

Original Research

Analysis of nickel and chromium levels in the saliva of patients undergoing fixed orthodontic treatment: An observational study

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ABSTRACT:

Background: To assess the nickel and chromium levels in the saliva undergoing fixed orthodontic treatment. **Materials & methods:** A total of 50 patients who were scheduled to undergo fixed orthodontic treatment and were less than 30 years of age were enrolled. Each orthodontic patient had two samples of stimulated saliva taken: prior to the placement of the fixed appliance (which served as a baseline level for salivary nickel and chromium levels) and 10 days after the placement of the appliance. SPSS software was used to evaluate the outcome. The nickel and chromium contents of these samples were determined using an autoanalyzer, and their values were reported in micro g/L. **Results:** Mean age of the patients was 19.8 years. Amount of salivary nickel and chromium at the baseline was 5.7 micro gram/ L and 3.4 micro gram/ L respectively. There was slight increase in both the measurements after 12 days of orthodontic treatment and the levels of nickel were 7.1 micro gram/ L and chromium was 4.3 micro gram/ L. Significant results were obtained while comparing the nickel and chromium levels at different time intervals. **Conclusion:** When compared to baseline values, salivary nickel and chromium concentrations considerably increased after the placement of fixed orthodontic appliances.

Keywords: Orthodontic, Treatment, Saliva

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INTRODUCTION

One of the most prevalent irregularities in tooth development is malocclusion, which typically shows up in children as misaligned teeth or an unnatural relationship between the dental arches. Malocclusion is thought by some researchers to be an aesthetic variation from the norm rather than a widespread health issue. Different prevalence percentages have been reported by numerous studies that have assessed the prevalence of malocclusion in diverse groups. Malocclusion causes a number of issues for those who have it, including dissatisfaction with facial appearance, issues with the masticatory system's performance, temporomandibular joint dysfunction, difficulties speaking and swallowing, vulnerability to facial traumatic injuries, and the emergence of caries and periodontal issues.¹⁻³

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.⁴⁻⁶ Hence, this study was conducted to assess the nickel and chromium levels in the saliva undergoing fixed orthodontic treatment.

MATERIALS & METHODS

A total of 50 patients who were scheduled to undergo fixed orthodontic treatment and were less than 30 years of age were enrolled. Each orthodontic patient had two samples of stimulated saliva taken: prior to the placement of the fixed appliance (which served as a baseline level for salivary nickel and chromium levels) and 10 days after the placement of the appliance. SPSS software was used to evaluate the outcome. The nickel and chromium contents of these samples were determined using an autoanalyzer, and

their values were reported in micro g/L. Data were gathered. SPSS software was used to evaluate the outcome.

RESULTS

Mean age of the patients was 19.8 years. Amount of salivary nickel and chromium at the baseline was

5.7micro gram/ L and 3.4micro gram/ L respectively. There was slight increase in both the measurements after 12 days of orthodontic treatment and the levels of nickel were 7.1micro gram/ L and chromium was4.3micro gram/ L. Significant results were obtained while comparing the nickel and chromium levels at different time intervals.

Table 1: Salivary nickel and chromium (micro gram/ L) at different time intervals

Metal	Baseline (before treatment)	After 12 days of orthodontic treatment	P - value
Mean Nickel	5.7	7.1	0.000 (Significant)
Mean Chromium	3.4	4.3	0.001 (Significant)

DISCUSSION

According to one research, the placement of fixed orthodontic appliances may affect salivary electrolytes, causing an increase in nickel or chromium concentrations in the saliva. The majority of authors, however, did not note a rise in nickel and chromium levels in patients' saliva after the installation of orthodontic gear. The ecology of the oral cavity is well known for causing the biodegradation of metals, which typically takes place 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. Fortunately, most orthodontic patients do not have apparent reactions to orthodontic materials on the oral mucosa, most likely as a result of saliva's impact.⁷⁻⁹ Hence, this study was conducted to assess the nickel and chromium levels in the saliva undergoing fixed orthodontic treatment.

Mean age of the patients was 19.8 years. Amount of salivary nickel and chromium at the baseline was 5.7 micro gram/ L and 3.4micro gram/ L respectively. There was slight increase in both the measurements after 12 days of orthodontic treatment and the levels of nickel were 7.1 micro gram/ L and chromium was4.3 micro gram/ L. Significant results were obtained while comparing the nickel and chromium levels at different time intervals. Jurela A et al measured Salivary levels of nickel (Ni), titanium (Ti), chromium (Cr), cobalt (Co), copper (Cu) and zinc (Zn) 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 might conclude 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 Imani, M. M., et al reviewed the effect of fixed orthodontic treatment on salivary levels of these ions by doing a meta-analysis on cross-sectional and cohort studies. The Web of Science, Scopus, Cochrane Library, and PubMed databases were searched for articles on salivary profile of nickel or chromium in patients under fixed orthodontic treatment published from January 1983 to October 2017. A random-effect meta-analysis was done using Review Manager 5.3 to calculate mean difference (MD) and 95% confidence interval (CI), and the quality of questionnaire was evaluated by the Newcastle–Ottawa scale. Fourteen studies were included and analyzed in this meta-analysis. Salivary nickel level was higher in periods of 10 min or less and one day after initiation of treatment compared to baseline (before the insertion of appliance). Salivary chromium level was higher in periods of one day and one week after the initiation of treatment compared to baseline.¹¹

CONCLUSION

When compared to baseline values, salivary nickel and chromium concentrations considerably increased after the placement of fixed orthodontic appliances.

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