



Main considerations of the immune system and caries disease: a systematic review

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Abstract

Introduction: According to the World Dental Federation, the hypothesis that more than 90.0% of the world population will have any oral disease in their lifetime. The discovery of an immunoenzymatic mucosal defense system, coupled with the advances of immunology, demonstrate the need to know their concepts and their possible interrelations with the installation and progression of the cariogenic process.

Objective: Therefore, the present work carried out a literature review to verify the main approaches regarding the influence of the immune system on caries disease.

Methods: Experimental and clinical studies were included (case reports, retrospective, prospective and randomized trials) with qualitative and/or quantitative analysis. Initially, the keywords were determined by searching the DeCS tool (Descriptors in Health Sciences, BIREME base) and later verified and validated by MeSh system (Medical Subject Headings, the US National Library of Medicine). Series of Articles And Eligibility: A total of 27 articles were found involving. Initially, it was held the exclusion existing title and duplications in accordance with the interest described this work. After this process, the summaries were evaluated and a new exclusion was held. A total of 22 articles were evaluated in full, and 18 were included and discussed in this study.

Conclusion: There are an important network and cascade of defense events between immunological processes and caries disease. Thus, it is necessary to have a healthy immune response to reduce the incidence of caries.

Keywords: Caries disease. Immune system. Mechanisms of action. Treatment.

Introduction

According to the World Dental Federation, the hypothesis is that more than 90.0% of the world's population will have an oral disease in their lifetime [1]. In addition, only 60.0% of the population has access to oral hygiene [1]. In childhood and adolescence, caries and periodontal disease are the most common diseases in the world, and in Brazil, caries is the main oral health problem [2].

Despite the advancements in scientific research and the positive results achieved in oral health, dental caries remains a serious public health problem that warrants attention, affecting a significant portion of the Brazilian population and being prevalent worldwide, particularly in developing countries [2,3]. It is known that the occurrence of dental caries can bring consequences to different vital functions of the individual, which cause a great impact on the quality of life, especially in children, causing pain and suffering to them [3,4].

The discovery of a mucosal immunoenzymatic defense system, combined with advances in immunology, highlights the importance of understanding its concepts and potential interrelations with the initiation and progression of the cariogenic process [1-4].

Therefore, the present work carried out a review of the literature in order to verify the main approaches regarding the influence of the immune system on caries disease.

Methods

Experimental and clinical studies were included (case reports, retrospective, prospective and randomized trials) with qualitative and/or quantitative analysis. Initially, the keywords were determined by

searching the DeCS tool (Descriptors in Health Sciences, BIREME base) and later verified and validated by MeSH system (Medical Subject Headings, the US National Library of Medicine) in order to achieve consistent search, following the rules of systematic review-**PRISMA** (Transparent reporting of systematic reviews and meta-analyses-<http://www.prisma-statement.org/>).

DeCS and MeSH Terms

The descriptors that were included are *Caries disease. Immune system. Mechanisms of action. Treatment.* For further specification, the Dental implants description for refinement was added during searches. The literature search was conducted through online databases: Pubmed, Scopus, Embase, Medline, Web of Science, and Google Scholar. It was stipulated deadline, and the related search covering all available literature on virtual libraries.

Results and Discussion

Series of Articles and Eligibility

A total of 27 articles were found involving *caries disease*. Initially, it was held the exclusion existing title and duplications in accordance with the interest described this work. After this process, the summaries were evaluated and a new exclusion was held. A total of 22 articles were evaluated in full, and 18 were included and discussed in this study (Figure 1).

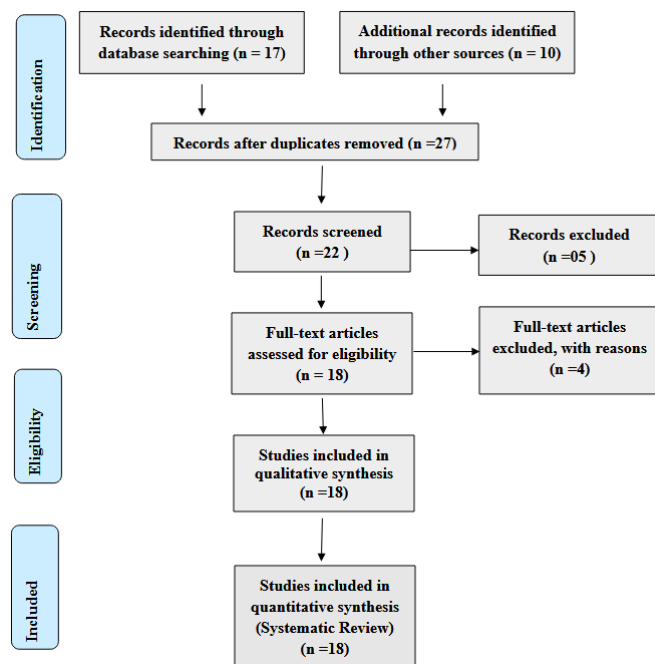


Figure 1. Selection of the studies. Source: Own authorship.

Literature Review and Discussion

One of the justifications for assessing the origin of severe caries in the present case report can be attributed to the high percentage of microorganisms that cause caries in maternal saliva [1,2]. This favors

transmission during the eruption of deciduous teeth in children, and the development of caries depends on the moment when an infection, due to earlier colonization, is associated with a higher prevalence of dental caries [3].

The oral microbiota is the most complex part of our whole body, and there are bacteria with more than 30 different genera, covering more than 500 different species. The authors showed that, in the mouth, there are about 350 bacterial species were developed and 200 were distinguished by genetic studies [2-4]. Since dental caries is a multifactorial disease, the presence of microorganisms is essential for its development. The main etiological agents are the *Streptococcus mutans* and *Streptococcus sobrinus* species, observing that Lactobacilli play a great potential role in the progression of this disease, but not in the etiology of this disease [4].

Immune Mechanisms and Caries

The mechanisms of the immune response against extracellular bacteria can be distinguished into innate or natural immunity and acquired or adaptive immunity [1]. The mechanisms of innate immunity are represented by macrophages and macrophages or polymorphonuclear neutrophils, and by the complement system as a representative factor of humoral immunity [2].

In the acquired immunity, we highlight the humoral factors, all classes of immunoglobulins produced by the plasma cells, which result from the activation of B lymphocytes, modulated by regulatory T lymphocytes, as well as T and B lymphocytes [3-5]. In this sense, the T and B lymphocytes of the sulcular fluid and the gingival conjunctival stroma are stimulated by the antigens present in the bacterial plaque, causing them to produce innumerable cytokines. These molecules act synergistically, blocking the migration of macrophages and fixing them in the infectious focus, mainly by the action of Interleukin 1 (IL 1) [5].

In this context, among the immunoglobulins present in saliva, we highlight the secretory IgA (IgA-s), which is actively secreted by the glandular stromal plasmocytes, and the IgG and IgM immunoglobulins. Unlike serum IgA, which is a monomeric molecule, IgA-s is an IgA molecule dimer associated with a secretory component and a protein [4]. This secretory component increases the resistance of this immunoglobulin to the proteolytic enzymes of the oral cavity and is added during its passage through the secretory cells of the epithelium of the salivary gland [4].

In addition, IgA-s acts mainly on the supragingival plaque, covering the bacterial surfaces, preventing its adhesion to the acquired enamel film, since, besides

blocking the receptors present on the surface of the bacteria, IgA-s also promotes bacterial agglutination, thus facilitating its removal from the oral cavity through the salivary flow [3,4]. IgA-s is also an extremely efficient agglutinin since each molecule of this immunoglobulin has four antigen-binding sites [4].

Despite this ideal ability of IgA-s and the numerous studies in this field, the researchers are still not decisive in affirming this possibility of action against *Streptococcus mutans* in humans, emphasizing that the immunity by IgA-s would be dependent on the dental colonization, since when they already adhere to its surface, the protection exerted by this antibody is minimal [2-4].

In turn, IgG and IgM play a similar action to IgA; however, they act mainly at the subgingival plaque level [1,2]. In addition, IgM antibodies are associated with IgA deficiency, in which the first group of antibodies is synthesized locally on the mucosal surfaces in order to compensate for the low or absent amount of IgA [3].

Furthermore, there is the ability of the cellular immune response in defense against caries. Most cariogenic microorganisms, especially *Streptococcus mutans*, have the ability to stimulate lymphocyte proliferation, especially TCD4 and cytokine production, leading to a negative correlation between the caries index and lymphocyte stimulation [3].

In this respect, the cariogenic bacteria infect, colonize, and accumulate on the surface of the teeth and can cause caries. Dental eruption is necessary for the initial colonization of several bacterial types, such as *Streptococcus mitis* and *salivarius*, occurring around the first or second year of life, and in the case of *Streptococcus mutans* its colonization happens around the third and fourth year of life [3].

In this context, at birth, IgA is absent in saliva, increasing rapidly as the child is exposed to bacterial, viral, and alimentary antigens [2,3]. After the first few weeks of life, it is possible to detect IgA levels against some types of streptococci, such as *Streptococcus mitis*, *salivarius*, and *mutans*, wherein the following years, the increase in the level of these antibodies is detected, being detected on average at 28 months of age. age in the case of IgA against *Streptococcus mutans*. This increase in IgA is important in colonization of the oral cavity of infants, which is facilitated by the increase in the number of their retentive surfaces [4].

The development of antibodies against *Streptococcus mutans* shortly after birth is related to exposure to this microorganism and not to the response to other antigens, such as bacterial, viral, and food [6-8]. In view of the presence of an immune response to *Streptococcus mutans* in the apparent absence of infection in some studies, it may represent an immune

response to the maternal bacterial clone, suggesting the influence of the mucosal immune response and breast milk in this event [9-12].

Thus, health education represents one of the main elements for the promotion of health and a way of caring that leads to the development of a critical and reflexive awareness [13-15] and for the emancipation of the subjects by enabling the production of a knowledge that helps people to take better care of themselves and their families [16-18].

Conclusion

It was concluded that there is an important network and cascade of defense events between immunological processes and caries disease. Thus, it is necessary to have a healthy immune response to reduce the incidence of caries.

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Similarity Check

It was applied by Ithenticate®.

Application of Artificial Intelligence (AI)

Not applicable.

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It was performed.

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