

# Preterm Birth Complications On Oro-Dental Structures: An Updated Review

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## ABSTRACT

Preterm birth is the birth of a baby of less than 37 weeks gestational age. The cause of preterm birth is in many situations elusive and unknown. Premature infants have a short prenatal development period and are at greater risk for short and long term complications, including disabilities and impediments in growth and mental development. The prevalence of oral defects in the deciduous and permanent dentition has been reported to be higher in premature infants. Premature birth can cause enamel defects such as quantitative loss of enamel (hypoplasia), qualitative change in the translucence (opacity) of the enamel, or a combination of both. Other dental defects in preterm babies include notching of the alveolar ridge, palatal grooving, high arched palate, dental crossbite and palatal asymmetry. Moreover, delayed eruption/maturation and developmental defects of both the primary and permanent dentitions have also been reported. With the introduction of intensive medical care including the increased use of antenatal corticosteroids and the recent routine administration of surfactant replacement therapy, survival of prematurely born infants has improved markedly. However, the significant progress has been made in the care of premature infants but not in reducing the prevalence of preterm birth, making the reduction of preterm birth a challenging proposition.

**Keywords :** Preterm, Hypoplasia, Maturation, Enamel.

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## INTRODUCTION

Preterm births refer to births that take place before 37 weeks of the gestation period or in which the birth weight is below 2500 gram (1). Such a baby is sometimes called as a 'preemie' or 'preemie'. Preterm birth is among the top causes of death in infants worldwide (2). It refers to a baby before the developing organs are mature enough to allow normal postnatal survival.

India is the biggest contributor to the world's prematurity burden, with almost 3.6 million premature births out of 15 million global preterm births reported each year (2). The rate of premature births in India is rising and is presently around 21% of babies, according to the report released by WHO in

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collaboration with Indian Foundation for Premature Babies (IFPB), a grouping of doctors across India (2).

The etiology of preterm births is usually multi-factorial and may be related to disease in the foetus or mother, although in many cases the etiology is unknown (3). The report by the Indian Foundation for Premature Babies included the factors resulting in premature births such as young or advanced age, low maternal body mass index, short inter pregnancy intervals, pre-existing non communicable disease, maternal smoking, low socio-economic status and increasing psychological stress (2).

Premature childbirth is the most frequent cause of low birth weight (4). Preterm infants are at disadvantage because their internal organs are immature with a higher risk to develop complications such as breathing problems, patent ductus arteriosus, anemia and infant jaundice, temperature control problems, underdeveloped immune system, hypocalcemia, impaired cognitive skills, visual problems, hearing problems, dental problems and other alterations that affect health and growth (5,6). While not all premature babies experience complications. The earlier a baby is born, the higher the risk of complications. Birth weight plays an important role. Some problems may be apparent at birth, while others may not develop for weeks or months. Children who have been critically ill are at increased risk of developing dental problems, such as delayed tooth eruption, tooth discoloration and improperly aligned teeth. In some premature babies, difficulties may not appear until later in childhood or even adulthood (7).

## DENTAL OUTCOMES IN PRE-TERM INFANTS

### Effects on dental enamel

Enamel defects are well studied complication of prematurity (8-10). Enamel is a unique hard tissue in that it does

not remodel and structural changes resulting from insults during amelogenesis are permanently recorded (11). Changes in dental enamel are one of the most noticeable oral effects of preterm birth, and may classically present as enamel hypoplasia or as enamel opacity. Enamel hypoplasia is defined as 'deficient quantity of enamel resulting from developmental aberrations and may occur in the form of pits, grooves or larger areas of missing enamel (12). Enamel opacity is defined as a qualitative change in the translucency of the enamel (13).

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 caries and in severe cases may even cause space loss and malocclusion (9).

The possible pathogenesis of dental defects in preterm children includes systemic illnesses, metabolic disorders of 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 (14,15). 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.

The biochemical cause of enamel hypoplasia is not fully understood, but growing evidence indicates that it is strongly linked to calcium homeostasis (16). There are several studies that suggest a direct relationship between enamel hypoplasia in primary teeth and neonatal hypocalcemia (17,18). There are numerous prenatal and postnatal

problems that cause hypocalcemia in the newborn. The more premature and the lower the birth weight, the more problems with calcium homeostasis. Seow *et al* (19) reported a direct relationship between birth weight and gestational age with the greatest prevalence of enamel defects occurring in the lowest birth weight group. 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 (20). 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 oro-tracheal intubation. Maternal infections like rubella or cytomegalovirus reported to cause direct damage to ameloblasts resulted in enamel defects (8).

The clinical significance of enamel defects is not only esthetic, although these teeth can appear cream colored, yellow or brown. 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. Enamel hypoplasia is linked to plaque accumulation, dental caries, and in more severe cases, with space loss and malocclusion. In a longitudinal study by Lai *et al* (10) there was a significant association with enamel defects and dental caries in the very low birth weight preterm children noted at 44 and 52 months of age. The most dental caries were observed in those children who had both enamel hypoplasia and opacity.

Enamel defects have also been identified in the permanent dentition of children born prematurely. Pimlott *et al* (9) found enamel hypocalcification in at least one maxillary permanent incisor in 58% of the 106 very low birth weight premature infants examined. Seow (21) matched 55 very low birth

weights and 55 normal birth weights controls at a mean age of 7.7 years for defects in enamel of permanent incisors and molars. The first group had a higher percentage of enamel defects in the permanent molars (21% vs 11%) and permanent lateral incisors (12% vs 0%) compared with controls. Most of the defects were enamel opacities. Aine *et al* (22) matched 32 preterm to 64 control children. The prevalence of enamel defects in preterm compared with control children was higher in both primary (78% v 20%) and permanent (83% v 36%) dentitions. Because the permanent teeth are believed to begin mineralization a few months after the preterm birth, it is hypothesized that persistent metabolic disturbances affect the mineralization and calcium homeostasis of the first few permanent teeth.

Enamel defects can be generalized or localized and both. Generalized defects are symmetrically distributed and likely caused by systemic illnesses associated with prematurity. As mineral stores in the preterm infant are depleted, calcium and phosphorus entering the developing tooth is insufficient for enamel formation. This theory is supported by a study of preterm children who had neonatal rickets secondary to severe osteopenia (23).

### Effects of Preterm birth on Palate

Multiple factors influence abnormal palate formation. The narrow elongated 'preemie head' may cause a narrow high vaulted palate contributing to collapse of the palate. The endo-tracheal tubes given in such patients may press on the midline palate and alveolar ridge disturbing its growth. The pressure applied to the endo-tracheal tube to keep it properly positioned may further affect the developing palate. Babies sucking on their endo-tracheal tubes may also result in some molding of the tissues (24). Conceivably, the altered palatal morphology can lead to malocclusions such as crossbite resulting in an increasing need for orthodontic treatment. Moreover, changes in the

path of eruption of teeth; which influence the occlusion and tooth spacing, also contribute to an increasing need for orthodontic treatment.

Kopra and Davis (25) found a higher incidence of palatal abnormalities in two groups of low birth weight children ages 3 to 5 and 7 to 10 years old who had been intubated when compared with control group. In both age groups, intubated subjects had a greater incidence of high vaulted palate, palatal grooving and posterior crossbite compared with the control group. Their speech was also judged to be less intelligible. This study is one of the few that demonstrates these defects persist into middle childhood. They concluded that a high vaulted or grooved palate may result in the tongue not meeting the palate correctly. This may adversely affect the production of normal speech sounds and contribute to hyper-nasality and poorer speech intelligibility. Further, they concluded that length of intubation did not influence oral defects and speech characteristics.

Macey-Dare *et al* (26) in premature infants measured palatal widths, arch widths, and palatal depths in premature children. The children who had been intubated had significantly narrower palate widths posteriorly, and palatal vaults were steeper anteriorly. The intubated group also had palatal width asymmetry with the left side consistently wider than the right. In contrast to these findings, Seow *et al* (27) compared palate and dental arch symmetry between intubated and non-intubated groups of children. They found no significant differences in the two groups but none of the children in the intubated group had been intubated for more than 20 days.

### Effect of Preterm on Tooth Maturation/Development and Eruption

The timing of primary teeth eruption in premature infants has not been well established. Studies (21,28) demon-

strated a delay in tooth maturation/development and eruption among the premature children but when corrected age was considered, no delay was found in tooth maturation/development and eruption. Seow (21) and Seow *et al* (28) also showed that lower the birth weight, the more the delay in dental eruption. However, Seow *et al* (28) declared that when corrected age was considered, there were no differences between the groups, implying that the delay in dental eruption among the children with lowest birth weight was simply attributable to their early birth. Moreover, Seow (21) reported that the greatest delay was found in children younger than 6 years of age, whereas for those aged 9 years or older, there was no difference, indicating that a "catch-up" had occurred. Viscardi *et al* (29) attempted to relate delayed tooth eruption to neonatal factors other than birth weight and gestational age. The late erupting group was comprised of those with birth weights more than 1000 grams and/or more than 31 weeks gestation. Other factors appeared to be important related to nutrition. They concluded that prolonged intubation for illness and inadequate nutrition were important factors affecting the timing of tooth eruption.

Backstrom *et al* (30) also investigated the effects of intake of different minerals (calcium, phosphorous) and vitamin D supplementation on dental maturation in the neonatal period. They found that mineral or vitamin D intake did not affect the tooth maturation of the primary dentition. However, higher vitamin D dose resulted in a more mature permanent dentition but mineral intake did not affect maturation of the permanent teeth. Backstrom *et al* (30) also investigated whether tooth development was associated with bone mineral status in premature children but found no such association.

### Effect on tooth crown dimension

Harila-Kaera *et al* (16) studied the effect of preterm birth on permanent tooth

crown dimensions. Three hundred twenty eight premature black and white children and 1804 control children were examined at 6 to 12 years of age. The study suggested decreased tooth crown dimensions in some preterm infants. One significant difference was increased crown dimensions of some permanent teeth in the white preterm boys and black preterm girls and smaller dimensions in the white girls and black boys. Differences between gender, race, and growth patterns, especially accelerated or catch-up growth, may influence the determination of permanent tooth crown dimensions.

It is clear that primary and permanent teeth of the preterm infant can be affected in a variety of ways. The American Academy of Pediatric Dentistry (AAPD), the American Dental Association (ADA), and other dental organizations recommend that the first dental visit should be around 1 year of age (31). Risk factors for dental problems are linked to a number of prenatal and postnatal conditions. The dental problems discussed may, in some cases, be permanent and cannot be corrected. Some problems can be minimized with good dental care. 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. Health care providers need to include oral health and dental care as part of a routine examination and discussion with parents. Parent education needs to focus on preventive dental care and why good dental health is important. Parents need to appreciate the link between the oral cavity and systemic health issues as well. Maternal dental care and good prenatal care must also be included in the education provided (32).

### Other effects of Preterm birth on dental tissues

In few children, the local traumatic forces from laryngoscopy and endotracheal intubation may be sufficiently se-

vere to cause dilaceration of the crown (33). This is usually observed in the lowest birth weight groups in whom the intubation process is likely to be traumatic. Furthermore, the lowest birth weight children are susceptible to the most serious osteopenia and thinning of the bone cortices which in turn may render the developing teeth more susceptible to local trauma.

Tooth discoloration generally occurs only in those preemies who had high bilirubin levels admitted in the neonatal intensive care unit. A yellow-brown or greenish discoloration is seen only on the primary teeth and cannot be removed by brushing or having them cleaned by the dentist (34).

Pre-term birth - The Scenario in India According to report by Indian Foundation for Premature Babies (2) the paradigm of premature deliveries in India is changing and has become a disease of the marginalized as well as the affluent. Around 300,000 pre-term babies annually die due to complications in India. The most important intervention in this regard is birth spacing and maternal infections. Thus, creating the highest level of awareness on this issue is critical. The report also raises concerns about the financial burden on families to save premature infants. The study highlighted the stress among Indian women and their lack of rest during pregnancy is one of the leading factors for pre-term births. The report also said that three quarters of premature babies could be saved with current, cost effective interventions even without the availability of neonatal intensive care facilities. Measures such as antenatal steroid injections, kangaroo mother care, antiseptic cream for the umbilical cord and antibiotics to treat newborn infections were some of the measures mentioned.

### CONCLUSION

The lower the birth weight of the children, greater the propensity to develop dental defects including enamel hypo-

plasia/opacity. The clinical significance of enamel defects is poor esthetics and predisposition for the development of dental caries in later childhood. The present review has significant implications in the dental management of preterm children as instructions about the dental health, healthy dietary and oral hygiene habits as well as the adoption of preventive measures are paramount importance in low birth weight babies to give them a better quality of life.

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