

Early Childhood Caries in Preschool Children of Ambala District: A Cross-sectional Study

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ABSTRACT

Introduction: With increased focus on preventive and promotive interventions in recent years, initial noncavitated carious lesions have drawn attention of healthcare planners as a relevant dental health indicator.

Aim and objectives: The aim of the present study was to assess the prevalence and clinical sequelae of early childhood caries in District Ambala, Haryana.

Materials and method: The present cross-sectional study was conducted among 1,474 children aged 36–71 months old from randomly selected anganwadi centers or preschools. Clinical examination was carried out by single trained calibrated principal investigator and data was recorded on self-structured recording format. The caries assessment was made using International Caries Detection and Assessment system-II [ICDAS -II] and Pulpal Involvement, Ulceration, Fistula and Abscess [pufa/PUFA] Index, respectively. Later decayed, missing, and filled teeth [dmft] values were deduced from ICDAS codes to compare with known indices.

Results: The prevalence of ECC was found to be 65.5% [ICDAS code other than 0] and 38.2% [dmft < 0]. Prevalence of clinical sequelae [pufa < 0] was found to be 16.5%. There was increase in prevalence of dental caries [ICDAS code other than 0] with increasing age, and difference was statistically significant.

Conclusion: The high prevalence of dental caries in this younger age-group suggests the need to curate strategies for prevention of early childhood caries and oral health promotion that include supportive and practical advice for parents and caregivers of preschool and anganwadi children.

Clinical significance: Traditionally, dental caries are detected at cavitation stage however last 20 years have seen the shift to detection of noncavitated lesions that have slow rate of progression and it is the right time for controlling the severity of the lesion. The present study also highlights the need for the non-surgical management of noncavitated lesions.

Keywords: Early childhood caries [ECC], ICDAS-II, pufa/PUFA

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INTRODUCTION

Around the world, children constitute a main concern group and there has been an increased emphasis on diseases and conditions that affect their health.¹ A healthy start in life helps them to reach their full prospective while a poor start favors an adverse outcome.² India is second most populous nation and 15.92% of the population has been in the age-group 0 to 6 years according to the Census 2011.^{3,4} This reminds us of onerous responsibility to ensure that all children attain the highest level of health as healthy children are more likely to become healthy adults.¹

Several noncommunicable diseases like asthma, diabetes, and obesity are known to affect children, with dental caries being the most common.⁵ Despite of the fact that preventive strategies have been in action for decades, early childhood caries [ECC] still remains a substantial concern in both developed and developing nations. However, ECC remains relatively unexplored and poorly defined in many developing countries and India is no exception.⁶ Dental caries affecting primary teeth also called as ECC has become the 10th most prevalent disease.⁷

Severe form of ECC can advance to rampant decay, infection, pain, abscesses, chewing problems, malnutrition, gastrointestinal disorders, and compromised self-esteem.⁸ Moreover, children with ECC experience have higher probability of developing new carious lesions as they get older.⁹ Various published studies report an ECC prevalence of 19% to 54% in the Indian population. Irrespective of availability of the prevalence data, long waiting lists for treatment of ECC still indicate that many children still suffer from ECC.¹⁰

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During the past decades, the DMFT/dmft caries index had been used extensively worldwide to assess the caries experience of the communities.¹¹ It considers dental caries to be an undisputable cavitated lesion extending into dentin¹² and ignores the presence of precavitated lesions¹³ that progress slower as compared to cavitated lesions.¹⁴ Recognizing the need for early assessment of dental caries in young children, International Caries Detection and Assessment System -II [ICDAS-II]¹⁵ was used to assess ECC in present study. The detection of early and noncavitated lesions, reduce economic burden on the families and healthcare system in developing countries, by adopting appropriate preventive measures.¹⁶ Both these indices do not deliver any information on sequelae of untreated dental caries which have been proven to be serious than the carious lesion itself. Recently, a pulp involvement, ulceration, fistula, abscess PUFA/pufa index describing the clinical

consequences of untreated dental caries was presented.¹⁷ This data in combination will provide the true picture of the spectrum of dental caries in the population and can form the basis for the various health care programs to reduce the burden of dental caries. Currently there is no data available regarding prevalence, pattern of ECC in Ambala district, Haryana. Hence cross sectional study was planned to determine the prevalence, pattern and clinical sequelae of early childhood caries in district Ambala, Haryana.

MATERIALS AND METHOD

The present research designed as cross-sectional study was carried out for a period of six months [June to November 2017] and is being reported affirming to STROBE statement.¹⁸

Ethical Considerations

This study was approved by Institutional Ethics Committee [Project no: - 907, dated: 17.12.2016]. Written permission was obtained from the office of District Program Officer, Ambala to carry out the study.

Sample Size Estimation; Sampling Frame and Procedure

The sample size was estimated to be 1474 based on ECC prevalence of 42% using epi infoTM.¹⁹ The list of schools and anganwadi centres of five blocks²⁰ obtained from Department of School Education, Government of Haryana and District Program Officer [Ambala], respectively constituted the sampling frame. simple random sampling procedure using online random number generator²¹ was employed for the selection of primary sampling unit [PSU]. The number that appeared on the screen was selected from the sampling frame and it constituted our PSU. Patient information sheet/Informed consent was provided to Headmaster/Principal/Anganwadi worker and they were requested to circulate among the parents and sufficient time was given to them to decide whether they voluntarily want to be part of this research. In case of refusal, it was decided a priori, that next unit will be opted for inclusion in the research. None of the schools or anganwadi centres refused to participate in the study, thus response rate in the present study was 100%. All the schools were subsequently sent reports of the examination findings. To attain equal representation 250 to 300 subjects were selected from each block. Thereafter, census sampling was adopted for the selection of study sample from each primary sampling unit. All the children aged 36 to 71 months present on the day of examination were included; children with special care needs²² and those who failed to cooperate were excluded from the study.

To ensure uniform interpretation understanding and application of the criteria and codes for dmft, ICDAS-II, pufa Index, training and calibration exercise was undertaken on the target

group. For ICDAS II, the principal investigator was trained using a e-learning program available at www.icdas.org/elearning program.²³ and for pufa,¹⁷ five days of theoretical and clinical training using laminated pictures as reference was done. A pilot study was conducted on 60 subjects to check the feasibility of the study and to finalise the recording format. These subjects were excluded from final analysis. The presence of dental caries was assessed using ICDAS-II^{15,23} and clinical sequelae were assessed using pufa index.¹⁷ Later, dmft values were deduced from ICDAS-II to calculate caries experience of the sample and ascertain comparability with previous studies. All the examinations were conducted in premises of anganwadi or school following pronounced protocol for the criteria^{15,17,23} used and information was recorded on a prestructured format by a trained recorder. Infection control²⁴ and sterilization measures were observed throughout the study. All the Biomedical wastes generated during the study were managed according to the biomedical waste management and handling guidelines.²⁵

Statistical Analysis

Data analysis was carried with Statistical Package for Social Sciences²⁶ [SPSS] Software v 16.0°. The caries prevalence that is, percentage of children with ICDAS-II codes 1 & above, dmft > 0 and pufa > 0 was calculated for sampled population and separately for each group [3, 4, and 5 years]. The mean caries experience and pufa scores were expressed in terms of mean \pm SD. The statistical significance was determined by Chi-square test, Analysis of Variance [ANOVA] and level of significance was set at $p < 0.05$.

RESULTS

Among 1,474 subjects examined, 302 [20.5%] were 3 years old, 513 [34.8%] were 4 years old and 659 [44.7%] were 5 years old. Comparison of dental caries status among both the genders did not reveal statistically significant difference ruling out the role of gender in dental caries prevalence in the present study.

International Caries Detection and Assessment System- II: The prevalence of dental caries [at least one surface with code 1 or above was 65.5% [965]. A statistically significant difference was seen in prevalence of dental caries among three age-groups with $p = 0.003$ [Table 1]. Out of total teeth examined, 3.4% [1005] had initial stage caries [code 1 and 2], 2.2% [661] had moderate stage caries [code 3 and 4], and 1% [313] had extensive stage caries [code 5 and 6]. Intergroup comparison showed a statistically significant difference among 3, 4, and 5 years old with $p = 0.001$ [Table 2]. Comparison of International Caries Classification and Management System [ICCMS] merged categories among 3, 4, and 5 years revealed an increase in caries severity with increase in age but the difference was not statistically significant [Table 3].

Table 1: Prevalence of caries among study subjects using ICDAS criteria [caries severity]

| ICDAS | Age in years | | | Prevalence |
|---------------------------------------|--------------|------------|-----------|-------------|
| | 3 n[%] | 4 n[%] | 5 n[%] | |
| Absent [Caries Severity Code 0] | 130 [43] | 181 [35.3] | 198 [30] | 509 [34.5%] |
| Present [Caries Severity Code 1–6] | 172 [57] | 332 [64.7] | 461 [70] | 965 [65.5%] |
| Total | 302 [100] | 51 [100] | 659 [100] | 1465 [100] |

Note: difference was statistically significant [$p = 0.003$] using Chi-square test

Dental Caries Experience [Table 4]

The dental caries experience of the study subjects [dmft >0] was found to be 38.2 % [563] with a mean value of 1.19 ± 2.18. The missing & filled components were 0. The prevalence of caries using ICDAS was found to be 65.5% [965] in which prevalence of caries using dmft [dmft > 0] was found to be 38.2% [563].

Clinical Sequelae of Untreated Dental Caries [Table 5]

The prevalence of clinical sequelae of untreated caries [pufa >0] among study subjects was found to be 16.5% [243]. There was

statistically significant increase in prevalence of pufa with increasing age [$p = 0.001$].

DISCUSSION

ECC is recognized as a significant public health problem in both developing and industrialized countries.²⁷ The disease not only afflicts the dental tissue but is also responsible for many morbid conditions of the oral cavity and other systems of the body.²⁸ The infection in the later stages may affect health and quality of

Table 2: Dental caries status of teeth among study subjects using the International Caries Detection and Assessment System -II Criteria [caries severity]

| ICDAS Codes | Age in years | | | | | | p value |
|---|---------------|----------------|---------------|----------------|---------------|----------------|---------|
| | 3 | | 4 | | 5 | | |
| | Frequency (n) | Percentage (%) | Frequency (n) | Percentage (%) | Frequency (n) | Percentage (%) | |
| Code 0 (Sound tooth surface) | 5696 | 94.3 | 9590 | 93.5 | 12215 | 92.7 | 0.001* |
| Code 1 (First visual change in enamel) | 104 | 1.7 | 179 | 1.7 | 240 | 1.8 | |
| Code 2 (Distinct visual change in enamel) | 85 | 1.5 | 168 | 1.6 | 229 | 1.7 | |
| Code 3 (Localized enamel breakdown) | 70 | 1.1 | 149 | 1.5 | 216 | 1.6 | |
| Code 4 (Underlying dark shadow with or without enamel-breakdown) | 43 | 0.71 | 77 | 0.76 | 106 | 0.81 | |
| Code 5 (Distinct cavity with visible dentin) | 31 | 0.51 | 61 | 0.59 | 114 | 0.86 | |
| Code 6 (Extensive distinct cavity with visible dentin) | 11 | 0.18 | 36 | 0.35 | 60 | 0.45 | |
| Total(N) | 6040# | 100 | 10260# | 100 | 13180# | 100 | |

#Total number of teeth examined in each age-group

*Difference was statistically significant [< 0.001] using Chi-square test

Table 3: Dental caries status of teeth among study subjects according to the International Caries Classification and Management System Merged Category

| ICCMS Merged Categories | 3 Years | | 4 Years | | 5 Years | |
|--|-------------|--------------|-------------|--------------|-------------|--------------|
| | Frequency n | Percentage % | Frequency n | Percentage % | Frequency n | Percentage % |
| Code 0 [Sound surfaces] | 5696 | 94.3 | 9590 | 93.4 | 12,215 | 92.6 |
| Initial stage caries [ICDAS code 1&2] | 189 | 3.3 | 347 | 3.5 | 469 | 3.7 |
| Moderate stage caries [ICDAS code 3&4] | 113 | 1.8 | 226 | 2.2 | 322 | 2.4 |
| Extensive stage caries [ICDAS code 5 & 6] | 42 | 0.69 | 97 | 0.94 | 174 | 1.3 |
| Total [N] | 6040# | 100 | 10,260# | 100 | 13,180# | 100 |

#Total number of teeth examined in each age-group

*Difference was statistically not significant [$p = 0.17$] using Chi-square test

life of children, leading to pain, sleep and eating difficulties, low BMI, loss of school hours, or even hospitalization.²⁹ All of these complications are costly to child, their parents and whole society. Poor oral health in children increases the chances of restricted activities 12 times as compared to those who have optimal oral health.³⁰

The use of ICDAS-II in the present study unearthed high ECC burden at the individual level, 65.5% of the subjects were caries positive [Codes 1–6] that is in accord with results of a previous study.³¹ Surface condition component of ICDAS-II Criteria was found to be zero that highlights the unmet dental needs of the children. In the present study, not a single tooth received dental attention that could be possibly due to neglecting attitude of parents toward primary dentition. Another possible explanation could be evidences of recent years that indicate that most deciduous teeth with untreated caries remain without symptoms until replacement with a permanent tooth.³² Most of Indian parents underestimate the role of oral health in general health and are unaware of the additional risks poor oral health can pose to their children’s overall well-being.^{33,34} In present study, there was a statistically significant difference in prevalence of dental caries among 3, 4, and 5 years old [$p = 0.003$]. Corresponding to earlier studies ECC prevalence increased with increase in age that might be due to increased exposure of teeth to the oral environment, as caries is a continuous and cumulative process. This upward trend may be partly due to increased consumption of sugar containing food and change in eating patterns with age.³²

Assessing the results at the tooth level, 1.8% [523] and 1.6 % [482] had first and distinct changes in enamel, respectively. Among the total teeth examined 3.4% [1005] teeth were categorized as Initial Stage Caries [Noncavitated lesions] found in this study indicates that there is an increased possibility of progression toward cavity formation unless timely attention and monitoring is provided. Early detection of these noncavitated lesions allows preventive strategies to be implemented when the lesions have greatest opportunity to arrest in children¹⁴ and allowing a short-term control of the disease, with long-term effects.³⁵

According to ICCMS merged categories,³⁶ 2.4% of the teeth examined had moderate stage caries and 1% had extensive stage

caries. The ICCMS provides choices to allow dentist to combine and synthesize patient information, risk status for planning and management of dental caries in clinical and public health practice. Thus, in present study, 3.4 % of total teeth examined required operative dental care as management strategy.

In our study the prevalence of clinical sequelae of untreated caries [pufa > 0] was found to be 16.5%.The prevalence of pufa was higher in children aged 5 years of age [20.2%] with mean pufa scores of 0.49 ± 1.2 with all the contribution from the “p” component which is in concurrence with the findings of an earlier study conducted in same area.³⁷ However when compared with some other studies^{17,38} prevalence of odontogenic infections [pufa] was less.

In the present study, caries experience [dmft > 0] was found to be 38.1 % as compared to 65.5 % [ICDAS] that highlights the inability of the index to detect initial carious lesions on tooth surface. Hence, a more rigorous diagnostic criteria was needed for identifying and measuring both cavitated and noncavitated lesions of dental caries. Early detection, assessment, and correct diagnosis of these lesions are fundamental targets to move away from curative to preventive dentistry.¹² The mean±SD dmft of the sample was 1.19 ± 2.1 , with decayed component making the major contribution in the score denoting the burden of unattended treatment requirements. Lack of oral awareness in parents, oral hygiene practices, high cost of dental treatment and limited accessibility and availability of dental services could be plausible reasons for it.³⁹ Also it does not furnish details regarding clinical sequelae of untreated caries. This implies that DMFT/dmft data alone cannot provide data on severity of caries or consequences on general health and quality of life necessary for health planning and implementation.⁴⁰

The ICDAS has put a definitive system for early detection of carious lesions to pivot the spotlight back on prevention.⁴¹ In absence of National Oral Health Policy, the dental services are mostly in private hands with major emphasis on the curative services. In Indian scenario, the ICDAS system will help the physician to concentrate on preventive strategies rather than curative tertiary level services. Recent research has indicated an increased prevalence of dental caries and the dental health care provider would be able to serve masses if this system is implemented at all levels.⁴² In our study prevalence calculated by the dmft was lower [38.2%] than that detected by ICDAS [65.5%] because dmft index does not include enamel lesions, and does not differentiate among severities of caries lesions, which is essential for health planning. Comparability is an important advantage of the dmft, dmft average can be compared with findings from the 1940s onwards and with information gathered from around the world.⁴² Studies about this system revealed that reproducibility and accuracy of data obtained from ICDAS system is as high as those of DiagnoDent.

Table 4: Comparison between International Caries Detection and Assessment System -II [ICDAS-II] and decayed, missing, filled teeth [dmft]

| Criteria | Caries present | Caries absent |
|---|----------------|---------------|
| International Caries Detection and Assessment System -II [ICDAS-II] | 65.5% [965] | 34.5% [509] |
| Decayed, Missing, Filled Teeth [dmft] | 38.2% [563] | 61.8% [911] |

Table 5: Prevalence of clinical sequelae of untreated caries [pufa] among study subjects

| pufa | Age [In years] | | | | | | p value |
|--------------------|----------------|----------------|---------------|----------------|---------------|----------------|---------|
| | 3 | | 4 | | 5 | | |
| | Frequency [n] | Percentage [%] | Frequency [n] | Percentage [%] | Frequency [n] | Percentage [%] | |
| Absent [pufa = 0] | 268 | 88.7 | 441 | 86 | 522 | 79.2 | 0.001* |
| Present [pufa > 0] | 34 | 11.3 | 72 | 14 | 137 | 20.8 | |
| Total [N] | 302 | 100 | 513 | 100 | 659 | 100 | |

* Denotes statistical significance using Chi square test



ICDAS system provides patients with more information about their dental health conditions, treatment remedies, the need for taking dental radiographs and the need for evaluation of the present restorations are clarified for the patients.⁴³

According to the literature, ICDAS is one of the most elaborate methods to use and its disadvantages reported in literature.^{44,45} Use of a two-digit system and numerous codes made it cumbersome to record and analyze data, and the application of air to dry surfaces made the procedure time-consuming.⁴² Although this method took longer to apply [12 minutes], taking an average of more than 7 minutes longer than the dmf, but it provided a true picture of the current scenario among the sample age-group. The data of the present study presented a more comprehensive estimate of dental caries that can be used to develop preventive strategies, to halt and reverse the disease.

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