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Research Article

ANTAGONISTIC EFFECT OF MOBILE PHONES ON FIXED ORTHODONTIC TREATMENT- A BEFORE AND AFTER NON RANDOMIZED TRIAL

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A B S T R A C T

The aim of the study was to evaluate effect of Radiofrequency Electromagnetic Radiation (RER) emitted by mobile phones on levels of nickel in saliva in patients with fixed orthodontic appliances. Before and after non randomized trial with control group on 54 assessed antagonist effects of mobile. This study was carried out in Department of Orthodontics, Modern Dental College and Research Centre, Indore, M.P., India. Subjects which were not undergoing orthodontic treatment were selected. Subjects were asked not to use their phones for a week and provide their saliva samples. Recall was done for same subjects after 1 week of previous assessment with use of phones and salivary samples were again recorded (Control Group). Experimental group comprised of same group of patients who were than undergoing orthodontic treatment and assessment was done both without using and after using phones. Analysis was done using paired and unpaired t test. Results of paired t test revealed no significant difference (p value = .798) in control group and highly significant difference in experimental group (p value =.001). Use of mobile phones enhanced the use of Nickel (Ni) release from saliva during orthodontic treatment. Ions were released in doses that are nontoxic to humans.

INTRODUCTION

Mobile phones are the important aspect of modern telecommunications but may have adverse impact on human health and their different organs and cells. Mobile phones emit radiofrequency electro-magnetic radiations (RFER). Biocompatibility of alloy material in dentistry has been investigated over the last 20 years[1]. NiTi alloys were introduced for use as orthodontic wires to be allergenic in the 1970s[2]. Because titanium is mainly inert and non-cytotoxic; the main potential risk of cytotoxicity is due to biologic side effect of nickel.

Nickel alloys are well known, cytotoxic and mutagenic. Nickel containing alloys are present in a substantial number and wide variety of appliances, auxiliaries and utilities used in orthodontics and thus become an integral part of almost every routine orthodontic intervention. The anatomic location of parotid gland makes it conceivable candidate to be influenced by exposure to RFER on the side of head where mobile phone is held[3]. Thus, the RFER emitted from the mobile phones may influence the amount of nickel released from the fixed orthodontic appliance.

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A wide range of appliances, auxillaries and utilities in orthodontics contain Nickel alloys thus arousing an integral part of almost every and any orthodontic intervention.

METHODS

The antagonist effects of mobile on fixed orthodontic treatment was assessed in a non-randomised trial. Ethical clearance was obtained from Institutional Review Board of Modern Dental College & Research Centre, Indore. Participants were informed prior about the study and a written informed consent was taken prior to the start of study. Candidate needed placement of fixed orthodontic appliance to satisfy the inclusion criteria in experimental group. The exclusion criteria included patient with systemic disease or on medication intake, smokers or alcohol consumers, those with any metallic restorations or fixed prosthesis. 54 subjects not undergoing any orthodontic treatment were selected for the study. The subjects were divided into control and experimental group. Subjects were first requested not to use their mobile phones for a week and provide their saliva samples. Same patients were instructed to use their mobile phones for 45 min a day in the following week and stopwatch was given to them. Recall was done at the end of 1 week of previous assessment and salivary samples were again collected. The both initial saliva samples collected have integrated as control group. The experimental group comprised of the same group of patients who were than undergoing orthodontic treatment and after banding, bonding and initial arch wire placement they were

recalled after 15 days assessment of salivary sample was done both without using and after using mobile phones.

The samples were collected in a sterile Nickel free container and stored at -20 degree Celsius temperature until further analysis. Patients were further instructed to exhibit the mobile usage to 45 min per day as preciously for a period of one week. The saliva samples were then collected at the end of one week. The levels of Nickel of the patients with restricted and unrestricted mobile usage before and during orthodontic treatment were analysed in saliva samples using Atomic Absorption Spectrophotometer (AAS) [ISO 9001:2015] to measure the amount of Ni in saliva samples.

Fig 1

RESULTS

The data collected was entered in Microsoft Excel spread sheet and subjected to statistical analysis using Statistical Package for Social Sciences (SPSS, IBM version 20.0). The level of significance was fixed at 5% and $p \leq 0.05$ was considered statistically significant. Evaluation of mean values of nickel release in control and experimental group was done by paired and unpaired t test.

To compare the mean values of Nickel release in the control group with restricted and unrestricted usage, paired t-test was used. The test showed no statistical significance between the groups.($p \leq 0.05$)

Table 1 Comparison of mean measured concentration of nickel in saliva in control group

Control Group	N	Mean ± S.D.	p value
Without NiTi restricted Mobile	54	2.86±.50	.798
Without NiTi unrestricted mobile	54	2.89±.46	

Statistical employed: paired t test
s=significant (p value ≤.05)

Table 2 Comparison of mean measured concentration of nickel in saliva in experimental group

Experimental Group	N	Mean ± S.D.	p value
With NiTi restricted Mobile	54	4.57± 1.74	
With NiTi unrestricted mobile	54	10.59± 1.47	.001*

Statistical employed: paired t test
s=significant (p value ≤.05)

When the experimental group was compared for restricted and unrestricted usage there was a significant difference in the nickel levels in saliva.(p=0.001)

Table 3 Comparison of mean measured concentration of nickel in saliva in control group

Variable	N	Mean ± S.D.	p value
Without NiTi restricted Mobile	54	2.86±.50	
With NiTi restricted mobile	54	4.57± 1.74	.001*

Statistical employed: unpaired t test
s=significant (p value ≤.05)

Unpaired t-test was employed to compare the levels of nickel in the control and experimental group with restricted mobile usage prior and during orthodontic treatment, a significant difference was observed in the Ni levels of saliva.(p=0.001)

Table 4 Comparison of mean measured concentration of nickel in saliva in control group

Variable	N	Mean ± S.D.	p value
Without NiTi unrestricted Mobile	54	2.89± .46	.001*
With NiTi unrestricted mobile	54	10.59± 1.47	

Statistical employed: unpaired t test
s=significant (p value ≤.05)

DISCUSSION

Mobile phones are known to generate heat and emit RFER in the form of non-ionizing electromagnetic radiations in the range of 800-2200 MHz[4,5]. The objective of the study was to examine whether the use of mobile phones influences the nickel released from fixed orthodontic appliances in saliva. The main outcome was higher level of Ni is found in saliva of patients using their mobile phones after comparison from those which are not using in both experimental and control group. On comparisons amongst the experimental and control group, results showed significant release of Ni ions in experimental group when patients were using their mobile phones than control group. According to a study conducted by Goldwein O, Aframian D [4] in 2010 the effect of using the mobile phones on the parotid gland were studied and it was concluded that Parotid glands adjacent to handheld mobile phones in use respond by elevated salivary rates which was very similar to our study. Heavy users of mobile phones demonstrated increased rate of salivary flow and greater volumes of the parotid gland which have a diluting effect, mostly on salivary macromolecules and to a lesser extent on ions since the ions diffuse relatively easily along with watery secretions.[6] Our results showed that concentrations of nickel ions after using a cell phone for 1 week significantly higher than the concentration in the pretreatment group. This might be attributed to the greater flow rate which in turn results in more nickel released from fixed orthodontic appliance into the saliva. Thus, the necessity of studying the effects of this radiations on metal ion released from fixed orthodontic appliance seems to be undeniable[3]. The study was conducted to test whether the use of nickel titanium wires along with the use of mobile phones is harmful for the patient or not and this study is clinically relevant in nickel hypersensitivity cases.

CONCLUSION

Though significant difference is present between the level of nickel in patient with and without NiTi wires when mobile phones were not used and highly significant difference when mobile phones are used. But, according to the outcome of the study, it can be concluded that ions were released in doses after using mobile phones that are nontoxic to humans.

Limitations

This study depends on patient's compliance and further large scale studies which should include more parameters like specification of individual mobile phone radiation and brands should be taken into consideration.

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