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REVIEW ARTICLE

Dental caries: A comprehensive review

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ABSTRACT:
Dental caries is a common chronic infectious, transmissible disease resulting from tooth-adherent specific bacteria, primarily Streptococci Mutans that metabolize sugars to produce acid, which over time, demineralizes the tooth structure. Despite the advancements in dental caries detection and prevention, it is still a common infectious disease. Even with recent dental caries research, most clinical practice is still based on treating the disease by restorative treatment once it is detected, rather than on prevention.

Key words: Caries, Disease, Prevention

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INTRODUCTION

Dental caries is one of the oldest and most common diseases found in humans. While there have been continuous efforts to reduce its prevalence, it is still widespread, especially in lower socio-economic classes. Traditional caries management strategies adopted a surgical model of treatment: after removing the decay, a more geometrically perfect cavity is created and filled with the most compatible and artificial material. This surgical model eventually created bigger and bigger cavities as secondary dental caries progressed even after restorative treatment, subsequently requiring re-treatment, until eventually the tooth was lost. With the shift from the surgical model to a medical model of disease management, the newer strategies emphasize disease prevention and conservation of tooth structure.[1- 3]

DISEASE VS. LESION

For many centuries, dental science remained happily divorced from biology and was very contented to be married to mechanics, despite the warning of Dr. G. V. Black against such an estrangement in 1908. Caries in Latin means, 'rotten'. For a nonprofessional, caries meant a hole in the tooth and for the dental professionals, it meant destruction of the tooth structure in the form of cavitation. We, 'operative surgeons,' logically adopted the surgical model of treatment for such a cavity, only to make a bigger, more geometrically perfect cavity, and fill it with the most compatible, artificial materials. This surgical model of 'drill and fill' resulted in more 'drills and fills' and the tooth seemed to land from the socket into the bucket, which Simonsen later called the 'Molar cycle'.[4- 6]

Despite several breakthroughs in systematic scientific research in dental caries that started as early as the 1800s, this concept of making stereotypical, preconceived shapes of cavities prevailed in dental training programs as well. This is well stated by EAM Kidd "…as soft, brown, demineralized dentin only appeared in the clinic, as a considerable inconvenience, to view these preconceived shapes."[4- 7]

As the saying, 'seeing is believing' suggest, it was easier to believe in the effect that was seen (the cavity) and work on it and difficult or even impossible to imagine the unseen pathological causal mechanism (the disease) that resulted in this obvious effect. However, a paradigm shift is an inherent characteristic of any evolving science and it happened to cariology too. The shift was from the 'mechanics-based surgical model to a biology-based medical model' of disease management.[8- 10]

Any disease should have causative factor(s), pathogenesis, clinical manifestation or a sign, and predisposing risk factors. Dental caries perfectly fitted into this medical model of disease as background knowledge of this condition kept expanding. This shift paved the way for a double-pronged attack on the disease and its lesion. The above two successful changeovers are not just stand-alone changeovers, but are associated with many other radical changeovers. Undoubtedly, this metamorphosis of dental caries may not be entirely new to the reader, but a comprehensive understanding of these changes and their consequences may still be lacking. Therefore, the need of the hour is to link all these transformations into one logical scientific chain and translate them for effective application. [8- 10]

BACTERIA ASSOCIATED

Caries-associated bacteria traditionally have been identified by using culture-based methods, which exclude not-yet-cultivated species. Molecular methods for bacterial identification and enumeration now are performed routinely to more precisely study bacterial species that are associated with dental caries, including those that are not presently cultivable. In a previous study, authors compared the bacterial species found in early childhood caries to those found in caries-free children. Some species, such as Streptococcus sanguinis, were associated with health, while others, such as S. mutans, other Streptococcus spp., Veillonella spp., Actinomyces spp., Bifidobacterium spp., and Lactobacillus fermentum, were associated with caries. These data also suggested that Actinomyces gerencseriae and other Actinomyces spp. play an important role in caries initiation. Previous group of authors used cultural and molecular techniques similar to ours to determine those species associated with the middle and advancing front of dental caries in adults. The authors demonstrated a diverse bacterial community, including S. mutans, Lactobacillus spp., Rothia dentocariosa, and Propionibacterium spp. They also found that numerous novel taxa were present in carious lesions. Another group of authors used similar molecular techniques to determine the microbial diversity in advanced caries in adults. They demonstrated an abundance of species of the genera Lactobacillus, Prevotella, Selenomonas, Dialister, Fusobacterium, Eubacterium, Olsenella, Bifidobacterium, Propionibacterium, and Pseudoramibacter. S. mutans was not commonly detected. Previous group of authors examined the bacteria associated with dental caries and health in a subset of 204 twins aged 1.5 to 7 years old. A strain of an Actinomyces species, S. mutans, and Lactobacillus spp. were associated with disease. In contrast, bacterial species, including Streptococcus parasanguinis, Abiotrophia defectiva, Streptococcus mitis, Streptococcus oralis, and S. sanguinis, predominated in the indigenous bacterial flora of caries-free subject.[10- 15]

THE CARIES CONTINUUM, THE CARIES BALANCE AND CLINICAL RELEVANCE

Dental caries is a disease that is manifested as a dynamic process in the mouth. Cycles of demineralization and remineralization continue in the mouth as long as there are cariogenic bacteria, fermentable carbohydrates and saliva present. Whether demineralization or remineralization is proceeding at any one time is determined by the balance between pathological factors and protective factors. The concept of a balance is supported by clinical observations that the caries process can be arrested for a long time and then progress if one of the components is changed. An obvious extreme example is when a person becomes xerostomic as a result of radiation to the head and neck as cancer therapy. The salivary gland function can then be severely impaired leading to rampant caries in months if aggressive preventive measures are not taken. For some people, brushing twice a day with a fluoride-containing toothpaste can tip the balance and eliminate future carious lesions. When the bacterial challenge is high it is difficult for fluoride therapy to overcome the challenge and caries can progress. This can be the case in high caries risk individuals when antibacterial therapy as well as fluoride therapy is needed.[16- 20]

VISUAL INSPECTION

Visual examination is the most commonly used method for detecting caries lesions, because it is an easy technique that is routinely performed in clinical practice. Visual examination has presented high specificity (proportion of sound sites correctly identified), but low sensitivity (proportion of carious sites correctly identified), and low reproducibility; the latter because of its subjective nature. The use of detailed visual indices, however, may improve sensitivity and be an important factor in minimizing the examiner's interpretation of the clinical characteristics of a lesion, and thus improve reproducibility. Such indices may also describe the characteristics of all clinically relevant stages in the caries disease process, making them a cost-effective method of recording caries lesions. The use of indices has permitted early caries signs to be detected and recorded in a reliable and accurate way in visual examination.10–16 However, initial caries lesion stages have generated most of the disagreements between examiners in several studies, and their evaluation demands more training and more time for examination.[18- 21]

CONCLUSION

Despite the advancements in dental caries detection and prevention, it is still a common infectious disease. Even with recent dental caries research, most clinical practice is still based on treating the disease by restorative treatment once it is detected, rather than on prevention. Future education and clinical research efforts should continue to emphasize early detection and caries prevention.

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