Characterization of nickel-induced allergic contact stomatitis associated with fixed orthodontic appliances

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Introduction: In some orthodontic patients, an oral inflammatory response is induced by corrosion of orthodontic appliances and subsequent nickel release. This inflammatory response is manifested as stomatitis (nickel-induced allergic contact stomatitis [NiACS]). The etiology and diagnosis of NiACS are difficult to determine. The purpose of this retrospective analysis was to investigate the roles of age, sex, previous allergic history, and time of exposure to fixed orthodontic appliances in the etiopathogeny of NiACS.

Methods: Forty-four orthodontic patients (range, 10-44 years) were divided into 2 groups, depending on their NiACS clinical manifestations. Results: Young patients, especially females with a history of allergic reactions, had a greater predisposition to NiACS clinical manifestations; time of exposure to orthodontic appliances was not a significant factor. Conclusions: A previous allergic reaction should be considered a predictive factor of NiACS clinical manifestations and should be noted in the patient’s medical history. (Am J Orthod Dentofacial Orthop 2005;128:378-81)

Nickel is a powerful sensitizer metal and a common allergen. The incidence of nickel-induced allergic contact dermatitis had been reported in the literature. Some oral clinical manifestations in orthodontic patients, such as gingival hyperplasia, labial desquamation, angular cheilitis, multiform erythema, and periodontitis might be associated with an inflammatory response induced by the corrosion of orthodontic appliances and the subsequent release of nickel. This inflammatory response, from an immunologic standpoint, is considered type IV hypersensitivity. It is manifested as nickel allergic contact stomatitis (NiACS), and its etiology and diagnosis are difficult to establish.

In its initial phase, clinical lesions have diverse features depending on the concentration and intensity of the exposure, the presence of local barriers, and the area affected. A burning sensation is the most frequent symptom. The aspect of the affected mucosa is also variable, from slight erythema to shiny lesions with or without edema. Vesicles are rarely observed, but, when they are present, they quickly rupture, forming erosion areas. In chronic cases, the affected mucosa is typically in contact with the causal agent and appears erythematous or hyperkeratotic to ulcerated. Other symptoms can also be present, such as perioral dermatitis and, rarely, orolingual paresthesia.

Diagnosing NiACS is more difficult in the oral mucosa than on the skin. Lesions caused by NiACS can be confused with mechanical injury, autoimmune lesions, aphthous stomatitis, or poor oral hygiene.

Sensitivity to nickel has been evaluated through biocompatibility tests, including cutaneous sensitivity (patch) tests, and reactivity to nickel has been evaluated with in-vitro cell-proliferation assays.

In orthodontic patients with mild signs and symptoms of NiACS, the appliances should be removed immediately. Patients with more intense reactions...
should also be treated with antihistamines, anesthetics, or topical corticoids.16,23

Because NiACS is a little-known pathologic entity that is difficult to diagnose, the purpose of this study was to assess the roles of age, sex, previous allergic history, and time of exposure in the NiACS etiopathogeny induced by fixed orthodontic appliances.

MATERIAL AND METHODS

Forty-eight orthodontic patients, aged 10 to 44 years, with good general and oral health, undergoing fixed appliance therapy, were characterized by sex, age, exposure time to orthodontic appliances, and previous allergic history. The patients were evaluated with clinical parameters17 and classified into 2 groups: those with no clinical manifestations of hypersensitivity to nickel released by orthodontic appliances and those with clinical manifestations (such as slight to moderate gingival hyperplastic lesions, labial desquamation with no perioral involvement [mild/moderate manifestation], remarkable gingival hyperplasia with clear involvement of orthodontic appliances associated with angular cheilitis or labial desquamation, and perioral involvement [intense manifestation]).

The orthodontic appliances used in this study were the same kind and from the same manufacturer and therefore probably contained the same amounts of nickel. The Student t test was used to compare average exposure times, age, and sex of patients with and without clinical manifestations of NiACS. The chi-square test was performed to verify the association between NiACS clinical manifestations and allergic history. Differences with a P value less than .05 were considered significant.

The study was approved by the Ethical Committee of Universidade Federal de Minas Gerais and Universidade Vale do Rio Doce. Informed consent was obtained from all subjects and their parents.

RESULTS

Age, sex, and, average exposure time to orthodontic appliance are shown in the Table.

Patients with NiACS clinical manifestations were significantly younger than those with no manifestations (P < .05). Patients with and without NiACS clinical manifestations were mainly female, although this difference was not statistically significant (P = .076). The average exposure time to orthodontic appliances was 29 months for patients with NiACS clinical manifestations and 23.1 months for those without. The difference was not significant (P > .05).

Previous allergic history was associated with NiACS clinical manifestations. Most patients who reported allergic reactions before orthodontic treatment also had oral reactions; none of the patients without clinical manifestations reported previous allergic episodes (P < .05) (Fig).

DISCUSSION

In view of the high frequency of cutaneous hypersensitivity to nickel,1-4,7 relatively few cases of oral lesions have been reported in the literature. This might be partially explained by the fact that a nickel concentration 5 to 12 times greater is required to trigger mucosal lesions than skin lesions.24

In addition, NiACS is difficult to diagnose because relatively little information is available about the pathologic entity. Mucosal lesions are hard to interpret, and hypersensitivity is not always considered as a differential diagnosis. Orthodontic patients with NiACS features have complaints that can be confused with other problems. Nevertheless, clinical information obtained from the patient, such as good oral health, low index of bacterial plaque, and positive allergic history might help in diagnosis.25 Removal of the orthodontic appliance is helpful.

In this study, NiACS clinical manifestations did not depend on how long the subject was exposed to orthodontic appliances. Other factors, such as family predisposition to NiACS26 and certain major histocompatibility complex haplotypes might be more important.27

Our results have also shown that people with NiACS manifestations were significantly younger. Van

### Table. Characterization of patients undergoing orthodontic treatment with fixed appliances, with and without NiACS clinical manifestations

<table>
<thead>
<tr>
<th>Clinical characterization</th>
<th>Patients without NiACS</th>
<th>Patients with NiACS</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average age (y) (range)</td>
<td>21.27 (11-44)</td>
<td>14.23 (10-21)</td>
<td>&lt;.05</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>9</td>
<td>8</td>
<td>&gt;.05</td>
</tr>
<tr>
<td>Female</td>
<td>13</td>
<td>18</td>
<td>&gt;.05</td>
</tr>
<tr>
<td>Average exposure time to orthodontic appliance (mo)</td>
<td>23.1</td>
<td>29</td>
<td>&gt;.05</td>
</tr>
</tbody>
</table>
Hoogstraten et al. made a similar observation. A possible explanation might be the oral tolerance mechanism that consists of the reduction or absence of immune system responsiveness to successive exposures to the antigen through the oral cavity.

Bass et al. and Kerosuo et al. stated that hypersensitivity to nickel differs between sexes and is found more often in females. Our results agreed with these studies, although the difference was not statistically significant ($P = .076$). The greater frequency of females with NiACS clinical manifestations might be explained by greater exposure to sensitizing allergens. This trend, however, could be changing as more males begin to wear jewelry and other objects containing nickel.

Previous allergic history was the most important variable characterizing NiACS. Ear piercing has been the most frequent allergy mentioned by patients, in accordance with the findings of Starkjaer and Menné. In our study, previous allergic history was significantly associated with a response to hypersensitivity to the nickel released by orthodontic appliances. Most patients (69.2%) with NiACS clinical manifestation had a previous allergic history; only 30.8% of them reported no allergic history. In addition, no patients in the group with no clinical manifestations reported previous allergic episodes.

Patients seeking orthodontic therapy who might be hypersensitive to nickel can be treated with alternative materials or techniques, such as appliances coated with epoxy resin. Ceramics and new metals, such as titanium, vanadium, and aluminum, might also help these patients avoid NiACS.

CONCLUSIONS

Most patients with NiACS clinical manifestations were young and female, and had a history of allergies; NiACS was not associated with how long the patients were exposed to fixed orthodontic appliances. A detailed history, with special attention to previous allergic reactions, is the main prognostic factor to avoid NiACS manifestations during orthodontic therapy.

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REFERENCES


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