Research Article
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Efficacy and safety of intravenous laser irradiation of blood for lumbar facet joint syndrome: a randomized, parallel, active-controlled trial

Abstract

Background: Lumbar facet joint syndrome (FJS) is a common cause of chronic lower back pain and may substantially impair quality of life. Intravenous laser irradiation of blood (iLIB) has shown potential for treating musculoskeletal disorders because of its tissue penetration and favorable safety profile. Although its clinical effects have been investigated in acute and osteoarthritic pain, its efficacy in chronic lumbar FJS has not yet been established. This study aimed to evaluate the therapeutic efficacy of iLIB in patients with lumbar FJS.

Patients and methods: A prospective, randomized, controlled trial enrolled 65 patients with chronic LFS confirmed by medial branch block and scintigraphic evidence. Participants were randomly assigned to the iLIB group (n = 34) or the diclofenac group (n = 31). Pain and functional status were assessed using the visual analogue scale (VAS), Oswestry disability index (ODI), and Roland-Morris questionnaire (RMQ) before treatment and at 3 months. The iLIB group received treatment for 3 months (10 days/course, with 3 courses), while the diclofenac group received oral diclofenac (daily dose = 20 mg) for the same period.

Results: At 3 months, both groups demonstrated significant improvement in pain, with a greater net change in the iLIB group (3.47±1.46 vs. 1.91±1.42, p=0.008). Significant between-group differences were also observed in ODI scores (18.75±14.83 vs. 8.80±3.57, p= 0.028) and RMQ scores (4.68±3.48 vs. 2.16±2.38, p=0.012).

Conclusion: Intervention of iLIB appears to be an effective and safe treatment for chronic lumbar LFS, with a low incidence of side effects. It provides meaningful pain relief and improves lumbar function and neuropathic symptoms. These findings suggest that iLIB may represent a promising non-invasive alternative to interventional pain procedures for chronic LFS.

Keywords: lumbar facet joint syndrome, visual analogue scale, oswestry disability index, roland-morris questionnaire, scintigraphic rehabilitation

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Introduction

Chronic lower back pain is the leading cause of physical disability among the working-age population and is also one of the conditions that most substantially impairs health-related quality of life.[1] Lumbar facet joint syndrome (FJS) is characterized by pain originating in the spinal and paraspinal regions. Approximately 80% of individuals experience lower back pain at some point in their lifetime, with the prevalence of lumbar FJS reported to range from 15 to 45%.[2] The condition appears to affect women more frequently than men.[3,4] Patients with lumbar facet joint pain generally do not present neurological symptoms. Acute lumbar facet joint pain refers to pain lasting less than 1 month and is generally considered a self-limiting condition that may not require specific treatment. When pain recurs and persists for more than 3 months after its onset, it is regarded as chronic lumbar facet joint pain. Persistent back pain, particularly pain associated with the lumbar facet joints, may result in considerable limitations in daily activities, higher rates of disability, and increased healthcare expenditures.[3] Accordingly, the primary objectives of treating lumbar FJS are to relieve pain and enhance patients' quality of life.

Various non-pharmacological approaches have been used to manage FJS including chiropractic joint manipulation and conventional physical modalities. Low-level laser therapy has been shown to improve pain and range of motion in patients with cervical facet dysfunction.[5] Vascular laser therapy has also been applied in the treatment of temporomandibular joint disorders.[6] Invasive approaches have been less commonly used because of their limited popularity and feasibility, including laser ablation[7] and radiofrequency ablation targeting the medial lumbar branch.[8]

Intravascular laser irradiation of blood (iLIB) has been used since the 1960s. To date, this invasive modality has been applied in the management of cardiovascular diseases and is believed to promote blood circulation and improve cellular blood function.[9] Its applications have also extended to vascular disorders, cardiac conditions, and mucositis,[10] as well as diseases involving the kidney and lung[11,12] and various pathological conditions.[13] Furthermore, iLIB has been used as an adjunctive therapy for pain management in conditions such as fibromyalgia and musculoskeletal pain,[14,15] as well as in certain immune disorders.[16–18] In addition, iLIB has demonstrated considerable therapeutic potential in the management of neurological diseases and their associated disorders.[19–25]

The therapeutic effects of iLIB have been demonstrated in patients with knee joint arthritis;[26] however, its efficacy in chronic FJS has not yet been investigated. Therefore, the present study aimed to compare the efficacy and safety of iLIB with those of diclofenac in patients with chronic FJS.

Patients and methods

Study design

This randomized, parallel-group, active-controlled trial was conducted from January 2022 to December 2023 at the Department of Rehabilitation. Eligible participants were randomly allocated to either the iLIB group or the diclofenac group using numbered, sealed envelopes. The study was performed in accordance with the ethical principles outlined in the Declaration of Helsinki. Written informed consent was obtained from every participant before enrollment. The study protocol was reviewed and approved by the Institutional Review Board (KSVGH20-CT-16).

The initial eligibility criteria for patient recruitment included an age between 30 to 70 years old, a history of FJS lasting more than 3 months before study enrollment, and a diagnosis of chronic FJS for which conservative treatments/managements had been provided. Patients were also required to have received non-steroid anti-inflammatory drugs (NSAIDs) or paracetamol for the management of chronic FJS within 28 days before entering the study. In addition, participants had to be capable of discontinuing all other analgesics, NSAIDs, glucocorticoids, benzodiazepines, and other muscle relaxants throughout the study period. A 10-cm visual analogue scale (VAS) pain score of at least 4.0 cm was required at both the screening visit and baseline assessment. Pre-treatment EMG and imaging examinations were performed at baseline to exclude potential confounding diagnoses. Specific neurophysiologic assessments, including F-wave latency, sensory conduction velocity, quantitative EMG, and evaluation of the paraspinal muscles, could help determine the neural effects of iLIB and should be interpreted in relation to the affected dermatomes and facet innervation patterns. In addition, scintigraphic evaluation was performed before iLIB treatment using single-photon emission computed tomography with computed tomography (SPECT-CT) (Figure 1A).

Additional inclusion criteria consisted of low back pain persisting for ≥ 3 months in duration, absence of neurological symptoms, and focal tenderness localized to one or more facet joints. Patients with persistent low back pain or hip pain without radicular syndrome were also eligible. Furthermore, participants were required to have inadequate responses to conservative treatments, including physiotherapy, chiropractic manipulation, exercise, and medical therapy.

The exclusion criteria included neurological low back pain; age > 70 years or < 30 years; coagulopathy; infection, including infection at the puncture site, lung, or urinary tract; tumors; tuberculosis; and severe lumbar kyphosis. Patients who had undergone surgery for backache within 6 months before entry the study were excluded. A history of asthma, urticaria, or allergic reactions following aspirin or any other kinds of NSAIDs was also considered an exclusion criterion. Additional exclusion criteria included gastric ulcer, gastritis, dyspepsia, depression, alcohol/drug abuse, or confirmed hepatic impairment (alanine aminotransferase or asparate aminotransferase > 2.5 times upper range of normal). Patients with renal impairments (serum creatinine > 1.5 mg/dl), systolic blood pressure > 160 mmHg, diastolic blood pressure > 105 mmHg, or severe heart failure were also excluded.

Protocol and interventions

We used a laser illumination system manufactured by "Liverage" (Multi-wavelength Laser treatment instrument SL-1200, LIVERAGE BIOMEDICAL INC., Taiwan), which provided dual wavelengths of 415 nm (blue light, energy 15.12–16.56 J, energy density 12096–13248 J/cm2, power output 3.36–3.68 w/cm2, and power intensity 2.285–2.502 w/cm2) and 650 nm (red light, energy 13.68–15.12 J, energy density 10944–12096 J/cm2, power output 3.04–3.36 w/cm2, and power intensity 2.128–2.352 w/cm2). A trained nurse connected the Optical Fiber Needle ("Liverage" Multi-wavelength Laser Treatment Instrument Accessories, GA-024) to the venipuncture site and simultaneously administered both wavelengths at equal intensity and duration. The applied intensity was 3–5 mW, with an energy density of 22.86 J/cm2 for each wavelength. Each session lasted 60 minutes, with equal exposure time for both wavelengths.

Administration of iLIB started on weekdays for two consecutive weeks as a single treatment course. When additional courses were required, they were separated by rest periods of one to three weeks, with the overall treatment period lasting three months. During treatment, a 0.5 mm-diameter optical fiber was introduced through a phlebotomy cannula into an accessible peripheral vein, allowing nearly 100% of the circulating blood volume to receive laser irradiation during each 60-minute session. Although venous catheterization is required, iLIB is considered minimally invasive because it does not require surgical incisions or major operative procedures. Possible complications of catheter placement include mild discomfort, bleeding, infection, and venous inflammation.[27]

Analytical methods and efficacy measurement

Two populations were included in the statistical analysis. The primary efficacy endpoint was defined as the net change in pain score from baseline to the 90th day of assessment. Pain intensity was evaluated using the 10-cm visual analogue scale (VAS), ranging from 0 (no pain) to 10 (extreme or the worst imaginable pain). VAS is a reliable instrument for assessing subjective pain experiences across different pain characteristics. Additional outcome measures included the Oswestry Disability Index (ODI) and the Roland-Morris questionnaire (RMQ), which were assessed by both the investigator and the patient.

ODI is a widely used instrument for assessing backache[28] and contains 10 sections covering different aspects of functional disability. Each section is scored from 0, representing the statement associated with the least disability, to 5, representing the statement indicating the greatest disability. The overall ODI score was calculated as follows, with the percentage rounded to a whole number: ODI score =[total score/(5 × number of questions/sections answered)] × 100%. RMQ consists of 24 statements related to daily life and patients' conditions, with each checked item ("Yes" or a checkmark) scoring 1 point and each unchecked item scoring 0 points; the total score ranges from 0 to 24, with higher scores indicating greater disability and more severe restrictions in daily activities, work, or mobility due to back pain. RMQ has demonstrated good reliability and validity for assessing the level of disability and is sensitive to changes over time in patients with back pain. Clinically, changes in RMQ scores before and after treatment can be used to evaluate improvements in back pain and functional disability.[29] Scintigraphic assessment with SPECT-CT was performed at 3 months at the end of the study (Figure 1B).

Statistical analysis

Statistical analyses were performed using SPSS software, version 22.0 (IBM-SPSS, Armonk, NY, USA) and GraphPad Prism software (GraphPad Software, Inc., La Jolla, CA, USA). Continuous variables were summarized using descriptive statistics, presented as means ± standard deviations (SDs), whereas categorical variables were summarized in frequency tables. Baseline characteristics were

compared between the treatment groups using either the two sample t-test or Wilcoxon rank sum test for continuous variables, and Fisher's exact test for categorical variables, to assess the comparability of the two groups. Inferential statistical results were reported as estimated means with two-sided 95% confidence intervals (CI). Changes in laboratory test results and vital signs from the beginning to the end of the study were calculated and compared between treatment groups using analysis of covariance (ANCOVA), with treatment effect and baseline values included as covariates. The ANCOVA model was also applied to evaluate between-group differences in the net changes of 10-cm VAS, ODI, and RMQ scores. All statistical analyses were two-tailed, with α=0.05. A P value of < 0.05 was considered statistically significant.

Results

Subject and baseline characteristics

A total of 65 patients were randomly assigned to this study, including 43 patients in the iLIB treatment group and 31 patients in the diclofenac treatment group. The comparability of the two treatment groups was assessed before and after treatment. Demographic and baseline characteristics, including age, gender, weight, height, and body mass index, are presented in Table 1. The proportions of males were 64.71% (33 out of 34) in the iLIB group and 64.52% (20 out of 31) in the diclofenac group, respectively. None of the comparisons of mean values between the two groups for the demographic variables reached statistical significance, indicating that the groups were comparable with respect to demographic characteristics.

Table 1 Demographic characteristics and baseline scores of visual analogue scale (VAS), Oswestry Disability Index (ODI) and Roland-Morris questionnaire (RMQ) the in the two groups

Demographic characteristics	ILIB group (N=34) (Mean±SD)	Diclofenac group (N = 31) (Mean±SD)	Total (N = 65) (Mean±SD)	P value
Age (years)	34.25±14.27	34.29±16.74	34.27±15.29	0.623[a]
Gender (Male : Female)	22:12	20:11	42:23:00	1.000[b]
Weight (kg)	64.88±8.68	68.45±10.59	66.54±9.67	0.220[c]
Height (cm)	167.52±8.35	169.83±9.48	168.60±8.87	0.389[c]
Body mass index (kg/m^2)	23.12±2.63	23.74±3.55	23.41±3.07	0.918[a]
VAS scores (cm)	6.10±0.75	6.03±0.84	5.06±0.78	0.608[a]
ODI score (%)	34.78±12.67	32.02±10.41	32.48±11.52	0.431[c]
RMQ	18.36±3.46	19.41±3.49	18.89±4.55	0.937[c]

a: Wilcoxon rank sum test

b: Fisher's exact test

c: Two sample *t*-test

ILIB, intravenous laser irradiation of blood

The mean ± SD duration of FJS was 1.88 ±2.74 years in the iLIB group and 1.43 ± 2.60 years in the diclofenac group. No statistically significant differences were observed between the two treatment groups with respect to disease history or medication use. Baseline VAS, ODI, and RMQ scores are also presented in Table 1. The mean baseline VAS and ODI scores were slightly higher in the iLIB group than in the diclofenac group (6.10 cm and 34.78% vs. 6.03 cm and 32.02%, respectively). Nevertheless, neither baseline VAS nor ODI scores differed significantly between the two groups. Similarly, no significant between-group difference was observed in the RMQ scores (18.36±3.46 vs. 19.41±3.49, p=0.937). Overall, the comparisons of baseline demographic and clinical characteristics showed no statistically significant differences between the two treatment groups. Thus, both groups were considered comparable at baseline.

Efficacy results

Efficacy endpoints were assessed at 3 months, corresponding to the final visit after completion of the 3-course treatment, and comparisons were made between the two groups. The first efficacy endpoint was the net change in the 10-cm VAS pain score from baseline to the end of treatment, with the results presented in Table 2. Both treatment groups demonstrated significant improvements in VAS scores, with a greater reduction observed in the iLIB group. The mean ± SD net changes were 3.47 ±1.46 and 1.91±1.42 in the two groups, respectively, and the P value for the comparison of mean net changes was 0.008. These findings indicated that iLIB produced a greater reduction in VAS pain scores than diclofenac.

Table 2 Net changes of visual analogue scale (VAS) score (cm), Oswestry disability index (ODI) and Roland-Morris questionnaire (RMQ) from baseline to the final visit in the two groups

Statistics	ILIB group	Diclofenac group	Difference [95% CI]a	P value[b]
VAS score				
N	34	31		
Mean±SD	3.47±1.46	1.91±1.42	1.236 [0.327; 2.146]	0.008
LS_Mean [95% CI][b]	3.054 [2.427; 3.682]	1.817 [1.160; 2.474]		
ODI score				
N	34	31		

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Table 2 Continued...

Mean±SD	18.07±14.83	8.80±3.57	8.418 [0.864; 15.951]	0.028
LS_Mean [95% CI][b]	17.704 [12.574; 22.835]	9.296 [3.791; 14.801]		
RMQ				
N	34	31		
Mean±SD	4.68±3.48	2.16±3.38	3.321 [0.712; 9.413]	0.012
LS_Mean [95% CI][b]	3.86 [2.18; 6.45]	2.86 [0.94; 4.01]		

a: ILIB minus Diclofenac

b: ANCOVA with treatment effect and covariate of baseline

ILIB, intravenous laser irradiation of blood

The second efficacy endpoint was the net change in ODI score from baseline to the final visit, and the corresponding results are shown in Table 2. A statistically significant improvement from baseline to the final assessment was observed in both treatment groups. The mean ± SD net changes were 18.75±14.83 and 8.80 ±9.71, respectively, with a P value of 0.028 for the comparison of mean net changes. The iLIB group demonstrated greater improvement in ODI scores across the study visits. A more pronounced reduction in RMQ scores was observed in patients receiving iLIB compared with those receiving diclofenac at 3 months after treatment (4.68 ± 3.48 vs. 2.16 ± 2.38, $p < 0.001$). Abnormal scintigraphic images of SPECT-CT, a symmetrical high uptake (yellow) in the facet joints of L3 and L4, showed complete diminished in the 2nd images when compared with the 1st images obtained before iLIB (Figure 1A,1B).

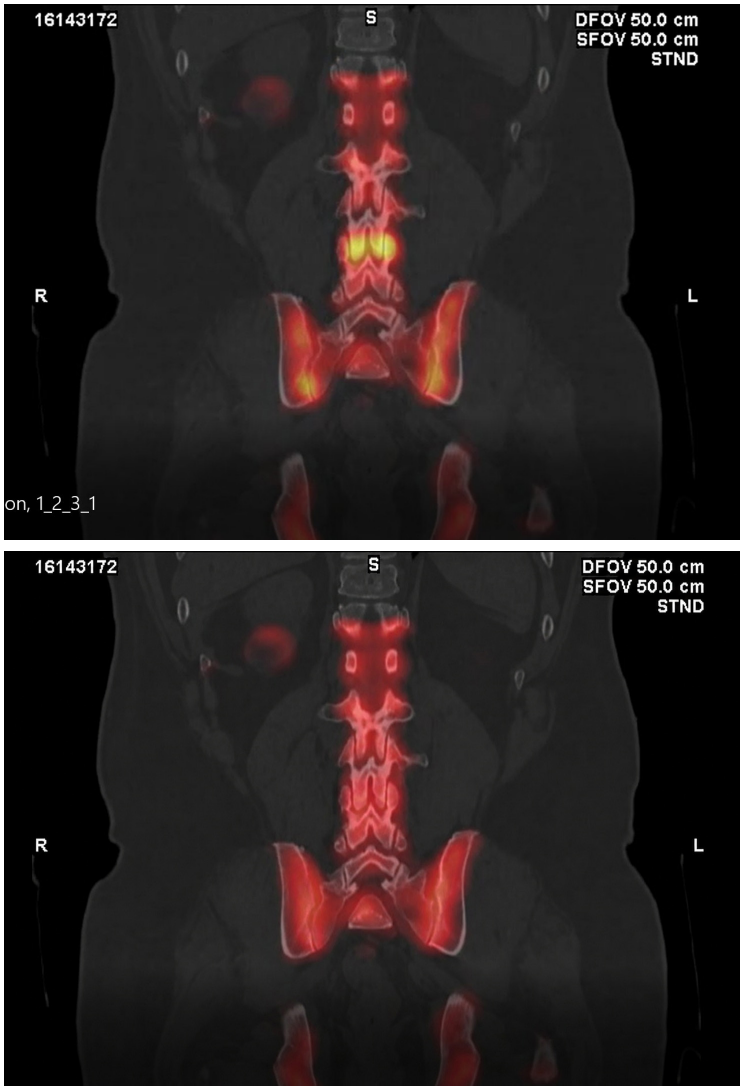

Figure 1 Scintigraphic images of SPECT-CT of one of the iLIB groups. A symmetrical high uptake (yellow) in the facet joints of L3 and L4 (A), and disappear in B. A, before treatment of intravenous laser irradiation of blood (iLIB); B: after iLIB.

Safety assessment of adverse events

Vital signs, including blood pressure, pulse rate, and body temperature, were measured at baseline and at the end of treatment. The net changes from baseline to the final visit in vital signs, as well as hematological and laboratory parameters, are summarized in Table 3. The mean diastolic blood pressure in the diclofenac group and mean systolic blood pressure in the PBC group showed statistically significant decreases from baseline. However, the magnitude of these changes was relatively small and was not clinically significant. Regarding laboratory parameters, the diclofenac group demonstrated a significant increase in WBC count and a significant decrease in hemoglobin levels. A significant between-group difference in the mean net change of WBC count was also observed. Apart from the findings described above, no significant between-group differences in mean net changes were detected for the other vital signs. Likewise, no significant differences in mean net changes in laboratory test results were observed between the two groups.

Table 3 Net changes of vital signs and hematological and biochemical profiles in the two groups

Parameters	ILIB group		Diclofenac group		Difference [95% CI][a]	*P* value[b]
	Mean±SD	LS_Mean [95% CI][b]	Mean±SD	LS_Mean [95% CI][b]		
Diastolic BP (mmHg)	3.00±11.77	3.193 [-6.02; 6.989]	6.60±9.37	6.378 [2.307; 10.448]	-3.184 [-8.751; 2.383]	0.255
Systolic BP (mmHg)	3.04±9.51	3.549 [0.239; 6.859]	3.15±8.63	2.569 [-0.983; 6.120]	0.980 [-3.980; 5.851]	0.686
Pulse rate (beats/min)	-0.22±12.05	-0.403 [-4.560; 3.755]	-4.55±8.74	-4.337 [-8.796; 0.122]	3.934 [-2.166; 10.035]	0.200
Body temperature (°C)	0.17±0.75	0.119 [-0.141; 0.380]	-0.10±0.81	-0.042 [-0.322; 0.237]	0.162 [-0.021; 0.545]	0.399
White blood cells (10^3/uL)	-0.06±1.16	-0.085 [-0.594; 0.424]	-0.90±1.88	-0.867 [-1.414; -0.321]	0.783 [0.036; 1.529]	0.040
Red blood cells (10^6/uL)	0.12±0.29	0.100 [-0.008; 0.209]	0.04±0.26	0.066 [-0.050; 0.182]	0.034 [-0.125; 0.194]	0.665
Hemoglobin (g/dL)	0.32±0.92	0.342 [-0.032; 0.716]	0.44±1.06	0.412 [0.011; 0.813]	-0.070 [-0.619; 0.479]	0.798
Hematocrit (%)	0.94±2.77	0.969 [-0.075; 2.012]	0.85±2.81	0.821 [-0.298; 1.940]	0.147 [-1.383; 1.678]	0.847
Platelet counts (10^3/uL)	-5.30±25.25	-5.224 [-18.53; 8.084]	-3.30±43.96	-3.393 [-17.66; 10.878]	-1.831 [-21.34; 17.682]	0.851
Porthrombin time (sec)	0.06±0.52	-0.008 [-0.201; 0.186]	0.05±0.41	0.124 [-0.085; 0.333]	-0.131 [-0.427; 0.164]	0.375
Partial thromboplastin time (sec)	0.22±2.08	0.441 [-0.166; 1.049]	0.33±1.13	0.072 [-0.580; 0.725]	0.369 [-0.536; 1.274]	0.415
Asparate aminotransferase (U/L)	3.13±10.00	2.230 [-2.194; 6.654]	-1.50±15.48	-0.465 [-5.212; 4.282]	2.695 [-3.821; 9.211]	0.408
Alanine aminotransferase (U/L)	2.83±12.37	1.165 [-2.440; 4.770]	-1.00 ±10.57	0.910 [-2.962; 4.782]	0.255 [-5.101; 5.612]	0.924
BUN (mg/dL)	-0.48±3.17	-0.310 [-2.022; 1.402]	-1.25±6.26	-1.444 [-3.280; 0.393]	1.134 [-1.380; 3.647]	0.367
Creatinine (mg/dL)	-0.03±0.12	-0.026 [-0.073; 0.022]	0.04±0.13	0.025 [-0.027; 0.076]	-0.050 [-0.121; 0.020]	0.157
Total bilirubin mg/dL)	-0.03±0.41	-0.034 [-0.199; 0.131]	-0.01±0.37	-0.001 [-0.178; 0.176]	-0.033 [-0.276; 0.210]	0.784

a: ILIB minus Diclofenac

b: ANCOVA with treatment effect and covariate of baseline

BP, blood pressure

ILIB, intravenous laser irradiation of blood

AST, asparate aminotransferase

ALT, alanine aminotransferase

Discussion

This randomized controlled trial provides evidence for the efficacy and safety of iLIB in patients with chronic lumbar FJS. Treatment was associated with clinically meaningful improvements in pain severity, functional disability, and features of neuropathic pain. Overall, iLIB appeared to be a safe and effective minimally invasive treatment option for chronic lumbar FJS, with statistically and clinically significant improvements in pain intensity, functional impairment, and neuropathic pain symptoms.

A major finding of this study was the improvement in facet joint pain following iLIB treatment, as reflected by the VAS, ODI, and RMQ scores. Significant improvements in these outcome measures were observed at the end of the study. Together with previous preclinical and clinical evidence, our findings support the possibility that iLIB exerts neuromodulatory effects.

Recent systematic reviews have demonstrated the clinical efficacy of iLIB.[17,18,30] Our findings further extend the potential application of iLIB to FJS and provide additional evidence for its effects in spinal disorders. Although post-treatment electrophysiological assessments were not performed, peripheral nerve involvement, including polyneuropathy and radiculopathy, was excluded at baseline. Combined with the analyses of VAS, ODK, and RMQ outcomes, this approach provides clinically relevant evidence and may serve as a basis for future investigations.

To our knowledge, this study represents the first application of this approach in the spine and extends the potential therapeutic application of iLIB to spinal joint-related scintigraphic abnormalities. A notable finding was the resolution of scintigraphic uptake involving the lumbar facet joints and adjacent vertebrae after iLIB treatment. Previous research involving iLIB in osteoarthritic knee disease demonstrated therapeutic effects in the knee.[26] Therefore, we assume that iLIB might exert similar biological effects on inflammatory processes

involving the vertebral bodies and associated articular structures, like facet joints.

Imaging findings may provide objective evidence of therapeutic response. In the present study, the scintigraphic improvements occurred in parallel with the clinical outcomes, suggesting that the observed imaging changes may reflect biological modulation rather than merely a pharmacological effect. The persistence of clinical benefits during the 3-month follow-up further supports this possibility.

Another novel aspect of this study was the evaluation of FJS using spinal scintigraphic images following iLIB treatment. Scintigraphic images of SPECT-CT showed symmetrical high uptake (yellow) in the facet joints of L3 and L4 before iLIB and diminished after iLI (Figure 1A,1B). The imaging findings, together with the observed clinical improvements, support the biological plausibility of iLIB-mediated modulation of joint inflammation as well as nociceptive and neuropathic sensitization. Nevertheless, these findings should be interpreted cautiously. Larger multicenter studies with longer follow-up periods and more comprehensive outcome measures are necessary to validate and further clarify these observations. Overall, iLIB appears to be a promising minimally invasive treatment modality that may address multiple aspects of FJS while remaining well tolerated.

Based on the statistical findings, we postulate that iLIB may have greater therapeutic effects on chronic pain than on acute pain associated with osteoarticular inflammation. In the present study, iLIB produced greater improvements than diclofenac across all efficacy outcomes in patients with chronic FJS, suggesting that iLIB may provide more sustained pain relief than diclofenac by the end of treatment. The underlying mechanism may be closely associated with its effects on red blood cell deformability, including the formation of dumbbell, crescent, and tadpole shapes following iLIB.[31]

With regard to safety, the mean diastolic blood pressure in the diclofenac group and the mean systolic blood pressure in the iLIB group decreased significantly from baseline. However, the corresponding net changes were relatively small and were considered harmless and clinically insignificant. The modest changes in blood pressure may have contributed to the additional benefits associated with significant pain relief. Overall, these findings support the safety of iLIB. Considering vital signs, laboratory examinations, and biochemical parameters, iLIB appeared to be at least as safe as diclofenac.

Several limitations of this study should be acknowledged. First, accurately quantifying outcomes in patients with lumbar FJS was challenging because pain, lumbar function, and quality of life were evaluated using descriptive questionnaires, which are inherently subjective measures. Second, the recurrence rate following iLIB treatment was not evaluated. Third, although pre-treatment EMG and imaging examinations were performed to exclude potential confounding diagnoses at baseline, post-treatment electrophysiological follow-up assessments were not conducted. Fourth, our cohort was selected according to a positive response to diagnostic medial branch blocks. Although this approach is considered a gold standard for diagnosing FJS, it may limit the generalizability of our findings to patients with mixed lower back pain pathologies. Fifth, this was a single-center study with a relatively small sample size. Therefore, the findings may not be fully generalizable to broader and more diverse patient populations or healthcare settings.

In summary, iLIB is a minimally invasive therapeutic approach that uses low-level laser irradiation to promote systemic blood circulation to affect cytokines and eliminate the inflammatory process in facet joints. Treatment is delivered through a venous catheter, allowing nearly the entire circulating blood volume to be exposed to laser irradiation during each treatment session. Future studies should incorporate multicenter designs, larger and more diverse patient populations, longer follow-up periods, and direct comparisons with other therapeutic approaches, including complex exercise techniques that have also been reported to be effective for FJS.

Conclusion

In conclusion, iLIB appears to be an effective and safe therapeutic option for patients with lumbar FJS. Treatment with iLIB may provide substantial and sustained pain relief, accompanied by significant improvements in lumbar function and quality of life during long-term follow-up. SPECT-CT assessment may also offer a feasible imaging approach for the evaluation and diagnosis of lumbar FJS in the category of scintigraphic rehabilitation.

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None.

Conflicts of interest

The authors declare that there are no conflicts of interest.

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