Evaluation of Modified Taste Perception in Oral Submucous Fibrosis Patients- A Case-Control Study.

Dr. Vishal Mehrotra[1] ,Dr. Shashank Gaur [2], Dr. Kriti Garg[3] , Dr. Neha Singh[4], Dr. Shiv Kumar Singh[5] , Dr. Gauri Mishra [6] ,

[1] Professor & HOD, Department of Oral Medicine and Radiology, Rama Dental College Hospital and Research Centre, Kanpur, UP, India

[2] Professor & Head, Department of Pediatric & Preventive Dentistry, Bhabha College of Dental Sciences, Bhopal, MP India

[3]Associate Professor, Department of Oral Medicine and Radiology, Rama Dental College Hospital and Research Centre, Kanpur, UP, India

[4] Professor, Department of Pediatric & Preventive Dentistry, Bhabha College of Dental Sciences, Bhopal, MP India

[5]Assistant Professor, Department of Oral Medicine and Radiology, Maharana Pratap Dental College, Kanpur, UP, India

[6]Professor , Rajkiya Medical College,Jalaun, UP, India

Corresponding Author: Dr Vishal Mehrotra, Professor & HOD, Department of Oral Medicine and Radiology, Rama Dental College Hospital and Research Centre, Kanpur, UP, India Email: vishal4march@rediffmail.com

Abstract

Background: Taste sensation is one the most important factor which not only affects but also regulates the choice of acceptance or nonacceptance of food. Very limited research works are there based on the alteration of taste sensation in patients with Oral submucous fibrosis (OSMF). The aim of the study is to assess and compare taste perception among Oral submucous fibrosis patients and healthy controls. Material and methods: This study was conducted to analyze the taste impairment in OSMF patients by using four basic tastes: Sweet, sour, salty, and bitter, with a sample size of 60 subjects (30 patients with OSMF comprising the study group and 30 healthy controls) by making use of physiological taste stimuli tastants. Result: The results demonstrated that there was a delayed perception of sweet followed by salt, bitter, and sour in the study group as compared with the control group. Conclusion: This study proved that there are significant alterations to taste perception with the highest reported sweet taste followed by salt, bitter, and lastly sour in OSMF subjects. Thus, altered taste sensation can be stated as a subjective sign in OSMF patients

Keywords: Oral Submucous Fibrosis, Gustatory, Taste, Sensation, Premalignant

Introduction

Oral submucous fibrosis (OSMF) is one of the most primitive long-standing insidious irreparable diseases influencing humans with a complex origin.[1] OSMF was first illustrated as early as 600 BC by Sushruta and in ancient times was referred to by the name of 'VIDARI'. This premalignant condition was named as 'atropica idiopathica mucosae oris' by Schwartz in 1952 and later as 'oral submucous fibrosis' by Joshi in 1953.[2]

Later Pindborg in 1966 defined this condition as "an insidious chronic disease affecting any part of the oral cavity and sometimes pharynx. Although occasionally preceded by and/or associated with vesicle formation, it is always associated with juxtaepithelial inflammatory reaction followed by fibroelastic changes in the lamina propria, with epithelial atrophy leading to stiffness of the oral mucosa causing trismus and difficulty in eating".[3] This condition has a high prevalence rate in Asian countries namely India, China etc. OSMF in India has a prevalence rate of 0.2- 1.2% and is commonly encountered in young male adults in the age group of 20- 35yrs. [2,4]

OSMF has an intricate etiology with areca nut being the key etiological agent as this is rich in alkaloids, flavonoids, and other trace elements like copper leading to fibrosis. This blanching and fibrosis of the oral mucosa may lead to a burning sensation on consuming hot and spicy food, impaired mastication, speech ability and difficulty in swallowing and pain in throat and ears and loss of gestation.[5,6]

Numerous taste buds situated over the dorsum of the tongue, larynx, and esophagus are responsible for taste perception which may also have an influence on food intake. Once the food is ingested the various gustatory receptors present in the taste buds send sensory signals to the brain which further separates, assesses, and differentiates the stimuli, giving rise to an experience defined as "flavor."

Humans have the ability to differentiate a total of five tastes namely sweet, sour, salt, bitter, and umami (savory). Any adverse effect on the taste qualities may result in an alteration in food preferences and also may significantly have an ill effect on the appetite. Thus, gustatory changes in OSMF patients should be a center of attention during the treatment of this potentially malignant condition as this may definitely play a vital role in the improvement of their nutritive status and also the effectiveness of the therapeutics. As taste perception affects nutrition which in succession affects the immune system, which favors the transformation of premalignant disorders to oral cancer, importance, and preference should be given to research based on the importance of taste dysfunction and its role in OSMF.[7,8]

In the literature, the various signs and symptoms associated with OSMF are well described and various studies have been reported on its significance on human health but the adverse effect of OSMF on gustatory reflex has not been given much importance[4]. Thus, gustatory dysfunction should not only be recognized in OSMF patients but should also be compared with the underlying disease severity because a proper gustatory function plays a key role in maintaining a healthier quality of life. Thus, this study was carried out on taste impairment by using liquid tastant for four basic tastes: Sweet, salty, sour, and bitter. The study was accomplished using whole-mouth rinse and spatial or localized tests .The aim of this study was to assess the gustatory functions in clinically diagnosed OSMF subjects and to compare with the control group comprising normal healthy adults.

Subjects and Methods

This present study was carried out on 60 male subjects in the age group ranging from 20 to 50 years. All the subjects were randomly selected from the Department of Oral Medicine and

Radiology, after obtaining the ethical clearance from the institutional ethical committee informed consent was taken from all the study subjects that were included in the study and served as both cases and controls.

The subjects were divided into a study group (n = 30) with clinically diagnosed OSMF (stage II,III) patients with a given history of chronic chewing of areca nut with tobacco for at least minimum of 5 years of duration and a control group (n = 30) with healthy individuals of the same age and gender devoid of any systemic illness, without any deleterious habit such as chewing tobacco, areca nut, or gutkha. The exclusion criteria for the present study consisted of patients suffering from various systemic illnesses such as diabetes mellitus, hypertension and, peripheral neuropathies.

The gustatory testing for assessing the four different tastes namely sweet, salty, sour, and bitter was carried out by formulating four different freshly prepared solutions in three varied concentrations namely low, medium, and high. These include sucrose for sweet (0.1-1.0 mol/l), citric acid for sour (0.320-0.032 mol/l), quinine hydrochloride for bitter (0.01-1.0 mol/l), sodium chloride for salty (0.01-1.0 mol/l) were used. Once the solutions are freshly prepared this is followed by performing two distinct tests on both study groups and controls namely spatial or localized, and whole-mouth rinse tests.

The spatial/localized testing was carried out by directly applying four different tastants (using cotton swabs) in three progressively increasing concentrations over the numerous taste buds situated on the dorsum of the tongue, approximately for 5 seconds, and the taste intensity response score was recorded.

For the whole-mouth rinse test: Three sets of different concentrations (5 ml each) of the same tastant were prepared and each taste solution was randomly arranged with two cups of 5 ml of distilled water. The subjects were asked to sip and rinse for 10 seconds and then to spit it, followed by identification of different tastants and recording of the taste intensity. Depending upon the ability of the subjects to identify the taste and if the study subjects fail to identify the taste, next higher concentration of the taste solution was given to the study subjects. A similar procedure will be accomplished for all four taste (tastants) in every subject which will be followed by distilled water rinsing which will be done for each different taste solution. Once the spatial and whole mouth rinsing is over for all the types of tastants, scoring will be noted which will be based upon 'low concentration' as 1 to 3, 'medium concentration' as 4 to 6, and 'high concentration' as 7 to 9. The data obtained were then tabulated and analyzed by unpaired t-test. $p < 0.05$ was considered statistically significant.

Results

In this study, 60 male subjects in the age range of 20 to 50 years with a mean age of 30 years were present. After analyzing the response of the patients to different taste perceptions the results demonstrated that there was a delayed perception of sweet followed by salt, bitter, and sour in the study group as compared with the control. It was also noted that altered taste perception was increasing with the severity of OSMF. Table 1 indicates the data of significant differences between the study and control groups. Table 2 shows study group results with different concentrations.

In this study, all OSMF patients showed marked early response to sour taste followed by bitter, salt, and sweet with both spatial as well as whole-mouth rinse tests. In 10 of the subjects, delayed response to sweet taste was observed followed by 8 in salt, 4 in bitter and lastly, the least decline in sensitivity to sour taste was recorded in 2 subjects sour taste.

Discussion:

Taste is one of the five senses, which helps us to perceive different flavors from substances that we consume either as food or drink through the mechanism of chemoreception. In OSMF along with other signs and symptoms, fibrosis of submucosa causes atrophy of superficial epithelium which involves taste cells leading to impaired taste sensation which is one of the subjective symptoms of this disease. [9,10]

Experimental evidence suggests that each neurologically distinct component of the gustatory system responds independently to each of the four taste stimuli and the inability to detect or recognize a particular taste might represent different pathologic states. It has also been observed that some patients may occasionally perceive their inability to taste one quality without loss of sensation for the other three; these symptoms are seldom established by demonstration of specific taste loss. Likewise, few reports confirm the loss of specific taste as a manifestation of a particular pathologic state. [11]

Gustometry or measuring the taste sensation objectively employs two examination processes- Electrogustometry and application of taste substances on the dorsal surface of the tongue which merely application of low-level electric current to compute the nerve excitability. [12]

Electrogustometry is characterized by the application of low-level electric current to measure nerve excitability and is a method specifically helpful in estimating the efficiency of sensory pathways.[12,13] Taste strips that contain taste molecules play a vital role in evaluating taste. To avoid the limitations like faulty taste perception, we utilized physiological stimuli in the form of chemical solutions to assess the presence of taste impairment. The tastants were freshly prepared at standard concentrations as sodium chloride for salt (0.01-1.0mol/l), sucrose for sweet (0.1-1.0mol/l), citric acid for sour (0.320- 0.032mol/l) and quinine hydrochloride for bitter (0.01-1.0mol/l) and the sample size consisted of 30 OSMF patients and 30 controls. Response to the tastants in all the study subjects was recorded by a single investigator. A similar method to estimate gustatory dysfunction was also employed by Prasad B et al in their study on 60 OSMF patients and 30 controls. [1]

Previous studies conducted by Soni et al. and Chaturvedi et al. have utilized electrogustometry for assessing taste in OSMF patients. [4,14] Results from their study revealed that 46% of cases showed taste sensation impairment. On the contrary in our study we employed different concentrations of the tastants and about 50% of OSMF cases reported taste impairment.

By and large, it is believed that taste sensitivity decreases as the age advances and mostly occurs after the age of 60 years. Study conducted by Mojet et al. and Pinjelet al. describes that gustatory changes can occur as an aging process as well. [15,16] A few other systemic diseases can also cause loss of taste perception most commonly diabetes mellitus. A study done by Govindkar et al.concluded that sweet taste perception gets impaired in diabetes patients in relation to blood glucose levels. Considering the above facts, the subjects of this study were confined to an age group from 20 to 60 years and free from systemic diseases. [17]

Out of various studies mentioned in the literature, in the studies conducted by Dyasanoor et al. and Deeplaxmi et al. who compared both 45 OSMF patients with normal subjects reached the conclusion that sensitivity to salt taste was reduced among OSMF individuals as the disease progressed to advanced stage followed by sweet taste, sour taste and bitter taste. [18,19] According to a study conducted by Nishat et al. [20] among OSMF and areca nut chewers, there was significant decrease in sensitivity for salt taste followed by sour taste, sweet taste and lastly bitter taste. In the present study the highest delayed response was observed in sweet taste followed by salt, bitter and least in sour taste.

The results obtained from the study conducted by Deeplakhmi et al. showed delayed perception with sweet followed by salt, bitter, and sour in OSMF subjects. This finding is consistent with our study where we recorded the highest delayed perception of sweet followed by salt, bitter, and sour. [19] The taste receptor cell found on the taste buds are found in the oral cavity including the tongue, throat, larynx, and esophagus. [21] Taste dysfunction may result from underlying inflammation and infection in the oral cavity that reduces blood flow to the tongue and interferes with saliva production[22] and leads to injury to the cell receptors or atrophy of taste buds. In this study, the alteration in the taste perception with the severity of OSMF showed a significant difference, this might be due to the reason that OSMF inflammation and atrophy increase as the stages advance. [22]

Conclusion:

The results from the present study reflect a significant difference between the study and control group for taste impairment, thus establishing an, 'altered taste perception' as a subjective sign of OSMF. The ease of handling the procedure, cost-effectiveness, and self-made solutions make this study recommendable for clinical assessment of taste perception in OSMF patients.

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Tables

Taste	Groups	Mean	SD	t-value	p-value
Sweet	Study group	8.01	0.92	7.10	<0.01
	Control group	8.99	0.38		
Salt	Study group	8.12	0.94	6.12	<0.001
	Control group	8.98	0.37		
Sour	Study group	7.98	1.14	3.01	<0.01
	Control group	8.99	0.98		
Bitter	Study group	7.47	1.24	3.04	<0.01
	Control group	8.22	0.78		

Table1: Estimation of the “t” and “p” values in the study and control groups

Case	Age	Gender	OSMF staging	T1-Sweet			T2-Salt			T3-Sour			T4-Bitter		
				C1	C2	C3	C1	C2	C3	C1	C2	C3	C1	C2	C3
1.	20	Male	II	1	0	0	1	0	0	1	0	0	1	0	0
2.	25	Male	II	1	0	0	1	0	0	1	0	0	1	0	0
3.	28	Male	II	1	0	0	1	0	0	1	0	0	1	0	0
4.	29	Male	II	1	0	0	2	1	0	2	1	0	1	0	0
5.	27	Male	II	2	1	0	1	0	1	1	0	0	1	0	0
6.	28	Male	III	2	1	0	1	0	0	1	0	0	1	0	0
7.	28	Male	II	1	0	0	1	0	0	1	0	0	1	0	0
8.	30	Male	II	1	0	0	1	0	0	1	0	0	1	0	0
9.	30	Male	II	1	0	0	1	0	0	1	0	0	1	0	0
10.	32	Male	II	1	0	0	2	0	0	1	0	0	1	0	0
11.	32	Male	II	2	2	1	2	0	0	1	0	0	1	0	0
12.	31	Male	III	2	0	0	2	0	0	1	0	0	1	0	0
13.	35	Male	II	1	0	0	2	0	0	1	0	0	1	0	0
14.	37	Male	II	1	0	0	1	0	0	2	1	0	2	1	0
15.	34	Male	II	1	0	0	1	0	0	1	0	0	1	0	0
16.	36	Male	III	2	1	0	1	0	0	1	0	0	1	0	0
17.	43	Male	III	2	2	1	1	0	0	1	0	0	1	0	0
18.	43	Male	III	2	2	1	2	0	0	1	0	0	1	0	0

19.	40	Male	III	2	1	0	1	0	0	1	0	0	1	0	0
20.	41	Male	II	1	0	0	1	0	0	1	0	0	1	0	0
21.	46	Male	II	1	0	0	1	0	0	1	0	0	1	0	0
22.	50	Male	II	1	0	0	1	0	0	1	0	0	1	0	0
23.	50	Male	II	1	0	0	1	0	0	1	0	0	1	0	0
24.	51	Male	II	1	0	0	1	0	0	1	0	0	1	0	0
25.	56	Male	II	1	0	0	1	0	0	1	0	0	1	0	0
26.	56	Male	II	2	2	1	2	0	0	1	0	0	2	1	0
27.	50	Male	III	2	2	1	2	0	0	1	0	0	2	1	0
28.	60	Male	III	2	2	1	1	0	0	1	0	0	2	1	0
29.	22	Male	II	1	0	0	1	0	0	1	0	0	1	0	0
30.	24	Male	II	1	0	0	1	0	0	1	0	0	1	0	0

Table 2: Study group results with different concentration

1: Present; 2: Absent; 0: Not required to perform test because results obtained with previous test; C1: Low concentration; C2: Medium concentration; C3: High concentration