Guideline on Caries Risk Assessment and Management

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Purpose
The American Academy of Pediatric Dentistry (AAPD) recognizes that caries-risk assessment and guidelines can assist clinicians with decisions regarding treatment based on caries risk and patient compliance; and is an essential element of contemporary clinical care for infants, children, ~~and~~ adolescents, and persons with special health care needs. These guidelines are intended to educate healthcare providers and other interested parties on the assessment of caries risk in contemporary pediatric dentistry and aid in clinical decision making regarding diagnostic, fluoride, dietary and restorative protocols.

Methods
This guideline is an update of the previous document, Policy on Use of a Caries-risk Assessment Tool (CAT) for Infants, Children, and Adolescents", revised in 2006, as well as including the additional concepts of dental caries protocols. The update used electronic and hand searches of English written articles in the medical and dental literature within the last ten years using the search terms, "caries risk assessment", "caries management", and "caries clinical protocols". From this search 1,909 articles were evaluated by title or by abstract. Information from 75 articles were used to update this guideline. When data did not appear sufficient or were inconclusive, recommendations were based upon expert and/or consensus opinion by experienced researchers and clinicians.

Caries Risk Assessment

Risk assessment procedures currently used in medical practice normally have sufficient data to accurately quantitate disease susceptibility of a person and allow for preventive measures. [1] Even though caries risk data in dentistry still are not sufficient to quantitate the models, the process of determining risk should be a necessary component in the clinical decision making process.[2] Risk assessment fosters the treatment of the disease process instead of treating the outcome of the disease; it gives an understanding of the disease factors for a specific patient and aids in individualizing preventive discussions with patients; it individualizes and selects and determines frequency of preventive and restorative treatment for a patient; and it anticipates caries progression or stabilization.

Caries risk assessment models currently involve~~s~~ a combination of factors including diet, fluoride exposure, a susceptible host, ~~and~~ microflora and a variety of social, cultural, and behavioral factors.[3-6] Caries risk assessment is the determination of the likelihood of the incidence of caries (i.e., the number of new cavitated or incipient lesions) during a certain time period, [7] or the likelihood that there will be a change in the size or activity of lesions already present. With the ability to detect caries in its earliest stages (i.e., white spot lesions), health care providers can help prevent cavitation.[8-10]

Caries risk indicators are variables that are thought to cause the disease directly (e.g., microflora) or have been shown useful in predicting it (e.g., socioeconomic status), and includes those variables that may be considered protective factors. Currently, there are no caries risk factors or combination of factors that have achieved high levels of both positive and negative predictive values.[2] Although the best tool to predict future caries is past caries experience [2], it is not particularly useful in young children since it is important to determine caries risk before the disease is manifest. Children with white spot lesions should be considered at high caries risk since white spot lesions are precavitated lesions that are indicative of caries activity in the mouth. [11] Plaque accumulation also is strongly associated with caries development in young children.[12,13] As a corollary to the presence of plaque [14], a child's mutans streptococci levels,[3] and the age that a child becomes colonized with cariogenic flora [15-16] are valuable in risk assessment, especially in preschool children.

While there is no question that fermentable carbohydrates are a necessary link in the causal chain for dental caries, a systematic study of sugar consumption and caries risk has concluded that the relationship between sugar consumption and caries is much weaker in the modern age of fluoride exposure than previously thought.[17] However, there is evidence that night-time use of the bottle, especially when it is prolonged, may be associated with early childhood caries.[18] Despite the fact that normal salivary flow is an extremely important intrinsic host factor providing protection against caries, there is little data about the prevalence of low salivary flow in children.[19,20]

Sociodemographic factors have been extensively studied to determine their effect on caries risk. Children with immigrant backgrounds have three times higher caries rates than non immigrants.[21] Most consistently, an inverse relationship~~s~~ between socio-economic status and caries prevalence is found in studies of children less than six years of age. [22] Perhaps another type of sociodemographic variable is parents' history of cavities and abscessed teeth which has been found to be a predictor of treatment for early childhood caries.[23,24]

The most studied factors that are protective of dental caries include systemic and topical fluoride, sugar substitutes, and tooth brushing with fluoridated toothpaste. Teeth of children who reside in a fluoridated community have been shown to have higher fluoride content than those of children who reside in suboptimal fluoridated communities. [25] Additionally, both pre- and post-eruption fluoride exposure maximize the caries preventive effects. [26,27] For those individuals that reside in non-fluoridated communities fluoride supplements have shown a significant caries reduction in primary and permanent teeth.[28] With regard to fluoridated toothpaste, studies have shown consistent reduction in caries experience.[29] Professional topical fluoride applications performed semiannually also reduce caries, [30] and fluoride varnishes generally are equal to that of other professional topical fluoride vehicles.[31]

The effect of sugar substitutes on caries rates have been evaluated in several populations with high caries prevalence.[32] Studies indicate that xylitol can decrease mutans streptococci levels in plaque and saliva and can reduce dental caries in young children and mothers.[33] With regard to tooth-brushing there only is a weak relationship between frequency of brushing and decreased dental caries, which is confounded because it is difficult to distinguish whether the effect is actually a measure of fluoride application or whether it is a result of mechanical removal of plaque.[34] Currently, the "dental home" or regular periodic care by the same practitioner, is included in many caries risk assessment models because of its known benefit for dental health.[35]

Risk assessment tools can aid in the identification of reliable predictors and allow dental practitioners, physicians and other non-dental providers to become more actively involved in identifying and referring high-risk children. Tables 1, 2, and 3 incorporate available evidence into practical tools to assist dental practitioners, physicians and other non-dental providers in assessing levels of risk for caries development in infants, children, and adolescents. As new evidence emergences, these tools can be refined to provide greater predictably of caries in children prior to disease initiation. Furthermore, the evolution of caries assessment tools and protocols can assist in providing evidence for and justifying periodicity of services, modification of third-party involvement in the delivery of dental services, and quality of care with outcomes assessment to address limited resources and workforce issues.

Caries Management Protocols

Clinical management protocols are documents designed to assist in clinical decision making by providing criteria regarding diagnosis and treatment and that lead to recommended courses of action. They are based on evidence from current peer-reviewed literature, the considered judgment of expert panels, as well as clinical experience of practitioners. These protocols should be updated frequently as new technologies and evidence develop.

Historically, the management of dental caries was based on the notion that it was a progressive disease that eventually destroyed the tooth unless there was surgical and restorative intervention. Decisions for intervention often were learned from unstandardized dental school instruction, and then refined by clinicians over years of practice. Still little is known about the criteria dentists use when making decisions involving restoration of carious lesions.[36]

It is now known that surgical intervention of dental caries alone does not stop the disease process. Additionally, many lesions do not progress, and tooth restorations have a finite longevity. Therefore, modern management of dental caries should be more conservative and includes early detection of noncavitated lesions, identification of an individual's risk for caries progression, understanding of the disease process for that individual, and "active surveillance"to apply preventive measures and carefully monitor for signs of arrestment or progression.

Caries management protocols for children further refine the decisions concerning individualized treatment of caries and treatment thresholds based on a specific patient's risk levels, age, and compliance with preventive strategies (Tables 4, 5, 6). Such protocols should yield greater probability of success and better cost effectiveness of treatment than less standardized treatment. Additionally, caries management protocols free practitioners of the necessity for repetitive high level treatment decisions, standardize the decision making and treatment strategies [36-38] eliminate treatment uncertainties, and guarantee more correct strategies.[39]

Current content of the present caries management protocol are based on results of clinical trials, systematic reviews, and expert panel recommendations that give better understanding to, and recommendations for, diagnostic, preventive and restorative treatments. The radiographic diagnostic guidelines are based on the latest guidelines from the ADA.[40] Systemic fluoride protocols are base on the CDC's recommendations for using fluoride.[29] Guidelines for the use of topical fluoride treatment are based on the ADA's Council on Scientific Affairs' recommendations for professionally applied topical fluoride, [41] the Scottish Intercollegiate Guideline Network guideline for the management of caries in pre-school children,[42] a Maternal and Child Health Bureau Expert Panel,[43] and the CDC's fluoride guidelines.[29] Guidelines for pit and fissure sealants are based on ADA's Council on Scientific Affairs recommendations for the use of pit-and-fissure sealants.[44] Guidelines on diet counseling to prevent caries are based on two review papers.[45,46] Guidelines for the use of xylitol are based on the the AAPD's Oral Health Policy on Xylitol,[32] a well executed clinical trial on high caries risk infants and toddlers,[47] and on two evidence-based reviews.[48,49] Active surveillance (prevention therapies and close monitoring) of enamel lesions is based on the concept that treatment of disease may only be necessary if there is disease progression ;[50] that caries progression has diminished over recent decades,[51] and that the majority of proximal lesions, even in dentin, are not cavitated.[52]

Other approaches to the assessment and treatment of dental caries will emerge with time, and with evidence of effectiveness, may be included in future guidelines on caries risk assessment and management protocols. For example, there are emerging trends to use calcium and phosphate remineralizing solution to reverse dental caries.[53] Other fluoride compounds, such as silver diamine fluoride,[54] and stannous fluoride [55] may be more effective than sodium fluoride for topical applications. There has been interest in antimicrobials to affect the caries rates, but evidence from caries trials still are inconclusive.[56] However, some other proven methods, such as prescription fluoride drops and tablets, may be removed from this protocol in the future due to attitudes, risks or compliance.[57,58]

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