

## ORIGINAL RESEARCH

### ASSESSMENT OF LONGITUDINAL CHANGES IN GINGIVAL CREVICULAR FLUID AFTER PLACEMENT OF FIXED ORTHODONTIC APPLIANCES

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#### ABSTRACT:

**Background:** Orthodontic compounds are produced using different metals, among which chromium and nickel are of significant concern. Both of these genotoxic, mutagenic, and cytotoxic metals may instigate contact sensitivity, asthma, touchiness, birth surrenders, and regenerative harm. Gingival crevicular liquid (GCF) is the material gotten from the gingival sulcus and might go about as potential hotspot for different biomarkers in the orthodontic setup on the grounds that fiery actuated reaction is specifically identified with orthodontic powers in GCF. In the light of previously mentioned information, we arranged the present investigation to survey and assess the progressions happening in nickel and chromium levels in the GCF in fixed orthodontic patients. **Materials and methods:** Total 35 patients were included in study which includes 19 males and 16 females who had fixed orthodontic appliances. Nickel and chromium focuses were measured before treatment and 1 month and after 6 months utilizing atomic absorption spectrophotometry. The impacts of treatment on GCF particles were examined. Tests were taken three times from the GCF. The examples were gathered at following time interims: At pattern time (pre-treatment time), One month after the beginning of orthodontic treatment, and at 6 months time after the initiation of orthodontic treatment. Cellulose strips were utilized for confinement of the tooth area. For accumulation of the GCF gathering, an institutionalized cellulose acetic acid derivation spongy strip was utilized. Arrangement of the strips was done in the sulcus for gathering of the specimens. Refrigeration of the example bottles was accomplished for at least seven days and was then sent to research center where examples were exchanged for the atomic absorption spectrophotometry. **Result:** The gingival index intensified after some time. The mean nickel levels were  $3.8 \pm 1.32$ ,  $5.6 \pm 2.6$ , and  $16.7 \pm 7.8$  mg for every gram, separately, at benchmark, month 1, and month 6. Chromium fixations were  $1.78 \pm 0.7$ ,  $4.5 \pm 1.8$ , and  $11.7 \pm 3.5$  mg for every gram, separately. While looking at the mean nickel levels in the middle of first month and 6th month and between pattern time and 6th month, critical outcomes were gotten. **Conclusion:** Levels of nickel and chromium may indicate significant height in the GCF with time alongside increment in seriousness of aggravation in the gingival wellbeing in patients experiencing settled orthodontic treatment. Normal oral prophylaxis of the patients experiencing orthodontic treatment ought to be done to keep away from toxicities caused by arrival of nickel and chromium and for support of good oral cleanliness and oral wellbeing.

**Keywords:** Chromium, Nickel, Orthodontic treatment.

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**INTRODUCTION:** Orthodontic alloys are produced using different metals, among which chromium and nickel are of significant concern.<sup>1</sup> Both of these genotoxic, mutagenic, and cytotoxic metals may initiate contact sensitivity, asthma, touchiness, birth surrenders, and regenerative harm. Erosion of orthodontic compounds may prompt arrival of impressive measures of nickel and chromium particles into spit. The systemic ingestion of such metals is an additional wellbeing risk. Corrosion of these materials happens inside

the oral cavity because of various ecological or oral variables which follow up on them.<sup>2</sup> Appliances end up becoming weak because of activity of every one of these specialists and begins discharging nickel, chromium and so on into the oral cavity. Critical part is played by nickel and chromium which gone under the classification of trace elements.<sup>3,4</sup>

Gingival crevicular liquid (GCF) contains an exudates that can be acquired from the gingival sulcus and is a potential hotspot for collecting different components which are

related with periodontal changes which happen affected by orthodontic treatment.<sup>5,6</sup> GCF may go about as potential hotspot for different biomarkers in the orthodontic setup on the grounds that provocative instigated reaction is specifically identified with orthodontic forces in GCF.<sup>7</sup> In the light of previously mentioned information, we arranged the present investigation to survey and assess the progressions happening in nickel and chromium levels in the GCF during fixed orthodontic patients.

**MATERIALS AND METHODS:** This prospective preliminary study was performed on 35 orthodontic patients (19 males, 16 females) The sample size was predetermined based on a pilot study and power calculations. The protocol ethics were approved by the research committee of the university, and written consents were taken from the subjects or their parents after thorough verbal and written explanation. The patients were selected from attendees to the Orthodontics Department of dental hospital during the years 2014– 2015. The inclusion criteria comprised the subjects’ willingness to participate, the indication for bimaxillary non-ext fixed orthodontic treatment, the age range of 14 to 32 years old, having all the permanent teeth fully erupted (no semi-eruptions, no missing, or extraction) excluding the third molars, the absence of any systemic diseases, any history of allergic reactions, medication intake, alcohol consumption or smoking, the absence of any caries, any metal restorations such as amalgam fillings or fixed prostheses placed before or during the treatment, , as well as no history of previous orthodontic treatment of any kind. All the inclusion criteria needed to be met during the study period and they were also asked not to eat or drink on the morning of the scheduled visit.

The examining was done 3 times (before treatment, what's more, 1 month and after 6 months) by a senior orthodontics graduate understudy prepared and adjusted by a periodontist. The teeth and gingivae were not splashed with water or flushed to counteract evacuation of the GCF. To wipe out spit defilement, the teeth what's more, encompassing gingivae were delicately air dried. The area was isolated with cellulose strips. An institutionalized cellulose acetic acid derivation spongy strip with 45-mm micropores was utilized for the GCF gathering. It was tenderly put in the sulcus for 60 seconds. In every patient, 4 destinations for GCF gathering were haphazardly chosen in

the primary testing session in view of the absence of draining and the likelihood of embeddings the PerioPaper strip for no less than 1 mm. On the off chance that a site or tooth demonstrated bleeding on examining, after the draining halted, different destinations or teeth were arbitrarily chosen and examined. What's more, if calculus did not permit embeddings the strip, another site was arbitrarily chosen. Also, if a particular sulcus did no totally wet the strip inside 60 seconds (decided visibly), the strip was disposed of, and another one was utilized to test the gingival liquid from another haphazardly chose site. After each effective examining, the PerioPaper strip was evacuated and put in a glass compartment with a top. Each container was loaded with 4 strips, each absorbed just 1 site from every patient (no PerioPaper strip was utilized to test from more than 1 site). The examples were kept in a fridge at 1degreeC for a greatest of 1 week and afterward sent to the lab. The locales of examining in the primary session were recorded for every patient to be tested in the second and third sessions too, in the event that they kept up legitimate conditions for inspecting. In the event that the locales were not accessible, another inspecting site would be arbitrarily chosen rather than each site that had draining or analytics or inadequate GCF. The strips were weighed prior and then afterward GCF inspecting. Gingival health was assessed by evaluating the gingival index of Loe.<sup>8</sup> This index categorized a

- 0: No inflammation,
- 1: Mild inflammatory response, Slight discoloration, slight edema, absence of ulceration or continuous bleeding,
- 2: Moderate inflammatory response, bleeding on probing,
- 3: Sever inflammatory response, ulceration along with spontaneous bleeding.

**RESULT:** The patients' mean age was 23.3 ±3.5 years (range 14-32 years). There was no critical relationship between's the particle levels with the exception of the pair of nickel levels at the baseline and the 6th month. Near assessment of mean nickel and Chromium levels in GCF at different time interims is appeared in Table 1. While contrasting the mean nickel levels in the middle of first month and 6th month and between standard time and 6th month, critical outcomes were gotten. Gingival wellbeing list of the patients was observed to be related with expanded aggravation with movement of time of orthodontic treatment (Table 2).

**Table 1:** Nickel and Chromium levels in GCF

Parameter	Different time intervals		
	Baseline time	First month	Sixth month
Value of nickel in µg/ g of GCF	3.8 ±1.32,	5.6 ± 2.6	16.7 ± 7.8
Value of Chromium in µg/ g of GCF	1.78 ± 0.7	, 4.5 ± 1.8,	11.7 ± 3.5

**Table 2:** Gingival health index

Time interval	Inflammation (n=35)			
	Normal	Mild	Moderate	Severe
Baseline time	19	13	3	0
One month time	0	16	19	0
Sixth month time	0	11	19	5

**DISCUSSION:**

Due to the potential increments in plaque accumulation, fixed orthodontic treatment may increment gingival inflammation. This may trade off attractive treatment results by diminishing solid periodontal connective.<sup>9</sup> This examination demonstrated that periodontal conditions may exacerbate amid the underlying phase of orthodontic treatment.

Nickel and chromium are contained in factor sum in appliances utilized for fixed orthodontic treatment. The stainless steel appliances utilized as a part of the development of fixed orthodontic treatment incorporates chromium and nickel in 18 percent and 8 percent ratio. Around 50% nickel is available in the orthodontic arch wires which are comprised of nickel titanium because of electrochemical breakdown, there is arrival of nickel and chromium in patients experiencing fixed orthodontic treatment, which may additionally can possibly start "extreme hypersensitivity" response.<sup>10,11</sup>

Nickel got specific significance in the current past when examines highlighted its connection with different obsessive conditions. In particular, chemotaxis of leukocytes alongside incitement of neutrophils to wind up plainly aspherical was observed to be weakened with nickel with sums as low as 2.5 ng/mL (ppm).<sup>12</sup> Hence; we arranged the present investigation to survey and assess the progressions happening in nickel and chromium levels in the GCF in fixed orthodontic patients.

In this examination, it was appeared surprisingly that nickel and chromium in GCF may increment extensively contrasted and the gauge levels inside the initial 6 months of settled orthodontic treatment. Past examinations have demonstrated very disputable outcomes. Urinary nickel levels can increment in orthodontic patients. In the present examination, we watched that mean estimations of nickel and chromium in GCF were  $3.8 \pm 1.32$  and  $1.78 \pm 0.7$   $\mu\text{g/g}$  of GCF at standard pre-treatment time. Altogether while looking at the mean estimations of nickel and chromium levels in GCF when thought about in the middle of gauge time and 6th month time. Our outcomes were in connection with the outcomes gotten by Amini et al who watched comparative discoveries in their study.<sup>13</sup> We additionally watched an expansion in seriousness of irritation of the gingival with time. Amini et al additionally detailed comparable discoveries in their examination where they watched fall in the helth of

gingival tissue with time in patients experiencing orthodontic treatment.<sup>14</sup> Amini et al surveyed the distinction in levels of nickel and chromium levels in gingival crevicular liquid in patients experiencing fixed orthodontic treatment.<sup>15</sup>

Singh et al assessed the adjustment in levels of salivary nickel and chromium focus in patients experiencing fixed orthodontic treatment.<sup>16</sup> They evaluated 10 patients who were intended to experience settled orthodontic treatment. 17.5 years was the mean age of the subjects. All the salivary specimens were gathered thrice; at the pre-treatment time, after the principal week of inclusion of the orthodontic machine lastly at three weeks of addition of the apparatus. Atomic absorption spectrometer was utilized for appraisal of nickel and chromium content. They watched huge distinction in salivary nickel and chromium fixations at various time sessions in patients after insertion of fixed orthodontic apparatuses. From the outcomes, the creators reasoned that huge height in levels of salivary nickel and chromium focuses happen after insertion of fixed orthodontic appliances.<sup>17</sup>

The metal levels in the GCF seen in this investigation concurred more with the example of systemic metal particle disposal contrasted and the vacillations watched in salivary levels. This may preclude an extensive measure of undetected salivation sullyng in light of the fact that salivary nickel and chromium levels may tend to decrease after the primary months of treatment. When GCF is not debased with plaque or spit, it may reflect systemic particle changes. Be that as it may, undetected plaque tainting may in any case frustrate the outcomes.<sup>18</sup> Plaque microorganisms may extensively ingest and amass metals, for example, nickel by complexing them with glycoproteins and beforehand assimilated ions. This expansion in plaque particles may be undetected in salivary tests.<sup>19</sup> Swallowed plaque particles may be ingested into the circulatory system and might legitimize the systemic increments not predictable with salivary increases. Bracket-upgraded plaque may influence the particle levels in GCF by specifically debasing it or possibly expanding the blood fixations. In spite of the fact that the patients were asked for and trained over and over to keep up legitimate oral cleanliness, it was essentially difficult to take out plaque totally.

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