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Relationship of Gestational Age, Birth Weight and Dental Status in Infants at the Age of 6th, 9th And 12th Month – A Longitudinal Clinical Study

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Abstract

Premature birth has been shown to affect the craniofacial complex and tissues of the oral cavity, including the primary and permanent dentition. Risk factors for dental problems are linked to a number of prenatal and postnatal conditions which can be looked after with good dental care. The purpose of this study was to identify the relation between gestational age, birth weight and dental status at the age 6, 9 and 12 months and also to evaluate the co-relation between the same. This study was carried out on 174 infants of the age group of 0-12 months. Neonatal data was obtained from pre-recorded hospital records. Oral examination of the selected infants was carried out by the principal investigator at 6 months of age to assess the eruption status. Follow up examination was carried out at 9 & 12 months of age respectively. A statistically significant delay in the eruption of first primary tooth was noted among the preterm inafant group as compared to the group with full term infants with NBW. The time of eruption of the first primary tooth was found to be inversely related to the weight of infant. A statistically significant delay in the eruption of first primary tooth was noted among the preterm inafant group as compared to the group with full term infants with NBW and the time of eruption of the first primary tooth was found to be inversely related to the weight of infant.

Keywords: Gestational age, Preterm infants, Oral examination.

Introduction

The word ‘gestation’ hails its origin from the latin word ‘gestare’ which refers to ‘carry in the womb’. Gestation period is the time period between conception and birth,

measured in weeks, from the first day of the woman's last menstrual cycle to the date of birth. Normal pregnancy period ranges from 38 to 42 weeks. World Health Organization (WHO) defines preterm birth as birth occurring before 37 weeks of gestation. It is estimated that each day, globally, there are 41,000 infants who are born prematurely. Prematurity is the leading cause of death in children under the age of 5 and are increasing every year.[1]

Children born prematurely can be subcategorized according to their gestational age at the time of delivery, into: Extremely premature (less than 28 weeks gestation), very premature (28 to less than 32 weeks gestation) and late premature (32 to less than 37 weeks gestation).Premature birth may also be defined by the birth weight of the child into: Extremely low birth weight (less than 1,000 g), very low birth weight (less than 1,500 g) and low birth weight (less than 2,500 g).[2]

The etiology of premature birth may be related to the mother, foetus, or both. Maternal factors include multiple gestations, smoking, pre-eclampsia, diabetes and highbody mass index. While foetal factors include congenital malformations, intra-uterine growth restriction and intra-uterine infections.[3] In over half of the cases of premature birth, the cause is unknown.[4] Preterm infants are at disadvantage because their internal organs are immature with a higher risk of developing various complications such as patent ductus arteriosus, anaemia, neonatal jaundice, temperature control problems, underdeveloped immune system, hypocalcaemia, impaired cognitive skills, visual problems, breathing 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 increased is the risk of complications.[7]

Tooth eruption is the phase of tooth development, characterized by movement of the tooth through the alveolar bone into the oral cavity. It is a normal part of child growth and development.The timing of eruption of primary teeth is usually between 6 and 36 months. The typical order of tooth emergence is central incisor, lateral incisor, first molar, canine and second molar in the mandibular arch and maxillary arch [8,9] Eruption of primary teeth is seen earlier in mandibular arch as compared to maxillary arch. The primary incisor teeth are functional in the mouth for approximately five to six years, while primary molars remain functional for nine to ten years.Calcification of primary teeth begins during the fourth month of foetal life and like everyother biological process, the period of calcification and eruption of the primary teeth is subjected to several individual variants.[10]

Growth parameters and feeding pattern may be determinants of the timing of teeth eruption in healthy infant.Presently, there exists some controversy about the relationship between birth weight and time of first dental eruption.10 In a study done by Viscardi and co-workers (1994)[11], the delay of eruption of primary teeth was shown in low birth weight and premature infants. Lowoyin et al. (1996)[12] observed that the number of erupted teeth was related to age and to some extent to the weight of the infant. Fadavi and co-workers' (1992)[13] carried out a study on low birth weight and very low birth weight infants, and showed that premature infants had less numbers of erupted teeth in comparison with normal birth weight infants of same age group. Studies by Seow [14] and Seow et al [15] have demonstrated a delay in tooth maturation/ development and eruption among the premature children.

Premature birth has been shown to affect the craniofacial complex and tissues of the oral cavity, including the primary and permanent dentition. 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.[15]

Risk factors for dental problems are linked to a number of prenatal and postnatal conditions which can be looked after with good dental care. Education of both health care professionals and parents regarding overall dental health is of paramount importance, not only to minimize problems but also to promote good overall health. Parental education needs to focus on preventive dental care and why good dental health is important. Parents need to understand 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.[16] For the reasons given above, the American Academy of Pediatric Dentistry, recommend that every infant should receive an oral health risk assessment by a qualified health care professional by six months of age. It also suggests establishment of dental home for infants by 12 months of age.[17]

It is very commonly observed that, most parents are anxious about the variation in the timing of the eruption, which is considered as an important milestone during child's development. A good knowledge of factors influencing dental development helps a dental surgeon satisfy parents and more importantly, to design an appropriate treatment plan by predicting the dental development rate. The purpose of this study is to identify the relation between gestational age, birth weight and dental status at the age 6, 9 and 12 months and also to evaluate the co-relation between the same.

Materials & Methods

Thisobservational longitudinal type of study was carried out on 174 infants of the age group of 0-12 months. It included Indian infants who were born in hospitals of Delhi- National Capital Region or had reported to the same for vaccination or routine checkup. Inclusion criteria were Indianinfants with gestational age from 30 to 42 weeks, birth weight > 1000 grams.They were screened and examined in the hospitals where they presented for regular vaccination or routine health check-up after obtaining written informed consent from parent/guardian. Simple random sampling method was used for selection. Infants were stratified according to:

a. Gender: Male & Female
b. Gestational age : Pre term & Full term
c. Birth weight: Very low birth weight, low birth weight & normal birth weight

Neonatal data which comprised of hospital name, patient registration number, mother's name, child's date of birth, birth weight was obtained from pre-recorded hospital records with the assistance of hospital staff. Oral examination of the selected infants was carried out using disposable mouth mask, sterile gloves, sterile mouth mirror no.5 and sterile kidney tray by the principal investigator at 6 months of age to assess the eruption status.Follow up examination for assessment of tooth eruption status was carried out at 9 and 12 months of age respectively, when the infants presented for vaccination by the same principal investigator and the data was recorded.

Data was analyzed using Statisical Package for Social Sciences (SPSS) version 21.Descriptives of categorical variables and continuces variables were presented as frequencies and means respectively. For bivariate analysis Independent Student's test and One way Analysis of Variance test (ANOVA) were used.

Results & Discussion

In this study out of 174, 42 were preterm, 44 were full term with low birth weight and 88 were full term with normal birth weight infants.

Gender distribution of the study population is depicted in Table 1.

Mean birth weight of preterm infants was 1.24 kg, full term with low birth weight was 2.10 kg and full term with normal birth weight was 3.17 kg.

The distribution of population according to the eruption timing of teeth is depicted in composite Table 2. Correlationship between gender and time of eruption of primary teeth in full term infants with NBW is shown in Table 3.

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. The rate of premature births in India is rising and is presently around 21% of infants, according to the report released by WHO (2012) in collaboration with Indian Foundation for Premature Babies (IFPB), a grouping of doctors across India. As reported by IFPB (2012), factors predisposing to premature birth are young or advanced age of mother, low maternal body mass index, short inter pregnancy levels, pre-existing non communicable disease, maternal smoking, low socio-economic status and increasing psychological stress.[18]

Apart from other systemic complications various dental abnormalities have been documented in the literature, which have been associated with preterm infants and full term infants with low birth weight. These include enamel hypoplasia, narrow high vaulted palate, delayed eruption of teeth, decreased crown dimension and dilacerations.[7]

Tooth eruption is an important event during child's development, and significant deviations from accepted norms of eruption times are often observed in clinical practice, which are a source of concern for parents. Information on tooth eruption also supplements maturity indicators in the diagnosis of certain growth disturbances and in forensic dentistry to estimate the chronological age of children with unknown birth records. Existing literature suggests that standards for tooth emergenceshould be derived from the population in which they are to be applied because factors related to emergence may vary considerably in both dentitions. Therefore, the present study attempted to investigate the relationship between eruption status of the primary teeth, gestational age and birth weight. In the present research, variation in timing of tooth emergence in males and females was also observed.

In this study, eruption status was assessed at 6th, 9th and 12th month interval which coincided with the vaccination schedule. Assessment at intervals of 3 months for the eruption timings has not been reported in the literature before.

In the present study when the preterm infants were examined at 6th month, none of the teeth had erupted in any of the subjects. At 9 months of age presence of mandibular central incisors was noted in 4.8% of the cases and no maxillary central incisors were seen. At 12 months follow-up, mandibular central incisor were erupted in 97.6% of the cases and 2.4% showed presence of lateral incisor along with central incisor.Maxillary central incisors were seen in 11.9%. These findings are in accordance with the studies done by Viscardi et al,[11] Lowoyin et al,[12] Seow and Seow WK et al[14] and Pavivin IS et al [19] who concluded that very low birth weight and shortened gestational age are predictors for later ages of emergence of the first primary tooth.

On examination of full term with low birth weight infants it was observed that at 6thmonth none of the teeth had erupted. At 9 months of age 100% of the infants had mandibular central incisor erupted and 9.1% had maxillary

central incisor present. At 12 months follow-up mandibular central incisor were present in 15.9% of the infants and 84.1% had both central and lateral incisor. In maxillary arch central incisors were seen in 95.5% and central and lateral incisors together were present in 4.5%. Ramos et al [20] and Aktoren et al [21] also suggested similar findings from their studies and concluded that infants with lower birth weight demonstrated significant delayed eruption of the first primary tooth.

In case of full term with normal birth weight children it was observed that at 6th month 23.9% of the infants had mandibular central incisor but presence of maxillary central incisor was not observed in any of the cases. At 9th month, the percentage increased to 100% for mandibular and 83% for maxillary central incisors. At 12th month follow-up only mandibular incisors were present in 21.6% and central incisor along with lateral incisor was observed in 78.4% of cases and in maxillary arch the percentage was 27.3% and 72.7% respectively. In this group it was observed that the earliest primary tooth to emerge in the oral cavity was mandibular central incisor, followed by maxillary central incisor, then maxillary lateral incisor, mandibular lateral incisor and also found delay in eruption of teeth in the study sample. Similar to the present study, Vinod K et al [22] and Kohli MV et al [23] found delay in eruption of teeth in present generation.

12

In this study when samples were stratified according to gender, a non significant relationship was found between the time of eruption of primary teeth for girls and boys. This is in accordance with study conducted by Holman DJ et al [24] who concluded that no difference is seen in emergence of primary teeth in girls and boys. However this result is contradictory to studies conducted byMoreno M et al [25] and Zadzinska E [26] who concluded that primary teeth showed earlier emergence in girls. Studies by Tanguay R et al,[27] GunaShekhar M and Tenny J [28] and Oziegbe EO et al [29] showed earlier emergence in boys. Hence sexual dimorphism of primary tooth emergence is still controversial. This may be due to hereditary and individual factors, such as sex and race, associated with external factors, such as geographic location, socioeconomic status, nutrition, pregnancy problems, and severe maternal illness. These can cause differences in patterns of eruption.

Additionally, this study showed that in general the gestational age strongly affects the time of eruption of teeth. In this series of preterm, low birth weight children and normal birth weight, the average age of eruption of the first primary teeth was 11 months, 10 months and 8 months respectively.

Group		Male	Female
Preterm	N	23	19
	%	54.8	45.2
Full Term with LBW	N	23	21
	%	52.3	47.7
Full Term with NBW	N	52	36
	%	59.1	40.9

Table 1: Gender distributionof study population

Tooth	Groups		6 months (Central Incisor)		Chi Square value	p-value	9 months (Central Incisor)		Chi Square value	p-value	12 months			Chi Square value	p-value
			Absent	Present			Absent	Present			No Teeth	Central Incisor	Lateral Incisor		
Mandibular Incisor	Preterm (N=42)	N	42	0	23.340	<0.001	40	2	163.241	<0.001	0	41	1	81.497	<0.001
		%	100.0	0.0			95.2	4.8			0.0	97.6	2.4		
	Full Term with LBW (N=44)	N	44	0			0	44			0	7	37		
		%	100.0	0.0			0.0	100.0			0.0	15.9	84.1		
	Full Term with NBW (N=88)	N	67	21			0	88			0	19	69		
		%	76.1	23.9			0.0	100.0			0.0	21.6	78.4		
Maxillary Incisor	Preterm (N=42)	N	42	0	-	-	42	0	108.821	<0.001	37	5	0	216.337	<0.001
		%	100.0	0.0			100.0	0.0			88.1	11.9	0.0		
	Full Term with LBW (N=44)	N	44	0			40	4			0	42	2		
		%	100.0	0.0			90.9	9.1			0.0	95.5	4.5		
	Full Term with NBW (N=88)	N	88	0			15	73			0	24	64		
		%	100.0	0.0			17.0	83.0			0.0	27.3	72.7		

Table 2: Distribution of study population according to presence of teeth among the three groups: preterm, full term with LBW and full term with NBW infants at 6 months, 9 months and 12 months.

	Groups		6 months (Central Incisor)		Chi Square value	p-value	9 months (Central Incisor)		Chi Square value	p-value	12 months			Chi Square value	p-value
			Absent	Present			Absent	Present			No Teeth	Central Incisor	Lateral Incisor		
Mandibular Incisor Full Term with NBW (N=88)	Male (N=52)	N	43	9	3.007	0.083	0	52	-	-	0	7	44	4.753	0.029
		%	82.7	17.3			0.0	100.0			0.0	13.7	86.3		
	Female (N=36)	N	24	12			0	36			0	12	24		
		%	66.7	33.3			0.0	100.0			0.0	33.3	66.7		
Maxillary Incisor	Male (N=52)	N	52	0	-	-	11	41	1.517	0.218	0	14	38	0.028	0.866
		%	100.0	0.0			21.2	78.8			0.0	26.9	73.1		
	Female	N	36	0			4	32			0	10	26		

Full Term with NBW (N=88)	(N=36)	%	100.0	0.0			11.1	89.9			0.0	27.8	72.2		

Table 3: Distribution of study population acording to presence of mandibular and maxillary incisors between males and females of the NBW full term infant group at 6 months, 9 months and 12 months.

Conclusions

Thus, from this study conducted on 174 infants the following conclusions can be drawn:

A statistically significant delay in the eruption of first primary tooth was noted among the preterm inafant group as compared to the group with full term infants with NBW.

The time of eruption of the first primary tooth was found to be inversely related to the weight of infant.

There was no significant correlation between gender and time of eruption of primary teeth in full term infants with NBW.

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