RESTORATION AND POST-SURGICAL PREVENTION WILL NOT SOLVE EARLY CHILDHOOD CARIES

ABSTRACT

Early childhood caries (ECC) is the most common childhood infectious disease with increasing prevalence in young children in many countries. Diet and non-biological factors such as race and poverty are considered prime suspects in the worsening of this affliction. In spite of extensive study, control of ECC remains elusive. Restoration of carious primary teeth and intense preventive post-surgical therapy often have little effect on the disease’s progression. Children afflicted with ECC continue to suffer from its effects throughout childhood and growing evidence favors a predilection for continued progress of the carious process into the permanent dentition. Prevention of ECC through early dental visits, with both pediatricians and dentists involved, may be the only way to eliminate the disease and reduce the number of children with significant co-morbidities. The purpose of this report is to describe the nature of ECC, the evidence documenting the ineffectiveness of restoration as a cure, and the limits of preventive therapies in preventing recurrence of the disease once established.

Key words: Dental Caries, Morbidity, Prevention

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INTRODUCTION

In the analysis of the latest NHANES (US) data, many observers were surprised to see that dental caries in primary teeth in very young children had increased while dental caries in permanent teeth continued to decline. Long in the shadow of consistent declines in permanent tooth decay, early childhood caries, or ECC, had languished in a holding pattern with no significant change in the US. Two decades ago, concern was raised about the lagging status of ECC, but in the absence of a statistically significant change and with the euphoria of a continued decline in permanent caries, little attention was given to the lack of change in ECC prevalence or to the extent of the disease itself. Shenkin recently proposed that the statistically significant increase in the minimally discriminating NHANES prevalence measures is really a sign of successful access to treatment and not necessarily an increase in disease. In other words, the increase was due to higher values in the filled or extracted (m) components, suggesting treatment was being performed. Most authorities, however, have taken the NHANES data at face value and accept that ECC in the US has increased and relate the increase to a variety of traditional biological as well as newly appreciated cultural, familial, and societal risk factors. Individual state studies of US Head Start and pre-school populations suggest that the ECC increase is real and that a troubling overlay of pain has emerged with this increase. Developed countries around the world also report the epidemic of ECC. Early childhood caries is a complex, aggressive disease. Access to dental care and a dental home remains a problem in the US shown by frequent visits to a hospital emergency department for an acute dental need. In 2006, 24.982 children visited emergency rooms (ERs) across the US due to an oral health-related need. In 2007, a survey was sent to parents of children aged 1 to 17 years of age. Ten percent, or 7.5 million children, had experienced a toothache in the previous 6 months. Toothaches were significantly more common in minority children, those with special health care needs, and those without a primary care physician. In addition to these disparities, the prevalence of ECC in American Indian and Alaska Native (AI/AN) children is estimated to be 400% higher than in all US races. These children have a particularly high burden of dental disease, with over 25% of pre-school children in some communities requiring full mouth rehabilitation under general anesthesia (GA). Preventive strategies have resulted in little or no long-term improvements in ECC prevalence or severity in AI/AN children.

Suppositions Regarding the ECC Increase

Acceptance of a real ECC increase is more plausible in light of its distribution in the poor and minority populations who have traditionally experienced higher levels of oral disease and lack of access to preventive and educational interventions. The largest population increase in the US has been in its minorities, particularly Hispanic people, and the ECC increment in Hispanic children is the highest compared to white and black children in the 2-5 year age range. The reluctance of dentists to care for very young children and the reluctance of professionals to embrace the 1-year dental visit until recently also certainly contribute to an explanation of ECC increase. Of lesser notoriety, but an equally provocative explanation relates to profound changes in the early childhood diet including the displacement of milk by juice and sugar-containing carbonated beverages beginning as early as a year of age. Other less-explored but still interesting explanations include more susceptible enamel which relates to poor maternal nutrition during pregnancy, a theory not inconsistent with what is known about diet and nutrition of women in the child-bearing years and supported by animal data.

Why Should We Have Concern About ECC?

Whatever the cause of the increase in ECC, and if one believes that it is real, the prevention and management of the condition become critical, more so with recognition that ECC can have significant co-morbidity. With the growing interest in ECC, more studies have investigated the morbidities associated with what many worldwide still consider a childhood rite of passage. Impact on quality of life in ECC-afflicted children is well-established. ECC has been implicated in failure-to-thrive (FTT), child-abuse risk, sleep disorders, familial stress, and school performance. Less well understood are the effects of ECC on society and the health care system such as devotion of resources to treatment and prevention, hospitalizations, and even deaths from treatment mishaps. Surgical care to eliminate ECC, often delayed until children are likely to cooperate for care, has been the focus for efforts to eliminate the condition and accounts for a significant portion of expenditures related to ECC management.

Evidence Supporting the Tenacity of ECC Infection

For a quarter-century, a thread of research has painted a discouraging view of attempts to surgically eliminate ECC. Unfortunately, the work, which has come from many sources,
seems to have escaped recognition by many in the dental profession, academia and public health. More importantly, this lack of awareness of the stubbornness of ECC infection by decision-makers perpetuates ill-conceived and primarily treatment-directed solutions to the epidemic. It is the purpose of this paper to present evidence on the treatment-resistance of ECC, the ineffectiveness of post-diagnosis or post-surgical prevention in ECC, and to recommend potentially successful and promising preventive approaches.

**Limits of Restorative Intervention**

With the increase in prevalence of ECC and its occurrence in younger patients, management of these children has become more complex, with more dentists utilizing GA as a behavior management modality. While dental rehabilitation under general anesthesia may solve the immediate issue of pain or decreased oral health quality of life in these children, long-term success in eliminating ECC has not been shown. In a study following patients for 2 years after dental rehabilitation while under GA, 79% of 194 children originally treated had new carious lesions at recall visits. These children developed new caries at an average of 17.7 months post-GA. In addition, 17% of these children required a second GA to address new caries within 2 years of the initial dental rehabilitation. In addition, a study in the UK showed 14.5% of children who had dental treatment while under GA presented with a toothache and/or swelling related to new carious lesions at least once in 6 years following the GA.

There is a tendency for poor follow-up for recall visits after GA which may contribute to the post-GA relapse. Lack of follow-up is a complex phenomenon and may encompass social and behavioral factors. Chase et al evaluated the health outcomes of children after treatment under general anesthesia. Their study found a high relapse rate after dental surgery not related to a specific health locus of control (as defined as professional, parent, child, media, fate, and divine loci of control). However, the study did conclude that those parents who returned for follow up care had an external health locus of control whereas those who did not return for follow up had an external locus. This may point to the fact that parents need to develop an internal locus of control- the knowledge-base and confidence to understand they can make an impact on their child's oral health.

Children with ECC have a high propensity for developing new carious lesions, even when full mouth rehabilitation is completed at a young age. Berkowitz et al showed that children treated for nursing caries utilizing GA were not responsive to follow up care; over half of the children presented with new smooth surface caries at 6 months post-treatment. It is reasonable to conclude that ECC is a risk indicator for future caries. Because of this fact, children need to be treated more aggressively in the operating room due to this high risk. More conservative approaches to treatment while under GA have been associated with higher restorative failure or the development of new caries. For example, stainless steel crowns have a significantly higher success rate than do composite restorations or composite strip crowns, evaluated using the criterion of presence of new carious lesions.

Unfortunately, restoring the dentition does not have a long-term impact on reducing S. mutans levels in saliva of these children. Without a treatment plan to address the extremely high bacterial level of these children, clinicians will not be successful in eliminating the progression of disease. In addition, preventive treatment to modify feeding habits and behaviors has shown limited success. Wright et al. showed that dental rehabilitation significantly reduced bacterial populations in saliva of children with high levels of mutants streptococci pre-treatment (≥2.5x10^4 colony forming units per mL saliva), but the populations were predicted to return to baseline levels within 5 months post-treatment. A study evaluating the levels of S. mutans in Head Start children in one Northwest Indian Community showed children who had full mouth restoration for severe ECC had the highest levels of S. mutans (>1x10^6 cfus). The temporal success of restorative treatment does not result in clinical cure for these children long-term.

Children with ECC are not only at risk for developing new caries within the primary dentition, but ECC is a risk indicator for caries in the permanent dentition as well. Several studies that followed children longitudinally from primary to permanent dentition show consistently that caries in primary dentition is a risk indicator for caries in the permanent dentition. For example, Skeie et al. examined children at age 5 and 10 years. A significant association was found between caries experience in the two dentitions. A child with more than 2 surfaces of caries experience in primary molars, was at high risk at age 10, indicated by 1 carious surface into dentin or 1 filled surface on the mesial surface of a first permanent molar. Kaste showed a dmft ≥5 in the primary dentition was an indicator of caries risk in the permanent dentition, with the presence of DMFT ≥5 as well. Warren, in 2006, showed in a longitudinal study of children...
examined at five years of age and again at age 9 years, that 31% of non-cavitated pit and fissure caries at the baseline visit progressed into cavitations or filled surfaces by the follow-up visit. In contrast, 7% of non-cavitated smooth surface lesions at baseline developed into cavitations or filled surfaces by the follow-up. Thus, pit-and-fissure caries were shown to be more susceptible to progression than smooth surface lesions and would benefit from preventive treatment such as sealants or frequent follow up visits.27

**Does Prevention Post-Diagnosis of ECC Work?**

When a child is recognized as having ECC, intensive preventive strategies and oral hygiene education are currently advocated in an attempt to prevent further decay. An effort to understand and modify oral health behaviors of children and their parents is extremely difficult and complex --- reasons our current strategies have limited success. In an attempt to understand the efficacy of current preventive plans in the late mixed dentition, Hausen et al.30 divided 12-year-old children into high risk and low risk groups. The high risk group of children was randomly assigned to receive either an intensive prevention plan or a basic prevention plan. These children were followed for 3 years. The intensive prevention plan included dietary counseling, fluoride varnish applications, oral health instruction, evaluation of S. mutans levels, placement of sealants, chlorhexidine gel for brushing, and the recommendation of fluoride lozenges and xylitol gum. The basic prevention regimen included fluoride varnish applications once per year, sealant placement, and the recommendation of oral hygiene, diet, and brushing. After 3 years, the intensive prevention plan group had 2 fewer caries surfaces per year than the basic prevention group—thus, the intensive prevention plan showed no clinical difference and no additional benefit to the high risk group.30 Another study evaluating the oral health-related behaviors of 11 and 12 year-old Finnish children found that at baseline, children who brushed their teeth twice daily were more receptive to additional measures of prevention. However, children who had established the habit of eating candy daily by 11 to12 years of age, were more resistant to changing their oral health behaviors.31 These health behaviors are set by school-age with parents having a strong influence on their children. The oral health behaviors of 3 children aged 12 to 14 months were evaluated and were followed for 2 years. The children were randomly assigned to a control, self-efficacy, or high frequency fluoride group (applied monthly). The self-efficacy group consisted of 10 training sessions to increase confidence of the parents to stop the nursing bottle habit and start brushing their child's teeth. All of the parents were educated in infant oral health and the effects of nursing bottle caries. Despite these efforts, all of these children developed dental caries by three years of age.32 This study and others cited point to several key factors in ECC development.

1. Traditional preventive strategies have variable success and may not be the answer for ECC.
2. Modifying health behaviors is extremely difficult and not possible for all families. Health behaviors often are established well before school-age and possibly before the child's first birthday.
3. Dentists need to re-evaluate their traditional preventive strategies to be successful in the ECC group of children.

Guidelines outlining caries prevention for children and teens exist in many countries. However, the studies described in this paper show the lack of effectiveness of these guidelines. Petti examined why this may be, pointing to a lack of methodology in the development of these prevention guidelines as well as lack of data on long-term effectiveness. To be successful in preventing ECC, a methodical approach to prevention must be scientifically based and not just clinically-based.33

**Looking for Effective Ways to Prevent ECC**

Motivational interviewing is one new approach that may prove beneficial in evoking change in health behaviors. In this approach, the healthcare professional develops a rapport with the parent/guardian and evokes their motivation to change a particular health behavior. Children with ECC do not seem to respond to basic or intensive preventive strategies and are subject to a high relapse rate after treatment. Dental treatment may solve the immediate problem, but treatment relapse rates are extremely high and predictable in these children. Even current intensive preventive strategies are not effective because of many factors, which include established and entrenched health habits and health behaviors. Behavioral interventions alone show little chance of significant improvement. A multimodal approach to prevention may prove to be helpful, but more research is necessary. For example, a method to prevent or delay acquisition of S. mutans by decreasing maternal levels of the bacteria has been studied. Prevention of S. mutans...
from growing to pathologic levels is another approach, potentially by applying topical antimicrobial agents.34

A Preventive Solution to ECC?

The only really promising solution to ECC may be to assess children early and prevent caries before the onset ever occurs. Early assessment of these children, no later than one year of age, is imperative to prevent dental disease. General practitioners as well as pediatricians can be essential team members in identifying high risk children at a young age. A dental home for children is necessary to provide the foundation and opportunity to identify those children at high risk of dental disease so that the disease can be prevented before its onset, the only proven way to manage ECC. Evidence of the success of early dental intervention at this time is minimal, but some evidence suggests that the earlier the intervention, the less extensive are the restorative needs throughout childhood.35 Prevention of ECC should begin in the prenatal period and continue through the perinatal period. Unfortunately in the US, dentists have been slow to incorporate early dental visits into routine practice. Dental education has also lagged in providing infant oral health experiences to dental students. Even the pediatric (medical) community, in spite of national guidelines encouraging incorporation of oral health screening and fluoride varnish application into well child visits, has failed to embrace what may be the only true preventive tool to eliminate ECC in children. Over a ten year period, very few pediatric physicians embraced the AAP guidelines on early childhood oral health.36 In order to successfully address ECC, a collaborative effort between communities, dental, primary care, and public health practitioners, as well as policy-makers is required. Primary medical care providers have the opportunity to complement the work of dental health professionals. They are likely to see these children before a dentist and therefore have the opportunity to provide infant oral health education in the context of the well-child visit.

CONCLUSION

It is clear that waiting for ECC to develop with the hope that restoration can cure it is an ineffective approach to this most prevalent of childhood conditions. Further, growing evidence suggests that once established, ECC cannot be eradicated with today’s surgical and chemotherapeutic armamentarium. Preventing ECC through early dental intervention by both physicians and dentists presents the next best hope to eliminate the early childhood caries epidemic.

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