Original Article

Assessing the gustatory threshold and salivary flow rate in very early oral submucous fibrosis
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Abstract

Background: Early diagnosis of oral submucous fibrosis (OSMF) is difficult, given the insidious nature of its presentation. The earliest symptom in most cases is the burning sensation of the oral mucosa, especially to spicy food. If the burning sensation is accompanied by oral mucosal fibrosis and reduced salivary flow, it would strengthen the OSMF diagnosis, although at such a stage the disease would be considered well established and progressing. The ideal approach in treating OSMF would be to recognize and treat the disease before the mucosal fibrosis is established. The taste buds are highly sensitive to changes in their surrounding environment. Thus, we hypothesized that even at the incipient stages of OSMF, there could be taste alterations.

Aim: The aim of the study was to assess potential taste alterations in patients diagnosed with very early OSMF with a history of areca nut (AN) habit.

Materials and Methods: The study group (n = 70) consisted of patients clinicopathologically diagnosed with early OSMF with a history of AN use. The control groups (n = 30) were healthy individuals with no habit history. The patients were asked to sip and rinse four blinded solutions, each with sweet, sour, salty, and bitter flavors for 1 min each. Depending on the threshold of the taste perception, the comparison was made between the control and the OSMF patients. The flow rate was assessed by placing sterilized cotton in the patient’s mouth for 1 min. The saliva-soaked cotton was weighed, and the weight difference was taken as the salivary flow rate (SFR).

Results: There was no significant difference (P > 0.05) in the SFRs between the control (0.55 ml/min) and the very early OSMF (0.41 ml/min) patients. The gustatory threshold of very early OSMF patients also remained similar to that of the control group (P > 0.05).

Conclusion: In contrary to our hypothesis, there was no change in the gustatory threshold of the very early OSMF patients. Thus, gustation, similar to salivary flow, remains unaltered in the initial phase of OSMF and cannot be used as an early diagnostic indicator.

Keywords: Areca nut, gustatory threshold, oral submucous fibrosis, salivary flow rate

Introduction

Oral submucous fibrosis (OSMF) was first described by Schwartz in 1952 in tobacco-chewing women of Indian origin in Kenya as atrophica idiopathica based on its clinical manifestations. It was later renamed as OSMF based on its histopathological nature. It is defined aptly by Pindborg and Sirsat as a chronic insidious disease affecting the oral cavity, and sometimes, pharynx predominant in the Indian subcontinent.1-3 The disease is easy to diagnose but difficult to manage, and there are no reports suggesting its spontaneous regression.4 Among the multifactorial etiology of the disease, betel quid chewing has been recognized as one of the most important risk factors.5-9 Areca nut (AN) is commonly used worldwide as a psychoactive substance by approximately 600 million people. The arecoline and guvacoline alkaloids present in AN get hydrolyzed in the presence of lime (calcium oxide), into arecaidine and guvacine, respectively, which, in turn, induces progressive fibrotic changes culminating in OSMF.10,11 In most cases, patients present with characteristic features including intolerance to spicy food and limited tongue and oral cavity movements. An additional feature noted in OSMF is reduced salivary flow rate (SFR) which, in turn, can have a significant impact on the oro-dental health.12

Received: 10 June 2019;
Accepted: 31 August 2019
doi: 10.15713/ins.jodm.22
The limitation in using SFR changes as a diagnostic parameter in OSMF is that any significant change in SFR indicates a relatively advanced OSMF involving salivary gland tissues. Thus, a parameter which would indicate OSMF at an incipient stage before progression to oral mucosal and salivary gland fibrosis is the need of the hour. Gustatory stimuli are considered to be highly sensitive to the surrounding environment and have shown to exhibit changes in OSMF patients.\cite{13,14} Thus, we hypothesized that there could be potential changes in the gustatory threshold, even in the incipient (very early) stages of OSMF. Based on this hypothesis, the present study aimed to assess potential alteration in taste perception among OSMF patients with a history of AN use. The SFR of the patients was also recorded to indicate if the OSMF has progressed to involve the salivary gland tissue.

Materials and Methods

The study was performed on 100 individuals (70 very early OSMF patients with a history of AN chewing and 30 healthy individuals with no habit history), visiting the Department of Oral Medicine and Radiology, Dr. D.Y. Patil Dental College and Hospital, Dr. D.Y. Patil Vidyapeeth, India. Institutional ethics committee approval was obtained for the study. Informed consent was obtained from all the participants.

Control group selection criteria

Inclusion criteria
Healthy volunteers with no habit of history were included in the study.

Exclusion criteria
Patients with a history of cancer/potential malignant disorder/radiation/chemotherapy therapy, pregnant women, and patients with acute or chronic diseases of the oral mucosa or salivary glands and systemic diseases were excluded from the study.

Study group selection criteria

Inclusion criteria
Patients who were clinicopathologically diagnosed with very early OSMF and patients with a history of AN use were included in the study.

The diagnosis of very early OSMF in the present study is based on the classification given by Khanna JN and Andrade NN,\cite{15} indicating the following clinical and histopathological features.

Clinical features
The clinical features were burning sensation, acute ulceration, and recurrent stomatitis.

Histopathological features
Fine fibrillary collagen network interspersed with edema, dilated, and congested blood vessels, plump fibroblasts, and inflammatory cells predominantly neutrophils [Figure 1]. The epithelium is normal.

Exclusion criteria
Patients with OSMF showing features of dysplasia or frank malignancy, patients with a history of cancer/potentially malignant disorder other than OSMF/radiation/chemotherapy therapy; pregnant women, and patients with acute or chronic diseases of the oral mucosa or salivary glands and systemic diseases were excluded from the study.

Tasting solutions

Four different solutions for four basic tastes (sweet, salty, sour, and bitter) were prepared in five different concentrations for eliciting the gustatory stimuli. Tastant solutions included sucrose for sweet (0.01 mol/l–1 mol/l), citric acid for sour (0.01 mol/l–1 mol/l), sodium chloride for salty (0.01 mol/l–1 mol/l), and quinine hydrochloride for bitter (0.01 mol/l–1 mol/l). Whole mouth rinse test was performed with 5 ml of each solution.

Whole mouth rinse test

The patients were asked to sip, rinse for 10 s, and spit. If patients were unable to identify the taste (sweet, salty, sour, and bitter), a higher concentration of the same tastant was given. The procedure was repeated until the patients were able to identify the taste and the respective concentration was noted. After identifying the taste, the patients were asked to identify the intensity of taste as they were subjected to higher concentrations of the tastants.

SFR test

The test was performed in the morning hours between 11 am and 1 pm, 2 h after breakfast to avoid any diurnal variations. Patients were comfortably seated. Pre-weighed sterilized cotton (a) was placed in a patient’s mouth for 1 min. The moist cotton was weighed (b), and the difference in weight was taken as the SFR of the patient.

Figure 1: Histopathological presentation of very early oral submucous fibrosis. Plump fibroblast and inflammatory cells are noted in the edematous connective tissue.
### Results

Seventy patients made up the study group (54 males and 16 females). The average age was similar for both men and women (45 years). SFR showed no significant change \((P > 0.05)\) between the study \((0.41 \text{ ml/min})\) and control group \((0.55 \text{ ml/min})\). Furthermore, all the patients from the study were able to identify different tastants at a concentration of 0.01 mol/l–1 mol/l, which is in the same range as the control group [Table 1].

### Discussion

Salivary secretion involves complex integration from higher centers and their intricate responses to both parasympathetic and sympathetic stimulus.\(^{[14,17]}\) Being an easily available and a non-invasive diagnostic tool, SFR estimation is used in a wide range of diseases. Altered SFR could be associated with various pathologies including the oral, pharyngeal esophageal neoplastic diseases, metabolic, nutritional, inflammatory, genetic, autoimmune, and nervous system disorders.\(^{[18,19]}\) SFR also depends on physiological parameters including age and gender.\(^{[20,21]}\) Pharmaceutical agents such as anticholinergics, diuretics, antihistaminics, antihypertensive agents, and psychoactive substances have shown to alter SFR.\(^{[22]}\) SFR alteration in OSMF patients is a relatively common feature which is relatively well explored in the literature.\(^{[12,23-26]}\) On the contrary, very few studies have investigated gustatory changes in OSMF.\(^{[13,14]}\) Even the few studies which have reported altered taste sensation have done so in moderate to advanced OSMF. Thus, there is no evidence in the literature to indicate any potential taste alterations in the very early stages of OSMF. Some of the studies which evaluated potential gustatory alterations in OSMF cases include Deeplaxmi R et al in 2012 and Dyasanoor et al in 2016. Deeplaxmi R et al reported significant alteration with sweet taste followed by sour, bitter, and salty in OSMF patients.\(^{[11]}\) Dyasanoor et al reported significant hypoguesia to sweet and salt and dysgeusia to sour in OSMF patients.\(^{[14]}\) The decrease in SFR and hypoguesia were noted in stage II OSMF which, in turn, are relatively more advanced state than the very early OSMF patients included in the present study. The lack of any significant changes in the gustatory stimuli in the present study indicates that similar to SFR, the incipient stages of OSMF do not influence the taste perception.

### Table 1: Average threshold taste concentration of the test solution between the control and the very early oral submucous fibrosis (study) group

| Comparison groups | Average salivary flow rate | Average threshold taste concentration of the test solution |
|-------------------|---------------------------|-----------------------------------------------------|
|                   |                           | Sweet          | Salt          | Sour          | Bitter         |
| Study group       | 0.55                      | 0.01 mol/l–1 mol/l | 0.01 mol/l–1 mol/l | 0.01 mol/l–1 mol/l | 0.01 mol/l–1 mol/l |
| Control group     | 0.41                      | 0.01 mol/l–1 mol/l | 0.01 mol/l–1 mol/l | 0.01 mol/l–1 mol/l | 0.01 mol/l–1 mol/l |
| Statistical significance | >0.05                | >0.05          | >0.05         | >0.05         | >0.05          |

### Conclusion

There was no statistically significant difference in taste nor SFR between the control and the very early OSMF groups. Future studies could potentially include progressive stages of OSMF cases (very early, early, moderate, and advanced OSMF) to estimate the exact stage at which taste sensation is altered in OSMF. If taste alterations are altered at an earlier OSMF stage than SFR alterations, gustatory threshold could potentially be used as an adjunct early diagnostic tool.

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How to cite this article: Gupta AA, Reddy M, Kheur S. Assessing the gustatory threshold and salivary flow rate in very early oral submucous fibrosis. J Oral Dis Markers 2019;3:18-21.