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Diode laser-assisted gingivectomy and gingivoplasty associated with osteotomy for altered passive eruption: A case report

Gengivectomia e gengivoplastia assistidas por laser de diodo associadas a osteotomia para erupção passiva alterada: Relato de caso

Gingivectomía y gingivoplastia asistida por láser de diodo asociada a osteotomía para erupción pasiva alterada: Reporte de un caso

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Abstract
Altered passive eruption (APE) is a clinical a developmental condition where the gingival margin fails to recede to the cemento-enamel junction, caused by excessive gum overlapping over the enamel limits, resulting in a short clinical crown. Minimally invasive surgical approaches using diode laser have been proposed for APE management due to their hemostatic properties and potential for improved postoperative comfort. The aim of this case report is to describe APE treated with diode laser-assisted gingivectomy and gingivoplasty combined with osteotomy. A 28-year-old systemically healthy female patient presented with esthetic complaint of excessive gingival display and short clinical crowns. Clinical and radiographic examinations revealed gingival enlargement associated with APE and vestibular exostoses, without signs of active periodontal disease. Initial therapy included oral hygiene conditioning and scaling and root planing. The treatment consisted of diode laser-assisted gingivectomy and gingivoplasty (980 nm, Therapy XT, DMC), combined with osteotomy and osteoplasty to reestablish biologic width and improve crown proportions. Postoperative photobiomodulation using low-level laser therapy was performed to support tissue healing. Clinical follow-up was performed weekly, with final evaluation at 90 days. The patient reported absence of postoperative pain, favorable healing pattern, and high satisfaction with the esthetic outcome. This case demonstrates that diode laser-assisted periodontal plastic surgery associated with osseous resective therapy may represent a conservative therapeutic approach for management of gingival excess associated with APE.
Keywords: Gingivectomy; Gingivoplasty; Oral surgery; Laser therapy.

Resumo
A erupção passiva alterada (EPA) é uma condição clínica e de desenvolvimento na qual a margem gengival não recua até a junção cemento-esmalte, causada pela sobreposição excessiva da gengiva sobre os limites do esmalte, resultando em uma coroa clínica curta. Abordagens cirúrgicas minimamente invasivas utilizando laser de diodo têm sido propostas para o tratamento da EPA devido às suas propriedades hemostáticas e ao potencial para maior conforto pós-operatório. O objetivo deste relato de caso é descrever a EPA tratada com gengivectomia e gengivoplastia assistidas por laser de diodo, combinadas com osteotomia. Uma paciente de 28 anos, sistemicamente saudável, apresentou queixa estética de exposição gengival excessiva e coroas clínicas curtas. Os exames clínicos e radiográficos revelaram

aumento gengival associado à EPA e exostoses vestibulares, sem sinais de doença periodontal ativa. A terapia inicial incluiu condicionamento da higiene oral e raspagem e alisamento radicular. O tratamento consistiu em gengivectomia e gengivoplastia assistidas por laser de diodo (980 nm, Therapy XT, DMC), combinadas com osteotomia e osteoplastia para restabelecer a largura biológica e melhorar as proporções da coroa. A fotobiomodulação pós-operatória com terapia a laser de baixa intensidade foi realizada para auxiliar na cicatrização tecidual. O acompanhamento clínico foi realizado semanalmente, com avaliação final em 90 dias. O paciente relatou ausência de dor pós-operatória, padrão de cicatrização favorável e alta satisfação com o resultado estético. Este caso demonstra que a cirurgia plástica periodontal assistida por laser de diodo, associada à terapia de ressecção óssea, pode representar uma abordagem terapêutica conservadora para o tratamento do excesso gengival associado à EPA.
Palavras-chave: Gengivectomia; Gengivoplastia; Cirurgia oral; Terapia a laser.

Resumen
La erupción pasiva alterada (EPA) es una afección clínica del desarrollo en la que el margen gingival no retrocede hasta la unión amelocementaria, debido a una superposición excesiva de la encía sobre los límites del esmalte, lo que resulta en una corona clínica corta. Se han propuesto abordajes quirúrgicos mínimamente invasivos con láser de diodo para el manejo de la EPA debido a sus propiedades hemostáticas y su potencial para mejorar la comodidad postoperatoria. El objetivo de este informe de caso es describir el tratamiento de EPA mediante gingivectomía asistida por láser de diodo y gingivoplastia combinada con osteotomía. Una paciente de 28 años, sistémicamente sana, presentó una queja estética de exposición gingival excesiva y coronas clínicas cortas. Los exámenes clínicos y radiográficos revelaron agrandamiento gingival asociado con EPA y exostosis vestibular, sin signos de enfermedad periodontal activa. El tratamiento inicial incluyó acondicionamiento de higiene bucal, raspado y alisado radicular. El tratamiento consistió en gingivectomía y gingivoplastia asistidas con láser de diodo (980 nm, Therapy XT, DMC), combinadas con osteotomía y osteoplastia para restablecer el ancho biológico y mejorar las proporciones de la corona. Se realizó fotobiomodulación postoperatoria con láser de baja intensidad para favorecer la cicatrización tisular. Se realizó seguimiento clínico semanal, con evaluación final a los 90 días. El paciente refirió ausencia de dolor postoperatorio, un patrón de cicatrización favorable y una alta satisfacción con el resultado estético. Este caso demuestra que la cirugía plástica periodontal asistida por láser de diodo, asociada a la terapia de resección ósea, puede representar un enfoque terapéutico conservador para el manejo del exceso gingival asociado con EPA.
Palabras clave: Gingivectomía; Gingivoplastia; Cirugía oral; Terapia láser.

1. Introduction

The smile esthetics are directly connected with the harmony between face and oral cavity components, such as lips, teeth and gums. When there is any alteration in the esthetic clinical parameters used, this may negatively affect smile esthetics, resulting in patient dissatisfaction (Coachman et al., 2017; Kolte et al., 2023). In the literature, one of the most prevalent esthetic complications in dentistry is excessive gingival exposure (EGE), also known as gummy smile (GS) (Jardim et al., 2019; Borham et al., 2024).

GS is characterized by gingival exposure above 4 mm during smiling and can sometimes be associated with the presence of vestibular exostoses that may aggravate soft tissue exposure between the lower border of the upper lip and the gingival margin of the maxillary central incisors (Dym & Pierre, 2020; Diaspro et al., 2018). According to Ashry et al., 2023 and Andijani & Tatakis, 2019, GS prevalence is approximately between 10.5 and 29% in young adults aged 20 to 30 years, with a slight predilection for females, being approximately 7% in males and 14% in females. According to Tatakis et al., 2024, the presence of EGE and GS was significantly higher ($p \leq 0.017$) among Black or mixed individuals, demonstrating a possible epidemiological predilection.

EGE etiology is multifactorial. Skeletal factors include excessive vertical maxillary growth and/or maxillary protrusion; muscular factors include labial hyperactivity and short upper lip; dental factors include dentoalveolar extrusion; and gingival factors include plaque-induced gingival enlargement, drug-induced gingival enlargement, and altered passive eruption (APE) (Fonseca et al., 2020; Mele et al., 2018; Gibson & Tatakis, 2017). To determine the correct diagnosis, measurements should be obtained using clinical, digital, and tomographic data, including clinical crown length (from the gingival margin to the incisal edge), anatomical crown length (from the cementoenamel junction to the incisal edge), clinical attachment level, width of keratinized gingiva, vertical smile limits, frenulum insertion, labial mobility, and facial third proportions (Fonseca et al., 2020; Mele et al., 2018; Gibson & Tatakis, 2017).

Regarding GS treatment, each etiology requires specific therapeutic approaches; therefore, precise diagnosis is essential. Periodontal treatment is indicated for gingival etiologies such as APE. In cases of short lip, surgical approaches such as lip repositioning or non-surgical approaches such as botulinum toxin injection may be considered (Marzadori et al., 2018). In cases of APE, treatment commonly involves gingivectomy and gingivoplasty of excessive soft tissue, which may be associated with osteotomy to reestablish supracrestal tissue attachment. APE is characterized by an increased width of keratinized gingival tissue and occurs during the passive eruption phase, when gingival tissues should migrate apically for gradual exposure of the clinical crown. However, due to developmental or genetic factors, this apical migration may be altered, resulting in excessive gingival display during smiling (Aroni et al., 2019).

Classically, gingivectomy is defined as the surgical removal of excess gingival tissue, while gingivoplasty refers to surgical reshaping of gingival contours, commonly performed using conventional scalpel blades or gingivotomes. However, these instruments may provide limited intraoperative hemostasis, potentially contributing to postoperative edema and discomfort (Bastidas, 2021). With the development of high-power lasers, such as diode lasers, their use in dentistry has increased. These devices allow soft tissue incision associated with coagulation and hemostasis, which may contribute to reduced intraoperative bleeding and postoperative discomfort. However, detailed clinical reports describing combined soft and hard tissue management using diode lasers and structured follow-up remain limited in the literature. Therefore, the aim of this case report is to describe APE treated with diode laser-assisted gingivectomy and gingivoplasty combined with osteotomy.

2. Methodology

A descriptive, qualitative study (Pereira et al., 2018; Risemberg et al., 2026) was conducted, specifically as a clinical case report (Toassi & Petry, 2021), complied with ethical criteria for studies conducted with humans, with the patient signing the written informed consent term allowing the disclosure of information and images of the case for scientific purposes, and followed the ethical guidelines of the National Health Council Resolution No. 466/2012, ensuring the confidentiality and privacy of the patient involved and followed Care Guideline and Checklist, also the patient signed the written inform consent form publication. A 28-year-old systemically healthy female patient, non-smoker, with no history of systemic diseases or allergies, was referred to a dental school clinic in northern Brazil with the main complaints of “small teeth”, esthetic dissatisfaction during smiling, and EGE.

During anamnesis and intraoral exam, approximately 4 mm of keratinized gingival exposure was observed during smiling. Intraoral examination revealed thick gingival phenotype, short clinical crowns, presence of buccal vestibular exostoses, and absence of bleeding on probing. No suppuration, dental plaque or calculus accumulation, gingival recession, tooth mobility, or active carious lesions were observed (Figure 1). Periodontal probing depth (PD) was measured using a North Carolina periodontal probe on the buccal surfaces of teeth 15 to 25. Measurements were recorded before and after local anesthesia, as shown in Table 1.

Figure 1 - Initial photo demonstrating excessive gingival display during smiling.

Source: Authors' archive (2025).

Table 1 - Probing depth measurements before and after anesthesia.

Parameters	Pre-anesthesia	Post-anesthesia
Tooth 15	2mm	3mm
Tooth 14	2mm	3mm
Tooth 13	3mm	5mm
Tooth 12	2mm	3mm
Tooth 11	2mm	4mm
Tooth 21	2mm	3mm
Tooth 22	2mm	3mm
Tooth 23	4mm	4mm
Tooth 24	2mm	3mm
Tooth 25	2mm	3mm

Source: Authors' archive (2025).

Extraoral exam, the patient presented facial symmetry and absence of lip hypermobility. The patient also reported noticing gingival enlargement after previous orthodontic treatment. Radiographic examination showed absence of interproximal bone loss, normal periodontal ligament space, and intact lamina dura. Based on clinical findings and an average post-anesthesia probing depth of 3.4 mm, the working diagnosis was gingival enlargement associated with APE and previous orthodontic movement. The proposed treatment plan included oral hygiene optimization followed by diode laser-assisted gingivectomy and gingivoplasty associated with osteotomy to reestablish supracrestal tissue attachment and osteoplasty for buccal exostosis reduction in teeth 15 to 25.

3. Results

Initial therapy consisted of oral hygiene conditioning through scaling and root planing using Gracey curettes, irrigation with 0.12% chlorhexidine solution, and oral hygiene instructions using the modified Bass technique. After 30 days of adequate plaque control was achieved. Then, preoperative medical evaluation was performed and medical clearance obtained. Local anesthesia was administered using 4% articaine with epinephrine via infraorbital nerve block combined with supracrestal infiltrative anesthesia from teeth 15 to 25.

Preoperative bleeding points were marked to guide gingival tissue removal (Figure 2). Intrasulcular and external bevel incisions at approximately 90° were performed with diode laser at a power of 1.5W, pulsed mode and cylindrical tip fiber, for gingival collar removal (Figure 3). Laser-assisted soft tissue removal resulted in simultaneous coagulation and tissue cauterization; the incised tissue was removed using Gracey curettes (Figure 4).

Figure 2 - Preoperative bleeding demarcations.

Source: Authors' archive (2025).

Figure 3 - Diode laser incisions to remove EGE.

Source: Authors' archive (2025).

Figure 4 - Cauterized tissue being removed by Gracey curettes.

Source: Authors' archive (2025).

After completion of gingivectomy and gingivoplasty in the first quadrant, differences in clinical attachment level between hemi-arches became evident, confirming the presence of APE (Figure 5). Later, gingival margin refinement and zenith contour adjustment were performed using microsurgical scissors (Figure 6).

Figure 5 - Clinical attachment level heights difference.

Source: Authors' archive (2025).

Figure 6 - Gingival margin and zenith refinement.

Source: Authors' archive (2025).

An intrasulcular incision was then performed using a 15C blade, followed by full-thickness flap elevation using a Molt periosteal elevator (Figure 7). Following flap elevation, osteotomy was performed to reestablish supracrestal tissue attachment using a carbide surgical bur. Crestal bone recontouring was refined using a microchisel, maintaining approximately 3 mm distance between the bone crest and the cementoenamel junction.

Figure 7 - Total flap management.

Source: Authors' archive (2025).

Osteoplasty was performed using a spherical diamond bur to reduce buccal exostosis volume and improve alveolar bone architecture. Later, the flap repositioning was performed and stabilized using vertical mattress sutures with nylon thread (Figure 8). Postoperative care included standard instructions and prescription of analgesics as needed. Adjunctive photobiomodulation therapy was performed using low-level laser therapy (660 nm GaAlAs). Three postoperative sessions were performed at weekly intervals, using continuous red mode, delivering 3 J/cm² for 30 seconds per point, with a total energy delivery of 15 J/cm² per session.

Follow-up was conducted weekly, with final evaluation at 90 days. The patient reported absence of postoperative pain and did not require analgesic medication. No postoperative edema or increased morbidity was observed. Favorable tissue healing and stable gingival contour were observed at the 90-day follow-up (Figure 9).

Figure 8 - Immediate postoperative.

Source: Authors' archive (2025).

Figure 9 - Postoperative 90-day follow-up.

Source: Authors' archive (2025).

4. Discussion

Traditionally, soft tissue excision procedures are performed using conventional methods such as scalpel blades or electrosurgery due to their accessibility, low cost, and precise cutting ability, which facilitates gingival margin coaptation and supports wound healing (Capodiferro & Kazakova, 2022; Verma et al., 2012; Tatakis & Silva, 2023). However, these methods may present limitations, including limited intraoperative hemostasis, potential increase in surgical time due to bleeding control, reduced surgical field visibility, and possible increase in postoperative discomfort and edema (De Micheli et al., 2011; Fonseca et al., 2025). In the present case, it was observed that although diode laser allowed adequate soft tissue removal and intraoperative hemostasis, final gingival margin refinement required the use of microsurgical scissors, suggesting that combined instrumentation may be beneficial in specific clinical scenarios.

Previous studies have reported potential advantages of HPL, especially diode lasers, including improved hemostasis, shorter surgical time, adequate coagulation, and potential reduction in postoperative discomfort and edema (Verma et al., 2012; Tatakis & Silva, 2023). These devices have been described for several soft tissue procedures, including esthetic gingival recontouring, gingivectomy, gingivoplasty, exposure of impacted teeth, removal of inflamed or hypertrophic soft tissue lesions, frenectomies, and adjunctive photobiomodulation therapy (Amaral et al., 2015; Çayan et al., 2019). Additionally, a potential antimicrobial effect associated with local thermal action has been suggested (Çayan et al., 2019).

Supporting the intraoperative findings of the present case, previous studies reported reduced intraoperative and postoperative bleeding when diode lasers were compared with conventional scalpel incisions (Çayan et al., 2019). However, available literature remains heterogeneous, particularly regarding wound healing outcomes. Regarding postoperative pain, some studies reported no statistically significant differences between diode laser and scalpel techniques, suggesting that postoperative discomfort may be multifactorial (Çayan et al., 2019). In the present case, the patient reported absence of postoperative pain. However, it is important to consider that adjunctive photobiomodulation therapy using low-level laser therapy (LLLT) was performed, which may have contributed to postoperative comfort. Randomized clinical trials are necessary to better determine the individual and combined effects of HPL and LLLT on postoperative pain modulation.

Silva et al., 2022, in a split-mouth clinical study involving six female patients with gummy smile associated with APE, compared diode laser (2W and continuous mode) with conventional scalpel gingivectomy. The authors observed no statistically significant differences in postoperative pain between groups. However, the laser group demonstrated superior intraoperative bleeding control, consistent with the findings of the present case. Conversely, conventional scalpel techniques showed potentially more favorable tissue repair patterns, reinforcing that technique selection should be individualized.

Reduction in postoperative pain associated with HPL use has been attributed to possible nerve ending sealing during tissue vaporization (Silva et al., 2022). However, in the present case, postoperative comfort may also be related to adjunctive photobiomodulation therapy. Similar findings regarding reduced procedure time and intraoperative bleeding using diode lasers were reported by Fonseca et al., 2025. However, the authors also observed larger postoperative wound areas in laser-treated sites, highlighting the importance of appropriate energy parameter selection and surgical technique. Diode lasers may contribute to reduced surgical trauma and improved intraoperative visibility due to their hemostatic effect (Kaur et al., 2018). Nevertheless, outcomes may vary depending on operator experience, laser parameters, and tissue characteristics.

HPL include several types, such as carbon dioxide, Er:YAG, Nd:YAG, and diode lasers. Diode lasers are solid-state semiconductor devices typically composed of aluminum, gallium, and arsenide (AlGaAs) or indium gallium arsenide (InGaAs), producing wavelengths typically ranging from 810 nm to 980 nm. These wavelengths are preferentially absorbed by chromophores such as hemoglobin and melanin, which explains their clinical effectiveness in soft tissue procedures. Due to low absorption by hydroxyapatite, diode lasers have minimal interaction with dental hard tissues, although dentin hypersensitivity may occur in some cases. This effect was not observed in the present case (Maboudi et al., 2023).

5. Conclusion

Diode laser-assisted periodontal surgery demonstrated favorable intraoperative hemostasis and satisfactory postoperative clinical outcomes, including absence of patient-reported postoperative pain and favorable tissue healing. The use of this therapeutic approach may represent a minimally invasive alternative for selected cases of gingival enlargement associated with altered passive eruption when supported by appropriate diagnosis, surgical planning, and operator experience. Although potential advantages such as improved surgical field visibility and patient-reported postoperative comfort were observed in this case, these findings should be interpreted with caution, as adjunctive photobiomodulation therapy, individual biological response, and surgical technique may have influenced clinical outcomes.

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Author’s Contributions

R.R.S.F.: contributed to Conceptualization, Project Administration and Supervision. C.E.M.H. and L.A.P.A.: contributed to Data Curation. M.A.N.R. and A.C.M.H.: contributed to Investigation. C.E.M.H., L.A.P.A., M.A.N.R. and A.C.M.H.: contributed to Formal Analysis. C.E.M.H., L.A.P.A., M.A.N.R. and A.C.M.H.: contributed to Methodology. R.R.S.F.: contributed to Writing-Original Draft Preparation. R.R.S.F.: contributed to Review and Editing of the manuscript.

Conflicts of interest

The authors declare no conflicts of interests.

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