Effect Of Low Birth Weight And Very Low Birth Weight On Primary Dentition In The Indian Population

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Citation

Abstract
Prematurity and low birth weight [LBW] children account for approximately 7-17% of all live births. They are prone to several medical complications during the antenatal and postnatal period which may adversely affect the development of oral tissues. The purpose of the study was to study the prevalence of enamel defects in prematurely born LBW and very low birth weight children [VLBW] in Indian population. The study was made on children between 9 months to 35 months of age. This study shows that the prevalence of enamel defects increases with decreasing birth weight. The prevalence in VLBW children [weight <1.5 kg], LBW children [weight <2.5 kg] and normal weight children [weight >2.5 kg] was 74.1%, 26.5% and 18% respectively. In very low birth weight children left sided defect occurred twice as frequently as right sided defects; probably the result of trauma from left sided laryngoscopy.

INTRODUCTION
Preterm children have low birth weights and shorter the gestational age, lower is the weight at birth. Low birth weight (LBW), defined as a birth weight <2500 g, is a very important indirect cause of morbidity and mortality in neonates the world over. According to World Health Organization, approximately 17% of neonates, or nearly 20 million, are born LBW each year in developing countries – almost double the level in industrialized countries [7%]. The highest incidence [31%] of LBW is found in South Asia. India accounts for nearly 40% of all LBW babies in the developing countries.

LBW may be caused by intrauterine growth restriction (IUGR), or prematurity or both. Prematurity is defined as gestation age less than 37 completed weeks. In India, prematurity accounts for 21% of total births. With advancements in neonatal care in the past decade, the survival rates of the most preterm children have improved dramatically. The survival rates of preterm children range from >90 per cent for those with birth weights 1000-1500g to around 50 percent for those with birth weights of 500 -750 g. Short-term and long-term consequences of prematurity on the physical and psychological growth and development of the child have evolved considerable interest. Preterm children show significant delay in many areas of physical and psychological growth and development.

The primary teeth have a long antenatal and postnatal development period. The incisors start developing before the 10th intrauterine week and continue for few months after birth. Any kind of distress during this development period will result in enamel defects. Enamel is a unique hard tissue in that it does not remodel so that structural changes resulting from insults during amelogenesis are permanently recorded. Changes in dental enamel are one of the most noticeable oral effects of preterm birth, and may classically present as enamel hypoplasia which is defined as a quantitative loss of enamel, or as enamel opacity which is defined as a qualitative change in the translucency of the enamel. These defects are usually located on the primary teeth which are undergoing mineralization around the time of the premature birth. Clinically, these enamel defects may present with problems of aesthetics. In addition, enamel hypoplasia may predispose to plaque accumulation and carries and in severe cases may even cause space loss and malocclusion.

The possible pathogenesis of dental defects in preterm children may be many of the systemic illnesses which include metabolic disorders such as liver and renal disease, gastroenteritis, pneumonia, rubella, nutritional disorders such as vitamin D and calcium deficiency, birth asphyxia and respiratory distress. The probable pathology is osteopenia due to insufficiency of supply and gastro-intestinal absorption of mineral substrate as well as impaired
vitamin D metabolism. This depletion of mineral stores in preterm children leads to inadequate entry of calcium and phosphorus into the developing tooth germ and thereby affecting enamel formation.

As there are no studies on the effect of low birth weight on enamel in Indian children so the present paper studies the deleterious affects of preterm birth on the development of the enamel in primary dentition.

**METHOD**

**PATIENT SELECTION AND STUDY DESIGN**

One hundred seventy two children with primary teeth and attending Pediatric Outdoor Patient Department of Teerthankar Mahaveer Medical College, Moradabad were included in this retrospective study. Their age group ranged from 9 months to 35 months. This study was conducted in the Pediatric department. The research project was approved by the Ethical Research Committee of Teerthankar Mahaveer University and written informed consent was obtained from the parents or guardians.

**INCLUSION CRITERIA**- Birth weight and birth date was the selection criteria. Maternal and neonatal medical histories were obtained from the records kept by mother. Children with genetic syndromes were excluded. For preterm infants, corrected age was considered, i.e., chronological age reduced by the number of weeks born before 40 weeks of gestation. They were divided into three groups according to their birth weights- normal birth weight group (>2500gm), low birth weight group (LBW 1500 - 2500gm) and very low birth weight group (VLBW <1500gm).

In the normal birth weight group, 50 children [27 males and 23 females] were selected. They were all products of full term pregnancies and their mean birth weight was 3100 ± 250 gm. None of these children were intubated during the neonatal period. The LBW group consisted of 64 children (23 males and 41 females). Their mean birth weight was 1890 ± 196 gm and their mean gestational age was 34.9 ± 2.0 weeks [range 32-37 weeks]. Five of these children were intubated. The VLBW group comprised of 58 children (19 males and 39 females). Their mean birth weight was 1134 ± 178 gm and their mean gestational age was 29.4 ± 2.5 weeks [range 27-32 weeks]. Forty seven of these children were intubated.

**CLINICAL EXAMINATION**

Dental examination was conducted under ideal conditions in the Pedodontic Department of Teerthankar Mahaveer Dental College [located adjacent to Medical College], where the staff are adept at examining the dentition of such age group. For infants and toddlers the method of examination was ‘lap to lap’ position in which the child’s head is placed on dentist’s lap and both hands and legs of the patient are on mother’s lap. For older age group, child was held in the lap of his mother who then sat on the dental chair.

**Figure 1**

Picture: 1. ‘Lap-to-lap technique (a 3 year old boy)

**Figure 2**

Picture: 2: Lap to lap technique (close-up of a 16 mo child)

Dental examination was done by two Pedodontists who were totally unaware of the study being conducted. Hence there was no possibility of a reporting bias. It was a single blinded study. In order to avoid masking of defects by dental plaque, teeth were cleaned with a toothbrush. Teeth were evaluated...
under artificial light using a dental mirror and dental probe without previous drying. Dental examination was performed in accordance with FDI criteria (modified DDE Index)\textsuperscript{18}.

A tooth was considered erupted if any portion of the crown had penetrated the mucosa. If more than 2/3 of the tooth surface was restored, decayed or fractured the tooth was considered excluded. A single defect measuring less than 1 mm in diameter was scored as normal. The buccal, lingual and occlusal surfaces were examined. The teeth were examined for opacities and enamel hypoplasia. The diagnosis of enamel opacity was restricted to teeth with white or yellow-brown areas that did not have hypoplastic enamel, i.e., pitting, ridging or other disturbances of surface contour. Hypoplasias had the localization registered.

**Figure 3**  
Picture 3 & 4: Enamel hypoplasia with pitting

Opacities were differentiated from white spot carious lesions based on color, texture, demarcation and relationship to gingival margin. All tooth surfaces were examined and all dental defects were recorded in a comprehensive chart. Intraoral photographs were taken in some children. An informed consent form was signed by parents or legal guardians expressing agreement to answer the questionnaire and granting authorization for the child’s participation in the study.

**Figure 4**  
Picture 5: Enamel opacity

**RESULTS**

**PREVALENCE OF ENAMEL HYPOPLASIA**

**Figure 5**  
Table I shows the prevalence of enamel hypoplasia in the 3 groups of subjects.

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Birth Weight [g] Mean ± SD</th>
<th>Prevalence of Enamel Defects</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[Opacities]</td>
<td>[Hypoplasia]</td>
</tr>
<tr>
<td>VLBW [n=58]</td>
<td>1134 ± 178</td>
<td>9 (15.3%)</td>
</tr>
<tr>
<td>LBW [n=64]</td>
<td>1890 ± 196</td>
<td>4 (6.2%)</td>
</tr>
<tr>
<td>Normal [n=50]</td>
<td>3100 ± 250</td>
<td>4 (8%)</td>
</tr>
</tbody>
</table>

Table 1: Prevalence Of Enamel Hypoplasia in Children with Very Low [VLBW], Low [LBW] And Normal Birth weights

[The difference in prevalence of enamel defects in the three groups is statistically significant P < 0.001]
In the VLBW groups, 43 of 58 children showed at least one tooth with enamel defect, giving a prevalence of 74.1%. Of these, 9 children (15.3%) had enamel opacities alone and 34 (58.6%) had enamel hypoplasia with or without opacities. However, in the LBW group a lower prevalence of enamel defects [26.5%] was obtained (17 of 64 children affected). Of these, 13 [20.3%] children had hypoplasia and only 4 [6.2%] had opacities alone. In the normal birth weight group of children there was a much lower prevalence of 18% where only 9 of 50 children were affected. Of these, only 4 (8.0%) had opacities alone. The difference in prevalence among the 3 study groups is statistically significant (P < 0.001), indicating that prevalence of enamel hypoplasia varies in direct relation to birth weight.

**DISTRIBUTION OF ENAMEL HYPOPLASIA**

The distribution of enamel hypoplasia was also analyzed in the 3 groups of children for possible insight into the etiology of the dental defects. Table 2 shows the distribution of enamel hypoplasia in the study groups. In the VLBW group 64.3% of all affected teeth occurred on the left side compared with 30.9% on the right side. This difference was statistically significant (P < 0.005). In contrast, in both the low and normal birth weight groups, the dental defects appeared fairly evenly distributed on both left and right sides (P > 0.1).

**DISCUSSION**

This paper contributes to prevalence data of enamel defects in Indians since no study have examined it in Indian population. Previous investigations have indicated a high prevalence of enamel defects in low birth weight children ranging from 20 to 96% (Table-3) with the highest frequency in very low birth weight children.

In the present study, the prevalence of dental defects in LBW children was 26.5%, while it was comparatively higher
for the VLBW group at 74.1%. Higher prevalence of enamel defects in LBW children in some studies\textsuperscript{6, 10, 22, 25-27} could be because no differentiation was made in these studies between LBW and VLBW children. Our study clearly shows that the VLBW group is relatively more predisposed to enamel defects. Similar findings were reported by Seow et al\textsuperscript{10} & Lai et al\textsuperscript{19}. The prevalence of dental defects in normal birth-weight children in the present study was 18%, a figure close to studies by other authors.\textsuperscript{19, 21, 25, 26} However, few studies\textsuperscript{10, 12, 24} have reported exceptionally high prevalence rates ranging from 26-45%. The reasons for this gross discrepancy could be due to variations in sample size and distribution or sampling errors from low acceptance rates. Also the optimum time to evaluate enamel defects is soon after tooth eruption because the findings may be lost due to dental trauma, attrition or caries so the children of the present study were taken between 9-35 months of age. This could be another reason for the difference between the studies.

Systemic insults to the developing dentition may occur prenatally, neonatally or postnatally. The possible pathogenesis behind enamel defects in LBW is probably multi-factorial. Causes include:

Maternal infections [eg. Rubella, cytomegalovirus] - causing direct damage to ameloblasts.


Deranged calcium metabolism occurs to some extent in most preterms because 2/3 of the foetal stores of calcium accumulate in the last trimester and preterms miss much of this accretion.

Local traumatic factors associated with laryngoscopy and oro-tracheal intubation during the critical period of amelogenesis may also be responsible for enamel defects in preterm children.\textsuperscript{26-30} In the present study more defects were seen on left anterior maxillary teeth in the VLBW and LBW group. This maybe due to laryngoscopy, which is often required in preterm babies and tends to cause more defects on the left maxillary teeth. Though ideally there should be no traumatic force applied to the anterior alveolus, but practically some force is often exerted on the left side as the laryngoscope is pushed to that side to create sufficient space while inserting the endotracheal tube. A close correlation exists between birth weight, dental defects and the intubation period, the prevalence of dental defects generally increasing with a longer period of orotracheal intubation.\textsuperscript{30}

Enamel defects related to systemic factors are usually symmetrical and involve those teeth undergoing development and enamel formation at that time, but local tissue variability in development must be taken into consideration. Hypoplasia has been considered a significant predictor of dental caries. Mild enamel defects such as opacities without hypoplasia do not increase caries prevalence, but severe enamel hypoplasia is strongly associated with enamel decay.\textsuperscript{24}

**CONCLUSIONS**

This study shows that rates of enamel defects in LBW and VLBW Indian population are similar to previous studies in other parts of the world. The lower the birth weight of a child the greater the propensity to develop enamel hypoplasia which is likely to be associated with low bone mineral stores. The clinical significance of enamel defects is poor esthetics and predisposition of the lesions to dental caries. The results of these clinical studies may have significant implications in the dental management of preterm children. Instructions about dental health and the development of healthy dietary and oral hygiene habits, as well as the adoption of efficient preventive measures are of paramount importance in low birth weight babies to prevent dental problems in later childhood.

In this study enamel defects were only studied in primary dentition. Further studies on permanent dentition are required as permanent teeth are thought to commence their mineralization a few months after preterm birth. More studies in the area of enamel defects with children born prematurely should be conducted, and results should be used to establish preventive measures and health promotion programs to give children a better quality of life. These children should be routinely followed and should receive instructions about diet and hygiene habits from neonatology team in the hospital.

**References**

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