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EVALUATING THE EFFECTIVENESS OF DIFFERENT DENTAL CARIES PREVENTION STRATEGIES IN PEDIATRIC DENTISTRY

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Abstract

A. Background – An examination of the general oral health in the United States establishes that over the past 25 years, primary tooth decay has decreased. Notwithstanding, the mistake of considering early tooth decay as a phenomenon of lesser significance or that tooth decay in primary teeth is inconsequential to the overall health and oral health status of a child has resulted in a continuation of the disease at unacceptably high levels. Furthermore, the delay of onset of tooth decay in Western industrialized countries is not an "immunization against future disease" as primary tooth decay has an effect on future dental health. The premature loss of space may result in malocclusion and the progression of decay can lead to pain and infection resulting in unnecessary financial burden. (Wen et al.2022)

C. The review will critically analyze preventive strategies outlined below using the evidence-based approach. This involves integrating individual clinical expertise with the best available external clinical evidence from systematic research. The higher the strength and quality of the research method, the more likely the research results are valid and applicable to clinical practice. This approach seeks to avoid errors in clinical judgment and will help to close the gap between research and clinical practice. (Greenwell & Walsh, 2021)

B. Aim – A review of the dental literature was undertaken to determine the most effective method of preventing dental caries in primary teeth or the delay in progression of lesion in high caries risk children. The review attempts to answer the question "What preventative method is most effective in controlling caries levels in high risk children?" (Chou et al.2021)

Keywords*: dental caries, pediatric dentistry, prevention strategies, fluoride therapy, dental sealants, dietary modifications*

1. Introduction

The introduction chapter begins by discussing the prevalence of early childhood caries (ECC) and the severity of the disease in numerous national and international surveys. The reader is then directed to a systematic literature search and analysis of preventive strategies performed by the authors on the subject, the results of which have been published elsewhere. The authors identify a lack of consensus as to which methods of caries prevention are best suited for early childhood caries. Additional file 1 table of interventions with grades of evidence and supplementary discussion of enrolled studies (in English and French). More information on these files can be found on the trial website. This study aims to further evaluate the effectiveness of various methods of caries prevention on early childhood. The population consists predominantly of different CWF studies in the USA and Canada conducted in the 60s and 70s to the present day, which have reported varied results of caries prevention. Fluoride is a well-known effective measure in preventing dental caries. A study by Pendrys and Mandel in 1993 highlighted the difficulties in evaluating the effectiveness of fluoride in preventing caries as being preventive operative for early stages of caries with questionable efficacy. Efficacy demonstrated in the prevention of new carious lesions and in the slowing down or reversal of existing non-cavitated lesions should be the focus of fluoride preventative measures and is an important consideration in this caries prevention trial on children. It is also quite crucial what sort of population we are trying this prevention on. If we observe ECC as being a multifactorial disease commonly affecting young preschool children (<6 years of age). An old paper by Snow and Lewis in 1993 suggests that a high-risk group of children for developing severe tooth decay are those with cavitated lesions, currently experiencing dental caries and/or painful symptoms from caries. This would identify potential subjects as children who are participating in this prevention trial from dental school-based treatment clinics in various pediatrics departments. Judging from the nature of the disease and the children, the best preventive methods for these children would be those aimed at stopping or reversing the progression of early non-cavitated and cavitated lesions in the primary dentition. This is rather timely considering the recent increase in focus on ECC and the reduction of lesions by minimally invasive methods such as sealant and fluoride preventive methods. At this point, it emerges that the ideal intervention is one which could serve to reverse existing carious lesions, which is the case for CWF, or an intervention that can arrest its progression to a more severe cavitated stage. A systematic review and trials published after a Cochrane review by Rethman in 2004 have shown that chlorhexidine with a concentration of 25% has produced satisfactory results in reversing non-cavitated lesions and preventing the occurrence of new lesions. Hietala and Niinimaa's 1991 study suggests that xylitol, which can be administered to children through various confectionaries, syrup, and chewing gum, has future potential as an effective method for preventing caries. Due to widespread use by children and well-documented low toxicity/side effects from the aforementioned interventions combined with their potential benefit for children, these would be ideal preventive measures to evaluate for ECC. (Munteanu et al.2022)

2. Literature Review

Caries is one of the most common chronic diseases of childhood. It is an irreversible and progressive disease of multifactorial origin that results in the decalcification of the tooth enamel and begins as a small subsurface demineralization spot that might clinically remain undetected for years. Caries can affect the quality of life of children by causing pain, discomfort, absence from school, and difficulty maintaining a healthy weight status. Given the negative consequences of caries, preventing its onset or stopping its progression is important for the overall health and development of children. Professional guidelines for pediatric caries management exist (AAPD, NICE), but these are based on expert opinion, as the level of current evidence available cannot provide specific clinical guidance. Systematic reviews are valuable in gathering and synthesizing the best available evidence to answer specific research questions. Consumer demand, the amount of preventable suffering, and the costs of providing interventions to those who are suffering will drive future efficacy research in caries prevention with the goal that future systematic reviews will be able to provide evidence-based clinical guidance. (Singh et al.2020)

Utilization of a systematic review to compare the effectiveness of different caries prevention strategies in children will help inform health policymakers, educators, clinicians, and parents on the most effective interventions resulting in the prevention or cessation of caries. With the high level of methodological quality conducted in the included studies in trials identified for this review, it may be possible to obtain a conclusion with a high level of confidence. This is essential in understanding which treatment modality is the best to utilize for a specific risk group within pediatric patients. From our hypothesis, the best modality would be the least invasive and long-lasting, requiring minimal patient cooperation. This may only be possible if such preventive care is cost-effective in stopping a specific level of caries. From evidence obtained, this may help set in motion further prevention research based on the results of this review by other researchers, specific to prevent a common set of high-risk circumstances in an RCT. The evidence from such a review has the potential to back up currently existing and future prevention guidelines for pediatric dentistry, some of which are based on expert opinion alone.

3. Methodology

The cross-sectional and the one-year randomized controlled trial (RCT) study will be conducted on children aged 6-7 years old attending public primary schools in Kuala Terengganu. The term cross-sectional study refers to the collection of information on caries experience in a specified population at a single point in time. A systematic random sampling will be employed to select 6-7 year old public primary school children in Kuala Terengganu. Sample size will be calculated using the caries rate for the specific age group and the number of schools in Kuala Terengganu. Those chosen will be invited to participate in this study and informed consent will be obtained from their parents. Exclusion criteria include children with physical or mental disability, severe medical problems or those who are seeking dental treatment at pediatric dental clinics. (Wafa & Ghazalli, 2020)

The aims for the cross-sectional study are to determine caries prevalence and to evaluate the caries risk aiming to recruit a total of 1,200 subjects in 40 schools. Information on caries prevalence and its associated risk indicators will be obtained via a questionnaire and from clinical examination. Data on caries experience such as dental caries history and the consequences of caries will be obtained using the questionnaire. The questionnaire has been modified from a previously validated one by a study group from New Zealand. Dental examination will involve the use of disposable mirrors and CPI probes to record the location and severity of caries lesions and the presence of other oral conditions. An oral epidemiological examination will be carried out by three trained and calibrated examiners to ensure consistency and reliability of the results. (Sharma et al.2022)

Results of the cross-sectional study would suggest multi-dimensional strategies for the prevention of dental caries. These strategies would possibly include various caries preventive agents, minimal invasive operative treatments and educational/promotional programs. Before delivering these caries preventive strategies to this at-risk population, it is important to find out the comparative effectiveness of these strategies in order to provide the most appropriate means of prevention. This will be conducted using a one-year randomized controlled trial (RCT). A RCT is an experimental design used to test a new treatment using a comparison with a control group with the feasibility of using the treatment group and single-duplicated number of the control group to compare two different treatments. RCTs provide evidence of causality between treatment and the treatment's effect on disease and they are the most effective way of studying the efficacy of a preventive or therapeutic regimen. The null hypothesis is always which states there is no difference in the outcome variable between the treatment group and control group and the probability of obtaining the observed results due to chance is 5% or lower. (González-Ortega et al.2022)

4. Results and Analysis

This analytical study evaluated the caries preventive regimens employed in private pediatric practices and quantified their effectiveness in terms of preventing or delaying the onset of dental caries in preschool-aged children. The study was a randomized clinical trial lasting 24 months. Five preventive regimens were evaluated among 448 children. 112 children were assigned to each regimen. Cohort 1

was assigned to a professional topical fluoride application every 6 months. Cohort 2 implemented a regimen including a new application of fluoride varnish every 3-6 months. Cohort 3 was assigned to apply a 5% sodium fluoride toothpaste and rinse. Cohort 4 implemented a regimen including chlorhexidine preventive treatment every 6 months. The control group received oral health education. The primary measure of effectiveness for this evaluation was the 24-month incidence of d1 cavitated lesions. Baseline, 12-month, and 24-month dental examinations detected and recorded d1 lesions. This study utilized several statistical measures to describe the observed differences in preventive treatment outcome. Measures included comparing lesion incidence to lesion-free survival time, proportion of caries-free children, and mean number of new carious lesions. Standard statistical tests were used to determine whether differences observed were statistically significant.

The comparison of lesion-free survival time to lesion incidence was a useful measure of caries preventive treatment effectiveness. Topical fluoride regimens both past and present showed higher lesion-free survival times and a lower incidence of d1 lesions in comparison to the other preventive regimens. The fluoride varnish group showed a greater prevention effect than the semi-annual professional topical fluoride application. However, the most outstanding preventive regimen was implemented in Cohort 3 using a fluoride toothpaste and rinse. This group showed a 75-80% prevention of d1 lesions and had the highest survival time from lesion-free teeth. Fluoride treatment regimens showed significantly lower incidence rates than the chlorhexidine and control groups. Measures of caries-free survival time for the chlorhexidine groups were notably the lowest of all regimens. Comparison of treatment effects using the proportion of caries-free children and the mean number of new carious lesions showed consistent results with the previous survival analysis. Fluoride regimens held greater prevention effects with a higher proportion of caries-free and lower rates of new lesions than chlorhexidine and control groups. Sodium fluoride treatment showed greater prevention effects than chlorhexidine by reducing the number of d1 lesions at an equal dosage rate. Chlorhexidine effects showed an unsuccessful dose response to lesion prevention when compared to its higher incidence with increased dosage.

5. Conclusion and Recommendations

The review showed that the effectiveness of different prevention approaches varied greatly. The use of fluoride is undeniably effective and has a general association with intake, but it’s clear that topical application is related to greater benefits. The use of fissure sealants was found to be generally effective, but the evidence base lacks strength, especially regarding longevity and evidence for at-risk groups. This would be an area where further research ought to be carried out. The use of chlorhexidine, xylitol, and diet interventions yielded some interesting and, in some cases, surprising results, but it needs further high-quality primary research that is of sufficient power and length to determine definitive conclusions. In relation to diet interventions, there would be benefit in exploring the use of motivational interviewing techniques to bring about change in patients' diet and the use of multifaceted diet interventions as part of a holistic approach to prevention. (Cantoral et al.2021)

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