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Review Article

Assessment and prevention of tooth decay in children

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ABSTRACT

It has been solidified by science that dental decay is transmittable. Despite improvements in other age groups, there is indication that dental decay in young children is on the rise. There has not been an improvement in practice as a result of risk assessment research. Although definite trials are required, antiseptics, chlorhexidine varnish, and polyvinylpyrrolidone iodine (PVI-I) may be useful. Despite not being extensively distributed to the most vulnerable, fluorides continue to be the most beneficial interventions. Although conclusive trials have not been carried out, fluoride varnish is a fairly efficient topical preventative for young children. The promise of silver diamine fluoride must be studied in the US. Xylitol is safe and reliable, according to the data, although it is not widely used. Despite numerous studies, wide adoption of dental sealants has not taken place, despite being a fundamental component of public policy. We draw the conclusion that while research has demonstrated the negative public health impact of tooth decay, not enough of it has been conducted to address the growing incidence of pediatric dental disease globally. Technology must be translated from studies to practice in order to stop childhood teeth decay. This should include conducting translational studies and putting the latest technological and scientific developments into use.

Keywords: Early childhood caries, Dental decay, Risk assessment, Caries detection, Caries prevention, Xylitol, Diamine silver fluoride, Fluoride varnish

INTRODUCTION

The demineralizing of enamel and dentin caused by caries, a transmittable infectious disease in which pathogen related risk factors outweigh protective factors, has been widely studied.[1] Dental tissue destruction and surface cavitation will occur if the condition is left to advance. Because of its propensity to adhere to smooth dental tissues and its capability to generate large quantities of acid, mutans *Streptococci* (MS) is regarded as one of the most significant bacteria in the cariogenic

pathway. It is understood that these microbes can be passed from caretaker to child by direct contact or salivary transfer (vertical propagation), such as usage of shared utensils.[1] Even prior to the emergence of the first tooth, caretakers with large levels of harmful pathogens in their oral cavity can transfer these organisms into a child's mouth. It has been demonstrated that newborns with elevated MS levels or those whose oral cavities had been colonized soon had a higher risk of developing early childhood caries (ECC).[2-5]

LITERATURE SEARCH

This study is based on a comprehensive literature search conducted on December 13, 2022, in the Medline and Cochrane databases, utilizing the medical topic headings (MeSH) and a combination of all available related terms, according to the database. To prevent missing any possible research, a manual search for publications was conducted through Google Scholar, using the reference lists of the previously listed papers as a starting point. We looked for valuable information in papers that discussed the information about assessment and prevention of tooth decay in children. There were no restrictions on date, language, participant age, or type of publication.

DISCUSSION

The infectious aspect of pathology can be exploited in preventative and control measures for dental caries, or the condition can be seen as independent of infection. The correlation between maternal salivary levels of mutans *Streptococci* (MS), which includes *S. mutans*, *S. sobrinus*, and other species less commonly seen in humans, and the earlier colonizing of offspring and the early onset of caries in the child, as well as the identity of the mother with the colonizing pathogens and her offspring depending on bacteriocin testing, endonucleases, and ribotyping provide further proof of transmission, originally from mother to offspring.[4,6-9] There is a solid scientific foundation for the evaluation of young mothers' microbiological state as indicators of the colonized teeth in children.[4] Strategies for the mother to inhibit her MS lengthen the time it takes for her offspring to colonize, as well as lengthen the duration and decrease the extent of the onset of a carious lesion.[10-12] Following investigations that revealed colonizing in early childhood and before tooth eruption, the idea of a distinct window of infectiousness until around two years and two months of age, in which period the disease transmits has been enlarged.[13] According to one investigation, at least 20% of infants under the age of 14 months and at least 25% of predentate infants are thought to be MS carriers.[14] After age 5, the cause of MS is unknown, however it is at least possible that siblings and caregivers are involved. The following text reviews current literature on tooth decay screening and risk assessment and improved dental decay preventive methods. Advanced tools created by the sector enable the early diagnosis of dental decay.

Detection and risk assessment

By taking a "medical" approach, early detection could boost the chance to cease and reverse dental damage and avoid the requirement for conventional operative procedures that either completely eliminate the teeth or extract them.[15] Broadly speaking, the tools have a high sensitivity but poor specificity. Since one approach cannot be applied to all tooth surfaces and conditions, its clinical utility is further constrained.[16] Currently, it seems that the devices don't really improve competent visual/tactile assessment.[17,18] Furthermore, rather than bolstering attempts to arrest early lesions, these devices could be used improperly to support surgical procedures and the creation of restorations, which are frequently branded as "minimally invasive." The most effective equipment is expensive, heavy, and time-consuming to use, with little usage in a conventional dentist office, community clinic, or community-based health center. Fiber-optic transillumination and other straightforward methods might be more easily adopted.[19] The international caries detection and assessment system, (ICDAS) which emphasizes early lesion identification prior to the onset of caries activity, is being tested by an international research group.[20,21] The reasoning is that early recognition will raise the chance to cease and rectify lesions and reduce the requirement for operative procedures, just like with technology-based solutions. ICDAS is still under progress but has adequate reliability and validity.[22] Although there has not been much of an influence on dental student instruction or adoption by community or health center practices up to this point, things might quickly shift if research shows the most influential way to accomplish this goal. These techniques-visual or high tech-rely on the post-lesion identification of lesions.

As mentioned above, finding carious lesions in young infants is a reliable indicator of the likelihood of finding them in older children. Initial carious lesions, or "white patches," are another factor that strongly predicts gross cavitation of the teeth.[4] Additionally crucial are nutritional risk factors. To assist clinicians, risk assessment techniques have been advocated.[23,24] Family physicians who frequently treat infants and toddlers may find these tactics useful. The CAMBRA caries risk assessment form for age 0 to 5 years is one illustration.[25] Nevertheless, evaluations of the mothers or caregivers of the offspring with respect to their infection status, cavities history, or microbiology may also be useful.[9] The degree of MS colonization is an indication and a predictor of caries development at the extremes.[4] Children who have ECC typically have higher amounts.[14,26] The link is worse at lower staged of colonization, which is undoubtedly caused-at least in part-by the confounding impact of fluoride and the various testing techniques used. If testing results in effective guidance and the prevention of morbidity in children, it is comparatively simple and cost-effective. However, bacterial testing is very common in dental clinics. It is necessary to conduct research on

how these technologies are being used in primary care and dental practices.

Interventions to improve prevention of tooth decay

The discovery of immunization-based dental caries vaccines is ongoing. The secretory immune response to MS antigens can affect the etiology of caries.[27-29] With a few exceptions, the majority of research has used animal models. Salivary sIgA antibodies are responsible for the protection (active). Also of relevance are antibodies that are produced in one host and given to humans (passive immunity). Both active and passive techniques aim to suppress a range of processes crucial to MS in the microbial film residing on dentition by choosing various antigenic proteins as the focus for immunization.

In both experimental animals and humans, the substitution of caries causing MS by noncariogenic *Streptococci* is being studied.[30] Though no *in vivo* corroboration has been revealed, early in vitro research on particularly targeted antimicrobial peptides is still ongoing.[31] Due to unsolved risk-benefit concerns and the need for commercial investment to finance extensive trials to satisfy regulatory standards, approval of particular immunizations and clinical applications is still challenging. Numerous research has examined the effectiveness of antiseptic substances in preventing dental cavities in elderly, cooperative people.[15,32] Some professionals strongly support pairing fluorides with different antimicrobial drugs for toddlers as topical fluorides do not completely prevent against dental caries, especially for children with discrepancies and whose homes are mobile.[33] The topical antimicrobials chlorhexidine digluconate (CH) and polyvinylpyrrolidone iodine have both been studied somewhat (PVP-I).

The amount of chlorhexidine rinses offered in the United States is lower than that of those sold in other nations (to lessen tooth discoloration), but they are still accessible by prescription. No formula has US food and drug administration's approval for controlling caries in young patients, only for controlling gingivitis. The usefulness of a CH varnish coating for the dentition has been studied in research with mixed findings. A recent systematic evaluation of 14 articles of controlled clinical studies concluded that using the varnish every three to four months had a modest effect in decreasing dental cavities.[34] The bioavailability and consequent impact of CH may have been significantly impacted by the variation in CH varnish compositions. Although there is insufficient data to endorse any pediatric products in the United States, CH varnishes and other CH-containing carriers may be useful in preventing caries in very early childhood.

The iodine studies on tooth caries is encouraging, but the majority of human investigations were quite small scaled.[35,36] Data from pilot and small-scale clinical investigations on the effectiveness of PVP-I in young infants, some of whom had active ECC that had already developed, are quite positive.[37-40] Assessments on a larger scale are necessary and appropriate. The advantages of applying fluoride professionally, at home, and in toothpaste, gels, and mouth rinses are widely known. On communities with inadequate access to dentists, these tactics have had little effect. Fluoridation of community water supplies is very effective but is reliant on the availability of public water supplies and popular support for their fluoridation. Individualized compliance with mouthwashes, gels, and toothpastes depends on accessibility and affordability. The US FDA granted manufacturers permission to start selling topically administered sodium fluoride varnishes in the late 1990s. They are used to prevent and stop pediatric carious lesions, and strong data indicates more positive findings than the earlier methods, even though they are officially prescribed for adults exclusively.[41,42] These are suitable for young children and newborns. However, producers have not looked for a caries prevention indicator, probably since they believe there is a limited market and a limited return on investment. The creation of varnishes is mainly unorganized, and producers have created a variety of varnishes that change the varnish's qualities. There is no evidence that these rival items are interchangeable. The varnishes are essential because they give toddlers, our most vulnerable group, a simple, affordable, and safe way to consume fluoride. Varnish is being utilized more frequently in public health settings, but not as frequently in private dentistry settings. There has been a push for dentists and nurses to administer varnish.[1] Topical fluoride treatment has not been accepted for primary prevention in children younger than 24 months. American academy of pediatrics guidelines particularly mention the lack of a conclusive trial. Therefore, to show the efficacy of topical fluoride administered by primary care dental nursing staff during well-baby visits, a multicenter research trial is required. There is a need for fresh research on how this technology is being used in daily life. Almost no attempts have been made to research how to increase adoption.

Diamine silver fluoride is valuable for both stopping ECC in its tracks and preventing it from returning. Although this product has long been accessible in Japan and a number of other nations, it has never been imported to the United States. It is at minimum two times more successful as sodium fluoride varnish, according to the evidence.[43,44] One disadvantage, discoloration of the cavity or tooth after intervention, may be avoidable.[45] More research is required to understand how this substance functions. The FDA has classified xylitol as "generally regarded as safe" (GRAS). It is not just protective against caries but also anticariogenic in adolescents and young adults. Similar to other sugar alcohols, its use is constrained by how little of it the gastrointestinal tract can absorb. When added to chewing gum or other treats regularly consumed, xylitol is a safe and reliable dental disease preventive agent.[46-48] Its usage, similar to fluorides, is linked with advancement

remineralizing of whitish spots and lesions. Its advantage cannot be credited simply to a prosalivatory effect of chewing gum use. The metabolism of MS is believed to be inhibited by it, according to a large body of evidence.[49,50] The American academy of pediatric dentistry endorses the usage of xylitol chewing gum as a cavities inhibitor but suggests further investigations. It underlines the importance of xylitol product labeling so that caregivers and health professionals may make informed decisions.[51] However, the lack of formulas that require minimum adherence and are appropriate in a wider range of contexts, like in early childhood settings and schools, has restricted utilization. Adults require at least of 5 to 6 g divided in three doses daily from chewing gum or sweets to experience a therapeutic effect.[52] An eight-gram recommended dosage of xylitol syrup applied twice or thrice everyday was found to be beneficial in avoiding ECC in a recent trial.[53] An important study found that preschoolers whose moms consumed high-content xylitol chewing gum regularly experienced slowed colonization, decreased amounts of MS, and likewise delayed and significantly reduced caries.[11] Despite an increasing variety of products and a substantial body of research demonstrating xylitol's efficacy and safety, its use is still relatively uncommon, especially in the days immediately following childbirth. When compared to other sugar-free goods, xylitol products are rather expensive, but they are inexpensive when compared to the expense of treating caries.

Although the use of sealants holds importance among practitioners, the practical use of sealants by practitioners has not been reached. When the permanent dentition emerges is when sealants are meant to be applied (roughly ages 7–8 years and 13-14 years).[54,55] The creation and distribution of glass ionomer sealants have been the only recent advances. The justification for this is that glass ionomer can be applied to partly erupted permanent dentition, where it generates minute quantities of fluorides that are thought to prevent the growth of local lesions. However, there are just a few pilot investigations of these materials, and their promise has not yet been fully realized. Glass ionomer cement sealants have lower retention rates than the present generation of traditional resin-based sealants.

There has been a lot of interest in creating innovative remineralizing substances that can supplement or take the place of fluoride's clinical usefulness. Investigations that are mostly funded by business have been carried out to sell goods that promise to remineralize early caries.[56,57] These materials are manufactured as clinically applied pastes, toothpastes, and gums. The concept is appealing theoretically. However, the effort is not concentrated on the management of ECC early lesions, and assertions of benefit are not well supported. Minimal research has been conducted to determine how these products could help children.

CONCLUSION

For extremely young patients, dental caries is a severe and growing concern. It affects living quality. Despite the fact that dental caries is an infectious disease, this idea is not widely used in daily life. In order to avoid and treat dental decay, antimicrobial strategies that are aimed at both mothers and early children are crucial. Fluorides continue to be the most efficient treatments, although they are not frequently given to those in most need. Really young children can benefit from fluoride varnish as a topical preventative, although there have been no conclusive studies on its use in primary care. It is necessary to conduct thorough tests on new materials that can be applied to erupting teeth. The translation of technology from study to application demands more academic attention.

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