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Comparative evaluation of two caries detection systems for detecting the prevalence of early childhood caries: A cross-sectional study

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ABSTRACT

Background: The early diagnosis of dental caries is very crucial to prevent tooth loss, which leads to serious consequences in preschool children. The aim of this study is to compare the diagnostic outcome by the World Health Organization (WHO) and WHO and early carious lesions (ECLs) (i.e., WHO + ECL) criteria for assessing early childhood caries (ECC) in preschool children.

Materials and Methods: A cross-sectional, comparative study was conducted among 3–5 year old children ($n = 358$). Clinical examination was conducted using WHO and WHO + ECL criteria. The data were assessed using paired "t" test. $P < 0.05$ was considered as statistically significant.

Results: There was statistically significant difference between the mean decayed, missing, or filled teeth recorded by the WHO + ECL and WHO ($P < 0.05$) method.

Conclusion: It was concluded that WHO + ECL criteria were significant and more precise in assessing the presence of ECL in preschool children.

Key Words: Caries, preschool children, World Health Organization

INTRODUCTION

Dental caries is a common chronic infectious transmissible disease resulting from tooth adherent-specific bacteria, primarily mutans streptococci that metabolize sugars to produce acids which over period of time demineralizes the tooth structure. Early childhood caries (ECC) is the presence of one or more decayed (noncavitated or cavitated lesions), missing (due to caries), or filled tooth surfaces in any primary tooth in a child under the age of 6.[1] Teeth are most susceptible to dental caries soon after they erupt; therefore, the peak age for dental caries is 2–5 years for deciduous dentition.[2] The early diagnosis of caries is of extreme importance because it can provide valuable information for the establishment of preventive measures, especially in young children with high caries activity but without cavitation. These measures if taken at the right time allow for the enhancement of tooth remineralization and prevention of progression to frank cavitations.[3]

ECC progresses rapidly owing to the lower degree of mineralization, higher carbonate content, and higher porosity of the mineralized tissues of primary teeth than that of permanent teeth. Thus, when diagnosis is delayed in a young child, primary teeth may become destroyed or lost faster, leading to serious

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consequences, such as pain, problems in speech and mastication, installation of incorrect oral habits, loss of guidance for permanent teeth eruption, reduced percentile category of height/weight, and loss of school days. Hence, a new criterion for diagnosing early carious lesions (ECLs) was added for the examination of patients.[3-5] These codes were very well described by Assaf *et al*. in 2006,[4] wherein it has separate scores for detecting ECLs in addition to the original World Health Organization (WHO) criteria. Hence, this study was conducted to evaluate the effect of addition of these new criteria, ECL to standard WHO caries detection criteria on the prevalence of ECC in preschool children.

MATERIALS AND METHODS

This cross-sectional, comparative study was conducted by the Department of Pedodontics and Preventive Dentistry and approved by the Institutional Research Board and Institutional Ethical Committee of the Institute. Three preschools were randomly selected from the city for this study, and appropriate permissions were obtained from the school principals. Children in the age group of 3–5 years and who were willing to participate were included. Children who were suffering from any systemic disease or mental disorder were excluded from the study (this personal information was obtained from their school medical records). Written informed consent for examination was obtained from parents, school teacher, and verbal assent was obtained from children. Sample size was estimated by sample size formula using the prevalence from the previous studies, and thus, the final sample size was calculated to be 358.

Three examiners conducted the oral examination of preschool children. They were trained and calibrated before the main study for conducting examinations using both the criteria to eliminate bias. The kappa values for intraexaminer (k = 0.82) and interexaminer (k = 0.8) reliability were obtained.

Diagnostic criteria
Children were assessed using two diagnostic criteria, i.e., WHO and WHO + ECL.[5] The WHO criteria for caries detection enables for diagnosing decayed teeth if they have frank cavitations. Unlike WHO criteria, the WHO + ECL criteria allow to assess the presence of ECL as white, chalky, spot lesion present with the presence or absence of decayed or sound teeth or

occurrence of ECL in association with filled teeth or teeth with secondary caries.[3,4]

Examinations
Oral examinations were carried out under natural light using mouth mirror and ball-ended probe. Gauze was employed to clean and dry the surface for better examination of ECLs.

Statistical analysis
Statistical analysis was done using Statistical Package for the Social Sciences (SPSS Inc., Chicago IL, USA, version 21). Data obtained were entered into Microsoft Office Excel Sheet. Descriptive statistics were done, and paired "*t*" test was applied to compare the outcome of two different diagnostic criteria; $P < 0.05$ was considered as statistically significant.

RESULTS

This study was conducted to assess the prevalence of ECC among preschool children and compare the dental caries outcome using two different diagnostic methods, i.e., WHO and WHO + ECL. The study was conducted among 358 preschool children aged 3–5 years. There were 45% (n = 161) female students and 55% (n = 197) male students. The mean age of the participants was 4.47 (±0.629) years.

Intraexaminer reliability was assessed among three examiners, and the Cronbach's alpha value was 0.814 for WHO, while for WHO + ECL, the value was 0.752.

The mean decayed, missing, or filled (dmf) score was 2.69 (±3.03) for preschool children according to the WHO. According to the WHO criteria, 34.63% of the children were diagnosed caries-free [Table 1]. According to the WHO + ECL criteria, 61.17% of children had ECLs, while 39.38% and 55.58% children were diagnosed as decayed and decayed with

Table 1: Mean and Standard deviation using World Health Organization criteria

WHO criteria	Mean (SD)
B: Cavitated	2.61 (2.96)
C: Filled, with a cavity	0.01 (0.9)
D: Filled, with no cavity	0.04 (0.18)
E: Missing as a result of caries	0.06 (0.33)
F: Missing owing to any other reason	0.00 (0.00)
Number of caries-free children	123
Percentage of caries-free children	34.63
Mean dmft	2.69±3.03

WHO: World Health Organization; SD: Standard deviation; dmft: decayed, missing, or filled teeth

ECLs, respectively, and only 12.56% children were caries-free [Table 2].

There was statistically significant difference between mean decayed teeth score using the WHO and WHO + ECL (ECL, B [Cavitated], B + ECL) criteria (mean difference [MD] = 1.59, t = 16.9, P < 0.05). There was statistically significant difference between dmf score recorded using the WHO and WHO + ECL criteria (MD = 1.60, t = 17.0, P < 0.05) [Table 3].

DISCUSSION

ECC is a serious socio-behavioral disease of children and manifests dental problems that afflict infants and toddlers worldwide.[6] It is a complex disease involving the maxillary primary incisors within a month after eruption and spreads rapidly to involve other primary teeth and presents with multisurface caries (both cavitated and noncavitated). Hence, role of pedodontist is very important to deliver preventive measures,[7] since it places a large financial, health,

Table 2: Mean and standard deviation using World Health Organization + early carious lesions criteria

WHO + ECL criteria	Mean (SD)
ECL	1.56 (1.68)
B: Cavitated lesion	0.83 (1.31)
BECL: Cavitated + ECL	1.82 (2.43)
C: Filled, with a chronic cavity	0.07 (0.63)
CECL: Filled + cavity + ECL	0.00 (0)
D: Filled, with no cavity	0.03 (0.18)
DECL: Filled + ECL	0.00 (0.31)
4: Missing as a result of caries	0.06 (0.33)
5: Missing owing to any other reason	0.00 (0.00)
Number of caries-free children	45
Percentage of caries-free children	12.56
Mean dmf	4.30

WHO: World Health Organization; ECL: Early carious lesions; SD: Standard deviation; dmf: decayed, missing, or filled

Table 3: Mean differences in number of decayed teeth and total dmf score using World Health Organization and World Health Organization + early carious lesions criteria

Criteria	Mean	SD	Mean difference	t	P
WHO (Decayed)	2.6	2.9	1.59	16.9	<0.05*
WHO + ECL (total decayed)	4.2	4.1			
WHO (dmf)	2.6	3.03	1.60	17.0	<0.05*
WHO + ECL (dmf)	4.3	3.15			

*P<0.05 is statistically significant. WHO: World Health Organization; ECL: Early carious lesions; SD: Standard deviation; dmf: decayed, missing, or filled

and time burden on the family.[8] The principal methods dentists currently use to diagnose carious lesions are visual and visual & tactile examinations and radiographic assessment. With the technological advancements, illumination has improved and magnification is more easily employed for visual examinations, while radiation doses have decreased for radiographic assessments as both equipment and film have been improved. Recently, however, a wider variety of new methods and refinements in existing methods for the detection of carious lesions have become available, including fiber optic transillumination, direct digital imaging, electrical conductance, and most recently laser fluorescence.[9]

This study was conducted in preschool children to compare the caries outcome by the WHO criteria and WHO + ECL criteria. Clinical examination was done by three calibrated examiners. The good intraexaminer reliability was observed for all three examiners, suggesting a good agreement for detection of caries using WHO + ECL and WHO criteria.

Not all noncavitated lesions progress to become dentinal lesions requiring restorative treatment and a good proportion of them remain static or even remineralize, especially the smooth surface lesions. These lesions are thus reversible, as opposed to dentinal lesions, which are generally considered irreversible. Because there are usually more noncavitated than cavitated lesions, at any one time in both high caries and low caries population, the decision as to whether to include or exclude them can make a substantial difference in the oral health profile obtained.[10] With this diagnostic dilemma and wide variety of advanced treatment options available,[11] successful management of ECC is one of the greatest challenges to pediatric dentists.

The addition of ECL criteria to WHO caries detection criteria has shown to influence the final caries outcome in 3–5 year old preschool children. Their mean dmf surface scores recorded by the WHO + ECL criteria were almost double than that of the WHO criteria. Our study suggested that inclusion of ECL in the WHO criteria can be considered as appropriate and important factor in estimating the output of ECC.

When compared with the threshold based in the diagnosis of cavities (WHO), the inclusion of ECL in surveys clearly has a major effect on the assessment of dental health needs, as it allows the proportion of the studied population requiring preventive and restorative care to be identified and estimated.[4] This

suggests that there is high prevalence of ECLs in preschool children, which is in consensus with the study conducted by Parisotto *et al.*[3]

Surface level estimation of dental caries (defs) would have been done for better assessment of estimation of dental caries. This was the limitation of our study. Further longitudinal studies are suggested for assessing the defs and factors which can contribute to ECLs.

CONCLUSION

The prevalence of ECC was higher in 3–5 year old children. WHO + ECL criteria were more significant in assessing the prevalence of ECC as it is sensitive toward diagnosing ECLs than WHO criteria. Since sizeable group of children suffers from ECL, emphasis should be placed on targeting these children for reversing ECL.

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Conflicts of interest
The authors of this manuscript declare that they have no conflicts of interest, real or perceived, financial or non-financial in this article.

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