

Original Research

Assessment salivary nickel level in patients with fixed orthodontic treatment- A clinical study

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ABSTRACT:

Background: The present study was conducted to assess salivary nickel level in patients with fixed orthodontic treatment. **Materials & Methods:** 32 patients undergoing fixed orthodontic treatment of both genders were recruited. Group I was fixed orthodontic treatment group and group II was healthy subjects. The assessment of salivary nickel levels was done using atomic absorption spectrophotometer. **Results:** In group I, there were 5 males and 11 females and in group II 7 males and 9 females. The mean nickel level in group I was 20.5 ng/ml and in group II was 12.3 ng/ml. The difference was significant ($P < 0.05$).

Conclusion: The level of nickel in fixed orthodontic group was high as compared to healthy control subjects.

Key words: Nickel, Salivary, Orthodontic.

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INTRODUCTION

Fixed orthodontic appliances including brackets and arches are commonly made of stainless steel and nickel-titanium (NiTi) alloys and, therefore, have corrosion potential in the oral environment.¹ The amount of nickel as the main constituent of contemporary orthodontic appliances may vary from 8% in stainless steel to more than 50% in NiTi alloys. Stainless-steel alloys include 17% to 22% of chromium.²

Nickel-containing alloys exist in a wide variety of appliances and auxiliary devices used in orthodontics, with a content of up to 55% by weight. Likewise, the in vivo release of nickel ions varies greatly from 0.5 to 105.7 $\mu\text{g/l}$, according to the alloy type, body fluid, temperature, mechanical stress or pH.³ In general,

orthodontic materials are considered to be highly biocompatible. However, a number of adverse effects have been reported in the literature, including inflammatory and allergic reactions, and cytotoxicity and mutagenicity. Allergic reactions are the predominant adverse effects, owing to the inevitable release of nickel ions as a consequence of intraoral corrosion.⁴ This has caused concerns among orthodontic patients, their parents, and orthodontists, owing to the possible association of orthodontic treatment with the prevalence of nickel hypersensitivity. However, previous in vitro and in vivo evidence indicates that oral nickel intake, especially prior to cutaneous sensitization, may favour the induction of oral tolerance to nickel.⁵ The present study was conducted to assess

salivary nickel level in patients undergoing fixed orthodontic treatment.

MATERIALS & METHODS

The present study was conducted among 32 patients undergoing fixed orthodontic treatment of both genders. Equal number of controls was also included. All were informed regarding the study and written consent was obtained. Approval for the study was obtained from institutional ethical committee.

Data such as name, age, gender etc. was recorded. Patients were divided into 2 groups. Group I was fixed orthodontic treatment group and group II was healthy subjects. Fasting salivary samples were collected in cold polypropylene tube. The assessment of salivary nickel levels was done using atomic absorption spectrophotometer. Results were subjected to statistical analysis. P value less than 0.05 was considered significant.

RESULTS

Table I Distribution of patients

Groups	Group I	Group II
Status	Fixed orthodontic	Control
M:F	5:11	7:9

Table I shows that in group I, there were 5 males and 11 females and in group II 7 males and 9 females.

Graph I Distribution of patients

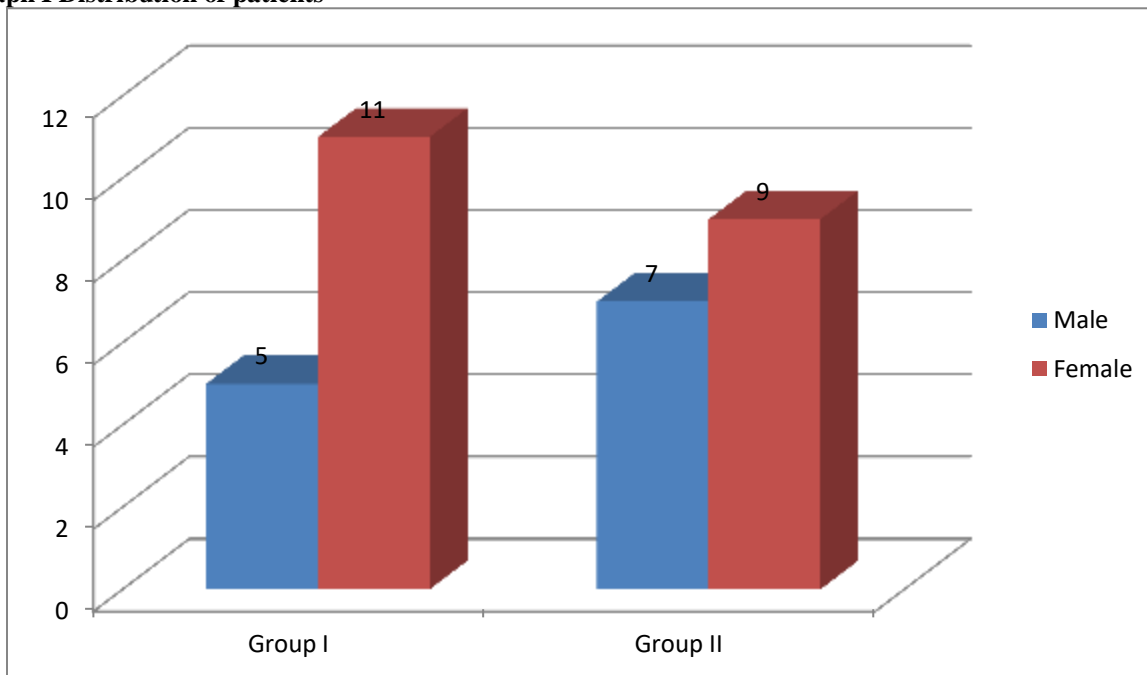
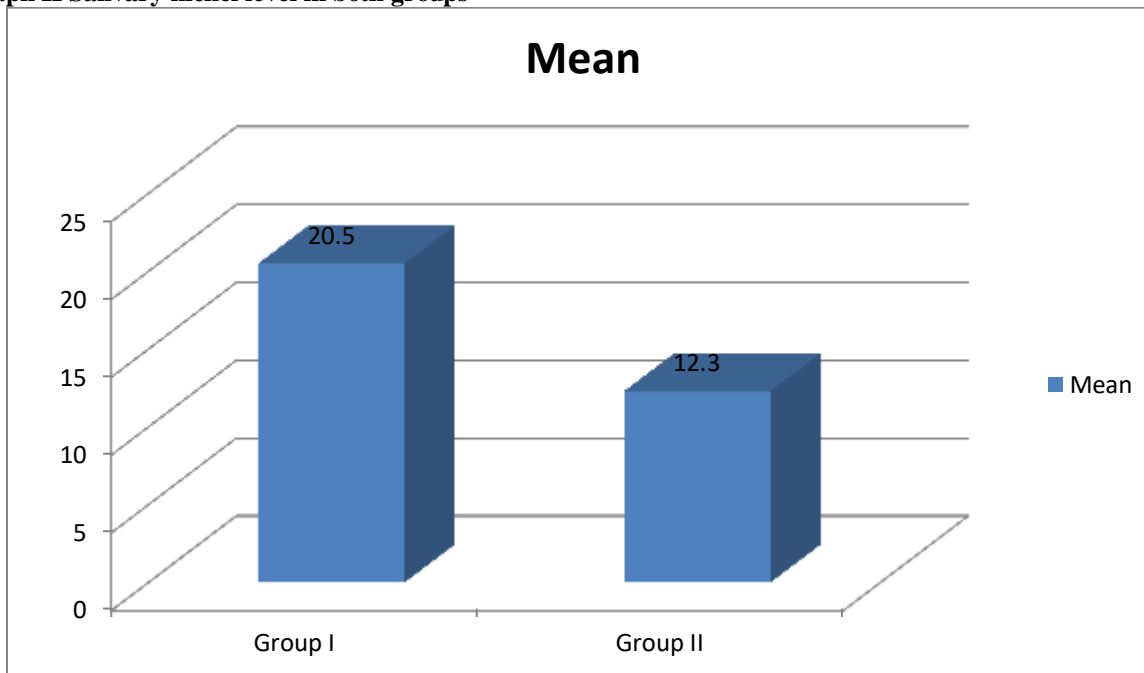


Table II Assessment of salivary nickel level in both groups

Groups	Mean (ng/ml)	P value
Group I	20.5	0.02
Group II	12.3	

Table II, graph II shows that mean nickel level in group I was 20.5 ng/ml and in group II was 12.3 ng/ml. The difference was significant (P< 0.05).

Graph II Salivary nickel level in both groups

DISCUSSION

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.⁶ Evaluation of the level of trace elements in patients using orthodontic appliances is a priority.⁷ Both nickel and chromium ions can cause hypersensitivity reactions in some people. In addition, nickel and chromium can cause dermatitis and asthma.⁸ The present study was conducted to assess salivary nickel level in patients with fixed orthodontic treatment.

We found that in group I, there were 5 males and 11 females and in group II, 7 males and 9 females. Amini et al⁹ conducted a study in which patients were divided into two groups and level of nickel was determined by atomic absorption spectrophotometry. Nickel concentration value (mg/L) in first group prior to starting treatment was 0.097 ± 0.071 . An increase in level of nickel was followed by decrease 4 and 8 weeks after applying the arch wire (0.208 ± 0.112) and (0.077 ± 0.056 mg/L) respectively. Nickel levels in saliva of the second group were showed minimal variation and ranged from 0.061 ± 0.044 mg/L to 0.083 ± 0.054 throughout period of study. It may be concluded that there could be a release of nickel from the appliances used in first group but it doesn't reach toxic level in saliva.

Orthodontic appliances (brackets and wires) exposed to the oral environment are affected by thermal alterations in the oral cavity and pH, constant presence of saliva,

exposure to foods and drinks, mechanical loads applied to them, and abrasion. They are subjected to aging as such and may undergo dissolution or oxidation. The placement of arch wires can cause an increase in salivary nickel and chromium levels and, therefore, nickel may be released from the wires as well as bands and brackets.¹⁰

We found that mean nickel level in group I was 20.5 ng/ml and in group II was 12.3 ng/ml. Agaoglu et al¹¹ determined any significant changes in these concentrations during any period of the treatment time. Saliva and blood samples were collected from 100 patients ranging in age from 12 to 33 years. Twenty samples from each group were obtained. The groups were as follows: In the first group, saliva and blood samples were collected before insertion of the fixed appliances. In the second, third, fourth, and fifth groups, samples were collected at 1 week, 1 month, 1 year, and 2 years after appliance insertion. In the serum, there were statistically significant increases in ion concentration in the second-year groups. In saliva samples, nickel and chromium reached their highest levels in the first month and decreased to their initial level in the rest of the groups. It can be concluded that fixed orthodontic appliances release measurable amount of nickel and chromium when placed in the mouth, but this increase doesn't reach toxic levels for nickel and chromium in the saliva and serum.

Raina et al¹² found that 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.

CONCLUSION

Authors concluded that the level of nickel in fixed orthodontic group was high as compared to healthy control subjects.

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