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REVIEW

Effectiveness of Radiofrequency Ablation for Chronic Low Back Pain: A Systematic Review of Sham-Controlled Randomized Controlled Trials

Tamerlan Shokanov[1], Talgat Anashev[1], Kazybek Baktybergen[2], Yerdar Shaukhin[1]

[1]Department of Orthopedic Trauma and Pain Management, National Scientific Center of Traumatology and Orthopedics Named After N.D. Batpenov, Astana, Kazakhstan; [2]Department of Trauma and Orthopedics, Nazarbayev University School of Medicine, Astana, Kazakhstan

Correspondence: Yerdar Shaukhin, National Scientific Center of Traumatology and Orthopedics named after N.D. Batpenov (NSCTO), Astana, Kazakhstan, Email shaukhin_ye@nscto.kz

Background: Radiofrequency ablation (RFA) is widely used as an interventional treatment for chronic low back pain; however, its clinical effectiveness across different pain generators remains uncertain, particularly when evaluated in rigorously controlled trials.

Objective: To systematically review randomized controlled trials assessing the effectiveness of RFA for chronic low back pain, stratified by pain generator and radiofrequency technique.

Methods: A systematic search of PubMed, Embase, the Cochrane Library, and ClinicalTrials.gov was conducted to identify randomized controlled trials evaluating RFA for chronic low back pain. Trials employing sham or active comparator interventions were included. Study selection, data extraction, and risk of bias assessment were performed independently by two reviewers.

Results: Six randomized controlled trials involving different pain generators were included. For discogenic low back pain, RFA of the ramus communicans did not demonstrate superiority over sham treatment, with pain reduction observed over time in both groups. Similarly, for facet joint pain, medial branch RFA was not superior to sham procedures within the studied follow-up period. For sacroiliac joint pain, results were heterogeneous. Sham-controlled trials evaluating conventional lateral branch RFA did not demonstrate a specific treatment effect, whereas studies employing alternative techniques, including strip-lesion, capsular, or cooled RFA, were associated with greater and more sustained pain reduction, with statistically significant between-group differences reported at up to 12 months in selected trials.

Conclusion: Based on a limited number of randomized controlled trials, RFA does not consistently demonstrate superiority over sham treatment for discogenic or facet joint-related chronic low back pain. For sacroiliac joint pain, selected RFA techniques may offer benefit in appropriately selected patients; however, conclusions remain constrained by heterogeneity and small sample sizes. Further high-quality, sham-controlled trials are required before definitive clinical recommendations can be made.

Keywords: radiofrequency ablation, chronic low back pain, randomized controlled trials, sham-controlled trials, sacroiliac joint, facet joint

Introduction

Low back pain (LBP) remains a major global health problem and one of the leading causes of disability worldwide.[1] According to the Global Burden of Disease Study, more than 619 million people were affected by low back pain in 2020, and this number is projected to increase substantially by 2050 due to population growth and population aging.[2] In Great Britain, the number of individuals living with low back pain is expected to exceed 9 million by 2040, representing an increase of approximately 2.5 million cases compared with 2019.[3]

LBP is highly prevalent, with up to 84% of individuals experiencing at least one episode during their lifetime, and recurrence rates remaining high despite treatment.[4] In the United States, the prevalence of chronic low back pain among adults exceeds 13%.[5] Epidemiological studies in Europe indicate that approximately 18–24% of the population suffers

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from chronic lumbar pain.[6] The increasing prevalence of chronic low back pain imposes a substantial clinical, social, and economic burden on healthcare systems.

Radiofrequency ablation (RFA) has been widely adopted as a minimally invasive interventional treatment for chronic low back pain. The technique delivers high-frequency electrical current through an electrode placed adjacent to nociceptive structures, producing controlled thermal lesions that interrupt pain transmission pathways. Temperature monitoring allows precise lesion formation and contributes to procedural safety.[7] Several RFA techniques have been described, differing in electrode placement, lesion geometry, and target structures, including medial branches, joint capsules, lateral branches, and the ramus communicans. Clinical outcomes vary substantially depending on the underlying pain generator and the technical approach used.

Current management of chronic low back pain follows a stepwise, multimodal approach, beginning with patient education, exercise therapy, and pharmacological treatment, including nonsteroidal anti-inflammatory drugs and adjuvant analgesics. For patients with persistent symptoms, interventional procedures such as epidural injections, facet joint injections, and sacroiliac joint injections are commonly employed before considering more invasive options. Within this treatment hierarchy, radiofrequency ablation is typically positioned as a second- or third-line intervention, reserved for patients with well-defined pain generators who have failed conservative therapy and demonstrated a positive response to diagnostic blocks.

Multiple systematic reviews and meta-analyses have previously evaluated the efficacy of RFA for chronic low back pain. Chappell et al analyzed 19 randomized controlled trials targeting different pain generators and reported modest short-term pain reduction with low overall certainty of evidence, largely due to substantial heterogeneity in study design and radiofrequency techniques.[8] Shih et al demonstrated short-term benefits of conventional, pulsed, and cooled RFA for facet and sacroiliac joint pain, although discogenic pain was not included and long-term outcomes were inconsistently assessed.[9] Li et al compared different RFA techniques for lumbar facet joint pain and suggested technique-dependent differences in short- and long-term outcomes; however, conclusions were limited by small sample sizes and methodological variability.[10] Reviews focusing on sacroiliac joint pain similarly demonstrated inconsistent results and a lack of consensus regarding the optimal RFA technique, with limited long-term follow-up data.[11–13] A detailed summary of previous systematic reviews is presented in Table 1.

Table 1 Previous Systematic Reviews on Radiofrequency Ablation for Low Back Pain

Author, Year	Number of RCTs	Types of Pain	RF Techniques	Main Findings	Limitations
Leggett et al, 2014[13]	11 RCTs	Facet, SIJ, discogenic	Conventional RF of medial branches, SIJ lateral branches, ramus communicans	Facet and SIJ RF reduced pain; evidence for discogenic pain was inconsistent; functional outcomes improved short term	Small sample sizes, heterogeneous inclusion criteria, lack of long-term data
Chappell et al, 2020[8]	19 RCTs	Facet, SIJ, discogenic, basivertebral nerve	Conventional, cooled, pulsed RF	Slight short-term pain reduction (<1 point on VAS/NRS); long-term effects (>6 months) not confirmed; overall evidence quality low (GRADE)	High heterogeneity, variable RF techniques, no single consistent target
Shih et al, 2020[9]	16 RCTs	Facet, SIJ	Conventional, pulsed, cooled RF	All methods reduced pain up to 12 months; cooled RF most effective for facet pain at 6 months	Discogenic pain not included; limited stratification by pain duration
Li et al, 2022[10]	10 RCTs (network meta-analysis)	Facet pain	CRF, ERFA, PRF-DRG, RF-FC, endoscopic RF	Short-term: CRF, ERFA, PRF-DRG most effective; Long-term: CRF, PRF, RF-FC, ERFA showed superiority	Small sample sizes, short follow-up, no SIJ or discogenic pain data
Lowe et al, 2022[11]	16 RCTs	SIJ pain	Cooled, strip, bipolar RF	15 of 16 RCTs showed positive results; no consensus on optimal technique	Lack of >12-month data; largest RCT (n=681, Juch et al) yielded negative results; high risk of bias

Despite its widespread clinical use, uncertainty remains regarding the true effectiveness of radiofrequency ablation across different pain etiologies. Although multiple systematic reviews and meta-analyses have been published over the past decade, many pooled heterogeneous pain generators, combined fundamentally different radiofrequency techniques, included non-randomized or non–sham-controlled trials, and inconsistently reported long-term outcomes. As a result, the extent to which reported benefits reflect true treatment effects rather than nonspecific or placebo-related responses remains unclear.

Therefore, the present systematic review focuses exclusively on randomized controlled trials with appropriate control conditions, stratified by pain generator and radiofrequency technique, in order to provide a more rigorous and clinically meaningful synthesis of the available evidence.

Methods

As part of this systematic review, an extensive literature search was conducted across the following databases: Cochrane and its integrated sources, including Embase (n=6879), ICTRP (n=2975), ClinicalTrials.gov (n=2628), CINAHL (n=296), PubMed (n=5325), as well as additional searches in Embase (n=77) and PubMed (n=2534) (Figure 1).

Search strategies incorporated controlled vocabulary terms, where applicable, and text words related to low back pain and radiofrequency ablation, with appropriate truncation and Boolean operators. Full database-specific electronic search strategies, including the use of controlled vocabulary and keyword combinations, are provided in the Supplementary Material (Supplementary Table S1).

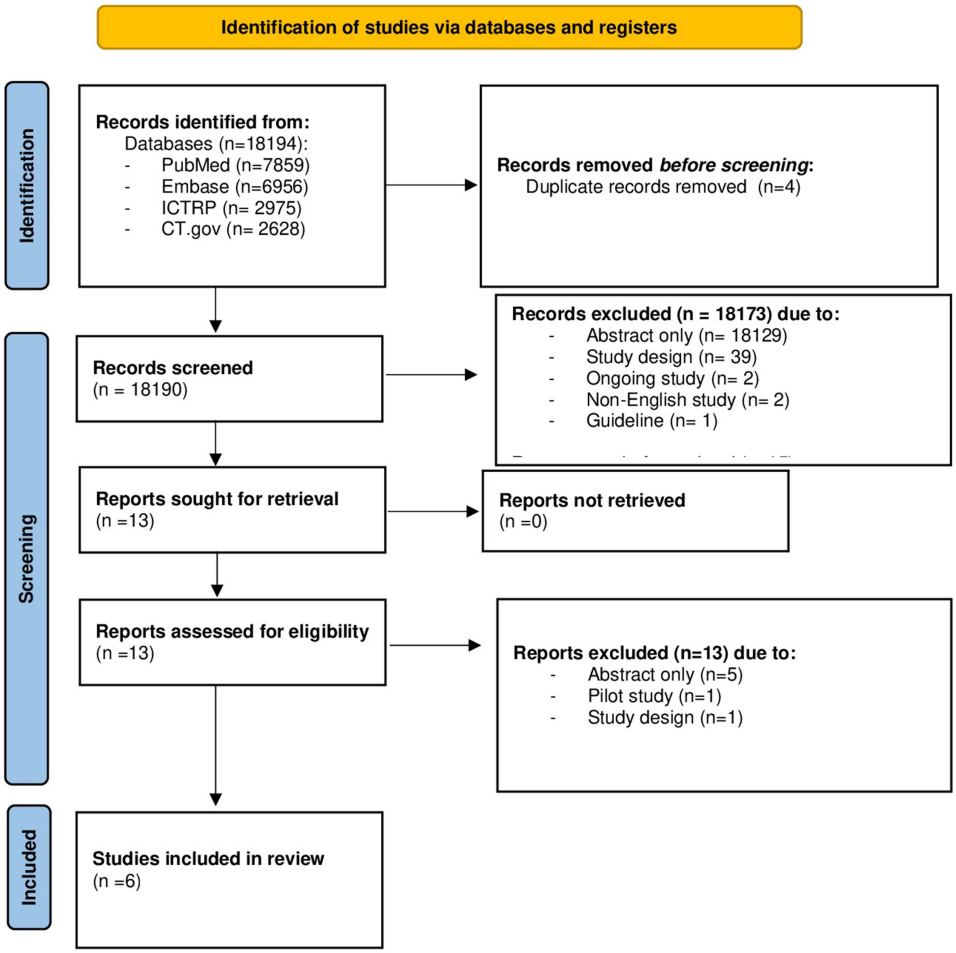

Figure 1 PRISMA 2020 flow diagram of study selection.

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Table 2 Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
Thermal, pulsed, or cooled RFA	Non-radiofrequency technology
Human studies	Animal studies
Original data	Non-original data
Adult population (>18 years)	Pediatric population
Pain duration >3 months before intervention	Pain <3 months
Follow-up >1 month with VAS or NRS outcomes	Abstract-only publications, posters

The search covered the period from January 1, 2014, to December 31, 2024. Keywords reflecting the pathological condition, such as "low back pain" and "back pain", were combined using the Boolean operator "OR". These terms were then linked with intervention-related terms using the operator "AND", including "radiofrequency", "RF", "radiofrequency ablation", "denervation", and "medial branch". The search was restricted to randomized controlled trials (RCTs) in humans. No additional filters were applied.

All abstracts were independently screened by three reviewers. Only studies meeting the following criteria progressed to full-text assessment: original data, RCT design with sham or active control, evaluation of radiofrequency ablation (RFA), inclusion of adult patients (>18 years) with chronic low back pain (duration >3 months), minimum follow-up of one month, and use of a Visual Analogue Scale (VAS) or Numeric Rating Scale (NRS) for pain assessment (Table 2).

Abstracts were excluded if they did not meet these criteria, included animal studies, relied on non-original data, or involved pediatric populations. The type of RFA (cooled, pulsed, or thermal), treatment temperature, and duration of the procedure were not considered exclusion criteria.

Studies selected by at least one reviewer advanced to full-text review. Any disagreements among reviewers were resolved through discussion and consensus. Additionally, the reference lists of included articles were manually screened to identify further relevant sources.

From each eligible study, data were extracted on patient selection methods, inclusion and exclusion criteria (Table 2), sample characteristics, procedural protocols, and outcomes. For both intervention and control groups, pain scores (mean and standard deviation) were recorded based on VAS or NRS measures. The methodological quality of each study was assessed using the Cochrane Risk of Bias Tool.

Due to substantial clinical and methodological heterogeneity across included studies, including differences in pain generators, radiofrequency techniques, comparator interventions, outcome definitions, and follow-up duration, quantitative synthesis was deemed inappropriate. In addition, crossover designs and the use of responder-based outcomes in some trials further limited the feasibility of pooled effect estimates. Therefore, a qualitative synthesis was performed.

Results

To evaluate the efficacy of various radiofrequency ablation (RFA) techniques for chronic low back pain, we analyzed randomized controlled trials that met the inclusion criteria of this systematic review. Below, we present a structured summary of key RCTs, including their objectives, study designs, main outcomes, and authors' conclusions.

Discogenic Pain

Van Tilburg et al (2016, European Journal of Pain)

Van Tilburg et al conducted a randomized, double-blind, sham-controlled trial evaluating radiofrequency ablation (RFA) of the ramus communicans in patients with discogenic low back pain. Eligible patients had chronic low back pain (>3 months) and were randomized to receive either conventional RFA of the ramus communicans or a sham procedure.

Baseline pain intensity was comparable between groups (NRS 6.2 ± 1.4 in the RFA group vs 6.3 ± 1.5 in the sham group). At follow-up, both groups demonstrated pain reduction over time; however, no statistically significant between-

group differences were observed at any time point. At 1 month, mean NRS scores were 5.6 ± 1.3 in the RFA group and 5.9 ± 1.7 in the sham group, while at 3 months they were 5.1 ± 1.2 and 5.8 ± 1.5, respectively.

Overall, RFA of the ramus communicans did not demonstrate superiority over sham within the studied follow-up period for discogenic pain. Observed improvements were similar in both groups and were not attributable to a specific treatment effect.

Facet Joint Pain

Van Tilburg et al (2016, Bone & Joint Journal)

In a randomized, double-blind, sham-controlled trial, van Tilburg et al evaluated medial branch RFA for lumbar facet joint pain. Patients with chronic low back pain and positive diagnostic blocks were randomized to receive conventional RFA of the medial branches or a sham procedure.

Baseline pain scores were similar between groups (NRS 7.0 ± 1.3 in the RFA group vs 6.9 ± 1.4 in the sham group). At 1 month, pain scores decreased in both groups to 5.8 ± 1.1 and 6.2 ± 1.2, respectively, without a statistically significant between-group difference. This pattern persisted at 3 months, with mean NRS scores of 5.4 ± 1.0 in the RFA group and 5.9 ± 1.3 in the sham group.

Thus, medial branch RFA did not demonstrate overall superiority over sham treatment for facet joint pain within the studied follow-up period.

Sacroiliac Joint (SIJ) Pain

Moussa et al (2016, European Spine Journal)

Moussa et al conducted a randomized controlled trial assessing capsular radiofrequency denervation for sacroiliac joint pain, using intra-articular steroid injection as an active control. Baseline pain intensity was comparable between groups (VAS 7.2 ± 1.5 in the RFA group vs 7.3 ± 1.4 in the control group).

At 3 months, pain scores favored RFA (4.3 ± 1.2 vs 5.8 ± 1.6), although the between-group difference did not reach statistical significance. At 6 months, pain reduction was maintained in the RFA group (4.2 ± 1.3) compared with the control group (6.1 ± 1.7), showing a trend favoring RFA. At 12 months, a statistically significant between-group difference was observed, with lower pain scores in the RFA group (4.1 ± 1.1 vs 6.0 ± 1.7; $p = 0.017$).

These findings suggest that capsular RFA may provide longer-lasting pain relief compared with intra-articular steroid injection in patients with SIJ pain.

Mehta et al (2018, Pain Physician)

Mehta et al performed a randomized, double-blind, sham-controlled trial evaluating strip-lesion RFA of the sacroiliac joint using the Simplicity system. Patients with chronic SIJ pain confirmed by diagnostic blocks were randomized in a 2:1 ratio to receive RFA or a sham procedure.

Baseline pain scores were similar between groups (NRS 8.1 ± 0.9 in the RFA group vs 8.2 ± 1.0 in the sham group). At the 3-month primary endpoint, the RFA group demonstrated a marked reduction in pain (3.4 ± 1.1), whereas the sham group showed minimal change (7.9 ± 1.0), resulting in a statistically significant between-group difference ($p < 0.001$). After the primary endpoint, sham patients crossed over to active treatment, precluding further valid between-group comparisons. Pain relief in the RFA group was maintained at 6 months.

Van Tilburg et al (2016, Clinical Journal of Pain)

In a randomized, double-blind, sham-controlled trial, van Tilburg et al investigated RFA of the lateral branches (L5–S4) for SIJ pain. Baseline pain scores were comparable between groups (NRS 6.4 ± 1.5 in the RFA group vs 6.3 ± 1.6 in the sham group).

At 1 month, mean pain scores were 4.9 ± 1.6 in the RFA group and 5.1 ± 1.7 in the sham group, with no statistically significant difference. Similar findings were observed at 3 months (4.8 ± 1.7 vs 4.9 ± 1.8), indicating pain reduction over time in both groups without evidence of a specific treatment effect.

Accordingly, lateral branch RFA did not demonstrate superiority over sham within the studied follow-up period for SIJ pain.

Table 3 summarizes the key characteristics of the included randomized controlled trials.

Table 3 Presents the Main Characteristics of Included RCTs: Eligibility Criteria, Intervention and Comparator Groups, and Key Outcomes Assessed by Pain and Functional Measures

Author, Year; Country	Pain Generator	Study Design	Sample Size (I/C)	Key Demographic Characteristics	Intervention (RFA Type and Target)	Control	Primary Endpoint	Follow-Up
Patel et al, 2015;[14] **USA**	Sacroiliac joint pain	Randomized, sham-controlled, crossover RCT	34 / 17	Mean age: ~55–57 yrs; Male: ~50%; Chronic SI pain >6 months	**Cooled RF** of L5 dorsal ramus and S1–S3 lateral branches	Sham RF (crossover allowed after 3 months)	≥50% pain reduction (NRS), ODI	1, 3, 6, 12 months
Van Tilburg et al, 2016;[15] **Netherlands**	Sacroiliac joint pain	Randomized, double-blind, sham-controlled RCT	30 / 30	Mean age: ~60 yrs; Male: ~45%; Chronic pain >3 months	Conventional RF of lateral branches (L5–S4)	Sham RF	Pain intensity (NRS 0–10)	1, 3 months
Van Tilburg et al, 2016;[16] **Netherlands**	Discogenic pain (ramus communicans)	Randomized, double-blind, sham-controlled RCT	30 / 30	Mean age: ~58–62 yrs; Male: ~50%; Discogenic LBP >3 months	Conventional RF of ramus communicans	Sham RF	Pain intensity (NRS 0–10)	1, 3 months
Van Tilburg et al, 2016;[17] **Netherlands**	Lumbar facet joint pain	Randomized, double-blind, sham-controlled RCT	30 / 30	Mean age: ~60–65 yrs; Male: ~45%; Chronic facet pain >3 months	Conventional RF of medial branches	Sham RF	Pain intensity (NRS 0–10), GPE	1, 3 months
Moussa et al,[18] **2016; Egypt**	Sacroiliac joint pain	Randomized controlled trial	40 / 40	Mean age: ~45–50 yrs; Male: ~55%; Chronic SI pain	Capsular RF denervation	Intra-articular steroid injection	Pain intensity (VAS 0–10)	3, 6, 12 months
Mehta et al,[19] **2018; UK**	Sacroiliac joint pain	Randomized controlled trial	11 / 6	Mean age: ~50–55 yrs; Male: ~45%; Chronic SI pain >6 months	Strip-lesion RF (Simplicity probe)	Sham procedure	Pain intensity (NRS 0–10)	3, 6 months

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Risk of Bias Assessment

The quality of included randomized controlled trials (RCTs) was assessed using the standardized Cochrane Risk of Bias Tool. Assessment covered the following domains: sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, completeness of outcome data, selective reporting, and other sources of bias. Results are presented in Table 4.

For a more detailed analysis, mean pain scores (NRS) in the intervention and control groups at different follow-up time points were summarized. This allows visualization of pain trajectories and the presence of statistically significant differences between groups. Data are presented in Table 5.

Heterogeneity of Included Studies

The included RCTs demonstrated considerable clinical, methodological, and statistical heterogeneity. First, the studies addressed different forms of chronic low back pain—discogenic, facet joint, and sacroiliac (SIJ) pain—each with distinct etiology and anatomical targets for radiofrequency (medial branches, facet capsule, ramus communicans, lateral branches S1–S4).

Second, various RFA techniques were used: conventional thermal, cooled RF, strip-denervation, and pulsed RF, differing in depth and area of ablation. Inclusion criteria also varied (diagnostic block protocols, baseline pain, symptom duration) as did outcome measures: some studies used NRS or VAS, others complemented with ODI and SF-36. Follow-up duration ranged from 1 month to 12 months, with primary endpoints typically at 3 months.

This diversity of populations, protocols, and outcomes precluded meaningful statistical pooling. Therefore, a meta-analysis was deemed inappropriate, and a qualitative comparative analysis was performed highlighting clinically relevant patterns.

Discussion

The present systematic review evaluated the effectiveness of radiofrequency ablation (RFA) for chronic low back pain across different pain generators, with particular attention to randomized controlled trials employing sham or active comparators. The findings highlight that the clinical value of RFA varies substantially depending on the underlying pain source, procedural technique, and patient selection. Although only six randomized trials met the strict inclusion criteria, this reflects the limited availability of high-quality sham-controlled evidence rather than a lack of research activity.

Unlike prior systematic reviews that pooled heterogeneous designs or included non–sham-controlled studies, the present review demonstrates that when analysis is restricted to rigorously controlled RCTs, evidence for discogenic and facet joint RFA becomes considerably weaker.

Clinical Interpretation of Findings

For discogenic low back pain, RFA of the ramus communicans did not demonstrate superiority over sham treatment. Although both intervention and control groups exhibited pain reduction over time, the absence of a specific treatment effect suggests that RFA is unlikely to provide consistent clinical benefit in this population. From a practical standpoint, these results argue against the routine use of RFA for discogenic pain and reinforce the need for alternative therapeutic strategies.

In patients with facet joint pain, medial branch RFA also failed to show clear superiority over sham procedures within short-term follow-up. While pain improvement was observed in both groups, this effect was not attributable to the intervention itself. Nevertheless, exploratory analyses in the original studies suggested that certain patient characteristics, such as older age and higher baseline pain intensity, may be associated with better outcomes. This finding supports a more selective approach to medial branch RFA rather than broad application.

The most clinically relevant findings emerged in the context of sacroiliac joint (SIJ) pain. Sham-controlled trials evaluating conventional lateral branch RFA did not demonstrate a specific treatment effect, underscoring the importance of technique and lesion strategy. In contrast, studies employing alternative RFA approaches, including strip-lesion and capsular or cooled RFA, reported clinically meaningful pain reduction with sustained benefit at longer follow-up intervals. These observations suggest that the anatomical complexity of SIJ innervation may require broader or more comprehensive lesioning strategies to achieve effective denervation.

Table 4 Risk of Bias Assessment of Included Randomized Controlled Trials (Ordered by Year)

Study (Year)	Randomization Process	Deviations from Intended Interventions	Missing Outcome Data	Measurement of the Outcome	Selection of the Reported Result	Overall Risk of Bias
Patel et al, 2015[14]	Low – randomized, sham-controlled design clearly described	Some concerns – crossover design with post-crossover unblinding	High – substantial attrition; per-protocol analysis without ITT	Some concerns – subjective outcomes (NRS, ODI, SF-36)	Low – outcomes reported according to protocol	Some concerns
Van Tilburg et al, 2016[15] Sacroiliac joint pain	Low – randomized, concealed allocation; multicenter design	Some concerns – planned crossover after 3 months with unblinding	Some concerns – missing data at later follow-up; no ITT	Some concerns – subjective outcomes (NRS, GPE)	Low – prespecified outcomes reported	Some concerns
Van Tilburg et al, 2016[16] Discogenic pain (ramus communicans)	Some concerns – randomization described, concealment limited	Some concerns – blinding insufficiently detailed	Some concerns – moderate attrition; ITT not clearly applied	Some concerns – pain and disability assessed by subjective scales	Some concerns – protocol not publicly accessible	Some concerns
Van Tilburg et al, 2016[17] Lumbar facet joint pain	Low – randomized, sealed envelopes; allocation concealment described	Low – sham-controlled, double-blind (patients, physicians, assessors)	Low – no loss to follow-up; complete data	Some concerns – subjective outcomes (NRS, GPE) despite adequate blinding	Low – outcomes predefined and fully reported	Low
Moussa et al, 2016[18]	Some concerns – randomization mentioned, methodological details limited	Some concerns – deviations from protocol cannot be fully excluded	Some concerns – missing data incompletely addressed	Some concerns – subjective outcome assessment	Some concerns – protocol not accessible	Some concerns
Mehta et al, 2018[19]	Some concerns – randomization reported, concealment unclear	Some concerns – blinding insufficiently described	Some concerns – incomplete reporting of withdrawals	Some concerns – subjective pain outcomes	Some concerns – selective reporting cannot be excluded	Some concerns

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Table 5 Pain Score Trajectories (Statistical Significance Between Groups Described in the Text)

Study (RCT)	Target Pain Source	Intervention	Control	Follow-Up	Pain Score–Intervention (Mean ± SD)	Pain Score–Control (Mean ± SD)	Between-Group Difference (p)
Patel et al, 2015[14]	Sacroiliac joint pain	Cooled RF of L5 dorsal ramus and S1–S3 lateral branches	Sham RF	Baseline	6.7 ± 1.8	6.5 ± 1.7	n.s.
				1 month	NR	NR	n.s.
				3 months (primary endpoint)	≥50% pain reduction in 47%	≥50% pain reduction in 12%	$p < 0.05$
				6 months	Sustained relief in 38%	Sham crossed over	NA
				12 months	Clinically meaningful relief maintained	No control data	NA
Van Tilburg et al,[15] 2016	Sacroiliac joint pain	Conventional RF of lateral branches (L5–S4)	Sham RF	Baseline	6.4 ± 1.5	6.3 ± 1.6	n.s.
				1 month	4.9 ± 1.6	5.1 ± 1.7	n.s.
				3 months	4.8 ± 1.7	4.9 ± 1.8	n.s. (Group×Time $p = 0.56$)
Van Tilburg et al,[16] 2016	Discogenic pain (ramus communicans)	Conventional RF of ramus communicans	Sham RF	Baseline	6.2 ± 1.4	6.3 ± 1.5	n.s.
				1 month	5.6 ± 1.3	5.9 ± 1.7	n.s.
				3 months	5.1 ± 1.2	5.8 ± 1.5	n.s.
Van Tilburg et al,[17] 2016	Lumbar facet joint pain	Conventional RF of medial branches	Sham RF	Baseline	7.0 ± 1.3	6.9 ± 1.4	n.s.
				1 month	5.8 ± 1.1	6.2 ± 1.2	n.s.
				3 months	5.4 ± 1.0	5.9 ± 1.3	n.s.
Moussa et al,[18] 2016	Sacroiliac joint pain	Capsular RF denervation	Intra-articular steroid injection	Baseline	7.2 ± 1.5	7.3 ± 1.4	n.s.
				3 months	4.3 ± 1.2	5.8 ± 1.6	n.s.
				6 months	4.2 ± 1.3	6.1 ± 1.7	Trend favoring RF
				12 months	4.1 ± 1.1	6.0 ± 1.7	$p = 0.017$
Mehta et al,[19] 2018	Sacroiliac joint pain	Strip-lesion RF (Simplicity probe)	Sham procedure	Baseline	8.1 ± 0.9	8.2 ± 1.0	n.s.
				3 months (primary endpoint)	3.4 ± 1.1	7.9 ± 1.0	$p < 0.001$
				6 months	Not reported as between-group comparison (control crossed over after primary endpoint)	Crossover after 3 months (blinding ended)	NA

Notes: Pain scores reported as NRS or VAS (0–10) as per original studies. NA — between-group comparison not applicable due to crossover design. n.s. — no statistically significant between-group difference. For Patel et al, outcomes are reported as responder rates (≥50% pain reduction), consistent with original study design.

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Implications for Clinical Practice

Taken together, these findings indicate that RFA should not be viewed as a uniform intervention for chronic low back pain. Instead, its clinical utility appears to be condition-specific and technique-dependent. The lack of benefit observed in discogenic pain and conventional medial branch RFA suggests that these approaches should be used cautiously and only after careful diagnostic evaluation. Conversely, for SIJ pain, certain RFA techniques may represent a reasonable therapeutic option in appropriately selected patients, particularly when conservative treatments have failed.

Importantly, the substantial pain reduction observed in sham groups across multiple trials highlights the significant role of placebo effects and contextual factors in interventional pain management. This underscores the necessity of rigorous trial designs and cautions clinicians against overinterpreting results from uncontrolled studies.

Comparison with Previous Systematic Reviews

The conclusions of this review are consistent with previous systematic reviews reporting mixed or limited evidence for RFA in chronic low back pain, particularly when analyses are restricted to sham-controlled randomized trials. Earlier reviews have similarly questioned the effectiveness of medial branch and discogenic RFA, while reporting more favorable outcomes for SIJ-related interventions. By focusing on randomized trials with appropriate control conditions, the present review provides a more conservative and clinically realistic assessment of RFA effectiveness.

Compared with prior syntheses, this review places greater emphasis on procedural heterogeneity and its impact on outcomes. Differences in target anatomy, lesion geometry, and comparator interventions likely contribute to the variability in reported effectiveness and should be considered when interpreting the literature.

Limitations

Several limitations should be acknowledged. First, heterogeneity in study design, outcome measures, and follow-up duration precluded quantitative meta-analysis. Second, crossover designs and active co-interventions in some trials limited the assessment of long-term between-group differences. Third, most included studies had relatively small sample sizes, which may have reduced statistical power to detect modest treatment effects.

Future Directions

Future studies should focus on well-powered, sham-controlled randomized trials with standardized outcome measures and longer follow-up periods. Particular emphasis should be placed on refining patient selection criteria and optimizing RFA techniques, especially for SIJ pain, where procedural differences appear to influence clinical outcomes. Comparative trials evaluating different RFA strategies may further clarify which techniques offer the greatest benefit.

Conclusion

Based on a limited number of randomized controlled trials, the available evidence suggests that radiofrequency ablation does not consistently demonstrate superiority over sham treatment for discogenic or facet joint-related chronic low back pain. However, these findings should be interpreted with caution given the small number of studies and modest sample sizes for each pain subtype.

For sacroiliac joint pain, selected radiofrequency ablation techniques have shown more promising results, although conclusions remain constrained by heterogeneity in study design, intervention techniques, and follow-up duration. Overall, current evidence supports a cautious, individualized application of radiofrequency ablation, emphasizing careful patient selection and the need for further high-quality randomized trials before definitive clinical recommendations can be made.

Ethics Approval

Ethics approval was not required for this systematic review.

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