Labial mucosa evaluation in systemic sclerosis using optical coherence tomography

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Abstract: A clinical study was developed to evaluate the labial mucosa using optical coherence tomography in 33 systemic sclerosis patients and 35 healthy control. The mucosa presented statistically significant characteristics between the groups.
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1. Introduction

Systemic sclerosis (SSc) is a chronic autoimmune disorder of connective tissue characterized by fibrosis of the skin visceral organs. The extent and progression of thickening caused by cutaneous, visceral and mucosal fibrosis is a determinant parameter in the clinical characteristics and morbimortality of the disease, and the oral mucosa is also often compromised in these patients [1,2]. Thus, the early identification of this thickening is fundamental.

Optical imaging techniques have been widely employed in several medical areas and optical coherence tomography (OCT) is a promising technique for providing in vivo, noninvasive in real time diagnostics [3]. Recently, Abignano et al. were the first to demonstrate the utility of OCT in skin evaluation of SSc patients [4]. However, oral mucosa has never been evaluated in these patients. Thus, this study proposed to evaluate the labial mucosa epithelium using OCT in patients with SSc.

2. Methods

The study was carried out in accordance to the Helsinki Declaration, and approved by the Ethics Committee of Federal University of Pernambuco (protocol number 54101316.1.0000.5208). Written informed consent was obtained from each patient before participation in the study. All patients were properly informed of the nature, benefits and possible risks of the study.

An observational clinical study was developed and carried out at the Rheumatology Clinic of the Clinical Hospital, UFPE, Brazil, location where the collection of rheumatologic clinical data and imaging procedure was performed.

Thirty-three Brazilian patients with SSc (28 female; mean age 46.1 years; range 19-71yrs) were recruited. Thirty-five healthy control - HC (28 women, mean age 39.2 years; range 20-68 years) were also included as a comparator group. All of them were ≥ 18 years. All individuals selected for this study underwent a rheumatologic clinical assessment with a professional experienced in the diagnosis of SSc and then two-dimensional images were obtained of all participants by two examiners of the central region of the inferior labial mucosa (Figure 1a) with a Swept Source-OCT (SS-OCT, Thorlabs Inc., New Jersey, USA), operating at 1325 nm central wavelength.

Images have undergone computational processing to calculate optical density using Matlab program (Mathworks Inc.) and were analyzed using ImageJ (Imaging Processing and Analysis in Java, National Institutes of Health, Bethesda, MD) for measuring the thickness of the epithelium (in μm) by measured three different points (Figure 1b) and their averaged were used for later comparisons. Using the same program, each labial mucosa image had its epithelium bounded to measure the number of pixels in relation to grayscale present (Figure 1b).

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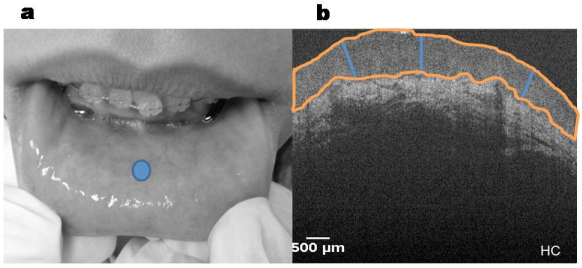

Figure 1. a) Central region of the inferior labial mucosa, where the OCT image was obtained; **b)** using Image J were made measurements (in µm) in three distinct mucosal epithelium points (blue lines) and bounded to the outer layer refers to epithelium (orange trace).

Data were tabulated in Excel (Microsoft Office 2007) and then subjected to statistical analysis employing the SYSTAT 9.0 Version Demo. A variance analysis (ANOVA) was carried out. In the event of significance by F test, then proceeded to the mean comparison tests using Tukey's test. p Value<0.05 was considered statically significant.

3. Results

In a qualitative analysis of the images obtained by the OCT in the central region of the inferior labial mucosa, the distinction between two layers representing the epithelium (hypodense) and the submucosa (hyperdense) was observed. It was also observed a difference in the total thickness of the layers of the mucosa, corresponding to the light penetration behavior, where in the healthy individuals it is deeper (Figure 2a e 2b). In the OD graphic, the intensity attenuation in the curves related to the HC was much higher than in the patients with SSc (Figure 2c).

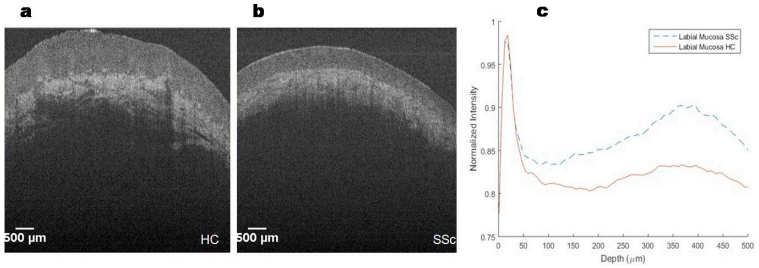

Figure 2. Qualitative analysis of the labial mucosa by OCT. a) illustrative image of the healthy control (HC); b) illustrative image of the patient with sclerosis systemic (SSc); c) graphical representation of the optical density mean in HC e SSc.

The thickness of the labial mucosa epithelium was significantly different between SSc and HC: 290.90µm and 442.63µm, respectively ($p<0.0001$). The number of pixels found in the shade 96 of the outer layer was 315.79 pixels in SSc and 576.71 pixels in HC ($p<0.0001$).

4. Discussion

The present results describe for the first time the evaluation of the oral mucosa of SSc patients through OCT. Qualitative analysis of the images from labial mucosa of the SSc patients, verified that the thickness of the layers of this mucosa is thinner than in the healthy individuals. The quantitative evaluation demonstrated that the thickness of the mucosa epithelium measured in µm as well as pixel quantification in the outer layer was lower in the SSc. Furthermore, we evaluated the level of gray tones from figure 2, and found another statistically significant difference between healthy and unhealthy patients. These aspects suggest the OCT as a potential tool for the clinical evaluation of these patients.

5. References

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