

## ORIGINAL RESEARCH

### Assessment of Salivary Nickel Levels in Patients Undergoing Orthodontic Treatment

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#### ABSTRACT:

**Background:** Nickel is a strong sensitizer and one of the most common causes of contact allergies. Patients and parents therefore may express concern about possible leakage of metal ions from an orthodontic appliance. **Aim of the study:** To assess salivary nickel levels in patients undergoing orthodontic treatment. **Materials and methods:** The study was conducted in the Department of Orthodontics of the dental institution. For the study, we selected 50 patients from the department of orthodontics who were scheduled for orthodontic treatment. The patients who had any systemic disease such as diabetes mellitus, and who consumed alcohol and had habit of chewing or smoking tobacco were excluded from the study. The age of the patients ranged from 14-28 years. The sample collection of saliva was done before the initiation of the treatment, after 6 months and 12 months post treatment. **Results:** A total of 50 patients were included in the study ranging from 14-28 years of age. The number of female patients was 26. The mean age of the patients was 18.25 years. We observed that mean nickel ions level before initiation of treatment was at 9.2 µg/L, after 6 months of treatment at 10.9 µg/L, and after 12 months at 8.6 µg/L. The level of nickel was comparable before the initiation of treatment and after 12 months. **Conclusion:** From the results of present study, this can be concluded that there is no significant difference in the level of nickel in saliva of patients before the treatment and after 6 months and 12 months of treatment.

**Keywords:** Nickel, orthodontic wires, saliva.

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#### INTRODUCTION:

Nickel is a strong sensitizer and one of the most common causes of contact allergies. Patients and parents therefore may express concern about possible leakage of metal ions from an orthodontic appliance.<sup>1, 2</sup> *In vitro* release of nickel from orthodontic appliances has been noted using microscopic analysis of corrosion as well as chemical analyses of orthodontic components when exposed in an artificial oral environment. When incubated in artificial saliva, orthodontic appliances of various types release 22–40 µg nickel per day, compared with the estimated dietary intake of between 100 and 800 µg per day.<sup>3, 4</sup> Release of nickel is reported to vary with composition and manufacturing of the appliance components and between archwire alloys and mechanical straining but not actual nickel content. Considering the potential danger of these trace elements, it is essential to define concentrations of these ions released during orthodontic treatments.<sup>5, 6</sup> Hence, the present study was conducted to assess salivary nickel levels in patients undergoing orthodontic treatment.

#### MATERIALS AND METHODS:

The study was conducted in the Department of Orthodontics of the dental institution. The ethical clearance for study protocol was obtained from ethical committee of the institution. For the study, we selected 50 patients from the department of orthodontics who were scheduled for orthodontic treatment. The patients who had any systemic disease such as diabetes mellitus, and who consumed

alcohol and had habit of chewing or smoking tobacco were excluded from the study. The age of the patients ranged from 14-28 years. An informed written consent was obtained from the patients and from the parents in case of juvenile patients. The fixed appliances at the time of sample collection consisted of bonded 0.018 in. slot pre-adjusted Roth prescription stainless steel brackets on all teeth except the molars and an average of four to eight stainless steel orthodontic bands. The arch wires consisted of 0.016- and 0.016×0.022-in stainless steel or 0.016- and 0.016×0.022-in nickel titanium, depending on the treatment phase. The sample collection of saliva was done before the initiation of the treatment, after 6 months and 12 months post treatment. For the collection of saliva sample, the patients were recommended to avoid consumption of foods rich in nickel for 24 hours before the collection of saliva. The saliva was collected using a nickel free polypropylene tube. Unstimulated saliva was collected from the patient's oral cavity after making them to rinse their mouth with distilled water for 30 seconds. The collected samples were stored in freezer and were sent to laboratory for estimation of nickel level.

The statistical analysis of the data was done using SPSS version 11.0 for windows. Chi-square and Student's t-test were used for checking the significance of the data. A p-value of 0.05 and lesser was defined to be statistical significant.

**RESULTS:**

A total of 50 patients were included in the study ranging from 14-28 years of age. Table 1 shows the demographic details of patients. The number of female patients was 26. The mean age of the patients was 18.25 years. Table 2 shows the mean nickel level in patients. We observed that mean nickel ions level before initiation of treatment was at 9.2 µg/L, after 6 months of treatment at 10.9 µg/L, and after 12 months at 8.6 µg/L. The level of nickel was comparable before the initiation of treatment and after 12 months. The results were statistically non-significant. (Fig 1)

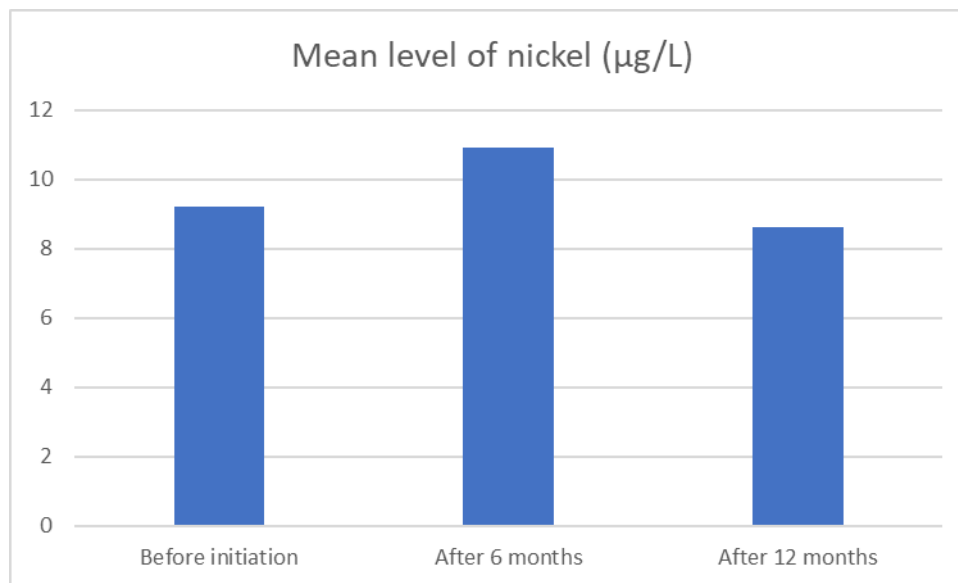
**Table 1: Demographic details of patients**

Variables	Number of patients
Total number of patients	50
Number of female	26
Mean age of patients	18.25 years

**Table 2: Mean nickel level in patients**

	Before initiation	After 6 months	After 12 months	p-value
Mean level of nickel (µg/L)	9.2	10.9	8.6	0.221

**Fig 1:**



**DISCUSSION:**

In the present study, we observed that there was no significant difference in the nickel level in saliva in patients who underwent orthodontic treatment for a year. The results were compared to previous studies. 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. They concluded that there was no significant difference in the average amount of salivary nickel and chromium of patients at various stages of orthodontic appliance placement. Amini F et al conducted a retrospective study to measure salivary levels of these ions during 1 year of orthodontic treatment. Saliva samples were collected from 20 orthodontic patients, before treatment (control) and 6 and 12 months later. Nickel and chromium concentrations were determined using atomic absorption spectrophotometry. Average nickel

level changed from  $9.75 \pm 5.02$  to  $10.37 \pm 6.94$  and then to  $8.32 \pm 4.36$   $\mu\text{g/L}$  in 1 year. Average chromium concentration changed from  $3.86 \pm 1.34$  to  $4.6 \pm 6.11$  and then to  $2.04 \pm 1.66$   $\mu\text{g/L}$ . Alterations in nickel values were not statistically significant, but fluctuations in chromium levels were. The decrease in chromium concentration after 12 months was significant compared to the control. Although slightly increased after 6 months, the concentration of both ions dropped to levels slightly lower than the control groups after 12 months.<sup>7,8</sup>

Singh DP et al examined whether orthodontic treatment induces an increase in salivary nickel and chromium concentration. Ten new patients (7 females and 3 males) beginning fixed orthodontic treatment were included in the study. The mean age of the sample was 17.5 years (range 14 to 24 years). Three samples of stimulated saliva were collected from each orthodontic patient, 1 at each of the following times: before insertion of the fixed appliance (which served as a baseline/reference level for salivary nickel and chromium content), 1 week after insertion of the appliance, and 3 weeks after insertion of the appliance. These samples were analyzed for nickel and chromium content using the atomic absorption spectrometer and their values recorded in ng/mL. The Friedman test was used to test the statistical significance of differences in concentrations of each metal before and after insertion of orthodontic appliances. Post-hoc comparisons were performed using the Wilcoxon signed rank test and Mann-Whitney U test. This study showed that there was a statistically significant difference in salivary nickel and chromium concentrations before and 1 week and 3 weeks after insertion of fixed orthodontic appliances. The highest concentrations of nickel and chromium were found after 1 week. The salivary nickel and chromium concentrations tapered off 3 weeks after insertion but were significantly higher than baseline levels. They concluded that the salivary nickel and chromium concentrations significantly increased after insertion of fixed orthodontic appliances as compared to baseline levels, with the maximum concentration seen in the first week after placement of fixed orthodontic appliances. Kerosuo H et al investigated nickel and chromium concentrations in saliva of patients with different types of fixed appliances. Saliva samples were collected from 47 orthodontic patients, ages 8 to 30 years. Four samples from each subject were collected: (1) before insertion of the appliance, (2) 1 to 2 days after, (3) 1 week after, and (4) 1 month after insertion of the appliance. A considerable variation in the concentrations of both nickel and chromium was observed. No significant differences were found between the no-appliance samples and the samples obtained after insertion of the appliances. The results suggest that nickel and chromium concentrations of saliva are not significantly affected by fixed orthodontic appliances during the first month of treatment.<sup>9,10</sup>

## CONCLUSION:

From the results of present study, this can be concluded that there is no significant difference in the level of nickel in saliva of patients before the treatment and after 6 months and 12 months of treatment.

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