $\pm$ 2.1	<0.001
	Implant loosening	7.4 $\pm$ 1.6	4.1 $\pm$ 2.9	<0.001	3.8 $\pm$ 3.1	<0.001	0.5 $\pm$ 0.7	0.001
	Continued pain with partial fusion	7.4 $\pm$ 1.0	6.0 $\pm$ 1.4	0.02	4.7 $\pm$ 1.2	0.003	–	–
	Implant malpositioning	7.0 $\pm$ 2.4	5.0 $\pm$ 4.2	0.30	2.0 $\pm$ 2.7	0.05	4.0 $\pm$ 5.7	0.14

NPRS, Numeric Pain Rating Scale; ODI, Oswestry Disability Index; PROs, Patient-Reported Outcomes; SD, standard deviation; SIJF, sacroiliac joint fusion.

removal in 2 patients, and a subsequent RSIJF in 1 patient secondary to continued pain. There were no cases of superficial or deep infection, neurological complications, or implant loosening.

Postoperative CT imaging was available for 81% of

patients, which demonstrated a 92% rate of definitive bridging bone across the SIJ. There were no cases of radiolucency or implant migration. Two examples of patient pre- and postoperative imaging, including radiographic fusion, are demonstrated in *Figures 7,8*.

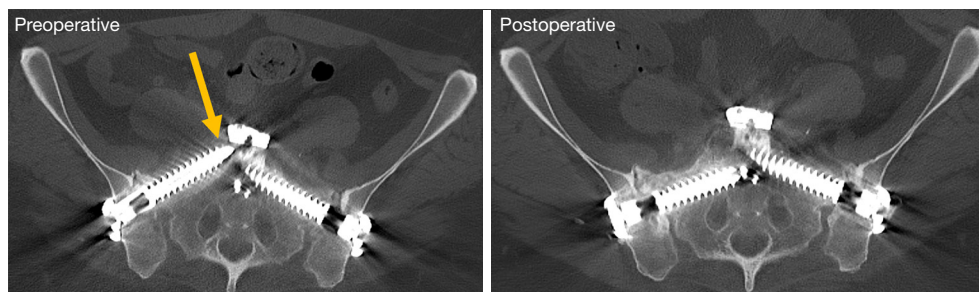


Figure 7 Pre- and postoperative imaging of a patient who underwent revision sacroiliac joint fusion. Preoperative imaging demonstrated a malpositioned implant anterior to the sacral ala (orange arrow). This patient experienced a full resolution of preoperative right foot paresthesia.

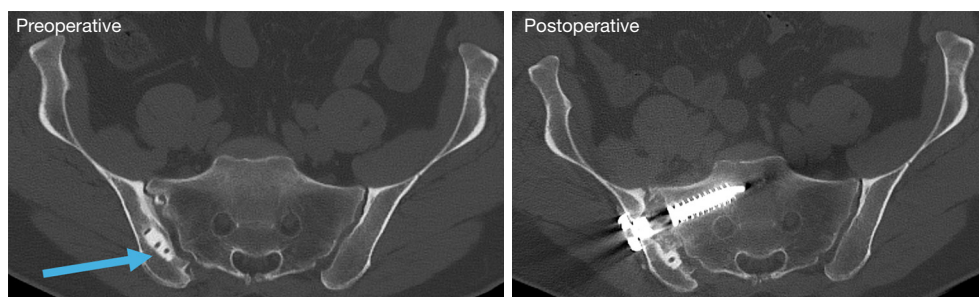


Figure 8 Pre- and postoperative imaging of a patient who underwent revision sacroiliac joint fusion. Imaging prior to revision was notable for pseudoarthrosis, as well as a bone plug located entirely within the ilium (blue arrow), bypassing the sacroiliac joint.

Discussion

Revision surgery represents an uncommon but significant sequela of SIJF. With the overall increase in SIJF procedures (10), largely secondary to improved recognition of SI-mediated pain and minimally invasive surgical techniques such as that described in the present study, the incidence of RSIJF is almost certain to rise. Counseling of patients who are considering revision is challenging, as current literature reporting on the outcomes of RSIJF is limited to studies with 1-year follow-up. This study evaluated the clinical, radiographic, and PROs of RSIJF through the 2-year follow-up timepoint and found significant yet moderate improvements in all PRO measures that were sustained at the 2-year follow-up timepoint. RSIJF was associated with a low complication rate, including a 2.1% rate of further revision surgery, and osseous bridging was observed in over 90% of cases.

This study found a mean decrease in NPRS scores of 4 points by 2 years postoperatively, which is comparable to a 3.1-point improvement reported by Thompson *et al.* by 1 year following RSIJF (16). This suggests that the

potential impact of RSIJF on pain may not only be sustained but amplified by 2 years postoperatively. While this study and Thompson *et al.* report sustained significant improvement in pain across all postoperative timepoints, a retrospective review of RSIJF patient outcomes by Brown *et al.* only found significant differences at early postoperative timepoints, with no difference at 1 year postoperatively (17). In the present study, it should also be noted that roughly 3 in 5 patients (59%) met MCID for NPRS, and similar findings were observed for ODI (40%). While improvements following RSIJF were statistically significant, contextualizing findings with MCID highlights the variability in patient outcome and the overall moderate improvement following revision surgery. Furthermore, findings from this study also emphasize the complex clinical picture for patients with refractory pain. Comprehensive patient discussions are mandatory in the preoperative setting, ensuring appropriate expectations are set prior to revision surgery.

The mean SANE score remained between 69% and 70% from 1- to 2-year follow-up in this study, highlighting

lasting improvements in patients' self-reported function and return to their pre-pain state. This is in line with mean SANE scores after RSIJF reported by Thompson *et al.* of 70% at 1-year (16). However, it must be noted that SANE scores following revision are notably lower than those following index SIJF, which range from 82% to 89% (30,32). The present study highlights that, while revision surgery offers moderate improvements, SIJ dysfunction is a challenging diagnosis often involving multiple pain generators. This remains a critical point in preoperative discussion for RSIJF.

Prior surgery near the SIJ, whether PLSS or PHS, was not significantly associated with differences in postoperative PROs in the present study. These findings add to those of Brown *et al.* and Thompson *et al.*, in which previous spine surgery, such as prior lumbar fusion, was not connected to differences in PROs following RSIJF (16,17). However, this study identified interesting differences in preoperative PROs by PHS—patients with pre-existing hip disease had inferior baseline PROs, indicating a clear relationship between hip mechanics and SIJ dysfunction.

This study did not identify any patient factors or indications for revision that were associated with increased postoperative improvement aside from superior NPRS scores following RSIJF for patients with implant malpositioning at 1 year postoperatively. This finding challenges current assertions that obvious implant loosening may not be a primary factor influencing the decision-making process for revision surgery. Overall, this remains an area lacking in current SI literature and an attractive area of future study. Specifically, future investigations should seek to correlate preoperative radiographic findings with clinical and PROs in order to better identify which patients may ultimately benefit from revision.

In this study, RSIJF was associated with an overall reoperation rate of 8.1% and a revision rate of 2.1%. There were no cases of infection, neurological compromise, or implant malpositioning or loosening in the present cohort. These findings align with rates reported in the current RSIJF literature, including a reported 5.8% reoperation rate by Brown *et al.*, including 2 patients who required reoperation secondary to S1 nerve root compression (3.8%) (17). Overall, the revision rate following primary SIJF approximates 2% to 4% (13–15), and findings of this study suggest that the risk of subsequent revision is similar between primary and RSIJF.

This study has limitations. Given its retrospective nature, the type and details of data collected were limited by that found within the medical record. This was a

single surgeon series using one minimally-invasive SIJF technique. This must be considered in line with the study findings, as individual surgeon practices, resources, and technique may influence patient outcomes in a manner that was not possible to quantify. It should be noted that results of this study may not be generalizable or applicable to other fusion systems. Additionally, variation in PRO reporting by postoperative timepoint was observed. RSIJF is an infrequently performed procedure and the senior author has established a destination practice for patients seeking revision. As such, some patients were not able to return for in-person clinical evaluation at each of the typical postoperative timepoints preferred by our practice. Specifically, while this study does report 2-year follow-up data, the number of patients with PROs at this timepoint was reduced compared to the 6-month and 1-year timepoints. Strengths of this study include the extended follow-up reporting of clinical and PROs, including the variety in PRO measures included in this study. Further, by incorporating the SANE score as part of the PROs collected, this study was able to isolate the SIJ from more generalized PROs and demonstrate a 70% rate of sustained improvement.

Conclusions

The overall results of this study demonstrate that RSIJF is associated with modest improvements in pain and function that are sustained through the 2-year postoperative timepoint. RSIJF is a safe procedure with a low subsequent revision rate and high rates of osseous bridging on postoperative imaging. Results of this study contribute important information for the surgeon in counseling patients with persistent or recurrent SIJ pain who present for an evaluation of RSIJF. Perhaps most importantly, this study highlights the complexity of this patient population and underscores the need for a detailed patient-surgeon discussion in the preoperative setting.

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Footnote

Reporting Checklist: The authors have completed the

STROBE reporting checklist. Available at <https://jss.amegroups.com/article/view/10.21037/jss-2026-1-0036/rc>

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Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki and its subsequent amendments. The study was approved by the institutional review board of Mayo Clinic (IRB No. 24-011137) and individual consent for this retrospective analysis was waived. All research activities were performed in line with the approved protocol.

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