REVIEW ARTICLE

Preventive Approach For Caries Management –A Pedodontic Panacea

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A B S T R A C T

Dental caries is responsive to prevention and management at both the individual and population levels. It is also readily treatable through conventional surgical interventions and dental restorations. Pediatric dentists have a critical role in preventing and reducing the severity of dental caries at an early age. Preventive approach for caries management has been progressively acknowledged as a significant element in reducing the prevalence and severity of dental caries. The present review focuses on this panacea of caries management with preventive strategies in light of recent developments.

Keywords: *Prevention, Panacea, Dental caries*

Introduction

The World Health Organization asserts that oral health is a basic human right, yet this is a right enjoyed by few.[1] Despite general advances in the overall health status of the people living in industrialized countries, including oral and dental health, the prevalence of dental caries in school aged children is up to 90% and majority of adults are also affected. Ubiquitousness and increasing prevalence of dental caries makes it one of the most critical problems in public health.[2] Due to high cost and lack of resources at primary level, prevention is undeniably better in dental caries management.

Dental caries is amenable to prevention and management at both the individual and population levels. It is also readily treatable through conventional surgical interventions and dental restorations. Pediatric dentists have a critical role in preventing and reducing the severity of dental caries at an early age. Preventive approach for caries management has been increasingly recognized as a significant

element of efforts by pediatric health care providers in reducing the prevalence and severity of dental caries.

The present review focuses on this panacea of caries management with preventive strategies in light of recent developments. A targeted approach model in this regard has been put forth, taking into account the various available preventive armamentaria for dental caries.

Current concepts of caries[3]

Caries is a communicable, transmissible, infectious bacterial infection. Caries now is understood to be a biological disease, one that can be managed from the medical perspective versus only a surgical or restorative process. The bacterial cause of the disease was established a decade ago, however, it failed to address intervention and methods to intercept the process bacteriologically and antimicrobially. The disease or decay was identified and typically removed surgically, followed by restoration of the tooth by filling. However, dentistry is heading towards the medical model, which is to identify the cause of the disease and eliminate the cause. When the previously used preventive strategies are discussed, it is well accepted that they do not hold good in the present minimal invasive era (Table I).

Targeted approach model for caries prevention

As caries is a dynamic bacterial process, the authors present a targeted approach model for caries management in pediatric age group[4] (Table II). This model is based on the caries timeline, i.e., the management tactic is time-based. The advantage of this approach is that caries can be prevented at a very early stage, which seems to be of special interest in pedodontic practice. The targeted approach also facilitates the caries management protocol scientifically based on the stages of caries formation. Consequently, this approach enables the clinician to instill a positive dental attitude in the patient at a very preliminary stage.

Caries prevention based on targeted approach

Treating caries as a physician first (etiological basis) and then a dentist (therapeutic/restorative basis) as follows,

1. Identify the individuals' caries risk and activity by a complete assessment procedure.
2. Control oral bacterial levels.
3. Identify measures that will shift the patient at risk to a low-risk category.
4. Identify how non-cavitated lesions should be treated for remineralization and reversal.
5. Cavitated lesions will be treated in the traditional manner.
6. Home and office maintenance procedures.

Table I: Previous strategies and sequelae

Previous Philosophies and Preventive Strategies	Sequelae of Previous Strategies
• Early identification of tooth surfaces with carious or cavitated lesions.	• Fails to address the cariogenic bacteria and their control.
• Use early operative intervention of these lesions to minimize tooth involvement.	• Fails to treat the initial lesion or white spot in a non-invasive fashion.
• Use of oral hygiene methods	• Over-treatment in many patients (especially the low risk patients).
• Use of fluoride	• Repair of the damage produced by the disease without identification of the causative agent

Table II: Targeted approach model for caries prevention[4]

	Target	Approach
Step one	Transmission and establishment of *S. mutans*	• Caries risk assessment • Early diagnosis with modern diagnostic aids • Dental health Education • Oral hygiene augmentation • Caries vaccine (enhancing research and human experiments)
Step two	Microbial shift	• Chemotherapeutic approach : Chlorhexidine,Triclosan,etc. • Probiotics • Plaque control measures

Step three	Exposure of microbes to cariogenic substrates	Dietary modification with sugar substitutes and counselling

Step four	Demineralization of enamel	• Augment salivary factors
		• Oral hygiene maintainance
		• Diet modification
		• Increasing tooth resistance
		  • Fluorides
		  • Pit and fissure sealants
		  • Remineralisation : CPP-ACP

Methods on the horizon (Table III)

The global need for prevention and treatment options and products for oral diseases that are safe, effective and economical comes from the rise in disease incidence and increased resistance by pathogenic bacteria to currently used antibiotics and chemotherapeutics.[5,6] There are several improvements in modalities aimed to enhance the diffusion of antimicrobials and remineralising agents into the dental plaque biofilm and development of controlled release delivery devices such as antimicrobials encapsulated in controlled-release microcapsules.[7] Additionally, methods to improve the

residual capacity of antimicrobial delivery including sustained-release materials, responsive release (smart) materials that are triggered by changes in pH, combination therapy (fluoride ⁄ mineral concentrates) release, and new biomaterials that buffer pH and that have impermeable margins.[8]

Recent developments in deciphering the human oral microbiome, an initiative of the Human Microbiome Project (http://commonfund.nih.gov/hmp) have allowed the survey in depth and also recognize the types of bacteria that are associated with dental health and disease. This has profound implications for therapy development in the future once the metabolic activity of acidogenic species in dental caries is understood. This will allow for development of methods to recognise and inhibit virulence factors. By applying metagenomics analysis and metabolic reconstruction of significant pathways it will be possible to effectively design new therapies for dental caries prevention. Methods of bacterial transplantation and ⁄ or bacterial replacement in the oral cavity may show promising avenues in the control of dental caries for high caries risk patients.[8, 9]

Ozone gas (O_3) has the ability to kill bacteria, fungi, and viruses.[10,11] Few well-controlled studies have been performed to investigate the bactericidal effect of various doses of ozone gas on oral microorganisms. Oizumi et al.[12] reported that an ozone generator using 20 mg/h of ozone was required to disinfect dentures that contained Streptococcus mutans (strain IID 973), Staphylococcus aureus (strain 209-P), and Candida albicans (strain LAM 14322). In vitro and in vivo reports support the potential of ozone to arrest caries and to possibly remineralize demineralized tooth structure.[13-15] However, more evidence of appropriate rigor and quality is required before ozone can be accepted for primary dental care or as an alternative to current methods for the management and treatment of dental caries.[16]

Another recent addition to caries preventive armamentarium includes the recognition and research in the field of phytotherapeutic agents like Mentha piperita, Rosmarinus officinalis essential oil, green tea extracts, cloves, garlic extract and Propolis against Streptococcus mutans. These agents are considered safe, economical and holistic. The phytomedicinals aid in dental caries prevention as well as treatment by combating bacteria through various modes as follows,[17]

- Inhibitors of Bacterial Growth
- Inhibitors of Acid Production and Acidurance
- Inhibition of Exopolysaccharide Synthesis
- Inhibition of Bacterial Adherence

The effects of filtered garlic extracts were evaluated on the acid production and the growth of Streptococcus mutans. Garlic extracts could enhance the rate of acid production and inhibit the growth of S. mutans. The authors concluded that despite the stimulation of acid production, garlic may prevent dental caries by the stimulation of salivary secretion and inhibition of bacterial growth in the oral cavity. Thus, garlic may have potential to prevent dental caries.[18] Mentha piperita and Rosmarinus officinalis essential oils were found to be wffective antimicrobial agents against Streptococcus mutans and Streptococcus pyogenes.[19] Likewise, clove extracts were found to reduce the synthesis of water insoluble glucan by almost 50% at a concentration as low as 0.5 mg/ml; indicating inhibitory effects on the cariogenic properties of S. mutans.[20] The anti-cariogenic activity of green tea has been postulated to be a direct bactericidal effect against Streptococcus mutans and S. sobrinus by inhibition of glucosyltransferase.[21] Similarly, iinvestigations carried out with crude propolis

extracts, isolated fractions, and purified compounds showed reductions in Streptococcus mutans counts and interference with their adhesion capacity and glucosyltransferase activity.[22] These findings indicate that propolis and/or its compounds are promising cariostatic agents.

However, the modes of adequate delivery into oral cavity and the potential side effects still need further scrutiny. Natural products, consequently, remain a largely unexplored source of effective antibiofilm molecules of potentially low toxicity that could be used in adjunctive anticaries therapies in preventive dentistry.

Discussion

"One-size-fits-all" tactics for caries prevention and disease management fails profoundly to reflect important differences in disease experience within and between populations. Interventions based on bio-technology/bio-material, clinical, behavioral, and social mediations that are risk-based, age-specific, safe and accepted at both individual and population levels need to be further explored.[23]

Archetypal approaches to dental caries repeatedly fail to capitalize on current scientific understanding of disease distribution, correlates,

Findings from Human Microbiome Project: Methods of bacterial transplantation and / or bacterial replacement in the oral cavity
Ozone disinfection
Phytotherapeutic agents
Antimicrobials encapsulated in controlled-release microcapsules
Sustained-release materials, responsive release and smart materials
Combination therapy (fluoride / mineral concentrates)
New biomaterials that buffer pH and that have impermeable margins

Table III Recent advances in caries prevention

and pathogenesis. Dental caries should be recognized and managed taking into account the dynamic, progressive, infectious, diet-dependent, behavioral nature of the disease. Although caries is a disease that manifests throughout the lifespan, prioritizing children is appropriate because caries is first established in early childhood and plays out across the lifetime.[24] Current conceptual frameworks that need to be addressed include shifting from characterizing dental caries as a condition to a disease; from passive to active management; from static to dynamic understanding of pathogenesis; from treatment to management;

and from dento-centricity to individual and family centricity.[23]

WHO recommends oral health interventions that (1) reduce disease burden through a "risk-factor" approach that focuses on high needs individuals and groups; (2) promote healthy lifestyles and reduce risk factors arising from environmental, economic, social, and behavioral sources; (3) develop oral health systems that equitably improve oral health outcomes, respond to legitimate needs, and are financially fair, and (4) integrate oral health into national and community health programs and promote oral health in public policy. The 2001 U.S. Surgeon General's invitational Workshop on Children and Oral Health focused attention on public and private policy interventions suitable for young children, including (1) start early and involve all who come in contact with young children and their families; (2) assure competencies of all providers; (3) be accountable through tracking and performance measures; (4) take public action through coalitions; (5) maximize utility of sound science; (6) improve public programs for the underserved; (7) grow an adequate and competent dental workforce; and (8) empower families to address their oral health.[25]

It is time that dental health care providers spurn the narrow surgical view seeking to apply interventive treatment as a one-off event at a certain trigger point of disease severity and admit the evidence that caries is an initially reversible, chronic disease with a known multi-factorial etiology. The caries process thus, should be managed over time in an individualized way for each patient.

Conclusion

Modern caries management must be based on the principles of disease management. These include accurate lesion detection, classification of lesion severity, assessment of caries risk, matching of treatment to the risk level, monitoring for evidence of remineralization or further demineralization, and assigning recall intervals according to treatment outcomes and current risk levels. Additional attention should be given to apply the fruits of new research in order to enhance the effectiveness of preventive agents and to bring them to developing regions of the world. It is now apparent that, by itself, restorative treatment of the disease does not 'cure' caries. Thus, the preventive targeted approach to dental caries stands out as a Pedodontic panacea in this regard.

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