

IMMUNOGLOBULINS IgA AND IgG IN CHILDREN WITH PERMANENT DENTITION AND DENTAL CARIES

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Abstract

The antibacterial and antiviral activity of saliva is mainly mediated by IgA, IgG, and, to a lesser extent, IgM immunoglobulins. Given that saliva is in constant contact with all tissues in the oral cavity and that it contains components with a protective role, maintaining the health of the oral mucosa and other oral tissues, implies the constant presence of these elements in physiological conditions. Salivary immunoglobulins are necessary for the preservation of all oral tissues and organs because they have a huge antimicrobial effect. Saliva immunoglobulins are synthesized locally in the plasma of enamel interstitial cells. Several species have been shown in the final saliva secretion, the most important of which are IgA, IgG, and IgM. The aim of this research was the relationship between the values of immunoglobulin A and immunoglobulin G in the saliva of children with permanent dentition and the presence of dental caries.

The study included 71 children (26 female and 45 male) with permanent dentition of both sexes at the age of 12 years. We performed the dental examinations using portable lamps with a power of 60 W with a white-blue spectrum sterilized periodontal probes No. 5 and a mirror. We took the saliva samples in the morning at least one hour after the last meal and brushing the teeth, with the absence of the subjects who were in the process of preparing for dental treatment. The evaluation of IgA and IgG in saliva was done with ready-made factory tests Synergy™ Microplate Readers and HTRF® Detection from BioTek Instruments, USA. The principle of the immunoturbidimetric methodology for the determination of IgA IgG is based on the fact that proteins in saliva form immune complexes in an immunochemical reaction with specific common anti-IgG and IgA antibodies. These complexes blur the sample at a maximum brightness of 334 nm - 340 nm. The intensity of blurring is proportional to the concentration of immunoglobulins in the sample. The result is evaluated through a standard curve. The Descriptive Statistics method was applied. Data analysis was performed in statistical programs Statistica 7.1 for Windows and SPSS Statistics 17.0.

The examined relationship between the values of immunoglobulin A in the saliva of children with permanent dentition and the presence of dental caries shows that for $R = -0.65$ ($p < 0.05$) a strong negative significant correlation was found. Namely, the increase in the values of immunoglobulin A in the saliva of children with permanent dentition is accompanied by a decrease in the presence of dental caries in children. The examined relationship between the values of immunoglobulin G in the saliva of children with permanent dentition and the presence of dental caries shows that for $R = -0.57$ ($p < 0.05$) a strong negative significant correlation was found. Namely, the increase in the values of immunoglobulin G in the saliva of children with permanent dentition is accompanied by a decrease in the presence of dental caries in children.

The examined relationship between the values of immunoglobulin A and immunoglobulin G in the saliva of children with permanent dentition and the presence of dental caries has a negative strong significant correlation ($p < 0.05$) determined also with the increase in the values of immunoglobulin A in the saliva of children with permanent dentition has been accompanied by a decrease in the presence of dental caries in children.

Key words: IgA, IgG, Dental caries, Permanent dentition.

1. Introduction

The most important organic components of saliva are proteins and glycoproteins, of which there are mostly: prealbumins, albumins, alpha acid glycoprotein, beta lipoprotein, lactoferrin, transferrin, immunoglobulins IgA, IgG, IgM, the enzyme amylase, etc.

Taking into account that the oral cavity is an "entrance door" to the whole organism for microorganisms from the external environment, saliva with its antimicrobial proteins is the host's first line of defense.

Antimicrobial protection of saliva can be specific, whose carriers are immunoglobulins and non-specific, which consists of numerous antimicrobial peptides, and proteins (histatin, defensins, lactoferrin, cathelicidins, mucins, capprotectin, lysozyme, peroxidase).

The antibacterial and antiviral effect of saliva is mainly achieved by immunoglobulins of the class IgA, IgG, and less often by IgM. Considering that saliva is in constant contact with all tissues in the oral cavity and that it contains components with a protective role, maintaining the health of the oral mucosa and other oral tissues implies the constant presence of these elements in physiological conditions. Salivary immunoglobulins are necessary for the preservation of all oral tissues and organs because they have an enormous antimicrobial effect. The immunoglobulins of the saliva are synthesized locally in the plasma of the cells of the enamel interstitium. Several types have been proven in the final secretion of the saliva, the most significant of which are: IgA, IgG, and IgM. IgA is the most numerous and is in a special form (dimeric combination of IgA with secretory components) which is known in the literature as secretory immunoglobulin A (sIgA). Together with IgG and sIgM, they constitute the secretory immunoglobulin system, a system important for specific humoral protection of the oral and mucous membranes of the digestive and respiratory systems against penetration of antigen and microbial infectious material. In humans, IgG is mainly of maternal origin and is the only one detectable in the saliva of newborns. Salivary IgA is absent at birth but is detected in newborns as young as one week of age. The concentration of IgG decreases and is undetectable after several months but reappears after teething. The formation of specific IgAs in saliva is associated with the colonization of bacteria in the oral cavity.

Immunoglobulins G and A and secretory IgA (sIgA) form the basis of the specific salivary defense against oral microbial flora, including Mutans streptococci. IgG is most abundant in saliva, as well as in other human secretions. Two IgA's are present in saliva, IgA1, which is the main component of Igs, although the relative amount of IgA2 is higher in saliva than in other secretions. In humans, IgG is mainly of maternal origin and is the only one detectable in the saliva of newborns. Secretory immunoglobulin A (sIgA) is the predominant immunoglobulin found in human secretions and mucosal surfaces.

Naturally occurring sIgA antibodies to many different antigens (oral, ocular, and respiratory microorganisms) are present in the mucosal fluid and can serve as a major immune defense against infections. Secretory IgA has several effector functions such as agglutination, precipitation, opsonization, suppression of inflammation, medicinal plasmid, inhibition of colonization, and neutralization of poisons, viruses, and enzymes. Secretory IgA is the primary immunoglobulin in the coating of mucosal surfaces and represents the first line of defense.

The aim of this research was the relationship between the values of immunoglobulin A and immunoglobulin G in the saliva of children with permanent dentition and the presence of dental caries.

2. Materials and Methods

The research included 71 children (26 female and 45 male) aged 12 years. We chose the age group of 12 years following the recommendations of the World Health Organization (WHO), which recommends that age for global monitoring of dental caries applies only to children with permanent dentition. We performed the dental examinations using portable lamps with a power of 60 W with a white-blue spectrum sterilized periodontal probes No. 5 and a mirror. To avoid visual fatigue, a maximum of 15 children were observed during one day. We conducted the tests after the oral consent of the subjects and parents. We took the saliva samples in the morning at least one hour after the last meal and brushing the teeth, with the absence of the subjects who were in the process of preparing for dental treatment.

We assessed IgA and IgG in saliva with ready-made Synergy™ Microplate Readers and HTRF® Detection tests from BioTek Instruments, Inc., headquartered in Winooski, USA (Figure 1). The principle of the immunoturbidimetric methodology for the determination of IgA and IgG is based on the fact that proteins in saliva form immune complexes in an immunochemical reaction with specific common anti-IgG and IgA antibodies. These complexes cloud the sample at a maximum light of 334 - 340 nm. The intensity of the turbidity is proportional to the concentration of immunoglobulins in the sample. The result is evaluated through a standard curve. Data analysis was performed in statistical programs Statistica 7.1 for Windows and SPSS Statistics 17.0.



Figure 1. Set for IgA, IgG determination

3. Results and Discussion

Figure 2 shows the investigated relationship between the values of immunoglobulin A in the saliva of children with permanent dentition and the presence of dental caries. For $R = -0.65$ ($p < 0.05$) a negative strong significant correlation was established. Namely, the increase in the values of immunoglobulin A in the saliva of children with permanent dentition is accompanied by a decrease in the presence of dental caries in children.

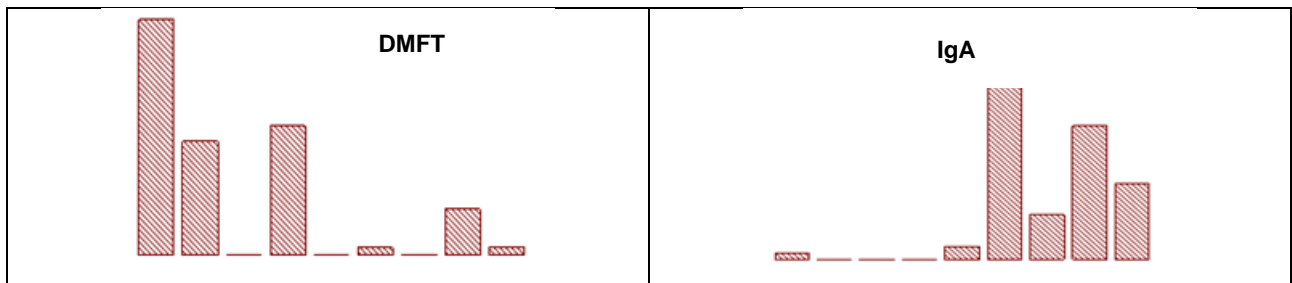


Figure 2. Relationship between DMFT index/IgA (Spearman rank $R = 0.57$ ($p < 0.05$))

Figure 3 shows the investigated relationship between the values of immunoglobulin G in the saliva of children with permanent dentition and the presence of dental caries. For $R = -0.57$ ($p < 0.05$) a negative strong significant correlation was established. Namely, the increase in the values of immunoglobulin G in the saliva of children with permanent dentition is accompanied by a decrease in the presence of dental caries in children.

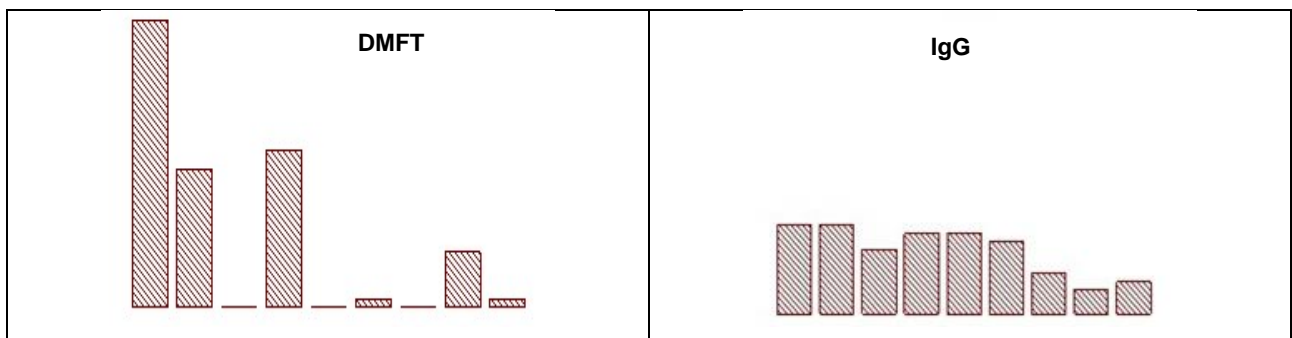


Figure 3. Relationship between DMFT index/IgG (Spearman rank $R = 0.57$ ($p < 0.05$))

The role of salivary Igs in the formation of dental caries is still debatable. Some experimental data indicate a protective role of anti-streptococcal IgGs, mainly measured by serum, against caries and colonization of *Streptococcus mutans* in early childhood and adults. The presence of active carious lesions can initiate the formation of specific IgGs and they can remain at a higher level for several weeks or months after the removal of the lesions, then it is assumed that some of the detected IgAs against *mutans streptococci* are generated by cross-reactivity with antigens from other bacteria. The values we obtained from our research for IgA in saliva in subjects from the control group vary in the interval 144.14 ± 26.05 mg/mL, and the test subjects from the experimental group of 115.13 ± 13.19 and the same from the control group were significantly higher concerning the value of IgA in the saliva of children from the experimental group ($p < 0.001$).

The examined relationship between the values of immunoglobulin A in the saliva of children with permanent dentition and the presence of dental caries has a negative strong significant correlation ($p < 0.05$) determined

and with the increase in the values of immunoglobulin A in the saliva of children with permanent dentition followed by with the decrease in the presence of dental caries in children. The values of IgG in subjects from the control group varied in the interval of 14.36 ± 1.53 and in the subjects from the control group in the interval of 11.92 ± 1.92 mg/mL, while the same from the control group were significantly higher compared to the value of IgA in the saliva of children from the experimental group ($p < 0.001$). The examined relationship between the values of immunoglobulin G in the saliva of children with permanent dentition and the presence of dental caries indicated the existence of a negative and strong significant correlation ($p < 0.05$) and the increase in the values of immunoglobulin G in the saliva of children with permanent dentition followed by is decreasing the presence of dental caries in children.

In humans, IgG mainly originates from the mother and is the only one that can be detected in the saliva of newborns. Salivary IgA is absent at birth, but is detected in newborns at the age of one week. The concentration of IgG decreases and cannot be detected after several months, but reappears after teething. The formation of specific IgAs in saliva is associated with the colonization of bacteria in the oral cavity according to Brown [1]

The role of salivary Igs in the formation of dental caries is still debatable. There are some experimental data that indicate a protective role of anti-streptococcal IgGs, mainly measured by serum, against caries and colonization of *Streptococcus mutans* in early childhood in adults according to Brown [1]

Kirstila [2] mentions that the presence of active carious lesions can initiate the formation of specific IgGs and that they can remain at a higher level for several weeks or months after removal of the lesions, then it is assumed that some of the detected IgAs against *mutans streptococci* are generated by cross-reactivity with antigens from other bacteria. Conflicting results have been obtained for salivary IgA and dental caries, described extensively by Marcotte and Lavoie.[3]

Tenovuo [4], emphasizes that some diseases, such as selective IgA immunodeficiency, should provide a unique model for assessing the role of sIgA in the colonization of *mutans streptococci* and in general, in oral health. However, even if these results are contradictory, any increase, decrease, or deficiency of IgA and susceptibility to caries has been proven. It supports the conclusion about the clinical significance of all antimicrobial components and their role in oral health which is also the case with the results of our investigations.

If we take into account that dental caries are effective, the hypothesis that the immunity of the host can regulate the caries' activity is possible. If acquired immunity can regulate caries activity then immunoglobulins may be correlated. C-IgA antibodies generated by the mucosal immune system are thought to play an important role in the immune response against caries. Corthésy [5], demonstrated a high level of total S-IgA in the saliva of children with a low degree of caries, which is in agreement with the results we obtained.

Hegde [6], examined the level of S-IgA in saliva and caries activity of caries and found that they were significantly correlated with caries activity. In contrast, S-IgG showed no correlation with dental caries. This emphasizes the importance of immunoglobulins in controlling caries activity in the oral environment.

Our results are in accordance with Gregory's studies [7] in his research, which found a correlation between a low rate of caries activity and higher levels of salivary IgA antibody levels in adults.

4. Conclusions

- According to certain authors, some diseases, such as selective IgA immunodeficiency, should provide a unique model for assessing the role of sIgA in the colonization of *mutans streptococci* and oral health in general. However, even if these results are contradictory any increase, decrease, or deficiency of IgA and caries susceptibility has been proven. The conclusion about the clinical significance of all antimicrobial components and their role in oral health is supported, which is also the case with the results of our studies.

- The realization of our research on salivary parameters and the association with dental caries for which we have provided respectable results can be used as serious screening factors and seriously participate as an instrument for caries risk assessment.

5. References

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