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Caries Risk, Caries Experience, and Treatment Needs of Children in Goa, India at their First Dental Visit

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KEYWORDS

First dental visit, Caries risk assessment, Dental caries, Treatment needs, Children

ABSTRACT:

Introduction: A child's first dental visit (FDV) is a crucial milestone in the overall health and development. Early dental visits play a vital role in preventing and managing caries.

Objectives: The aim of the study was to assess the caries risk, caries experience, and treatment needs of children during their first dental visit in Goa state, India.

Methods: The cross-sectional study was conducted in the department of Pediatric and Preventive Dentistry. Children who reported for the first dental visit were included. Caries risk was assessed using the AAPD-2022 caries risk assessment forms. DMFT/dmft index was recorded. Treatment needs were recorded on the WHO-1997 form. Statistical analysis was performed using the STATA (version 17; StataCorp LLC, College Station, TX) software.

Results: A total of 544 children participated in the study. Most children (39.70%) had a high risk of developing dental caries. The mean DMFT/dmft score was 6.78 ± 4.09. Most children required preventive (topical fluoride, diet counselling, oral hygiene instructions) and corrective (restorations, pulp therapy, crowns) dental treatment.

Conclusions: A delay in the age of the children's FDV was found to have a negative influence on their oral health status. Educational initiatives are necessary in Goa to raise parental awareness about the importance of early first dental visits for maintaining optimal oral health in children.

1. Introduction

Dental caries continues to be the most prevalent chronic disease of childhood and a major public health challenge across the world [1]. Not only does it affect the general health and well-being of a child, but also places a significant economic burden on families [2]. Data from a survey conducted between 1988-2002 revealed that 41.0% of two- to 11-year-olds had carious primary teeth and 42.0% of six- to 19-year-olds had carious permanent teeth [3]. With an overall prevalence of 54.16% and an increase in caries with advancing age, dental caries affects majority of children in India [4].

Untreated dental disease in children can result in significant pain, challenging emergency dental visits, and millions of school and caregiver work hours lost each year. A significant number of school hours are disrupted annually as a result of dental issues, and children with poor oral health are at a greatest risk for absence from schools [3,5].

Early dental visits are expected to reduce a child's future risk of dental diseases, resulting in an improved oral health, and reduced treatment costs. Untreated dental disease progressively worsens over time, requiring more complex and expensive treatments. Therefore, timely intervention holds significant potential to reduce the overall costs of dental care in young children [6].

Risk assessment is a fundamental component of modern preventive care [7]. Caries risk assessment (CRA) is integrated into a comprehensive treatment planning approach that begins with the child's initial dental visit at age one [8]. With a goal to prevent disease by identifying patients at high risk for caries and developing individualized preventive measures, the American

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Academy of Pediatric Dentistry (AAPD) has recommended that CRA should be performed as soon as the first primary tooth erupts and be reassessed periodically [7].

Understanding of the oral health status of children and the caries risk at the first dental visit (FDV) is crucial. Literature on these aspects of the FDV of a child is limited. Therefore, the study aimed to assess the caries risk, experience, and treatment needs of children during their FDV in Goa state, India.

2. Methods

This cross-sectional study was conducted in the department of Pediatric and Preventive Dentistry, in a government dental college and hospital. The study included children up to 13 years of age, visiting the department between November 2023 and April 2024 for their FDV, accompanied by parents/ guardians willing to provide written informed consent to participate in the study. Un-cooperative children (Frankl behavior rating 1 and 2) and those with special health care needs were excluded.

The required sample size was determined using a single-mean formula to estimate the mean DMFT/dmft score among children at their first dental visit with a specified precision:

$$n=(EZ1-\alpha/2\sigma)2$$

where n is the minimum sample size, Z is the standard normal deviate corresponding to the desired confidence level, σ is the estimated standard deviation of DMFT/dmft, and E is the allowable margin of error. Substituting results obtained from a previous study, at a 95% confidence level and a precision of ±0.1, the minimum required sample size was 484 children [8].

Examination was carried out by a single examiner who was calibrated to limit the intra-examiner variability. To test the intra-examiner reliability, DMFT/dmft and treatment needs were recorded for age-matched samples of 30 children in identical conditions on two occasions, at least two weeks apart. The intra-examiner reproducibility (kappa values) was calculated to range between 0.8-1.0.

The primary investigator, wearing a surgical face mask and sterile nitrile gloves carried out the intra-oral examination, with children seated on a dental chair, using a sterile mouth mirror and community periodontal index (CPI) probe (knee-to-knee method of examination was employed for infants and toddlers). Teeth were cleaned with a piece of wet gauze and examined wet, and when air-dried with a three-way syringe for five seconds. Data entry was carried out by an assistant.

Each child was assessed for the:

(1) Risk for developing caries using the AAPD-2022 CRA form
(2) Caries experience using the DMFT/dmft index
(3) Treatment needs using the WHO-1997 form (the need for emergency dental treatment was recorded separately). Radiographic examination was performed in cases where clinical examination was inadequate to assess the status of pulp involvement.

The duration of examination was approximately 10 minutes per child.

Statistical analysis was performed utilizing the STATA: statistical software for data science by StataCorp LLC, version 17. Categorical variables were summarized using frequencies and percentages. Continuous variables were summarized using means and standard deviations. The chi-square test of independence was used to test the association between variables. The One-way analysis of variance (ANOVA) test was used to find the association of caries experience with the age-groups, and treatment needs with the age-groups. The pairwise post hoc Bonferroni test was used to compare the caries experience among age-groups. The significance level was set to $P < 0.05$.

3. Results

A total of 544 children (52.02% males and 49.98% females) participated in the study. The mean age of the children was 7.15 ± 2.98 years.

Table 1 describes the caries risk of children at their FDV. The child who reported in the age-group of 0-1 year had a low caries risk (0.18%). The majority of children in the age-groups of 1-3 years (1.47%), 3-6 years (12.87%) and 6-13 years (25.18%) had a high caries risk. The overall risk of developing caries was found to be high (39.70%).

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The Chi-square test for the distribution of caries risk was found to be statistically significant (*P*: 0.022).

Table 1: Caries risk of the study population

Caries Risk	Age group N (%)				Total N (%)	Chi2 (*P*-value)
	0-1 year	1-3 years	3-6 years	6-13 years		
High	0	8 (1.47)	70 (12.87)	138 (25.18)	216 (39.70)	**0.022**
Moderate	0	7 (1.29)	57 (10.48)	126 (23.16)	190 (34.92)	
Low	1 (0.18)	5 (0.92)	35 (6.43)	97 (17.83)	138 (25.36)	
Total	1 (0.18)	20 (3.68)	162 (29.78)	361 (66.36)	544 (100)	

(N= frequency; %= percentage)

Table 2 describes the caries experience (DMFT/dmft score) of children at their FDV. The overall caries experience was found to be 6.78 ± 4.09. An increase in the caries experience was reported with an increase in the age at FDV. The mean dmft scores for age group of 1-3 years and 3-6 years was 5.45 ± 4.48 and 7.61 ± 4.39, respectively. The mean DMFT + dmft score for the age-group of 6-13 years was 7.73 ± 3.09. The result was found to be statistically significant (*P*: 0.022).

Table 2: Caries experience of the study population

Age group	N	Mean	Standard Deviation	Range	One way ANOVA	*P*-value
0-1 year	-	-	-	-	3.85	**0.022**
1-3 years	20	5.45	4.48	0-20		
3-6 years	162	7.61	4.39	0-20		
6-13 years						
DMFT	325	3.43	1.29	0-12		
dmft	306	4.30	3.36	0-15		
Total	361	7.73	3.09	0-18		
Overall caries experience	543	6.78	4.09	0-20		

(N= frequency; dmft= decayed, missing, and filled teeth; DMFT= Decayed, Missing, and Filled Teeth; ANOVA= One-way analysis of variance)

Table 3 describes the difference in caries experience among age-groups. Pair wise post hoc Bonferroni test revealed a significant difference in the caries experience between age-groups of 3-6 years and 1-3 years (2.16; *P*: 0.033); and 6-13 years and 1-3 years (2.28; *P*: 0.017), with an insignificant difference in the caries experience between age-groups of 6-13 years and 3-6 years (0.12; *P*: 1.0).

Table 3: Pairwise post hoc Bonferroni test for comparison of caries experience among age-groups

I	J	Mean difference	*P*-value
3-6 years	1-3 years	2.16	**0.033**
6-13 years	1-3 years	2.28	**0.017**

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6-13 years	3-6 years	0.12	1.0

(I, J= study groups compared)

Table 4 and 5 describes the treatment needs of the children. The majority of children (58.64%) required emergency dental treatment at their FDV. It was found that 0.55% children did not require treatment, 36.76% required preventive care, 7.53% required fissure sealants, 54.04% required one surface fillings, 54.59% required two or more surface fillings, 75.55% required crowns, 70.95% required pulp care and 31.43% required extractions. Statistically significant results were found for the distribution of preventive care ($P < 0.001$) and pulp therapy (P: 0.002) among age-groups.

Table 4: Distribution of emergency treatment needs for the study population

Requirement of emergency treatment	Age group								Total		Chi2 (p value)
	0-1 year		1-3 years		3-6 years		6-13 years				
	N	%	N	%	N	%	N	%	N	%	0.236
No	1	0.18	7	1.29	59	10.85	158	29.04	225	41.36	
Yes	0	0	13	2.39	103	18.93	203	37.32	319	58.64	
Total	1	0.18	20	3.68	162	29.78	261	66.36	544	100	

(N= frequency; %= percentage)

Table 5: Distribution of treatment needs for the study population

Treatment needs	Age groups N (%)				Total N (%)	One-way ANOVA (F)	*P*-value
	0-1 year	1-3 years	3-6 years	6-13 years			
No need of treatment	1 (100)	0	0	2 (1.47)	3 (0.55)	-	
Preventive, caries arresting care	0	12 (60)	68 (41.97)	120 (88.23)	200 (36.76)	7.17	**<0.001**
Fissure sealant	0	0	0	41 (11.35)	41 (7.53)	-	
One surface filling	0	8 (40)	97 (59.87)	189 (52.35)	294 (54.04)	1	0.434
Two or more surface fillings	0	7 (35)	115 (70.98)	175 (48.47)	297 (54.59)	1.46	0.144
Crown for any reason	0	15 (75)	135 (83.3)	261 (72.29)	411 (75.55)	1.546	0.125
Pulp care and restoration	0	13 (65)	128 (79.01)	245 (67.86)	386 (70.95)	2.56	**0.0029**
Extractions	0	3 (15)	42 (25.9)	126 (34.90)	171 (31.43)	0.99	00.441

(N= frequency; %= percentage; ANOVA= One-way analysis of variance)

4. Discussion

The significance of oral health in the early years of life is well documented [10]. The influence and outcome of early childhood oral health is considered crucial in shaping oral health trajectories throughout life, and can impact oral health and disease occurrence in adulthood [11,12]. Early dental visits serve as a foundation upon

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which a lifetime of preventive education and oral health can be built [13]. Currently, major professional associations recommend that all children should have their FDV at the time of eruption of the first primary tooth and no later than 12 months of age [7].

To prevent the occurrence of dental caries, high-risk individuals should be identified at the earliest. Nowak et al. reported that the age at the FDV is a strong predictor of children's caries risk [13]. Hence, in the present study, we intended to identify the same.

The AAPD (2022) CRA tool assists dental practitioners, physicians, and other non-dental health care providers in assessing the risk of developing caries in infants, children, and adolescents [14]. Consequently, it was used in the present study.

It was found that most children had a high caries risk at the FDV (39.70%). The distribution of caries risk among age-groups revealed that the infant who reported in the age-group of 0-1 year had a low caries risk. This was because the infant was in the gum-pad stage (factors such as visible plaque and caries susceptible tooth surfaces were not present), was not exposed to sugar-containing foods and the oral hygiene was well maintained by the mother. The high caries risk observed in children who reported for their FDV after one-year of age could have occurred due to the presence of risk factors such as an increase in the consumption of sweetened foods, frequent snacking habits, inadequate oral hygiene maintenance, low fluoride exposure, and untreated dental caries.

An earlier dental visit in these children could have reduced the risk of developing dental caries by providing oral hygiene counselling to parents and children, assessing appropriateness of feeding practices, providing dietary counselling related to oral health, and introducing preventive measures such as pit and fissure sealants and topical/systemic fluorides for caries susceptible individuals.

Literature on the assessment of the risk of developing caries in children at the FDV is limited. Nowak et al., reported an increase in the proportion of children with high risk of early childhood caries (ECC) as the age of the FDV increased (a 42% probability of caries at an 18-months FDV versus 83% at a FDV at four-years of age) [13]. However, the authors utilized a customized ECC risk-screening tool to assess the caries risk of children between 18-months to four-years of age. Hence, due to the methodological inconsistencies, a direct comparison between our results and that of the referenced study was deemed inappropriate.

Dental caries is a common oral health problem affecting children globally [15]. Nowak *et al.* reported that for each additional year that the FDV is delayed, the odds of having caries increases 110% [16]. In the present study, dental caries was recorded by utilizing the DMFT/ dmft indices, following the procedure mentioned by the WHO [17], however, with a few modifications. Since the present study was conducted in a dental health care setup, non-cavitated carious lesions were recorded as 'decayed'. Hence, the study's reported total caries experience comprised both cavitated and non-cavitated carious lesions. The underestimation of dental caries was thus avoided.

Of the 544 children examined, only 2% were caries free. The mean DMFT/dmft score for the total studied population was 6.78 ± 4.09. Mika *et al.* reported a lower mean DMFT/dmft score (3.82) in their study population [18]. This could have occurred since non-cavitated lesions were not recorded in their study. The current study also observed an increase in the caries experience with an increase in the age at the FDV. The irreversible nature of cavitated carious lesions and the presence of untreated dental caries accumulating over time could be the possible justifications for the same.

Despite intensive efforts to promote and educate the pediatric community over the last decade, the incorporation of oral health into pediatric medical practice has been limited [19]. Evidence suggests that dental health related expenditure increases as children age, and as the severity of dental caries increase [20]. This indicates that children who are seen by a dentist within the first few years of life would require less restorative care than those who wait until later in childhood. Data on treatment needs are of great value at local and national levels because they provide a basis for estimating personnel requirements and costs of an oral health programme [21]. Hence, the study recorded the treatment needs of the children at their FDV.

It was observed that most children required restorations, crowns, pulp care and extractions when they reported for

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their FDV. The majority of children required an emergency dental treatment (58.64%). This indicates that most children had their FDV for corrective rather than preventive purposes. Mika *et al.* reported that 23.1% children required preventive measures, 68.44% required conservative treatment, 7.81% necessitated both non-invasive and surgical management, and 0.63% required surgical treatment when they reported for the FDV [18].

These findings indicate that there is an urgent need to promote early dental visits and create awareness about the importance of the primary dentition. An interdisciplinary team work approach could be beneficial to overcome the hurdles and pave way for the betterment of future generations.

The limitation of the study is that incipient proximal carious lesions may have been missed as radiographs were not taken to assess the same. This may have led to an underestimation of the association between the age of the FDV and dental caries.

5. Conclusion

This study underscores the vital role of the FDV in assessing caries risk, evaluating caries experience, and identifying treatment needs in young children. Early dental visits facilitate timely risk assessment, which allows for targeted preventive care and early intervention to minimize the progression of dental caries. By addressing treatment needs promptly, clinicians can reduce the burden of extensive dental procedures and improve long-term oral health outcomes. These findings support the implementation of early dental visits as a key strategy in pediatric oral healthcare to optimize disease management and resource allocation.

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