



# Lumbar Facet Syndrome and the Use of Radiofrequency Ablation Technique as an Alternative Therapy: A Systematic Review

## *Síndrome facetária lombar e a utilização da técnica de ablação por radiofrequência como terapia alternativa: uma revisão sistemática*

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### Abstract

Lumbar facet syndrome stands out as a significant cause for the increasing prevalence of back pain complaints. Alternatives such as radiofrequency (RF) ablation may be a therapeutic option to relieve the chronic pain associated with this condition. It is critical to analyze the effectiveness of lumbar facet syndrome treatment using the traditional RF ablation technique and the relief generated by it in chronic low back pain (CLBP). This study is a systematic review using the following inclusion criteria: title, observational studies, clinical trials, controlled clinical trials, clinical studies, and publications over the last 17 years (from 2005 to 2022). The exclusion criteria included papers addressing other themes and review articles. The databases used for data collection included the Medical Literature Analysis and Retrieval System Online (Medline), PubMed, Scientific Electronic Library Online (SciELO), Lilacs, and *Biblioteca Virtual em Saúde* (Virtual Health Library in Portuguese). The query used the following terms: facet, pain, lumbar, and radiofrequency. The application of these filters yielded 142 studies, and 12 were included in this review. Most studies indicated that the traditional RF ablation technique was beneficial in relieving CLBP refractory to conservative treatment.

### Keywords

- ▶ zygapophyseal joint
- ▶ low back pain
- ▶ radiofrequency therapy
- ▶ lumbar vertebrae

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## Resumo

### Palavras-chave

- ▶ articulação zigapofisária
- ▶ dor lombar
- ▶ terapia por radiofrequência
- ▶ vértebras lombares

Em um contexto de aumento da prevalência de queixas de dores na coluna, a síndrome facetária se destaca como um importante causador. Alternativas como a ablação por radiofrequência (RF) podem ser uma opção de terapia para alívio da dor crônica que essa patologia pode causar. É necessário analisar a eficácia do tratamento da síndrome facetária pela técnica de ablação por radiofrequência tradicional e o alívio gerado nas dores lombares crônicas (DLC). O presente estudo trata-se de uma revisão sistemática cujo os critérios de inclusão para análise foram: título; estudos observacionais; ensaios clínicos; ensaio clínico controlado; estudos clínicos e publicação nos últimos dezessete anos (2005–2022). Já os critérios de exclusão foram: artigos que abordavam outras temáticas e artigos de revisão. As bases utilizadas para coleta de dados incluíram *Medical Literature Analysis and Retrieval System online* (Medline), Pubmed, *Scientific Electronic Library Online* (SciELO), Lilacs, Biblioteca Virtual em Saúde. Os termos utilizados para a pesquisa foram: facet; pain; lumbar; radiofrequency. Aplicando-se os filtros foram encontrados 142 estudos, 12 foram incluídos. Os estudos em sua maioria apontaram ser benéfica a técnica de ablação por radiofrequência tradicional no alívio das dores lombares crônicas refratárias ao tratamento conservador.

## Introduction

Low back pain is one of the main medical complaints worldwide, generating high social costs. The several potential causes for low back pain generate numerous differential diagnoses.<sup>1,2</sup> There are several facet joints, called zygoapophyseal joints, along the entire spine. These joints connect one vertebra to another, allowing the spine movement back and forth,<sup>3</sup> and promoting flexibility and stability.<sup>4</sup> The lumbar facet joints are a common source of pain.<sup>1,2</sup>

These joints can present inflammation, wear, and tear resulting from trauma, repetitive movements, and several other factors, leading to facet syndrome, one of the main conditions causing back pain.<sup>5</sup> There is a consensus that the lumbar facet joints are among the most commonly affected by facet syndrome. The L4-L5 level is the most affected, followed by L5-S1.<sup>5</sup>

After diagnosis, the initial therapy consists of rest, physical therapy to strengthen the core muscles around the spine, stretching, and oral medications, such as non-steroidal anti-inflammatory drugs (NSAIDs) and opioids.<sup>6</sup> Other techniques may be instituted if conservative treatment fails, such as medial branch block, neurolysis (chemical ablation), intra-articular steroid injections, and radiofrequency ablation (RFA). These techniques may be an alternative for patients who do not respond well to injections.<sup>7</sup>

RFA or rhizotomy is a minimally invasive procedure consisting of inserting needles at specific points of the spine aided by fluoroscopy. Radiofrequency (RF) emits heat waves at the tip of the needle; heat leads to thermal injury and protein denaturation, resulting in sick tissue absorption and deactivation of the nerve branches responsible for painful sensitivity.<sup>8</sup> As such, these branches stop sending pain signals to the brain and spinal cord, relieving pain for approximately 12 months or more.<sup>8</sup>

Nerve fibers subjected to RF may self-regenerate.<sup>9</sup> Because of this fact and other variables, its effectiveness is

controversial. The present study analyzed the literature through a systematic review and gathered information about the traditional RFA in facet syndrome to demonstrate whether there is a consensus on the technique's effectiveness in relieving chronic low back pain (CLBP) refractory to conservative treatment.

## Materials and Methods

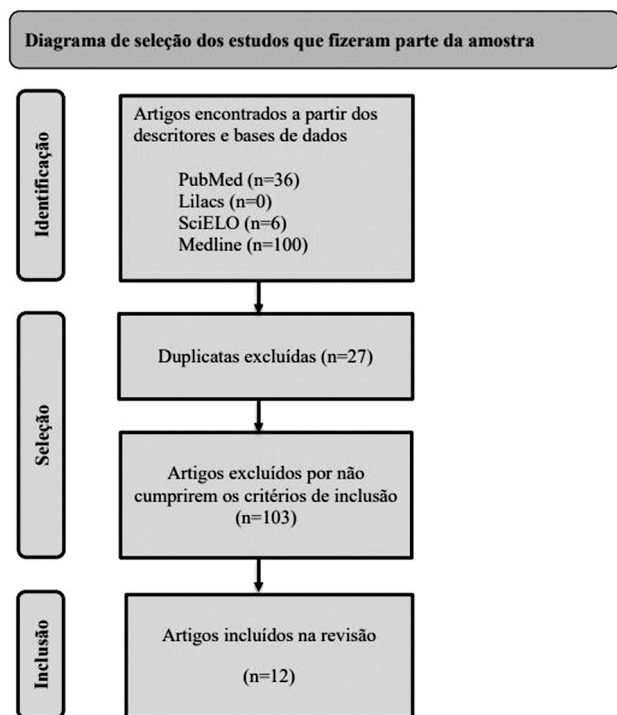
This study is a systematic literature review based on queries at the PubMed, Scielo, Lilacs, and Medline databases; these last two databases were available from *Biblioteca Virtual em Saúde* (Virtual Health Library in Portuguese). Queries occurred in June and July 2022. The following terms were selected according to the Descriptors in Health Sciences/Medical Subject Headings (DeCS/MeSH): facet, pain, lumbar, and radiofrequency. This review followed the recommendations of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) model for systematic reviews and meta-analyses.

After paper selection, we read their titles and abstracts to determine which ones met the inclusion and exclusion criteria. The inclusion criteria for analysis were title, observational studies, clinical trials, comparative and clinical studies, English and Portuguese language, and publication over the past seventeen years (2005–2022). The exclusion criteria were papers addressing other themes and review articles.

We analyzed the selected papers to extract the following data: first author, year of publication, study method, and final outcome of RFA in facet syndrome.

## Results

The electronic query yielded 142 publications with the established terms and filters. After reading the titles and



**Fig. 1** Diagram of the studies selected to be part of the sample. Source: Authors, 2022.

abstracts and excluding 27 duplicate articles, we selected 12 papers for analysis (► **Figure 1**).

All selected studies were double-blind randomized clinical trials and observational studies, totaling 972 patients. ► **Table 1**<sup>10-21</sup> summarizes the main features of each study, highlighting the author, year of publication, number of patients, their age and distribution, and the main conclusions.

These studies showed that the traditional RFA was positive when performed in correctly selected patients. All patients suffered from CLBP due to involvement of the zygoapophyseal joint and had no pain relief with drug treatments. Most studies used the visual analog scale (VAS) for pain evaluation, in addition to the EQ-5D Quality-of-Life questionnaire, the Global Perceived Effect (GPE) questionnaire, and the Oswestry disability index (ODI). Patients undergoing the traditional RF reported improvement in low back pain and referred leg pain.<sup>15</sup> Some studies revealed no differences in 3 months between injection therapy and the ablation technique.<sup>16</sup> Other studies have shown that RF proved to be an alternative for pain relief for 6 months or more.<sup>18-20</sup> In the short term, the injection technique seems more advantageous but RF results in better outcomes in the long term.<sup>20</sup>

## Discussion

This study is a systematic literature review to analyze the relevance of the traditional RFA ablation technique to treat chronic pain caused by facet syndrome.

The idea of performing RFA by changing the traditional therapeutic target, the medial dorsal branch, to the joint capsule is more effective, providing a longer period of relief

of the chronic pain resulting from facet syndrome. In addition, we observed that groups undergoing RFA obtained a clear improvement compared to control groups, thus showing the effectiveness of RFA on CLBP due to facet syndrome.<sup>11</sup>

The use of different temperatures for RF neuroablation was effective even in 49 patients with pain due to a secondary etiology.<sup>12</sup> Outcomes regarding the effectiveness of neuroablation were equally effective in terms of different temperatures and time variables from each group. RF at 90 °C yielded better outcomes compared with a temperature of 80 °C.<sup>12</sup> Another study also confirmed the same fact by performing RF at 90 °C in one group of patients and at 80 °C in another set of subjects; in this paper, temperature was the only variable.<sup>22</sup> Those undergoing RF at 90 °C had a 3.1-times higher chance ( $p=0.0004$ ) of obtaining a functional improvement of at least 50% compared with those undergoing RF at 80 °C.<sup>22</sup>

When comparing RF denervation and betamethasone injections using VAS, some studies found that both techniques resulted in the same outcomes in 6 months.<sup>21</sup> Two other studies reported a higher benefit of RF as a long-term treatment for chronic pain.<sup>14,20</sup> We can infer that the corticoid injection technique improves pain on an immediate and short-term basis. Corticoid injections are the first option in chronic pain cases before performing the RFA technique. In addition, it is a fundamental tool to confirm the pain originates from the facet joints.<sup>23</sup>

The following parameters allow analyzes and outcome assessments: a pain diary using the VAS scale, including one for low back pain (VAS-back) and one for referred leg pain (VAS-leg); physical activities score; reports on the number of analgesic agents used in the last 24 hours; and the perceived GPE by the modified Likert scale. These parameters show a significant improvement in the VAS-back score of both groups undergoing RF or not (control) and in the VAS-leg score of the RF group. However, the evaluation of such outcomes must be careful because the blinding period ended in 3 months, and both groups had patients lost at follow-up. This study reported that the GPE score favored RF therapy in CLBP, mainly in elderly patients, females, patients with a history of chronic pain, working subjects, and patients with no history of lumbar surgery.<sup>13</sup>

Radiograph as a guide for RFA was a positive technique. Patients undergoing radiographs achieved a 90% efficacy rate in the immediate period and a 67.5% rate at 6 months post-treatment. It is worth noting that it is believed that 79% of back pain cases result from conditions affecting the zygoapophyseal joints.<sup>14</sup>

The selection of patients for the ablation technique must be careful and based on a positive diagnostic block. Despite having a margin of error of 20 to 40% of false-positive results, the diagnostic block is still used to refer patients with CLBP for RF.<sup>24</sup>

## Conclusion

CLBP treatment is a challenge, but this systematic review suggests that the RFA technique is an effective therapy for

**Table 1** Papers included in the review according to the authors, year of publication, number of patients, average or minimum and maximum age, distribution of patients' groups, and main conclusions.

Author/Year	Number of subjects in the study	Age	Distribution	Main conclusions
Xue et al., 2020 <sup>10</sup>	60 patients.	Mean age of the ERFA groups: 65.73 ± 7.62. Mean age of the control group: 64.78 ± 6.62.	Two groups with 30 patients each. One group (control) underwent RF ablation. The second group, ERFA, underwent endoscopic RF rhizotomy. The total follow-up period was 1 year.	Outcomes from the ERFA group were positive, showing advantages such as better needle positioning during the procedure, more precise denervation, and better long-term efficacy. There were complications as the study had a small sample and a short time for more complete evaluations.
Moussa et al., 2016 <sup>11</sup>	120 patients.	18 to 73 years old.	Patients were divided into three groups, each with 40 subjects. Group 1: Percutaneous RF coagulation on the facet joint capsule. Group 2: medial dorsal branch denervation. Group 3: control (no RF performed).	This study showed that RF denervation directed to the lumbar facet joint is technically easier and provides longer CLBP control compared with the traditional approach to the medial branch of the facet joint. However, both were effective in improving CLBP.
Ertilav et al., 2022 <sup>12</sup>	96 patients.	62.3.	Patients were divided into three groups. RF therapy on the medial branches occurred at different temperatures. One group of 31 patients received 90 °C for 50 seconds, a second group of 32 patients received 85 °C for 60 seconds, and the third group of 33 patients received 70 °C for 90 seconds.	The study demonstrated that RF treatment on the medial branch of the facet is effective in relieving chronic pain in patients with facet syndrome.
Wijk et al., 2005 <sup>13</sup>	81 patients.	Age over 17 years old.	Patients were divided into two groups, a control group and a group undergoing RF.	Overall, the VAS and combined outcome measure scores revealed major differences between the RF and sham groups, even though both achieved significant VAS improvement. The GPE score favored the RF technique in CLBP.
Zhou et al., 2016 <sup>14</sup>	80 patients.	Mean age of the control group: 54.6 ± 7.5. Mean age of the denervation group: 56.5 ± 8.7.	Patients were divided into two groups: group 1 had n = 40 and underwent percutaneous thermocoagulation, and group 2 (control) had n = 40 and received an injection of betamethasone and lidocaine at the lumbar facet joint.	The study demonstrated that radiography-guided RF denervation by thermocoagulation is minimally invasive and effective, showing it can treat low back pain resulting from lumbar facet syndrome.
Nath et al., 2008 <sup>15</sup>	40 patients.	Mean age of the active group: 56 years old. Mean age of the placebo group: 53 years old.	Patients were equally divided in an active group and a placebo group.	Patients from the active group had an improvement in lumbar and referred leg pain. Differences in pain reduction between the two groups (active and placebo) were statistically significant (P = 0.004).

Table 1 (Continued)

Author/Year	Number of subjects in the study	Age	Distribution	Main conclusions
Tilburg et al., 2016 <sup>16</sup>	60 patients.	Age over 18 years old.	Patients received a lidocaine injection near the medial branches; next, they were divided into two groups: a treatment group undergoing RF and a sham group	The study showed no significant difference between groups over a 3-month period.
Paulsen et al., 2019 <sup>17</sup>	19 patients.	Age over 18 years old.	Patients were divided into two groups: Group 1: Patients achieving at least 80% improvement in pain relief after both diagnostic blocks. Group 2: Patients achieving pain improvement ranging from 50% to 79% after diagnostic blocks.	Patients achieving an 80% improvement in pain after the diagnostic block had significant and consistent improvement during follow-up. Those achieving relief ranging from 50 to 79% did not show significant improvement, except after 1 week. The total sample showed ODI score improvement during the first 3 months. In addition, there was also improvement after 6 months in group 1 regarding EQ-5D. However, the sample had no further significant improvements in EQ-5D and ODI scores. Group 1 presented an average improvement of 22.5 points in VAS, which is clinically relevant.
Tome-Bermejo et al., 2011 <sup>18</sup>	86 patients.	Mean age: 49.97.	All subjects underwent the same ablation technique.	RF therapy significantly improved ( $p < 0.05$ ) the VAS and ODI scores, showing improvement in disability and quality of life. A total of 89% of the patients had a significant improvement in pain after the ablation technique for a total period of 6 months. After 6 months, the improvement declined and, in 1 year of follow-up, 50% of patients reported improvement. After one year, 75.67% of the patients would undergo the RFA technique again.
Gofeld et al., 2007 <sup>19</sup>	174 patients.	-	All patients underwent a RF technique.	The study demonstrated that a total of 55 patients did not improve with the procedure at any time or did it only for 6 months. One hundred and nineteen patients reported significant pain relief in the second follow-up, 6 months after RF. The average duration of pain relief for all 174 patients was 9 months.
Civelek et al., 2012 <sup>20</sup>	100 patients.	Mean age of the FJJ group: $56.5 \pm 17.7$ .	Patients were divided into two groups: FJJ group: 50 patients undergoing	The study concluded that the success rate of the FJJ group in general and at the VNS, EQ-

(Continued)



Table 1 (Continued)

Author/Year	Number of subjects in the study	Age	Distribution	Main conclusions
Lakemeier et al., 2013 <sup>21</sup>	56 patients; however, only 50 complete the follow-up period of 6 months.	Mean age of the FJRF group: 51.8 ± 17.0.	corticosteroid injection. FJRF group: 50 patients undergoing RF therapy.  Patients were divided into two groups: One group received injections and the second group underwent RF therapy.	5D, and NASS scores was significantly better. In the short term, FJI appears more effective than FJRF, but in the medium-term follow-up, FJRF had more satisfactory outcomes than FJI.  The evidence from this study demonstrated that both the injection and the RF technique can be used for chronic pain in the lumbar facets and that both improved pain over at least 6 months, with no difference between treatments in this period.

Abbreviations: CLBP, Chronic low back pain; EQ-5D, quality-of-life questionnaire; ERFA, endoscopic-guided percutaneous radiofrequency ablation; GPE, Global Perceived Effect; FJI, facet joint injections; FJRF, facet joint radiofrequency; NASS, North American Spine Society questionnaire on patient's satisfaction; ODI, Oswestry Disability Index; RF, radiofrequency; VAS, Visual Analog Scale; VNS, Visual Numeric Scale for pain.

these patients with pain caused by the involvement of the facet joint by the facet syndrome. Due to the significance of the subject, it is worth noting the need to develop new clinical studies to obtain more information on alternative treatments for facet syndrome. Furthermore, we highlight the importance of meticulously selecting patients undergoing RFA therapy.

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#### Conflict of Interests

The authors declare no conflict of interests.

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