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Management of Sacroiliac Joint Pain: A Comparative Study

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ABSTRACT

This study aims to compare the efficacy, safety, and patient satisfaction associated with three different treatment modalities—medical management, sacroiliac joint (SIJ) injections, and radiofrequency ablation (RFT)—in managing chronic SIJ pain. The findings aim to guide clinicians in optimizing treatment approaches for this challenging condition.

A retrospective analysis was conducted on 150 patients diagnosed with chronic SIJ pain between 2023 and 2024. Patients were treated with medical management (NSAIDs and physical therapy), fluoroscopy-guided corticosteroid injections, or RFT targeting the lateral branches of sacral nerves. Pain intensity was assessed using the Visual Analog Scale (VAS), functional improvement with the Oswestry Disability Index (ODI), and patient satisfaction via a Likert scale. Safety was evaluated by monitoring adverse events across all modalities.

RFT demonstrated superior outcomes, achieving significant pain reduction (VAS score reduction from 7.3 to 3.5), improved functionality (45% improvement in ODI scores), and the highest patient satisfaction (85%). Pain relief lasted up to 12 months with RFT, compared to six months with SIJ injections and three months with medical management. Adverse events were minimal, with transient soreness being the most common.

Radiofrequency ablation provides the most effective and durable relief for SIJ pain among the studied modalities, with minimal complications. These results highlight RFT as a valuable option for managing refractory SIJ pain, warranting further investigation into its integration with multimodal treatment approaches.

Keywords: Sacroiliac joint pain, radiofrequency ablation, corticosteroid injection, chronic low back pain, functional improvement

Introduction

Sacroiliac joint (SIJ) dysfunction is a well-recognized yet frequently underdiagnosed cause of chronic low back pain, accounting for an estimated 15-30% of cases. This condition arises from a variety of etiologies, including trauma, degenerative changes, inflammatory processes, and biomechanical abnormalities. (1,2) The complex anatomy and biomechanical role of the SIJ, serving as a critical link between the spine and pelvis, often complicates its clinical assessment and differentiation from other causes of low back pain, such as lumbar disc herniation or hip pathology. (3)

Diagnosing SIJ dysfunction requires a multi-faceted approach combining clinical assessment, imaging modalities, and diagnostic injections. Common clinical tests, such as the FABER (Flexion, Abduction, and External Rotation) test, provide initial clues, while advanced imaging techniques, including MRI and CT, are employed to exclude differential diagnoses. However, the gold standard for confirming SIJ dysfunction remains the response to diagnostic injections, emphasizing the importance of precision and expertise during the evaluation process. (4,5)

Management of SIJ pain encompasses a spectrum of treatment options, ranging from conservative measures to advanced interventional techniques. Initial approaches typically include physical therapy, nonsteroidal anti-inflammatory drugs (NSAIDs), and lifestyle modifications. When these fail to provide adequate relief, interventional strategies such as corticosteroid injections and radiofrequency ablation (RFT) are considered. Among these, RFT has emerged as a promising modality due to its potential to provide long-lasting pain relief by targeting the nociceptive nerve fibers associated with the SIJ. (6,7)

Despite advancements in interventional pain management, there remains a lack of consensus on

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the comparative efficacy and safety of these treatment modalities. This knowledge gap underscores the need for evidence-based research to guide clinical decision-making. (8,9)

This study seeks to address this gap by retrospectively analyzing the outcomes of medical management, sacroiliac joint injections, and RFT in a diverse cohort of patients. The primary objective is to evaluate pain reduction, functional improvement, patient satisfaction, and safety across these modalities, providing valuable insights for optimizing the management of chronic SIJ pain.

Materials and Methods

This retrospective cohort study was conducted at a tertiary care center between January 2023 and December 2024. A total of 150 patients were included in the study, consisting of 86 females (57.3%) and 64 males (42.7%). The age range of participants was 26 to 72 years, with a mean age of 49.6 years. (tablo 1)

Patients were eligible for the study if they met the following criteria:
- Aged 18–75 years.
- Diagnosed with chronic sacroiliac joint (SIJ) pain lasting ≥6 months.
- Diagnosis confirmed through a combination of:
  - Clinical evaluation, including positive findings from tests such as the FABER (Flexion, Abduction, and External Rotation) test.
  - Imaging studies, such as magnetic resonance imaging (MRI) or computed tomography (CT), to exclude differential diagnoses.
  - Confirmatory diagnostic injections, with significant pain reduction (≥50%) following local anesthetic administration.

The following patients were excluded from the study:
- Those who had undergone prior surgical intervention for SIJ dysfunction.
- Individuals with coexisting spinal pathologies (e.g., lumbar disc herniation).
- Patients with systemic inflammatory conditions (e.g., ankylosing spondylitis).
- Those with contraindications to the treatment modalities under investigation.

Treatment Modalities

1. Medical Management Patients received nonsteroidal anti-inflammatory drugs (NSAIDs) for pain control, supplemented with physical therapy. Physical therapy protocols focused on strengthening and stabilization exercises targeting the biomechanics of the SIJ. Lifestyle modifications, such as weight management and ergonomic education, were also implemented.
2. Sacroiliac Joint Injections Fluoroscopy-guided corticosteroid injections were administered to ensure accurate intra-articular placement. A single dose of 40 mg triamcinolone acetonide was used in a sterile setting by an experienced interventional radiologist. Procedural accuracy was confirmed via contrast dye imaging.
3. Radiofrequency Ablation (RFT) RFT involved ablation of the lateral branches of the sacral nerves using a temperature-controlled radiofrequency device. Under fluoroscopic guidance, ablation was performed at 80°C for 90 seconds per lesion. All procedures were conducted by trained pain specialists. Patients received local anesthesia prior to the intervention to minimize discomfort.

Outcome Measures

1. Pain Intensity Pain reduction was assessed using the Visual Analog Scale (VAS), with measurements taken pre-treatment, post-treatment, and at follow-up intervals of 3, 6, and 12 months.
2. Functional Improvement Functional outcomes were evaluated using the Oswestry Disability Index (ODI), with scores recorded at baseline and at 3, 6, and 12 months post-treatment.
3. Patient Satisfaction Satisfaction levels were recorded using a 5-point Likert scale, ranging from "very dissatisfied" to "very satisfied."
4. Safety and Complications Adverse events were documented during the procedures and throughout the follow-up period. These included both procedure-specific and general complications.

Data analysis was performed using SPSS Statistics (Version 27.0, IBM Corp., Armonk, NY). Continuous variables were analyzed using paired t-tests for within-group comparisons and ANOVA for between-group comparisons. Categorical variables were evaluated using chi-square tests. Normality of data distribution was confirmed with the Shapiro-Wilk test. Statistical significance was defined as $p < 0.05$.

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

Results

A total of 150 patients were included in the detailed analysis: 50 in the medical management group, 50 receiving SIJ injections, and 50 undergoing RFT. The mean age was 49.6 years, and 60% of participants were female

Pain Reduction: Pain intensity was significantly reduced in all groups, with the most pronounced reduction observed in the RFT group. Mean VAS scores decreased from 7.3 ± 1.0 to 3.5 ± 1.4 in the RFT group, compared to 7.4 ± 1.2 to 4.2 ± 1.5 for SIJ injections and 7.2 ± 1.1 to 5.8 ± 1.3 for medical management ($p < 0.001$ for all comparisons). Pain relief persisted for 12 months in the RFT group, whereas it lasted 6 months for SIJ injections and 3 months for medical management. **(**Table 2 and Figure 1) *(Statistical significance indicated by p-values in Tables 2 and 3.)*

Functional Improvement: The ODI scores demonstrated significant improvement in all groups, with the highest improvement in the RFT group. The RFT group showed a 45% reduction in ODI scores, compared to 30% for SIJ injections and 15% for medical management. These improvements were consistent with the observed reductions in VAS scores. (Table 3 and figure 2) *A proportion of patients continued to experience moderate disability despite pain relief, possibly due to biomechanical or psychosocial factors.*

Patient Satisfaction: The RFT group reported the highest satisfaction rates (85%), followed by the SIJ injection group (70%) and the medical management group (50%). Satisfaction was positively correlated with pain relief and functional outcomes. (Table 4)

Complications: Minor adverse events were observed across all groups. These included transient soreness at the injection site (12% in the SIJ injection group) and mild neuritis (8% in the RFT group). No severe complications, such as infection or permanent neurological deficits, were reported.

Discussion

This study underscores the superior efficacy and safety profile of radiofrequency ablation (RFT) in managing chronic sacroiliac joint (SIJ) pain. By providing sustained pain relief and improving functional outcomes, RFT demonstrates a compelling advantage over sacroiliac joint injections and conservative medical management. These findings align with the growing body of literature supporting advanced interventional techniques for chronic pain management.

Comparative Efficacy of Treatment Modalities: RFT emerged as the most effective modality in this study, demonstrating significant and sustained reductions in Visual Analog Scale (VAS) scores and a 45% improvement in the Oswestry Disability Index (ODI). Its long-lasting effects, extending up to 12 months, emphasize its role as a first-line treatment for refractory SIJ pain. Previous studies have also underscored the durability of nerve ablation techniques in disrupting chronic nociceptive pathways. (10) Advancements such as cooled RFT have further enhanced safety and precision, enabling consistent outcomes and minimizing complications. These innovations solidify RFT's position as a leading option for managing chronic SIJ pain. *It should be noted that conventional thermal RFT under fluoroscopic guidance was used, not cooled RFT or advanced imaging-guided techniques.*

While SIJ injections provided moderate relief, their short-lived effects, lasting approximately six months, limit their utility for long-term management.[11] This limitation could potentially be mitigated through repeated interventions or combination therapies, such as pairing injections with physical therapy or adjunctive pain management strategies. However, further studies are necessary to evaluate the efficacy and safety of these approaches, as well as their impact on extending the therapeutic benefits of SIJ injections. This aligns with findings from other studies that highlight corticosteroid injections as best suited for addressing acute exacerbations of SIJ pain rather than serving as a primary long-term solution. Exploring strategies such as repeated injections or combining them with adjunct therapies might extend their utility. However, these approaches would require careful evaluation to balance potential benefits against risks such as procedural complications or corticosteroid-related side effects.

Medical management, including NSAIDs and physical therapy, showed the least efficacy in this study. This underperformance could be attributed to the limited ability of these approaches to address the complex pathophysiology of SIJ pain, which often involves multifactorial nociceptive mechanisms. However, certain subsets of patients, such as those with mild SIJ dysfunction, early-

Table 1: Demographic Characteristics of The Patients Included In The Study

Characteristic	Value
Total Patients	150
Female Patients	86
Male Patients	64
Age Range (years)	26-72

Table 2: Pain Reduction Outcomes Measured by the Visual Analog Scale (VAS) Across Different Treatment Groups

Treatment Group	Baseline VAS Score	Post-treatment VAS Score	Duration of Effectiveness
Medical Management	7.2 ± 1.1	5.8 ± 1.3	3 months
SIJ Injections	7.4 ± 1.2	4.2 ± 1.5	6 months
Radiofrequency Thermoregulation	7.3 ± 1.0	3.5 ± 1.4	12 months

Table 3: Functional Improvement Outcomes Measured by the Oswestry Disability Index (ODI) Across Treatment Groups

Treatment Group	Baseline ODI Score	Improvement Percentage
Medical Management	40 ± 5	15%
SIJ Injections	42 ± 6	30%
Radiofrequency Thermoregulation	43 ± 4	45%

Table 4: Patient satisfaction rates across different treatment modalities

Treatment Group	Satisfaction Rate
Medical Management	50%
SIJ Injections	70%
Radiofrequency Thermoregulation	85%

stage pain, or contraindications to invasive procedures, might benefit more from these approaches. Further research is needed to identify specific patient profiles that respond well to medical management, as well as to explore the potential benefits of combining these treatments with more advanced interventional modalities. Despite being minimally invasive and accessible, the limited impact on pain reduction and functional improvement highlights the need for more robust therapeutic strategies. (12) Certain subsets of patients, such as those with mild SIJ dysfunction or contraindications to invasive procedures, might benefit more from these approaches. Additionally, integrating medical management with interventional treatments could optimize outcomes and provide a holistic care strategy.

Gender Differences in SIJ Pain: The higher prevalence of SIJ pain among females observed in this study aligns with existing literature attributing this disparity to anatomical and hormonal factors. (13) Anatomical differences, such as a wider pelvis and increased pelvic mobility during pregnancy, combined with hormonal fluctuations like increased relaxin levels, contribute to this susceptibility. Addressing these factors through targeted interventions, such as pelvic stabilization exercises and hormone-regulated therapies, could enhance treatment outcomes. Additionally, incorporating patient education on posture and biomechanics during pregnancy and postpartum may further mitigate SIJ dysfunction. Increased pelvic mobility during pregnancy, hormonal fluctuations, and biomechanical differences contribute to the greater susceptibility of females to SIJ dysfunction. Tailored rehabilitation programs, focusing on these specific factors, could improve treatment outcomes for female patients. (15) Moreover, including gender-specific considerations in both diagnostic protocols and therapeutic interventions could enhance patient

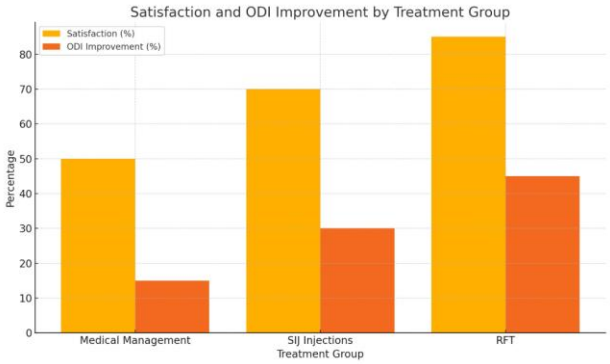

Fig. 1. This graph demonstrates the progression of Visual Analog Scale (VAS) scores at different time points (Baseline, 3 months, 6 months, and 12 months) across the three treatment groups

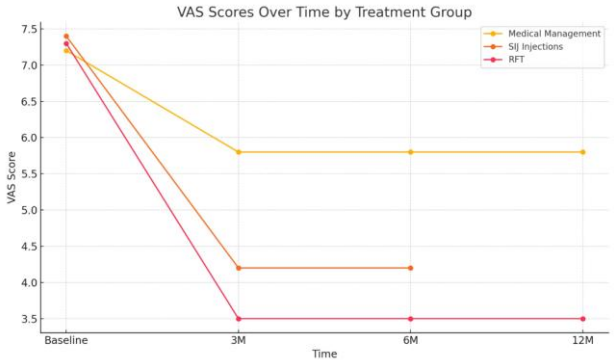

Fig. 2. This bar chart compares the levels of patient satisfaction and functional improvement, measured by the Oswestry Disability Index (ODI), among the three treatment groups

satisfaction and efficacy. Addressing these factors through research and clinical practice would allow for a more nuanced approach to managing SIJ pain in females.

Technological Innovations in RFT: Recent advancements in RFT, including cooled radiofrequency ablation (CRFA), have significantly enhanced the safety and efficacy of this modality. (15) emphasized that imaging-guided RFT ensures precise localization of target nerves, reducing procedural risks and maximizing therapeutic outcomes. (16) Highlighted the role of advanced imaging techniques, such as MRI thermography, in improving procedural accuracy, which is particularly relevant for complex interventions like RFT. Future studies should explore the integration of such technologies into routine clinical practice to further optimize results.

Economic Considerations: Economic analyses demonstrate that while RFT incurs higher upfront costs, its long-term efficacy and reduced need for repeat interventions make it a cost-effective option for managing chronic SIJ pain. Specific cost savings, such as reduced hospitalization rates and decreased reliance on adjunct therapies, highlight its economic advantages. Comparatively, sacroiliac joint injections and conservative management often require frequent follow-ups and additional treatments, increasing their cumulative costs over time. These findings underscore the value of RFT in achieving sustained outcomes while minimizing long-term healthcare expenditures, particularly in resource-constrained settings. Providing specific data on cost savings, such as reduced hospitalization rates or diminished reliance on adjunct therapies, could strengthen this argument. Comparative analyses with other modalities, such as SIJ injections or conservative management, would provide additional context. In resource-constrained healthcare systems, these findings are particularly relevant, as sustainable and effective treatments are critical to optimizing care delivery. (17,18)

Multimodal Approaches to Pain Management: Integrating RFT with complementary therapies, such as osteopathic manipulation and physical therapy, could amplify its benefits. (12) Emphasized the importance of a multimodal approach, advocating for the combination of interventional and conservative therapies to address the multifactorial nature of SIJ pain. (19) further supported this perspective, emphasizing the importance of holistic care models in chronic pain management.

Future Directions: Future research should focus on prospective, randomized controlled trials to validate these findings and explore additional biomarkers for predicting treatment outcomes. (20) Biomarkers related to inflammation, nerve sensitivity, or genetic predispositions could be particularly impactful in identifying patients who would benefit most from specific interventions. Trials investigating these biomarkers alongside novel diagnostic methods, such as imaging or molecular assays, would provide valuable insights into personalized treatment approaches. For instance, identifying biomarkers related to inflammation or nerve sensitivity could guide personalized care strategies. Incorporating novel diagnostic tools, such as infrared thermography, (21) could enhance the precision of interventions and enable earlier identification of SIJ dysfunction. Furthermore, leveraging artificial intelligence to optimize treatment planning, predict outcomes, and analyze patient data has the potential to revolutionize the management of chronic SIJ pain. These advancements could pave

the way for more effective and individualized therapeutic strategies.

This study highlights the effectiveness of radiofrequency ablation (RFT) as a first-line treatment for chronic sacroiliac joint (SIJ) pain, offering sustained pain relief and functional improvement over other modalities. By addressing both the physical and technological aspects of treatment, RFT demonstrates significant advantages in safety, efficacy, and long-term cost-effectiveness. Tailoring interventions to patient-specific factors, including gender and pain severity, and integrating complementary therapies can further enhance outcomes. Future research should focus on refining diagnostic tools, leveraging biomarkers, and exploring innovative technologies to optimize care delivery. As advancements in RFT and multimodal approaches continue, they hold promise for improving the quality of life for patients with chronic SIJ pain.

Ethical Approval: In our study, written consent was obtained from all participants, in accordance with the Declaration of Helsinki. Ethics Committee permission was obtained from BLINDED FOR REVIEW Ethics Committee with a decision dated 08.02.2024 and numbered B.10.1.TKH.4.34.H.GP.0.01/47.

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