Assessment of Salivary Flow Rate and Carbon Monoxide Level among Smokers, Tobacco Chewers and Control Group

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Abstract

Aim: To assess salivary flow rate and carbon monoxide level among smokers, tobacco chewers and control group.

Methodology: The study has total of 45 subjects, which were divided into 3 groups and 15 subjects in each. Group A- smokers' group, Group B- chewers' group, Group C-control group. Unstimulated whole saliva was measured by performing modified Schirmer tear strip test(MST). Smokerlyzer used for measuring CO levels from exhaled breath.

Result: On analysing the data of SFR between smokers, chewer's and control group, there was statistically significant result at p value of 0.05 between all groups. On evaluating the co level in smoking group 53.3% presented with higher CO level and 60% chewers presented with lower CO level. In control group 100% were under no risk.

Conclusion: The salivary flow rate is reduced in tobacco users in either form. Since smoking group is at higher risk monitoring of carbon monoxide level can be used as the important tool in motivating the tobacco users to quit the habit.

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Keywords: *Smoker's, Tobacco chewer's, Salivary flow rate, Xerostomia, Premalignancy, Carbonmonoxide level*

Introduction

Tobacco consumption is a problem which is seen universally and tobacco is consumed in various forms such as smoking, chewing, snuffing and dipping. Many life threatening medical complications and health issues are caused by using tobacco for a long time period [1]. Tobacco chewing habit and premalignant lesions such as oral sub mucous fibrosis are said to have strong relation [2]. Both systematic and localized ill effects are created by using tobacco [3]. Saliva is the first victim to encounter the ill effects caused by the toxic chemicals present in the tobacco [4, 5]. Measuring of salivary flow rate (SFR) is done on stimulates and unstimulated saliva.

SFR for unstimulated saliva is 0.3ml/ minute and stimulated SFR is 1.5 to 2.0 ml/minute [6]. Earlier in 18th century it was discovered that salivary gland activity

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is increased in smoking. But the observation was that only during the initial stages of smoking habit people had increased salivary gland activity. [7]. Long term use of tobacco causes alteration in the taste receptors function leading to decrease in salivary reflux. Main content of tobacco is nicotine which acts on cholinergic receptors of brain causing decrease in salivary secretion. [8]. This decrease in salivary flow leads to disorders such as dysgeusia, pain and burning mouth, dental caries and other oral infectious diseases. [9]. During smoking carbon monoxide (CO) enters the blood circulation from cigarette smoke and forms carboxyhaemoglobin (COHb).Elimination of CO occurs primarily through respiration and a strong correlation exists between CObreath and COHb[10, 11, 12] enabling it to be used as a important tool for assessing smoking status.

This study is conducted to assess salivary flow rate in different groups with many parameters along with assessment of carbon monoxide level in smokers and tobacco chewers.

Materials and Methodology

The study participants are the patients reported to department of oral medicine and radiology of a private dental college in Chennai. The subjects were explained about the purpose and procedure of this study and consent was obtained. The demographic details with history of smoking and chewing habit were also collected from the subjects. Ethical clearance was obtained from the institutional ethical committee.

Inclusion criteria include subjects of age above 18 years and who has a habit of smoking, chewing for at least 6 months and the subjects who do not have any systemic disease.

Exclusion criteria include subjects below 18 years of age, subjects with systemic diseases, salivary gland disease, the patients under radiotherapy and the patients who had quit their habit.

The study has total of 45 subjects, which were divided into 3 groups (A, B, and C) and 15 subjects in each.

Group A- subjects who have smoking habit only (smokers group),

Group B- subject who have chewing habit only (chewers group)

Group C- subject who are healthy and without smoking or chewing habit (control group).

Assessment of Salivary Flow Rate.

Unstimulated whole saliva was measured by performing modified Schirmer tear strip test(MST). Before performing the test, the participants were asked to sit upright in dental chair and relax. The subject were then asked to swallow the salivary secretion in the mouth and told not to swallow during the test. Also the subject was asked to elevate the tongue during the procedure and were retracted gently to avoid inappropriate wetting of test strips. With the help of the cotton plier the test strip is held vertically and the rounded end place in the floor of the mouth either side of lingual frenum. According to the length of the wetting, the reading were noted at 5 minutes. Inference: reading 1 to 5mm/ 5minutes was taken as severe, 6 to 10mm/ 5minutes as moderate, and above 10mm to 24mm/ 5minutes as mild, 25mm to 30mm/5mm as normal.

Assessment of Xerostomia: This was done using a questionnaire which is modified from Fox et al. (1987), and Pai et al. (2001), questionnaire [13, 14]. [Table.1]

TABLE- 1 Modified questionnaire of assessment of xerostomia.

1.	**Do you feel your mouth dry?**	**Mild xerostomia**
2.	Do you sip liquids to aid in swallowing dry food?	
3.	Do you feel thirsty very frequently?	Moderate xerostomia
4.	Do you have difficulties swallowing any food?	
5.	Does your mouth feels dry throughout the day?	Severe xerostomia
6.	Do you chew gums/hard candies/minutest daily to relieve oral dryness	

Based on the severity of the symptoms, subjects were classified as mild, moderate and severe xerostomia.

Assessment of Co Level:

CO levels were monitored by breath carbon monoxide monitor which is product of BEDFONT scientific Ltd. Approved by ISO13485 medical devices quality management. Smokerlyzer used for measuring CO levels from exhaled breath according to manufacturer direction. It was an immediate, non-invasive and well established used to clarify from smokers to non-smokers. The smokerlyzer were placed in the patients mouth. The patient is asked to exhale into the smokerlyzer for 15seconds without pausing, inhalation and in a uniform place. Two readings were recorded in 10 minutes time interval. The highest of these 2 CO levels and carboxyhaemoglobin percentage obtained were recorded. Inference 0-1(reading:01-06ppm) no risk,1.1-3(reading:07-10ppm) lower risk, >3(reading:11-30ppm) high risk.

Statistical Analysis

Data was analysed using the statistical package for social service (spss) software, using student t-test, chi-square test ANOVA. These were applied to assess between the group differences. P-value of less than 0.05 was considered as statistically significant. Significance level of 0.05 and confidence level of 95% was considered.

Results

The study included forty five subjects. On analysing the given data among smoker group the mean age was 37.8±16.88 (mean ± SD) having predominant male population (100%). In chewers group the mean age was 37.8±16.88 (mean ± SD) with 87% of male and 13% of female population. The mean age of control group was 36.13 ± 11.69 (mean ± SD) with 53.3% of males and 46.6% of the female population. In age distribution the P-value is 0.4784 which is not statistically significant at $p < 0.05$ but in gender distribution p-value is 0.13124 which is significant at $p<0.05$.[Table.2]

Table.2. Gender Distribution.

GENDER	smoking	Chewing	control	Row Totals
MALE	15 (12.00) [0.75]	13 (12.00) [0.08]	8 (12.00) [1.33]	36
FEMALE	0 (0.00) [0.00]	2 (2.20) [0.42]	7 (4.00) [4.00]	9
Column	15	15	15	45 (Grand Total)
The chi-square statistic is 8.6667. The p-value is .013124. The result is significant at p < .05.				

On analysing various parameters like frequency, duration and quantity of tobacco consumption between the smokers and chewers group, there was no significance in frequency and duration but a significance at $p<0.05$ in the quantity of tobacco consumption (1 - 5 packets/day) in smokers as 46.6% , and in chewers 87% was obtained.[Fig.1]

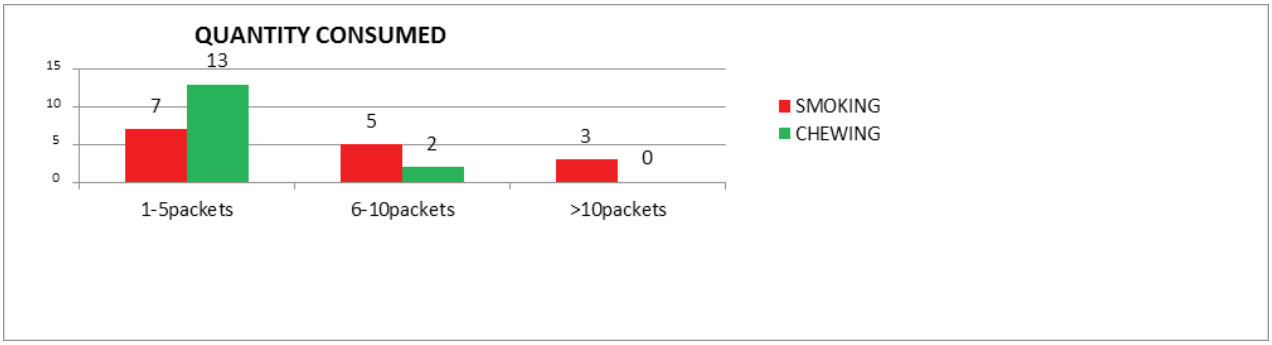

Figure.1- QUANTITY CONSUMED

On evaluating the oral mucosal lesions both the smokers and chewers group presented with 86.6% where as in control only 7%. The p value is 0.00001. Indicating significance at $p<0.05$ for oral lesions among smokers, chewers and control.[Fig.2.]

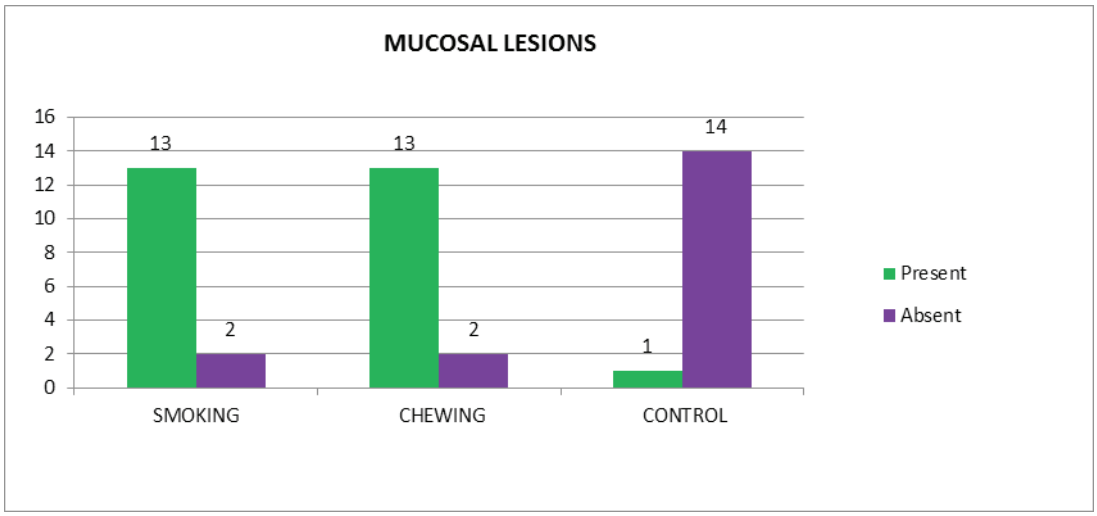

Figure.2-MUCOSAL LESIONS

Both smokers and chewer's presented with 20% of premalignant lesions where as none was in control group. The p value is 0.04908 which is significant at $p<0.05$.

On evaluating periodontal lesions among the 3 groups: 26.66% of smokers and 40% of chewers and 33.3% in control presented with the lesion with a P value of 0.7408, there was no significance at $p<0.05$.

Likewise on evaluating the dental caries there was no significance, 53.3% in smokers group, 80% in chewers group and 86.6% in control group presented with dental caries with a p value of (0.7408).

On analysing the data of SFR between smokers and control group using student t test the mean value was -3.600 with the p value of 0.003 [Table.3]. Likewise the mean value was -2.533 between chewers and control with p value of 0.012 [Table.4.]. There was statistically significant result at p value of 0.05 between smokers and control group, and chewers and control group.

Table.3. SFR between smokers and control group

Mean	SD	Std. Error Mean	95%ConfidenCe Interval of the Difference			Df	p-value
			Lower	Upper			
-3.600	3.961	1.023	-5.793	-1.407	-3.520	14	.003

Table.4. SFR between chewers and control group

Mean	SD	Std. Error Mean	95%ConfidenCe Interval of the Difference		T	Df	p-value
			Lower	Upper			
-2.533	3.420	.883	-4.427	-.639	-2.869	14	.012

Xerostomia:

On analysing the data for xerostomia between smokers and control the mean value was 0.267 with the p value of 0.484. Likewise the mean value between chewers group and control is 0.133 with the p value of 0.653. There was a statistically significant difference between smokers and control group. But no significance between chewers and control group.

CO Level:

On evaluating the co level the smoking group (53.3%)presented with higher CO level (high risk) In chewers (60%) presented with lower CO level(lower risk). The control group (100%) were at no risk. [fig.3.]

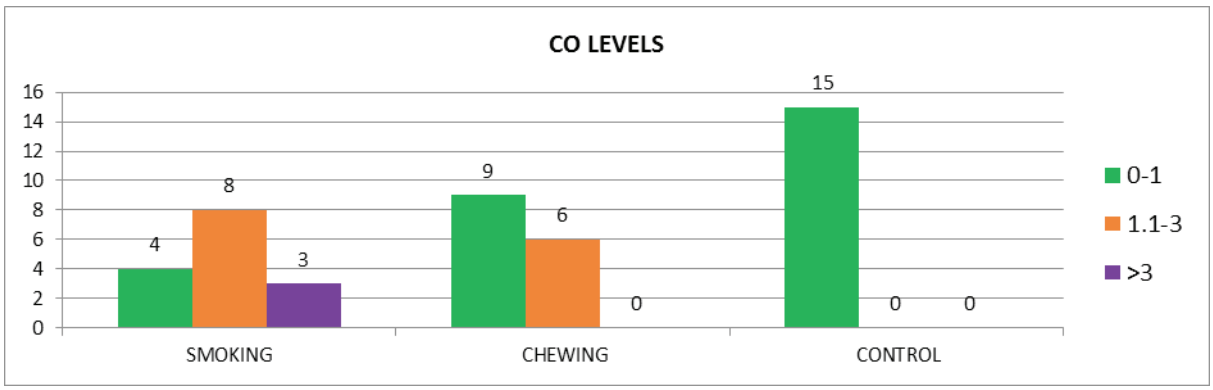

Figure.3-CO LEVEL

Discussion

In maintaining the oral environment saliva has a important role [15]. Taking this into account the alterations in salivary flow rate either qualitatively or quantitatively may lead to local adverse effects such as dental caries, oral mucositis, oral infections, chewing disorders, or extra oral adverse effects like dysphagia, halitosis, weight loss [16,17,18]. Measurement of salivary secretion can be done through various methods such as unstimulated whole saliva and stimulated saliva. Unstimulated whole saliva reflects basal salivary flow rate, it is present in our mouth for 14 hours and provides protection to the oral tissues while stimulated saliva is present during food intake and for 2 hours [19]. In our study, we have chosen to measure unstimulated saliva, as it is easy, non-invasive and comfortable procedure for the patients.

Tobacco both in smoked and smokeless form contains many toxic compositions which causes changes functionally and structurally in saliva [20].

In the present study SFR was reduced in smokers and chewrer's group when compared with the control. This finding is in accordance with the study conducted by Rooban et al[21](2006) and Alpana Kanwar et al[22] (2013) on long term effects of tobacco on resting whole

mouth salivary flow where there was a significant difference between two groups of smoked and smokeless tobacco. This might be due to effects of nicotine REF 8Other factors that influence salivary flow rate are gender and smoking status, women show lower salivary flow rate[23, 24, 25]. The relation between salivary secretion and smoking is controversial, as normal secretion and presence of hyposalivation have both been reported [26, 27, 28, 29, 30].

In the present study xerostomia was observed in smokers but not in chewers and control group. This is in accordance with the study conducted by Maryam Rod et al [5] in which smokers had reduced salivary flow rate and xerostomia.

Oral mucosal lesions were seen in both smoker's and chewer's at 86.6% where as only 7% in control. This shows that the habit of using tobacco has a higher chance of oral mucosal lesions. According to the study conducted by Sujatha et al(2012)[31] detectable mucosal changes were seen in 38.2% of patients who used smoked form of tobacco when compared with smokeless tobacco users no changes were seen in 43.3%. There was a significant correlation of occurrence of lesions with the duration of habit. In contrast in the present study frequency and duration did not have any significance and only quantity of tobacco consumed add a significant value for 5 packets per day in both smokers and chewers group. Dose response relationship is important because it gives a evidence for educating tobacco users about the ill effects of such habits and to reduce the quantity or completely stop such habits [31].

In a study conducted by C H-Lee(2003) et al [32] risk of premalignant lesions was seen in non-smokers who had the habit of chewing quid without tobacco when compared with those who used tobacco. Likewise in our study both the smokers and chewers presented with premalignant lesions and none was presented in control group.This shows that tobacco is the important risk factor in causing premalignant lesions.

In our study there was no significance for both the periodontal lesions and dental caries among the 3 groups but comparatively chewer's group had a slight predominance for both the conditions. This is in accordance with the study conducted by Offenbatcher et al (1985) [33] where using smokeless tobacco was a risk factor for the prevalence of gingival pathology and dental caries. In a study conducted by Sandberg et al (2011) [34] on assessing carbon monoxide level smokers group were at the higher risk group than non-smokers. Likewise in the present study smokers were at a high risk and this shows that breath carbon monoxide level assessing tool can be used to motivate the smoker's and help to quit the habit.

Conclusion

From the present study we can conclude that the salivary flow rate is reduced in tobacco users in either forms smoke and smokeless along with smoker's being at a higher risk for carbon monoxide level .It is also found that using tobacco makes oral mucosa vulnerable to many oral mucosal and dental diseases. Breath carbon monoxide level monitor can be used as an important tool in motivating the tobacco users to quit the habit as it is easy and non invasive.Since this is a preliminary study in which the sample size is small with multiple factors in future it can be carried on a larger sample.

Conflict of Interest: Nil.

Source of Funding: Nil

Ethical Clearance: Obtained.

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