REVIEW ARTICLE

Dental Caries Vaccine: Need of the Hour

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ABSTRACT

Dental caries vaccine is the most awaited vaccine of the recent era, since the transformation of dental caries from a mere disease to an epidemic in most of the developed and developing countries of the world. After years of research and verification, the scientist had finally led to the conclusion that it is basically Streptococcus mutans responsible for dental caries and IgA is the natural ingredient, present in saliva, to protect the teeth from dental caries. But in most of the human beings, IgA alone is merely not enough to prevent dental caries, so vaccines are the need of the hour to protect us from this new epidemic.

KEYWORDS: Dental caries vaccine, Streptococcus mutans, Vaccine, Immunity, Immunoglobulin A

INTRODUCTION

A vaccine is a biological preparation that provides active acquired immunity to a particular disease. A vaccine typically contains an agent that resembles a disease-causing micro-organism and is often made from weakened or killed forms of the microbe, its toxins or one of its surface proteins. [1]

The basic agenda are whether to have a topical vaccine and/or an intra-venous or intra-muscular approach and that the vaccine should be long lasting and it should be biocompatible.

The vaccine should be biocompatible, safe, effective, and provides long-term protection and easily applicable.

Dental caries is caused basically by the most ubiquitous bacterial infection of humans. In most of the developing and developed countries, dental caries is approaching the epidemic scale, and thus it has become quite important that a more effective public-health measures are taken to combat dental caries.[2,4,5]

In 1940s, Lactobacilli were among the principle bacterial targets. In the latter half of the 20th century, the attention was diverted on Streptococcus mutans, because of its repeated association with dental caries.[3,7]

Current immunization strategies against dental caries are using the virulence factors as the basic antigen and introducing these antigens into novel mucosal vaccine systems and delivering them with or without adjuvants to mucosal IgA inductive sites. The most common routes of mucosal immunization are via the oral and nasal route. Mucosal immunization strategies result in the induction of salivary IgA antibody responses and pose fewer problems than parentral injection of antigen.[6,8]

The World Oral Health Report 2003, published by the WHO, mentioned that dental caries is a major health problem in most developed and developing countries, affecting 60 to 90% of school children and most adults. On an average the number of missing, filled and decayed, permanent teeth for individuals of 12 years of age is 3.5 in the Americans, 2.4 in the western Pacific, 2.0 in Europe, 2.0 in the eastern Mediterranean, and 1.5 in Southeast Asia and Africa.

It is expected that the percentage of dental caries will increase in Africa as a result of growing consumption of sugar and inadequate exposure to fluoride. In the United States, 98% of individuals of 40 to 44 years of age have experienced cariogenic infection (with an average of 44 cariogenic surfaces per individual).[2,4,9]

STREPTOCOCCUS MUTANS

It is a bacterium which is majorly responsible for the initiation and development of carious lesions. It is facultative anaerobic, non-haemolytic, acidogenic organism, producing extracellular and intracellular polysaccharides. The minimum infective dose in man is 10^4 to 10^5 S. mutans per ml of saliva.

There are many strains of S. mutans but the ones that are majorl responsible for cariogenicity in humans are of serotypes c, e and f. Serotype c contains only polymers of glucose and rhamnose. It consists of cell and protoplasmic membrane which encloses the protoplasm of the organism. The surface antigens of the protoplast are involved in the immunogenicity of the organism.[3,9,10]

WALL-ASSOCIATED PROTEINS

The basic wall-associated protein of interest is Antigen A, which is a small molecular weight cell wall protein (29,000 daltons).[3,6,8,9,10]

The vaccine using Antigen A, is a topical vaccine, that has been produced on a large scale and initial trial using volunteers is pending.[3,6,8,9,10]

SOURCE OF ANTIBODIES IN SALIVA

Dental caries can be provided by two different antibodies,

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i.e., IgG antibodies from serum, IgA antibodies in salivary secretions, and a combination of the both.[3,6,8,9,10]

The percentage of IgA is higher as compared to IgG in the saliva. Also IgA is found to be resistant to digestive proteolytic enzymes, thus, IgA is quite helpful in resistance against the colonization of streptococci by agglutination of the organisms; due to common mucosal immune system.[3,6,7,8,9,10]

RECENT ADVANCES

Recently a vaccine has been discovered; a protein called p1025. This protein tricks Streptococcus mutans, into believing that there are no vacant sites on the tooth for it to attack. The bacteria consists of a surface protein that adheres to the enamel. Researchers have found that p1025 mimics the protein of the bacterium, occupying all docking sites.[2,4,8,9,10]

CONCLUSION

In the times prevail there had been numerous methods such as topical or systemic use of fluorides, fissure sealants, and dietary control, so developed to control and prevent various cariogenic activity in the oral cavity, in humans. But all these methods have been proved quite inefficient in the long run in preventing dental caries, which finally gave rise to the need of development of dental caries vaccination, for human beings.[10]

The research is still an ongoing process and till date, none of the universally accepted vaccines has been able to evolve in the market.

The development of the vaccine, still in process, an effort made possible by the contribution of various devotees both from the dental and engineering field.

Dentists are eagerly looking highly upon it as it would specifically be very useful in cases of medically and/or physically handicapped patients, old aged individuals, etc.

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