

Department of Odontology, Orthodontics and Department of Public Health and Clinical  
Medicine, Dermatology and Venereology, Umeå University, Umeå

# **Nickel allergy in a Swedish adolescent population and its relation to orthodontic treatment and lifestyle factors**

Akademisk avhandling

Som med vederbörligt tillstånd av Rektorsämbetet vid Umeå Universitet för avläggande av  
medicine doktorexamen kommer att offentligen försvaras i sal B, Tandläkarhögskolan  
9 tr, Umeå torsdagen den 22 maj 2008, klockan 9.00.

av

**Ronny Fors**



Fakultetsopponent: Professor Arne Hensten  
Institutt for klinisk odontologi  
Det medicinske fakultet,  
Universitetet i Tromsø

## **Nickel allergy in a Swedish adolescent population and its relation to orthodontic treatment and lifestyle factors**

Ronny Fors, Department of Odontology, Orthodontics and Department of Public Health and Clinical Medicine, Dermatology and Venereology, Umeå University, SE-90187 Umeå, Sweden

### **ABSTRACT**

Nickel stands out as the main cause of contact allergy in both children and adults, which has given rise to concern and the introduction of regulations by official bodies. Today's youths are frequently exposed to body piercing and orthodontic treatment. Changes in youth lifestyle practices are also likely to influence nickel exposure and thus, the occurrence of nickel allergy. However, against patient and parental concern regarding nickel exposure to orthodontic appliances, often evoked by allergies following piercing, stand results from studies indicating that early orthodontic appliance treatment may reduce, rather than increase, prevalence of nickel allergy; a finding that has been suggested to result from tolerance induction by early exposure to nickel via the oral route.

The objective of the present thesis was to investigate the association between nickel allergy and exposure to different orthodontic appliances and lifestyle, in particular piercing, as well as to study nickel release from orthodontic appliances into the oral cavity. Furthermore, one objective was to establish baseline prevalence data of nickel allergy in a Swedish adolescent population.

Data was generated from a cross-sectional survey, in which about 6000 youths completed a questionnaire and almost 4500 of these were patch-tested for contact allergy. Information on exposure to orthodontic appliances was verified by dental records, whilst nickel content in saliva and dental biofilm was measured in a clinical study.

Questionnaire data demonstrated a reduced risk of nickel allergy when orthodontic treatment preceded piercing (OR 0.5; 95 % CI 0.3-0.8) and similar results were found for data verified from dental records, however statistical significance was lost when adjusting for background factors (OR 0.6, 95 % CI 0.4-1.0). Exposure to full fixed appliances with NiTi-containing alloys, as well as a pooled 'high nickel-releasing' appliance group prior to piercing correlated with a significantly reduced risk of nickel allergy and a trend towards a reduced risk with exposure duration. Nickel could also be found in significantly higher concentrations from dental plaque samples, but not saliva samples, in orthodontic patients who were well into treatment compared to patients who had not been exposed to orthodontic appliances. The effect was not found to be due to differences in estimated dietary nickel intake between the two groups.

Significantly more girls than boys (13.3 % versus 2.5 %) were found to be patch-test positive to nickel. Positive nickel tests were also most prevalent in occupational programmes and least prevalent in natural science programmes, indicating differences in lifestyle and exposure to nickel. Dropout from testing was handled using a missing-value analysis. This internal validation showed that our results overestimated the occurrence of nickel allergy to a minor degree. More girls than boys reported piercing, vegetarian/vegan diet, and smoking practices, whereas an interesting shift in tattooing prevalence was observed with a larger proportion of girls reporting this practice compared to boys. Sex, number of piercings, smoking and orthodontic appliance treatment prior to piercing were found to influence weighted risk estimates of nickel allergy.

To conclude, although orthodontic patients are exposed to nickel intraorally, we found no increased risk of sensitising adolescents to nickel by the use of oral orthodontic appliances. On the contrary, early orthodontic treatment preceding piercing reduced the risk of nickel allergy by a factor of 1.5-2.0. This reduced risk appears to be associated with estimated nickel release of the appliance and duration of treatment, in all supporting a hypothesised induction of immunological tolerance via oral administration of nickel. Our study also showed a strong association between lifestyle and nickel allergy. Although there have been changes in lifestyle over time, as indicated by the strong shift in tattooing practices, no large change in nickel allergy prevalence was found compared with previous Swedish data. Our data will serve as a baseline for future studies of the effect of nickel exposure regulations, such as the Nickel Directive, and for studies of lifestyle changes and their effects on nickel allergy.

**Key words:** *adolescent, dental plaque, lifestyle, nickel, oral, orthodontic treatment, patch test, questionnaire, sensitisation, tolerance*