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Gingival graft and use of high-power laser in the treatment of proliferative verrucous leukoplakia: Case report with 20-month follow-up

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RELATO DE CASO

RESUMO

Introdução: A leucoplasia verrucosa proliferativa (LVP) é uma forma distinta e rara de leucoplasia oral multifocal caracterizada por um curso clínico progressivo e persistente, associado a uma alta taxa de transformação maligna. **Objetivo:** O objetivo deste trabalho é relatar um caso clínico de LVP tratado com o uso de enxerto gengival livre (EGL) e laser de diodo de alta potência, com acompanhamento de 1 ano e 8 meses. **Relato de caso:** Paciente do sexo feminino, 45 anos, leucoderma, sem histórico de tabagismo e etilismo, compareceu a clínica de periodontia encaminhada pelo serviço de histopatologia, com presença de uma lesão extensa de LVP, de dimensões 9 cm × 0,6 cm, localizada em gengiva, mucosa alveolar e lábio inferior. O diagnóstico histopatológico prévio revelou displasia epitelial moderada. Uma semana após a avaliação inicial realizou-se a confecção de um retalho em espessura parcial, para a remoção completa da lesão, em seguida, fixou-se ao leito cirúrgico um enxerto gengival livre (EGL). O tecido removido foi enviado para análise microscópica, revelando displasia epitelial severa. Após 30 dias, observou-se que o EGL foi totalmente integrado ao leito receptor, no entanto, foi observada a presença de 4 placas brancas com características morfológicas semelhantes à lesão inicial, mas limitadas ao tecido ceratinizado e sem recorrência em mucosa alveolar e labial. Realizou-se uma biópsia pela exérese da lesão presente na gengiva do elemento 31 e 33, com resultado de displasia epitelial leve. A fotoablação das lesões remanescentes foram realizadas após 7 dias utilizando o laser de diodo de alta potência (808 ± 10 nm) para tratamento coadjuvante das lesões remanescentes. **Conclusão:** Dessa forma, o uso de EGL se destaca como uma abordagem promissora para expandir a faixa de mucosa ceratinizada e preservar os tecidos de suporte, favorecendo futuras intervenções cirúrgicas. Além disso, o laser de diodo de alta potência mostrou-se eficaz no controle das lesões remanescentes, uma vez que não houve recorrência nas áreas tratadas após 20 meses de acompanhamento.

Palavras-chave: Leucoplasia, Enxerto Gengival, Terapia a Laser, Periodontia.

Gingival graft and use of high-power laser in the treatment of proliferative verrucous leukoplakia: Case report with 20-month follow-up

ABSTRACT

Introduction: Proliferative verrucous leukoplakia (PVL) is a distinct and rare form of multifocal oral leukoplakia, characterized by a progressive and persistent clinical course and associated with a high rate of malignant transformation. Objective: This study aims to report a clinical case of PVL treated using a free gingival graft (FGG) and high-power diode laser, with a follow-up period of 1 year and 8 months. Case report: A 45-year-old leucoderma female patient, with no history of smoking or alcohol consumption, presented to the periodontics clinic referred by the histopathology service, with an extensive PVL lesion measuring 9 cm × 0.6 cm, located on the gingiva, alveolar mucosa, and lower lip. A previous histopathological diagnosis revealed moderate epithelial dysplasia. One week after the initial evaluation, a partial-thickness flap was performed to completely remove the lesion, followed by the placement of a free gingival graft (FGG) onto the surgical bed. The excised tissue was sent for microscopic analysis, which revealed severe epithelial dysplasia. After 30 days, the FGG was found to be fully integrated into the recipient bed. However, four white plaques with morphological features similar to the initial lesion were observed, although they were limited to keratinized tissue, with no recurrence in the alveolar or labial mucosa. An excisional biopsy was performed on the lesions in the gingiva of teeth 31 and 33, revealing mild epithelial dysplasia. Photocoagulation of the remaining lesions was performed after 7 days using a high-power diode laser (808 ± 10 nm) as an adjunct treatment. Conclusion: The use of FGG proved to be a promising approach for expanding the band of keratinized mucosa and preserving the supporting tissues, facilitating future surgical interventions. Furthermore, the high-power diode laser was effective in controlling the remaining lesions, as no recurrence was observed in the treated areas after 20 months of follow-up.

Keywords: Leukoplakia, Gingival graft, Laser therapy, Periodontics.

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INTRODUCTION

The oral cavity is a direct reflection of an individual's overall health, making it essential for dental surgeons to pay close attention to potentially malignant lesions of the oral mucosa [1]. Early diagnosis is therefore critical for achieving the best prognosis for the patient. In this context, the screening of oral potentially malignant disorders (OPMDs) is fundamental [2]. OPMDs are a group of lesions affecting the oral mucosa with an increased risk of malignant transformation, and biopsy is mandatory for confirming the diagnosis [3,4].

Lorini et al. [5] highlight leukoplakia, erythroplakia, erythroleukoplakia, oral lichen planus, oral submucous fibrosis, and oral epithelial dysplasia as the main OPMDs. The malignant transformation potential of these disorders is related to the progression of epithelial changes in each case, as well as connective tissue atypia, without necessarily following a chronological or linear evolution. Thus, epithelial dysplasia may either regress to normal or progress to severe dysplasia [2]. Factors such as lesion location, clinical appearance, and size are indicative of the risk of progression. In addition, patient-related aspects—such as habits, genetic characteristics, and age—also contribute to the malignant potential and must be considered during the clinical examination [6].

Leukoplakia, in particular, is considered the main OPMD and is subclassified into homogeneous and non-homogeneous types, with the latter being associated with a higher risk of malignant transformation [7,8]. Proliferative verrucous leukoplakia (PVL) is a distinct and rare form of multifocal oral leukoplakia characterized by a progressive and persistent clinical course and a high rate of malignant transformation into oral squamous cell carcinoma [9,10]. PVL is most prevalent in the gingiva, followed by the alveolar and buccal mucosa, and tends to spread to other areas of the oral cavity due to its continuous growth over a short period of time. The resulting lesions are exophytic and verrucous, with a higher prevalence in females than in males and no association with racial factors [4,11–13]. However, its etiology remains poorly defined [14,15].

The treatment of PVL is broad and diverse, often involving more than one

technique, such as conventional surgery, electrocautery, cryosurgery, and high-power laser surgery, or conservative approaches including the use of retinoids, photodynamic therapy, and antioxidants [15–17]. Surgical treatment of PVL in the attached gingiva with a thin phenotype is particularly challenging due to the risk of root and bone exposure during lesion excision. Moreover, surgery can reduce the width of keratinized mucosa, potentially compromising future procedures, especially given the high recurrence rates associated with PVL [9,18,19].

Therefore, the combination of a free gingival graft (FGG), harvested from a lesion-free area of the palate, may represent a beneficial approach for managing PVL. This procedure aims to modify the affected tissue by increasing the thickness and width of keratinized mucosa in the treated region, an important factor in facilitating future surgical interventions in cases of recurrence. Furthermore, high-power lasers, such as diode lasers, have proven effective in the safe removal of extensive oral leukoplakia lesions, promoting healing without adverse effects on adjacent tissues.

In this regard, the objective of this study is to report a clinical case of PVL located in the anterior mandibular region, treated through complete lesion excision using a partial-thickness flap, followed by the placement of a free gingival graft at the surgical site, and photocoagulation of the recurrent lesion areas with a high-power diode laser.

CASE REPORT

A 45-year-old leucoderma female patient was referred to the periodontics clinic by the histopathology service with a clinical diagnosis of proliferative verrucous leukoplakia (PVL). During anamnesis, the patient reported rapid lesion growth and absence of local symptoms, as well as a history of vitiligo, but denied any history of smoking or alcohol consumption. Clinical examination revealed multiple whitish plaques with a rough surface, poorly defined contours, and irregular borders, measuring approximately 9 cm × 0.6 cm, located on the gingival tissue, alveolar mucosa, and lower lip (Figure 1).

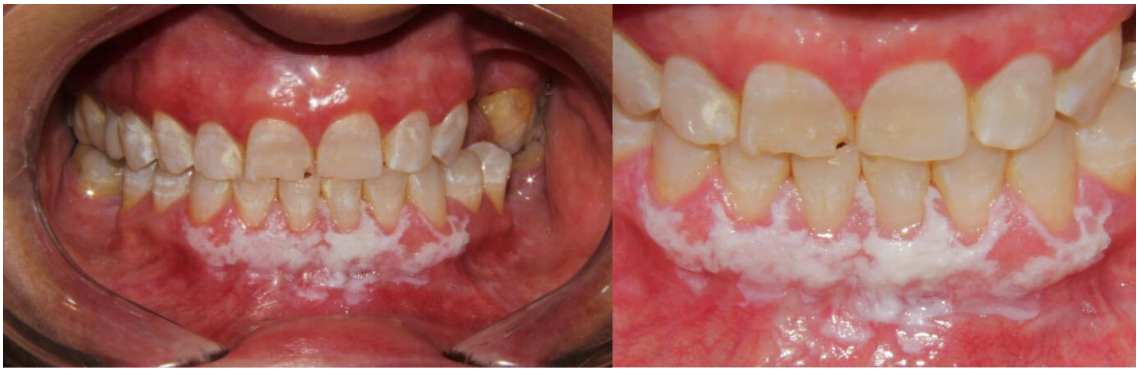

Figure 1: Initial clinical aspect of the lesion, showing a white plaque with a rough surface on the gingiva, alveolar mucosa, and lower lip.

Histopathological analysis from an incisional biopsy revealed epithelial hyperplasia in the basal layer, hyperchromatism, and prominent nucleoli extending to the spinous layer, consistent with moderate epithelial dysplasia. During follow-up, additional biopsies revealed varying degrees of dysplasia, as shown in Figure 2.

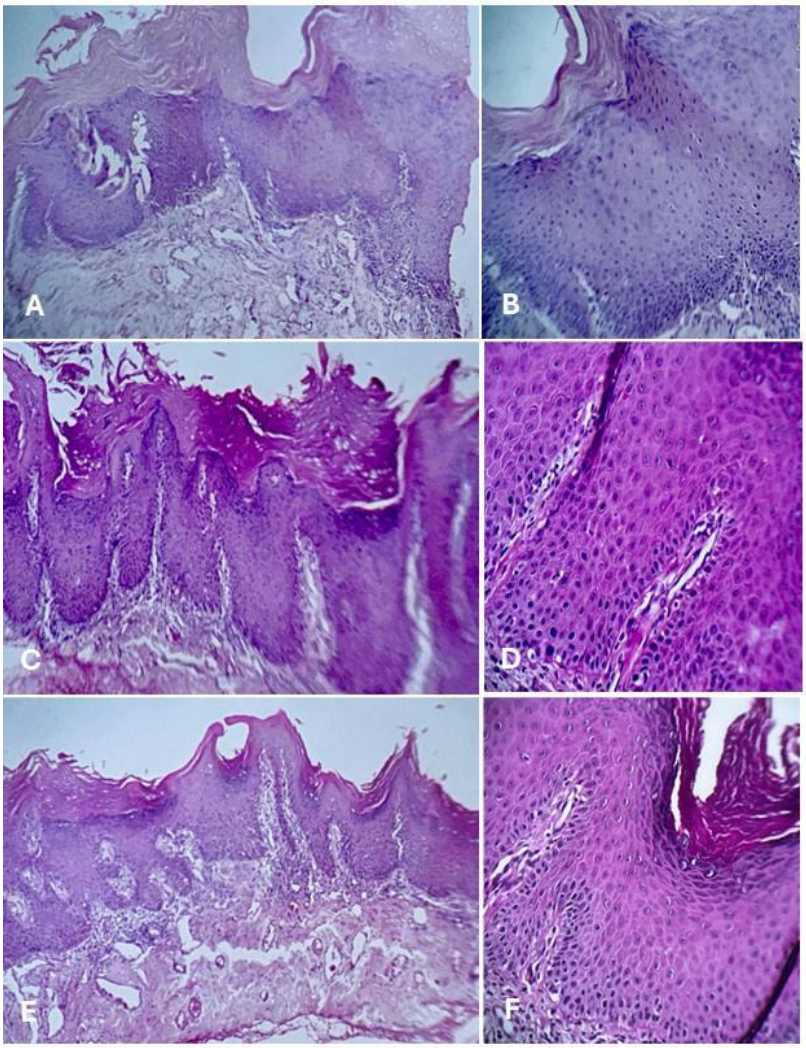

Figure 2: (A) Photomicrograph showing moderate epithelial dysplasia (H&E – 100x); (B) Higher magnification photomicrograph characterizing moderate epithelial dysplasia (H&E – 200x); (C) Photomicrograph showing severe epithelial dysplasia (H&E – 100x); (D) Higher magnification photomicrograph characterizing severe epithelial dysplasia (H&E – 200x); (E) Photomicrograph showing mild epithelial dysplasia (H&E – 100x); (F) Higher magnification photomicrograph characterizing mild epithelial dysplasia (H&E – 200x).

Given the lesion's extent and involvement of critical areas such as attached gingiva, free gingiva, and interdental papillae, as well as the risk of root exposure due to the thin gingival phenotype, a partial-thickness flap was planned to fully remove the lesion. A free gingival graft (FGG) was then indicated to be fixed to the surgical bed, aiming to preserve the band of keratinized mucosa and increase gingival thickness. This

technique was chosen to provide a thicker tissue barrier, which is important in cases of recurrence and allows for subsequent surgical intervention if necessary.

Under local infiltrative anesthesia with 4% articaine and 1:200,000 epinephrine (DFL®, Brazil), the flap encompassing the lesion and free margins was elevated up to the labial mucosa and excised at its base using Goldman-Fox scissors (Golgran®, Brazil). The removed tissue was preserved in 10% formalin and sent for histopathological examination. The flap margins were then inverted and sutured to the periosteum at the vestibular depth using 5-0 polyglycolic acid suture (Bioline®, Brazil) (Figure 3).

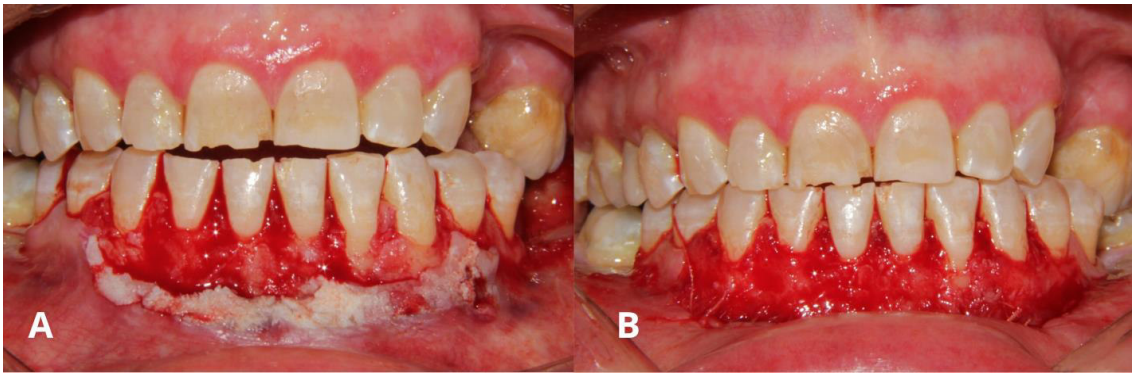

Figure 3: (A) Lesion excision with partial-thickness flap creation; (B) Surgical wound covered by periosteum and subepithelial connective tissue after flap removal and suture at the vestibular base.

After lesion excision, the required dimensions for the FGG were measured using a template based on the recipient site to serve as a guide. The graft was harvested from the anterior palate, between the distal of the first molar and the mesial of the canine. The donor site was sutured with 5-0 nylon using a double-X technique. Excess adipose tissue was carefully removed with Goldman-Fox scissors, and the graft was positioned in the recipient site. The FGG was secured using simple sutures at the base of the de-epithelialized papillae and vertical mattress sutures anchored in the periosteum and teeth using 5-0 polypropylene and polyglycolic acid sutures (Bioline®, Brazil) (Figure 4).

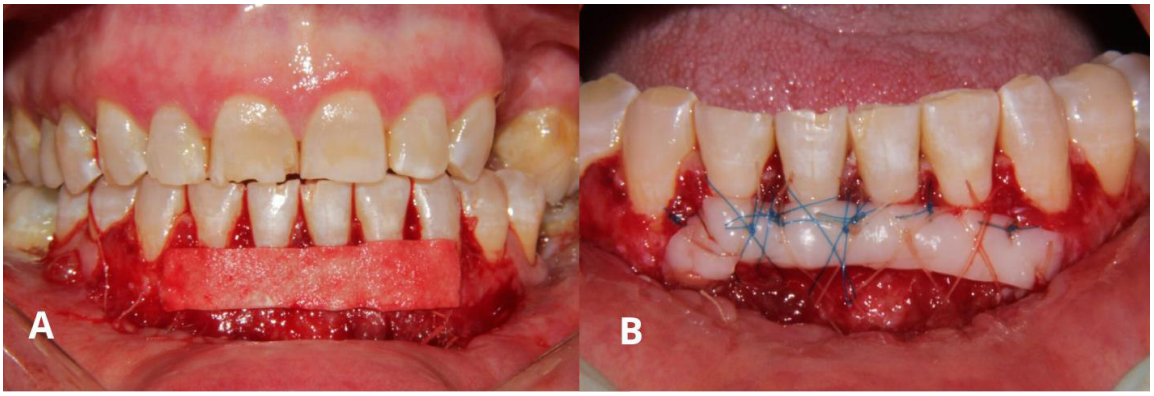

Figure 4: (A) Template used to determine graft dimensions; (B) FGG fixed in the recipient bed.

The patient was instructed to avoid brushing the surgical site for 14 days, and a soft-bristle toothbrush (Curaprox CS 5460 Ultra Soft) was recommended for the remaining teeth. Additional postoperative care instructions were provided. The postoperative prescriptions included: nimesulide (200 mg, once daily for 4 days), dipyrone (500 mg every 6 hours as needed), and 0.12% chlorhexidine mouthwash (15 ml twice daily for 14 days). Sutures were removed after 14 days, and monthly follow-up visits were scheduled to monitor recurrence or new lesion development.

Histopathological evaluation of the excised tissue revealed severe epithelial dysplasia, characterized by epithelial hyperchromatism, cellular and nuclear pleomorphism, and prominent nucleoli extending to the superficial layer. At the one-month postoperative evaluation, the FGG was found to be fully integrated into the surgical bed, increasing the band of keratinized mucosa and gingival thickness. However, four white plaques were observed, with morphological characteristics similar to the initial lesion, restricted to keratinized tissue and without recurrence in the alveolar or labial mucosa. As a therapeutic measure, excisional biopsy of the lesion in the gingiva of teeth 31 and 33 was performed with free margins, extending to the root surface. A partial-thickness flap was prepared, laterally repositioned, and sutured with 5-0 polypropylene suture (Bioline®, Brazil) to cover the root exposure (Figure 5).

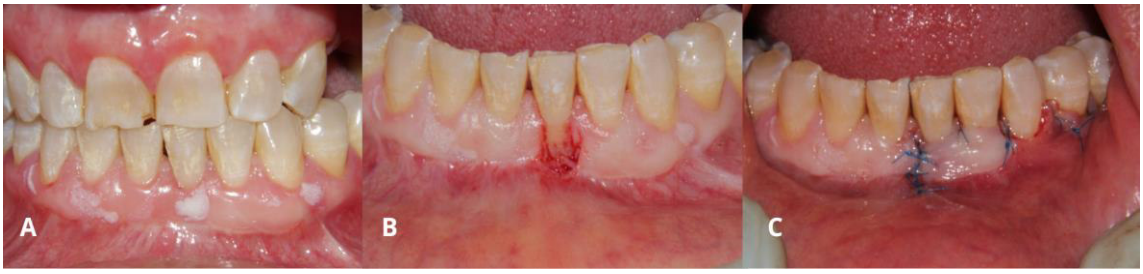

Figure 5: (A) Clinical aspect one month after surgery showing four white plaques on the gingiva of teeth 33, 31, 42, and 43. (B) Excision of the lesion in the gingiva of tooth 31. (C) Immediate postoperative result after laterally repositioned flap to cover root exposure.

Microscopic analysis of the lesions in the gingiva of teeth 33 and 31 revealed hyperkeratosis with areas of mild epithelial dysplasia. On postoperative day 7, sutures were removed. Under local infiltration anesthesia with 2% mepivacaine and 1:100,000 epinephrine (DFL®, Brazil), photocoagulation of the remaining lesions was performed using a high-power diode laser (TW SURGICAL, MM Optics, Brazil). The device was set to continuous mode, wavelength of 808 ± 10 nm, and output power of 1.5 W. The light was delivered using a 400 µm optical fiber, pre-activated on carbon paper, and positioned at a 45° angle, sweeping over the tissue until complete epithelial removal (Figure 6).

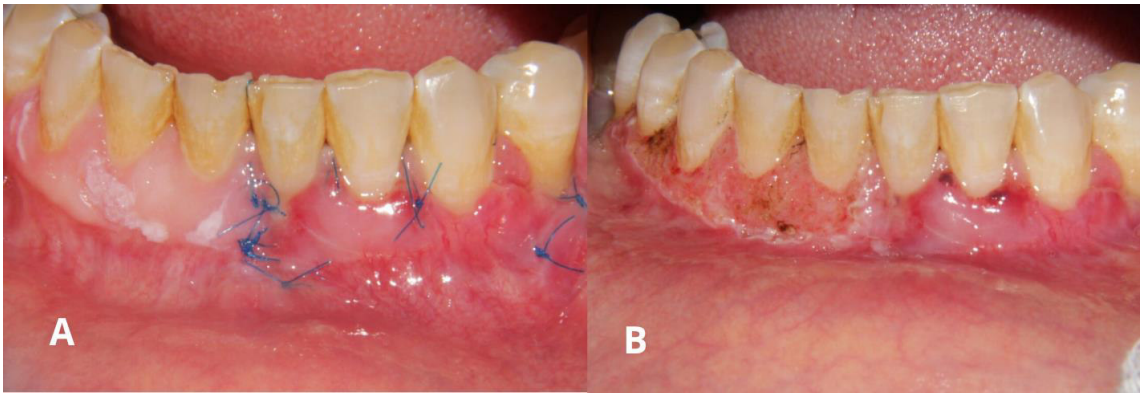

Figure 6: (A) Clinical aspect 7 days after surgery; (B) Immediate result after high-power diode laser photocoagulation of residual lesions.

The patient was monitored quarterly. At the 8-month follow-up, a discrete white plaque was observed in the keratinized mucosa and interproximal papilla between teeth

33 and 34, measuring 4 mm in height and 5 mm in width. No recurrence of leukoplakia was noted on the side treated with the diode laser. A second photocoagulation session was performed following the same protocol. Due to local ischemia from the vasoconstrictor, lesion visibility was compromised. Therefore, a 0.01% methylene blue solution was used to stain the altered tissue and guide laser application, which also encompassed clinically normal-appearing gingival tissue (Figure 7).

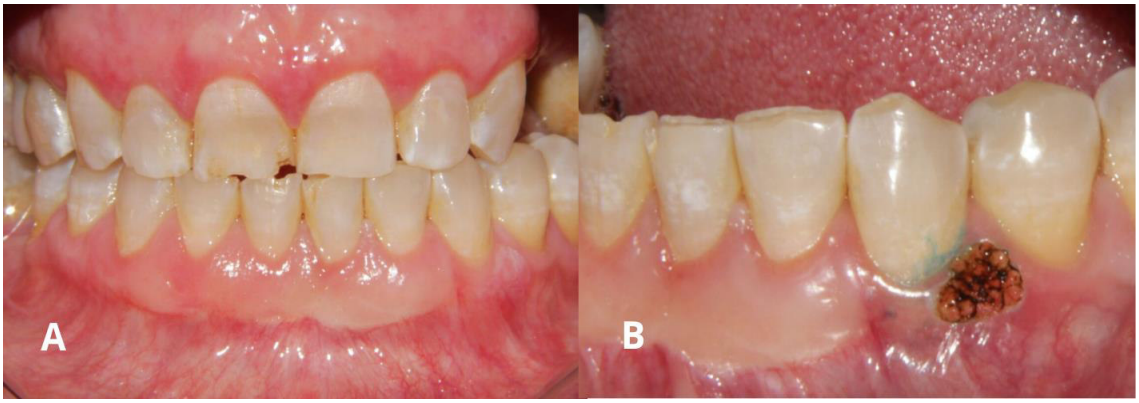

Figure 7: (A) Lesion in the keratinized mucosa and interproximal papilla between teeth 33 and 34; (B) Area after photocoagulation using high-power diode laser.

The patient continued quarterly follow-ups for keratosis screening and oral health maintenance. At each visit, ultrasonic scaling and restorations of incisal edges of teeth 11, 21, 32, 31, 41, and 42 were performed. At the 12-month evaluation following the last procedure (20 months after the initial treatment), no recurrence of leukoplakic lesions was observed in the treated region or elsewhere in the oral cavity. Clinically healthy gingival tissues were present, and the area treated with FGG maintained a wide band of keratinized mucosa (3.2 cm × 0.9 cm) without signs of gingival recession.

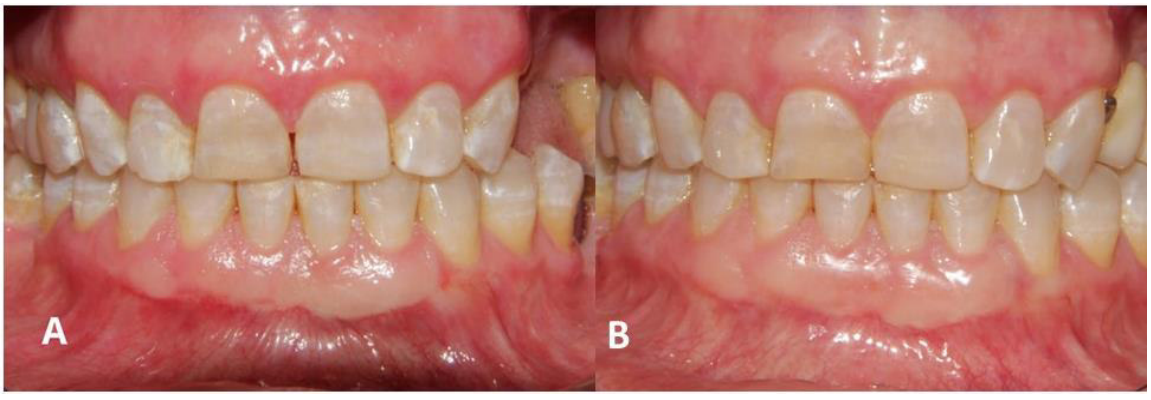

Figure 8: (A) Clinical aspect at 3-month postoperative follow-up, showing preserved

keratinized mucosa and absence of lesions. (B) Clinical aspect at 1 year and 8 months post-treatment, showing a wide band of keratinized mucosa, no recurrence of leukoplakic lesions, and healthy gingival condition.

DISCUSSION

Oral potentially malignant disorders (OPMDs) are alterations of the oral mucosa with a high risk of malignant transformation. They exhibit distinct clinical and histopathological variations and are often associated with multiple risk factors, requiring biopsy for diagnostic confirmation [4,5]. Among them, proliferative verrucous leukoplakia (PVL) is characterized as a multifocal lesion with the highest malignancy rate and a high recurrence rate [12,14,15,18,20].

PVL predominantly affects elderly women, with higher incidence in the seventh decade of life and no racial predilection [4,9,12,18,21]. In agreement with the literature, the present case involved a female patient; however, her age differed from the typical range, as she was in her fourth decade of life. Nonetheless, considering the clinical course of PVL, the appearance of new lesions with advancing age is expected. Furthermore, the etiology of PVL is often linked to factors such as Candida albicans infection, HPV type 16, EBV, oncogenes, and genetic and immunological influences, although none of these associations have been definitively established [9,15,18]. In the present case, the presence of a genetic factor associated with an autoimmune condition (vitiligo) may be related to the clinical manifestation of PVL.

To establish an accurate diagnosis, clinicopathological evidence must be considered along with disease progression [9]. Clinically, the patient presented with extensive PVL lesions, totaling approximately 9 cm × 0.6 cm, with a verrucous and exophytic appearance, affecting the gingiva, alveolar mucosa, and lower lip. These are among the most frequently affected regions in PVL [4,12,22], with the gingiva particularly associated with a higher risk of malignant transformation [3,23]. In addition, an incisional biopsy prior to the first surgical intervention revealed moderate epithelial dysplasia. After complete excision and histopathological analysis, severe epithelial

dysplasia was confirmed, characterized by stratified hyperparakeratinized squamous epithelium, acanthosis, basal layer hyperplasia, cellular pleomorphism, prominent nucleoli, dyskeratosis, typical mitoses, keratin plugs, and drop-shaped epithelial projections.

In this case, the patient met the criteria proposed by Cerero-Lapiedra et al. [20], who classified PVL according to major and minor criteria. Major criteria include: (A) leukoplakia lesions in more than two oral sites—most frequently in the gingiva, alveolar processes, and palate; (B) at least one verrucous area; (C) proliferative behavior; (D) recurrence; and (E) histopathologically, the presence of epithelial hyperkeratosis, verrucous hyperplasia, verrucous carcinoma, or in situ/invasive squamous cell carcinoma. Minor criteria include: (a) lesion occupying at least 3 cm in total across affected areas; (b) female sex; (c) nonsmoking status, regardless of sex; and (d) disease evolution longer than five years. For diagnosis, at least three major criteria (including E) or two major criteria (including E) plus two minor criteria must be met. In this case, major criteria B, C, D, and E and minor criteria a, b, and c were fulfilled. This classification helps differentiate PVL from other lesions, enabling earlier diagnosis, targeted treatment, and improved prognosis, given PVL's malignant potential [10,18].

Due to its unknown etiology and high recurrence rate, establishing an effective treatment strategy for PVL lesions remains a challenge [16,18,23]. Various therapeutic approaches are described in the literature, ranging from more invasive methods—such as conventional surgery, electrocautery, cryosurgery, and high-power laser surgery—to more conservative techniques, including the use of retinoids, photodynamic therapy, antioxidants, or combinations thereof [18,19,21].

Among the surgical options, conventional cold-blade excision is commonly employed [18]. However, it has drawbacks when used for extensive lesions, as it may result in esthetic and functional defects. Almeida et al. [24], for example, removed a leukoplakia lesion in the gingival region and, after seven days, observed 3 mm of gingival recession and less than 2 mm of attached gingiva, requiring a new intervention with a subepithelial connective tissue graft (SCTG). Thus, in the present case, the authors opted to perform a free gingival graft (FGG) in advance, considering the patient's thin gingival

phenotype, which increases the risk of gingival recession and complicates future procedures in the area.

Surgical removal of PVL in attached gingiva with a thin phenotype is notably challenging due to the risk of root and bone exposure during excision. Furthermore, the reduction of keratinized mucosa resulting from surgery may compromise the prognosis of future procedures, especially given PVL's high recurrence rate. In this study, the lesion affected the entire gingival tissue of mandibular incisors and canines, and was associated with a shallow vestibule—factors that significantly increased the risk of root and bone exposure with conventional surgical approaches. As such, an FGG harvested from a lesion-free area of the palate was planned to increase the width of keratinized mucosa and gingival thickness, with the aim of modifying the tissue characteristics and facilitating future surgical interventions in case of recurrence.

Although FGGs have esthetic limitations due to the donor site's epithelial characteristics, they offer advantages such as easier graft handling and greater adherence at the recipient site [25]. Additionally, in large surgical wounds, the presence of epithelial tissue provides more predictable coverage, making the technique more effective in increasing the keratinized mucosa band and preserving supporting tissues [26].

Consistent with these findings, in this case the FGG fully integrated with the recipient bed within one month postoperatively, increasing the band of keratinized mucosa and altering the gingival phenotype. This result enabled the use of a high-power diode laser (808 ± 10 nm, 1.5 W) for controlling and treating recurrent areas, ensuring deeper tissue removal via photoablation and achieving no recurrence in the treated areas over 20 months of follow-up. Similar results were observed by Giri et al. [27] and Bombeccari et al. [28], who used high-power diode lasers to treat persistent lesions and reported no recurrence during follow-up. For both authors, the diode laser was considered an effective therapeutic option due to its ability to promote hemostasis, decontamination, and bactericidal action, while minimizing inflammation and providing postoperative analgesia [27,28].

These recurrences can be explained by the concept of field cancerization, first

described by Slaughter et al. [29], which refers to somatic epithelial cell changes in adjacent areas due to exposure of the head and neck regions to carcinogenic agents. This cellular population presents the phenotypic potential for malignancy, resulting in resistant, multicentric, and proliferative lesions with a tendency for malignant transformation in multiple areas of the oral cavity [9,18]. PVL, in particular, has a high recurrence rate ranging from 87–100% [9,12,16,23].

In the present case, the appearance of new lesions in the grafted area one month after surgery was likely due to incomplete lesion removal, caused by the extensive surgical field and significant intraoperative bleeding, which compromised visualization and resulted in residual epithelial tissue. However, the recurrence observed at eight months in an area not treated with the diode laser is better explained by PVL's intrinsic features and the concept of field cancerization.

The patient was closely monitored for 20 months after the initial surgical intervention and showed no recurrence during the final 12 months of follow-up, along with improved histopathological findings. Continuous monitoring is essential for early detection and treatment of new PVL areas, enabling less invasive therapeutic approaches. Early detection and strict control through multiple biopsies are key to managing this disease, as treatment of PVL is largely preventive rather than curative, given its chronic, proliferative, persistent, and progressive behavior, with multiple recurrences and resistance to therapy. This condition demands repeated biopsies over time [9,18,23].

Despite the use of effective therapies, PVL still presents high recurrence rates. This often results in multiple surgical interventions in the same area, which—if not properly managed—may require more invasive approaches in the long term. In this context, the use of FGG appears to be a promising strategy to expand the keratinized mucosa and preserve the supporting tissues, allowing for future surgical interventions. In addition, periodontal phenotype modification therapy allows for reshaping of recipient tissue morphology, correcting gingival defects, and optimizing the clinical prognosis [28,29].

However, current literature lacks reports of using FGG to modify the tissue

characteristics of areas affected by PVL. Therefore, despite the encouraging results of this technique in combination with high-power laser therapy, controlled clinical studies are essential to assess the efficacy and safety of this therapeutic approach in PVL management.

CONCLUSION

Based on the reported case, gingival phenotype modification therapy using a free gingival graft (FGG) proved to be a promising alternative for preserving mucogingival tissues, increasing the width of keratinized mucosa, and enabling future interventions in cases of recurrence. Additionally, the use of high-power laser therapy for controlling new lesions demonstrated effectiveness in managing residual lesions, as no recurrence was observed in the treated areas after 12 months of follow-up.

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