Dentistry Section

Prevalence and Association of Developmental Defects of Enamel with, Dental- Caries and Nutritional Status in Pre-School Children, Lucknow

PRAMOD KUMAR YADAV[1], SABYASACHI SAHA[2], G.V.JAGANNATH[3], SANJAY SINGH[4]

ABSTRACT

Background: Developmental Defects of Enamel in the primary dentition may be associated and predictors of dental caries and nutritional status. The aim of the present study was to assess the Prevalence of Developmental Defects of Enamel and its Association with, Dental-Caries and Nutritional Status in Pre-School Children of Lucknow, India.

Materials and Methods: Multistage Sampling was done. A total of 302 pre-school (Rural and Urban) children were examined. Type III examination was conducted with WHO Probe. Developmental Enamel Defects (DED) and Dental Caries were assessed using WHO (1997) Proforma.

Results: The prevalence of DED of any type was 39.9% with that of demarcated opacities being the highest, followed by hypoplasia. The most frequently affected teeth were maxillary anterior teeth, while the least affected teeth were mandibular incisors. The mean dmft was 3.5. A positive association between DED and caries was observed. Association between Dental Caries & BMI was non-significant whereas Pearson correlation showed a negative correlation between the two.

Conclusion: The prevalence of enamel defects and caries was high, as the enamel defects were strongly associated with caries.

Keywords: Caries, Diffuse opacity, Nutrition, Primary teeth, Public health

INTRODUCTION

Enamel is a rare mineralized tissue in its method of development, structure and chemical nature. Enamel hypoplasia results due to interference in the process of enamel matrix formation, which leads to defect in quality and width of enamel [1]. Tooth enamel is the only hard tissue in the body that cannot be remodelled. As a result all the changes in the structure caused by insults during its development are permanently registered. Developmental enamel defects may have a significant clinical impact on aesthetics, tooth sensitivity, tooth wear and dentofacial anomalies. Developmental enamel defects may be additional valuable information in context to the child's early environment and also may be predictive indicator in the permanent dentition. The abnormal structure and morphology of the affected teeth may cause the initiation and progression of caries [2]. Yihong et al., reported that low birth weight and premature children have significantly more hypoplasia than children with normal weight at birth, suggesting that prenatal and neo-natal conditions might play a role in the development of this defect [3]. S Salanitri stated that DDE are increasingly documented as principal risk factors for dental caries but the condition is not well diagnosed and aetiology is still doubtful [4].

Enamel hypoplasia is one of the most frequently observed developmental abnormalities of the human dentition. It is a defect of enamel matrix formation with reduced or altered amounts of enamel caused by insult to the ameloblast cells. Clinically the defect is visually and morphologically identified by various irregularities such as pits, grooves or absence of enamel structure, over the tooth surfaces [3].

Public Health mentioned developmental defects in the enamel as a significant predictive role in the initiation of dental caries. Study conducted by Edward et al., reported higher prevalence rate of demarcated opacities in those permanent teeth of which their primary predecessor teeth had caries than in those without caries

(7.5 vs. 3.8%, p < 0.001) [5]. Enamel defects and diffuse opacities prevalence was reported between 27 to 57% while caries ranged between 18% to 29% among the different fluoride exposure groups [4]. Study by Jose et al., reported caries with hypoplasia i.e.,507 (9%) among 6 – 15 years school children out of 5500 school children, with mean of 3.1 carious teeth per child [6]. Populations affected by developmental defects in the enamel needed primary preventive approaches with prompt treatment [7]. A few epidemiological studies have been reported on the prevalence of developmental defects of teeth in deciduous dentition as compared with mixed and permanent dentition [8]. The aim of the present study was to assess the prevalence and association of Developmental Defects of Enamel, Dental-Caries and Nutritional Status in Pre-school Children of Lucknow.

The objectives of this study were to: Estimate and association of prevalence of developmental defects in the enamel, nutritional status and dental caries [9-11].

MATERIALS AND METHODS

A cross-sectional study was designed to find out the prevalence of developmental defects of enamel (DDE) and its association with dental caries and nutritional status of pre-school children in and around Lucknow city. The study was conducted for a period of 2 months from May to June 2011, in the Department of Public Health Dentistry of Sardar Patel Post Graduate Institute of Dental & Medical Sciences, Lucknow. The study was carried out among 3 to 5-year-old preschool children of Lucknow city. A pilot study was conducted using the proforma on 20 pre-school children to assess the operational feasibility of the study and needful changes were made in the proforma.

Multistage cluster sampling was done in which Lucknow city was divided into 5 zones i.e. East, West, South, and North & Central. Twenty two wards were present in these zones. One ward was

selected from each zone. One Aanganwadi School and one private school were selected from each ward randomly. Sixteen children from each public and private school were randomly selected from lottery system thus making sample size of total 320 children. After applying the inclusion and exclusion criteria 18 children were excluded from the sample, thus making final sample of total 302 children.

The purpose of the study was reviewed by the institutional ethical committee and ethical clearance was obtained. Informed written consent was obtained from mothers/guardians. Prior approval was obtained from the school authorities before the commencement of this survey.

All the children of age 3 to 5 years whose parents had given informed consent and present on the day of examination were included in the study. Those children who were not co-operative and children who had systemic diseases were excluded. A single examiner interviewed and examined the subjects. The examiner visited the selected schools on the scheduled dates with one recording clerk. In each school subjects present on the day of examination were examined by the examiner by making each subject sit on a small chair with back rest, the recorder sitting in front of the subject close to the examiner. The examiner counter checked the entries made by the recorder at the end of each examination. Armamentarium used for examination purpose were, Mouth mirror, WHO Probe, Mouth mask, Disposable gloves, Kidney tray, Cotton, Disinfectants, Torch. The proforma consist of 2 parts.

a First part comprised of a questionnaire. In this information regarding demographic data, oral health practices, dietary pattern, feeding practices were recorded from respective mothers.

b Second part consisted of clinical assessment. In this the examiner used :

i. Modified Development Enamel Defect (Clarkson JJ And O. Mullane DM) [7]

ii. Dentition Status and Treatment Need (Oral Health Surveys: Basic Methods 1997, 4th edition WHO Geneva [8].

iii. Body Mass Index (Belgian polymath Adolphe Quetelet) [9].

Prior to the start of the study the examiner was calibrated in the department of Public Health Dentistry. The intra-examiner reliability coefficient was 0.86. Two interns from the department were taken as recording assistants who were also trained prior to start of study in the department.

STATISTICAL ANALYSIS

Data was analysed using statistical package for social sciences (SPSS) software, version 15. Statistical significance for differences between proportions was assessed using the chi-square test. The association between developmental enamel defect, dental caries & nutritional status was assessed using chi-square and student t-test. Pearson correlation test was also used for relation between BMI and Dental caries.

RESULTS

- Enamel opacities are found more in under-weight groups followed by hypoplasia. It shows that BMI and Enamel opacities/hypoplasia was associated significantly.

- Mean dmft was more in under-weight (3.84±1.90) group than normal (3.5±1.90) and over-weight group (2.87±1.0). However the difference between different groups was not significant but the Pearson correlation showed a negative correlation between BMI and Dental Caries.

- Enamel opacities are more in subjects having ≥ 3 dmft. There was significant association (<0.001) in subjects having ≥3 dmft and enamel opacities.

DISCUSSION

BMI and Enamel Opacities/Hypoplasia

According to present study enamel opacities were found in 33.7% subjects out of 302 preschool children in underweight group [Table/Fig-1], as depicted in. In recent years, a number of studies by Li Y et al., showed the association between the prevalence of enamel opacities/hypoplasia and nutritional status in various population groups [12]. The primary teeth have a long pre and postnatal development period. Any disturbance during tooth formation will give rise to a permanent defect in the enamel. Low birth weight (< 2500 gm) and prematurity are indicators of fetal malnutrition and have been associated with enamel defects in primary teeth [3]. The comparison of the results of present study with other studies has been given in [Table/Fig-2] [1,2,6,8,12-14].

UW	177	102	303
NW	6	10	1
OW	2	1	1

[Table/Fig-1]: Shows association between Enamel Opacities/Hypoplasia and BMI
χ^2=17.4; p=.0016 (significant)

Authors	Year	Country of study	Prevalence (%)
Li Y [1], Navia JM, Bian JY [13]	1995	Beijing, China	23.9
Li et al., [12]	1996	China	22
Farsi, Najat [2]	2010	Jeddah, Saudi Arabia	45.4
Seow WK, Ford D, Kazoullis S, Newman B, Holcombe T [14]	2011	Australia	25%
Yadav PK et al., (present study)	2011	Lucknow, India	39.9%
Jose Joy Idiculla, VR Brave RS Puranik, S Vanaki [6]	2013	Bagalkot, Karnataka	13
Shailee Fotedar, G. M. Sogi1, K. R. Sharma [1]	2015	Shimla, India	18.2
Deepak Chauhan, Tripti Chauhan [8]	2015	Himachal Pradesh, India	2.9%

[Table/Fig-2]: Comparison of the results of present study with other studies has been given in table

	Normal	Opacities	Hypoplasia
<3	181	90	302
≥3	0	23	5

[Table/Fig-3]: Shows association between Enamel Opacities /Hypoplasia and Dental Caries
χ^2=61.94; p= <.001(significant)

BMI	Dental Caries
Under wt.	3.84±1.90
Normal wt.	3.5±1.90
Over wt.	2.87±1.0

[Table/Fig-4]: Shows association between BMI and Dental Caries
f=1.02; p= .35(non significant)

Dental Caries and Opacities

According to present study the mean dmft is more than 3 (3.5) and total number of enamel opacities found in 33.7% out of 302 pre-school children. A significant association was observed between dental caries and enamel opacities [Table/Fig-3]. Similar result was found by Najat Farsi, mean dmft was more than 3 (4.94) and in 45% preschool children enamel opacities were found [2].

BMI and Dental Caries

According to present study the mean dmft is non-significant in relation to different BMI groups. There was negative correlation between BMI and dental caries [Table/Fig-4]. Similar results were obtained by Macek [15] and Mitola and Chen et al., [16]. These researchers concluded that there was no statistically significant

association between BMI groups and dental caries for the primary dentition.

LIMITATION

One limitation of our study is the use of cross-sectional data to examine the association between nutritional status and developmental defects in the enamel. To test the cause effect relation, a longitudinal design should be conducted.

CONCLUSION

The study findings reveal positive association between nutritional status and developmental defects in enamel which could be a potential risk factor for dental caries and affects the growth and development of children.
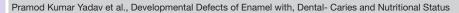
ACKNOWLEDGEMENT

This study was conducted independently and not sponsored by a research grant from any outside body.
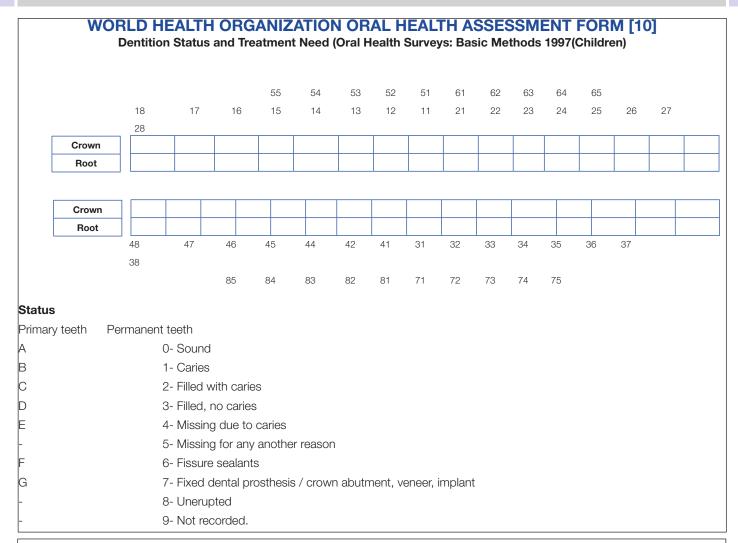
REFERENCES

[1] Fotedar S, Sogi GM, Sharma KR. Enamel hypoplasia and its correlation with dental caries in 12 and 15 years old school children in Shimla, India. *J Indian Assoc Public Health Dent*. 2015;12:18-22.
[2] Farsi N. Developmental Enamel Defects and their Association with Dental Caries in Pre-schoolers in Jeddah. *Oral Health and Preventive Dentistry*. 2010;8:85-92.
[3] Yihong, et al. Prevalence and Distribution of Developmental Enamel Defects in Primary Dentition of Chinese children 3-5 years old. *Community Dental Oral Epidemiology*. 1995;23:72-79.
[4] Salanitri S, Seow WK. Developmental enamel defects in the primary dentition: aaetiology and clinical management. *Aust Dent J*. 2013;58(2):133-40.
[5] Lo ECM, Zheng CG, King NM. Relationship between the Presence of Demarcated Opacities and Hypoplasia in Permanent Teeth and Caries in Their Primary Predecessors. *Caries Res*. 2003;37:456-61.
[6] Idiculla JJ. Enamel Hypoplasia and its Correlation with Dental Caries In School Children of Bagalkot, Karnataka. *JOHCD*. 2011;5(1):31-36.
[7] Lunardelli SE, Peres MA. Prevalence and Distribution of Developmental Enamel Defects in the Primary Dentition of Pre-school Children. *Braz Oral Res*. 2005;19(2):144-49.
[8] Chauhan D, Chauhan T. Prevalence of developmental defects of enamel in mixed and permanent dentition of 9 and 12 year old children of Himachal Pradesh, India: A cross sectional study. *Int J Health Allied Sci*. 2013;2:185-88.
[9] Clarkson J, O' Mullane D. A modified DDE index for use in epidemiological studies of enamel defects. *Dent Res*. 1989;68:445-50.
[10] Oral health surveys: Basic methods, 4th ed. Geneva: WHO; 1997.
[11] Aykroyd WR, Mayer J. Food and nutrition terminology. In: WHO Doc NUT/68.6. Geneva: WHO; 1968; 667.
[12] Li Y, Navia JM, Bian JY. Caries experience in deciduous dentition of rural Chinese children 3-5-year-old in relation to the presence and absence of enamel hypoplasia. *Caries Res*. 1996;30:8-15.
[13] Li Y, Navia JM, Bian JY. Prevalence and distribution of developmental enamel defects in primary dentition of Chinese children 3-5-year-old. *Community Dent Oral Epidemiol*. 1995;23:72-79.
[14] Seow WK, Ford D, Kazoullis S, Newman B, Holcombe T. Comparison of enamel defects in the primary and permanent dentitions of children from a low-fluoride district in Australia. *Pediatr Dent*. 2011;33:207–12.
[15] Macek MD, Mitola DJ. Exploring the association between overweight and dental caries among US children. Pediatric *Dentistry*. 2006;28:375-80.
[16] Chen, et al. lack of association between obesity and dental caries in three-year-old children. Chung-Hua Min kuo Hsiao. *Erh Ko I Hseuh Hui Tsa Chih*. 1998;39:109-11.
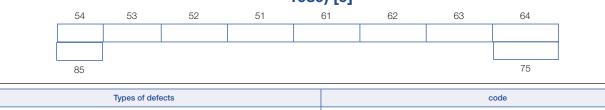

ANNEXURE 1 FORM

GENERAL INFORMATION

1. FORM NO………………………… 2. DATE: …………………….

3. NAME ………………………………....4. AGE: …………………….

5. GENDER   M ☐   F ☐

6. EDUCATION

7. LOCATION OF THE SCHOOL:-

PERSONAL INFORMATION ORAL HYGIENE PRACTICES

Material used: **Type of cleaning**

1)Tooth paste/brush ☐   1) Self ☐

2)Tooth powder/finger ☐   2) Assisted ☐

3)Tooth paste/finger ☐   3) Not - Yet Brushing ☐

4)Others ☐   4) No answer ☐

Frequency of cleaning / brushing

1) Once ☐

2) Twice ☐

3) Thrice ☐

DIETARY PATTERN

1. Feeding habits

1) Breast fed only ☐

2) mixed breast fed & bottle fed ☐

3) bottle fed only ☐

4) no answer ☐

2. Day Time Sugar Intake

a. 1-3 times /Day ☐

b. 4-5 times/Day ☐

c. > 5 times/Day ☐

Nutritional Status

- Height
- Weight

Body mass index = Weight(kgs) / Height (M^2)

WORLD HEALTH ORGANIZATION ORAL HEALTH ASSESSMENT FORM [10]
Dentition Status and Treatment Need (Oral Health Surveys: Basic Methods 1997(Children)

	55	54	53	52	51	61	62	63	64	65	
18	17	16	15	14	13	12	11	21	22	23	24	25	26	27

28

| Crown | | | | | | | | | | | | | | | | |
| Root | | | | | | | | | | | | | | | | |

| Crown | | | | | | | | | | | | | | | | |
| Root | | | | | | | | | | | | | | | | |

| 48 | 47 | 46 | 45 | 44 | 42 | 41 | 31 | 32 | 33 | 34 | 35 | 36 | 37 |

38

| | 85 | 84 | 83 | 82 | 81 | 71 | 72 | 73 | 74 | 75 | |

Status

Primary teeth	Permanent teeth
A	0- Sound
B	1- Caries
C	2- Filled with caries
D	3- Filled, no caries
E	4- Missing due to caries
-	5- Missing for any another reason
F	6- Fissure sealants
G	7- Fixed dental prosthesis / crown abutment, veneer, implant
-	8- Unerupted
-	9- Not recorded.

MODIFIED DEVELOPMENT ENAMEL DEFECT (CLARKSON J. J. AND O. MULLANE D M, 1989) [9]

54	53	52	51	61	62	63	64

85   75

Types of defects	code
Normal	0
Demarcated	1
Diffuse Opacity	2
Hypoplasia	3
Other Defects	4
Combinations	**code**
Demarcated and Diffuse	5
Demarcated and Hypoplasia	6
Diffuse and Hypoplasia	7
All Three Defects	8

PARTICULARS OF CONTRIBUTORS:
1. Senior Lecturer, Department of Public Health Dentistry, K.D. Dental College and Hospital, Mathura, Uttar Pradesh, India.
2. Professor and Head, Department of Public Health Dentistry, Sardar Patel Post Graduate Institute of Dental & Medical Sciences, Lucknow, Uttar Pradesh, India.
3. Reader, Department of Public Health Dentistry, Sardar Patel Post Graduate Institute of Dental & Medical Sciences, Lucknow, Uttar Pradesh, India.
4. Senior Lecturer, Department of Public Health Dentistry, Sardar Patel Post Graduate Institute of Dental & Medical Sciences, Lucknow, Uttar Pradesh, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Pramod Kumar Yadav,
Senior Lecturer, Department of Public Health Dentistry, K.D. Dental College and Hospital,
Mathura-281001, Uttar Pradesh, India.
E-mail : pramod468@gmail.com

FINANCIAL OR OTHER COMPETING INTERESTS: None.