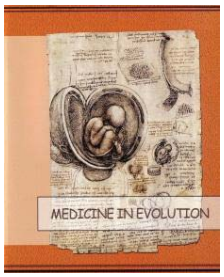
# Autofluorescence evaluation of oral keratotic lesions




**Părlătescu I.[1], Rădulescu A.[2,] Nicolae C.[1]**

[1]*Oral Medicine Department, Faculty of Dental Medicine, Carol Davila University of Medicine and Pharmacy, Bucharest*
[2]*General Dentist, Bucharest*

*Correspondence to:*
*Name: Parlatescu Ioanina*
*Address: Eforie Street no. 4-6, district 5, floor 3rd*
*Phone: +40 724950104*
*E-mail address: ioanina.parlatescu@umfcd.ro*

## Abstract

**Objective**: The aim of this study is to assess the value of tissular fluorescence visualization for the diagnosis of oral white lesions.

**Material and method:** The study was conducted in the Department of Oral Medicine of the UMF Carol Davila and included 25 patients with the preliminary clinical diagnosis of oral keratotic lesions. The lesions were evaluated using tissue autofluorescence and the diagnosis was confirmed histologically.

**Results:** In this study for tissue autofluorescence, a sensitivity of 0.57 and a specificity of 0.72 were obtained.

**Conclusion:**According to the data analyzed in the present study, this adjuvant investigation does not bring superior benefits in the assessment of oral keratotic lesions, although this method is convenient, easy to use for patients who need long term follow-up, it requires caution because benign lesions can mimic suspicious disorders.

**Keywords:** oral keratotic lesions, autofluorescenc e evaluation.

## INTRODUCTION

Oral mucosal white lesions can raise difficulties in diagnosis mainly because of the resemblances in the clinical appearance. In this category of oral disorders are included various lesions with different etiologic causes. Thus benign lesions such as traumatic keratosis, hyperplastic candidiasis, nicotinic stomatitis can show similarities with oral lichen planus or the challenging leukoplakia or even the leukoplakic onset of oral carcinoma[1]. The quick and correct diagnosis of those lesions improves the prognosis and evolution in cases of suspicious lesions or for lesions that have malignant potential.

The present diagnostic recommendations for oral keratotic lesions includes the following steps: a preliminary evaluation and a definitive diagnosis[2]. The preliminary phase includes the identification by conventional oral examination and palpation and the removal of possible local factors (tobacco, local trauma, Candida infection). A definitive diagnosis is obtained after the biopsy. The biopsy which implies invasive methods can be done from the beginning in case of idiopathic leukoplakia or in case of persisting lesions after the removal of local factors. After the histopathological examination, the final diagnosis is established by identifying the degree of dysplasia and including the lesion in suspicious or non-suspicious type [2].

For the early detection of oral keratotic lesions, complementary diagnostic methods were studied and are used in present. These adjuvant techniques improve identification of the lesions (based on tissue reflection, autofluorescence, and vital staining), lesion assessment (cytology and vital staining) and risk assessment (salivary biomarkers)[3]. Moreover, all of these methods are used for screening for oral squamous cell carcinoma and oral epithelial dysplasia[4]. But these methods do not replace the conventional oral examination or the histological evaluation which remains the golden standard for oral keratotic lesions.

One adjuvant system is VELscope Vx which is a device that is based on tissue fluorescence visualization. This has a significant advantage that it allows the clinician to detect changes in cellular, structural or metabolic activity in oral mucosal tissues. This system uses a handpiece that emits light at 400-460nm wavelength, under which normal mucosa is fluorescent green and abnormal tissue is dark as it absorbs the light [5].

This adjuvant examination method is based on modification of the normal autofluorescence which is caused by tissue changes such as disruption of collagen matrix and elastin and metabolic alterations such as decresing of flavin-adenin dinucleotide quantity and increasing of the reduced form of dinucleotide nicotinamide adenine[5].

### *Aim and objectives*

The aim of this study is to assess the value of tissular fluorescence visualization for the diagnosis of oral white lesions. This was done by comparing the dysplasia degree from the histopathological examination of the lesions with the VELscope images taken previously.

## MATERIALS AND METHODS

For the present study, we reviewed the medical charts of patients diagnosed with white lesions of the oral mucosa. The patients were referred for diagnosis to the Oral Medicine/Oral Pathology Discipline, Faculty of Dental Medicine between March 2017 to March 2018. A number of 45 medical sheets were retrieved. Of these, 20 cases with incomplete clinical data, without VELscope evaluation or without histopathological exam were excluded. The remaining 25 cases were selected and analyzed. The inclusion criteria in the present study were the following: clinical diagnosis of the oral keratotic lesion, the histopathological exam, stored image of the lesion in conventional light and through the tissue autofluorescence device(VELscope Vx system), the patient's informed written consent for study participation.

The patients were examined by an Oral Medicine specialist by a detailed and rigorous conventional oral examination (visualization in the incandescent light of the dental chair and palpation) and evaluation with the VELscope system. During VELscope examination the room light was dimmed in order to assist visualization and to increase the contrast. The device was positioned 10 centimetres from the lesion. Pictures of the lesions in conventional light and using VELscope device were taken. The biopsy of the lesions was done and the histopathological evaluation conducted to the final diagnosis.

From the medical charts, the following data were retrieved: demographic data-age, gender, smoking details, symptoms, location, and the dimension of the lesion, histopathological result.

## RESULTS

Of the total number of patients included in this study, 52% (n = 13) were women and 48% (n = 12) men. Regarding age, most of the patients were 40 to 60 years old (10 cases), over 60 years (8 cases) and 7 cases younger than 40years. According to smoking, the group was divided into smokers (13 patients- 52%), non-smokers (six patients- 24%) and former smokers (six patients- 24%). The most frequent oral mucosa site affected was the tongue (six cases) and multiple locations - more than two affected areas - (six cases), followed by gingiva (five cases), hard palate (four cases), buccal mucosa (three cases) and soft palate (one case). The lesions identified were classified by size as having less than 2 $cm^2$ (11 cases), between 2 and 4 $cm^2$ (11 cases) and more than 4 $cm^2$ (three cases).

The clinical preliminary diagnosis were leukoplakia: in 21 patients (84%); oral lichen planus: in three patients (12%) and oral papilloma: in one patient (4%).

For all these lesions the autofluorescence evaluation and the histopathological results are presented in Table 1.

Table 1. Concordance between autofluorescence and histopathological diagnosis

| | Non-dysplastic lesions | Dysplastic lesions | Carcinoma |
|---|---|---|---|
| Autofluorescence retained | 13 cases | 3 cases | |
| Lost autofluorescence | 5 cases | 2 cases | 2 cases |
| Total number of cases | 18 cases | 5 cases | 2 cases |

Although the group analyzed in this study is not a large one, we observed in lesions without dysplasia, where we would have expected all patients to have retained autofluorescence (Figure 1), there were five cases out of 18, in which autofluorescence was lost (Figure 2). Regarding the dysplastic lesions, for which we would have assumed that they will show lost autofluorescence, a great number of cases (three patients) had the autofluorescence preserved compared to only two patients with lost autofluorescence. In oral carcinoma cases, the result was as expected with lost autofluorescence.

For the present results, analyzing the sensitivity and specificity for VELscope system, we obtained the following values for sensitivity: 0.57 and for specificity: 0.72(Table 2). This means that autofluorescence correctly identified (positive test) 57% of the dysplastic lesions and 72% of the nondysplastic lesions (negative test).

Table 2. Contingency table 2x2 with the four possibilities regarding the result of a diagnostic test

| | Present disease | Absent disease | Total |
|---|---|---|---|
| Positive diagnostic test | 4 | 5 | 9 |
| Negative diagnostic test | 3 | 13 | 16 |
| Total | 7 | 18 | 25 |

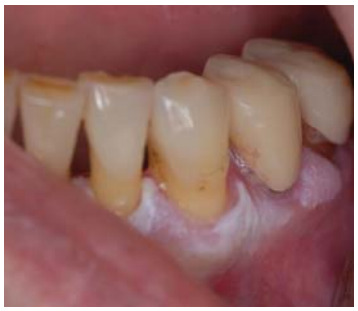


Figure 1A. Clinical aspect of gingival leukoplakia

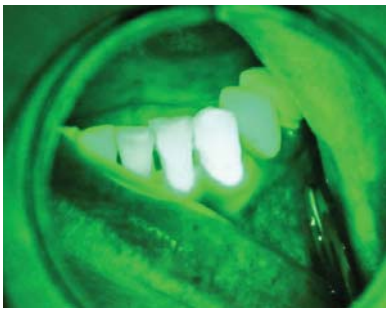


Figure 1B. Autofluorescence image with no loss of autofluorescence

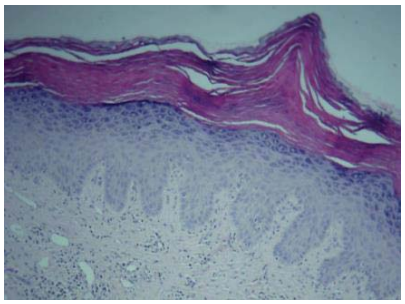


Figure 1C. Histology of the lesion showing no dysplasia(HE20x)

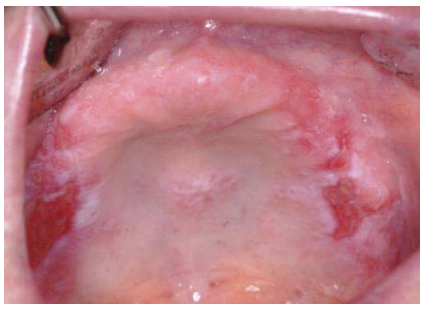


Figure 2A. Atypical hard palate location of erosive oral lichen planus with keratosis and ulcers

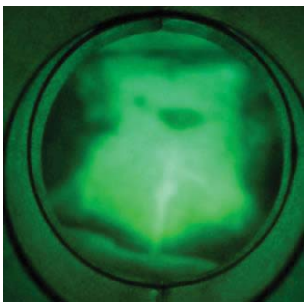


Figure 2B. Visual autofluorescence lost

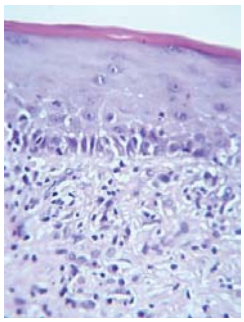


Figure 2C. Histology diagnosis oral lichen planus without dysplasia (HEx400)

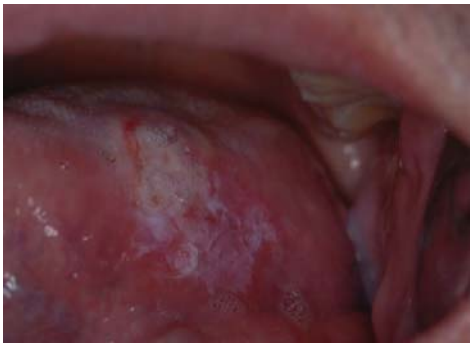


Figure 3A. Tongue tumor with non-homogenous leukoplakic areas

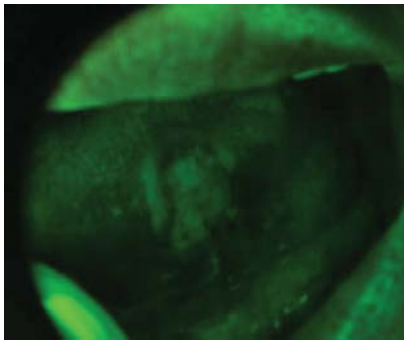


Figure 3B. VELscope image of the tumor showing loss of autofluorescence

## DISCUSSIONS

We assessed the autofluorescence visualization's benefits for oral keratotic lesions when compared with the histopathological outcome. The autofluorescence evaluation of oral lesions is a non-invasive technique that does not require consumables, is well-accepted by the patients. It can be repeated frequently adjuvant to the conventional oral cavity examination, allows objective interpretation, with rapid results and does require minimal training[6]. Our study results suggest a good sensitivity (0.57) and specificity(0.72) but a study limitation is the small sample size of patients. Moreover, this investigation is limited by a high number of false-positive results, as the inflammatory or vascular lesion, focal melanosis, amalgam pigmentation show a loss of fluorescence visualization [6].

A meta-analysis of seven studies published in 2017 analyzed the accuracy of this complementary optical diagnostic method with reference to a total number of 616 oral lesions. The results show that 90% (sensitivity 0.90) of the lesions and 72% (0.72 specificity) of the unchanged tissue are correctly identified by tissue autofluorescence [3].

In three of the studies cited in the aforementioned article [7,8,9], tissue autofluorescence recorded a sensitivity between 0.22 - 1 and specificity between 0.084 - 0, 8. The presentation of the obtained results, compared to other similar studies, is shown in Table 3. The specificity of the test, of 0.72, is identical to that reported by Lingen in 2017. The sensitivity value of 0.57 is close to the data reported by Awan and Farah.
Although some authors appreciate that VELscope has a moderate to high sensitivity and low specificity and cannot distinct between benign and malignant lesions, these devices improve the clinical data obtained by conventional examination. There are larger studies undertaken in present for this subject mainly in order to detect their applicability in primary dental care[10].

Table 3. Comparison of the results of tissue autofluorescence obtained in the present study with those of the specialized literature

| Author / year | Number of lesions | Results: Sensitivity (Se), Specificity (Sp) |
|---|---|---|
| Present study | 25 | Se = 0.57, Sp = 0.72 |
| Awan K.H. et al. 2011 [7] | 125 | Se = 0.84, Sp = 0.15 |
| Farah C.S. et al. 2012 [8] | 112 | Se = 0.30, Sp = 0.63 |
| Hanken H et al. 2013 [9] | 120 | Se = 0.22, Sp = 0.08 |
| Lingen M.W. et al. 2017 [3] | 616 | Se = 0.90, Sp = 0.72 |

## CONCLUSIONS

According to the data analyzed in the present study, this adjuvant investigation does not bring superior benefits in the assessment of oral keratotic lesions, although this method is convenient, easy to use for patients who need long term follow-up, it requires caution because benign lesions can mimic suspicious disorders.

**Conflict of interests statement**

All the authors declare that they have no financial or other conflict of interests regarding the present study and the device involved in this article.

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