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Comparative Efficacy of Laser Versus Conventional Method in the Success of Circumferential Supracrestal Fiberotomy in Orthodontic Patients: A Systematic Review

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Abstract

Introduction: The relapse of rotated teeth is a significant concern in orthodontics, and circumferential supracrestal fiberotomy (CSF) presents a potential solution. Traditionally, CSF is performed using a surgical blade; however, employing a laser may reduce complications. This study aimed to systematically review the literature comparing laser-assisted CSF with conventional methods in orthodontic patients.

Methods: A comprehensive search was conducted across the PubMed, Scopus, Web of Science, and Cochrane Library databases using a specific search strategy up to June 16, 2024. Data extraction was done in accordance with the defined inclusion and exclusion criteria.

Results: Initially, a total of 293 articles were identified through the search process, and ultimately, four were selected for analysis based on specific inclusion and exclusion criteria. The studies involved various types of lasers including diode (810 to 940 nm), Er:YAG, and Er,Cr:YSGG lasers, and examined the effects of low-level laser therapy (LLLT) in conjunction with surgical interventions. Regarding relapse rates, two studies reported that both laser and surgical blade techniques demonstrated comparable efficacy, while adjunctive LLLT was effective in reducing relapse. In the other two studies, the use of laser therapy was found to be effective in decreasing relapse rates compared to the control group. Pain assessment results were inconclusive; one study reported reduced pain in the laser group, while another found no significant difference in pain levels between the laser and blade techniques. Furthermore, no significant differences were observed in periodontal pocket depth or gingival recession between the two methods.

Conclusion: Within the limitations of the current systematic review, our findings indicate that there is no significant difference in relapse rates between laser and blade CSF procedures. Furthermore, our results suggest that the incorporation of photobiomodulation at higher doses is correlated with a reduction in relapse rates following fiberotomy procedures.

Keywords: Laser; Low-level laser therapy; Orthodontic treatment; Relapse; Rotated teeth; Fiberotomy.

Introduction

In orthodontics, the retention phase of treatment can sometimes play a more critical role than the active phase in ensuring the long-term success of the treatment plan.[1,2] The orthodontic relapse, which refers to the tendency of teeth to return to their pre-treatment positions, is a common issue following orthodontic treatment. Several factors contribute to this phenomenon, including unfavorable skeletal growth, soft tissue rebound after the release of orthodontic forces, and inadequate reorganization of periodontal fibers.[2-4] Teeth with pre-existing rotation may be at an increased risk of relapse due to the complex interplay of various factors, such as gingival elasticity, bone regeneration, and the stability of

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surrounding tissues.[5,6] The role of the periodontium in tooth relapse during removable orthodontic treatment has been extensively investigated.[7] Numerous studies have demonstrated a correlation between relapse following orthodontic treatment and deficiencies in supracrestal periodontal fiber reorganization and reorientation.[8] In the extracellular matrix of the gingival tissue, collagen and elastin fibers coexist.[9] For instance, Type I collagen has a high turnover rate,[10] while elastic fibers have a half-life of approximately 70 years.[11]

Circumferential supracrestal fiberotomy (CSF) has emerged as the most feasible and effective treatment for twisted teeth, outperforming overeruption, delayed retention, overcorrection, and relaxin injection.[5,12] In the initial application of this technique, a surgical blade was used to trim the supracrestal fibers of the gingiva, facilitating better compatibility with new tooth positioning. This separation helps prevent relapse by reducing the tension exerted by the fibers, which can otherwise drive the teeth back to their original positions.[13] However, this approach has certain drawbacks in addition to its benefits. Risks associated with CSF include bleeding, soreness, and discomfort following the procedure, as well as an increase in pocket depth. Various alternative treatments, such as CSF performed via electrosurgery and lasers, have been attempted to alleviate these issues.[14] The recommended procedures are expected to have fewer side effects, including reduced post-treatment edema, pain, and infection.[15] Research has been assessed to evaluate the effectiveness of different types of lasers, including diode and Er:YAG lasers, in performing CSF compared to conventional surgical methods.[13,14,16,17] Studies have shown that laser-assisted CSF can effectively reduce the relapse of corrected orthodontic rotations.[18] Furthermore, the efficacy of combining laser-aided fiberotomy with low-level laser therapy (LLLT) has been explored in relation to its potential to prevent rotational relapse in patients who have undergone orthodontic treatment.[13,14,19]

The current study aimed to determine whether laser-assisted CSF yields a reduced incidence of complications, including relapse, discomfort, and pocket depth, compared with traditional CSF procedures performed with a surgical blade. This investigation was prompted by the absence of a relevant systematic review that comprehensively evaluates both techniques. Also, the novelty of this study lies in its comprehensive comparison of high-power lasers and surgical blades in CSF procedures, with a particular focus on the implications of thermal ablation, a mechanism unique to lasers. Additionally, it explored the adjunctive use of low-level lasers in managing CSF relapse, providing novel perspectives on their therapeutic efficacy.

Materials and Methods

Protocol and Registration

This systematic review was conducted in accordance with the guidelines established by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).[20] Furthermore, the protocol for this systematic review was completed and registered at the International Prospective Register of Systematic Reviews (PROSPERO: CRD42021243379).

Search Strategy

PubMed, Scopus, Web of Science, and the Cochrane Library databases were searched up to June 16, 2024. For this purpose, relevant terms were explored in the Medical Subject Headings (MeSH) database. Finally, the exact search string was as follows: (“Orthodontics” OR “Orthodontic”) AND (“Recurrence” OR “Recurrences” OR “Relapse” OR “Relapses” OR “Rotation” OR “Rotations” OR “Rotated” OR “fiberotomy”) AND (“laser” OR “lasers”). A manual search was also conducted on Google Scholar. The results obtained from all databases were subsequently entered into EndNote version 9 software.

Inclusion and Exclusion Criteria

All randomized clinical trials (RCTs) that compared the efficacy of various types of lasers with surgical blades in the context of CSF for individuals undergoing orthodontic treatment were included in the current study. According to the population, intervention, comparison, and outcomes (PICO) criteria, the target population consisted of individuals who had at least one rotated, healthy incisor or premolar tooth and had completed orthodontic treatment. The interventions involved the application of different types of lasers for CSF. The comparator was the standard method of CSF, which utilizes a surgical blade for fiberotomy. The primary outcome measured was the relapse rate of orthodontic treatment following CSF, while secondary outcomes included changes in periodontal pocket depth, gingival recession, and pain levels.

Non-English language articles, studies involving study populations with systemic diseases, the use of medications that interfere with orthodontic movement (such as non-steroidal anti-inflammatory drugs, bisphosphonates, and corticosteroids), poor hygiene with a plaque index exceeding 10%, periodontal issues, active progressive recession, pregnant or lactating women, and studies that examined other types of fiberotomy, were excluded.

Selection of Studies

After eliminating duplicate articles, two authors independently screened the titles and abstracts of the remaining articles. Any articles excluded by the authors were subsequently re-evaluated by the senior author. The full texts of the remaining articles were then assessed according to the inclusion and exclusion criteria, as well as the primary research question. As in the previous stage, any disagreements were addressed and resolved by the senior author.

Quality Assessment

The clinical trials were assessed for methodological quality using the Risk of Bias (ROB) 2.0 checklist. The trials were scored according to the guidelines established by Sterne et al.[21]

Data Extraction

After identifying the final articles included in this systematic review, we extracted the following characteristics from each study: the name of the first author, year of publication, study location, study design, number of groups within each study, sample size, participant characteristics (such as age and sex), types of interventions administered in each group, characteristics of the lasers used, follow-up duration, and the results of each study.

Results

The initial search yielded a total of 293 articles. After identifying and eliminating duplicate entries, 155 articles remained. Following a review of the titles and abstracts, 133 articles were excluded as not completely relevant. Among the 22 remaining articles, the full texts of two were not available. After reviewing the full texts of the remaining 20 articles, only four met the inclusion criteria and were included in this systematic review. The review process of these studies is shown in Figure 1.

Risk of Bias Assessment

The results of the risk of bias assessment are summarized in Figure 2.

General characteristics of the included studies

Four RCTs that met the inclusion criteria were included in this systematic review.[14,16,17,22] The general characteristics and quantitative data extracted from these studies are summarized in Table 1.

All of these studies were published in English and were conducted between 2010 and 2023 in Iran[14,17,22] and India.[16] A total of 226 participants were involved in the clinical trials[14,16,17,22] The lasers utilized for CSF in the intervention group included Er,Cr:YSGG,[17] Er: YAG,[14] 810 nm,[14,16] and 940 nm.[22] The laser power employed in these studies ranged from 0.2 W to 1.5 W. The clinical

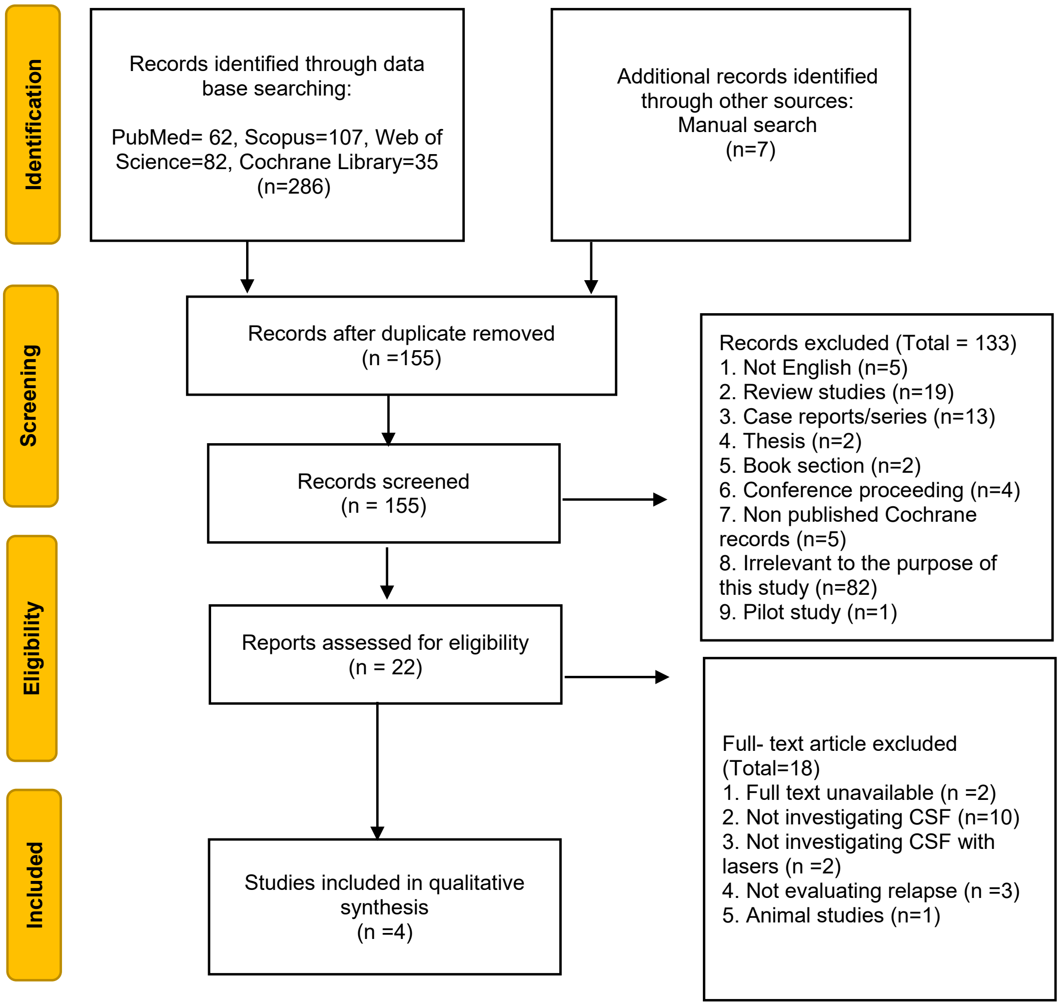

Figure 1. PRISMA Flowchart

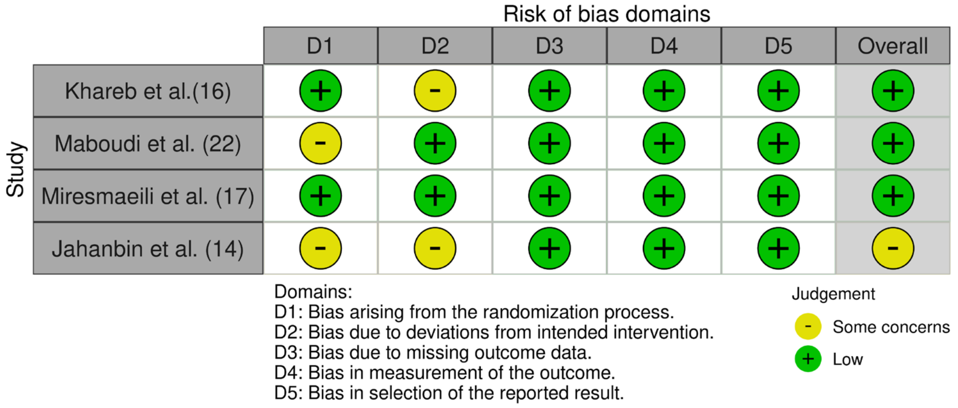

Figure 2. Results of Cochrane Risk-of-Bias Tool for RCTs

trials included groups with no CSF, CSF with a surgical blade, and CSF with a laser.[14,16,17,22] Follow-up intervals varied from one week to two months post-CSF. Two approaches of using a high-power laser[14,16,17,22] or a low-level laser[14, 22] were applied in the included articles. Only two studies utilized both high and low power lasers.[14,22] All high-power lasers were utilized in pulsed mode, whereas LLLT was administered in a continuous mode of irradiation. The energy density applied in LLLT was 4 J/cm^2 using a 940 nm diode laser and 35.7 J/cm^2 using an 810 nm laser, as reported in the studies by Maboudi et al[22] and Jahanbin et al,[14] respectively.

Study Populations

The study populations across the included trials consisted of patients undergoing orthodontic treatment with varying degrees of tooth rotation. Kharb et al[16] studied patients with mandibular crowding (5-8 mm) and rotations greater than 10°, treated without extractions using a straight wire appliance. Maboudi et al[22] focused on patients with rotated maxillary and mandibular anterior teeth undergoing fixed orthodontic treatment. Farhang Miresmæili et al[17] included patients with moderate to severe rotation (30-50° and > 50°, respectively) in mandibular incisors before orthodontic treatment. Lastly, Jahanbin et al[14] examined patients with rotation of 30-70° in at least one maxillary incisor prior to orthodontic treatment.

The Relapse Following CSF

To evaluate the relapse following CSF using either a laser or a surgical blade, reference lines were established on plaster casts after molding with alginate at specific time points. Subsequently, the rate of rotation and relapse of the teeth was examined in relation to these reference lines.[14,16,17,22] In the study conducted by Kharb et al,[16] the researchers measured irregularity in the lower anterior region using Little's Irregularity Index, [23] as well as the mean difference in rotation of the anterior mandibular teeth immediately after and one month post-cessation of CSF. The results indicated a greater relapse in the control group for both the irregularity index and rotational angulations compared to the blade and laser CSF groups, with statistical significance ($P < 0.001$). However, there was no statistically significant difference in the irregularity index and rotational relapse between the blade-assisted and laser-assisted CSF groups ($P > 0.05$).[16] In the clinical trial conducted by Maboudi et al, the magnitude of relapse was assessed at one and two months post-intervention across various study groups. Additionally, the percentage of relapse was calculated based on the magnitude of relapse and the primary angle of rotation. The findings revealed significant differences in both the magnitude of relapse and the percentage of relapse between the six study groups ($P = 0.014$ and $P = 0.035$, respectively). The highest mean values for both magnitude and percentage of relapse were observed in the control group (no CSF), followed by the photobiomodulation group, the conventional CSF + photobiomodulation group, the diode laser CSF group, the conventional CSF group, and the diode laser CSF + photobiomodulation group.[22] In the trial conducted by Farhang Miresmæili et al, the relapse rate in the mandibular incisors was assessed between one and two months following CSF. The mean relapse rates in the conventional group (CSF with surgical blade No. 11) and the laser group (CSF with the Er,Cr:YSGG laser) were 5.09 ± 1.59° and 4.87 ± 2.08°, respectively. Both rates were significantly lower than the control group, which had a mean relapse rate of 11.28 ± 2.938°. The difference between the two treatment groups was not statistically significant ($P > 0.05$), indicating that both methods were equally effective in reducing relapse.[17] In the clinical trial conducted by Jahanbin et al, the mean relapse rate in the maxillary incisors between one and two months after CSF was 4.24 ± 1.12° in the conventional group (CSF with surgical blade No. 11) and 6.12 ± 1.77° in the laser group (CSF with the Er:YAG laser). Additionally, this study included a group that received LLLT using an 810 nm laser, which exhibited a relapse rate of 5.33 ± 1.91°. The relapse rates among these groups were not statistically

Table 1. Data Extracted From Included Studies

Author, country, year	Study type	Study population	Study groups		Age (Range or mean ± SD)	Follow up	Outcome measures	Results
Kharb et al, India, 2023[16]	RCT	Patients with mandibular crowding ranging between 5-8 mm and rotation > 10° treated without extraction with a straight wire appliance prescription	Control	no CSF (n = 22)	18-25 y	Immediately and 1 m after CSF	1. Teeth irregularity index (Little's irregularity index) 2. Teeth rotation difference	No significant difference between CSF with surgical blade and 810 nm diode laser
			Case	Conventional CSF with surgical blade (n = 22) CSF with 810 nm diode Laser) 1.2 W, pulsed mode (n = 22)				
Maboudi et al, Iran, 2023[22]	RCT	Patients with rotated maxillary and mandibular anterior teeth who were under fixed orthodontic treatment	Control	no CSF (n = 15)	22.88 ± 5.68 y	1 and 2 m after CSF	1. Magnitude and percentage of relapse 2. Gingival recession 3. Periodontal pocket depth 4. VAS pain score (24 hours after CSF)	- Relapse: Laser CSF + LLLT < blade CSF + LLLT < blade CSF < laser CSF < LLLT < control group - Changes in pocket depth, gingival recession, and pain level did not reveal any significant differences between the groups.
			Case	Conventional CSF with surgical blade (n = 15) LLLT 940 nm, 0.2 W, CW, 4 J/cm², 0.16 W/cm², four points (a total of 16 J/cm² for each tooth) (n = 15) CSF with 940 nm diode laser (1.5 W, pulsed mode) CSF with diode laser + LLLT (n = 15) CSF with surgical blade + LLLT (n = 15)				
Farhang Miresmæili et al, Iran, 2019[17]	RCT	Patients with moderate (30-50 degrees) or severe (more than 50 degrees) rotation in the mandibular incisor before orthodontic treatment	Control	no CSF (n = 14)	21.06 ± 5.03 y	Immediately and 1 m after CSF	1. Relapse rate 2. Periodontal pocket depth 3. VAS pain score (24 hours after CSF)	-Relapse: CSF with Er,Cr:YSGG laser was as effective as blade CSF. -The level of pain and pocket depth: no significant difference between laser and blade groups.
			Case	Conventional CSF with surgical blade (n = 15) CSF with Er,Cr:YSGG laser (2780 nm, 1.5 W, 30 Hz, water spray: 40%, air spray: 20%, GOLD handpiece with MZ5 tip with a diameter of 4.5 mm (n = 15)				
Jahanbin et al, Iran, 2014,[14]	RCT	Patients with rotation of 30-70 degrees in at least one maxillary incisor before orthodontic treatment	Control	Conventional CSF with surgical blade (n = 6)	24.5 ± 5.1 y	1 and 2 m after CSF	1. Relapse rate 2. gingival recession 3. Periodontal pocket depth 4. VAS pain score (24 hours after CSF)	-Relapse: no significant differences in the degrees and percentages of relapse between study groups (laser, blade and LLLT. - Pocket depth: no significant difference in pocket depth alterations between the conventional and laser-aided CSF groups -Gingival recession: A small amount of gingival recession was observed in both conventional and laser-aided CSF with no significant differences -Level of pain: significantly less pain in patients who underwent laser aided CSF compared with conventional CSF
			Case	CSF with Er: YAG laser, (2940 nm, energy 100 mJ, frequency: 10 Hz, water and air spray, tip diameter: 1.1 mm (n = 6) LLLT with 810 nm diode laser (0.2 W, continuous wave, 50 s per point, 4-point, spot size: 0.28 cm², 35.7 J/cm², twice a week for 4 weeks) (n = 6)				

RCT, Randomized control trial; LLLT: Low level laser therapy.

different from one another. However, the relapse was significantly greater in the control group compared to the experimental groups ($P < 0.05$). The findings of this study indicate that CSF with the Er:YAG laser is as effective as conventional CSF in reducing relapse while causing less pain and discomfort for the patient. Furthermore, LLLT with a high radiation dose (35.7 J/cm²) could also reduce the relapse, at least in the short term.[14]

Periodontal Pocket Depth and Gingival Recession

In addition to the relapse rate, the changes in periodontal pocket depth and the rate of gingival recession were also evaluated in three out of the four included studies. Maboudi et al reported no significant differences in the mean values of changes in pocket depth and gingival recession between the one-month and two-month time points after the interventions among the six study groups ($P = 0.293$ and $P = 0.979$, respectively).[22] Farhang Miresmæili et al assessed the changes in probing depth between the immediate time point and two months after CSF. They reported changes in probing depths of 0.14 ± 0.15 mm in the control group (CSF with surgical blade No. 11) and 0.21 ± 0.14 mm in the case group (CSF with the Er,Cr:YSGG laser), and they were not statistically significant ($P = 0.097$).[17] In the study conducted by Jahanbin et al, the mean change in pocket depth between the one-month and two-month time points after CSF was 0.18 ± 0.12 mm in the CSF group with the surgical blade and 0.36 ± 0.21 mm in the CSF group with the Er:YAG laser. The difference between the two groups was not statistically significant ($P = 0.138$). Additionally, Jahanbin et al reported the mean gingival recession as 0.23 ± 1.31 mm in the blade group and 0.46 ± 1.41 mm in the Er:YAG laser group at the same time points. This difference was also not statistically significant ($P = 0.257$).[14]

Pain Score

In addition to the aforementioned variables, the level of pain was evaluated using the visual analog scale (VAS) pain questionnaire[24] across clinical trials.[14,17,22] In these studies, patients were asked to rate their maximum pain during the first 24 hours following the CSF procedure on a scale from 0 (no pain) to 10 (the most severe pain). Maboudi et al reported the highest pain scores in the diode laser CSF group and the lowest in the LLLT group among the five interventional groups. However, the differences in pain scores between these groups were not statistically significant ($P = 0.570$).[22] In the study by Farhang Miresmæili et al, the mean pain scores in the conventional CSF group and in the Er,Cr:YSGG laser CSF group were 0.86 and 2.2, respectively. However, the difference between the two groups was not statistically significant ($P > 0.05$).[17] In Jahanbin and colleagues' study, the mean level of pain in the conventional CSF group and in the Er:YAG laser CSF group were 4.04 ± 1.12 and 1.97 ± 0.72, respectively. Based on the results of this study, the pain caused by CSF with a laser was significantly less than CSF with a surgical blade ($P = 0.003$).[14]

Discussion

Tooth rotation is one of the most commonly encountered issues in orthodontic patients, with prevalence rates ranging from 2.2% to 5.1% across different populations.[19] Non-surgical orthodontic approaches generally yield positive outcomes; however, a significant drawback is the considerable risk of relapse shortly after treatment. This issue is attributed to the supracrestal fibers' inability to adapt to the mechanical changes induced by orthodontic appliances.[25] As a result, complementary surgical procedures are often considered for these patients. One of the most popular surgical treatments is supragingival fiberotomy, which involves cutting the supragingival fibers to minimize complications and reduce the likelihood of relapse following the orthodontic treatment. Initially, surgical blades were utilized to cut the tissue in fiberotomy. However, this approach has become less popular due to its lack of precision and the high levels of postoperative pain associated with it.[26,27] Lasers are an efficient alternative for blades in oral and maxillofacial surgeries.[28] Lasers, both high-level and low-level, are particularly beneficial in orthodontic treatments as they can accelerate tooth,[29] regenerate bone,[30] etch the tooth surface prior to bonding,[31] debond ceramic brackets,[32] alleviate pain and discomfort following orthodontic procedures,[33] prevent enamel demineralization,[34] and disinfect appliances.[35] Additionally, lasers can be employed in soft tissue surgeries, such as frenectomy, gingival contouring, exposing unerupted teeth, and crown lengthening.[36-38] However, the results of studies on this topic vary due to differences in the characteristics of the various lasers used. Consequently, the current systematic review was conducted to compare the results of these studies more precisely.

The included studies employed various strategies to monitor relapse. Kharb et al[16] established the midsagittal plane by drawing a line perpendicular to the line connecting the mesial pits of the first molars on either side. The six angles formed for each of the six anterior teeth were calculated by a line by connecting each tooth's mesial and distal contact points to the midsagittal plane. The inferior and inner angles were measured, and the average of all angles was subsequently determined. In the studies by Maboudi et al,[22] Farhang Miresmæili et al,[17] and Jahanbin et al,[14] a reference line was drawn perpendicular to the line connecting the central fossae of the first molars and passing through the midline of the maxillary dentition. The angle formed between the incisal edge line of the experimental teeth and the reference line was subsequently calculated. This calculation was performed using photographs of dental casts taken at two time points: one month and two months after CSF. The relapse was measured as the difference between the two calculated angles. In a pilot study by Gokhale et al,[39] the researchers calculated the distance between the centers of the brackets and the distance between the cusp tips of the selected teeth to measure relapse one month after CSF.

A VAS, recognized as one of the most reliable scales for measuring pain following surgery, was utilized in three of the included studies.[14,17,22] While Maboudi et al[22] and Farhang Miresmæili et al[17] reported no significant difference in post-CSF pain levels between diode laser and surgical blade groups, Jahanbin et al[14] reported a significantly lower pain level after Er:YAG laser-aided CSF compared to the surgical scalpel. The literature indicates that the use of lasers enhances blood coagulation, sterilization, and precision in tissue cutting,[40,41] which consequently accelerates the wound healing process.[42] Furthermore, patients report experiencing less pain and discomfort after surgery when lasers are employed, as opposed to traditional surgical blades.[43-45] Unlike surgical blades, lasers generally facilitate wound healing in soft tissue procedures. This is attributed to their ability to inflict less damage to the tissue, resulting in lower inflammation and decreased bleeding at the wound site. Additionally, lasers enhance coagulation, which further supports the healing process.[46, 47]

In two included studies, LLLT was utilized alone[14] or in combination with a high-power laser or a blade.[22] LLLT, recently referred to as photobiomodulation, is defined as a type of non-thermal light treatment that employs non-ionizing light sources, including lasers and light-emitting diodes. During this process, light is absorbed by specific photo-acceptors within cells, which initiates several signaling pathways that modulate cellular reactions.[48,49] Lasers with an output power of less than 1000 mW (preferably less than 500 mW) are used in photobiomodulation. Among the numerous benefits of photobiomodulation, we can highlight acceleration in tissue healing and management of pain and inflammation.[29] It has been demonstrated that laser parameters, particularly energy density in photobiomodulation, can influence the inhibitory or stimulating effects of treatment.[50]

Different types of lasers have been utilized in the studies reviewed. Diode lasers were the most commonly used lasers for CSF. Diode lasers are compact, cost-effective devices that have recently emerged in the dental market as a new technological advancement. The literature demonstrates the high efficacy of diode lasers in gingival recontouring for cases of hyperplastic gingiva.[46,47] In a study examining various settings for CSF, Maboudi et al[22] reported the most significant reduction in relapse rates when using a 940 nm diode laser with 1.5 W output power in pulsed mode in conjunction with photobiomodulation. This reduction was notably lower than that observed with other settings. Similarly, Gokhale et al[39] also reported the efficacy of continuous irradiation of a 980 nm diode laser with 1.2 W power in reducing relapse after CSF compared to surgical blades. However, Kharb et al[16] observed no differences regarding either irregularity or rotation between CSF with a surgical blade and an 810 nm (1.2 W, pulsed mode) diode laser. This difference may arise from variations in the dosimetry of lasers or differences in individual tooth anatomy related to supracrestal fibers. It is recognized that various factors, including the laser wavelength, total energy delivered, pulse repetition rate, dosage, and optical characteristics of the tissues being irradiated, are directly correlated with cellular responses and laser therapy efficacy.[51] Maboudi et al[22] demonstrated that the integration of CSF with photobiomodulation yielded the most favorable results in minimizing orthodontic relapse. Elkattan et al[52] conducted a comparative analysis of two distinct diode laser dosages in the context of orthodontic tooth movement and subsequent relapse in a rat model. The findings indicated that, although high-dose photobiomodulation (wavelength of 940 nm, 250 W/cm², 5000 J/cm², in continuous wave mode) was employed, low-dose photobiomodulation (wavelength of 940 nm, 250 W/cm², 2500 J/cm², also in continuous wave mode) demonstrated a capacity to enhance the rate of tooth movement. Furthermore, it was observed that low-dose irradiation was associated with an increased propensity for relapse. The study posited that the influence of photobiomodulation on relapse is contingent upon its energy density, with high-energy density photobiomodulation exhibiting a potential to mitigate relapse, in contrast to low-energy density photobiomodulation, which may exacerbate it. Jahanbin et al[14] indicated that LLLT administered at excessively high energy densities was comparably effective to circumferential supracrestal fiberotomy (CSF) procedures in mitigating relapse, at least in the short term, which aligns with the aforementioned assertion. Erbium family lasers are another type of laser used in dental procedures. The results of the clinical trial conducted by Farhang Miresmæili et al[17] revealed that there is no significant difference in the rate of relapse between the use of surgical blades and the Er,Cr:YSGG laser. According to the findings of the study by Jahanbin et al[14] the use of Er:YAG lasers significantly reduced postoperative pain within 24 hours following CSF. Furthermore, it has been demonstrated that the application of the Er,Cr:YSGG laser during frenectomy alleviates postoperative symptoms and eliminates the need for anesthesia.[53]

Our research encountered several limitations. A significant limitation is the lack of standard high-quality RCTs on this topic. Moreover, heterogeneity in methodology, laser types, and dosimetry precluded the present researchers from conducting a meta-analysis in the current study. Further studies with larger sample sizes and comparisons of different laser protocols are highly recommended.

Conclusion

Within the limitations of the current systematic review, it was demonstrated that the use of surgical lasers, including diode and erbium family lasers, has a comparable or lower rate of relapse compared to conventional CSF. Moreover, our data showed that the addition of photobiomodulation has varying effects depending on the laser dose; lower doses tend to increase relapse rates, while higher doses decrease the relapse following fiberotomy procedures. However, due to the limited number of studies included, these results should be interpreted with caution. More rigorously designed studies with larger sample sizes are necessary to confirm our findings.

Authors' Contribution

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Competing Interests

None declared.

Ethical Approval

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