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ORIGINAL RESEARCH

Assessment of salivary nickel levels in patients undergoing orthodontic treatment

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ABSTRACT:
Background: In orthodontics, the various components of fixed appliances are fabricated by the use of varying materials which have their own physical and mechanical properties. Nickel and chromium ions released from fixed orthodontic appliances can serve as allergens or may have serious biological side effects. Hence; the present study was conducted for assessing salivary nickel levels in patients undergoing orthodontic treatment. **Materials & methods:** A total of 20 patients were enrolled in the present study. Complete demographic details of all the patients were obtained. Clinical examination was carried out with mouth mirror and probe. Salivary samples were obtained and were sent to laboratory. Orthodontic brackets were placed and orthodontic treatment was started and salivary samples were obtained at 1 week after placement of orthodontic appliance and 1 month after placement of orthodontic appliance. In the laboratory, auto-analyzer was used for evaluation of salivary nickel levels. All the results were recorded in Microsoft excel sheet and were analyzed by SPSS software. **Results:** Mean salivary nickel levels before placement of appliance, 1 week after placement of appliance, and 1 month after placement of appliance were found to be 1.214µg/L, 7.897µg/L and 4.196µg/L respectively. While comparing statistically, it was observed that a significant rise in the salivary nickel levels occur one week after placement of orthodontic appliance followed by a significant fall in its concentration 1 month afterplacement of orthodontic appliance. **Conclusion:** Salivary nickel levels are raised significantly during the course of orthodontic treatment.
Key words: Nickel, Orthodontic, Salivary

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INTRODUCTION

In orthodontics, the various components of fixed appliances are fabricated by the use of varying materials which have their own physical and mechanical properties. Stainless steel is most commonly used for the construction of these components such as wires, brackets, bands, buccal tubes, and other auxiliaries due to its low cost, high strength, resistance to corrosion, and biocompatibility. According to the clinical needs, besides stainless steel wires, other wires such as Ni-Ti, beta titanium, cobalt chromium, and teflon polyethylene coated wires are also used.[1-3] Stainless-steel alloys include 17% to 22% of chromium. Fixed orthodontic treatment causes major changes in the composition of the saliva. Nickel and chromium ions released from fixed orthodontic appliances can serve as allergens or may have serious biological side effects. Moreover, they are cytotoxic, mutagenic, and carcinogenic in small quantities in the range of nanograms. Evaluation of the level of trace elements in patients using orthodontic appliances is a priority. Both nickel and chromium ions can cause hypersensitivity reactions in some people.[4, 5]Hence; the present study was conducted for assessing salivary

nickel levels in patients undergoing orthodontic treatment.

MATERIALS & METHODS

The present study was conducted in the department of orthodontics of the dental institute and it included evaluation of salivary nickel levels in patients undergoing orthodontic treatment. Ethical approval was obtained from institutional ethical committee and written consent was obtained from all the patients after explaining in detail the entire research protocol. A total of 20 patients were enrolled in the present study. Complete demographic details of all the patients were obtained. Clinical examination was carried out with mouth mirror and probe. Radiographs were taken and diagnostic casts were made. Based on the diagnostic radiographs and casts, treating planning was done. Salivary samples were obtained and were sent to laboratory. Orthodontic brackets were placed and orthodontic treatment was started and salivary samples were obtained at 1 week after placement of orthodontic appliance and 1 month after placement of orthodontic appliance. In the laboratory, auto-analyzer was used for evaluation of salivary nickel levels. All the results were recorded in Microsoft excel sheet and were analyzed by SPSS software. Mann-Whitney U test and student t test were used for evaluation of level of significance.

RESULTS

In the present study, a total of 20 patients scheduled to orthodontic treatment were enrolled. Mean age of the patients was found to be 15.9 years. 40 percent of the patients each belonged to the age group of less than 15 years and 15 to 20 years. 75 percent of the patients were males while the remaining were females. In the present study, mean salivary nickel levels before placement of appliance, 1 week after placement of appliance, and 1 month after placement of appliance were found to be 1.214µg/L, 7.897µg/L and 4.196µg/L respectively. While comparing statistically, it was observed that a significant rise in the salivary nickel levels occur one week after placement of orthodontic appliance followed by a significant fall in its concentration 1 month after placement of orthodontic appliance.

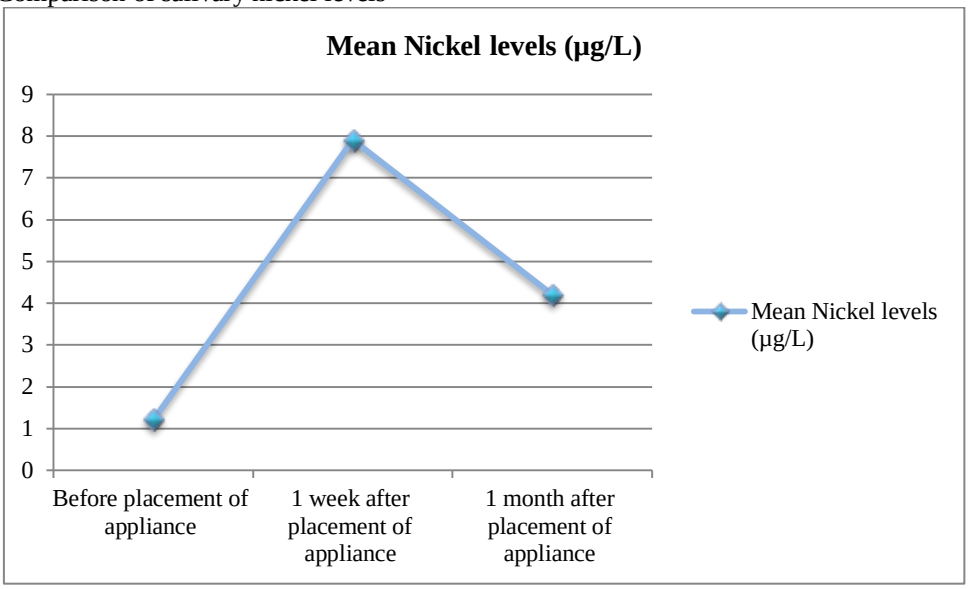
Table 1: Demographic data

Parameter		Number of patients	Percentage
Age group (years)	Less than 15	8	40
	15 to 20	8	40
	More than 20	4	20
Gender	Males	15	75
	Females	5	25

Table 2: Comparison of salivary nickel levels

Time interval	Mean Nickel levels (µg/L)	p- value
Before placement of appliance	1.214	0.00 (Significant)
1 week after placement of appliance	7.897	
1 month after placement of appliance	4.196	

Graph 1: Comparison of salivary nickel levels



DISCUSSION

Various factors such as temperature, pH variation, salivary conditions, mechanical loads, microbiological and enzymatic activity, physical and chemical properties of food and oral health conditions provide an environment for the corrosion of dental materials. This results in weakening of the appliance and the release of nickel, chromium, and iron, etc., Nickel and chromium are trace minerals or micronutrients, and they play an important part in the overall health of the human body.[6, 7]Hence; the present study was conducted for assessing salivary nickel levels in patients undergoing orthodontic treatment.

In the present study, a total of 20 patients scheduled to orthodontic treatment were enrolled. Mean age of the patients was found to be 15.9 years. 40 percent of the patients each belonged to the age group of less than 15 years and 15 to 20 years. 75 percent of the patients were males while the remaining were females. Yassaei S et al investigated the salivary concentration of nickel and chromium of patients undergoing orthodontic treatment. In this study 32 patients who presented to the orthodontic clinic were selected. The salivary samples were taken from the patients in four stages: before appliance placement and 20 days, 3 months, and 6 months following appliance placement. The salivary samples were collected in a plastic tube and were stored in the freezer before analysis. The samples were then transferred to the laboratory, and the amounts of metals were determined by graphite furnace atomic absorption spectrometry with an autosampler. Each sample was analyzed three times, and the average was reported. It was found that the average amount of nickel in the saliva 20 days after appliance placement was 0.8 μg/L more than before placement. Also, the amount of salivary nickel 20 days after the appliance placement was more than at the other stages, but the differences were not significant. The average amount of chromium in the saliva was found to be between 2.6 and 3.6 μg/L. The amount of chromium at all stages after appliance placement was more than before, but the differences between the chromium levels of saliva at all stages were not significant. There was no significant difference in the average amount of salivary nickel and chromium of patients at various stages of orthodontic appliance placement.[9]

In the present study, mean salivary nickel levels before placement of appliance, 1 week after placement of appliance, and 1 month after placement of appliance were found to be 1.214μg/L, 7.897μg/L and 4.196μg/L respectively. While comparing statistically, it was observed that a significant rise in the salivary nickel levels occur one week after placement of orthodontic appliance followed by a significant fall in its concentration 1 month afterplacement of orthodontic appliance. Dwivedi A et al compared the level of nickel and chromium in the saliva of patients undergoing fixed orthodontic treatment at different time periods. The sample of saliva of 13 patients was taken at different time periods that is: Group 1 (before appliance placement), Group II, III, and IV (after 1-week, 1-month, and 3 months of appliance placement respectively). The fixed appliance comprised of brackets, bands, buccal tubes, lingual sheath, transpalatal arch and wires composed of Ni-Ti and stainless steel. The level of ions was determined using graphite furnace atomic absorption spectro-photometry. Level of nickel and chromium in saliva was highest in Group II and lowest in Groups I for both the ions. On comparison among different Groups, it was statistically significant for all the groups (<0.001) except between Group III and Group IV. The release of nickel and chromium was maximum at 1-week and then the level gradually declined. These values were well below the toxic dose of these ions. The results should be viewed with caution in subjects with Ni hypersensitivity.[10]

CONCLUSION

From the above results, the authors concluded that salivary nickel levels are raised significantly during the course of orthodontic treatment. However; further studies are recommended.

REFERENCES

1. Sfondrini MF, Cacciafesta V, Maffia E, Massironi S, Scribante A, Alberti G, et al. Chromium release from new stainless steel, recycled and nickel-free orthodontic brackets. Angle Orthod 2009;79:361-7.
2. Pillai AR, Gangadharan A, Gangadharan J, Kumar NV. Cytotoxic effects of the nickel release from the stainless steel brackets: An in vitro study. J Pharm BioalliedSci 2013;5:S1-4.
3. Ehrnrooth M, Kerosuo H. Face and neck dermatitis from a stainless steel orthodontic appliance. Angle Orthod 2009;79:1194-6.
4. Maijer R, Smith DC. Biodegradation of the orthodontic bracket system. Am J OrthodDentofacialOrthop 1986;90:195-8.
5. Kerosuo H, Moe G, KlevenE.In vitro release of nickel and chromium from different types of simulated orthodontic appliances. Angle Orthod 1995;65:111-6.
6. Barceloux DG. Nickel. J ToxicolClinToxicol 1999;37:239-58.
7. Agaoglu G, Arun T, Izgi B, Yarat A. Nickel and chromium levels in the saliva and serum of patients with fixed orthodontic appliances. Angle Orthod 2001;71:375-9.
8. Sahoo N, Kailasam V, Padmanabhan S, Chitharanjan AB. In-vivo evaluation of salivary nickel and chromium levels in conventional and self-ligating brackets. Am J OrthodDentofacialOrthop 2011;140:340-5.
9. Yassaei S1, Dadfarnia S, Ahadian H, Moradi F. Nickel and chromium levels in the saliva of patients with fixed orthodontic appliances. Orthodontics (Chic.). 2013;14(1):e76-81.
10. Dwivedi A, Tikku T, Khanna R, Maurya RP, Verma G, Murthy R C. Release of nickel and chromium ions in the saliva of patients with fixed orthodontic appliance: An in-vivo study. Natl J MaxillofacSurg 2015;6:62-6