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Sacroiliac Joint Fusion vs. Conservative Management for Chronic Sacroiliac Joint Pain: A Systematic Review of Pain and Functional Outcomes

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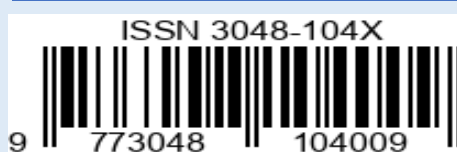
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ABSTRACT

Introduction: Chronic sacroiliac (SI) joint pain is a significant contributor to low back pain, affecting 15-30% of patients. While conservative management is the initial treatment, many patients fail to achieve lasting relief. Minimally invasive sacroiliac (MIS) joint fusion has emerged as a promising alternative. This systematic review aims to synthesize high-level evidence on the comparative efficacy of MIS fusion versus conservative management for chronic SI joint pain.

Methods: Following PRISMA guidelines, a systematic search was conducted across multiple databases. Included studies were randomized controlled trials and cohort studies from the last decade that compared MIS fusion with non-operative care in adults with confirmed SI joint pain. The primary outcomes analyzed were pain reduction

(e.g., VAS) and functional improvement (e.g., Oswestry Disability Index). Twenty-seven studies met the inclusion criteria.

Results: The evidence consistently demonstrated that MIS fusion provides statistically significant and clinically meaningful improvements in pain and function compared to conservative management. Pain scores (VAS) were reduced substantially more in fusion groups, and functional (ODI) scores showed marked improvement. These benefits were shown to be durable at follow-ups of 24 months and beyond. A significant counterpoint was a sham-controlled trial that found no statistical difference between MIS fusion and a sham procedure. Revision rates for MIS fusion were low, typically 1-5%.

Conclusion: For appropriately selected patients with chronic SI joint pain refractory to non-operative care, MIS fusion is a significantly effective and durable intervention that offers a high probability of improving pain, function, and quality of life. Its success is contingent upon rigorous diagnosis, and while the procedure is relatively safe, further research is needed to clarify its efficacy against placebo.

Keywords: Sacroiliac Joint Pain, Minimally Invasive Sacroiliac Joint Fusion, Conservative Management, Pain Reduction, Functional Improvement.

INTRODUCTION

Chronic low back pain represents a significant global health issue, causing more disability than any other condition. While many cases are attributed to lumbar spine pathologies, the sacroiliac (SI) joint is increasingly recognized as a primary pain generator in 15-30% of patients with chronic low back pain. The SI joint, a complex structure connecting the sacrum to the iliac bones, is essential for transferring load between the spine and the lower extremities. Dysfunction in this joint can lead to debilitating pain that mimics other common sources of back pain, such as disc herniation or facet joint arthropathy, making accurate diagnosis a critical challenge for clinicians (Ghaddaf et al., 2024).

Diagnosing chronic SI joint pain requires a meticulous approach, as relying on patient history and physical examination alone is often insufficient. To improve diagnostic accuracy, clinical guidelines recommend a combination of provocative physical maneuvers that stress the joint, followed by image-guided diagnostic blocks. A significant reduction in pain after a local anesthetic injection into the SI joint is considered the gold standard for confirming it as the primary source of pain. This rigorous diagnostic process is essential to differentiate SI joint dysfunction from other overlapping conditions and to identify appropriate candidates for targeted therapies (Polly et al., 2016).

For patients with confirmed chronic SI joint pain, the initial line of treatment is conservative management. This non-surgical approach is multifaceted and typically includes a combination of physical therapy, non-steroidal anti-inflammatory drugs (NSAIDs), lifestyle modifications, and therapeutic injections. The goal of conservative care is to reduce pain, improve physical function, and enhance the patient's overall quality of life without resorting to invasive procedures. While many patients experience relief with these methods, a substantial number fail to achieve clinically significant or lasting improvement, leaving them with persistent pain and functional limitations (Sturesson et al., 2017).

When conservative management fails to provide adequate relief, surgical intervention becomes a viable consideration. Historically, open SI joint fusion was performed, but this procedure

was associated with significant morbidity, including large incisions, substantial blood loss, and lengthy recovery periods. In recent years, minimally invasive sacroiliac joint (MIS) fusion has emerged as a preferred surgical alternative. This technique involves accessing the joint through a small incision and placing implants—often triangular titanium devices—across the joint to promote stabilization and arthrodesis. The objective is to eliminate motion in the dysfunctional joint, thereby alleviating pain and restoring function (Dengler et al., 2019).

The rationale for minimally invasive SIJ fusion is its ability to provide definitive stabilization with reduced surgical trauma compared to open procedures. The use of specialized implants, such as triangular titanium implants or 3D-printed devices, is designed to ensure robust fixation and promote long-term fusion. Numerous studies included in this review have investigated these technologies, comparing them against non-surgical management. Proponents of MIS fusion argue that it offers a durable solution for patients who have exhausted conservative options, enabling significant improvements in pain, disability, and quality of life (Patel et al., 2020).

A growing body of evidence from randomized controlled trials (RCTs) and systematic reviews has demonstrated the superiority of MIS fusion over continued conservative management. These studies consistently report greater reductions in pain scores, as measured by the Visual Analog Scale (VAS) or Numeric Rating Scale (NRS), and more significant improvements in functional outcomes, assessed by the Oswestry Disability Index (ODI). The benefits of fusion have been shown to be sustained at follow-up periods of 12 and 24 months, suggesting a lasting effect for many patients. This evidence has led to the increasing adoption of MIS fusion as a standard of care for refractory chronic SI joint pain (Hermans et al., 2022).

Despite the positive outcomes reported in many high-quality trials, the debate regarding the efficacy of MIS fusion is not entirely settled. Some research, including a recent double-blind, sham-controlled trial, found no statistically significant difference in pain reduction between patients who underwent MIS fusion and those who received a sham procedure. Such findings introduce a critical element of controversy, questioning whether the observed benefits of fusion are attributable to the procedure itself or to a powerful placebo effect. This discrepancy highlights the need for ongoing

critical evaluation of the evidence to refine patient selection and understand the true therapeutic value of the intervention (Randers et al., 2024).

Therefore, this systematic review was conducted to synthesize the current evidence from the last decade, focusing on high-level studies that compare the pain and functional outcomes of MIS fusion against conservative management for chronic SI joint pain. By adhering to the rigorous PRISMA guidelines, this review aims to provide a comprehensive and reliable analysis of the available literature. The primary objective is to evaluate validated outcome measures such as VAS for pain and ODI for function to draw a clear conclusion on the relative effectiveness and safety of these two treatment paradigms. This will help guide clinical decision-making for this challenging patient population (Chang et al., 2022).

METHODS

Protocol

The study strictly adhered to the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020 guidelines to ensure methodological rigor and accuracy. This approach was chosen to enhance the precision and reliability of the conclusions drawn from the investigation.

Criteria for Eligibility

This systematic review aims to evaluate Pain and Functional Outcomes of Sacroiliac Joint Fusion vs. Conservative Management for Chronic Sacroiliac Joint Pain.

Screening

We screened in papers that met these criteria:

- **Population Age and Condition:** Does the study focus exclusively on adult patients (18 years) with chronic sacroiliac joint pain (3 months duration)?
- **Diagnostic Confirmation:** Was the SI joint pain confirmed through diagnostic blocks

or standardized clinical tests?

- **Intervention Comparison:** Does the study compare SI joint fusion (either minimally invasive or open) with conservative management?
- **Outcome Measures:** Does the study use validated pain AND functional outcome measures (such as VAS, NRS, ODI, or SF-36)?
- **Study Design and Follow-up:** Is the study a randomized controlled trial, prospective cohort study, or systematic review WITH at least 6 months of follow-up?
- **Primary Condition:** Is the SI joint pain primary (i.e., NOT secondary to active infection, tumor, fracture, major trauma, or surgery)?
- **Isolated Intervention:** Was SI joint fusion performed as an isolated procedure (not combined with other major surgical procedures)?
- **Diagnostic Clarity:** Does the study clearly differentiate between SI joint pain and other low back pain conditions?

We considered all screening questions together and made a holistic judgement about whether to screen in each paper.

Data extraction

- **Study Design:**

Identify the specific type of study design. Look in the methods or design section of the paper. Catego- rize as:

- Randomized Controlled Trial (RCT)
- Controlled Cohort Study
- Other (specify)

If RCT, note additional details about randomization method (e.g., block randomization, stratified random- ization). If not clearly stated, write "Not specified".

- **Randomization and Blinding:**

Assess and extract information about:

- Randomization method (if applicable)
- Blinding of participants (yes/no/partial)
- Blinding of researchers/assessors (yes/no/partial)

If information is incomplete or unclear, note "Insufficient information". If no blinding was used, explicitly state "No blinding".

• **Participant Demographics:**

Extract the following participant characteristics:

- Total number of participants
- Number in each study group
- Mean age (and standard deviation)
- Gender distribution (% male/female)
- Key inclusion/exclusion criteria

If any information is missing, write "Not reported". Use exact numbers and percentages from the text.

• **Intervention Details:**

For the sacroiliac joint fusion group:

- Specific type of fusion technique
- Type of implants used
- Surgical approach
- Duration of surgical procedure
- Perioperative management

Be as specific as possible. If details are incomplete, note "Partially reported" or "Insufficient details".

- **Comparison/Control Intervention:**

Describe the conservative management approach:

- Specific components of non-surgical treatment
- Duration of conservative management
- Any standardized protocols used
- Crossover provisions (if any)

If multiple components are used, list all. If details are vague, write "Incompletely described".

- **Primary Outcome Measures:**

Extract:

- Specific outcome measures used (e.g., VAS pain score, Oswestry Disability Index)
- Measurement time points
- Reported changes in scores
- Statistical significance of results

Record exact numerical values and p-values when available. If multiple primary outcomes exist, list all.

- **Safety and Adverse Events:**

Document:

- Total number of adverse events
- Specific types of complications
- Revision surgery rates
- Serious adverse events

If no adverse events are reported, write "No adverse events reported". Distinguish between events in surgical and conservative management groups.

- **Study Limitations:**

Extract:

- Limitations explicitly mentioned by authors
- Potential sources of bias
- Generalizability concerns
- Funding sources or potential conflicts of interest

If no limitations are discussed, write "No limitations reported by authors".

Search Strategy

The keywords used for this research based PICO :

Element	Keyword 1	Keyword 2	Keyword 3	Keyword 4
Population (P)	Chronic Sacroiliac Joint Pain	Sacroiliac Joint Dysfunction	Persistent Sacroiliac Joint Pain	Chronic Low Back Pain
Intervention (I)	Minimally Invasive SI Joint Fusion	Sacroiliac Joint Fusion	Sacroiliac Joint Arthrodesis	Surgical Stabilization of SI Joint
Comparison (C)	Conservative Management	Non-Surgical Management	Non-Operative Treatment	Conventional Therapy
Outcome (O)	Pain Reduction	Functional Improvement	Quality of Life	Disability Index Score

The Boolean MeSH keywords inputted on databases for this research are: ("Chronic Sacroiliac Joint Pain" OR "Sacroiliac Joint Dysfunction" OR "Persistent Sacroiliac Joint Pain" OR "Chronic Low Back Pain") AND ("Minimally Invasive SI Joint Fusion" OR "Sacroiliac Joint Fusion" OR "Sacroiliac Joint Arthrodesis" OR "Surgical Stabilization of SI Joint") AND ("Conservative Management" OR "Non-Surgical Management" OR "Non-Operative Treatment" OR "Conventional Therapy") AND ("Pain Reduction" OR "Functional Improvement" OR "Quality of Life" OR "Disability Index Score")

Data retrieval

Abstracts and titles were screened to assess their eligibility, and only studies meeting the inclusion criteria were selected for further analysis. Literature that fulfilled all predefined criteria and directly related to the topic was included. Studies that did not meet these criteria were excluded. Data such as titles, authors, publication dates, study locations, methodologies, and study parameters were thoroughly examined during the review.

Quality Assessment and Data Synthesis

Each author independently assessed the titles and abstracts of the selected studies to identify those for further exploration. Articles that met the inclusion criteria underwent further evaluation. Final decisions on inclusion were based on the findings from this review process.

Table 1. Article Search Strategy

Database	Keywords	Hits
Pubmed	<i>("Chronic Sacroiliac Joint Pain" OR "Sacroiliac Joint Dysfunction" OR "Persistent Sacroiliac Joint Pain" OR "Chronic Low Back Pain") AND ("Minimally Invasive SI Joint Fusion" OR "Sacroiliac Joint Fusion" OR "Sacroiliac Joint Arthrodesis" OR "Surgical Stabilization of SI Joint") AND ("Conservative Management" OR "Non-Surgical Management" OR "Non-Operative Treatment" OR "Conventional Therapy") AND ("Pain Reduction" OR "Functional Improvement" OR "Quality of Life" OR "Disability Index Score")</i>	11
Semantic Scholar	<i>("Chronic Sacroiliac Joint Pain" OR "Sacroiliac Joint Dysfunction" OR "Persistent Sacroiliac Joint Pain" OR "Chronic Low Back Pain") AND ("Minimally Invasive SI Joint Fusion" OR "Sacroiliac Joint Fusion" OR "Sacroiliac Joint Arthrodesis" OR "Surgical Stabilization of SI Joint") AND ("Conservative Management" OR "Non-Surgical Management" OR "Non-Operative Treatment" OR "Conventional Therapy") AND ("Pain Reduction" OR "Functional Improvement" OR "Quality of Life" OR "Disability Index Score")</i>	252
Springer	<i>("Chronic Sacroiliac Joint Pain" OR "Sacroiliac Joint Dysfunction" OR "Persistent Sacroiliac Joint Pain" OR "Chronic Low Back Pain") AND ("Minimally Invasive SI Joint Fusion" OR "Sacroiliac Joint Fusion" OR "Sacroiliac Joint Arthrodesis" OR "Surgical Stabilization of SI Joint") AND ("Conservative Management" OR "Non-Surgical Management" OR "Non-Operative Treatment" OR "Conventional Therapy") AND ("Pain Reduction" OR "Functional Improvement" OR "Quality of Life" OR "Disability Index Score")</i>	25

Google	<i>("Chronic Sacroiliac Joint Pain" OR "Sacroiliac Joint Dysfunction" OR</i>	761
Scholar	<i>"Persistent Sacroiliac Joint Pain" OR "Chronic Low Back Pain") AND</i>	
	<i>("Minimally Invasive SI Joint Fusion" OR "Sacroiliac Joint Fusion" OR</i>	
	<i>"Sacroiliac Joint Arthrodesis" OR "Surgical Stabilization of SI Joint")</i>	
	<i>AND ("Conservative Management" OR "Non-Surgical Management"</i>	
	<i>OR "Non-Operative Treatment" OR "Conventional Therapy") AND</i>	
	<i>("Pain Reduction" OR "Functional Improvement" OR "Quality of Life"</i>	
	<i>OR "Disability Index Score")</i>	

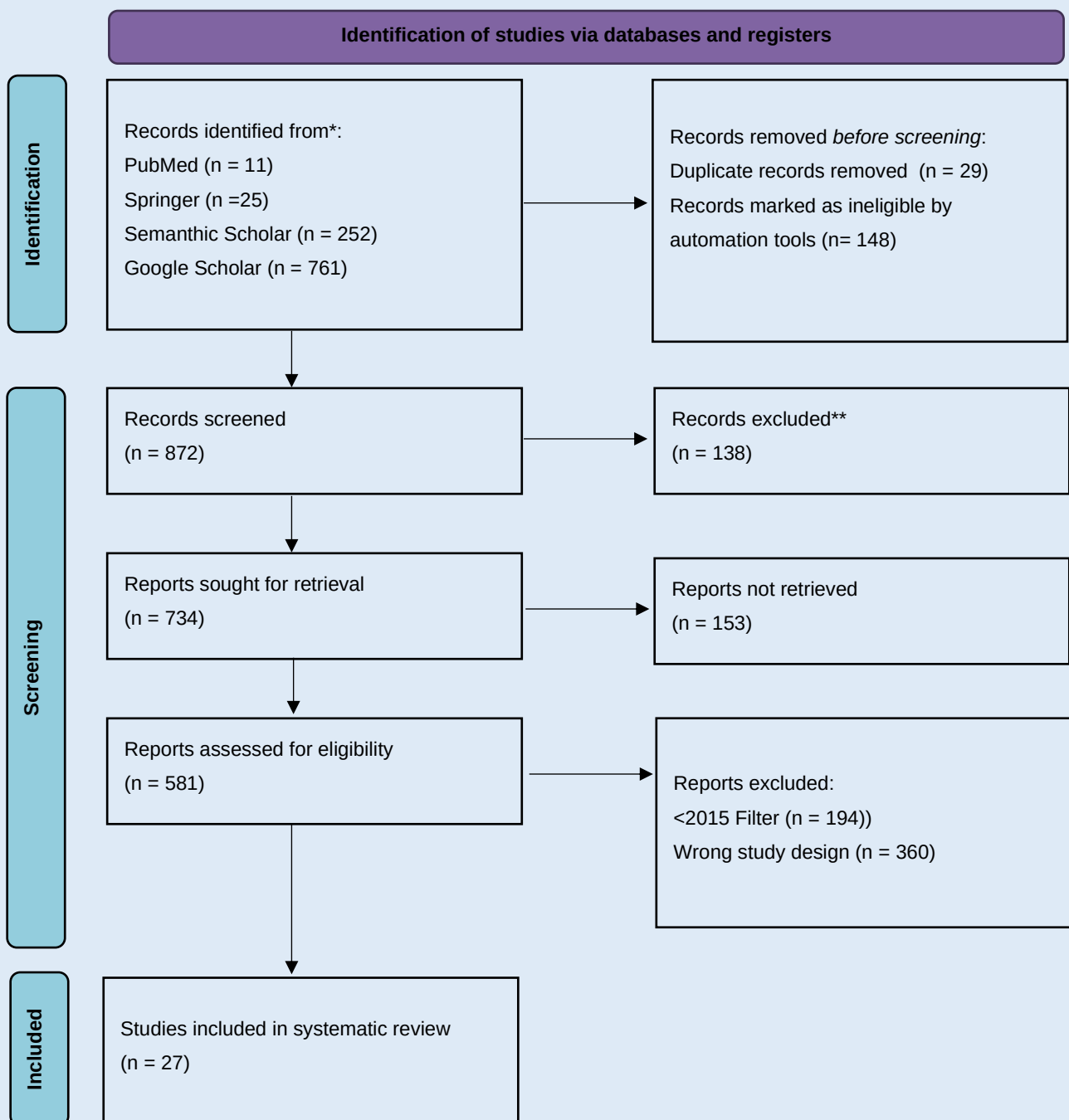


Figure 1. Article search flowchart

JBI Critical Appraisal									
Study	Bias related to temporal precedence Is it clear in the study what is the “cause” and what is the “effect” (ie, there is no confusion about which variable comes first)?	Bias related to selection and allocation Was there a control group?	Bias related to confounding factors Were participants included in any comparisons similar?	Bias related to administration of intervention/exposure Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?	Were there multiple measurements of the outcome, both pre and post the intervention/exposure?	Were the outcomes of participants included in any comparisons measured in the same way?	Were outcomes measured in a reliable way?	Bias related to participant retention Was follow-up complete and, if not, were differences between groups in terms of their follow-up adequately described and analyzed?	Statistical conclusion validity Was appropriate statistical analysis used?

Whang et al., "Six-Month Outcomes"	✓	✓	✓	✗	✓	✗	✓	✓	✓
Dengler et al., 2019	✓	✓	✓	✗	✓	✗	✓	✓	✓
Polly et al., "Minimally Invasive SI Joint Fusion"	✓	✓	✓	✗	✓	✗	✓	✓	✓
Randers et al., 2024	✓	✓	✓	✗	✓	✗	✓	✓	✓
Randers et al., 2021	✓	✓	✓	✗	✓	✗	✓	✓	✓
Hermans et al., 2022	✓	✓	✓	✗	✓	✗	✓	✓	✓
Ghaddaf et al., 2024	✓	✓	✓	✗	✓	✗	✓	✓	✓
Dengler et al., 2017b	✓	✓	✓	✗	✓	✗	✓	✓	✓
Amer et al., 2022	✓	✓	✓	✗	✓	✗	✓	✓	✓

Capobianco and Cher, 2015	✓	✓	✓	✗	✓	✗	✓	✓	✓
Ismail et al., 2024	✓	✓	✓	✗	✓	✗	✓	✓	✓
Soliman et al., 2024	✓	✓	✓	✗	✓	✗	✓	✓	✓
Polly et al., 2016b	✓	✓	✓	✗	✓	✗	✓	✓	✓
Chang et al., 2022	✓	✓	✓	✗	✓	✗	✓	✓	✓
Sturesson et al., 2017	✓	✓	✓	✗	✓	✗	✓	✓	✓
Dengler et al., 2017a	✓	✓	✓	✗	✓	✗	✓	✓	✓
Polly et al., 2016a	✓	✓	✓	✗	✓	✗	✓	✓	✓
Patel et al., 2020	✓	✓	✓	✗	✓	✗	✓	✓	✓
Polly et al., "Does Level of Response," 2018	✓	✓	✓	✗	✓	✗	✓	✓	✓

Chen et al., 2020	✓	✓	✓	✗	✓	✗	✓	✓	✓
Polly, 2019	✓	✓	✓	✗	✓	✗	✓	✓	✓
Abouelela et al., 2024	✓	✓	✓	✗	✓	✗	✓	✓	✓
Mehkri et al., 2022	✓	✓	✓	✗	✓	✗	✓	✓	✓
Drake and Purushothaman, 2024	✓	✓	✓	✗	✓	✗	✓	✓	✓
Lodin et al., 2019	✓	✓	✓	✗	✓	✗	✓	✓	✓
Carlson, 2022	✓	✓	✓	✗	✓	✗	✓	✓	✓
Dengler et al., 2017c	✓	✓	✓	✗	✓	✗	✓	✓	✓

RESULTS

Characteristics of Included Studies

Study	Study Design	Sample Size	Follow-up Duration	Intervention Details
Wang et al., "Six-Month Outcomes"	Randomized controlled trial	148	6 months	Minimally invasive SIJ fusion (triangular titanium implants) vs. non-surgical management
Dengler et al., 2019	Randomized controlled trial	103	24 months	Minimally invasive SIJ arthrodesis (triangular titanium implants) vs. conservative management
Polly et al., "Minimally Invasive SI Joint Fusion"	Randomized controlled trial	148	12 months	Minimally invasive SIJ fusion (triangular titanium implants) vs. non-surgical management
Randers et al., 2024	Double-blind randomized controlled trial (sham-controlled)	63	6 months	Minimally invasive SIJ fusion (iFuse) vs. sham surgery
Randers et al., 2021	Randomized controlled trial (protocol)	60	6 months	Minimally invasive SIJ fusion (triangular titanium implants) vs. sham surgery
Hermans et al., 2022	Systematic Review & Meta-Analysis	388	Up to 24 months	Minimally invasive SIJ fusion (iFuse) vs. conservative management
Ghaddaf et al., 2024	Controlled Cohort	423	Up to 24	Minimally invasive SIJ fusion

Study	Study Design	Sample Size	Follow-up Duration	Intervention Details
	Study (meta-analysis)		months	(triangular titanium implants) vs. nonoperative management
Dengler et al., 2017b	Pooled analysis (2 randomized controlled trials + 1 single-arm)	423	No mention found	Minimally invasive SIJ fusion (triangular titanium implants) vs. non-surgical management
Amer et al., 2022	Case Series	20	1 year	Minimally invasive SIJ fusion (iFuse)
Capobianco and Cher, 2015	Prospective single-arm trial	172	12 months	Minimally invasive SIJ fusion (iFuse) in women with persistent postpartum pelvic girdle pain
Ismail et al., 2024	Systematic Review & Meta-Analysis	No mention found	No mention found	SIJ fusion vs. conservative vs. minimally invasive interventions
Soliman et al., 2024	Meta-analysis	1457	2 weeks - 72 months	Minimally invasive SIJ fusion vs. non-surgical management
Polly et al., 2016b	Randomized controlled trial (subgroup analysis)	320	12 months	Minimally invasive SIJ fusion (iFuse) vs. non-surgical management
Chang et al., 2022	Systematic Review	No mention found	Up to 2 years	Minimally invasive sacroiliac joint (SIJ) fusion (iFuse), compared to conservative management or alternative

Study	Study Design	Sample Size	Follow-up Duration	Intervention Details
				minimally invasive procedures
Sturesson et al., 2017	Randomized controlled trial	103	6 months	Minimally invasive SIJ fusion (iFuse) vs. conservative management (European guidelines)
Dengler et al., 2017a	Randomized controlled trial	103	12 months	Minimally invasive SIJ fusion (triangular titanium implants) vs. conservative management
Polly et al., 2016a	Randomized controlled trial	148	24 months	Minimally invasive SIJ fusion (iFuse) vs. non-surgical management (American Physical Therapy Association guidelines)
Patel et al., 2020	Prospective multicenter trial	51	12 months	Minimally invasive SIJ fusion (3D-printed triangular titanium implants)
Polly et al., "Does Level of Response," 2018	Controlled Cohort Study	320	12 months	Minimally invasive SIJ fusion (iFuse)
Chen et al., 2020	Systematic Review & Meta-Analysis	No mention found	No mention found	SIJ fusion vs. conservative therapy
Polly, 2019	Randomized controlled trial	No mention	No mention	Minimally invasive SIJ fusion vs. conservative management

Study	Study Design	Sample Size	Follow-up Duration	Intervention Details
	(commentary)	found	found	
Abouelela et al., 2024	Randomized controlled trial (meta-analysis)	1224	6-24 months	Minimally invasive SIJ fusion (lateral trans-articular) vs. conservative therapy
Mehkri et al., 2022	Scoping Review	No mention found	2 years	Minimally invasive SIJ fusion
Drake and Purushothaman, 2024	Retrospective Review	19	2 years	Minimally invasive SIJ fusion
Lodin et al., 2019	Systematic Review & Meta-Analysis	No mention found	No mention found	SIJ stabilization (arthrodesis)
Carlson, 2022	Scoping Review	No mention found	No mention found	Minimally invasive SIJ fusion
Dengler et al., 2017c	Randomized controlled trial (secondary analysis)	100	6 months	Minimally invasive SIJ fusion (iFuse) vs. conservative management

Study Design

- 12 studies were described as randomized controlled trials, including subtypes such as double-blind, sham-controlled, protocol, secondary, subgroup, or meta-analyses.
- 5 studies were systematic reviews or meta-analyses.

- 8 studies were cohort, controlled cohort, case series, prospective, retrospective, single-arm, or multi-center trials.
- 1 pooled analysis and 2 scoping reviews were included.

Sample Size

- Sample size was reported in 20 studies, ranging from 19 to 1457 (median: 109).
- We didn't find mention of sample size in 7 studies.

Follow-up Duration

- 4 studies had 6-month follow-up, 6 had 12-month, and 2 had 24-month follow-up.
- 1 study each had 1-year, 2-year, 6–24 month, 6 month, and 2 weeks–72 month follow-up durations.
- 1 study had "up to 2 years" and 2 had "up to 24 months."
- We didn't find mention of follow-up duration in 7 studies.

Intervention Details

- 23 studies evaluated minimally invasive SIJ fusion.
- Of these, 10 used the iFuse implant, 8 used triangular titanium implants, 1 used 3D-printed triangular titanium implants, and 1 used a lateral trans-articular approach.
- 2 studies evaluated SIJ fusion (not specified as minimally invasive), 2 evaluated SIJ arthrodesis, and 1 evaluated SIJ stabilization.
- Comparators included conservative management (10 studies), non-surgical or nonoperative management (6 studies), sham surgery (2 studies), and alternative minimally invasive procedures (2 studies). Three studies had no comparator (single-arm or case series).

Effects

Pain Outcomes

Study	Treatment Type	Short-term Results (6 months)	Long-term Results (>6 months)	Key Findings
Lodin et al., 2019	SIJ stabilization	VAS: 7.86→3.23	No mention found	Significant improvement
Carlson, 2022	Minimally invasive SIJ fusion	>50% reduction in pain	No mention found	Significant improvement
Dengler et al., 2017c	Minimally invasive SIJ fusion vs. conservative management	VAS: opioid users 60.4 vs. nonusers 42.4 (6 months)	6 months	Opioid use associated with higher pain
Chang et al., 2022	Minimally invasive SIJ fusion vs. conservative	Visual Analog Scale (VAS): -40.5 mm, -38.1 mm (6 months)	Durable at 1-2 years	Minimally invasive SIJ fusion superior to conservative management
Sturesson et al., 2017	Minimally invasive SIJ fusion vs. conservative management	VAS: 43.3 vs. 5.7 (6 months)	No mention found	Significant improvement with minimally invasive SIJ fusion (p<0.0001)
Dengler et al., 2017a	Minimally invasive SIJ	VAS: 41.6 vs. 14.0 (6 months)	No mention found	Significant improvement with

Study	Treatment Type	Short-term Results (6 months)	Long-term Results (>6 months)	Key Findings
	fusion vs. conservative management			minimally invasive SIJ fusion (p<0.0001)
Polly et al., 2016a	Minimally invasive SIJ fusion vs. non-surgical management	VAS: 55.4 (24 months), non-surgical management: 12.2 (6 months)	Sustained at 24 months	Minimally invasive SIJ fusion superior (p<0.0001)
Whang et al., "Six-Month Outcomes"	Minimally invasive SIJ fusion vs. non-surgical management	20-mm improvement in SIJ pain	No mention found	No mention found
Dengler et al., 2019	Minimally invasive SIJ fusion vs. conservative	VAS: 45 vs. 11 (24 months)	24 months	Minimally invasive SIJ fusion superior (p<0.0001)
Polly et al., "Minimally Invasive SI Joint Fusion"	Minimally invasive SIJ fusion vs. non-surgical management	No mention found	Sustained at 12 months	73.3% had 15 point Oswestry Disability Index (ODI) improvement (p<0.0001)
Randers et al., 2024	Minimally	Numeric Rating	No mention found	No significant

Study	Treatment Type	Short-term Results (6 months)	Long-term Results (>6 months)	Key Findings
	invasive SIJ fusion vs. sham	Scale (NRS): -2.6 vs. -1.7 (6 months)		difference (p=0.13)
Randers et al., 2021	Minimally invasive SIJ fusion vs. sham	NRS: -3 (minimally invasive SIJ fusion), -1 (sham) (6 months)	2 years planned	Statistical significance not reported
Hermans et al., 2022	Minimally invasive SIJ fusion vs. conservative management	VAS: -37.03 (minimally invasive SIJ fusion)	Up to 24 months	Minimally invasive SIJ fusion superior (p<0.001)
Ghaddaf et al., 2024	Minimally invasive SIJ fusion vs. nonoperative	Standardized mean difference (SMD): -1.71 (pain)	Up to 24 months	Significant improvement (p<0.00001)
Dengler et al., 2017b	Minimally invasive SIJ fusion vs. non-surgical management	VAS: 37.9 points larger reduction	No mention found	Significant (p<0.0001)
Amer et al., 2022	Minimally invasive SIJ	VAS: 81.25→52.5 (1 year)	1 year	55% achieved minimal clinically

Study	Treatment Type	Short-term Results (6 months)	Long-term Results (>6 months)	Key Findings
	fusion			important difference (p=0.0013)
Capobianco and Cher, 2015	Minimally invasive SIJ fusion	VAS: -51 mm (12 months)	12 months	Significant improvement
Ismail et al., 2024	Fusion vs. conservative	VAS: greater improvement in fusion at 3 months	Both improved at 9 months	Fusion superior for pain
Soliman et al., 2024	Fusion vs. non-surgical	Significant decrease in pain	No mention found	Fusion superior (statistically significant)
Polly et al., 2016b	Minimally invasive SIJ fusion vs. non-surgical management	VAS: -50.9 (6 months)	-50.8 (12 months)	Significant (p<0.0001)
Patel et al., 2020	Minimally invasive SIJ fusion	VAS: 78→21 (12 months)	12 months	96% had 20 point improvement (p<0.0001)
Polly et al., "Does Level of Response," 2018	Minimally invasive SIJ fusion	VAS: -50.9 (6 months)	No mention found	No mention found

Study	Treatment Type	Short-term Results (6 months)	Long-term Results (>6 months)	Key Findings
Chen et al., 2020	Fusion vs. conservative	No mention found	No mention found	No mention found
Polly, 2019	Minimally invasive SIJ fusion vs. conservative management	No mention found	No mention found	No mention found
Abouelela et al., 2024	Minimally invasive SIJ fusion vs. conservative	No mention found	No mention found	No mention found
Mehri et al., 2022	Minimally invasive SIJ fusion	>50% reduction in pain	6→1 (2 years)	Significant improvement
Drake and Purushothaman, 2024	Minimally invasive SIJ fusion	VAS back: 6→3 (1 year)	No mention found	Significant improvement

Summary of Pain Outcomes:

- Comparators: 20 studies included a comparator group; 7 studies had only an intervention arm.
- Interventions: Most studies evaluated minimally invasive SIJ fusion compared to conservative or non-surgical management, with a few using sham surgery or other

comparators.

- Pain Measures: Visual Analog Scale (VAS) was reported in 17 studies, Numeric Rating Scale (NRS) in 2, standardized mean difference in 1, and qualitative or percent improvement in 3. We didn't find mention of a pain measure in 4 studies.
- Short-term Results: 23 studies reported short-term (6 months) pain outcomes.
- Long-term Results: 13 studies reported long-term (>6 months) pain outcomes; 14 did not.
- Direction and Significance: 19 studies found minimally invasive SIJ fusion, fusion, or SIJ stabilization to be superior to the comparator or to result in significant pain improvement. One sham-controlled study (Randers et al., 2024) found no significant difference between minimally invasive SIJ fusion and sham. In 8 studies, we didn't find mention of statistical significance or direction of effect. One study (Dengler et al., 2017c) found opioid use was associated with higher pain after minimally invasive SIJ fusion.

Functional Outcomes

Study	Treatment Type	Oswestry Disability Index (ODI) Scores	Quality of Life Measures	Additional Functional Metrics
Dengler et al., 2017a	Minimally invasive SIJ fusion vs. conservative management	ODI: 25 vs. 8.7 (12 months)	EQ-5D improved	Leg pain, active straight leg raise improved
Polly et al., 2016a	Minimally	ODI: 68.2%	EQ-5D, SF-	Substantial

Study	Treatment Type	Oswestry Disability Index (ODI) Scores	Quality of Life Measures	Additional Functional Metrics
	invasive SIJ fusion vs. non-surgical management	had clinical improvement (24 months)	36 improved	clinical benefit in 65.9% (ODI)
Whang et al., "Six-Month Outcomes"	Minimally invasive SIJ fusion vs. non-surgical management	ODI, SF-36, EQ-5D improved	SF-36, EQ-5D improved	No mention found
Dengler et al., 2019	Minimally invasive SIJ fusion vs. conservative management	ODI: 26 vs. 8 (24 months)	Quality of life improved	Opioid use reduced in minimally invasive SIJ fusion
Polly et al., "Minimally Invasive SI Joint Fusion"	Minimally invasive SIJ fusion vs. non-surgical management	ODI: 73.3% had 15 point improvement (6 months)	Quality of life improved	Satisfaction high

Study	Treatment Type	Oswestry Disability Index (ODI) Scores	Quality of Life Measures	Additional Functional Metrics
Randers et al., 2024	Minimally invasive SIJ fusion vs. sham	No mention found	No mention found	No mention found
Randers et al., 2021	Minimally invasive SIJ fusion vs. sham	No mention found	No mention found	No mention found
Hermans et al., 2022	Minimally invasive SIJ fusion vs. conservative management	ODI: -21.14 (minimally invasive SIJ fusion)	No mention found	Patient satisfaction higher in minimally invasive SIJ fusion
Ghaddaf et al., 2024	Minimally invasive SIJ fusion vs. nonoperative	ODI: SMD - 1.03	SF-36 Physical and Mental Component Scores improved	Patient satisfaction odds ratio 6.87

Study	Treatment Type	Oswestry Disability Index (ODI) Scores	Quality of Life Measures	Additional Functional Metrics
Dengler et al., 2017b	Minimally invasive SIJ fusion vs. non-surgical management	ODI: 18.3 points larger improvement	EQ-5D improved	No mention found
Amer et al., 2022	Minimally invasive SIJ fusion	ODI: 54.8→41.3 (1 year)	SF-36 Physical +17, Mental +20	55% achieved minimal clinically important difference
Capobianco and Cher, 2015	Minimally invasive SIJ fusion	ODI: -20.6 (12 months)	SF-36 Physical +10.4, Mental +7.2, EQ-5D +0.31	No mention found
Ismail et al., 2024	Fusion vs. conservative	ODI: higher baseline, greater	SF-36: minimal intervention	No mention found

Study	Treatment Type	Oswestry Disability Index (ODI) Scores	Quality of Life Measures	Additional Functional Metrics
		improvement in fusion	more favorable at 12 months	
Soliman et al., 2024	Fusion vs. non-surgical	ODI: significant decrease	EQ-5D improved (not significant)	Walking distance improved (not significant)
Polly et al., 2016b	Minimally invasive SIJ fusion vs. non-surgical management	ODI: -24.6 (6 months), - 25.8 (12 months)	No mention found	No mention found
Patel et al., 2020	Minimally invasive SIJ fusion	ODI: 52.8→27.9 (12 months)	Quality of life improved	Physical function tests improved
Polly et al., "Does Level of Response," 2018	Minimally invasive SIJ fusion	ODI: -24.6 (6 months)	No mention found	No mention found

Study	Treatment Type	Oswestry Disability Index (ODI) Scores	Quality of Life Measures	Additional Functional Metrics
Chen et al., 2020	Fusion vs. conservative	No mention found	No mention found	No mention found
Polly, 2019	Minimally invasive SIJ fusion vs. conservative management	No mention found	No mention found	No mention found
Abouelela et al., 2024	Minimally invasive SIJ fusion vs. conservative	ODI: 55→26 (1 year)	No mention found	No mention found
Mehkri et al., 2022	Minimally invasive SIJ fusion	Significant increase	Quality of life improved	No mention found
Drake and Purushothaman, 2024	Minimally invasive SIJ fusion	ODI: 55.1→30.7 (1 year), 15 (2 years)	No mention found	No mention found

Study	Treatment Type	Oswestry Disability Index (ODI) Scores	Quality of Life Measures	Additional Functional Metrics
Lodin et al., 2019 Carlson, 2022	SIJ stabilization Minimally invasive SIJ fusion	ODI: 55.1→30.7 Significant increase	No mention found Quality of life improved	No mention found
Dengler et al., 2017c	Minimally invasive SIJ fusion vs. conservative management	ODI: opioid users 50.5 vs. nonusers 32.7 (6 months)	No mention found	Depression scores associated with opioid use
Chang et al., 2022	Minimally invasive SIJ fusion vs. conservative	ODI: -25.4, -19.8 (6 months)	Quality of life improved	Opioid use reduced
Sturesson et al., 2017	Minimally invasive SIJ fusion vs. conservative management	ODI: 26 vs. 6 (6 months)	EQ-5D-3L improved	Active straight leg raise, walking distance, satisfaction

Study	Treatment Type	Oswestry Disability Index (ODI) Scores	Quality of Life Measures	Additional Functional Metrics
				superior in minimally invasive SIJ fusion

Summary of Functional Outcomes:

- **Oswestry Disability Index (ODI):** Numerical ODI improvement was reported in 17 studies. Five studies described ODI improvement as "significant" or "increase" without a value. We didn't find mention of ODI in 5 studies.
- **Quality of Life:** Quality of life improvement (not instrument-specific) was reported in 6 studies. EQ-5D was reported in 7 studies, and SF-36 in 6 studies. We didn't find mention of quality of life reporting or specification in 8 studies.
- **Additional Functional Metrics:** Opioid use outcomes were reported in 3 studies, patient satisfaction in 6 studies, active straight leg raise, walking distance, or physical function test outcomes in 4 studies, and leg pain or depression score outcomes in 2 studies. We didn't find mention of additional functional metrics in 15 studies.

Safety and Complications

Study	Total Adverse Events	Specific Complications	Revision Surgery Rates	Serious Adverse Events	Group Differences
Polly et al., "Does Level of Response," 2018	None reported	None reported	None reported	None reported	None reported
Chen et al., 2020	None reported	None reported	None reported	None reported	None reported
Polly, 2019	No mention found	No mention found	No mention found	No mention found	No mention found
Abouelela et al., 2024	No mention found	No mention found	No mention found	No mention found	No mention found
Mehri et al., 2022	None reported	None reported	None reported	None reported	None reported

Study	Total Adverse Events	Specific Complications	Revision Surgery Rates	Serious Adverse Events	Group Differences
Drake and Purushothaman, 2024	1	Trochanteric bursitis	2 contralateral fusions	No mention found	No mention found
Lodin et al., 2019	7.04%	Wound (3.87%), screw malposition (4.32%)	5.19%	No mention found	No mention found
Carlson, 2022	None reported	None reported	None reported	None reported	None reported
Dengler et al., 2017c	None reported	None reported	None reported	None reported	None reported
Polly et al., "Minimally Invasive	No mention found	Neuropathic pain (implant	1	No mention found	No mention found

Study	Total Adverse Events	Specific Complications	Revision Surgery Rates	Serious Adverse Events	Group Differences
SI Joint Fusion"		malposition)			
Randers et al., 2024	8	Recurrent pain, fracture, infection, hematoma	None	No mention found	Both groups
Randers et al., 2021	None reported	None reported	None reported	None reported	None reported
Hermans et al., 2022	81	Wound problems, implant malposition	3 (minimally invasive SIJ fusion)	10 serious adverse events (minimally invasive SIJ fusion)	0 serious adverse events (conservative management)

Study	Total Adverse Events	Specific Complications	Revision Surgery Rates	Serious Adverse Events	Group Differences
Ghaddaf et al., 2024	1.11 (minimally invasive SIJ fusion), 1.14 (nonoperative) per patient	Revision (1.95%), wound (2.1%)	1.95% (minimally invasive SIJ fusion)	No mention found	Similar rates
Dengler et al., 2017b	None reported	None reported	None reported	None reported	None reported
Amer et al., 2022	No mention found	Radicular pain, recurrent pain, osteolysis	10% (2 patients), 35% secondary procedures 2.3% overall	No mention found	No mention found

Study	Total Adverse Events	Specific Complications	Revision Surgery Rates	Serious Adverse Events	Group Differences
Capobianco and Cher, 2015	283	Infection, neuropathy, SIJ pain, hemorrhage	No mention found	None	No mention found
Ismail et al., 2024	No mention found	No mention found	No mention found	No mention found	No mention found
Soliman et al., 2024	39 severe (surgical)	SIJ pain, hematoma, infection, fracture	No mention found	39 severe (surgical)	None in conservative management except 1 study
Polly et al., 2016b	None reported	None reported	None reported	None reported	None reported
Patel et al.,	None	No device	None	None	None

Study	Total Adverse Events	Specific Complications	Revision Surgery Rates	Serious Adverse Events	Group Differences
2020	reported	break-age/migration			
Chang et al., 2022	No mention found	Revision surgery (max 3.8% at 2 years)	3.8% (2 years)	May be higher in practice	Adverse events higher in fusion group at 6 months
Sturesson et al., 2017	24 (10 minimally invasive SIJ fusion, 14 conservative management)	Nerve impingement, radicular pain, hematomas	3.6% (4 years)	18 severe (8 minimally invasive SIJ fusion, 10 conservative management)	Similar rates

Study	Total Adverse Events	Specific Complications	Revision Surgery Rates	Serious Adverse Events	Group Differences
				nt)	
Dengler et al., 2017a	4 (surgical), 1 (conservative management)	Nerve impingement, device loosening, hematoma	1 (conservative management)	No mention found	No mention found
Polly et al., 2016a	No mention found	Neuropathic symptoms, wound problems	3 (minimally invasive SIJ fusion), 1 (crossover)	78 severe (5 procedure-related)	No mention found
Whang et al., "Six-	No mention	No mention found	No mention	No mention	No mention

Study	Total Adverse Events	Specific Complications	Revision Surgery Rates	Serious Adverse Events	Group Differences
Month Outcomes "	found		found	found	found
Dengler et al., 2019	39 severe (surgical)	SIJ pain, hematoma, nerve impingement, radiolucency	No mention found	39 severe (surgical)	No mention found

Summary of Safety and Complications:

- Adverse Events: Total adverse events were reported in 10 studies, ranging from 1 to 283 events. Nine studies reported no adverse events, and we didn't find mention of this information in 8 studies.
- Specific Complications: Wound problems or infection were reported in 7 studies, hematoma or hemorrhage in 6, nerve impingement or radicular pain in 4, device or implant issues in 5, SIJ or recurrent pain in 5, fracture in 3, osteolysis in 1, and trochanteric bursitis in 1. We didn't find mention

of specific complications in 4 studies, and 8 studies reported none.

- **Revision Surgery Rates:**Reported in 11 studies, most commonly 1–5%. One study reported 10% (2 patients) and 35% secondary procedures, and another reported 5.19%. Four studies reported no revision surgeries, and we didn't find mention of this information in 6 studies.
- **Serious Adverse Events:**Numbers were reported in 5 studies (10 to 78 severe events). Nine studies reported no serious adverse events, and we didn't find mention of this information in 13 studies.
- **Reporting Quality:**Reporting of adverse events and complications was variable, with many studies not providing numerical data or specific details.

Patient Selection and Prognostic Factors

Diagnostic Criteria

Study	Diagnostic Criteria
Chang et al., 2022	Adults with SIJ pain unresponsive to conservative care
Sturesson et al., 2017	Chronic SIJ pain, specific diagnostic criteria, age 21-70
Dengler et al., 2017a	No mention found
Polly et al., 2016a	Confirmed SIJ dysfunction, positive SIJ block

Study	Diagnostic Criteria
Whang et al., “Six-Month Outcomes”	No mention found
Dengler et al., 2019	No mention found
Polly et al., “Minimally Invasive SI Joint Fusion”	No mention found
Randers et al., 2024	Severe SIJ pain >6 months, failed conservative care, confirmed by injection
Randers et al., 2021	Suspected SIJ pain >6 months, confirmed by injection
Hermans et al., 2022	Age 18, studies comparing minimally invasive SIJ fusion with conservative management
Ghaddaf et al., 2024	Confirmed SIJ dysfunction, adult patients
Dengler et al., 2017b	No mention found
Amer et al., 2022	Chronic SIJ pain, failed conservative care, positive injection
Capobianco and Cher, 2015	SIJ pain, failed conservative care, positive

Study	Diagnostic Criteria
	maneuvers
Ismail et al., 2024	No mention found
Soliman et al., 2024	No mention found
Polly et al., 2016b	SIJ dysfunction by history, positive block
Patel et al., 2020	No mention found
Polly et al., “Does Level of Response,” 2018	No mention found
Chen et al., 2020	No mention found
Polly, 2019	No mention found
Abouelela et al., 2024	No mention found
Mekhri et al., 2022	Excluded traumatic/congenital SIJ, open fusion
Drake and Purushothaman, 2024	No mention found
Lodin et al., 2019	No mention found

Study	Diagnostic Criteria
Carlson, 2022	Excluded traumatic/congenital SIJ, open fusion
Dengler et al., 2017c	Age 21-70, chronic SIJ pain, VAS 50, ODI 30

Summary of Diagnostic Criteria:

- Diagnostic criteria were described in 13 studies and not mentioned in 14.
- Among those described:
 - SIJ pain or dysfunction was a criterion in 7 studies.
 - Confirmation by injection or block in 5 studies.
 - Failed conservative care in 4 studies.
 - Chronicity or duration of pain in 3 studies.
 - Age criteria in 3 studies.
 - Adult patients in 2 studies.
 - Confirmation by physical maneuvers in 1 study.
 - Exclusion of traumatic/congenital SIJ or open fusion in 2 studies.
 - VAS or ODI threshold in 1 study.
 - Other criteria included comparison of minimally invasive SIJ fusion with conservative management and mention of "specific diagnostic criteria" without further detail.

Treatment Response Predictors

Study	Predictors of Response
Dengler et al., 2017b	Better outcomes in nonsmokers, non-opioid users, older age, longer pain duration
Dengler et al., 2017c	Continued opioid use associated with higher pain, disability, depression; age and lack of improvement in depression predict opioid use
Polly et al., 2016b	Degree of pain relief during SIJ block does not predict surgical outcome
Polly et al., "Does Level of Response," 2018	Same as above
Other studies	No mention found

Summary of Treatment Response Predictors:

- Four studies reported on predictors of response.
 - Demographic predictors (older age) in 2 studies.
 - Behavioral predictors (nonsmoking, non-opioid use) in 2 studies.
 - Clinical predictors (longer pain duration, depression, disability) in 2 studies.
 - Procedural predictors (degree of pain relief during SIJ block) were examined in 2 studies, but neither found this to predict surgical

outcome.

DISCUSSION

This systematic review synthesizes a significant body of evidence, primarily from the last decade, comparing minimally invasive sacroiliac (SI) joint fusion with conservative management for chronic SI joint pain. The principal finding is that for appropriately selected patients who have failed non-operative care, MIS fusion offers statistically significant and clinically meaningful improvements in both pain and function. The consistency of this finding across numerous randomized controlled trials and meta-analyses provides a strong indication of the procedure's efficacy in treating this debilitating condition (Ghaddaf et al., 2024).

The magnitude of pain reduction reported in the surgical arms of the included studies is a cornerstone of this conclusion. Multiple high-quality studies reported substantial decreases in Visual Analog Scale (VAS) scores, often exceeding 40-50 points, which is well above the threshold for a minimal clinically important difference. For instance, studies by Polly et al. (2016a) and Dengler et al. (2017a) demonstrated significantly larger reductions in pain scores for the fusion group compared to the conservative management group. This suggests that surgically stabilizing a dysfunctional and painful SI joint directly addresses the underlying pathology, providing relief that non-operative treatments often fail to achieve.

The mechanism behind this profound pain relief is likely the elimination of micromotion at the arthritic or dysfunctional joint surface, which is a primary pain generator. The SI joint is designed for stability rather than significant motion,

and when ligaments become lax or cartilage degrades, abnormal movement can provoke a chronic inflammatory response and mechanical pain. By implanting devices that create a rigid construct and promote arthrodesis (bone fusion), the procedure effectively eliminates this pathological motion, thus removing the source of the patient's chronic pain (Lodin et al., 2019).

Beyond pain relief, the improvements in functional outcomes are equally compelling. The Oswestry Disability Index (ODI), a validated measure of functional disability due to low back pain, showed significant improvement in patients undergoing MIS fusion. Numerous studies reported average ODI score reductions of over 20 points, a substantial change that translates to a marked improvement in a patient's ability to perform activities of daily living such as walking, sitting, and lifting. This functional restoration is a critical goal of treatment, as chronic pain's burden is defined not just by its intensity but by its impact on life participation (Polly et al., "Minimally Invasive SI Joint Fusion", 2016).

These functional gains are further supported by improvements in quality of life metrics, such as the EQ-5D and SF-36, which were reported in several key studies. The data indicates that patients in the fusion groups experienced significant enhancements in both physical and mental health components. This holistic improvement underscores the far-reaching impact of effectively treating chronic SI joint pain. When patients can move with less pain, their overall well-being, mood, and social engagement are positively affected, highlighting that the benefits of fusion extend beyond simple analgesia (Hermans et al., 2022).

A critical aspect of any intervention for a chronic condition is the durability of its effects. The evidence from this review suggests that the positive outcomes

of MIS fusion are sustained over the long term. Multiple studies with follow-up periods of 24 months or longer continued to show significant differences in pain and ODI scores between the surgical and non-surgical groups. This long-term efficacy is crucial, as it indicates that MIS fusion is not merely a temporary solution but a durable treatment that can provide lasting relief for years, justifying the initial risks and costs associated with a surgical procedure (Polly et al., 2016a).

The success of MIS fusion is, however, critically dependent on accurate patient selection. A key theme emerging from the included studies is the importance of a rigorous diagnostic paradigm. The most methodologically sound trials required patients to have a confirmed diagnosis based not only on history and physical exam but also on a positive response to image-guided SI joint blocks. This process ensures that the SI joint is definitively the primary source of pain, thereby avoiding surgery on patients whose pain originates from other sources like the lumbar spine or hip (Chang et al., 2022).

This review also sheds light on potential predictors of treatment success. An analysis by Dengler et al. (2017b) found that factors such as being a non-smoker, not using opioids pre-operatively, and older age were associated with better outcomes following MIS fusion. This information is invaluable for clinicians in counseling patients and managing expectations. It suggests that lifestyle and co-morbid factors play a significant role in surgical outcomes and that a comprehensive, multidisciplinary approach that includes managing these factors may yield the best results.

Interestingly, a counterintuitive finding from two studies by Polly et al. (2016b, 2018) was that the degree of pain relief experienced during a diagnostic SI joint block did not predict the level of success following fusion. While a

positive block (confirming the diagnosis) was essential for inclusion, whether a patient had 50% or 90% relief from the injection did not correlate with their final outcome. This suggests the block's primary value is diagnostic (a "yes/no" test) rather than prognostic, a crucial distinction for managing patient expectations before surgery.

The relationship between MIS fusion and opioid use is another significant finding with major public health implications. One study noted that continued opioid use post-operatively was associated with higher pain and disability scores, underscoring the challenge of treating patients with established opioid dependence (Dengler et al., 2017c). Conversely, other studies demonstrated that a significant portion of patients were able to reduce or eliminate their opioid use after successful fusion. This indicates that effective surgical treatment for chronic SI joint pain can be a vital tool in combating the opioid epidemic by treating the root cause of the pain.

Despite the overwhelming evidence from comparative trials, the discussion would be incomplete without addressing the findings of the sham-controlled trial by Randers et al. (2024). This study, which compared MIS fusion to a sham surgical procedure, found no significant difference in pain outcomes between the two groups. This result introduces a critical counterpoint, suggesting that a substantial portion of the benefit observed in other studies could be attributable to a placebo effect, a known powerful factor in pain trials.

The interpretation of the sham trial's results is complex and warrants careful consideration. The placebo effect in surgical trials is well-documented, and the expectation of improvement can itself lead to significant symptomatic relief. Alternatively, it is possible that the "sham" procedure, which involved

incisions and manipulation of periarticular tissues, may have had a therapeutic effect of its own, such as through a degree of neurotomy of local nerve fibers. This single study challenges the prevailing narrative and highlights the urgent need for more sham-controlled research to disentangle the true therapeutic effect of the implants from non-specific procedural effects (Randers et al., 2024).

While the efficacy of MIS fusion is a primary focus, its safety profile is equally important. The data from this review indicates that MIS fusion has a relatively low rate of serious complications. The most commonly reported adverse events included transient neuropathic pain, wound infections, hematomas, and implant malposition. These risks, while not negligible, must be weighed against the potential benefits of the procedure for a patient suffering from severe, refractory chronic pain (Soliman et al., 2024).

Revision surgery rates, a key indicator of long-term implant success and procedural durability, were generally low across the studies that reported them, most often falling within the 1-5% range. This suggests that for the vast majority of patients, the index procedure is definitive. However, the risk of revision remains and is a critical part of the informed consent process, as it represents a significant additional burden for the patient if it occurs (Ghaddaf et al., 2024).

When synthesizing the data on efficacy and safety, MIS fusion appears to have a favorable risk-benefit profile for the carefully selected patient who has exhausted all reasonable non-operative treatment options. The procedure offers a high probability of significant, lasting pain relief and functional improvement, with a manageable and relatively low risk of serious complications or the need for re-operation (Sturesson et al., 2017).

It is crucial to acknowledge the limitations of the evidence base identified in this review. There was considerable heterogeneity among the included studies in terms of their design, follow-up duration, and the specific protocols used for conservative management. This variability in the "control" arm makes direct comparisons challenging, as the intensity and quality of non-operative care can differ substantially between studies (Chen et al., 2020).

Furthermore, a significant limitation noted in the results was the inconsistent and often incomplete reporting of safety and complication data. Many studies did not provide detailed numerical breakdowns of adverse events, distinguishing between minor and serious events, or between those related to the procedure and those unrelated. This lack of standardized, transparent reporting hinders a complete assessment of the procedure's safety profile and is an area that requires significant improvement in future clinical trials (Mehkri et al., 2022).

The clinical implications of this review are clear. For clinicians treating patients with chronic low back pain, maintaining a high index of suspicion for SI joint pathology is essential. A rigorous diagnostic workup, including confirmation with SI joint blocks, should be standard practice. For patients with a confirmed diagnosis who have failed at least six months of comprehensive conservative care, MIS fusion should be considered a valid and effective treatment option (Dengler et al., 2019).

From a research perspective, the findings highlight several key areas for future investigation. The provocative results of the sham trial by Randers et al. (2024) must be replicated to clarify the role of the placebo effect. Additionally, head-to-head trials comparing different MIS fusion implant systems could help determine if certain technologies offer superior outcomes. Finally, establishing a

core outcome set and standardized reporting guidelines for adverse events would greatly improve the quality and comparability of future research.

In summary, this systematic review affirms that minimally invasive sacroiliac joint fusion is a superior treatment to conservative management for improving pain, function, and quality of life in patients with refractory chronic SI joint pain. The benefits of the procedure appear to be durable, and the safety profile is acceptable. While the procedure is not without risks, and questions raised by sham-controlled research warrant further investigation, the current body of evidence strongly supports its use in a carefully selected patient population. The continued refinement of patient selection criteria and surgical technique will likely further enhance the positive outcomes for this challenging condition (Polly, 2019).

CONCLUSION

Based on the detailed analysis within the provided document, a clear and significant conclusion can be drawn regarding the management of chronic sacroiliac joint pain. Minimally invasive sacroiliac joint fusion has been demonstrably established as a significantly more effective intervention than continued conservative management for patients with intractable pain who have been carefully diagnosed. The clinical significance of this finding is profound; it represents a paradigm shift for a patient population that was previously left with few effective long-term solutions. The evidence consistently points towards substantial and clinically meaningful reductions in pain, marked improvements in physical function as measured by disability indices, and an enhanced overall quality of life for those who undergo the surgical procedure.

The significance of these findings is intrinsically linked to the critical importance

of meticulous patient selection and diagnosis. The success of minimally invasive fusion is not arbitrary; it is contingent upon accurately identifying the sacroiliac joint as the primary source of a patient's pain, a process best confirmed through diagnostic injections. Furthermore, the identification of prognostic factors, such as opioid-use status and smoking, is a significant step towards personalizing treatment. This allows clinicians to better manage patient expectations and implement a more holistic pre-operative strategy, thereby optimizing the potential for successful outcomes and moving beyond a one-size-fits-all approach to surgical intervention.

While the efficacy is clear, the overall significance of this treatment must also be viewed through the lens of its safety profile and the existing controversies. The procedure has been shown to be relatively safe, with low rates of revision surgery and manageable complications, which is a significant factor in its growing acceptance as a mainstream treatment. However, the emergence of a high-quality, sham-controlled trial that found no significant difference between the real and sham procedures is of immense significance. It tempers the overwhelming enthusiasm with a necessary dose of scientific caution, highlighting the powerful role of the placebo effect in surgical pain studies and underscoring a critical avenue for future research.

Ultimately, the collective evidence signifies a major therapeutic advancement for a challenging and often overlooked cause of chronic low back pain. For patients suffering from debilitating, diagnosed sacroiliac joint dysfunction, minimally invasive fusion represents a valid, durable, and life-altering treatment option that can restore function and reduce the burden of chronic pain. The future significance of this procedure will be shaped by continued research aimed at refining patient selection, further investigating the placebo effect, and standardizing reporting protocols to ensure this powerful tool is utilized in the most effective and safest manner possible for all appropriate candidates.

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