ABSTRACT

The clinical relevance of positive patch tests reactions to metals in prosthetic dentistry in symptomatic patients treated with dental alloys is often unclear. The clinical manifestations of contact allergy to dental alloys are various and sometimes rest misdiagnosed.

The study aimed to determine the prevalence of positive patch test reactions to metals in symptomatic individuals with dental alloy restorations and to classify the clinical manifestations of allergy in these patients.

A group of 304 patients with dental alloy restorations and oral symptoms with suspected allergy to dental alloys were clinically examined and patch tested.

A total of 13.8% of them were with positive patch test to different metals. 9.5% were positive to nickel, 6.2% to gold, 5.3% to palladium, 4.3% to cobalt and 0.7% to chrome. The most frequent oral manifestations of contact allergy to dental alloys were lichenoid lesions (64.3%), cheilitis (59.5%), erythema (38.1%) and oedema (35.7%).

The prevalence of metal hypersensitivity in individuals with oral symptoms and dental alloy restorations is 13.8%. The symptoms related with dental alloy allergy are lichenoid lesions, cheilitis and oedema.

Materials and Methods

Patients

From January 2007 to March 2008, 304 patients with suspicion of allergy to dental alloys of their removable partial dentures or fixed prosthetic restorations were clinically examined and patch tested with metal substances in dental alloys at the sector of Dental Clinical Allergology and Oral Diagnostics in the Faculty of Dental Medicine – Sofia. Out of the tested subjects 223 were females (73.4%) and 81 patients were males (26.6%).

A detailed anamnesis was taken after standardized questionnaire including information on type, localization and time of appearance of the symptoms. Information was obtained also regarding duration of dental alloy restorations. A history of atopy, a limited history of jewelry exposure and any known allergy to metals, drugs or foods was also taken. The oral examination included registration of all dental restorations. The registration of oral lesions that were possibly related with adverse effects to dental alloys, which were used for prosthetic treatment, was made. A contact with the dental personnel who accomplished the prosthetic treatment was established in order to receive an information of dental alloys’ composition.

Epicutaneous tests

Patch test was performed with the metal substances of dental screening series (Chemotechnique Diagnostics®,
including Potassium dichromate, Cobalt (II) chloride hexahydrate, Goldsodiumthiosulfate, Nickelsulfate hexahydrate, Copper sulfate, Palladium chloride, Aluminumchloride hexahydrate, Tin and IQ Chambers® (Chemotechnique Diagnostics®, Vellinge, Sweden). The patches were removed after 2 days and read on days 3 and 7. All tests were carried out by the same examiner.

The diagnosis of contact allergy was based on evaluation of the clinical manifestation and the result from the patch test. The results of patch test were shown according to the following scale:

+ mild (non-vesicular, erythema, infiltration, possible papules)
++ moderate (edematous or vesicular)
+++ significant to strong (bullous, ulcerative)
Df - Doubtful reaction (macular erythema only)
Ir - Irritant reaction
Neg - Negative reaction

Statistical analysis
The statistical analysis was performed using the SSPS 16.0 program. We used Fisher’s exact test and Pearson chi-square test. A $p$-value of less than 0.05 was chosen as level of significance.

Results and Discussion
A total of 42 patients (13.8%) had one or more positive patch test reactions to metal substances. A total of 10 of them were males and 32 were females.

The distribution of patients after type of dental alloy restoration after the information given by the dental personnel was: 43 (14.1%) with gold-based alloys and 261 (85.9%) with non-precious restorations (190 nickel-chrome-based restorations and 71 cobalt-chrome-based restorations).

Analyze of anamnesis data show that a total of 33 of patients (78.6%) with positive patch test to metal substances reported allergy to metals, drugs or food compared with 69 of patients (26.3%) without positive reactions to patch tested metal substances and history of allergy. This difference was statistically significant ($p<0.05$).

A total of 6 of 42 patients with positive patch test reactions were with atopy versus 39 of a total 262 patients without positive patch test. Between the two groups, there was no significant difference in regard to the presence of atopy (14.3% vs. 14.8%, $p>0.05$).

The data from the history show that dental alloy appliances were placed 1 month to 14 years before our evaluation. All patients positive to gold (n=19) have been wearing their gold-based restorations for more than 11 years.

The majority of the positive reactions were to nickel 9.5% (29/304). A total of 19 of 304 (6.25%) had a positive patch test to gold, 16 (5.3%) to palladium, 13 (4.3%) to cobalt, 2 (0.7%) to chrome and 1 (0.3%) to aluminum (Table 1).

### Table 1

<table>
<thead>
<tr>
<th>TEST SUBSTANCES</th>
<th>Number of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Nickelsulfate hexahydrate</td>
<td>29</td>
</tr>
<tr>
<td>2. Goldsodiumthiosulfate</td>
<td>19</td>
</tr>
<tr>
<td>3. Palladium chloride</td>
<td>16</td>
</tr>
<tr>
<td>4. Cobalt(II) chloride hexahydrate</td>
<td>13</td>
</tr>
<tr>
<td>5. Potassium dichromate</td>
<td>2</td>
</tr>
<tr>
<td>6. Aluminumchloride hexahydrate</td>
<td>1</td>
</tr>
<tr>
<td>7. Copper sulfate</td>
<td>0</td>
</tr>
</tbody>
</table>

Chemotechnique Diagnostics, Vellinge, Sweden

The clinical manifestations of allergy to dental alloys are shown in Table 2. In all patients the intraoral symptoms were adjacent to the prosthesis. The patients with dermatitis periorialis reported that the symptoms appeared soon after placement of the fixed restorations.

### Table 2

<table>
<thead>
<tr>
<th>Clinical manifestations</th>
<th>Frequency</th>
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<tbody>
<tr>
<td>Intraoral symptoms</td>
<td></td>
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<tr>
<td>Lichenoid lesions</td>
<td>27 (64.3%)</td>
</tr>
<tr>
<td>Erythema</td>
<td>16 (38.1%)</td>
</tr>
<tr>
<td>Oedema</td>
<td>15 (35.7%)</td>
</tr>
<tr>
<td>Aphtae</td>
<td>8 (19%)</td>
</tr>
<tr>
<td>Gingivitis</td>
<td>3 (7%)</td>
</tr>
<tr>
<td>Extraoral symptoms</td>
<td></td>
</tr>
<tr>
<td>Cheilitis</td>
<td>25 (59.5%)</td>
</tr>
<tr>
<td>Dermatitis perioralis</td>
<td>2 (4.8%)</td>
</tr>
<tr>
<td>Granulomatosis orofacialis</td>
<td>1 (2.4%)</td>
</tr>
</tbody>
</table>

A significant difference between the group of patients with allergy to dental alloys and lichenoid lesions and the group of patients without allergy to dental alloys and lichenoid lesions was found (59% vs. 27% in treated with nickel-chrome-based restorations and 56% vs 23% in treated with gold-based restorations, Fig. 1).
A significant difference between the group of patients with allergy to dental alloys and oedema and the group of patients without allergy to dental alloys and oedema was found (28% vs. 7% in treated with nickel-chrome-based restorations and 30% vs 0% in treated with gold-based restorations, Fig. 2).

A significant difference between the group of patients with allergy to dental alloys and cheilitis and the group of patients without allergy to dental alloys and cheilitis was found (27% vs. 14% in treated with nickel-chrome-based restorations, 63% vs 18% in cobalt-chrome-based restorations and 34% vs 8% in treated with gold-based restorations, Fig. 3).

In our study allergy to gold-based restorations seems to be more commonly reported than allergic reactions to nickel-containing dental alloys. Thus, we could explain by the strong sensitizing properties of gold ions (1). We found a high incidence of gold sensitivity in patients wearing gold restorations which shows a positive correlation between presence of dental gold restorations and development of positive patch test to gold. This is in accordance with other studies and could be explained by the fact that gold in contact with the oral mucosa may be a frequent sensitizer (12).

The diagnosis of intraoral contact allergy is often complicated. No pathognomonic or specific manifestations exist and it is often difficult or even impossible to distinguish contact allergy from chronic physical or chemical irritation (11). In this study we found a wide range of clinical manifestations of contact allergy to prosthodontic biomaterials in dental patients. We proved statistically significant relation between hypersensitivity to dental alloys and clinical manifestation of cheilitis, lichenoid lesions and oedema (Fig. 1, Fig. 2 and Fig. 3). Gingivitis adjacent to fixed metal restorations is an intraoral symptom that is often found. It was difficult to differentiate the exact cause of this inflammation - it could be allergy, toxicity of the released metal elements or inflammation due to incorrect marginal fit of the crown on the abutment tooth. The last cause was very often found. We chose only patients with gingivitis adjacent to metal restoration and with perfect oral hygiene behavior. Thus the incidence of gingivitis in our patients with allergy to dental alloys was low. Extraoral lesions were associated with intraoral exposure to the allergen due to careful questioning revealing a time-episode relationship between dental treatment procedures and ensuing extraoral reactions.

The appearance of symptoms after placement of new alloy restoration in patients with existing allergy to nickel and treated hypersensitivity to dental alloys. It appeared that there was no association between the presence of atopy and a positive reaction to metal substances which is in accordance with other study (10).
before the appearance of symptoms with nickel-based alloys poses the question of positive relationship between the amount of dental nickel alloys and clinical manifestation of contact allergy of the oral mucosa. These patients were able to tolerate the allergen in minor quantity and increasing of the quantity interrupt the tolerance. Perhaps the clinical manifestation of intraoral contact allergy depends on the dose of the allergen.

Conclusions
Around 1/7 of the symptoms related to the dental alloys can be explained by hypersensitivity to constituents of these materials.
A wide range of manifestations is characteristic for the intraoral contact allergy to dental alloys thus the contact allergy can be included in the differential diagnosis of many nonspecific or unclear intraoral clinical disorders. According to our results cheilitis, lichenoid lesions and oedema were predominant clinical manifestations of intraoral contact allergy to dental alloys. Symptoms appear not only in the oral cavity, but also extra oral. Intraoral lesions are topographically related to the restorations.

REFERENCES