



Evaluation of Dental Caries in Preterm Born Children with Enamel Defects

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Introduction: Predisposition of preterm born children to systemic illness and metabolic disorders leads to defects in hard tissue calcification. One such defect may manifest as hypoplasia of enamel. Imposed on this is frequent sugar exposure due to chronic medication, lowered immunocompetence that accounts for lower serum IgG, IgM and IgA antibodies further predisposes to these children to dental caries. This study is done to evaluate the dental caries in preterm born children with enamel defects.

Materials and Methods: A total of 200 children in age group of 2-8 years were taken, out of those group 1 comprised of preterm born children and group 2 comprised of children born full term. Intraoral examination was done to check for enamel hypoplasia and dental caries and was assessed using DDE (developmental defects of enamel) index for enamel hypoplasia and DMFS (Decayed missing filled) index, defs (decayed extracted filled surfaces) index for dental caries respectively.

Results: The results showed that enamel hypoplasia can be the major contributing factor to develop dental caries.

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Conclusion: Early recognition and intervention to treat enamel hypoplasia in preterm children should be a prime consideration so as to prevent development of dental caries. Education of both health care professionals and parents regarding overall dental health is of utmost importance.

Keywords: Pre term; enamel hypoplasia; dental caries.

1. INTRODUCTION

According to nomenclature of the W.H.O. Pre term births are defined as those birth occurring before 37 completed weeks of gestation [1], within this groups of births are also included where weight of child is less than 2500 gms at the time of birth [1,2].

The early and long term effects of birth prematurely on the physical and pshychological growth and development of the child are subjects of considerable interest. Most studies have indicated that in early childhood, preterm born children show significant delay in many areas of physical and psychological growth and development [3].

Enamel hypoplasia is defined as a defect of enamel matrix formation that results in altered enamel and disturbed calcification [4]. Defects may present as irregularities on the tooth surface and or reduced thickness of enamel. Pathogenic mechanisms of these dental defects are not clear but is likely that both local and systemic factors are involved. Any factor which can disrupt calcification stage of the tooth is most likely to cause enamel hypoplasia.

The techniques required to sustain life in preterm infants, like use of laryngoscopy and endotracheal intubation usually results in localized enamel hypoplasia, mainly involving maxillary anterior teeth [5,6].

Systemic causes related with enamel hypoplasia include vitamin D dependent Rickets, neonatal asphyxia, hyperbilirubinea and neonatal infection, osteopenia [7,8,9,10].

Children born prematurely have higher prevalence of enamel defects in the primary dentition than born at full term [11,12,13].

Permanent teeth (first molar and central incisors) in which deposition begins right after birth are also believed to be affected by hypocalcemia observed in first year of life of preterm born low birth weight children [14].

Prevalence of development dental defects in prematurely born children vary widely from 20 percent to 100 percent.

Morphologically underdeveloped primary teeth often have fragmentary coalesced deep pits and fissure, particularly on the primary first and second molars in addition to it rough surfaces are present on hypoplastic teeth.

These all factors promote food accumulation, plaque formation, bacterial (streptococcus mutans) adhesion and colony forming may lead to quick progression of dental caries [15,16].

The present investigation was conducted in order to collect further information about the prevalence of clinically discernible enamel hypoplasia in prematurely born children and as a risk factor to develop dental caries.

2. MATERIALS AND METHODS

A total of 200 children in age group of 2-8 years were taken. The age range between 2-8 years were chosen so that deciduous teeth and permanent molar and incisors are included in this study. Permanent molars are generally calcified during birth and premature birth can have an effect on its calcification and maturation also permanent incisors can have some effect on its calcification as they gets calcified during early months of neonatal life.

2.1 Study Group (Group 1)

The study group included 100 children and study case was defined as a child in the age group of 2-8 years who were born before 37 weeks of gestation or whose weight was less than 2500 grams at the time of birth.

2.2 Control Group (Group 2)

The control group included 100 children and a matched control is a child who belongs to the same age group, and no disparity existed between the study and control groups in the various factors that might be related to dental decay, except that they are born full term of the gestation period and their weight was more than 2500 grams at the time of the birth.

2.3 Data Collection

The study involved no invasive procedure in the subjects or neither any diagnostic procedures

were done which can have any hazardous effects on subjects.

2.3.1 Oral examination

Examination were carried out by same examiner using natural light and using standard ball ended probe. The data was collected for preterm children from pediatric department of medical college where these children were born and visit for routine follow ups and vaccination. Control group children were selected from pediatric dentistry department.

Dental caries was recorded using defs(decayed extracted filled surfaces) and DMFS(decayed missing filled surfaces) for primary and permanent tooth erupted. Separate scoring for both deciduous and permanent dentition was done.

Enamel hypoplasia was assessed using modified Developmental Dental defects of enamel (DDE) index. Enamel defects were examined using intraoral mirror and defects using a probe.

For the modified DDE index, results. The enamel defect score (EDS) for each individual was assessed

$$EDS = \sum (EHP \text{ code} \times \text{Number of defective tooth surfaces}) \times 10$$

Total tooth surfaces at risk

3. RESULTS

The most relevant findings of the present study was that teeth with enamel hypoplasia presented

a significantly higher prevalence of dental caries than was seen in sound teeth without enamel hypoplasia.

In the present study, out of 100 preterm children examined, 11 children had significant scores of enamel hypoplasia when assessed using DDE scores, although in the control group no cases of enamel hypoplasia were found in both dentitions.

When statistical comparison was done, the correlation coefficient between DDE score and defs was found to have positive and highly significant values ($p < 0.001$) which clearly indicate that high scores of enamel hypoplasia predispose these children to high risk of developing dental caries.

4. DISCUSSION

Dental caries is a common childhood disease with chronic characteristics modulated by behavior and involving colonization by *Streptococcus mutans* [17]. Although the prevalence of dental caries has decreased remarkably, it still remains the most prevalent pediatric disease [18].

The various etiological factors contributing to dental caries are well known, however the early life events like preterm birth and low birth weight which may contribute immensely to caries still continue to be poorly understood [19,20].

The present study's results confirmed that children born preterm with enamel defects had high caries score.

Table 1. Relation of enamel hypoplasia with dental caries

Group I (preterm)	Enamel hypoplasia	Number N	defs mean ± SD	COMP.	DMFS mean ±SD	COMP.
	Present	11	8.727 ± 6.528	t = 2.901; p = 0.005; Significant	1.364 ± 4.202 0.269 ± 0.939	t = 2.126; p = 0.036; Significant
	Absence	89	4.281 ± 4.56			
Group II (Control)	Present	0	0		0	
	Absence	100	4.18 +/- 4.97		0.20 +/- 0.57	

Table 2. Correlation coefficient between DDE score and defs, DMFS

	Defs	DMFS
DDE score	r = 0.419; p < 0.001; Highly significant	r = 0.191; p = 0.058; Not significant

r is Pearson's correlation coefficient. It shows that DDE score has positive and highly significant correlation with defs (p < 0.001). Whereas the correlation with DMFS is positive although it is not significant statistically

The present study's results also confirmed the hypothesis that, compared to full-term children, preterm children are more prone to develop enamel hypoplasia. Studies done by Seow et al., Grahnen et al. clearly linked increase in enamel defects in the deciduous dentition of pre term born children [21,22].

Developmental defects of enamel (DDE) can be defined as alterations of dental enamel that result from several disturbances during amelogenesis. Since dental enamel does not remodel, the defects that occur during its formation will be permanently recorded on tooth surface. Enamel hypoplasia has been reported to be presented over majority of preterm children. This condition is likely to be result of neonatal derangements in mineralization due to poor supply and absorption of calcium and phosphate, the disturbed calcium metabolism during the first days of life may be an important factor causing enamel aberrations in the deciduous dentition as it is a proven fact that calcium and phosphate accumulation takes place during the last trimester of pregnancy [23]. The earlier a child is born, the less calcium and phosphate are accumulated.

The other mechanism which is involved is due to immature parathyroid glands as a mature parathyroid glands are responsible for increased absorption of vitamin D and calcium from gastrointestinal tract when cessation of the maternal supply of calcium [22].

In addition to it, local trauma associated with laryngoscopy and endotracheal intubation also seems to be associated with mineralization disturbances of teeth in preterm children [6].

Enamel hypoplasia, are clinically important since they can result in increased caries risk, dental sensitivity, increased tooth wear as well as esthetic implications.

Previous studies have described a higher prevalence of Enamel hypoplasia in children born preterm.

Hypoplasia has been considered a significant predictor of dental caries as it strongly correlate with enamel decay [12].

In one of the other study the correlation between dental caries and enamel hypoplasia in 3-5 year old rural Chinese children was done and it was found that presence of enamel hypoplasia may be a predisposing factor for initiation and

progression of dental caries, and a predictor of high caries susceptibility in preterm born children [24].

Present study confirms that preterm children with high DDE score had higher caries index which clearly proves that more intense the hypoplastic defect, more likely the child is prone to develop dental caries.

5. CONCLUSION

Primary and permanent teeth of the preterm infants can be affected in variety of ways. Risk factors for dental problems are linked to a number of prenatal and post natal conditions. Early recognition and intervention to treat enamel hypoplasia should be a prime consideration so as to prevent development of dental caries. Education of both health care professionals and parents regarding overall dental health is important not only to minimize problems but also to promote good overall health in preterm born children. Pediatricians as primary care providers have to include oral health care as a part of routine examination and discuss with the dentist whenever an early intervention is required.

CONSENT

All authors declare that 'written informed consent was obtained from the patient (or other approved parties) for publication of this paper.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. World Health Organization. International classification of diseases and related health problems. 10th revision, Geneva, Switzerland. W.H.O; 2004.
2. Robertson NRC. A manual of neonatal intensive care. 3rd edition London, UK, Edward Arnold, A division of Hodder and Stoughton; 1993.
3. Marlow N, Roberts L, Cooke R. Outcome at 8 years for children with birth weights of

- 1250 grams or less. Arch Dis Child. 1993;68:286-90.
4. FDI commission on Oral Health Research and Epidemiology. A review of the development defects of enamel index (DDE index). Int Dent J. 1992;42(6):411-426.
 5. Seow WK, Brown JP, Tudehope DI, O'Callaghan M. Developmental defects in the primary dentition of very low birth weight infants: Adverse effects of laryngoscope and prolonged endotracheal intubation. Pediatr Dent. 1984;6:28-31.
 6. Seow WK, Brown JP, Tudehope DI, O'Callaghan M. Effect of neonatal laryngoscopy and endotracheal intubation on palatal asymmetry in two to five year old children. Pediatr Dent. 1985;7:30-36.
 7. Aine I, Backstrom MC, Maki R, et al. Enamel defects in primary and permanent teeth of children born prematurely. Oral Pathol Med. 2000;29:403-409.
 8. Pindborg JJ. Aetiology of developmental enamel defects not related to Fluorosis. Int Dent Journal. 1982;32:123-134.
 9. Nikiforuk G, Fraser D. The etiology of enamel hypoplasia unifying concept. J. Pediatr. 1981;98:888-893.
 10. Seow WK. Oral complications of premature birth. Aust Dent J. 1986;31:23-29.
 11. Aine L, Backstrom MC, Makir R, Kusela AL, Koivisto AM, Ikonen RS, et al. Enamel defects in primary and Permanent teeth of Children born prematurely. J Oral Pathol Med. 2000;29:403-409.
 12. Lai PY, Seow WK, Tudehope DI. Enamel hypoplasia and dental caries in very low birth weight children. A case controlled longitudinal study. Ped Dent. 1997;19(1): 42-49.
 13. Seow WK. Clinical diagnosis of enamel defects: Pitfalls and practical guidelines. Int Dent J. 1997;47(3):173-82.
 14. Tsang RC, Donovan EF, Steichen JJ. Calcium physiology and pathology in the neonate. Pediatr Clinic North America. 1976;23:611-626.
 15. Wan AKL, Seow WK, Purdie DM, Bird PS, Walsh LJ, Tudehope DI. A longitudinal study of streptococcus mutans colonization in Infants after tooth eruption. J Dent Res. 2003;82(7):504-508.
 16. Matte M, Hof MV, Maselle S, Mikx F, Helderman WP. Nursing caries, linear hypoplasia and weaning habits in Tanzanian Infants. Community Dent Oral Epidemiol. 1994;22(5/6):289-94.
 17. Seow WK. Biological mechanisms of early childhood caries. Community Dent Oral Epidemiology. 1998;26:8-27.
 18. Brown LJ, Wall T, Lazar V. Trends in total Caries experience permanent and primary teeth. Journal American Dental Assoc. 2000;131:223-31.
 19. Burt BA, Pai S. Does low birth weight increase the risk of caries? A systemic review. J. Dent Edu. 2001;65(10):1024-7.
 20. Davenport ES, Litenas C, Barbayianins P, Williams CE. The effects of diet, breast feeding and weaning on caries risk for preterm and low birth weight children. Int J. Pediatr Dent. 2004;14(4):251-9.
 21. Seow Wk, Humphreys C, Tudehope DI. Increased prevalence of developmental dental defects in low birth weight, prematurely born children: A controlled study. Pediatr Dent. 1987;9:221-5.
 22. Grahnen H, Sjolín S, Stenstrom A. Mineralisation defects of primary teeth in children born preterm. Scand. J Dent Res. 1974;82:396-400.
 23. WK Seow, WG Young, Annetta KL, Tsang KL, Gcerr T, Daley A. Study of primary dental enamel from preterm and full term. J Pediatric Dentistry. 2005;374-379.
 24. Li Y, Navia JM, Bian J-Y. Caries experience in deciduous dentition of rural Chinese children 3-5 years old in relation to the presence or absence of enamel hypoplasia. Caries Res. 1996;30:8-15.

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