Original Article

Prevalence of the developmental defects of the enamel in children aged 12–15 years in Kollam district

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Abstract

Aim and Objectives: To determine the prevalence of developmental defects of enamel in children aged 12–15 years in Kollam district and to examine the etiological factors associated with the developmental defects of the enamel (DDE). **Materials and Methods:** A total of 2,500 children from 10 urban and 10 rural schools were examined using modified DDE criteria for recording enamel defects. Ten index permanent teeth were screened for the DDE. **Results:** The overall prevalence of the DDE was found to be 32% and the prevalence is higher in urban schools (34.3%) compared to rural schools (29.6%). The most common tooth affected by the defect was maxillary right lateral incisor (P = 28.6%) and the tooth least affected was maxillary right first premolar (P = 3%). The most common deformity was demarcated opacities (P = 28.76%) and the least common deformity was combination of diffuse opacities and hypoplasia and combination of demarcated, diffuse opacities, and hypoplasia (P = 0%). There was a very high significant association between DDE and the mothers' pregnancy age, illness during pregnancy for mother, medication taken during pregnancy by mother, prematurity of birth, intubation done during prematurity, birth weight, systemic illness during the first 5 years of life, intake of drugs or chemicals during the first 5 years of life, nutritional status, and trauma or infection on deciduous teeth and dental caries. **Conclusions:** The study population showed a prevalence of 32% and very high significant association between perinatal, natal, and postnatal etiological factors. It indicates the need for educating the population about the risk factors for the DDE.

Key words: *Demarcated opacity, developmental defects of the enamel, diffuse opacity, enamel hypoplasia*

INTRODUCTION

The developmental defects of the enamel (DDE) may be defined as the alteration of enamel that may affect an area of one surface or may be wide spread affecting all the surfaces throughout its full thickness. They may be quantitative in nature that is manifested as a deficiency in adequate thickness of enamel or qualitative in nature as enamel opacities.[1]

DDE are associated with a wide spectrum of etiologic factors including systemic, genetic, local, and environmental conditions.[2] Enamel defects have significant impact on oral health and esthetics and act

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as a predisposing factor for caries. Most epidemiological studies have shown that the frequencies of DDE are on rise in all population streaming their clinical significance and evidence for public health initiatives.

The prevalence of DDE ranged from 6.7% to 67.1% in the developed countries and from 27% to 66.2% in the developing countries. Chauhan *et al*.[3] in 2013 assessed the prevalence and presentation of the DDE of healthy school children residing in hills of Himachal Pradesh, India, and reported to be 66.2%. Gisoo *et al*.[4] (2010) found a significant association between systemic illness during the first 5 years of life and the prevalence of DDE. Mihaela *et al*.[2] (2011) reported a significant association between intake of drugs or chemicals during the first 5 years of life and prevalence of DDE. Enache *et al*.[5] (2010) reported a significant association between nutritional status and prevalence of DDE.

The knowledge of the epidemiology of enamel defects is important in order to provide basic information within a community or country and between countries; and help in educating population. It is also important since it may contribute to the assessment and monitoring of environmental or systemic factors and for detecting possible etiological factors responsible for the occurrence of the enamel defects. The number of studies being done in this part of the country is scanty hence the present study was undertaken.

MATERIALS AND METHODS

The present study was done in 10 urban and 10 rural schools of Kollam district with a study duration of 6 months with sample size of 2,500 students. A multistage stratified random sampling method was used to select the schools. From the selected schools, per school at least 125 children were randomly selected and examined. These children aged 12–15 years from Kollam district who had not migrated from any other school and had complete permanent dentition without any systemic illness were included in the study. Those children who had migrated from other districts after 8 years of age and with mixed dentition were excluded.

The subjects were examined seated on a straight back chair and daylight was the source of light. The teeth were examined in a wet state and the buccal surfaces of 10 fully erupted index permanent teeth namely maxillary first premolars, canines and incisors, and mandibular first molars were examined using the modified DDE index based on the recommendations made in 1992 by the federation dentaire internationale (FDI) working group on the DDE index. The scores were recorded onto a data-recording sheet. The sequence of examination was from maxillary right first premolar to maxillary left first premolar and from mandibular left molar to mandibular right first molar. Missing, crowded, unerupted, severely fractured, or grossly carious teeth involving the buccal/labial surface of the teeth were recorded and excluded from the analysis. A sterilized mouth mirror was used to retract the cheeks or lips for better visualization. Instruments were disinfected by immersing the mouth mirror in 2% glutaraldehyde for 10 min and then autoclaving it for 20 min by using a portable autoclave. Intra-examiner reproducibility was ascertained by reexamining 10% of the subjects. A questionnaire was completed by the parents of the children diagnosed with any of the enamel defects.

The modified DDE index [Table 1] is a descriptive index developed from the DDE index. It covers all the defects based on their macroscopic appearance. It is a more practical and comparable index in epidemiological studies. The data were subsequently processed and analyzed using the Statistical Package for the Social Sciences (SPSS) statistical software programs. Chi-square test was used for the estimation of statistical significance.

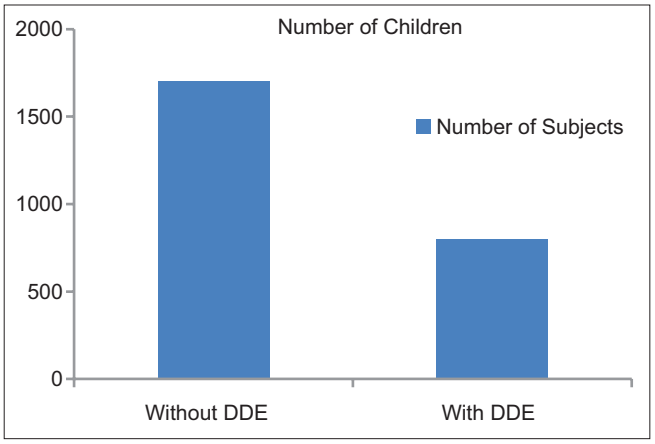
Table 1: Modified developmental defects of the enamel index

Defects	Code
Normal	0
Demarcated opacities:	
White/cream	1
Yellow/brown	2
Diffuse opacities:	
Diffuse-lines	3
Diffuse-patchy	4
Diffuse-confluent	5
Confluent/patchy + staining + loss of enamel	6
Hypoplasia:	
Pits	7
Missing enamel	8
Any other defects	9
Extent (areas of surface affected) of defect:	
Normal	0
<1/3	1
At least 1/3<2/3	2
At least 2/3	3
Combinations	
Demarcated and diffuse	A
Demarcated and hypoplasia	B
Diffuse and hypoplasia	C
All three defects	D

RESULTS

Of the 1,255 males examined, 447 (P = 35.6%) were having DDE, and of the 1,245 females examined, 352 (P = 28.3%) were having DDE. The prevalence of the DDE in children aged 12-15 years from Kollam district was found to be 32%. In the present study where 2,500 students were examined, 799 were found having defects [Graph 1]. The prevalence of DDE from urban schools was found to be 34.3% and the prevalence of DDE from rural schools was found to be 29.6%. The most common tooth affected by the defect was maxillary right lateral incisor (P = 28.6%) and the tooth least affected was maxillary right first premolar (P = 3%) [Table 2]. The most affected site was the incisal third and the least affected regions were cervical and middle third [Table 3]. Most DDEs seen were extending less than one-third of the tooth and the least extended were more than two-third of the tooth [Table 4]. The most common deformity was demarcated opacities (P = 28.76%) and the least common deformity was combination of diffuse opacities and hypoplasia and combination of demarcated, diffuse opacities, and hypoplasia (P = 0%) [Table 5 and Graph 2]. The prevalence of chronological DDE (73.2%) was more than localized DDE (P = 19%) followed by generalized DDE (P = 6.5%) [Table 6]. The prevalence of DDE due to environmental etiologic factors (P = 95%) is more than due to genetic factors (P = 5%).

The most prevalent prenatal factor associated with DDE was found to be for mothers with systemic illness during their pregnancy (17.4%) followed by mothers who consumed medication during their pregnancy (10.1%) followed by mothers' pregnancy age between 15 years and 20 years (1.5%). There was a very high significant association between mothers



Graph 1: Number of children with the DDE

Table 2: Tooth wise prevalence of the DDE

Teeth examined	Prevalence of DDE (%)
14	3
13	19
12	28.6
11	27.2
21	27.1
22	27.7
23	19
24	3.3
36	3.2
46	3.2

DDE: Defects of the enamel

Table 3: Site affected by the DDE

Site of defect	Prevalence of DDE (%)
Cervical third	7.9
Middle third	2.1
Incisal third	15.4
Cervical and middle third	0.9
Middle and incisal third	4.2
Cervical middle and incisal third	1.5

DDE: Defects of the enamel

Table 4: Extent of the DDE

Extent of defect	Number of defects	Prevalence of extent of defect (%)
Less than 1/3rd	634	79.3
Between 1/3rd and 2/3rd	126	15.8
More than 2/3rd	40	5

DDE: Defects of the enamel

Table 5: Prevalence of type of deformity in patients with DDE

Type of deformity	Prevalence of deformities (%)
Normal	68
Demarcated opacities	28.2
Diffuse opacities	2
Hypoplasia	0.8
Demarcated and diffuse opacities	3
Demarcated opacities and hypoplasia	0.25
Diffuse opacities and hypoplasia	0
All 3 defects	0

DDE: Defects of the enamel

Table 6: Prevalence of generalized, localized, and chronological DDE

	Prevalence of DDE (%)
Generalized DDE	6.5
Localized DDE	19
Chronological DDE	73.2

DDE: Defects of the enamel

with systemic illness during their pregnancy, mothers' pregnancy age between 15 years and 20 years, and medication taken during pregnancy by mother and DDE.

The most prevalent prenatal factor associated with DDE was found to be for children with a history of birth weight between 1 kg and 2 kg (10%), followed by premature birth (8.3%), and intubation during prematurity (2%). There was a very high significant association between birth weight, premature birth, intubation during prematurity, and DDE.

The most prevalent postnatal factor associated with DDE was nutritional status (31.7%) followed by systemic illness during the first 5 years of life (23.8%) followed by intake of drugs or chemicals during the first 5 years of life (11.8%) followed by trauma or infection to deciduous teeth (1.8%). There was a very high significant association between nutritional status, systemic illness during first 5 years of life, trauma or infection to deciduous teeth, and DDE [Table 7]. The confidence interval for the present study was 95%.

The prevalence of molar incisor hypomineralization was found to be 1.6%. Among the children with DDE, 42.8% of them had decay, missing, or filling [Graph 3]. There was a very high significant association between dental caries and DDE.

DISCUSSION

The developmental of enamel can be defined as any alteration resulting from diverse disturbances during the process of odontogenesis.[6] According to their clinical appearances, DDE have been classified as demarcated opacity, diffuse opacity, or hypoplasia. In the present study, the prevalence of DDE in children aged 12–15 years from 10 urban and 10 rural areas of Kollam district was found to be 32%. On international literature search, the least prevalence of DDE reported was 6.7% (Pasareanu *et al*.[7]) among 600 schoolchildren aged between 8 years and 11 years from Lasi and the highest prevalence of DDE reported was 67.1% (Sujak *et al*.[8]) among 1,024 school children aged 16 years from the island of Penang, Malaysia.

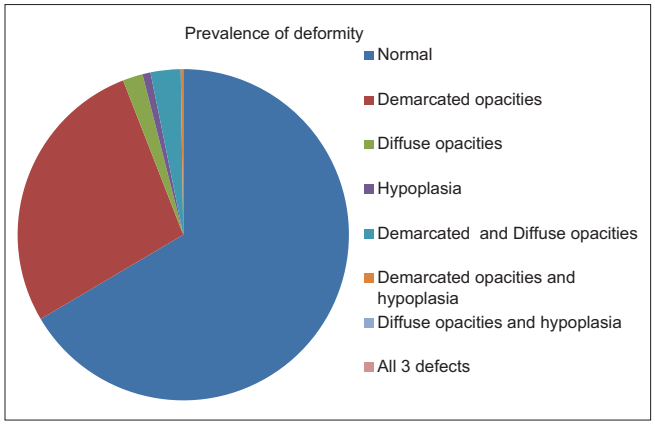
On national literature search, the least prevalence of DDE of 27% was reported (Ekanayake *et al*.[9] in a study on the prevalence of dental caries and DDE conducted in Sri Lanka. The highest prevalence of DDE reported was 66.2% (Chauhan *et al*.[3] among healthy school children residing in the hills of Himachal Pradesh, India.

The present study was comparable with that of Masmo *et al*.[10] (2013) which reported a prevalence of DDE to be 33.3%. Epidemiological studies on the prevalence of DDE exhibit a wide range of variability in the prevalence rate that may be explained by the specific

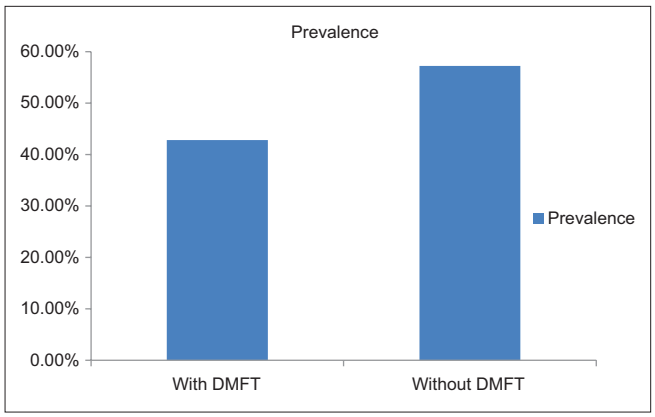
Table 7: The table shows association between etiological factors and DDE

Etiological factors	Chi-square value	DF	*P*
Mothers' pregnancy age	1487.187	3	0.000
Systemic illness during pregnancy of mother	313.340	2	0.000
Medication taken during pregnancy	178.216	1	0.000
Prematurity of birth	144.318	1	0.000
Intubation during prematurity	34.282	1	0.000
Birth weight	1751.457	2	0.000
Systemic illness during first 5 years of life	437.763	2	0.000
Drugs or chemicals during first 5 years	207.936	1	0.000
Nutritional status	599.260	1	0.000
Trauma or infection	219.453	3	0.000

DDE: Defects of the enamel



Graph 2: Prevalence of the type of deformity in patients with DDE



Graph 3: Prevalence of DMFT of children with DDE

characteristics and method adopted in the study such as indices used and the criteria used in the examination.

The prevalence of DDE was found to be higher in schools in urban area (34.32%) than the schools in rural area (29.6%), which was comparable to that of the study by Gopalakrishnan *et al*.[11] The prevalence was found to be higher in males (35.6%) compared to that in females (28.3%), which was similar to the findings of Hussein *et al*.[12] In the study by Ramesh *et al*.[13] (2011), the prevalence of defects was slightly higher in females (90.7%) as compared to males (87.9%), which was contradictory to the present study. The most common tooth affected by the defect was maxillary lateral incisor (P = 28.6%) and the tooth least affected was maxillary right first premolar (P = 3%), which was comparable to that reported by Montero *et al*.[14] (2003). Yusoff *et al*.[15] (2008) stated that posterior teeth were twice more commonly affected. The most affected site was the incisal third (15.4%) and the least affected site was cervical and middle third (0.9%), whereas Ruiz *et al*.[16] (2013) stated that the defects were located at the middle (40%) and incisal (33%) thirds. Yusoff *et al*.[15] (2006) stated that the majority of opacities were involving less than one-third of the tooth surface that was comparable with the present study.

Robles *et al*.[6] (2013) found that the most common type of DDE to be demarcated opacity similar to the present study while Ramesh *et al*.[17] (2011) reported diffuse opacity 61.2% to be most common. Chauhan *et al*.[3] (2013) found that diffuse opacity (25.3%) was found to be the most common defect followed by demarcated opacity (23.1%) and enamel hypoplasia was the least prevalent defect with prevalence of 2.9%.

The prevalence of molar incisor hypomineralization was found to be 1.6% in the present study. Gomez *et al*.[18]) (2012) reported that 17.85% had Molar incisor hypomineralization (MIH). Sonmez *et al*.[13] (2013) reported that the prevalence of MIH in their study was found to be 7.7%.

Vello *et al*.[19] (2010) and Faria *et al*.[20] (2013) reported significant association between the prevalence of the DDE and young maternal age. Gisoo *et al*.[4] (2010) found significant association between illness during pregnancy for mother and the prevalence of the DDE which they reported as 9.8% and children of mother's with intake of drug during pregnancy reported to be 13.8% which was comparable to the present study. Jacobsen *et al*.[21] (2013) reported a prevalence of 34% in children exposed to antiepileptic drugs. In the present study, since the questionnaire-based approach was adopted the type of drug taken could not be assessed.

Gisoo *et al*.[4] (2010) and Arrow[22] in 2010 reported significant association between prematurity of birth and prevalence of DDE. Vello *et al*.[19] (2010) and Takaoka *et al*.[23] (2011) found significant correlation between intubation during prematurity and prevalence of DDE.

The prevalence of the DDE of children with low birth weight in the present study was found to be 10%. While Funakoshi *et al*.[24] (1980) reported a prevalence of 26.9%, Enache *et al*.[12] (2010) reported a prevalence of 3.7%, The wide variation in the prevalence is attributed to the difference in the study population.

In contrary to the present study, Cruvinel *et al*.[25] (2012) did not find any significant association between the DDE and systemic illness during the first 5 years of life.

The percentage of children affected by DDE with intake of drugs or chemicals during their first 5 years of life was found to be 11.8%. There was a very high significant association between the intake of drugs or chemicals during the first 5 years of life and the prevalence of DDE. Mihaela *et al*.[2] (2011) reported a prevalence of 25.3%.

The percentage of children affected by the DDE with low nutritional status was found to be 31.7%. There was a very high significant association between nutritional status and the prevalence of DDE comparable to the results of Pasareanu *et al*.[7] (2001) and Enache *et al*.[5] (2010). The percentage of children with trauma or infection on deciduous teeth was found to be 8.6%. There was a very high significant association between trauma or infection on deciduous teeth and prevalence of DDE, which was same as that of the result of Taji *et al*.[26] (2000). Whereas contradictory to present study, Cruvinel *et al*.[25] (2012) did not find any significant association between the DDE and the systemic illness during the first 5 years of life, low nutritional status and trauma, or infection to deciduous teeth.

The prevalence of Decayed Missing Filled Teeth (DMFT) affected by DDE was found to be 42.8%. There was a very high significant association between the DMFT and the prevalence of the DDE, which was comparable to the findings of Idiculla *et al*.[27] (2011) and Nelson *et al*.[28] (2011).

CONCLUSION

The present study assessed the prevalence of DDE and also the etiological factors. It was inferred that the poor

nutritional factors and systemic illness were the most predominant risk factors for the DDE and educating the public to bring down the risk factors help to reduce the prevalence. The DDE present an important clinical problem since they may present esthetic problem, sensitivity, and act as predisposing factor for caries.

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Conflicts of interest

There are no conflicts of interest.

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