BJDOR
BRAZILIAN JOURNAL OF DENTISTRY AND ORAL RADIOLOGY

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PUBLICAÇÕES CIENTÍFICAS DE ACESSO ABERTO

Case Report

Low-power laser as an adjunct therapy in the postoperative period of clinical crown lengthening in the aesthetic area for the correction of gummy smile: a case report

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Abstract: Gummy Smile (GS) is an aesthetic condition characterized by excessive gum exposure when smiling, typically more than 2 mm. An effective technique for its treatment is Clinical Crown Lengthening (CCL) surgery, which involves procedures such as gingivectomy/gingivoplasty and osteotomy/osteoplasty. A promising adjunct therapy in the postoperative period is the use of Low-Power Laser (LPL), which contributes to inflammation control, bone regeneration, wound healing, and pain reduction. The study focuses on a clinical case of a 22-year-old patient who visited the Dental Clinic of INTA University Center - UNINTA, dissatisfied with the aesthetics of her smile due to excessive gum exposure. Examinations showed she had short clinical crowns and bulky, misaligned gums, especially in the upper incisors. CCL surgery was performed on teeth 15 to 25, and LPL was applied after the procedure and during the postoperative period. The results were positive, with the harmonization of the smile, reduced gum exposure, and increased tooth size, significantly improving the patient's self-esteem and quality of life. LPL proved to be an effective adjunct therapy, aiding in tissue recovery, and contributing to the patient's emotional well-being after GS correction.

Keywords: Smile; Gum; Gingivoplasty; Gingivectomy; Low-power laser.

Citation: Albuquerque RNA, Sousa LHT, Santiago NBM, Nunes NLT. Low-power laser as an adjunct therapy in the postoperative period of clinical crown lengthening in the aesthetic area for the correction of gummy smile: a case report. Brazilian Journal of Dentistry and Oral Radiology. 2024 Jan-Dec;3:bjd37.

doi: https://doi.org/10.52600/2965-8837.bjdor.2024.3.bjd37

Received: 31 March 2024
Accepted: 30 April 2024
Published: 1 May 2024

1. Introduction

Facial aesthetic harmony is directly correlated with the smile, which is composed of three elements: teeth, gums, and lips. The smile becomes aesthetically pleasing when these components are in appropriate proportions and are symmetrical [1]. According to Al-Harbi and Ahmad [2], the smile is responsible for expressions, gestures, affections, and can influence individuals' professional, emotional, and psychosocial lives. In aesthetic dentistry, a common complaint among patients is excessive gingival exposure when smiling [3]. The ideal exposure standard for dental elements during a smile is three-quarters of the crown height and 2 mm of gum, with a higher exposure in women than in men. Variations in the appearance of tooth and gum exposure when smiling are related to several factors, including anatomical crown length, lip length, the extent of lip elevation during smiling, and vertical maxillary length [4-6].

Gummy Smile (GS) or excessive gingival exposure presents a variety of causal factors, among which Altered Passive Eruption (APE), dentoalveolar extrusion, and short upper lip can be mentioned, occurring either in isolation or combined [7]. Among these, APE is one of the most prevalent conditions, in which a significant portion of the dental crown remains covered by the gum, and this excess gingival tissue

prevents the apical migration of the tissue to the Cemento-Enamel Junction (CEJ) [8]. Moreover, this condition results in short anterior teeth with excessive gingival exposure, indicating Clinical Crown Lengthening (CCL) surgery to correct GS [9]. Thus, the surgery aims to establish an appropriate relationship in the position of the gingival margin and the increase in clinical crown height of the teeth, restoring functional and aesthetic balance, being one of the therapeutic approaches frequently used in clinical practice [10, 11]. Conversely, the surgical removal of gingival tissue is carried out using techniques such as gingivectomy and/or gingivoplasty, with or without bone resection, indicated for correcting GS and re-establishing the space of the supracrestal tissues [12].

Subsequently, after the surgery, it is necessary to choose the most suitable suturing option that facilitates the joining of surgical edges and faster healing. Among the various suturing options, vertical mattress and/or inverted and simple interrupted sutures are described in the literature with good clinical results [8, 13]. In this context, it is essential for the dentist and the patient to focus on the healing process in the immediate postoperative period [14]. The repair process begins immediately after the injury, even before the onset of inflammation, and ultimately results in the complete repair and replacement of dead or injured cells with the formation of healthy new cells [15].

It is important to highlight that there is an adjunct therapy to the post-surgical tissue repair process, which is laser therapy. This therapy promotes high collagen production and improves the remodeling of connective tissues, with results appearing after 3 weeks [16, 17]. Furthermore, Moreira [18] highlighted in his studies various indications of lasers in dentistry, including periodontal abscess and access surgery for scaling, root canal decontamination, endodontic abscess, prosthesis and mucosal decontamination, dental surface decontamination, caries lesions, pericoronitis, oral herpes, oral candidiasis, oral mucositis, halitosis, necrosis, and osteonecrosis in the post-surgical context.

Low-power laser therapy has been extensively applied in the postoperative period of periodontal surgeries, specifically for pain control. Thus, it acts on the surface of the injured area, and its efficacy depends on the irradiated dose, the type of lesion, and the patient's response regarding absorption. After irradiation, there is stimulation of microcirculation and release of histamine, leading to improved plasma drainage and reduced edema. Additionally, the laser accelerates the process of mitosis, resulting in better tissue repair and healing [19]. The development of numerous types of lasers and various wavelengths has enabled their use in diverse treatments [20]. Therefore, the main therapeutic effects include anti-inflammatory and analgesic action, infection prevention, and acceleration of the initial phases of healing in biological tissues [21, 22].

Thus, this paper aimed to report a clinical case of the use of Low-Power Laser as an adjunct therapy in the postoperative period of CCL surgery.

2. Case Report

A 22-year-old female patient visited the Dental Clinic of INTA University Center – UNINTA, complaining about the appearance of her smile, which she considered unattractive due to the short size of her teeth and gum exposure when smiling, giving her a childish look. After anamnesis and general clinical examination, the patient was found to be systemically healthy. A simplified periodontal examination revealed no gingival bleeding, biofilm, or calculus deposits. The photographic protocol showed a broad and high smile, normal lip position, and excessive gingival exposure when smiling (Figures 1A to 1D).

During the intraoral examination, teeth with short, quadrangular clinical crowns and rounded, misaligned gingival margins were observed, with excessive volume particularly in the region of the upper incisors. Sulcular probing identified a gingival phenotype from intermediate to thick, leading to a diagnosis of Gummy

Smile (GS) (Figures 2A to 2E). The treatment proposed to address the patient's complaint and diagnosis was aesthetic Clinical Crown Lengthening (CCL) surgery on teeth 15 to 25, using the surgical technique of gingivectomy/gingivoplasty and osteotomy/osteoplasty. The surgical procedure began with the preparation and setup of the surgical table, and antiseptic treatment of the patient.

Figure 1: A and B. Initial frontal smile, in occlusion and disocclusion. C and D. Right and left lateral smile.

Figure 2: A and B. Initial clinical aspect in frontal view, with lip retraction, in occlusion and disocclusion. C and D. Right and left lateral views. E. Sulcular probing highlighting the thick gingival phenotype.

For intraoral disinfection, a 0.12% Chlorhexidine Digluconate solution (Periogard®, Colgate Palmolive Ltda – Osasco – SP) was provided for the patient to rinse with 10ml for one minute; on the facial region, 2% Iodopovidone (Riodeine®, Rioquímica – São José do Rio Preto – SP) was applied with sterile gauze for perioral skin disinfection. Subsequently, local injectable anesthesia with 4% Articaine and 1:200,000 Epinephrine (Articaine®, DFL – Rio de Janeiro – RJ) was initiated for blocking the anterior, middle, and posterior superior alveolar nerves, supplemented with infiltrative techniques in the region. A total of 4 cartridges of anesthetic were used for the procedure (Figure 3).

Figure 3: Surgical Table.

Using a North Carolina/PCP 15 periodontal probe (Supremo® – São Paulo – SP), probing was conducted at the position of the future gingival zenith, displaced 1mm distally, considering the long axis of tooth 21, obtaining a 3mm depth. From this measurement, two additional mesial and distovestibular measurements were obtained. After marking the estimated position of the Cemento-Enamel Junction (CEJ), considering the distalized gingival zenith on central incisors and canines and centralized on lateral incisors, an internal bevel incision was made with a 15C scalpel blade (Solidor® – Osasco – SP) attached to a straight round scalpel handle (Supremo® – São Paulo – SP), at a 45° angle, in the incisal-apical direction for better tissue adaptation to the dental emergence profile in the transition zone; subsequently, an intrasulcular incision was made to facilitate the removal of the gingival "collar" with the help of a crane ckaplan 6 curette (Trinity® – Extrema – MG) (Figures 4A to 4H).

Given the patient's gingival phenotype, which was considered intermediate to thick, a total flap reflection was performed using a Buser elevator (Supremo® – São Paulo – SP) to expose the dental crown and bone tissue. To re-establish the 3 mm supracrestal attachment space (distance from the Cemento-Enamel Junction (CEJ) to the alveolar bone crest) for teeth 15 to 25, osteotomy was carried out in an apico-coronal direction using an active-top cylindrical diamond bur FG 2173HL (KG Sorensen® – Cotia – SP) and an Ochsenbein micro chisel (Trinity® – Extrema – MG). Osteoplasty for recontouring the thickness of the vestibular alveolar fossae was performed in a buccal-palatal direction using a spherical diamond bur FGHL 3018HL (KG Sorensen® – Cotia – SP) (Figures 5A to 5Cc).

Throughout the procedure, physiological solution (Sorimax, Farmax® – Divinópolis – MG) was used for irrigation and better visualization of the surgical field. For the final positioning of the surgical gingival margins, the flap was adapted to the ideal position to favor a new gingival contour, with the main anatomical reference being the CEJ, as it determines the accuracy of the osteotomy and the stability of the

new gingival margin during healing. Sutures were performed with 5.0 nylon thread (Shalon Medical® – Goiânia – GO), using a modified vertical mattress technique for better aesthetics and healing (Figures 6A to 6C).

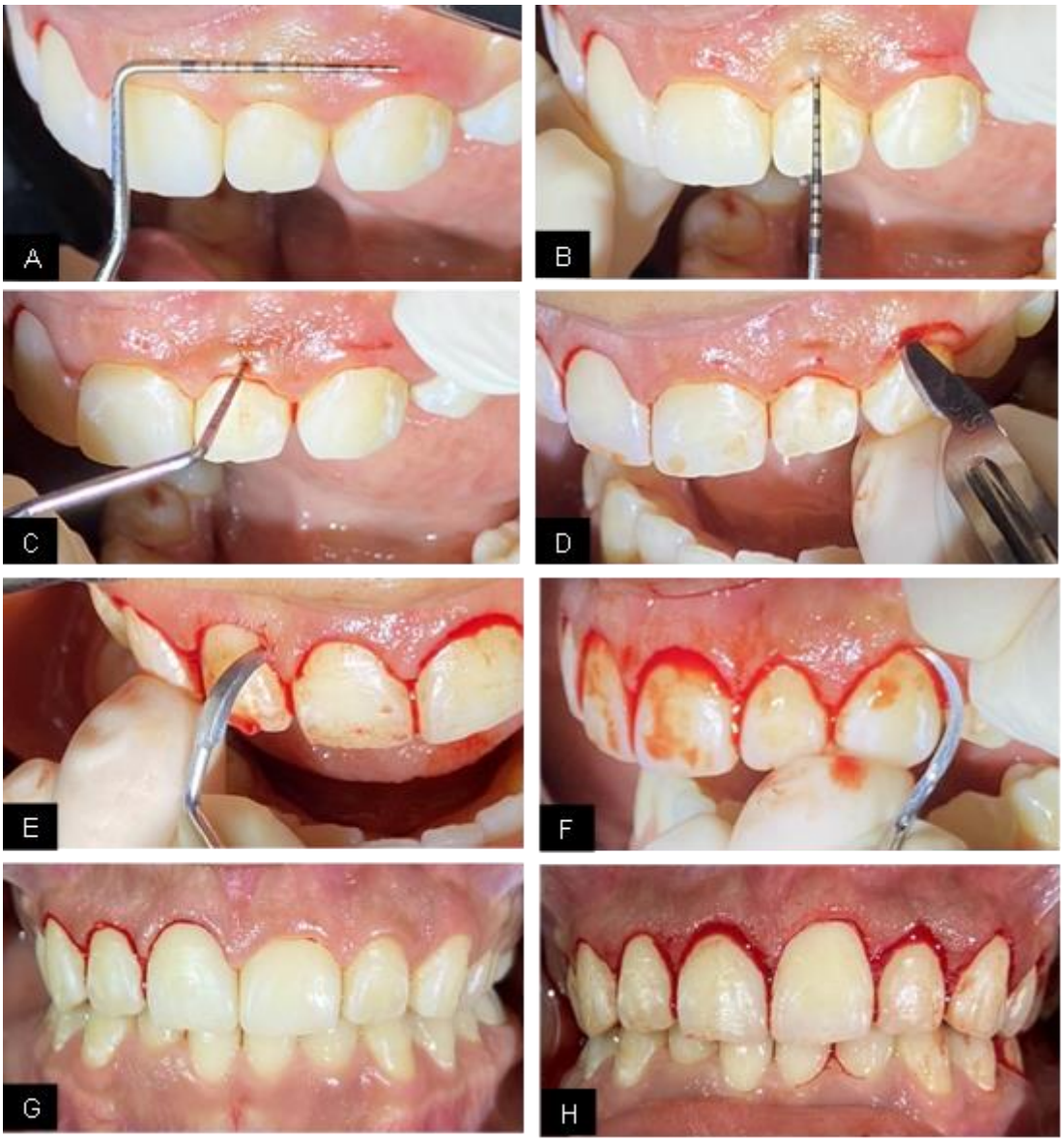

Figure 4: A and B. Periodontal probe positioned horizontally to verify the heights of the gingival zeniths. B. Periodontal probing to determine the position of the gingival zenith. C. Marking of the gingival zeniths at the level of the CEJ (Cemento-Enamel Junction). D. Internal bevel incision. E and F. Removal of the gingival collar in the interproximal and buccal regions. G. Defined surgical margin position on the right hemiarch. H. Position of the surgical margin on both hemiarchs.

After the surgical steps were completed, the laser application was performed by a single operator. The protocol used involved a low-power laser (Therapy EC – DMC® – Brazil) with a fixed power of 100mW and a spot size of 0.09 cm^2. For immediate post-surgical tissue repair and pain relief, the laser was used at red (660nm) and infrared (808nm) wavelengths, with an energy of 2j per point and an application time of 20s per point for each light spectrum. The applications were performed using the point method, with the tip positioned perpendicularly to the gingival tissue. The energy was distributed across teeth 15 to 25, at three distinct points on the buccal

surface: mesial, center, and distal, totaling 42 points and 84j of energy. The LBP was applied in subsequent phases of monitoring healing and post-operative pain, 24 hours and 7 days after the surgery, following the previously mentioned application protocol (Figures 7A to 7E).

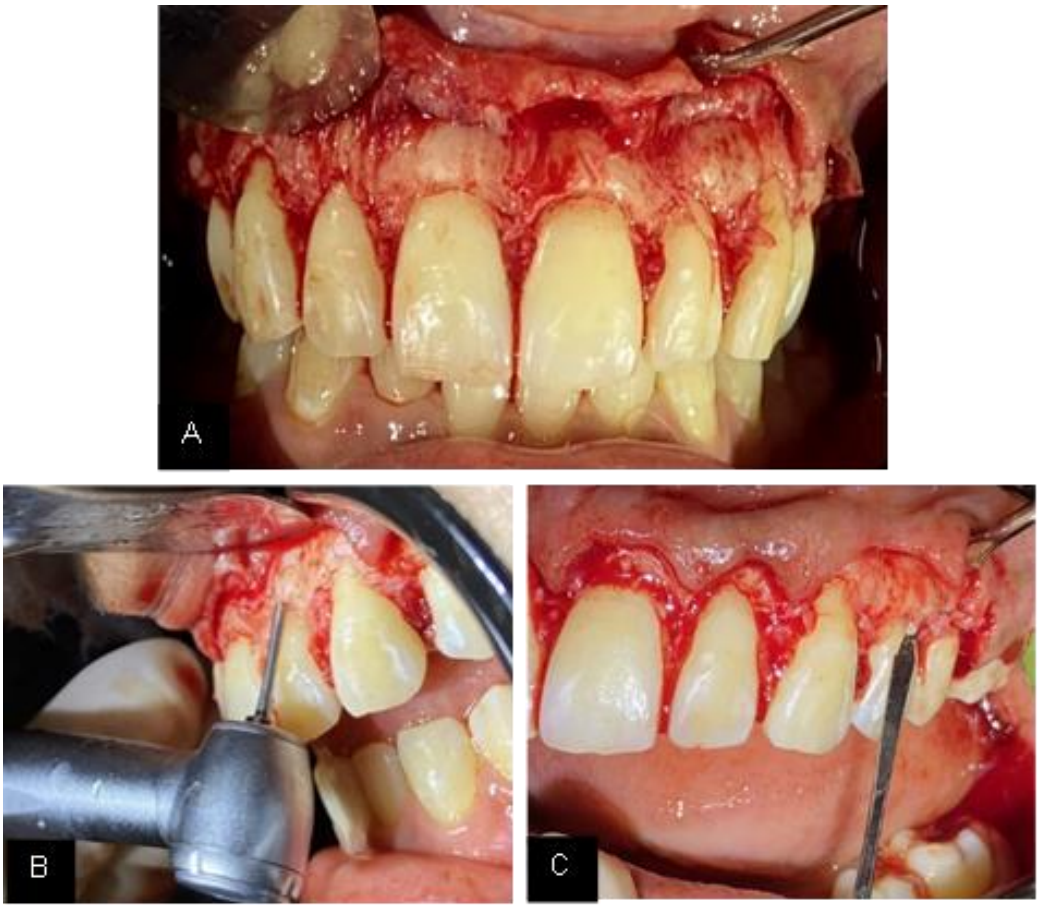

Figure 5: A. Total flap reflection, exposing the dental crown and bone tissue. B and C. Osteotomy, using a diamond bur and micro chisel.

At the end of the procedure, the patient was instructed on postoperative care, including rinsing with 0.12% Chlorhexidine Digluconate (Periogard®, Colgate Palmolive Ltda – Osasco – SP) every 12 hours, for 1 minute each time, for 7 days; recommendations for a diet of liquids and soft foods that are cold or at room temperature for the first few days; application of cold compresses in the first 24 hours; and prescription of Nimesulide 100mg every 12 hours for 3 days and Amoxicillin 500mg every 8 hours for 7 days, for postoperative control of pain, inflammation, and infection. Seven days after the surgery, the patient returned for suture removal and evaluation of healing, which was found to be satisfactory (Figures 8A to 8C). After 8 months of follow-up, complete gingival healing was observed (Figures 9A to 9H). Figures 10A and 10B show the initial and final clinical aspects of the reported case, highlighting the new position of the gingival zeniths.

3. Discussion

An aesthetic smile is composed of the relationship between the teeth, lips, and gums, and harmony among these three components is essential for a pleasing smile [23]. When there is more than 3 mm of gingival exposure while smiling, it is classified as a non-aesthetic condition called Gummy Smile (GS) [5]. The patient in this case

presented with the main complaint of short tooth size and gingival exposure when smiling, giving her a childish appearance, leading to the diagnosis of GS, which corroborates the studies mentioned above. Among the etiological factors that can lead to GS, Altered Passive Eruption (APE) can be cited, which presents a discrepancy in the distance between the Cemento-Enamel Junction (CEJ) and the bone crest. As a result, the patient clinically exhibits teeth with a disproportionate height to width. For this relationship to be considered harmonious, the anterior teeth should be longer than wide, with a pleasant proportion considered to be 75-80% between height and width [24]. In this clinical report, the patient had short, quadrangular clinical crowns, rounded and misaligned gingival margins, with excess volume mainly in the region of the upper incisors, and an intermediate to thick gingival phenotype, which reflects an indication of APE.

Figure 6: A. Suture and post-surgical appearance, frontal view. B and C. Right and left lateral views.

An accurate diagnosis and treatment plan depend on the use of some complementary resources, such as photographs and imaging exams [25, 26]. The patient in this clinical case had a diagnosis of GS resulting from APE, due to the presence of teeth with short clinical crowns. Therefore, to reach this diagnosis, the height of the clinical crown must be measured by the most apical distance of the marginal gingival concavity to the incisal edge or occlusal surface of the tooth, through periodontal probing [27]. For this case, the diagnostic resources used were general clinical examination, periodontal examination, and a photographic protocol. According to the studies by Batista Jr et al. [28], to achieve a better diagnosis and appropriate treatment plan for APE, the use of cone beam computed tomography can be employed, which allows for precise evaluation of the height and dimensional thickness of soft and hard tissues. Due to the patient's financial constraints, computed tomography was not performed to confirm the diagnosis of APE. However, the shape of the teeth, position of the upper lip, periodontal biotype, and periodontal probing can be taken as clinical parameters for this purpose.

The choice of treatment for correcting Gummy Smile (GS) depends on the etiology and degree of gingival exposure. Various therapeutic options can be utilized, including lip repositioning [29], botulinum toxin [30], orthognathic surgery [31], and gingivectomy and gingivoplasty, which may or may not be associated with osteotomy [32]. The most viable treatment option for cases of Altered Passive Eruption (APE) is periodontal surgery for Clinical Crown Lengthening (CCL) [33], aimed at restoring

the biological space and harmonizing the height and width relationships of the coronal portion of the dental element [34]. Thus, the treatment proposed for this case was aesthetic CCL surgery, using the surgical technique of gingivectomy/gingivoplasty and osteotomy/osteoplasty, due to the diagnosis of GS resulting from APE.

Figure 7: A and B. Immediate post-surgical laser application, frontal and lateral views. C and D. Application 24 hours after the procedure, frontal and lateral views. E. Application 7 days after the procedure.

The surgery was planned with the removal of a gingival collar/gingivectomy with an internal bevel, aiming to remove an excess strip of keratinized gum. Additionally, gingivoplasty was performed for anatomical remodeling. After the total flap reflection and exposure of the bone crest, the reduced distance from the CEJ to the bone crest was confirmed, corroborating the need to perform osteotomy to restore the 3 mm distance from the bone crest to the CEJ. This was followed by osteoplasty for the recontouring in thickness of the vestibular alveolar fossae. Thus, osteotomy aims to reestablish the distance from the marginal bone crest to the Gingival Attachment Complex (GAC), with the goal of achieving a new gingival margin [35]. Beyond performing the osteotomy, it is crucial to carry out osteoplasty, i.e., bone removal in thickness [5].

Following this, the suturing process was carried out, with suspension-type sutures being one of the most recommended in cases of CCL with osteotomy, as they provide good coronal adaptation of the gingival tissue [7]. According to Wennström and Zucchelli [36], suspension sutures are indicated for cases where the surgical procedure has a limited extent. However, other types of sutures show good clinical results, such as vertical mattress sutures [8, 13], which provide better adaptation and

maximum tissue approximation [37, 38], and are indicated for cases where it is necessary to reduce tension when moving a flap, in the case of a surgical wound with large proportions [39]. Due to the extent of the surgical procedure and the reflection of the flap beyond the mucogingival line, it was necessary to perform the modified vertical mattress suture, placing the suture point in the palatine region to better accommodate the papillae.

Figure 8: A. Clinical appearance 7 days post-surgery, frontal view. B and C. Right and left lateral views.

After the procedure, the patient was advised on postoperative care, including dietary instructions, medications, and the use of cold compresses. During the post-surgical follow-up phases at 24, 48, and 72 hours, the patient reported very mild pain only on the day of the surgery, necessitating only the use of anti-inflammatory medication to control the tissue repair process, similar to the studies by Oliveira and Venturim [40] and Lourenço et al. [41], who evaluated the postoperative sensitivity of patients undergoing periodontal plastic surgery, concluding that none of the patients reported painful symptoms.

According to Braga et al. [8] and Nascimento et al. [7], the use of antibiotics aims to prevent infections in cases where there is a long duration of surgery and bone tissue removal, corroborating with the case described, where antibiotic use was also chosen due to the aforementioned conditions. However, the literature does not uniformly agree on the indication for the use of antibiotics in CCL surgeries, with the systemic condition of the patient being the decisive factor for the rational use of this class of medications. Aiming to reduce postoperative complications, complementary therapies have been used to assist in the patient's post-surgical recovery phase, in terms of tissue repair processes [42].

In this report, low-power laser therapy (LPLT) was employed to promote immediate post-surgical tissue repair and during subsequent follow-up phases. According to studies by Maluf et al. [43] and Camelo [44], LPLT demonstrated analgesic effects, stimulating the release of endorphins, inhibiting nociceptive signals, and managing pain mediators. Additionally, it exhibited anti-inflammatory effects, reducing tissue edema and vascular hyperemia, and accelerating the healing of injured tissues. LPLT also promoted bone remodeling and repair, restored neural function after injuries, and modulated immune system cells to support the repair process. As a non-

pharmacological, non-invasive method, and given its biostimulation capabilities, LPLT is relevant for wound healing processes, providing anti-inflammatory and analgesic actions, promoting fibroblast cell proliferation, collagen formation, and angiogenesis [45].

Figure 9: A and B. Final frontal smile, in occlusion and disocclusion. C and D - Right and left lateral smile. E and F. Final clinical appearance in frontal view, with lip retraction, in occlusion and disocclusion. G and H. Right and left lateral views.

Aranha [46] notes that lasers in the red spectrum have a more superficial and reparative action, while infrared lasers have greater penetration power and can modulate inflammatory processes. The protocol for the patient involved the use of a low-power laser with a fixed power of 100mW and a spot size of 0.09 cm2, using red (660nm) and infrared (808nm) wavelengths, with an application time of 20 seconds per point for each light spectrum. Studies by Amorim [47] and Camelo [44] regarding the effects of laser on the healing of surgical wounds involved two groups: a test group that received laser applications and a control group that did not. Amorim [47] observed that wounds in the test group healed better over a period of 7 to 35 days compared to the control group. However, Camelo [44] found improved healing in the

test group only up to the 15th postoperative day. Therefore, it is suggested that laser can be used as an adjunct in postoperative gengivoplasty treatment, as clinical observations have shown better repair in the test group.

Figure 10: A. Initial clinical appearance, highlighting the position of the gingival zeniths. B. Final clinical appearance after 8 months of follow-up, showing the gingival zeniths slightly distalized relative to the long axis of the tooth, under frontal view.

According to Silva et al. [48], LPLT operates at the cellular level, causing bioenergetic, bioelectric, and biochemical changes, enhancing metabolism, cell proliferation and maturation, the amount of granulation tissue, and reducing inflammatory mediators, thereby inducing the healing process. Photobiostimulation by LPLT has been effectively used postoperatively for surgical wounds and in treating ulcerative lesions, resulting in faster tissue repair with a superior histological quality standard [49]. Seven days after the surgical procedure, the LPLT protocol was reapplied, showing satisfactory healing of the periodontal tissues, thereby elucidating the efficacy of LPLT as an adjunct therapy in post-surgical care. In the 8-month follow-up of the described clinical case, complete healing of the periodontal tissues was observed, along with the maintenance of the health and contours of the gingival margins. The results achieved in resolving the patient's complaint fully restored the aesthetics of her smile.

4. Conclusion

Obtaining an accurate diagnosis is crucial for developing an effective treatment plan and providing the patient with individualized care that yields satisfactory long-term results and meets their aesthetic and functional expectations. In the case under discussion, based on the diagnosis of Gummy Smile (GS) due to Altered Passive Eruption (APE), Clinical Crown Lengthening (CCL) in the aesthetic area was proposed. This approach enabled the restoration of smile harmony, reduction of gingival exposure when smiling, and an increase in tooth size, which significantly improved the patient's self-esteem and quality of life.

The application of Low-Power Laser (LPL) therapy in the postoperative period promoted satisfactory outcomes in terms of tissue healing. Therefore, it can be concluded that LPL was an effective adjunct therapy in the postoperative care phase of the surgery to correct GS. This case illustrates the importance of a tailored approach

that not only addresses the physical corrections required but also enhances the patient's psychological well-being by improving their smile aesthetics.

Funding: None.

Research Ethics Committee Approval: We affirm that the participant consented to the research by endorsing a clear consent document, and the investigation adhered to the ethical standards outlined in the Helsinki Declaration.

Acknowledgments: None.

Conflicts of Interest: None.

Supplementary Materials: None.

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