

# AFRICAN JOURNAL OF MEDICINE and medical sciences

VOLUME 35 NUMBER 3

SEPTEMBER 2006



Editor-in-Chief  
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Assistants Editor-in-Chief  
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ISSN 1116-1077

## Unusual allergic reaction to orthodontic wire: report of a case in a Nigerian patient and implications for clinical management

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### Summary

Material reactions of both an irritant and hypersensitivity nature are not uncommon in contemporary orthodontic practices. The most common hypersensitivity reactions in orthodontic patients are due to alloy components of metal-based orthodontic appliances. This article reports a case of an unusual reaction to the component of an orthodontic appliance in a 6-year-old girl. There was associated trauma with local irritation. The implications and suggestions for management in the orthodontic clinic are reviewed.

**Keywords:** Allergic reaction, orthodontic wire, patient, Nigerian, clinical management

### Résumé

Les réactions matérielles à un irritant et l'hypersensitivité naturelle sont moins commun aux pratiques orthodontiques contemporaines. Les réactions d'hypersensitivité plus commun chez les patients orthodontiques sont dues au alliage des objets orthodontiques à base du métal. Cet article rapporte un cas de réaction particulier d'alliage orthodontiques chez une fille de 6 ans, ayant un traumatisme et une irritation locale. Les implications et les suggestions sur les soins dans la clinique orthodontiques sont revues.

### Introduction

Adverse reactions to orthodontic materials, though rare, are occasionally reported in patients undergoing orthodontic treatment and may be of concern in contemporary orthodontic treatment. Such reactions are both of an irritant and of hypersensitivity nature. The reactions of an irritant nature occur as a result of direct friction between soft tissues of the mouth and parts or accessories of the orthodontic appliances [1]. However, hypersensitivity reactions are related to the antigenicity of some materials that result in adverse response in the patients, manifesting as allergic contact dermatitis (ACD) of the face and neck. Mucosal and gingival reactions as well as generalised, dermal and systemic reaction may occur in unusual circumstances [1].

Orthodontists commonly utilize alloys which contain 18% chromium and 8% nickel. Both of these component are

known allergens, but the nickel in particular is considered a common cause of contact dermatitis [2-7]. Nickel is known to be the most common metal-based contact allergen among women with the incidence of nickel sensitivity reported as being as high as 30% in females compared with only 3% of males among the studied individuals [2,8,9]. Hypersensitivity to nickel is strongly associated with ear piercing, especially multiple piercings [9]. Some studies found out that there was 31% prevalence among subjects with a history of pierced ears compared with subjects without pierced ears at 2% prevalence [9, 10].

The purpose of this case report is to illustrate an allergic response in a 6-year-old female patient who had a simple habit breaking orthodontic appliance of the fixed variety fitted. It will also review the implications of metal-based allergens and provide suggestions for management of such reactions in the orthodontic clinic.

### Case report

A 6-year-old girl, presented for treatment at the Orthodontic Clinic of the Lagos University Teaching Hospital (LUTH) with a history of long standing digit sucking habit. Prior to presenting this time, the parents had practiced monitoring, motivation and sensory feedback interventions prescribed by a general dentist which proved unsuccessful in breaking the habit. Hence they sought consultation with the orthodontist.



**Fig. 1:** Photograph of the 6-year-old girl with chronic digit sucking habit. Notice the proclined incisors, coronal fracture of the left upper central incisor and the gross incompetence of the lips

On examination, there were visible palatal distortions, an anterior open bite, lip incompetence and proclined upper incisors with retroclined lower incisors (Fig. 1). There was coronal fracture of the upper left central incisor. With a history of failed attempt at stopping the habit, the use of a simple habit breaking orthodontic appliance of the fixed variety which would disrupt the pleasurable sucking sensation and interrupt the subconscious habit, appeared the next possible option.

The appliance was a passive one with long palatal cribs contoured with a 0.9mm hard stainless steel wire, which worked as a mechanical barrier against the suction. The appliance was soldered to preselected molar bands on the upper first permanent molars and was cemented with glass ionomer cement which has some anti-cariogenic properties. The patient/parents were given post-insertion instructions. The whole procedure was well tolerated by the patient.



**Fig. 2a:** Photograph of the same patient showing soreness and redness of the lips, tongue and generalized inflammation of the gingival tissues. Notice there was absence of plaque.

However, after about a week of fitting the orthodontic appliance, she presented with generalized gingivitis manifesting as redness, soreness of the lip, dorsum and side of the tongue and inflammation of gingival tissues. What was striking was the absence of dental plaque (Fig. 2a and b). Extra-orally, there were some reactions manifesting as allergic contact dermatitis. The child was irritable and there was excessive salivation. It was reported also that there was loss of appetite with a general state of malaise. There was minor mechanical irritation from the prongs of the appliance on the anterior part of the tongue. She also reported the appearing of allergy symptoms shortly after the initial insertion of the orthodontic appliance. With this observation a more detailed medical history was taken. There was no report of previous allergic reaction on wearing earrings, even though the mother admitted she had always worn gold earrings. She was how-

ever referred for allergy testing at the Dermatological Unit of the same hospital where skin patch test was done to several substances including nickel sulphate. A clinical impression of allergic stomatitis was made though the causative factor was unknown as the skin patch test was negative.



**Fig. 2b:** Photograph of the same patient showing palatal mucosa involvement with the fixed habit breaking appliance in situ

The orthodontic appliance was subsequently removed. Antibiotic therapy, Amoxicillin 250mg (Amoxil/Smithkline Beecham/Nigeria) 8 hourly was given for 1 week to prevent secondary infection. Zovirax 100mg was also given 12 hourly for one week. Xylocaine gel and chlorhexidine mouthwash were used to relieve pain and as adjuvant in the treatment of the ulcerations respectively. Following the removal of the appliance, there was total remission of the reaction. However, the patient was reviewed weekly for the duration of one month.

She made full recovery and was later seen at the Orthodontic Clinic where a removable orthodontic appliance was fabricated and fitted without any further complaint.

### Discussion

Digit sucking has been observed during in-utero foetal X-ray studies [11]. It is a common and generally harmless behaviour in infancy and early childhood which is often spontaneously discontinued by about 5 years of age [12]. Persistence of the habit beyond 5 years of age, occasionally leads to dental, dermatological, orthopedic and psychological problems [13]. As a consequence of the chronic nature of the sucking habit reported in this paper, malocclusion manifesting as proclination of the upper incisors, retroclination of the lower incisors and anterior open bite (Fig. 1) was evident.

This case is typical of the patient who is likely to have an allergy to the metal based component of an orthodontic wire and more probably to the solder composition

of the appliance. Metal components of orthodontic appliances are known allergens, but nickel in particular is considered a common cause of contact allergy [2, 8]. Leaching of these elements may be a potential trigger to an allergic reaction [1]. The potential for orthodontic wires to cause allergic reactions is related to the pattern and mode of corrosion with subsequent release of metal ions, such as nickel into the oral cavity [7]. Nickel release has been demonstrated in several in-vitro studies and in-vivo assessments [1, 14, 15] showing corrosion of intra-oral orthodontic components over time. Grimsdottir *et al* [14] in their study reported that nickel release from orthodontic metal appliances is most related to the solder composition. They concluded that appliances using silver and gold solders showed enhanced release of nickel and chromium. In contrast however, alloys containing titanium, release little nickel as a result of binding [1]. Nickel elicited an allergic response which is a Type IV delayed hypersensitivity immune response [1, 4, 5]. Sensitization and elicitation phases are interrelated and are identified in any allergic response [7].

The patient in this report tested negative to nickel. It is important to take note however that testing positive in the patch test to nickel may not necessarily mean there would be evidence of inflammatory reactions, discomfort or localized allergic-type responses in relation to the orthodontic appliance. Bass and colleagues [6] concluded that the nickel-containing appliances had no allergic effects on the oral tissues, although the appliance may play a role in inducing nickel sensitivity.

History of allergy to certain substances should alert the clinician but in the reported case, there was no history of allergic reaction on wearing earrings though the mother admitted that the patient had always worn gold earrings. Use of jewelries made from impure metals is thought to be a major cause of sensitization to nickel as the prevalence in subjects with pierced ears was 31 per cent and those without pierced ears 2 per cent [10]. In addition, specific questions relating to nickel allergy from other sources should be asked.

Nickel sensitization is believed to be increased by mechanical irritation, skin maceration or oral mucosal injury, all of which may occur in orthodontic treatment [7]. Such was probably the case in this report. The prongs of the appliance caused some mechanical irritation of especially the tongue, thus aggravating the reaction.

Rahilly and Price [7] reported that extra-oral reactions are more common than intra-oral reactions. Conversely, intra-oral reactions were more commonly observed in the reported case and were more severe than the extra-oral mild reactions.

High nickel content wires should therefore be avoided in nickel sensitive patients. Reduced nickel content stainless steel is available for use in nickel sensitive patients [7].

In fixed appliance treatment cases, the use of titanium or epoxy-coated wires is recommended [3]. Other alternative materials for nickel allergy patients are twistflex stainless steel, fibre-reinforced composite archwires. Wires such as TMA, pure titanium, and gold-plated wires may also be used without risk. Altered nickel-titanium archwires include plastic/resin-coated nickel-titanium archwires [3]. Ion-implanted nickel-titanium archwires have their surfaces bombarded with nitrogen ions, forming an amorphous surface layer, conferring corrosion resistance and displacing nickel atoms. The resultant reduction in the release of nickel decreases the risk of an allergic response [7]. Nickel-free alternative brackets to stainless steel are ceramic brackets, polycarbonate brackets, titanium and gold-plated brackets. Manufacturers are becoming aware of the concern of nickel allergy and many are producing 'nickel-lite' stainless steel versions. Plastic-coated headgear studs are now available in extra-oral metal components in headgears.

In conclusion, caution and close monitoring should be exercised in patients with or without defined history of atopic dermatitis to nickel-containing metals. Nickel-free alternatives should be considered for those patients with a suspected history of allergy to nickel-containing metals. Avoiding orthodontic treatment in a contemporary society is unnecessary.

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Received: 16/11/05

Accepted: 27/07/06