

# Allergic Reactions in Orthodontic Patients: A Review

## Reacciones Alérgicas en Pacientes de Ortodoncia: Una Revisión

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**ABSTRACT:** Allergic reactions are host immune responses to endogenous or exogenous antigens, which can result in local and systemic problems. Among the main allergens are the dental materials used in orthodontics, which faces some challenges with regard to biocompatibility with oral tissues. This study aimed to analyze in the literature which materials used in orthodontics are related to the appearance of oral and perioral allergic reactions, as well as to investigate the most prevalent manifestations. An integrative review was carried out with articles published between 2010 and 2020 on the PubMed, Embase, and ScienceDirect on-line database. For this, MeSH descriptors and synonyms were used following two semantic fields: "Hypersensitivity" in association with "Orthodontic Appliances", the selection of studies counted with the stages of identification, screening, eligibility and inclusion. Randomized clinical trials, cross-sectional or cohort clinical trials; Patients with allergic reactions affecting the oral or perioral region due to contact with orthodontic material, were included in the review. From a total of 549 articles only 04 were selected for the study. In accordance with what has been analyzed in the evidence of these studies, periodontal changes such as gingival inflammation as well as erythema, edema, papules and blisters were the main reactions described. Furthermore, in all articles there was an association with nickel and in only one with chromium. It is possible to infer that inflammatory lesions are frequent manifestations on the use of nickel in orthodontic patients.

**KEY WORDS:** allergic reaction; orthodontics; biomedical and dental materials.

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## INTRODUCTION

The reactions of hypersensitivity or allergies, are excessive immune system responses to a particular endogenous or exogenous antigen/allergen and which may, according to the intensity of the response, present systemic or local consequences (Kumar, 2010). This fact occurs through subsequent exposure to the antigen preceded by a primary contact. Thus, the allergen releases inflammatory mediators by binding to IgE on the surface of mast cells, in order to cause smooth muscle contraction, vasodilation, increased glandular activity and capillary permeability (Gaujac *et al.*, 2009). Epidemiologically, 10 % to 15 % of the world population has some type of allergic reaction (Andrade *et al.*, 2004).

In systemic reactions, bronchospasm, vasomotor collapse, laryngeal edema, and hypotension are prevalent manifestations, evidencing the need for

greater attention in diagnosis and treatment, in view of the imminent risk of death. In addition, the individual's local responses involve papules, in addition to pruritus, urticaria and erythema, which may be associated with contact dermatitis (Gaujac *et al.*). In this scenario, the adhesive test is the standard procedure for the diagnosis of this manifestation arising from materials with high allergen potential, as well as being a necessary step to establish the recognition of the same (Chakravarthi *et al.*, 2012).

In this sense, it is known that many substances can trigger harmful effects. Thus, in the dental clinic, a wide variety of materials are handled, which come into contact with oral tissues and organic fluids, which can cause adverse reactions in the oral cavity (Freire *et al.*, 2012). This is due to the fact that the interaction that occurs at

the material/tissue interface is dynamic and depends on a series of factors such as the location to be implanted the biomaterial, the material properties and the biological response of the host (Anusavice, 2005).

Thus, among the dental specialties, orthodontics faces some challenges in relation to the biocompatibility of oral tissues with the materials used in orthodontic treatment, which are composed of metals such as nickel, cobalt and chromium, in addition to other compounds present in acrylic resins such as methyl-methacrylate monomers (Chakravarthi *et al.*). Therefore, the objective of this work is to learn from the literature which materials used in orthodontics are related to the appearance of oral and perioral allergic reactions, as well as to investigate the most prevalent manifestations.

## MATERIAL AND METHOD

**Search strategy:** In March 2020, an integrative search was conducted for data published from 2010 to 2020 in the online databases PubMed (National Library of Medicine), Embase and ScienceDirect. For this, MeSH descriptors and synonyms were used, organized in Boolean logic following two semantic fields: “Hypersensitivity” in association with “Orthodontic Appliances”. Table I shows the research strategies used.

**Select of studies.** The selection of studies involved the following steps: identification, screening, eligibility and inclusion. Two independent researchers (K=1.00, obtained with 42 % of the articles from the eligibility stage), participated in all phases and when a title was not agreed to choose, a third researcher decided.

For the selection of articles, no language limitation was imposed, in addition other inclusion criteria were: (1) article published in the last 10 years, (2) randomized clinical trials, cross-sectional or cohort studies, (3) patients with allergic reactions that affect tissues of the oral cavity or perioral region arising from contact with orthodontic material.

In the first approach, potentially eligible articles were chosen from reading the title and abstract using the website “Rayyan QCRI for Systematic Reviews”. Subsequently, articles common to the two databases were screened and excluded. For eligibility, the full articles were read considering the proposed criteria.

**Data extraction.** From the articles included in this review, some information was removed, such as authors and year of publication; kind of study; sample size; area (s) affected by an allergic reaction and allergy-related orthodontic material. Such data were grouped and organized in a descriptive manner in this article. All selected titles were stored and managed in the Mendeley Desktop version 1.19.5 reference management program.

Table I. Search strategies and terms used.

Database	Terms Of Research
PubMed Filter used: Publication Date From 2010 to 2020.	((Hypersensitivity OR Allergic Reaction OR Allergy OR Delayed Hypersensitivity OR Immediate Hypersensitivity OR Foreign-Body Reaction) AND (Orthodontic Appliances OR Dental braces OR Activator Appliances OR Removable Orthodontic Appliances OR Fixed Appliance OR Retainer Fixed OR Orthodontic Wires OR Orthodontic Brackets))
Embase Filter used: Publications years (including): 2010 to 2020.	(Hypersensitivity OR Allergic Reaction OR Allergy OR Delayed Hypersensitivity OR Immediate Hypersensitivity) AND (Orthodontic Appliances OR Dental braces OR Activator Appliances OR Removable Orthodontic Appliances OR Fixed Appliance OR Retainer Fixed OR Orthodontic Wires OR Orthodontic Brackets)
ScienceDirect Filters used: Publication Date From 2010 to 2020; Research articles.	(Hypersensitivity OR Allergic Reaction OR Delayed Hypersensitivity OR Immediate Hypersensitivity) AND (Orthodontic Appliances OR Dental braces OR Fixed Appliance OR Orthodontic Wires OR Orthodontic Brackets)

## RESULTS

In an initial search for terms, using the search strategies, 549 articles were found, 70 from the PubMed database, 126 from Embase and 353 from

ScienceDirect. Figure 1 shows the steps followed in this study, where after applying the inclusion criteria, only 04 articles were selected (Table II).

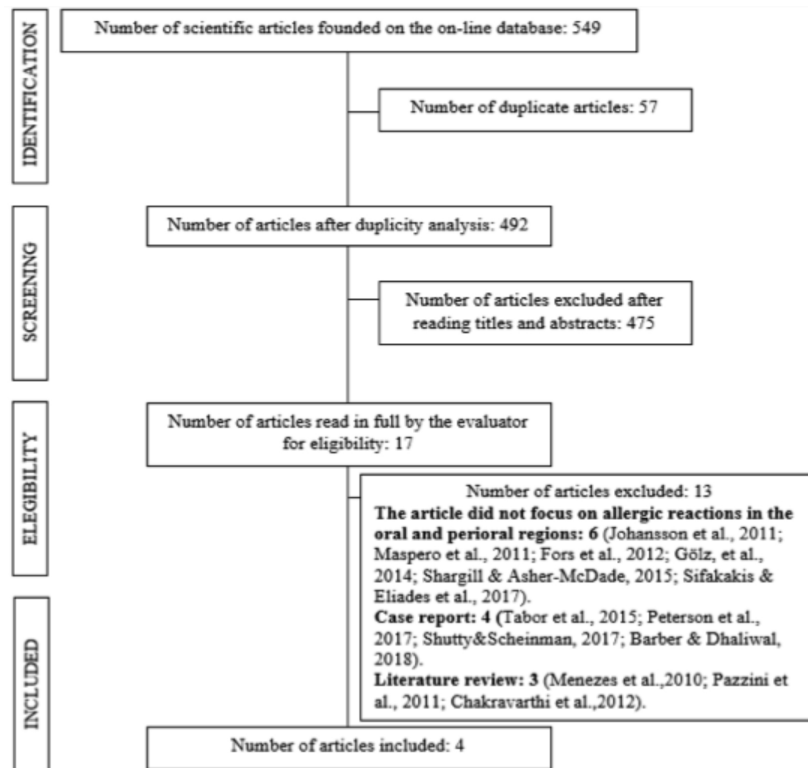


Fig. 1. Flowchart of selection of scientific articles.

Table II. Characterization of the articles selected in the review.

Authors	Kind Of Study	Sample Size	Area of allergic reaction	Orthodontic material related to allergy
Pazzini <i>et al.</i> (2012)	Longitudinal study	42 individuals	Not explicit (Erythema, edema, papules and blisters)	A relationship was found with the nickel of the orthodontic appliance.
Amini <i>et al.</i> (2011)	Longitudinal study	72 samples of 24 patients	Oral region (Gingival inflammation)	A relationship was found with the nickel and chromium of the orthodontic appliance present in the gingival fluid.
Pazzini <i>et al.</i> (2016a)	Longitudinal study	42 individuals	Oral region (Gingival inflammation)	A relationship was found with the nickel of the orthodontic appliance.
Pazzini <i>et al.</i> (2016b)	Case-control study	96 patients	Oral Region (Periodontal changes).	A relationship with nickel was found.

## DISCUSSION

Orthodontic appliances, removable or fixed, are mostly metallic, polymeric and biocompatible ceramic structures. However, changes in their properties can result in the release of ions in biological fluids and in the oral mucosa, causing harmful actions to health, including allergic reactions. Adverse effects of some of these released substances, must be considered in the selection of the material and throughout the orthodontic treatment, in order to reduce possible undesirable implications (Sifakakis & Eliades, 2017). In this context, it is extremely important to learn from the current literature, evidence that reports the relationship of the main substances present in materials used in orthodontics with the appearance of allergic reactions in tissues of the oral cavity and/or perioral region.

Preliminarily, due to the impossibility of access, there was difficulty in searching for studies in the PubMed, Embase and Science Direct databases, totaling 549 articles, which after the establishment of the criteria for the choice, aiming to limit the findings to the purpose of the review, those were selected. Focused on allergic reactions that affect tissues of the oral cavity or perioral region arising from contact with orthodontic materials, which led to a number of only 4 articles that were based on such criteria. In fact, most of the selected articles date from the year 2016 and have, for the most part, a descriptive or longitudinal observational design.

Regarding the area of allergic reaction, 3 articles specified the inflamed portion, with the perioral surface not mentioned and the oral region having greater predominance among those studied. Thus, periodontal changes, such as gingival inflammation, have been described. Only, Pazzini *et al.* (2016a,b) did not explain the affected allergic region, addressing only the type of response of the organism in erythema, edema, papules and blisters.

In this context, it is known that hypersensitivity reactions to metals in dentistry are usually type IV, mediated by T cells and monocytes/macrophages that can trigger harmful cascades with systemic or local manifestations (Menezes *et al.*, 2009). In this scenario, among the materials most highlighted in the literature in relation to the emergence of such reactions, nickel, considerably, stands out.

In fact, nickel has a high allergen potential, which can cause discoloration of adjacent soft tissues,

pain or allergic reactions (Quadras *et al.*, 2019). Therefore, all selected articles related the presence of this substance to the appearance of allergic reactions in the oral cavity. Among these studies, Amini *et al.* (2016), associated, in addition to this substance, the chromium present in the device as an adjuvant in the gingival inflammatory process.

Thus, more research in this area becomes substantial in order to elucidate the association of oral reactions with materials used in orthodontics, so that the dentist and the patient can better understand the possible risks arising from the treatment, in view of that the hypersensitivity reaction, adversely affects the general health, and therefore, the individual's quality of life, as well as time, efficiency and satisfaction with the treatment (Maheshwari *et al.*, 2015).

## CONCLUSION

It is possible to conclude that reactions such as erythema, edema, papules, blisters and periodontal changes, for example gingival inflammation, are frequent manifestations of contact with orthodontic materials in patients allergic to nickel or, in some cases, chromium. Therefore, prior knowledge of the dentist is essential for the correct management and treatment of these adverse reactions.

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**RESUMEN:** Las reacciones alérgicas son respuestas inmunes del huésped a antígenos endógenos o exógenos, los cuales pueden provocar problemas locales y sistémicos. Entre los principales alérgenos se encuentran los materiales dentales utilizados en la ortodoncia, la cual se enfrenta a algunos desafíos respecto a la biocompatibilidad de los tejidos orales. Este estudio tuvo como objetivo analizar en la literatura que materiales utilizados en ortodoncia están relacionados con la aparición de reacciones alérgicas orales y periorales, así como investigar las manifestaciones más prevalentes. Se llevó a cabo una revisión con artículos publicados entre 2010 y 2020 en las bases de datos PubMed, Embase y ScienceDirect. Para ello, se utilizaron descriptores y si-

nónimos de MeSH siguiendo dos campos semánticos: "Hipersensibilidad" en asociación con "Aparatos de Ortodoncia", la selección de estudios contó con las etapas de identificación, cribado, elegibilidad e inclusión. Ensayos clínicos aleatorizados, ensayos clínicos transversales o de cohortes; en la revisión se incluyeron pacientes con reacciones alérgicas que afectaron a la regiones oral o perioral debido al contacto con material de ortodoncia. De un total de 549 artículos sólo cuatro fueron seleccionados para el estudio. De acuerdo con lo que se analizó en la evidencia, las principales reacciones descritas fueron cambios periodontales, como inflamación gingival, eritema, edema, pápulas y ampollas. Además, en todos los artículos hubo una asociación con níquel y solamente en uno con cromo. Es posible inferir que las lesiones inflamatorias son manifestaciones frecuentes sobre el uso de níquel en pacientes de ortodoncia.

**PALABRAS CLAVE: reacción alérgica, ortodoncia, materiales biomédicos y dentales.**

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