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Evaluation of salivary chromium levels among patients undergoing fixed orthodontic treatment

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***Abstract*---**Aims: The present study was conducted for evaluation of salivary chromium levels among patients undergoing fixed orthodontic treatment. Materials & method: 20 patients who presented to the orthodontic clinic were selected. The salivary samples were taken from the patients in following stages: before appliance placement, one month, and 4 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. All the results were recorded and analysed by SPSS software. Results: Mean

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salivary chromium levels before appliance placement; one month after appliance placement and four months after appliance placement was 2.5 µg/L, 3.9 µg/L and 2.9 µg/L respectively. Significant results were obtained while comparing the alteration in salivary chromium levels. Significant results were obtained while comparing the salivary chromium levels at different time intervals. Conclusion: Corrosion of fixed orthodontic appliances leads to elevated salivary chromium levels early after the initiation of orthodontic treatment.

***Keywords*---**chromium, salivary, orthodontic treatment.

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. Nickel and chromium ions released from fixed orthodontic appliances can serve as allergens or may have serious biological side effects. 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. In addition, nickel and chromium can cause dermatitis and asthma.[1- 3]. 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 archwires 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. Therefore, in orthodontic practice, it is essential to know the exact amount of each ion released during the course of treatment, and informs the patient undergoing orthodontic treatment in this respect.[4, 5] Hence; the present study was conducted for evaluation of salivary chromium levels among patients undergoing fixed orthodontic treatment.

Materials and Methods

The present study was conducted for evaluation of salivary chromium levels among patients undergoing fixed orthodontic treatment. 20 patients who presented to the orthodontic clinic were selected. The salivary samples were taken from the patients in following stages: before appliance placement, one month, and 4 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. All the results were recorded and analysed by SPSS software.

Results

A total of 50 subjects were analysed. Mean age of the subjects was 19.7 years. Sixty percent of the subjects were males while the remaining were females. Mean salivary chromium levels before appliance placement; one month after appliance placement and four months after appliance placement was 2.5 µg/L, 3.9 µg/L and 2.9 µg/L respectively. Significant results were obtained while comparing the alteration in salivary chromium levels. Significant results were obtained while comparing the salivary chromium levels at different time intervals.

Table 1
Alteration in salivary chromium levels

Time period	Mean (µg/L)	SD	p- value
Before appliance placement	2.5	1.3	0.001 (Significant)
One month after appliance placement	3.9	1.8	
Four months after appliance placement	2.9	1.2	

Discussion

The oral cavity can be described as a vastly complex environment, where numerous synergistic and antagonistic interactions take place at different times among its elements. The kingpin in this environment is saliva, secreted by glands, which formed by water (99%) and other compounds (1%): Glucose, electrolytes (chloride ions, bicarbonates, phosphates, sodium ions, magnesium ions and calcium ions), nitrogen compounds (ammonia, urea) and proteins: enzymes, immunoglobulines, mucosal glycoproteins, albumins, oligopeptides, polypeptides and aquaporins and any additional constituent that may enhance the complexity of the oral environment in a variety of ways.[7- 9] Fixed orthodontic appliances introduce an additional constituent to the oral cavity complex that may enhance environment in a variety of ways.3 On the other hand, Orthodontic treatment leads to changes in the oral environmental factors that encourage changes in salivary flow rate, viscosity, pH, bacterial count, increased plaque index, and other more things which all are factors supplement the risk of caries activity and shake the stability of the oral environment. [10- 12]

Associations between overweight and obesity with oral diseases is still swinging between significance and non significance, but generally still no establishment for direct causation. So only what can be stated with some confidence is that obesity is one factor in a complex relationship between a multiple conditions, and this relationship requires further investigation. The same uncertainty and vague also surrounds the association between underweight status and oral diseases.[10- 12] In the present study, a total of 50 subjects were analysed. Mean age of the subjects was 19.7 years. Sixty percent of the subjects were males while the remaining were females. Mean salivary chromium levels before appliance placement; one month after appliance placement and four months after appliance placement was 2.5 µg/L, 3.9 µg/L and 2.9 µg/L respectively. Imani MM 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. Corrosion of fixed orthodontic appliances leads to elevated salivary nickel and chromium concentrations early after initiation of orthodontic treatment.[11]

In the present study, significant results were obtained while comparing the alteration in salivary chromium levels. Significant results were obtained while comparing the salivary chromium levels at different time intervals. Pritam A et al assess nickel and chromium level in gingival crevicular fluid in patients undergoing orthodontic treatment. Forty patients undergoing fixed orthodontic treatment were divided into 2 groups of 20 each. Group I was fixed orthodontic treatment group and was given nonfluoridated toothpaste and Group II was fixed orthodontic treatment group and was given fluoridated toothpaste. The assessment of salivary nickel and chromium levels was done using inductively coupled plasma mass spectrometry. In group I, there were 6 male and 14 female and in group II 7 males and 13 females. The mean nickel level (ng/ml) before treatment in group I was 0.49 and in group II was 0.52, on 7th day was 0.52 and 0.54, on 30th day was 13.4 and 100.2, and on 6th month was 0.54 and 0.52 in Group I and II, respectively. The mean chromium level (ng/ml) before treatment in Group I was 0.48 and in Group II was 0.52, on 7th day was 0.52 and 0.53, on s30th day was 40.6 and 62.4 and on 6th month was 4.9 and 0.52 in Group I and II, respectively. The difference was significant ($P < 0.05$). The release of metal ions such as nickel and chromium was more with fluoridated toothpaste as compared to nonfluoridated toothpaste in patients undergoing fixed orthodontics.[12]

Conclusion

Corrosion of fixed orthodontic appliances leads to elevated salivary chromium levels early after the initiation of orthodontic treatment.

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