Iranian J Publ Health, Vol. 43, No.4, Apr 2014, pp. 480-484

Original Article

Effect of Mobile Phone Usage Time on Total Antioxidant Capacity of Saliva and Salivary Immunoglobulin A

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(Received 09 Sep 2013; accepted 10 Jan 2014)

Abstract

Background: Nowadays mobile phone is very popular, causing concern about the effect it has on people's health. Parotid salivary glands are in close contact to cell phone while talking with the phone and the possibility of being affected by them. Limited studies have evaluated the effect of cell phone use on the secretions of these glands; so this study was designed to investigate the effects of duration of mobile phone use on the total antioxidant capacity of saliva.

Methods: Unstimulated saliva from 105 volunteers without oral lesions collected. The volunteers based on daily usage of mobile phones were divided into three groups then total antioxidant capacity of saliva was measured by Ferric Reducing Ability of Plasma (FRAP) method. Data were analyzed by SPSS software version 19. ANOVA was used to compare 3 groups and post-hoc Tukey test to compare between two groups.

Results: Average total antioxidant capacities of saliva in 3 groups were 657.91 µmol/lit, 726.77 µm/lit and 560.17µmol/lit, respectively. The two groups had statistically significant different (P=0.039).

Conclusion: Over an hour talking with a cell phone decreases total antioxidant capacity of saliva in comparison with talking less than twenty minutes.

Keywords: Cell phone, Saliva, Total antioxidant capacity

Introduction

Mobile phones have been increasingly used in the past decade and have become a cultural instrument (1, 2). There is a great concern over harmful effects of electromagnetic and radiofrequency waves as well as microwaves generated by mobile phones and their telecommunication stations on the health (2). The previous studies have been mostly focused on endocrine responses or immune system in the in vitro or animal studies (2-5). People who live near telecommunication stations covering mobile phones have higher level of cortisol and alpha amylase than those in control group, but their salivary IgA has not been affected (2). Parotid glands are the biggest salivary glands located in front of ear and behind ramus which produce maximum amount of saliva (1, 6).

However, the effect of mobile phone on the salivary glands has not been clarified well. Johanson

stated that using mobile phone is not followed by increased risks of lung and salivary gland cancers and leukemia (7). Frequent use of mobile phone will increase odds ratio 0.7 for malignant parotid gland tumors and 0.9 for benign pleomorphic adenomas (8). On the other hand, using mobile phone is not associated with risk of parotid cancer (9). Dentistry science underlines increasingly the significance of saliva in maintaining ecological balance of oral cavity (2).

The saliva plays an important role in preserving oral homeostasis as the first defensive line against microbial invasion which protect oral mucosa mechanically and immunologically (3, 5). A group of salivary proteins (such as lysozyme, peroxidase, myeloperoxidase and lactoferrin) along with other salivary components affect the oral environment by interfering with the growth of bacteria and fungi. Furthermore, salivary immunoglobulin prevents bacterial adhesion and accumulation (10). The previous studies have examined potential impact of mobile phone use on the salivary gland tumor; however, there is few studies investigating the effect of this device on the saliva components. Total salivary protein in the people using mobile phone is less than that in other people (1).

Considering the major protective role of antioxidant and its prevention from different cancers such as oral cancer and due to limited studies conducted in this field, the present investigation was carried out aiming to examine the effects of usage time of mobile phone on salivary antioxidant level.

Materials and Methods

This cross-sectional study was approved by Ethics Committee of Zahedan University of Medical Sciences. Because we did not find similar study, we designed this study as a pilot. Obtaining informed consents of all participants, 105 patients who had used mobile phone for at least five years were included in the study by Opsion method. Exclusion criteria consisted of drug consumption, use of alcohol, smoking, chronic systemic diseases, previous head and neck injuries, trauma, pregnancy, subjective and objective dry mouth, history of chemotherapy or radiotherapy, not signing the informed consent, persons under 18, use of dietary supplements, presence of periodontal pockets greater than 3mm and use of hands-free.

The patients in the current study were matched for age and gender and divided into three groups.

1st group: the persons using mobile less than 20 minutes per day.

2nd group: those using mobile phone 20-60 minutes per day.

3rd group: people using mobile phone more than an hour per day.

To collect saliva from the patients, they were asked not to eat and drink an hour before such collection. In order to prevent effects of changes, all samples were collected daily in the morning between 9 and 11. Unstimulated saliva (saliva in rest position without stimulated salivary gland) samples were collected by spitting method in containers provided by laboratory to the researcher. To do this, the subjects were asked to collect their saliva in a 15cc falcon tube for 2 minutes and then it was taken. Each tube containing saliva was immediately centrifuged after marking for 10 min (2500 rpm) in order for probable debris to be isolated. Then, pure sample of saliva for each subject was isolated and kept in the temperature of -70˚C up to the experiment day. As the sampling was ended, saliva containers were transferred to laboratory for analysis.

The Ferric Reducing Ability of Plasma (FRAP) standardized test was used to measure saliva total antioxidant capacity. This method is based on the ability of saliva to revive Fe (ferric) to Fe (ferrous) ions in the presence of a substance called TPTZ (Tripyridyl-s-Triazine) used as a reagent that result in blue colored Fe-TPTZ complex with maximum absorbance in 593nm. The revival power of saliva was measured through increasing the concentration of the Fe-TPTZ complex by spectrophotometer.

In order to examine the amount of salivary IgA levels, enzyme linked immunosorbent assay (ELISA) method was used (DiaMetra, Italy)

Statistical analysis

Data were analyzed by SPSS version 19 software. The ANOVA was used to evaluate differences between groups and Post-hoc Tukey test was used to make a pair comparison between the groups.

Results

Overall, 105 healthy people (35 persons per group) were included. The average age of the subjects in the first, second and third groups were 26.5±1.5, 28.4±1.4 and 27.3±1.6 years, respectively. There was no statistically significant difference between the groups in this respect (*P*=0.7).
In all groups, 17 participants were women and 18 others were men; there was no statistically significant difference between the groups in this regard.
The results of ANOVA test showed a statistically significant difference existing between three groups in terms of salivary flow rate, total antioxidant capacity of saliva and salivary IgA levels (Table 1).

Table 1: Unstimulated salivary flow rate, total antioxidant capacity of saliva and salivary IgA levels between all groups under study

Variable	Group	Mean ±SD	*P* value for ANOVA test
Unstimulated salivary flow rate (ml/5 min)	Less than 20min	2.65±1.22	0.001
	Between 20min and 1 hour	1.85±0.59	
	More than 1 hour	2.27±0.71	
Total antioxidant capacity of unstimulated saliva (µmol/lit)	Less than 20min	657.91±194.10	0.039
	Between 20min and 1 hour	726.77±373.56	
	More than 1 hour	560.17±04.36	
Salivary IgA levels (ng/mL)	Less than 20min	0.46±0.26	0.03
	Between 20min and 1 hour	0.47±0.22	
	More than 1 hour	0.35±0.14	

There was a statistically difference existing between the first (less than 20 min) and second (between 20 min and 1 hour) groups in terms of unstimulated salivary flow rate (*P*=0.001). However, there was no difference between these groups in respect of total antioxidant capacity of saliva and salivary IgA levels (*P* value was 0.3 and 0.9 respectively). The statistical difference between the second (between 20 min and 1 hour) and third (more than 1 hour) groups is significant in respect of unstimulated salivary flow rate, total antioxidant capacity of saliva and salivary IgA levels (*P* value was 0.01, 0.03 and 0.05 respectively). The unstimulated salivary flow rate in the third group is more than the other group and total antioxidant capacity of saliva and salivary IgA levels in the second group is more than those in the other group
There was a statistically significant difference between the first (less than 20 min) and third (more than 1 hour) in terms of total antioxidant capacity of saliva and salivary IgA levels (*P* value was 0.04 and 0.03 respectively); both variables in the first group are more than those in the other group The second group had the highest level of total antioxidant capacity of saliva and salivary IgA levels.

Discussion

Total antioxidant capacity of saliva and salivary IgA levels in the second group (Between 20 min and 1 hour) are more than those in other groups. On the other hand, unstimulated salivary flow rate in the same group was less than that in other groups.
In this investigation, salivary flow was reduced in the people speaking on the mobile phone between 20 minutes and 1 hour. However, as the time of

mobile phone use exceeds 1 hour, the salivary flow will increase too. In spite of the increased salivary flow, total antioxidant capacity of saliva has not raised; this is similar to the results of another study, where, as the mobile phone use was increased over years, salivary flow was increased too; but total protein amount of saliva was decreased (1). On the other hand, it may be attributed to different effects of using mobile phone on the sympathetic and parasympathetic pathways. Salivation is controlled by the sympathetic and parasympathetic nervous systems; parasympathetic pathway controls the fluid and the sympathetic pathway controls the secretion of protein components. Using mobile phone increases parasympathetic activity, but it decreases sympathetic activity at the same time; it may justify the results of the present study (11).

Furthermore, the salivary IgA levels was increased significantly, as the time of using mobile phone exceeds an hour (despite minor changes in salivary flow rate); it may suggest to the effect of prolonged use of mobile phone on the reduction of immune capacity of saliva.

Few studies have examined the effect of mobile phone use on the secretion of salivary glands. Augner et al. (2010) indicated that in the people who live near telecommunication stations covering mobile phone, cortisol and alpha-amylase levels are more than those in the control group, but the salivary IgA is not been affected (2). Though this study may not be compared completely with the present study, prolonged use of mobile phone in our study decreased salivary IgA levels; this is inconsistent with the results achieved already (2).

Goldwein showed that salivary flow rate was increased in mobile phone users and on the other hand, total protein amount of saliva decreased in such individuals (1). We could not compare our study with this researcher completely but antioxidant and IgA are protein so we can say salivary proteins were decreased in this study.

Bhargava (2012) has investigated into the effect of mobile phone use on the salivary flow rate and parotid gland volume. He divided 142 participants into two groups including the first group who used mobile phone averagely more than 2 hours and the second group who used it less that this period. So the salivary flow rate was increased in the people using mobile phone than others and the parotid gland volume was more in the position which was mostly used (13) but in our study salivary flow rate decreased.

However this study had some limitations like small sample size and no evaluation of specific salivary marker for oxidative stress such as uric acid.

Conclusion

Speaking on the mobile phone over an hour will decrease total antioxidant capacity of saliva and salivary IgA levels more than those speaking less than 20 minutes; this may increase the risk of inflammatory diseases or mouth cancer in the people. It is suggested that future studies be conducted with larger sample size examining the antioxidant system separately.

Ethical considerations

Ethical issues (Including plagiarism, Informed Consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc) have been completely observed by the authors.

Acknowledgment

This article was prepared based on doctoral thesis (number 567) approval by the Medical Ethics and Research office at the Zahedan University of Medical sciences. The authors declare that there is no conflict of interests.

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