Journal of Advanced Medical and Dental Sciences Research

@Society of Scientific Research and Studies

Journal home page: www.jamdsr.com doi: 10.21276/jamdsr

(e) ISSN Online: 2321-9599; (p) ISSN Print: 2348-6805

Original Article

Assessment of salivary nickel levels in patients undergoing fixed orthodontic treatment

Sakshi Raina[1], Adarshika[2], Romshi Raina[3], Amninder Babbar[4], Prashant Shriram[5]

[1]M.D.S. Orthodontist, ACPM Dental College Dhule, Maharashtra, India
[2]Consultant Orthodontist, Lucnkow, Uttar Pradesh, India,
[3]Registrar, Department of Public Health Dentistry, Govt. Dental College and Hospital, Srinagar, Jammu and Kashmir, India
[4]Dental Surgeon, Banga, Punjab, India,
[5]Consultant Oral Surgeon, Dhule, Maharashtra, India

***ABSTRACT*:**
Background: Nickel (Ni) and chromium (Cr) containing alloys are present in great numbers in a wide variety of appliances, auxiliaries, and utilities used in orthodontics and thus become an integral part of almost every routine orthodontic intervention. Most of the orthodontic patients do not have visible reactions on the oral mucosa caused by orthodontic materials, probably due to the influence of saliva.Hence; we planned the present study to assess to salivary nickel levels in patients undergoing fixed orthodontic treatment. **Materials & methods:** The present study included assessment nickel ion concentration in subjects undergoing orthodontic treatment. A total of 20 subjects undergoing fixed orthodontic treatment were enrolled in the present study. A total of 20 age and gender matched healthy controls were also included in the present study. All the subjects were called in the morning and fasting salivary samples were collected in cold polypropylene tube. Before sample collection, subjects were instructed to rinse their oral cavity from 25 to 30 seconds. All the samples were sent to laboratory for further assessment using atomic absorption spectrophotometer. All the results were compiled in Microsoft excel sheet and were analyzed by SPSS software. **Results:** Mean salivary nickel levels among the subjects of the study group was 18.9 ng/ml while mean salivary nickel levels among subjects of the control group was 8.9 ng/ml. Mean salivary nickel levels of the subjects of the study group was significantly higher than the subjects of the control group (P- value < 0.05).
Conclusion: Nickel levels are raised in patients undergoing fixed orthodontic treatment.
Key words: Nickel, Orthodontic treatment, Salivary.

Received: 11 August 2018 Revised: 22 September 2018 Accepted: 25 October 2018

Corresponding author: Dr Sakshi Raina, 149/c Wazir Bhag, Surya-vihar, Patta Bohri, Jammu Tawi, J&K, India

This article may be cited as: Raina S, Adarshika, Raina R, Babbar A, Shriram P. Assessment of salivary nickel levels in patients undergoing fixed orthodontic treatment. J Adv Med Dent Scie Res 2018;6(10):134-137.

INTRODUCTION

Nickel (Ni) and chromium (Cr) containing alloys are present in great numbers in a wide variety of appliances, auxiliaries, and utilities used in orthodontics and thus become an integral part of almost every routine orthodontic intervention.[1]

The use of various combinations of metal alloys for prolonged durations in orthodontic patients warrants special consideration regarding their biocompatibility. The oral cavity is a complete corrosion cell, with many factors that enhance the biodegradation of orthodontic appliances.[2]

A number of studies have investigated the release of metal ions from orthodontic alloys, but the results were not consistent. For example, while some authors have shown an increase in metal ion concentration in the oral fluid of patients with orthodontic appliances.[3, 4]

It is well known that oral cavity is an ecosystem which is known to cause biodegradation of metals which usually occurrs through the process of electrochemical breakdown. Besides, it is known that various orthodontic components such as nickel and chromium can cause hypersensitivity reactions in the oral cavity, cytotoxicity, and dermatitis.

Furthermore, they might have significant mutagenic and possibly carcinogenic potential. Luckily, most of the orthodontic patients do not have visible reactions on the oral mucosa caused by orthodontic materials, probably due to the influence of saliva.[5-8]
Hence; we planned the present study to assess to salivary nickel levels in patients undergoing fixed orthodontic treatment.

MATERIALS & METHODS

The present study was conducted in the department of orthodontics of the dental institute and it included assessment nickel ion concentration in subjects undergoing orthodontic treatment. A total of 20 subjects undergoing fixed orthodontic treatment were enrolled in the present study. A total of 20 age and gender matched healthy controls were also included in the present study. Inclusion criteria for the present study included:

- Patients undergoing fixed orthodontic treatment,
- Patients less than 20 years of age
- Patients in which orthodontic treatment has been started from at least past one year

Exclusion criteria for the present study included;

- Patients with absence of nickel titanium (NiTi) archwires as an orthodontic treatment component from past at least 1 month prior to sample collection
- Patients with history of any other systemic illness,
- Patients with presence of any form of metabolic disorder

All the subjects were called in the morning and fasting salivary samples were collected in cold polypropylene tube. Before sample collection, subjects were instructed to rinse their oral cavity from 25 to 30 seconds. All the samples were sent to laboratory for further assessment. In the laboratory, the assessment of salivary nickel levels was done using atomic absorption spectrophotometer. All the results were compiled in Microsoft excel sheet and were analyzed by SPSS software. Mann-Whitney U test was used for assessment of level of significance. P- value of less than 0.05 was taken as significant.

RESULTS

Demographic details of the subjects of the present study are shown in Table 1. Mean age of the subjects of the study group was 16.5 years whereas mean age of the subjects of the control group was 17.1 years. There were10 males and 10 females in the study group and there were 11 males and 9 females in the control group. Mean salivary nickel levels among the subjects of the study group was 18.9 ng/ml while mean salivary nickel levels among subjects of the control group was 8.9 ng/ml. Mean salivary nickel levels of the subjects of the study group was significantly higher than the subjects of the control group (P- value < 0.05).

Table 1: Demographic details

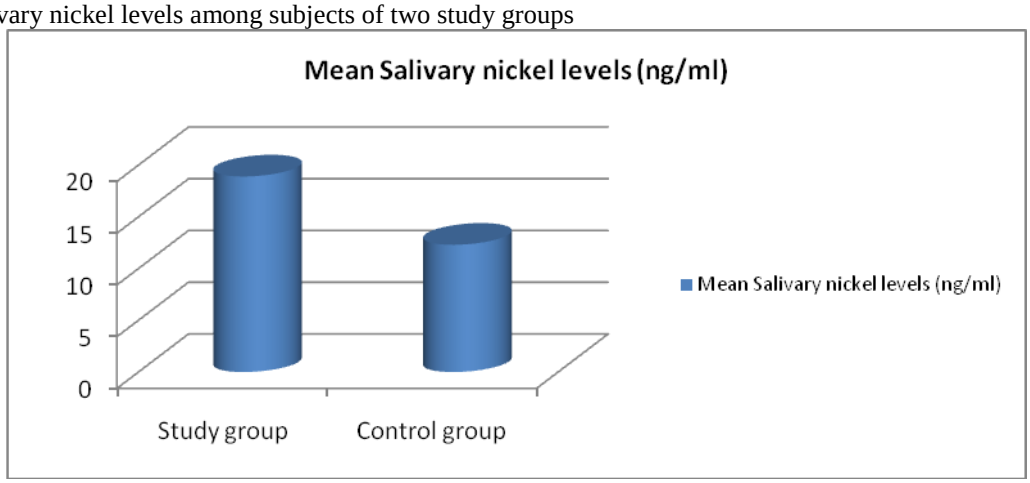
Parameter		Study group	Control group
Mean age (years)		16.5	17.1
Gender	Males	10	11
	Females	10	9

Table 2: Comparison of salivary nickel levels among subjects of two study groups

Parameter	Study group	Control group	P- value
Mean Salivary nickel levels (ng/ml)	18.9	12.3	0.01*
SD	12.5	8.9	

*: Significant

Graph 1: Salivary nickel levels among subjects of two study groups



DISCUSSION

In the present study, mean age of the subjects of the study group was 16.5 years whereas mean age of the subjects of the control group was 17.1 years. There were10 males and 10 females in the study group and there were 11 males and 9 females in the control group. Amini F et al tested the hypothesis that there is no difference in salivary metal ion content between subjects with fixed orthodontic appliances and their same-gender sister or brother without any orthodontic appliance. 28 subjects (16 females and 12 males) who had undergone fixed orthodontic therapy for duration of 12-18 months were enrolled. In order to limit the effects of dietary and hygiene habits on salivary metal ion concentration, a same-gender brother or sister (total of 28 subjects) was selected as a control. Approximately 5 ml of saliva was collected from each subject, and the samples were analysed using an atomic absorption spectrophotometer. The detection limit of the method for sample solutions was 1 ng/ml. Since some variables were not normally distributed, non-parametric tests (Mann-Whitney U and Wilcoxon W) were used for statistical analysis. The mean salivary nickel (Ni) content in subjects with and without a fixed orthodontic appliance was 18.5 ± 13.1 and 11.9 ± 11.4 ng/ml, respectively. A statistically significant difference ($P < 0.035$) was found between the two groups. The mean salivary chromium (Cr) ion level recorded was 2.6 ± 1.6 ng/ml in the study group and 2.2 ± 1.6 ng/ml in the control group. The difference, however, was statistically insignificant. They concluded that the presence of fixed orthodontic appliances leads to an increased concentration of metal ions in salivary secretions.[9]

In the present study, mean salivary nickel levels among the subjects of the study group was 18.9 ng/ml while mean salivary nickel levels among subjects of the control group was 8.9 ng/ml. Mean salivary nickel levels of the subjects of the study group was significantly higher than the subjects of the control group (P- value < 0.05).Jurela A et al assessed salivary levels of nickel (Ni), titanium (Ti), chromium (Cr), cobalt (Co), copper (Cu) and zinc (Zn) levels were measured in 42 patients with ceramic brackets and in 42 patients with metal conventional brackets prior to insertion of orthodontic appliances and six months after insertion of orthodontic appliances by means of inductive coupled plasma/mass spectrometry. The results showed that salivary level of titanium increased significantly six months after installment of orthodontic appliances. Salivary level of chromium and zinc significantly decreased after installment of orthodontic appliances. There were no significant differences in salivary levels of nickel, titanium, chromium, copper, cobalt and zinc between the patients with metallic and those with ceramic brackets. They concluded that the salivary level of titanium increased significantly six months after installment of orthodontic appliances unlike salivary levels of chromium and zinc which significantly decreased after installment of orthodontic appliances, regardless of bracket type which was used.[10]Amini F1 et al assessed salivary samples of 30 orthodontic patients. All the patients were randomly into two groups of conventional and MIM brackets, before treatment and 2 months later. Approved attendees with odd and even numbers were, respectively, assigned to the control and treatment groups. For blinding, the patients were not informed of their bracket types, and the saliva samples were coded. Nickel and chromium levels were determined using atomic absorption spectrophotometry. Mean nickel level increased from 7.87±8.14 (pre-treatment) to 12.57±9.96 (2nd month) in the control group, and from 8.62±9.85 (pre-treatment) to 8.86±6.42 µg/l in the MIM group. Both of these increases were significant (Wilcoxon $P < 0.03$). Average chromium level changed from 0.25±0.56 (pre-treatment) to 0.35±0.62 and from 0.42±0.48 to 0.26±0.57 µg/l in the MIM group. Only the reduction observed in the MIM group was significant (Wilcoxon $P = 0.0438$). Age and gender had no significant influence on ion levels ($P > 0.1$). The differences between both ions' levels measured in the 60th day in both bracket groups were not significant (Mann-Whitney $P > 0.05$). The extents of changes over time were not significantly different between the bracket types (Mann-Whitney $P > 0.05$). The current in vivo methods are unable to take such fluctuations into account. Nickel might increase in patients undergoing treatment with both bracket types, although the rate of increase might be greater in patients under treatment with conventional brackets.[11]

CONCLUSION

Form the above obtained results, the authors conclude that nickel levels are raised in patients undergoing fixed orthodontic treatment. Allergic reactions are of increasing concern to practitioners in health-related fields. Hence; dentists should be aware of the manifestations of the nickel allergy, if present; so that approximate therapeutic action could be taken to the earliest.

REFERENCES

1. Kuhta M, Pavlin D, Slaj M, Varga S, LapterVarga M, Slaj M. Type of archwire and level of acidity: effects on the relase of metal ions from orthodontic appliances. Angle Orthod. 2009. Jan;79(1):102–10.
2. Janson GR, Dainesi EA, Consolaro A, Woodside DG, Freitas MR. Nickel hypersensitivity reaction before, during, and after orthodontic therapy. Am J OrthodDentofacialOrthop. 1998;113:655–60.
3. Staffolani N, Damiani F, Lilli C, Guerra M, Staffolani NJ, Belcastro S, et al. Ion release from orthodontic appliances. J Dent. 1999. Aug;27(6):449–54.
4. Talic NF, Alnahwi HH, Al-Faraj AS. Nickel and chromium levels in the saliva of a Saudi sample treated with fixed orthodontic appliances. Saudi Dent J. 2013. Oct;25(4):129–33.
5. Lindsten R, Kurol J. Orthodontic appliances in relation to nickel hypersensitivity: A review. J OrofacOrthop. 1997;58:100–8.

6. Starkjaer L, Menné T. Nickel allergy and orthodontic treatment. Eur J Orthod. 1990;12:284–9.
7. Gürsoy S, Acar AG, Seşen C. Comparison of metal release from new and recycled bracket-archwire combination. Angle Orthod. 2005. Jan;75(1):92–4.
8. Lages RB, Bridi EC, Pérez CA, Basting RT. S alivary levels of nickel, chromium, iron, and copper in patients treated with metal or esthetic fixed orthodontic appliances: A retrospective cohort study. J Trace Elem Med Biol. 2017. Mar;40:67–71.
9. Amini F1, Jafari A, Amini P, Sepasi S. Metal ion release from fixed orthodontic appliances--an in vivo study. Eur J Orthod. 2012 Feb;34(1):126-30. doi: 10.1093/ejo/cjq181. Epub 2011 Feb 8.
10. Jurela A, Verzak Ž, Brailo V, Škrinjar I, Sudarević K, Janković B. Salivary Electrolytes in Patients with Metallic and Ceramic Orthodontic Brackets. ActaStomatol Croat. 2018;52(1):32-36.
11. Amini F1, Harandi S2, Mollaei M1, Rakhshan V3. Effects of fixed orthodontic treatment using conventional versus metal-injection molding brackets on salivary nickel and chromium levels: a double-blind randomized clinical trial. Eur J Orthod. 2015 Oct;37(5):522-30. doi: 10.1093/ejo/cju079. Epub 2014 Dec 17.

Source of support: Nil **Conflict of interest:** None declared