Journal of Dental Sciences 19 (2024) 1874–1876

Available online at www.sciencedirect.com

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journal homepage: www.e-jds.com

Perspective article

Laser evaporation and excision of oral leukoplakia: Highlighting the two techniques for treating different risk lesions

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Received 28 February 2024; Final revision received 1 March 2024

KEYWORDS
Laser therapy;
Malignant transformation;
Oral epithelial dysplasia;
Oral leukoplakia;
Recurrence

Laser therapy is one of the common treatment modalities for oral leukoplakia (OLK). The pooled recurrence rate of OLK received laser therapy was reported to be 16.5% (95% confidence interval [CI], 11.2–22.5%), suggested that laser therapy may decrease recurrence rates of OLK when compared with conventional treatments.[1] However, the recent studies reported that the recurrence rates of OLK received laser evaporation were about 50%,[2–4] suggested that laser evaporation may not decrease recurrence rate. Actually, two techniques using lasers can be used for treatment of OLK: (i) laser evaporation/ablation for superficial removal of the lesion up to the epithelium and (ii)

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https://doi.org/10.1016/j.jds.2024.03.001

laser excision for deeper removal of the lesion. It is important to distinguish the differences between laser evaporation and excision techniques for OLK treatment, while this issue seemingly does not catch attention in literature. Hence, we attempted to discuss the differences between laser evaporation and excision for OLK with emphasis on treating different risk lesions.

To begin with, we compared the effectiveness of laser evaporation versus excision on the recurrence and malignant transformation of OLK based on the previous studies. There were 4 studies including 2566 OLK lesions focusing on laser evaporation versus excision investigated concurrently in one and the same study (Supplementary Table S1).[5–8] Of these, a well-designed study investigated 2347 patients with homogeneous OLK without dysplasia treated with different protocols of CO_2 laser therapy.[6] Even if the lesions received laser evaporation almost were not dysplasia, the rate (95%CI) of recurrence and malignant transformation was 41.8% (35.2–48.6%) and 5.3% (3.9–9.4%), respectively; whereas the recurrence rate of the lesions received laser excision was 2.7% (95%CI, 1.9–3.7%) and there was not malignant transformation. The very high success rate of OLK received laser excision was mainly owing to complete excision for homogeneous non-dysplastic OLK in one session with $\geq$3 mm of surrounding margins and $\geq$1 mm in lesion depth. The reason of very low success rate of laser evaporation was that only the visible superficial white area was ablated and lack of safety margins.[6]

Laser evaporation technique should be suited for very low-risk OLK without dysplasia confirmed by an incisional biopsy, and homogenous lesions, particularly large-area multiple lesions. Even for larger defects, skin grafts or dressing materials are not required because of minimum damage and a coagulum which form on the wound.[9] Laser evaporation is considered a preferred treatment option for oral superficial mucosal lesions including lichen planus.[10] However, the accurate width and depth of the margins are unknown when vaporizing. Accordingly, evaporation should not be suited for dysplastic lesions because residual dysplastic epithelium may remain in the treated when laser is used for evaporation. Moreover, laser evaporation is only based on one or more small incisional biopsies, and clinicians are aware that an incisional biopsy can lead to an underdiagnosis of the whole lesion in a percentage of leukoplakia lesions. It is well accepted that a histological diagnosis of an incisional biopsy, performed for diagnosis of OLK, is a snapshot of the whole lesion, and sometimes can underestimate the true nature of the whole lesion.[9] Also, laser evaporation which ablates the tissue lacks depth control and the peripheric margins are cauterized. After evaporation, the tissular healing process and secondary intention may induce a centripetal regeneration of all margins of the wound, including the ill parts invaded by the leukoplakia. The healed area newly regenerated may be inseminated again by leukoplakia lesional cells. Future studies can provide more information about this hypothesis.

Laser excision technique is more suitable for low-moderate risk OLK with mild-moderate dysplasia, or non-homogenous lesions, or lateral/ventral tongue lesions. Laser offers many advantages over conventional surgery including minimal pain and inflammation, operation under local anesthesia, as well as providing a hemostatic effect and achieving less dysfunction, which is especially useful in large and vascularized zones.[9] Compared with evaporation, laser excision considered as an excisional biopsy can remove the deeper leukoplakia lesional tissue and the tissue removed can be sent for histological examination. It is an important difference that the likelihood of examining the whole lesion for histopathological examination between laser excision and evaporation treatment. Nevertheless, the thermal injury induced by the laser might still influence the quality of histopathological diagnosis on the

Table 1 Comparison of laser evaporation and laser excision for the treatment of oral leukoplakia.

Laser evaporation/ablation	Laser excision
Removal of lesion superficially	Deeper removal of lesion, consider an excisional biopsy
Indications	Indications
Non dysplasia	Mild/mild-moderate dysplasia
Homogeneous type	Non-homogeneous type
Large areas where excision could cause discomfort	Thick keratinized lesion
Low-risk site (e.g. gingiva)	High-risk site (e.g. lateral/ventral tongue)
Advantages	Advantages
It has limited post-operative discomfort and lesser pain	Tissue removed can be sent for histological examination
Can be performed in larger lesions	Chances of recurrences are lesser than laser ablation
Can be used in multiple lesions	Can obtain the excising margins
Faster healing	
Reduced scarring and better preservation of tissue's elastic property	
Can be repeated even if new lesions arise near the primary lesion	
Disadvantages	Disadvantages
Tissue cannot be sent for histological examination	Excising large lesions can cause functional problems
High chances of recurrence	Compared to evaporation it has a high chance of tissue scarring

tissue and cauterization of the tissue margins hinders examination by histopathology.[9] Furthermore, as for OLK with moderate-severe dysplasia or worse, or combined with non-homogenous lesions or combined with OLK lesions located at the lateral/ventral tongue, laser excision may be not suitable for these high-risk lesions due to the limited surrounding and bottom margins under local anesthesia.

Conventional surgery by scalpel remains the first-line treatment for high-risk and suspicious cancerous lesions because it can obtain the enough peripheral and bottom margins of over 10 mm. The extensive safety margins theoretically reduce the risk of OLK recurrence and malignant transformation.[11] Also, large defects after complete excision can be repaired by adjacent tissue flaps or skin grafts under general anesthesia. Even if extensive excision of the visible abnormal lesions, patients with OLK remain at risk of recurrence and malignant transformation due to field cancerization,[9] which is characterized by clones of cells even in clinically and histologically surrounding normal oral mucosa with molecular aberrations characterized as hallmarks of malignancy. It is accepted that the risk of recurrence and malignant transformation does not disappear when the oral dysplastic lesion is completely excised, similarly due to the theory of field cancerization. The molecular mechanisms of field changes underlying the development of dysplasia and carcinoma in OLK required further researches.

Collectively, laser evaporation and excision for OLK should be suited for different risk lesions with distinct advantages and disadvantages (Table 1, which was modified based on the summary by Shivhare et al.[5]). Evaporation technique should be suited for very low-risk OLK without dysplasia, and excision technique is more suitable for low-moderate risk lesions with mild-moderate dysplasia. The authors are of perspectives that caution should be exercised in laser evaporation for the low-moderate risk or worse lesions and laser excision for the high-risk and suspicious cancerous lesions. It highlights that intervention for treating OLK needs risk stratification and randomized controlled trials.[12]

Declaration of competing interest

The authors have no conflicts of interest relevant to this article.

Acknowledgments

This work was supported by National Natural Science Foundation of China (82370954) and Fengxian District Clinical Diagnosis & Treatment Center of Oral and Maxillofacial-Head and Neck Oncology (fxlczlzx-a-201705).

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jds.2024.03.001.

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