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Minimally Invasive Management of Homogenous Oral Leukoplakia using Diode Laser

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Минимально инвазивное лечение гомогенной лейкоплакии полости рта с помощью диодного лазера

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二极管激光微创治疗均质型口腔白斑

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Introduction. Leukoplakia is the most commonly occurring oral potentially malignant disorder, with a significant potential for malignant transformation. Thus, effective management is imperative to mitigate this risk. Though various treatment options exist, laser therapy has emerged as a promising minimally invasive approach with distinct advantages

Case report. We present a case of 44 year old male, with a history of tobacco chewing, presenting with a homogenous leukoplakic lesion of the right buccal mucosa. The lesion was excised using a diode laser with precise parameters, resulting in minimal postoperative discomfort, precise tissue excision, reduced bleeding, and uneventful healing.

Discussion. This report describes a minimally invasive surgical option and is unique in highlighting the clinical efficiency of laser excision in attaining favourable outcome with reduced complications compared to conventional scalpel technique. Additionally, long term- follow up provides a better understanding of its clinical efficacy as no recurrence was noted after 18 months. This report highlights the increasing role of diode laser as a preferred modality for oral leukoplakia management.

Key-words: Oral leukoplakia, Diode Laser, excision, Precancerous

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Актуальность. Лейкоплакия является наиболее распространенным заболеванием полости рта с потенциалом к злокачественной трансформации. Для снижения риска трансформации необходимо эффективное

лечение. Среди разнообразия существующих методов лечения лазерная терапия зарекомендовала себя как перспективный малоинвазивный подход, обладающий рядом преимуществ.

Клинический случай. Мы представляем случай 44-летнего мужчины с историей употребления жевательного табака, у которого был обнаружен гомогенный очаг лейкоплакии слизистой оболочки правой щеки. Очаг был удален с помощью диодного лазера с точными настройками, что привело к минимальному послеоперационному дискомфорту, аккуратному иссечению ткани, уменьшению кровотечения и заживлению без осложнений.

Обсуждение. В данной статье описан малоинвазивный хирургический метод и подчеркивается клиническая эффективность лазерной эксцизии для достижения благоприятных результатов с меньшим количеством осложнений по сравнению с традиционной техникой с использованием скальпеля. Долгосрочное наблюдение также демонстрирует клиническую эффективность, поскольку через 18 месяцев не было отмечено ни одного случая рецидива. В данной работе показана растущая роль диодного лазера как предпочтительного метода лечения лейкоплакии полости рта.

Ключевые слова: лейкоплакия полости рта, диодный лазер, эксцизия, предраковое состояние

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引言：白斑是最常见的口腔潜在恶性疾病，具有显著的恶变风险，因此有效管理对降低该风险至关重要。尽管已有多种治疗方案，但激光治疗作为一种微创方法因其独特优势而逐渐受到重视。

病例报告：本文报道一例 44 岁男性患者，有嚼烟史，右侧颊黏膜出现均质型白斑病损。采用设定精确参数的二极管激光行病损切除，术后仅有轻微不适，切除精确、出血量少，创口愈合过程顺利。

讨论：本病例介绍了一种微创外科治疗方案，其特点在于强调激光切除在获得良好疗效、并发症少方面较传统刀切技术的临床优势。此外，18 个月的长期随访中未见复发，有助于更好地理解其临床有效性。该病例提示二极管激光正逐渐成为口腔白斑管理的优选方式。

关键词：口腔白斑，二极管激光，切除，癌前病变

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Introduction

Oral leukoplakia is the most frequently occurring potentially malignant disorder, with a global prevalence of 2% and a potential for malignant transformation of 7–10% of the general population, with a higher incidence observed among older demographics [1–4].

While conventional scalpel excision has certain drawbacks such as, bleeding, edema and scarring, Laser excision therapy has gained traction for its superior characteristics. This includes, precision cutting, effective hemostasis, mitigated risk of recurrence [5, 6]. However, long-term follow-up studies are scarce. Thus,

this case report aims to underscore the clinical efficacy of diode laser in the minimally invasive management of leukoplakia and to assess the recurrence of the lesion, acknowledging a notable void in existing literature.

Case report

A 44-year-old male presented to dental outpatient department complaining of a persistent white patch on the right inner cheek for 3–4 months. The patient revealed a history of tobacco chewing in the form of Khaini (sun-dried coarsely cut tobacco leaves mixed



Figure 1. Represents intraoral presentation of a thick, non-scrapable, homogenous white plaque with a cracked-mud appearance on the right buccal mucosa

Рисунок 1. Представлен вид внутри ротовой полости с очагом толстого несоскабливаемого однородного белого налета с трещинами в виде «растрескавшейся земли» на слизистой оболочке правой щеки

with slaked lime paste) for 10 years, engaging in the habit three times daily, with each session lasting for 10–30 minutes each. He reported no relevant medical or family history.

Clinical examination revealed a non-scrapable, homogenous thick white plaque with “cracked-mud appearance” on right buccal mucosa extending from second premolar to second molar region and measuring antero-posteriorly and supero-inferiorly about 6 x 4 cm [Figure 1]. Based on clinical presentation and habit history provisional diagnosis of homogenous leukoplakia was made. A Punch biopsy was performed under local anesthesia. Histopathological findings confirmed the diagnosis of homogenous leukoplakia (Epithelial hyperkeratosis without dysplasia) [Figure 2]. Following a complete hematological examination, and enrolling the patient on tobacco cessation program a surgical excision of the lesion was performed utilizing a Lite- Medics® Diode Laser with a 980 nm wavelength equipped with a 300 μ m fiber optic tip at 3W in pulsed mode was selected to achieve precise excision with

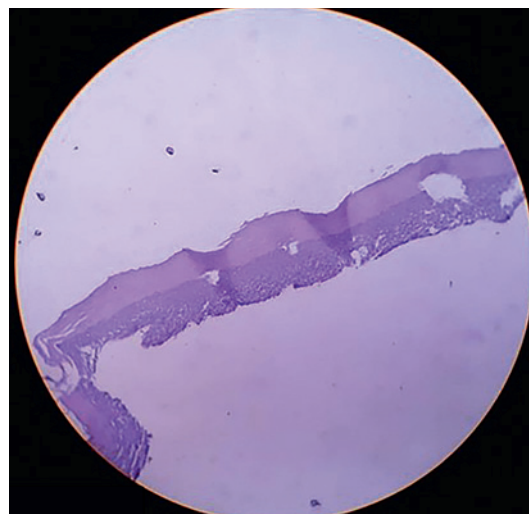


Figure 2. Represents histopathological picture showing epithelial hyperkeratosis without evidence of dysplasia (H&E staining, magnification 10x)

Рисунок 2. Представлена гистопатологическая картина эпителиального гиперкератоза без признаков дисплазии (окрашивание H&E, увеличение 10x)

minimal thermal damage and optimal hemostasis, as supported by Priyadarshini et al. 2024 [7], where similar parameters yielded favorable clinical outcomes for lesions of comparable size and histological type.

Under local anesthesia, with the laser fiber placement perpendicular to the lesion and a 1 mm safety margin complete excision of the lesion was conducted. The tissue was vaporized through direct contact with the surface of the oral mucosa achieving excision with minimal bleeding [Figure 3]. No post-operative complications were noted and satisfactory healing in follow-up visits was observed [Figure 4, 5].

After 18 months, patient confirmed of complete tobacco cessation, following treatment. Clinical examination revealed



Figure 3. Intraoperative image demonstrating excised lesion by diode laser using activated 300 μ m fiber at 3.5W in pulsed mode, with a 1mm safety margin

Рисунок 3. Интраоперационное изображение, демонстрирующее удаление очага с помощью диодного лазера с использованием активированного волокна 300 мкм при мощности 3,5 Вт в импульсном режиме с отступом 1 мм



Figure 4. Represents the excision site after one-week postoperative follow-up]

Рисунок 4. Представлено место иссечения после 1 недели послеоперационного наблюдения



Figure 5. Represents the excision site after two-week postoperative follow-up]

Рисунок 5. Представлено место иссечения после 2 недель послеоперационного наблюдения



Figure 6. Represents the excision site after 18 months of postoperative follow-up, which reveals complete mucosal healing with brownish pigmentation of the excision site and no evidence of recurrence

Рисунок 6. Представлено место иссечения после 18 месяцев послеоперационного наблюдения, наблюдается полное заживление слизистой оболочки с коричневатой пигментацией места иссечения и отсутствием признаков рецидива

no signs of recurrence; however, brownish pigmentation was noted at the excision site, suggestive of post-inflammatory hyperpigmentation (PIH) [Figure 6].

Discussion

Leukoplakia is a clinically diagnosed condition without specific histological features, exhibiting a variable behavioral pattern with a measurable potential for malignant transformation. Based on surface and morphological characteristics, leukoplakia can be presented as homogeneous leukoplakia, which appears

as a smooth, white, flat lesion with well-defined borders [8]. The management of leukoplakia involves a range of treatment approaches, including both surgical and non-surgical options. Non-surgical management primarily involves the use of various topical, intra-oral pharmacological drugs and herbal management, while surgical intervention traditionally relies on conventional scalpel excision. However, increased recurrence (10–30%) with non-surgical approaches have been reported and the surgical approaches are often associated with a higher risk of postoperative complications, such as infection, pain, and scarring due to suturing, making it a less favourable option for patients [9].

The advent of laser technology has provided oral physicians and oral surgeons with an advanced tool to perform surgical procedures with minimal pain, enhanced patient comfort, and accelerated healing [10]. Recent literature indicated that laser-assisted surgical excision gained recognition as a preferred treatment modality for oral leukoplakia in recent years. Ishi et al. [9] conducted a study involving 97 cases of oral leukoplakia to evaluate the recurrence rate and potential for malignant transformation following laser resection. Their findings demonstrated that malignant transformation occurred in only 1.2% of patients treated with laser surgery, while the recurrence rate was recorded at 29%. Similarly, a case series by Katara et al. [11] examined the outcomes of diode laser treatment (wavelength 940 nm) in five patients diagnosed with various oral conditions, including arteriovenous malformation, homogeneous leukoplakia, mucocoele, traumatic fibroma, and erosive lichen planus. Regular follow-up assessments revealed that lesion healing was achieved rapidly with minimal discomfort. The findings of the present report are consistent with the aforementioned cases, where the lesion was excised using a diode laser under controlled parameters. This approach provided several advantages over conventional excisional biopsy, including reduced postoperative pain, minimal bleeding, and precise tissue ablation. Furthermore, the precision of laser treatment helps preserve surrounding healthy tissue, potentially leading to reduced scarring and improved overall outcomes.

Studies conducted to compare outcomes of diode laser and conventional scalpel excision have found laser excision to be more favourable. Paglioni et al. (2025) [12] reported that pain scores depend more on the location of the lesion rather than method of excision as they found pain scores to be similar for both groups at 24 hours, 48 hours and 7 days. Conversely, Yasmeen et al. (2019) [13] found a statistically significant difference, with the diode laser group experiencing lesser pain on the 3rd and 7th postoperative days compared to the scalpel group. Both studies conclude that diode lasers offer superior short-term results. Paglioni et al. [12] observed significantly better healing in the laser group at 7 days, though this advantage equalized by 1 and 3 months. Similarly, Yasmeen et al. [13] noted that the diode group experienced significantly less edema and functional disturbance in the first week compared to the scalpel group. Yasmeen et al. reported a 0 % recurrence rate over 4 years for laser group, whereas the scalpel group had a 20 % recurrence rate.

In the present case, the only residual finding 18 months after therapy was a brownish discoloration localized to the site of excision, clinically consistent with (PIH). PIH in the oral mucosa indicates the deposition of increased melanin as a response to prior inflammation or a thermal insult and should be considered as a benign sequela, rather than a sign of persistent or recurrent potentially malignant disease. The area was asymptomatic, demonstrated no surface alteration or induration, and showed

no clinical features suggestive of recurrent leukoplakia, thereby supporting a favorable prognosis with routine surveillance rather than active intervention. Clinically, such pigmentation should be documented and monitored; however, patients can be reassured that, in the absence of new keratotic or ulcerative changes, PIH does not, by itself, indicate an increased risk of malignant transformation.

The precise tissue ablation capability of the diode laser, coupled with minimal postoperative pain and reduced healing time, makes it a favourable option for both patients and clinicians. The successful excision of the lesion with no postoperative complications reinforces the role of laser technology as a minimally invasive and highly effective treatment modality. This report provides promising evidence for the use of diode laser in such cases, however, since this is a single case report, future studies with larger sample sizes and long-term follow-up are recommended to further validate the benefits and establish laser therapy as a standard approach in managing oral leukoplakia. Studies with comparative analysis of laser excision and scalpel excision would also provide a more robust and clinically significant information for considering this as a viable treatment option.

This case report highlights not just the efficacy of diode laser treatment in the management of oral leukoplakia but also the vital role of interdisciplinary approach. Diagnosing the lesion, surgical planning, habit cessation counselling, and post-operative follow ups involved collaboration among oral physicians, surgeons and public health professionals. To ensure abstinence from vicious habits behavioral intervention and follow-up for longer duration across specialities was imperative in attaining a successful outcome.

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