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Comparison of the postoperative effect of low laser therapy and platelet rich fibrin on mandibular third molar surgery: a randomized study

Beste Erismen Agan^{1*}, Lokman Onur Uyanik² and Ceren Melahat Donmezer²

Abstract

Background This study investigates the postoperative benefits of low-level laser therapy (LLLT) and platelet-rich fibrin (PRF) in enhancing patient comfort and reducing complications after mandibular third molar extractions.

Methods Sixty patients with vertically impacted mandibular third molars were randomly assigned to one control and three test groups ($n = 15$ each). In Group 1, PRF was applied to the socket post-extraction. In Group 2, PRF was combined with LLLT (B-Cure Dental Laser, 808 nm wavelength, 4 J/cm² energy density, continuous wave) applied extra-orally for three days post-surgery. Group 3 received LLLT alone. Group 4 (control group) underwent traditional osteotomy without additional treatments. All patients were prescribed 875/125 mg amoxicillin/clavulanic acid twice daily for five days.

Results Postoperative parameters such as pain, swelling, analgesic use, and trismus were assessed on days 1, 2, 3, and 7. Significant improvements in pain, swelling, and trismus were observed in Groups 2 and 3 compared to the control ($p < 0.001$). Swelling was also significantly reduced in Group 1 compared to the control.

Conclusions The study demonstrated favorable clinical outcomes in the LLLT and PRF groups, suggesting that both treatments could be promising strategies for improving postoperative recovery in terms of comfort and reduced complications.

Trial registration Clinicaltrials.gov ID: NCT06262945. The trial was first registered on 16/02/2024. Retrospectively registered.

Keywords Low-level laser therapy, PRF, Wisdom teeth extraction

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Background

Extraction of impacted mandibular third molars is among dentistry's most common and frequent surgical procedures [1]. The postoperative complications of these interventions can significantly hinder a patient's recovery and overall quality of life. Pain, swelling, trismus, and secondary infections are widely recognized as the primary complications following surgery, exerting negative impacts on patient's well-being [2]. Various techniques have been explored to reduce complications, speed healing, and improve social functioning, including PRF, LLLT, cryotherapy, antibiotics, osteotomy with rotary instruments, wound drainage, flap techniques, ice compresses, corticosteroids, and analgesics [3–5].

PRF, a second-generation platelet concentrate derived from the patient's blood without anticoagulants, is popular for tissue regeneration and healing. Its biological properties promote both hard and soft tissue regeneration, accelerating healing when used alone or with a bone substitute. PRF is a promising approach in regenerative medicine [6–7].

Photobiomodulation (PBM) therapy, also known as LLLT, has attracted significant attention in oral and maxillofacial surgery, particularly after surgical extractions. LLLT, recognized internationally as a cellular bio-modulator, has gained attention for its therapeutic benefits, including reducing pain responses, mitigating inflammation, enhancing local micro-

circulation, and accelerating healing [7, 8]. Surgeons often use analgesics, NSAIDs, and steroids to manage postoperative complications, but these can cause adverse effects like gastrointestinal irritation and increased bleeding [9]. Existing studies indicate that LLLT has shown promising outcomes in managing postoperative pain and swelling without adverse effects [10, 11].

Laser therapy requires the correct dose for optimal results. Specific wavelengths and energy ranges are effective in reducing pain, swelling, and trismus. Proper laser contact, angulation, and adjustments for individual anatomy improve treatment quality. Optimizing wavelength, power, and energy density, along with the right application methods, establishes LLLT as an effective solution for postoperative complications. The B-Cure Laser used in our study aligns with established photobiomodulation therapies [12].

This study aims to investigate and compare the postoperative impacts of two different treatments: LLLT and PRF application on common complications such as pain, swelling, and trismus, with the objective of providing a comprehensive understanding of their respective efficacies in managing these postoperative challenges.

Methods

Ethical statements

The study protocol was approved by the Near East University Scientific Research Ethics Committee (project number YDU/2024/120–1808). The trial was registered on “clinicaltrials.gov” (United States National Library of Medicine), with the identification number NCT06262945.

Study design

This prospective, randomized study was conducted from February to March 2024 at Near East University Faculty of Dentistry, Nicosia, Turkey, with 60 patients aged 18–40. All patients had similar surgical conditions, including inferior alveolar nerve position, ramus relationship, impaction depth, and tooth position. To standardize difficulty levels, impacted third molars were classified according to the Pell and Gregory system, and all extractions were determined to be moderately difficult (Class I, Level C) [13]. The third molars were divided into one control group and three test groups, each with 15 patients. ($n = 15$)

Eligibility criteria

In this study, patient recruitment followed a consecutive approach based on the order in which patients presented to the clinic, with no formal randomization process. The first patients were assigned to the control group, the second to the PRF group, the third to the PRF plus laser group, and the fourth to the laser group. The randomization process was performed manually by a surgeon who was not involved in the operations. To reduce potential bias, the evaluator who assessed postoperative healing and pain scores was blinded to the treatment groups. Patients meet the predefined inclusion criteria such as the absence of systemic diseases, long-term opioid use, current infections or acute pericoronitis, smoking or alcohol abuse, pregnancy, and known antibiotic allergies. No restrictions, such as blocking or block size, were applied during the randomization process. Only patients with unilateral vertically impacted mandibular third molars were included.

Surgical procedure and groups

Each patient underwent clinical and panoramic exams at the same time of day by the same surgeon and assistant. Prior to surgery, patients were informed about the postoperative timeline and possible complications. Follow-up visits were scheduled for days 1, 2, 3, and 7 to assess the surgical site. No signs of infection or systemic issues were reported.

In group 1, PRF was applied to the extraction socket. Group 2 received PRF combined with extraoral LLLT for three days post-surgery. In group 3, LLLT was



Fig. 1 To prevent muscle involvement, a triangular flap (Archer's flap) was utilized in all cases

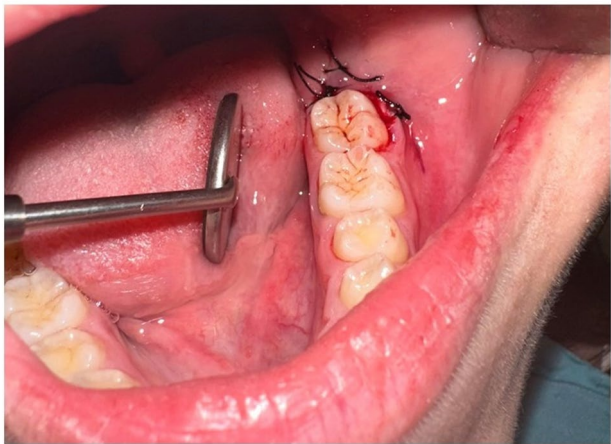


Fig. 2 The wound was promptly closed with 3–0 silk sutures

applied extraorally for three days. Group 4 (control) underwent traditional osteotomy. All patients were prescribed 875/125 milligram (mg) amoxicillin/clavulanic acid twice daily for five days and were instructed to take paracetamol 500 milligrams (mg) as an analgesic as required (every 4–6 h) and to use an antiseptic (7.5% povidone-iodine) mouthwash three times a day for 7 days. Visual Analogue Score (VAS) pain score, the number of analgesics, trismus, and swelling were evaluated preoperatively and postoperatively on days 1, 2, 3, and 7.

A triangular (Archer's) flap was used to prevent muscle involvement (Fig. 1). Surgeries were performed under local anesthesia with inferior alveolar, lingual nerve blocks, and buccal infiltration using articaine HCl and epinephrine. Full-thickness mucoperiosteal flaps were raised, and a uniform osteotomy was done using a 1.6 mm (mm) round bur at 40,000 rpm. No tooth



Fig. 3 The PRF clot was dissected

sectioning was performed, and elevators were used to loosen the tooth before extraction.

After tooth removal, the socket was irrigated with sterile saline, and PRF was placed gently. The wound was closed with 3–0 silk sutures (Fig. 2), and a gauze pad was applied for 30 min. Ice packs were given post-operatively for six hours, and sutures were removed after one week.

PRF preparation followed the method described by Choukroun et al. [14]. Before surgery, a blood sample was collected without anticoagulants and centrifuged to obtain PRF. The clot was carefully dissected to include platelets below the junction between the PRF and red blood cells. Each patient's PRF (Fig. 3) clot was sufficient to fill one extracted socket. In groups 1 and 2, PRF was placed into the socket.

In Groups 2 and 3, post-surgery, LLLT was applied to the patient's angulus region extraorally using the B-Cure Dental Pro Laser (Fig. 4) (Model: B-Cure Pro; Ergonex Technologies Ltd., Haifa, Israel). The angulus region, located at the mandibular angle, refers to the area where the body of the mandible meets the ramus. This region is positioned near the lower back of the jaw, just below the ear and temporomandibular joint (TMJ) [15]. The angulus region is commonly targeted in post-surgical recovery, especially after third molar extractions, due to its involvement in swelling and discomfort. Treated with LLLT, it helps reduce inflammation, accelerate healing, and alleviate pain by targeting both the muscles and the extraction socket to support the healing of both tissues [16].

The B-Cure Dental Pro Laser operates with a wavelength of 808 nanometers (nm) a continuous wave mode, an emitted power output of 250 milliwatt (mW), and an energy density of 4 J (J)/centimeter cubes (cm²). Each



Fig. 4 Low-level laser therapy (LLLT) was applied to the patient's angulus region extraorally using the B-Cure Dental Pro Laser

session lasted 480 s (s), with a spot size of 1 centimeter cubes (cm²). Treatments were administered once daily, beginning on the day of surgery and continuing for two additional days, totaling three sessions. Sessions were conducted at a consistent time each day to standardize the treatment's effects. To ensure optimal results, laser contact, angulation, and energy density were adjusted according to individual anatomical variations. The specific parameters were selected based on previous studies demonstrating efficacy in reducing postoperative pain, swelling, and trismus.

Evaluations

As stated in the study design, all extractions were classified as moderately difficult (Pell and Gregory Class I, Level C), ensuring similar surgical conditions across patients. Pain intensity was assessed using a 100 mm Line-Type Visual Analog Scale (VAS), with 0 representing 'no pain' and 100 indicating 'worst imaginable pain.' Participants marked their pain level on the line, and measurements were recorded in millimeters and recorded the analgesic tablet consumption [17]. Trismus was assessed by measuring the distance between the mesial incisal corners of the lower and upper right incisors during maximum mouth opening, as described by Üstün et al., on postoperative days 1, 2, 3, and 7. The swelling was assessed using the modified method of Gabka and Matsumara, also described by Üstün et al. [18]. According to this measurement method, three preoperative measurements were taken between five reference points, the tragus to the soft tissue pogonion, the lateral edge of the eye to the angle of the mandible, and the tragus to the corner of the mouth (Fig. 5.). Postoperative measurements for facial swelling and trismus were taken on days 1, 2, 3, and 7, using the total of three preoperative measurements as the baseline. The daily changes were recorded as percentages, with differences between postoperative measurements and baseline representing the values for swelling and trismus [19]. The operating time was defined as the period between the first incision and suturing completion. All assessments were performed by the same individual (not the operating surgeon) at a consistent time each day.

Statistical analyses

Statistical analyses were conducted using the Statistical Package for Social Sciences 20.



Fig. 5 This measurement method, three preoperative measurements were taken

Table 1 Comparison of visual analog score (VAS) values in patients that underwent impacted third molar surgery

Group	Control		Group1 (PRF)		Group2 (PRF + LLLT)		Group3 (LLLT)		p
	Avg ± SD	Med.(Q1:Q3)	Avg ± SD	Med.(Q1:Q3)	Avg ± SD	Med.(Q1:Q3)	Avg ± SD	Med.(Q1:Q3)	
VAS 1	49.4 ± 9.2	50.2(40.1:58.1)	41.5 ± 8.8	38.5(36.0:45.3)	31.5 ± 10.2	34.5(22.2:39.8)	31.0 ± 14.9	24.1(20.3:47.1)	< 0.001 ^{*AB}
VAS 2	38.6 ± 12.2	40.3(30.2:47.3)	25.4 ± 5.5	25.0(23.0:29.3)	16.5 ± 6.9	18.3(11.8:19.5)	14.0 ± 10.8	11.1(10.2:15.1)	< 0.001 ^{*B.C.D}
VAS 3	22.2 ± 10.6	25.4(13.7:31.8)	10.3 ± 7.2	10.3(2.3:15.4)	1.7 ± 2.0	0.9(0.4:2.3)	4.1 ± 9.5	0.8(0.0:4.3)	< 0.001 ^{*B.C}
Total VAS	110.2 ± 29.9	114.1(79.4:131.4)	77.2 ± 13.2	73.1(66.5:91.2)	49.7 ± 15.9	54.9(35.2:60.8)	49.1 ± 30.2	37.0(30.7:69.1)	< 0.001 ^{*B.C.D.E}

*<0.05; Kruskal Wallis Test Statistics; A=Control-Group1 (PRF); B=Control-Group2 (PRF + LLLT); C=ControlGroup3 (LLLT); D=Group3 (LLLT) -Group1 (PRF); E=Group1 (PRF) -Group2 (PRF + LLLT). Comparisons according to the control group

Table 2 Number of analgesics taken for all patients who underwent impacted mandibular third molar surgery

Group	Control		Group1 (PRF)		Group2 (PRF + LLLT)		Group3 (LLLT)		p
	Avg ± SD	Med.(Q1:Q3)	Avg ± SD	Med.(Q1:Q3)	Avg ± SD	Med.(Q1:Q3)	Avg ± SD	Med.(Q1:Q3)	
analgesic 1	3.7 ± 1.0	4.0(3.0:4.0)	4.6 ± 1.4	4.0(4.0:6.0)	2.3 ± 0.9	2.0(2.0:3.0)	2.4 ± 1.5	2.0(1.0:3.0)	< 0.001 ^{*A.B.C.D}
analgesic 2	3.0 ± 0.8	3.0(2.0:4.0)	2.0 ± 1.1	2.0(1.0:3.0)	1.3 ± 0.5	1.0(1.0:2.0)	1.3 ± 0.9	1.0(1.0:2.0)	< 0.001 ^{*A.C}
analgesic 3	2.1 ± 0.7	2.0(2.0:2.0)	0.6 ± 0.9	0.0(0.0:1.0)	0.5 ± 0.5	1.0(0.0:1.0)	0.5 ± 0.6	0.0(0.0:1.0)	< 0.001 ^{*A.C.E}
Total analgesic	8.8 ± 2.2	9.0(7.0:10.0)	7.2 ± 2.1	7.0(6.0:9.0)	4.2 ± 0.9	4.0(4.0:5.0)	4.3 ± 2.4	4.0(3.0:6.0)	< 0.001 ^{*A.B.C.D}

*<0.05; Kruskal Wallis Test Statistics; A=Control-Group2 (PRF + LLLT); B=Group1 (PRF) -Group2 (PRF + LLLT) C=Control-Group3 (LLLT); D=Group3 (LLLT) -Group1 (PRF); E=Control-Group1 (PRF). Comparisons according to the control group

For VAS pain score, analgesic intake, trismus, and swelling, the mean (Mean), standard deviation (SD), minimum (Min), maximum (Max), median (Med), and quartiles (Q1:Q3) were provided.

To evaluate the hypotheses, normality was assessed using the Kolmogorov-Smirnov and Shapiro-Wilk tests, and variance homogeneity was checked with the Levene Test. Since parametric assumptions were not met, the non-parametric Kruskal-Wallis test was applied. Pairwise comparisons were conducted when significant group differences were detected, with p-values below 0.05 considered statistically significant.

Results

All patients tolerated the medication well, with no critical harm or unintended effects observed in any group. Additionally, there were no reported side effects of PRF and LLLT treatments following surgery. Besides, there were no significant differences in the distribution of sex and operation side between the groups ($p > 0.05$).

Pain

On day 1, VAS pain scores in groups 1 and 2 were significantly lower than the control group ($p < 0.01$), while group 3 showed no significant difference. On day 2, groups 2 and 3 had significantly lower pain scores than the control group, but group 1 did not. On day 3, groups 2 and 3 showed similar pain score reductions as on day 2 ($p < 0.001$). Pain scores in groups 2 and 3 dropped from

day 1 to day 3, from 31.5 ± 10.2 to 1.7 ± 2.0 and from 31 ± 14.9 to 4.1 ± 9.5 , respectively (Table 1).

Analgesic

On day 1, analgesic consumption was significantly lower in groups 2 and 3 compared to the control group ($p < 0.001$), with no significant difference in group 1. Day 2 showed similar results ($p < 0.001$). On day 3, all groups consumed significantly less analgesic than the control, with results consistent with days 1 and 2 ($p < 0.001$). Analgesic intake decreased from 4.6 ± 1.4 to 0.6 ± 0.9 in group 1, from 2.3 ± 0.9 to 0.5 ± 0.5 in group 2, and from 2.4 ± 1.5 to 0.5 ± 0.6 in group 3. Total analgesic consumption (sum of days 1, 2, 3, and 7) was significantly lower in groups 2 and 3 compared to the control group ($p < 0.001$) (Table 2).

Trismus

On day 1, trismus in group 2 and 3 were significantly less than the control group ($p < 0.001$). On days 2 and 3, statistical differences in trismus were similar to day 1 ($p < 0.001$). On day 1, mouth opening changed from 43.6 ± 6.6 to 44.3 ± 6.0 for group 2 and from 40.3 ± 5.4 to 43.3 ± 5.8 for group 3. Overall, there was no significant difference in trismus values in group 1 (Table 3).

Swelling

On day 1, significant differences were observed between the control and group 1 ($p < 0.001$), but not between the control and groups 2 or 3. On day 2, groups 1 and 3

Table 3 Trismus values of all patients who underwent impacted mandibular third molar surgery

Group	Control		Group1 (PRF)		Group2 (PRF + LLLT)		Group3 (LLLT)		p
	Avg ± SD	Med.(Q1:Q3)	Avg ± SD	Med.(Q1:Q3)	Avg ± SD	Med.(Q1:Q3)	Avg ± SD	Med.(Q1:Q3)	
Preoperative TRISMUS	47.6 ± 6.6	49.2(40.4:54.2)	42.8 ± 4.1	42.8(38.8:45.9)	49.5 ± 6.6	50.0(44.1:54.7)	48.1 ± 6.1	49.3(42.5:52.1)	0.025 ^{*A}
1st day trismus	33.6 ± 5.3	31.3(29.8:40.1)	33.5 ± 8.6	33.3(24.4:41.0)	43.6 ± 6.6	43.0(38.4:47.1)	40.3 ± 5.4	40.7(38.2:44.3)	< 0.001 ^{*A,B,C}
2nd day trismus	32.5 ± 5.3	30.7(28.5:39.3)	34.5 ± 7.5	35.5(27.5:41.0)	43.3 ± 6.2	43.0(37.7:46.4)	40.5 ± 5.1	40.7(37.5:44.5)	< 0.001 ^{*A,B,C}
3th day trismus	32.3 ± 5.4	30.2(28.5:38.8)	36.2 ± 6.8	37.5(29.5:42.1)	44.3 ± 6.0	44.3(39.4:48.0)	43.3 ± 5.8	43.0(40.8:45.9)	< 0.001 ^{*A,B,C,D}

*<0.05; Kruskal Wallis Test Statistics; A=Group1 (PRF) -Group2 (PRF + LLLT); B=Control-Group3 (LLLT); C=Control-Group2 (PRF + LLLT); D=Group1 (PRF) -Group3 (LLLT). Comparisons according to the control group

showed significantly less swelling than the control group ($p < 0.001$). On day 3, the differences were similar to day 2. In group 1, swelling decreased from 372.6 ± 22.0 to 366 ± 21.8 , while in the control group, it increased from 431.8 ± 34.0 to 455.9 ± 41.6 (Table 4). No significant differences were found between the control and test groups on day 7.

Discussion

The common issues following third molar surgery; swelling, pain, and trismus, serve as key parameters for assessing the postoperative effects of LLLT and PRF treatments. The postoperative impact of PRF in third molar surgeries has been widely studied in numerous articles [4, 20].

PRF accelerates tissue healing by significantly boosting the recruitment and multiplication of various cell types, including endothelial cells, gingival fibroblasts, chondrocytes, and osteoblasts. This robustly promotes tissue repair and angiogenesis at the site of injury [15]. In recent years, LLLT has gained popularity and expanded its range of applications. It has been the subject of numerous studies investigating its effects on tissues and these studies.

continue to be conducted [21, 22].

This study aims to assess the impact of LLLT on postoperative pain following impacted wisdom tooth surgery, compared to a control group. Laser therapy was applied three times for 480 s. Literature suggests optimal outcomes are achieved with 2–3 treatments per week [8]. LLLT was administered immediately after surgery to two groups. Previous studies have highlighted its beneficial effects on healing. Renatto et al. noted that LLLT enhances energy during the first 48 h post-surgery, coinciding with inflammatory and edematous peaks [23]. Robson et al. found that LLLT improved mouth opening in bimaxillary orthognathic surgery patients [24]. In our study, trismus was significantly reduced in both the PRF+LLLT and LLLT groups compared to the control group.

Kumar et al. divided patients into two groups: one received PRE, and the other underwent primary closure.

They measured pain, swelling, mouth opening, periodontal pocket depth, and bone formation, finding that PRF reduced complications on the first postoperative day [25]. Similarly, in our study, the PRF group showed significantly lower VAS pain scores and reduced swelling compared to the control group, aligning with Kumar et al.'s findings.

Akkaya and Toptaş divided patients into control, PRF, diode laser, and PRF + diode laser groups to evaluate gingival blood perfusion and early socket bone healing. They found that co-administration of PRF and diode laser had a statistically significant effect on early bone regeneration [26].

In our study, the co-administration of these treatments was found to be more effective on certain days and parameters. The total VAS pain score, analgesic intake, and trismus were significantly lower in Group 2 (PRF + LLLT) compared to the control group.

Hosseinpour et al.'s review categorized 46 clinical studies by laser wavelength, power, and energy density, examining dose-dependent effects on pain, swelling, and trismus. As a result of this review, it was observed that the wavelength of the laser used in our study was 808 nanometers (nm), the power was 250 milliwatt (mW), and the energy density was 4.2 J (J), with a positive effect on the treatment [27].

Similarly with our study, Sun and Tunér (2004) evaluated LLLT in dental applications, affirming that wavelengths within this therapeutic window promote tissue healing and pain reduction, fundamental to photobiomodulation's effects [28].

Further supporting studies highlight the effectiveness of LLLT wavelength for achieving similar outcomes in reducing pain and promoting recovery. Hamblin and Demidova (2006) investigated the analgesic effects of LLLT at this specific wavelength and found a significant reduction in postoperative pain. Their study suggested that LLLT modulates inflammatory cytokines, aiding pain relief and faster recovery. These findings align with

Table 4 Swelling values of all patients who underwent impacted lower third molar surgery

Group	Control			Group1 (PRF)			Group2 (PRF + LLLT)			Group3 (LLLT)			P
	Avg ± SD	Med.(Q1:Q3)		Avg ± SD	Med.(Q1:Q3)		Avg ± SD	Med.(Q1:Q3)		Avg ± SD	Med.(Q1:Q3)		
Total	397.1 ± 27.4	393.0(379.0:416.0)		362.4 ± 21.2	359.5(354.0:367.0)		390.3 ± 28.4	390.0(365.0:417.5)		377.2 ± 18.2	380.0(360.0:390.0)		0.003 ^{*A}
preop swelling													
1st day	431.8 ± 34.0	432.0(404.0:452.0)		372.6 ± 22.0	369.5(359.0:379.0)		418.0 ± 23.7	411.0(400.5:440.0)		399.3 ± 18.0	403.0(385.0:420.0)		< 0.001 ^{*AB}
total swelling													
2nd day	446.9 ± 39.2	453.0(412.0:475.0)		377.2 ± 32.3	367.0(359.0:395.0)		418.2 ± 26.8	419.0(395.5:440.5)		397.8 ± 17.7	400.0(389.0:409.0)		< 0.001 ^{*A} , B, C
total swelling													
3rd day	455.9 ± 41.6	460.0(419.0:485.0)		366.9 ± 21.8	362.5(356.0:377.0)		413.8 ± 31.8	419.0(380.0:438.0)		390.5 ± 17.5	392.0(375.0:402.0)		< 0.001 ^{*A} , B, C
total swelling													

*<0.05; Kruskal Wallis Test Statistics; A = Control-Group1 (PRF); B = Group1 (PRF) -Group2 (PRF + LLLT); C = Control-Group3 (LLLT). Comparisons according to the control group

our results, where LLLT group patients had lower pain scores and reduced analgesic use [10].

Furthermore, Gavish et al. (2018) examined the efficacy of the B-Cure Laser Pro in dental applications and their findings indicated that LLLT applications resulted in shortened healing times, a result that was consistent with our observations. In particular, patients who received daily LLLT treatments exhibited reduced swelling and faster recovery times compared to those who did not receive laser therapy, emphasizing the potential of the B-Cure Laser in postoperative care [29].

Previous studies suggest that PRF and LLLT may accelerate the healing process following impacted third molar surgery. The reduction in pain, swelling, and trismus observed in the literature indicates that these methods could enhance postoperative patient comfort. PRF's role in promoting tissue healing and LLLT's biostimulatory effects during the early inflammatory phase highlight their potential in minimizing surgical complications. Compared to standard treatments, PRF and LLLT offer notable advantages, including their non-invasive nature and the possibility of reducing the need for pharmacological agents. However, further studies with larger patient cohorts, longer follow-up periods, and comparative analyses are necessary to establish their routine clinical application. Future research should particularly focus on aspects such as cost-effectiveness, application time, and optimal dosage protocols.

A limitation of this study is that the assessment of pain or swelling through self-reported scales may be subject to individual perception, potentially influencing the results.

A potential limitation of this study lies in the slight imbalance in the distribution of extractions (28 right, 32 left). While this difference is minimal and unlikely to introduce significant bias, it is important to acknowledge that the surgeon performing the extractions was right-handed. As the difficulty of extractions can differ based on the side of the procedure and the surgeon's dominant hand, this factor may have influenced the procedural difficulty, particularly for left-sided extractions. Although the impact on the results is expected to be negligible, this should be considered as a potential source of bias.

A further limitation of this study is the absence of a formal randomization process in patient allocation. Patients were assigned to treatment groups based on their order of presentation to the clinic, which may have introduced selection bias. Although efforts were made to reduce other sources of bias, including blinding of the evaluator, the lack of randomization should be acknowledged as a potential limitation in the study design.

Conclusions

This study showed that administering PRF and LLLT separately, as well as their combined administration following surgery, resulted in similar outcomes. Both approaches statistically reduced pain, analgesic intake, trismus, and swelling compared to the control group. Further studies are needed to assess the analgesic and anti-inflammatory effects of LLLT, combined with PRF's fibrin matrix, cellular components, and growth factor release, to optimize energy parameters.

Abbreviations

LLLT	Low-level laser therapy
PRF	Platelet-rich fibrin
PBM	Photobiomodulation
Mg	Milligram
VAS	Visual analog score
mm	Millimeter
TMJ	Temperomandibular joint
nm	Nanometer
mW	Miliwatt
SD	Standart deviation
Avg	Average
Min	Minimum
Max	Maximum
Med	Median

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12903-025-05828-3>.

Supplementary Material 1

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None.

Author contributions

B.E.A. wrote the main manuscript text and contributed to the conception, design, methodology, clinical study, formal analysis, and interpretation of the study, as well as drafting and critically revising the manuscript. C.M.D. maded randomisation, edited and critically revised the manuscript and provided professional supervision for the research. L.O.U. provided professional supervision for the research. All authors gave final approval of the manuscript and agreed to be accountable for all aspects of the work.

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Data availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request. Additionally, the data are securely stored at Near East University.

Declarations

Ethics approval and consent to participate

This study was conducted in accordance with the principles of the Declaration of Helsinki and was approved by the Near East University Scientific Research Ethics Committee (Approval Number: YDU/2024/120–1808). Written informed consent was obtained from all participants prior to their inclusion in the study.

Consent for publication

Written informed consent was obtained from the individual participant, who signed a consent form, for the publication of their personal and clinical details.

Any identifying images, such as the participant's face, have been anonymized (e.g., eyes blurred) to ensure confidentiality.

Competing interests

The authors declare no competing interests.

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