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Nickel induced allergic contact stomatitis in treatment using fixed orthodontic appliance

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ABSTRACT

Hypersensitivity towards the metals used in fixed orthodontic is sometimes seen in patients who receive orthodontic treatment with clinical symptoms found intraorally. Nickel is the metal that may cause sensitivity and often causes slow hypersensitivity reaction (immune response type IV) because nickel is the main component of orthodontic alloy. The allergic reaction is found in the form of oral inflammation triggered by the corrosion of orthodontic alloy. The allergic reaction is seen in the form of oral inflammation triggered by corrosion of orthodontic materials and continuous nickel particle release. Young patients, especially female patients, with allergic reaction show a predisposition of NiACS (Nickel Induced Allergic Contact Stomatitis) clinical symptoms. Therefore, dentists and orthodontists should be more careful and cautious in doing a clinical examination to patients through data collecting data on history of abnormalities and health history in the effort of making diagnosis and plan appropriate treatment.

Key words: Nickel, allergic reaction, fixed orthodontic appliance treatment

INTRODUCTION

Several metal alloys are frequently used in dentistry. Gold is used in orthodontic treatment up to the 1930s and 1940s. In 1929, the stainless steel was used for the first time to replace the gold. Currently, many other metal alloys are used in orthodontics such as cobalt-chromium, nickel titanium, beta titanium. Some of those alloys contain nickel. The percentage of nickel in the alloy is various between 8% in stainless steel and 50% in nickel-titanium alloy.[1]

Nickel is a metal that has a great potential to create sensitivity reaction and is well understood as an allergen as stated in the result of a study performed by Luciane.[2] This study stated that the biggest reaction is found for nickel sulphate 21.1% towards potassium dichromate 21.1% and towards manganese chloride 7.9%.[2]

Hipersensitivity towards nickel

The relationship of the metal difference in oral saliva where saliva is the connecting media that can create electrogalvanic flow produced by ion and metal content differences if it is combined with metal that is layered chemically. This product result can be swallowed or contact the mucosa and dental surface. The masticatory force can also produce ion release from the restoration used. This nickel ion release is a strong sensitivity reaction cause that may lead to hypersensitivity. The hypersensitivity reaction towards nickel

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directly relates with the presence of this metal in the mouth and may be caused by inhaling or direct contact with mucosa.

Several oral clinical symptoms in orthodontic patients such as gingival hyperplasia, labial desquamation, angular cheilitis, multiform erythema and periodontitis are very possibly caused by corrosion of materials used in orthodontic treatment and continuous nickel particle release. The orthodontic appliances that may cause allergic reaction to nickel are band, bracket, and stainless steel wire. The allergic reaction is usually found 1-2 days after the orthodontic treatment is started. Immunologically, this type of inflammation is mentioned as a hypersensitivity type IV. It is further referred to as Nickel Induced Allergic Contact Stomatitis (NiACS), with complicated etiology and diagnosis.[2-4]

Hypersensitivity type IV is also referred to as a slow hypersensitivity because it occurs 24 to 48 hours after the body contacts the antigen or allergen. This reaction is also often called a cellular type reaction because this type can only be moved passively with sensitive lymphocytes or its extract in the form of transfer factor and not via serum or antibody. This reaction is triggered because the sensitized lymphocytes react specifically with certain antigen leading to immune reactions with lymphocyte and monocyte (macrophage) infiltration manifestation and causing tissue induration in the area. There are two types of mechanism, afferent and efferent. The afferent mechanism is a specific mechanism that is found when the lymphocyte cells with sensitized specific receptors react to certain allergen and release lymphokine mediators. Then, this agent will work specifically in the efferent mechanism by affecting lymphocytes, monocytes and macrophages that will cause tissue damage.[5]

A study performed by Genelhu et al.[4] show that NiACS manifestation is found in patients of young age. Patients with and without clinical manifestation of NiACS are mostly women. The average contact time or the application of orthodontic appliance is 29 months for patients with NiACS clinical manifestation and 23.1 months for patients without NiACS manifestation.[4]

Although cutaneous hypersensitivity towards nickel is often seen, not many oral lesion cases are described in the literature. A part of the explanation shows that to be able to create mucosal lesion, a nickel concentration of 5 to 12 times of the concentration to create lesion on the skin is needed.[4]

Several studies show that patients with NiACS manifestation mostly come from the young age group which is probably due to poor oral defense mechanism in terms of deficiency or lack of immunity system for protection from external stimulus. The Olumide[6] study performed in Nigeria where the use of jewelry in men and women was comparable showed that the prevalence of sensitivity in the two gender as comparable. That is the reason why in other places women are more susceptible to the sensitivity since they contact nickel more than men.[2]

The allergic history is the factor that has most influence in NiACS manifestation. Ear piercing, jewelry use, wrist watch, glasses or other things that contain nickel and the occurrence of lesion on the ear are things that are closely related. The allergic history really affects hypersensitivity towards nickel particle released from orthodontic appliance. Suzuki[7] stated that ear piercing, the use of jewelry or other contact activities leave metal particle on the skin area long after the trigger is removed. This leads to various problem of irritation, allergy or cutaneous reaction. Most patients (69.2%) who experience NiACS clinical manifestation have previous allergic history. However, 30% of patients do not have allergy history. What is certain is that all patients who do not experience NiACS manifestation do not have allergy history.[4]

Jones[8] has performed a study on 100 patients (50 males and 50 females) to learn the relationship between age, gender and allergy history and hypersensitivity towards nickel. They found effects on blood pressure, heart rate and body temperature in some of the subjects. These nickel effects are not seen only in the contact area but also in other body parts. Hypersensitivity reaction is found in 20% of women and 2% of men. Another opinion from Tsalen and Zprianov[9] suggested that women were 3 to 5 times more vulnerable towards nickel while Prystowsky, Jones et al.[8,10] stated that women were 10 times more susceptible for nickel sensitivity. It turned out that it had strong relationship to the use of jewelry in women.[2]

Diagnosis and therapy

In the initial stage, the lesions appeared are various, depend on the concentration and contact intensity, barrier condition and the contact area. The symptom that is most frequently experienced by patients is hot feeling or pain. The mucosal aspect that is often affected is various, starting from mild erythema to shiny lesions with or without edema. Vesicle is not often seen, but if it is found, it usually breaks fast and leaves an eroded area. In chronic case, the affected mucosa usually has direct contact with the triggering object and causes erythema or hyperkeratosis to ulcers. Other symptoms that may be seen include perioral dermatitis and to, sometimes, orolingual paresthesia.[4]

NiACS diagnosis for oral mucosa is more difficult to make compared to the skin. The lesion caused by NiACS is difficult to separate from lesions caused by mechanical wound, autoimmune lesions, apthous stomatitis or lesions caused by poor oral hygiene.[11]

NiACS is also difficult to diagnose because there are not many data available for its pathology. Mucosal lesions are hard to interpret and hypersensitivity does not always mean unusual condition. Orthodontic patients with NiACS usually state complaints with uncertain causes. However, clinical information such as good oral hygiene, low plaque bacterial index and positive allergy history can help in making the diagnosis.

Sensitivity towards nickel can be tested using biocompatibility test, including cutaneous sensitivity (patch tests), and reactivity towards nickel can also be tested using in vitro cell-proliferation assays.

If a patient is suspected for nickel allergy, a skin patch test can be performed. The positive reaction is represented by rash. Rash caused by allergy to nickel often disappear without any effort when the skin is then free from nickel contact. In several cases, it is necessary to give corticosteroid cream to remove rash and reduce itch.[12]

In orthodontic treatment, Austenitic stainless steel that contains 18% chromium and 8% nickel is often used. This material is known as the material most frequently causes hypersensitivity. For patients who have NiACS manifestation case, the materials used in orthodontic treatment should be removed immediately. We can give treatment using alternative materials or technique such as using materials layered by ceramic resin epoxy or new metal such as titanium, vanadium and aluminum so that the patients will be prevented from experiencing NiACS. Patients with more severe reaction should get immediate therapy using anti histamine, anesthetic or topical corticosteroids.[4,13]

DISCUSSION

Nickel is a metal that has high potential to cause sensitivity reaction and is understood as allergen. The history of allergy has great influence. Most patients who experience NiACS manifestation have a history of allergy and oral reactions. All patients who do not experience NiACS manifestation have never experienced any allergy. The NiACS clinical manifestations are not influenced by the duration of contact with orthodontic appliance. Other factors such as family history of NiACS and several major histocompatibility complex haplotypes may become an important factor.

Bass and Kerosuo[8,11] stated that hypersensitivity towards nickel is different between male and female and that it is more frequently found in women. This may be due to the fact that women contact allergen or materials triggering hypersensitive, e.g. jewelry, more often. It may be assumed that if men use jewelry or other things containing nickel more often, the tendency will change. In men the hypersensitivity may relate to work contact, especially in industries that use nickel as the raw material. The condition is often found in young and female patients that may relate to the less keratin on the skin in these patients.

There is no effective medication to eliminate allergy towards nickel despite the fact that in several people sensitivity towards nickel is lessen when desensitization technique is used in a certain period including the application of allergy shots, i.e. treatment by giving gradually higher nickel dose during a certain period. However, if this not effective, it is better to avoid contact with nickel.[7]

In orthodontic treatment, although it is rare, is possible that pain and inflammation in soft tissue are not caused by orthodontic force but it is caused by allergy reaction instead. There are

two allergy reactions that may be seen, allergy towards latex in the gloves and allergy towards nickel in the band, bracket and wire. In several cases, allergy reaction towards nickel is found after application of face bows and neck straps. The type of symptoms that are often found in patients with nickel allergy in orthodontic treatment include the presence of erythema area and swelling in the oral mucosa tissue 1-2 days after orthodontic appliance application. To manage this, the materials that may cause allergy should be removed immediately and titanium bracket and tube or those that are made of materials with ceramic resin epoxy layer as the substitute of stainless steel should be used.[3,8]

CONCLUSION

Most patients who experience NiACS are women and those who have allergy history. NiACS does not affected by the duration of fixed orthodontic appliance use. A complete clinical history especially those related to previous allergy is very important to avoid NiACS manifestation in orthodontic treatment. Besides understanding physical, mechanical and chemical natures of dental materials, an orthodontist should understand the biological response for those materials in living tissue. A lot of materials used in dentistry may affect biological activities.

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