

Salivary parameters altered in smokers and possible correlations with the cariogenic activity

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ABSTRACT

Objectives. Our research team aimed to evaluate the effects smoking has on several salivary parameters and to assess if there are any correlations between smoking and the cariogenic activity.

Material and method. The present research included a total of 35 participants. Saliva was collected from every participant to the study. Salivary chloride, calcium and potassium levels, as well as salivary flux and pH were determined for all subjects.

Results. Our results showed significantly lower salivary flux and pH levels in smokers compared to non-smokers ($p < 0.01$). Chloride, calcium and potassium we found to have higher concentrations in smokers compared to the control group. However, a statistical significance could be found only for calcium ($p = 0.02$). Moreover, we were able to find in the smokers group a positive correlation in smokers between salivary chloride levels and cariogenic activity as well as a negative correlation could be found in smokers between salivary calcium levels and the cariogenic activity

Conclusions. The results of the present study show that smoking alters salivary parameters and that these modifications can favour the development of dental caries.

Keywords: smoking, saliva, dental caries

INTRODUCTION

Smoking has been identified as an important risk factor for systemic diseases such as lung cancer and cardiovascular diseases. However,

this vicious habit also affects oral health, increasing the risk for the development of disorders associated with xerostomia, teeth staining and oral cancers (1-3). Moreover, smoking promotes the development and progression of per-

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iodontal disease, resulting in attachment loss, mobility and graduate loss of the teeth (4).

Saliva covers the oral mucosa, therefore this fluid will be the first to interact with the negative effects that smoking has. Cigarette smoke contains over 4,000 chemical components of which 300 have carcinogenic potential (5). Saliva is a complex biological fluid with numerous roles and it offers protection against bacterial, fungal and viral infections (6). The qualities that saliva possesses have led to its use as a diagnosis and monitoring fluid for a large range of oral and systemic diseases.

Meanwhile, dental caries represent the most frequent oral pathology and affect people of all ages. This destructive process is produced by the imbalance between demineralization and mineralization. Left untreated, in time, dental caries lead to edentation, thus affecting both functionality and the esthetics and in the end the quality of life.

Taking this information into consideration, our research team aimed to evaluate the effects smoking has on several salivary parameters and to assess if there are any correlations between smoking and the cariogenic activity.

MATERIAL AND METHOD

Our study included a total of 35 participants. The first group consisted of 20 clinically and biologically subjects that smoke. The mean age for this group was of 35.05 ± 12.59 years. The second group acted as a control group and consisted of 15 clinically and biologically healthy subjects that were nonsmokers. The mean age for the control group was 33.87 ± 12.68 years.

Saliva was collected from every participant to the study between 8.30 and 9.30 in the morning. The subjects were asked to refrain from physical effort prior to the collection. Also, they were required not to eat for 12 hours before the collection and to avoid drug administration 24 hours preceding the sampling, excepting patients with mandatory medication. 30 minutes prior to the collection, patients were asked to rinse their mouths with distilled water. The samples were collected in graduated sterile tubes. The first 3 ml were thrown away. If the volume was smaller than 3 ml, sample collection was repeated 2 or even 3 times, after 10 minutes breaks. All the subjects were relaxed and requested not to swallow during collection. Immediately after the samples were obtained, the tubes were placed in ice recipients. Saliva sam-

ples were centrifuged for 20 minutes at 6,000 rotations/minute.

Salivary chloride, calcium and potassium levels, as well as salivary flux and pH were determined for all subjects. Ionic concentrations were determined using dry chemistry analyzers (VITROS 750XRC).

Results were expressed as mean \pm standard deviation (SD) for each lot. Statistical analysis was performed using Student t-test. A p -value < 0.05 was considered statistically significant, while p -values < 0.01 were considered to have high statistical significance. Correlations were established using the CORREL test.

RESULTS AND DISCUSSIONS

Our results showed significantly lower salivary flux levels in smokers compared to nonsmokers ($p < 0.01$). The mean salivary flux for smokers was 0.58 ± 0.17 ml/min, while nonsmokers had a mean of 0.83 ± 0.22 ml/min (Fig. 1). No subject included in the study presented xerostomia.



FIGURE 1. Salivary flux levels for the participants to the study

A decreased salivary flux can create a good environment for dental caries development and also cause discomfort, salivary flux alterations affecting not only the teeth, but the oral soft tissues and life quality as well (7,8). The data available from previous studies shows contradictory results. Khan et al. have found that long term smoking does not affect salivary rate, while Iida et al. reported a stimulation of the salivary flux during smoking (9,10). On the other hand, Rad et al. have found a significantly lower salivary flux in smokers versus nonsmokers (1).

The results of our study showed that salivary pH varies proportionally with the flux, similar

information being reported by Wu et al. (11). Salivary pH had a mean value of 6.58 ± 0.59 in smokers. At the same time, the mean salivary pH for nonsmokers was of 6.97 ± 0.74 (Fig. 2). Similar results were reported by Grover et al. (12).



FIGURE 2. Salivary pH levels in the 2 groups

Regarding the connection between smoking and cariogenic activity, our results displayed no correlation between salivary flux or pH and the cariogenic index. However, a significant correlation was found between cariogenic activity and salivary pH in nonsmokers ($p=0.01$) (Fig. 3).

Saliva provides protection against dental caries development by mechanical removal of the remaining food, tampon systems, but also through some on its anorganic components, such as calcium (13). Our research also showed that smokers display modifications regarding the salivary levels of some of the most important electrolytes. Chloride, calcium and potassi-

um we found to have higher concentrations in smokers compared to the control group. However, a statistical significance could be found only for calcium ($p = 0.02$).

Unstimulated total saliva presents a salivary chloride level of 24 mmols/l (14). Salivary concentrations for chloride in the 2 groups included in the present study were increased compared to this mean value reported by previous research (40.21 ± 14.35 mmol/l for nonsmokers and 43.88 ± 15.70 mmol/l for smokers). Thus, although salivary chloride levels were increased compared to the controls, no statistical significance could be found ($p = 0.25$) (Fig. 4).

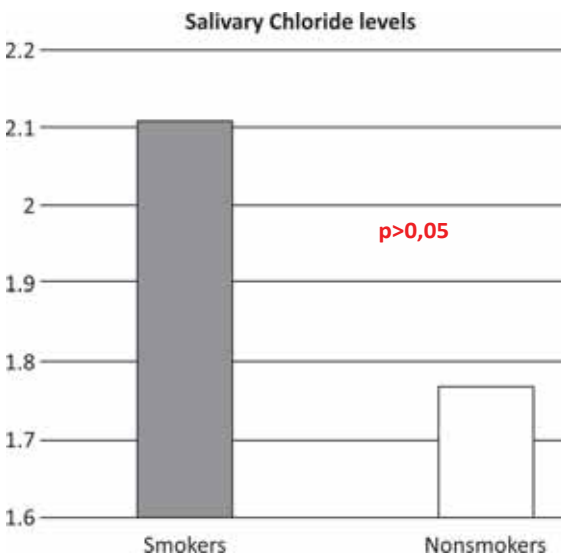


FIGURE 4. Salivary Chloride levels for smokers and nonsmokers

Moreover, a positive correlation could be found in smokers between salivary chloride levels and cariogenic activity ($p = 0.01$) (Fig. 5).

Mean salivary calcium levels are reported to be of 5.41 mg/dl in unstimulated total saliva (14). Our results displayed higher levels for sali-

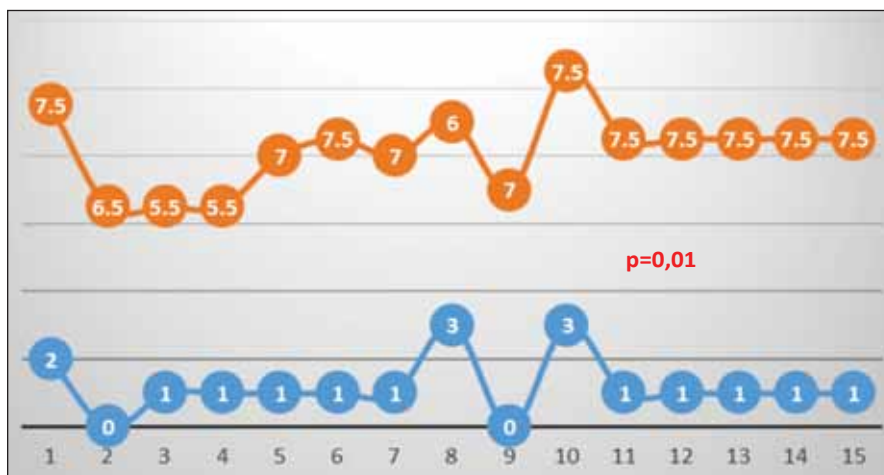


FIGURE 3. Correlation between salivary pH and cariogenic index in nonsmokers

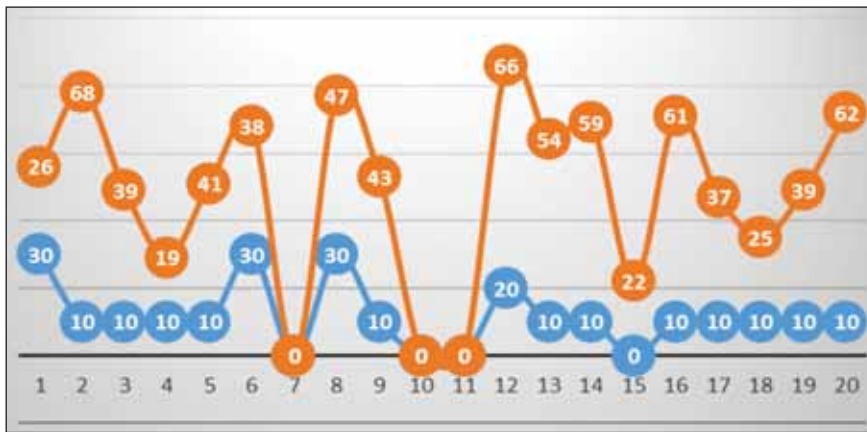


FIGURE 5. Correlation between salivary chloride levels and the cariogenic index (cariogenic index in blue and chloride levels in orange)

vary calcium in the smokers group compared to the nonsmokers (2.11 ± 0.51 mg/dl versus 1.77 ± 0.32 mg/dl, $p < 0.05$) (Fig. 6). Similar results were found by Khan et al. and Basic et al. (15,16).

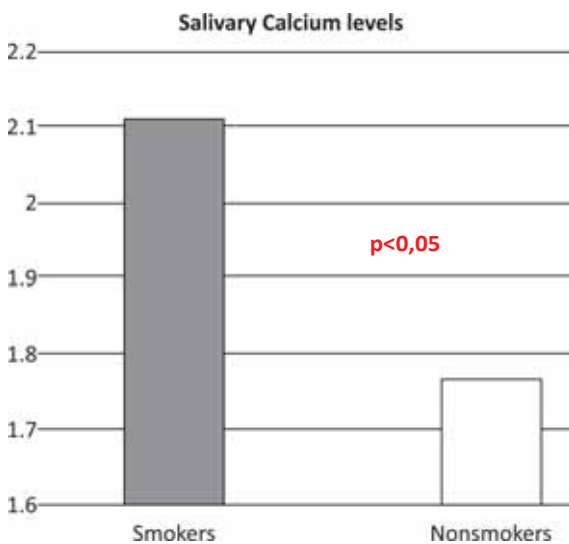


FIGURE 6. Salivary calcium levels in the two groups included in the study

In addition, a negative correlation could be found in smokers between salivary calcium levels and the cariogenic activity (Fig. 7).

This negative correlation was previously found in other studies that suggested that an increased salivary calcium levels is correlated to a higher number of healthy teeth, without dental caries (12,17,18), with this salivary component not only preventing demineralization, but also helping remineralize new lesions (17).

Salivary potassium levels are higher than plasmatic concentrations. Unstimulated total saliva has a mean potassium level of 21 mmols/l (14). Thus, the smokers included in our study had increased salivary levels for potassium compared to this data, the mean salivary K^+ concentration being 23.63 ± 7.66 mmol/l. These levels were found to be higher compared with the control group as well, the nonsmokers having a mean salivary potassium level of 20.79 ± 7.19 mmols/l. No statistical significance could be found however ($p = 0.20$) (Fig. 8). Meanwhile,

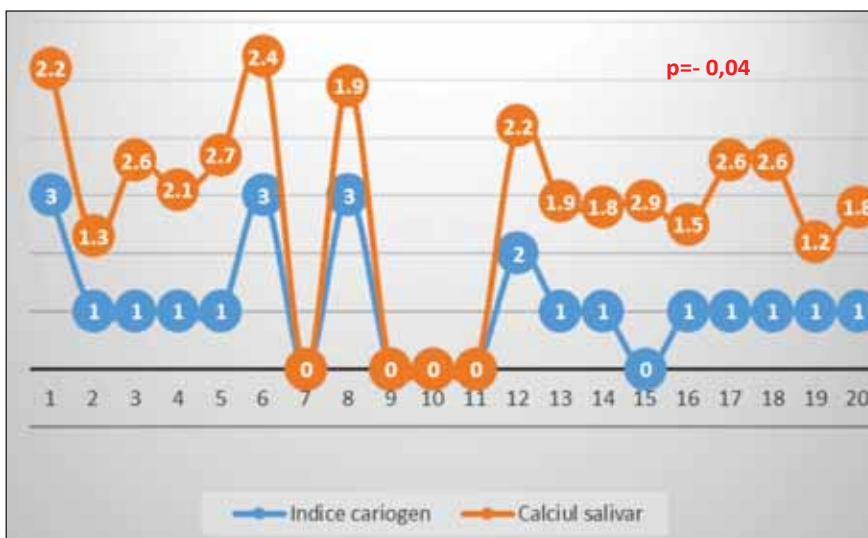


FIGURE 7. Correlation between salivary calcium levels and cariogenic activity in smokers (cariogenic index in blue and calcium levels in orange)

Khan et al. reported that nicotine stimulation does not lead to an increase of salivary potassium level (19).

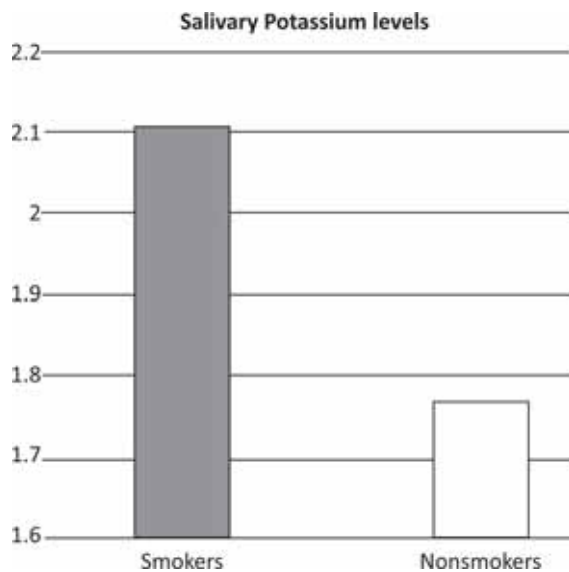


FIGURE 8. Salivary potassium levels in smokers and nonsmokers

CONCLUSIONS

Smoking represents a risk factors not only for systemic diseases, but also for oral pathologies. The connection between this habit and several oral affections such as oral cancer or periodontal disease have been studied for a long time. Our research aimed to evaluate the effects that smoking has on the main protection barrier in the oral cavity- saliva and to assess possible correlations between these effects and the most frequent oral pathology represented by dental caries. The results of the present study show that smoking alters salivary parameters and that these modifications can favour the development of dental caries. Nevertheless, further research is needed.

Acknowledgements

All authors contributed equally to the present work and therefore share first authorship.

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