



Contact Dermatitis Caused by Using Orthodontic Arch Wires and Brackets

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Abstract

Contact dermatitis is caused by an inflammatory process against external or internal stimulants which can lead to an allergic reaction. Nickel is one of the materials used abundantly in making orthodontic appliances, including Arch wires. This substance can cause allergic reactions. Usually, the inflammatory reaction to nickel appears as Stomatitis, which in this case, has caused inflammation and swelling of the lips and bilateral lesions in the corner of the mouth in a 12-year-old patient.

Keywords: *Lip Swelling; Arch Wires; Nickel; Allergic Dermatitis; Stomatitis*

Introduction

Contact dermatitis is caused by direct contact with the stimulus [1,2]. In allergic contact dermatitis, the person's body reacts to that stimulus, which has two stages of sensitization and elicitation. The first stage starts from the time of allergen entry, and in the second stage, the clinical signs and severe reactions will appear [1-3].

The first time in 1925, nickel contact dermatitis was introduced as an allergic response [3-5].

Nickel alloys are found in orthodontic appliances including brackets, wires, bands, and other orthodontic accessories. Unfortunately, allergic contact dermatitis to nickel is a Type IV delayed hypersensitivity immune response that appears very soon after the exposure [6]. In orthodontics, nickel is one of the most commonly used metals and can play an important role in the development of contact dermatitis [7]. Nickel is available in alloys used in orthodontics such as nickel-titanium and stainless steel [7].

If the amount of nickel in the alloy exceeds 50%, the likelihood of nickel liberation in the oral environment increases and causes

an allergic reaction in the mouth. Since the amount of nickel in the stainless steel is lower, the chance of free nickel ion release will diminish into the oral cavity, and hence the possibility of a nickel allergy will decrease [8].

Since allergic contact dermatitis to nickel often has not been reported in the form of swollen lips, this reaction is usually observed as Stomatitis.

Case Presentation

This patient (a 14 years old boy) started his orthodontic treatment two weeks ago. For this patient, the arch wire was used with dental braces as a source of force in correcting irregularities in the position of his teeth; in this case, it had a retentive purpose. Unfortunately, he referred to the clinic after two weeks of his orthodontic treatment. The chief complaint of the child's parents was the swelling of the upper and lower lips along with a small double-sided skin lesion at the corner of the mouth. There were some symptoms accompanied by this swelling including itching, redness, tenderness, and moderate pain. The symptoms occurred in daily episodes of mild to moderate intensity lasting 15 - 30 minutes.

His mother noted these signs and symptoms before the child was going to bed. No medical complication was recorded in his past medical history. Except for having malaise, the patient's general condition seemed satisfactory. He had an allergic reaction to a cat a few years ago which was not indicated in the questionnaire by his mother.

Prescribing the analgesics did not relieve the symptoms, however, using home remedies at home such as consumption of cold foods and drinks such as ice cream and cold drinks had a soothing effect.

After examining the dentist and observing this condition the patient was referred to a dermatologist for further investigation. The dermatologist also diagnosed the lesion as a contact dermatitis based on a clinical examination, and swollen lips were the result of this problem.

After diagnosing the metal allergic reaction, the Ni-Ti arch wires were replaced with stainless steel. His previous daily symptoms resolved within two weeks and he was symptom-free after two months. After passing one-year, he has not revisited the clinic for any complications so far.

Differential diagnosis

Many factors can contribute to causing swollen lips which may vary from normal to potentially dangerous. Here is some possible differential diagnosis that should be considered seriously for this case:

1. Dental infections of anterior teeth
2. Herpes
3. Angioedema
4. Herpangina
5. Cheilitis
6. Allergic reactions
7. Angular Cheilitis.

Discussion

Nickel allergy is often associated with earrings and other jewelry, but it can be found in many everyday items such as coins, wristwatches, cell phones, and even orthodontic or dental appliances.

The release of nickel ions from the orthodontic appliances can cause skin's inflammation. Their penetration into the skin could activate epithelial cells that produce various cytokines or chemokines. The reaction is the response to the activation of antigen-presenting cells and T cells in the body. Following the re-exposure to the same allergen, the T-cells would activate in the patient that enters the bloodstream and would show the signs and symptoms of allergic reactions or cell-mediated (type IV) hypersensitivity. Ni contact has different side effects including contact dermatitis, cardiovascular disease, asthma, lung fibrosis, and respiratory tract cancer [9,10].

Nickel is one of the most commonly used metals used in orthodontics, due to its flexibility and preservation of the shape of orthodontic wires. This metal is the most common metal that unfortunately causes contact dermatitis in orthodontic patients [11]. Most patients who develop a reaction to Ni-Ti arch wires subsequently tolerate stainless steel without a reaction [12].

Menne indicated that the occurrence of a harmful response by patients to nickel is about 0.1 - 0.2% [13]. If the concentration of nickel in the oral mucosa is greater than the skin it might elicit an allergic reaction [14].

Some experimental studies suggest that Nickel allergy affects women more than men, and is usually due to daily contact with jewelry, earrings, bed rails, metal buttons and snaps in underwear, safety pins, and belt buckles, metal toys, wristwatches, and so on [15-20].

Some researchers believe the most common cause of nickel allergic reaction is ear piercing [15,21]. The clinical pattern of nickel dermatitis is described in the classic paper of Calnan and Wells [22].

Nickel ACD can also occasionally be induced by orthodontic appliances. This can cause Cheilitis, Stomatitis, perioral eczema, and even systemic dermatitis [23,24].

When hypersensitivity occurs, Stomatitis develops that can even affect the entire oral mucosa. Often, an allergic reaction to orthodontic devices not only can cause Stomatitis but also may lead to Angioedema, facial edema, or even Eczema. But overall, extra-oral reactions produce more symptoms. Although pruritus is a common symptom of extraoral reactions, it is not seen in contact Stomatitis [25-27].

Allergic reactions to nickel increase with mechanical stimulation and damage to the oral mucosa and skin maceration, all of which occur during orthodontic treatment. However, the temperature of the environment and the duration of the treatment can be involved as resonator factors [27,28].

Suggested treatment

Topical steroids and moisturizing cream were immediately prescribed for this patient that showed a relative improvement during the next visit, but the problem was not resolved; this incomplete recovery was due to the persistence of exposure to an allergen after orthodontics.

Due to the presence of allergy symptoms even after taking the drug, the patient was again called into the allergy clinic. Given that the patient had never had any previous medication use, food, or contact allergy; and even no dental work was done before that (except for orthodontic treatment), both the dermatologist and the dentist agreed that there was a possibility of hypersensitivity to orthodontic appliances. Therefore, the allergy test (patch test) was performed in conjunction with the materials used in the orthodontic device. The result was convincing.

The positive result of the test for nickel and the negative impact of the rest of the material which was used in the appliance made the patient's physicians and parents are relieved from anxiety. As a result, nickel sensitization was the main cause of swelling of the lips and lesions in the corner of the mouth.

Substitute materials are recommended for patients who are allergic to nickel. In arch wires, because the amount of nickel in the type of stainless steel (8%) is less than titanium (50%), it is better

to use the first type [29]. Research has shown that patients with nickel sensitization can tolerate stainless steel with no severe reactions [30].

Most research suggests that stainless steel is a good material for orthodontic use in the mouth [31,32]. The use of wires such as TMA, pure titanium, and gold plated wires may be risk-free [33]. Nickel-titanium arch wire that has plastic or resin coatings can also be useful. To prevent nickel allergic reactions, stainless steel brackets, ceramic, and gold-plated brackets can be used.

Finally, it should be noted that soldering should be avoided in these nickel-sensitive patients [34].

Conclusion

Nickel is the most used metal in orthodontic appliances. Allergic contact dermatitis due to this metal has caused many problems. Unlike immediate hypersensitivities (such as pollen, insect venom, and most food allergies), the reaction in delayed-type hypersensitivity occurs some time after exposure. Nickel sensitization is often associated with earrings and other jewelry, but other things may cause this reaction. Nickel allergy signs and symptoms include: rash on the skin, Itching, redness, or changes in skin color accompany by blisters. But in our case, it appeared with lip swelling and bilateral lesions in the corner of the mouth.

Stainless steel orthodontic components are very unlikely to cause nickel hypersensitivity because they have a low percentage amount of nickel and they do not release radical ions. Consequently, they are preferred to be used in orthodontic appliances rather than nickel-titanium by the dentist.

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