



Oral Leukopakia Treated with Diode Laser: Case Report and Literature Review

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Abstract

Proliferative verrucous leukoplakia (PVL) is a rare and aggressive form of multifocal oral lesion characterized by slow progression, resistance to treatment, and a high rate of malignant transformation. This case report describes a 70-year-old female patient presenting with a six-year history of asymptomatic multiple white oral lesions. She reported no history of tobacco or alcohol use but had been wearing an ill-fitting removable denture and using a plant-based mouthwash on a daily basis. Clinical examination revealed multiple verrucous, non-scrapable, painless lesions of inhomogeneous thickness, located on the lateral border of the tongue, the floor of the mouth, and the alveolar ridge. A biopsy confirmed the diagnosis of oral leukoplakia without dysplasia, and the clinical-pathological correlation supported the diagnosis of PVL. Management included therapeutic education, elimination of local irritants, and two sessions of diode laser ablation. At five months, the patient remains clinically stable, with complete resolution of the tongue lesion and no signs of recurrence or malignant transformation. The aim of this report is to describe the clinical features and evolution of PVL and to highlight the therapeutic benefits of diode laser ablation, which offers a minimally invasive, precise, and hemostatic treatment option that promotes rapid healing with minimal discomfort. This case underscores the value of early diagnosis, patient engagement, and long-term follow-up in managing PVL effectively.

Subject Areas

Dentistry

Keywords

Proliferative Verrucous Leukoplakia, Oral Potentially Malignant Disorders, Diode Laser, Oral Pathology

1. Introduction

The World Health Organization (WHO) defines oral potentially malignant disorders (OPMDs) as “any oral mucosal abnormality that is associated with a statistically increased risk of developing oral cancer.” This definition emphasizes the importance of OPMDs, such as leukoplakia, as potential precursors of malignant lesions in the oral cavity [1] [2].

Proliferative verrucous leukoplakia (PVL) is a white lesion of the oral mucosa classified as an OPMD. It was first described in 1985 by Hansen *et al.* as a simple hyperkeratosis at onset, which tends to progressively enlarge and extend, eventually becoming multifocal [3].

These lesions are slow-growing, persistent, and irreversible, often developing erythematous areas. As the condition progresses, certain regions may develop an exophytic, wart-like appearance and gradually evolve to clinically resemble oral verrucous carcinoma (OVC). In addition, PVL is known to be resistant to various treatment modalities, making its management particularly challenging [3].

PVL is also notable for its high tendency to recur and notably high rate of malignant transformation—reaching up to 63.9%—often progressing to oral verrucous carcinoma or oral squamous cell carcinoma (OSCC) [4]-[6].

The aim of this case report is to present a patient diagnosed with PVL, highlighting the key clinical and diagnostic features, and demonstrating the effectiveness of diode laser therapy in its management. Considering the high risk of malignant transformation associated with PVL, early diagnosis and timely intervention are essential.

2. Case Report

A 70-year-old female patient with a medically controlled history of type 2-diabetes and hypertension presented to the Department of Oral Surgical Odontology at the Dental Consultation and Treatment Center in Casablanca, with whitish lesion on the lateral border of her tongue, which had been evolving over a six-year period. The lesion was asymptomatic and demonstrated a gradual increase in size. The patient was a non-smoker and did not consume alcohol.

The patient wore a complete removable denture, which was ill-fitting and caused chronic trauma to the mandibular mucosa. She also reported daily use of a plant-based mouthwash and acknowledged wearing the denture overnight.

Clinical examination revealed a primary white verrucous lesion with a yellowish hue on the ventral surface of the tongue, measuring approximately 30 mm along its major axis. The lesion presented with inhomogeneous thickness, and was discreetly exophytic in certain areas. It was associated with two additional lesions of moderate size, located on the floor of the mouth and on the lower alveolar ridge. All lesions were painless, non-scrapable and exhibited a rough texture. No sign of adjacent tissue infiltration was noted on palpation. Tongue sensitivity was preserved, and mobility was normal in both protraction and lateral movements (**Figure 1**).



Figure 1. Painless whitish lesion with heterogeneous areas, located on the lateral border of the tongue and extending to the floor of the mouth.

No cervical lymphadenopathy was observed. Through the analysis of the clinical characteristics of the lesion, the following differential diagnoses were considered: Squamous cell carcinoma, verrucous carcinoma, traumatic lesion and PVL.

A biopsy was performed under local anesthesia on the lateral border of the tongue (**Figure 2** and **Figure 3**). The tongue lesion was selected for biopsy because it represented the most clinically suspicious focus, combining a non-homogeneous appearance, focal verrucous surface changes, progressive enlargement, and localization at a high-risk anatomical site. Additional sites were considered; however, an initial single-site biopsy was chosen in order to sample the most representative and accessible area while minimizing procedural morbidity in this elderly patient. Given the recognized clinicopathological heterogeneity of proliferative verrucous leukoplakia (PVL), the patient was scheduled for close surveillance, and repeat biopsy was planned in the event of any increase in lesion thickness, development of erythematous or nodular areas, induration, ulceration, rapid enlargement, recurrence after treatment, or the appearance of new clinically suspicious foci.

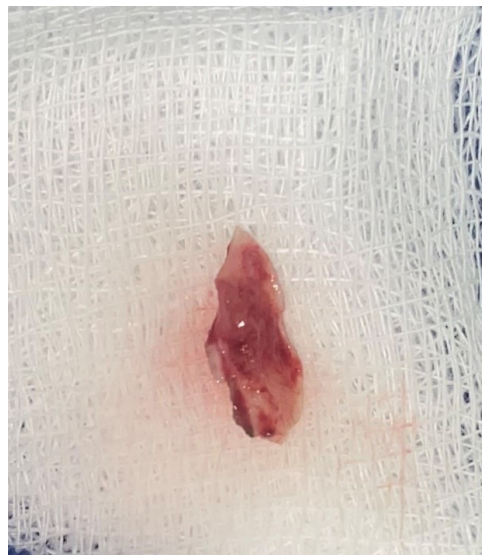


Figure 2. Surgical specimen showing the excised whitish lesion from the lateral border of the tongue.



Figure 3. Hemostasis was achieved with single interrupted sutures.

Histological examination revealed verrucous mucosa with epithelial hyperplasia and parakeratosis, while the overall epithelial architecture was preserved. Dyskeratotic cells were observed, but no pathogenic agents, viral infection, or significant nuclear atypia were identified. The underlying fibromuscular tissue appeared normal, and there was no evidence of epithelial dysplasia or malignant transformation (**Figure 4**). Correlation of clinical and pathological findings supported the diagnosis of PVL. Based on the original clinicopathologic description of proliferative verrucous leukoplakia [3], this case showed the key diagnostic characteristics of PVL, namely an initially hyperkeratotic leukoplakic lesion without dysplasia, subsequent multifocal extension involving the tongue, floor of mouth, and lower alveolar ridge, slow but persistent progression over time, and the development of verrucous surface change. These features, together with the long clinical history and the patient profile, supported the diagnosis of PVL despite the absence of epithelial dysplasia on the initial biopsy.

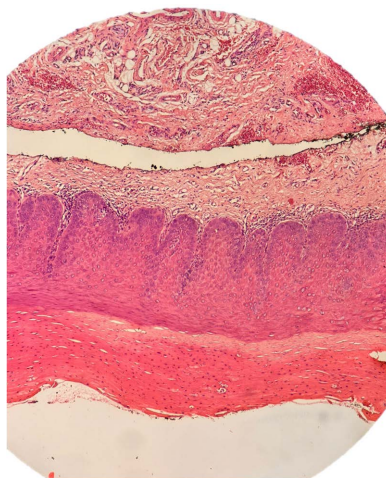


Figure 4. Slightly verrucous mucosa with a hyperplastic surface epithelium covered by a thick layer of parakeratosis. The epithelial architecture was preserved, with hyperplasia extending to the basal cell layers and the presence of dyskeratotic cells. No evidence of pathogenic agents, viral infestations, or significant nuclear atypia was observed. The fibromuscular tissue beneath the epithelium appeared normal, without any abnormalities.

The management approach consisted of several key steps. Initially, we informed the patient about the diagnosis, emphasizing the importance of therapeutic education: The risks of recurrence and malignant transformation were explained, and the patient was encouraged to maintain optimal oral and prosthetic hygiene. Recommendations also included discontinuing the nocturnal use of the complete removable prosthesis and ceasing the use of herbal mouthwashes. Regular attendance at follow-up visits was strongly advised to ensure early detection of any recurrence or malignant transformation.

At the 15-day follow-up, we observed the disappearance of the yellowish appearance of the lesion along with a slight reduction in its thickness (**Figure 5**).



Figure 5. 15-day post-operative follow-up.

Diode laser ablation was selected as the treatment modality. Perilesional infiltration with a local anesthetic was administered to ensure patient comfort during the procedure. A 980-nm diode laser (Doctor Smile®, Italy; 2–4 W, continuous mode) was employed. Laser energy was delivered through a flexible 400- μ m polyamide optical fiber (Medfibers), mounted on a handpiece to allow precise targeting of the lesion.

The technique involved the superficial removal of the lesion along with a margin of clinically healthy mucosa, typically involving 3 - 4 mm of surrounding healthy tissue and a depth of about 1 mm. Aseptic conditions were strictly maintained throughout the procedure, and both the patient and the operator wore laser safety eyeglasses (**Figure 6**). A second **ablative procedure** with a diode laser was performed. This procedure led to the disappearance of the lesion on the tongue and a reduction in the size of the lesion on the floor of the mouth (**Figure 7**).

During the follow-up visits, complete resolution of the verrucous lesion on the tongue was observed and patient showed clinical stability at a 5-month follow-up. Throughout this period, the importance of daily self-examination was strongly emphasized. The patient was instructed to monitor for any changes in mucosal texture, color, or appearance, and to seek immediate consultation should any abnormalities arise. In the event of suspicious changes, a new biopsy will be performed. At the five-month follow-up, the patient remains clinically stable (**Figure 8**).

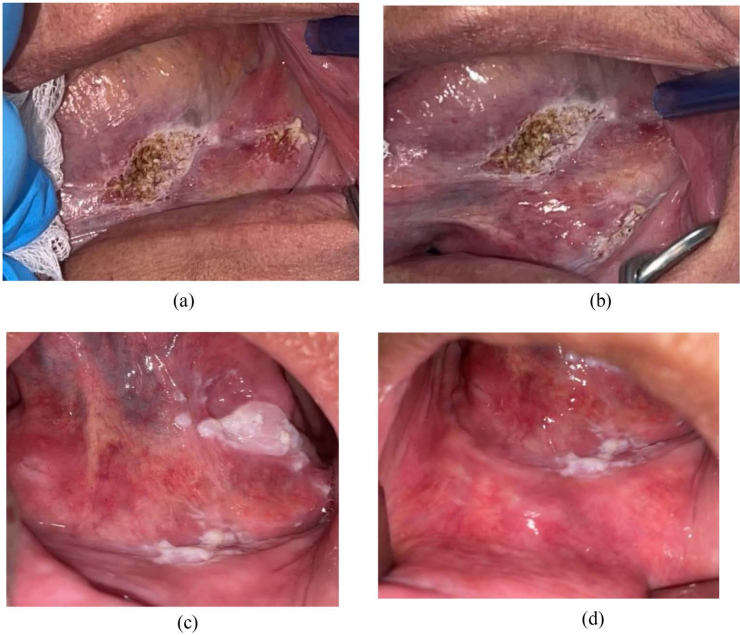


Figure 6. (a) and (b) Laser ablation on the lateral border of the tongue and extending to the floor of the mouth. (c) and (d) Two weeks after laser resection.

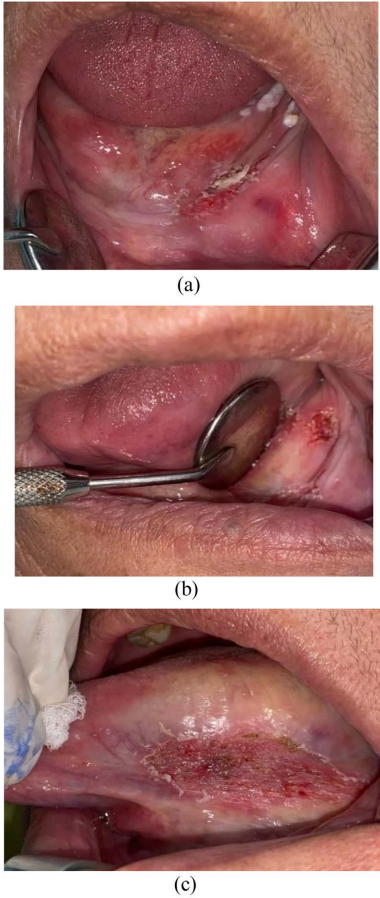


Figure 7. (a)-(c) Second ablative procedure using diode laser on the tongue and the floor of the mouth was performed.



Figure 8. 5 months post-operative follow-up.

3. Discussion

The World Health Organization describes proliferative verrucous leukoplakia (PVL) as a “distinct and aggressive form of oral potentially malignant disorder.” It is a rare and progressive type of oral leukoplakia that typically begins as a simple white plaque or clinical hyperkeratosis. Over time, it tends to expand, become multifocal, and show a persistent, gradual, and irreversible growth pattern. Ultimately, proliferative verrucous leukoplakia evolves into an exophytic, verrucous lesion that is highly resistant to treatment [5].

Several risk factors have been identified as contributing to the malignant transformation of oral leukoplakia. These include advanced age, female sex, and a history of head and neck cancer, which may reflect a predisposition due to field cancerization [7]-[9]. Non-smokers and non-alcohol users are also at increased risk, particularly in the context of proliferative verrucous leukoplakia, which appears to behave independently of traditional risk factors [10]. However, no study has clearly defined initiating risk factors specific to PVL, and current assumptions are largely extrapolated from the broader understanding of conventional oral leukoplakia.

From a clinical perspective, non-homogeneous leukoplakias, especially those with verrucous or erythroleukoplakic features, show a higher risk of malignant transformation. Lesion size exceeding 200 mm² and localization in high-risk areas, such as the lateral border of the tongue and the floor of the mouth, are strongly associated with an increased risk of malignant transformation. Additionally, the presence of *Candida albicans* and, most importantly, the degree of epithelial dysplasia that can be observed on histological examination, constitute key prognostic indicators [7].

The management of oral leukoplakia includes non-surgical approaches such as chemopreventive agents, including topical tretinoin or isotretinoin, topical bleomycin, 13-cis-retinoic acid, and photodynamic therapy. These agents, especially antioxidants, act as potent free radical scavengers, aiming to prevent carcinogenesis induced by oxidative stress. However, a major limitation of chemopreventive therapies is their toxicity and the high rate of lesion recurrence after treatment

discontinuation [6]. As a result, surgical excision remains the most effective treatment option, particularly for lesions with moderate to severe dysplasia or those considered at high-risk [11].

Despite the absence of epithelial dysplasia in the histopathological examination, several factors indicated a high risk of malignant transformation for our patient.

Firstly, the patient's age and female sex, both recognized in the literature as potential risk factors for malignant progression, were cause for concern. Secondly, the lesion exhibited clinical characteristics consistent with a high-risk subtype, namely proliferative verrucous leukoplakia. It was located in anatomically high-risk sites, including the lateral border of the tongue and the floor of the mouth. In addition, its size, measuring 30 mm in its greatest dimension, further increased concern regarding the risk of malignant potential.

In view of all these elements, we considered that a "wait and see" approach was not appropriate. Instead, we opted for active management through diode laser ablation, aiming to reduce the risk of progression and ensure optimal patient safety.

When treating oral leukoplakia, laser excision has a number of benefits over conventional surgery. Because of its hemostatic effect, it significantly decreases intraoperative bleeding and postoperative pain. Infection risk is decreased by the antibacterial effect, and fibrous scarring is prevented due to reduced tissue damage. Additionally, laser treatment typically results in lower recurrence rates [11].

Oral leukoplakia has been treated using a variety of lasers, such as diode lasers, potassium titanyl phosphate lasers (KTP), erbium-doped yttrium aluminum garnet lasers (Er:YAG), neodymium-doped yttrium aluminum garnet lasers (Nd:YAG), and carbon dioxide lasers (CO₂). The diode laser is distinctive among these because of a number of benefits. It is lightweight, portable, and manageable, especially for soft tissue procedures. It is an effective option since it is affordable and may be used in direct contact with the tissue, enabling precise control [11].

Several studies support our therapeutic decision, which was the use of diode laser ablation: According to Goharkhay *et al.*, the diode laser outperforms the Nd:YAG laser in terms of incision performance, with a cutting depth of 2 - 6 mm and better coagulation abilities because of its higher capacity to absorb hemoglobin. The diode laser, which has an average power of 4.5 W, neither chars nor damages the bone beneath the soft tissue in continuous wave or pulsed mode like the CO₂ laser does [12].

According to a systematic review and meta-analysis conducted by Mariana de Pauli Paglioni *et al.*, laser surgical excision of leukoplakia can reduce recurrence rates but has no effect on malignant transformation compared with conventional treatments [13].

4. Conclusions

After laser ablation of the leukoplakia, the treatment is not complete: a rigorous patient follow-up schedule must be drawn up, including a clinical examination of both the lesion and the lymph nodes, given the recurrence of the lesion and the

high rate of malignant transformation. Patient therapeutic education should be underlined, along with the promotion of self-assessment of the lesion. Indeed, after each change in colour, texture or morphology, a new biopsy must be taken to rule out malignant transformation.

In our case, the patient demonstrated favorable outcomes at the six-month follow-up and remains under ongoing clinical surveillance.

Conflicts of Interest

The authors declare no conflicts of interest.

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