Birth-Weight, Pregnancy Term, Pre-Natal and Natal Complications Related to Child's Dental Anomalies

Prokocimer T*/ Amir E**/ Blumer S***/ Peretz B****

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Objectives: *This cross-sectional study was aimed at determining whether certain pre-natal and natal conditions can predict specific dental anomalies. The conditions observed were: low birth-weight, preterm birth, pre-natal & natal complications. The dental anomalies observed were: enamel defects, total number of decayed, missing and filled teeth (total DMFT), disturbances in the tooth shape and disturbances in the number of teeth.* ***Study design:*** *Out of more than 2000 medical files of children aged 2-17 years old which were reviewed, 300 files met the selection criteria. Information recorded from the files included: age, gender, health status (the ASA physical status classification system by the American Society of Anesthesiologists), birth week, birth weight, total DMFT, hypomineralization, abnormal tooth shape, abnormal number of teeth and hypoplasia.* ***Results:*** *Twenty one children out of 300 (7%) were born after a high-risk pregnancy, 25 children (8.3%) were born after high-risk birth, 20 children (6.7%) were born preterm - before week 37, and 29 children (9.7%) were born with a low birth weight (LBW) - 2500 grams or less. A relationship between a preterm birth and LBW to hypomineralization was found. And a relationship between a preterm birth and high-risk pregnancy to abnormal number of teeth was found. No relationship was found between birth (normal/high-risk) and the other parameters inspected.* ***Conclusion****: Preterm birth and LBW may predict hypomineralization in both primary and permanent dentitions. Furthermore, the study demonstrated that preterm birth and high-risk pregnancy may predict abnormal number of teeth in both dentitions.*

Key words: Low birth weight, pregnancy, dental anomalies, caries

INTRODUCTION

Preterm labor is defined as labor occurring after 20 weeks but before 37 week gestation [1].

LBW and preterm birth are associated with some dental effects both in primary and in the permanent dentition [2].

The primary dentition may provide information related to in-utero development, beginning with the central incisors at fifteen to nineteen weeks postmenstrual age and ending with the second molars at twenty to twenty-two weeks [3,4]. Mineralization of the crowns of the entire primary dentition is not complete until about twelve months postnatally [4].

From the Department of Pediatric Dentistry, The Maurice and Gabriela Goldschleger School of Dental Medicine, Tel Aviv University, Tel Aviv, Israel.

*Tair Prokocimer, DMD, Post-graduate student.

**Erica Amir, DMD, Senior Teacher.

***Sigalit Blumer, DMD, Senior Staff Member.

****Benjamin Peretz, DMD, Associate Professor and Head

Send all correspondence to:

Prof. Benjamin Peretz,
Head, Department of Pediatric Dentistry
The Maurice and Gabriela Goldshleger School of Dental Medicine
Tel Aviv University
Tel Aviv 69978
Israel
E-mail: bperetz@post.tau.ac.il

Dental disturbances that are related to these problems:

At birth, even normal changes from intrauterine to extrauterine may have an adverse effect on amelogenesis known as the neonatal line [5]. Any stressful event during birth may lead to metabolic changes in the formation of the enamel and is likely to accentuate this line, resulting in clinically enamel defects [6,7]. Severe infections occurring during amelogenesis may be associated with enamel hypoplasia. The damage may be related to direct cellular damage by the infecting microorganisms, although secondary systemic insults may arise from malfunctions of the major organs affected. The increase in body temperature in many cases of infection may cause ameloblastic derangements [8].

The teeth affected with enamel hypoplasia are those that are at developmentally sensitive stages[9]. In a study which compared children who were born prematurely and in very low birth weight [VLBW] (less than 1500 grams) to children born at term, using light and electron microscope, hypoplasia and thin enamel were more prevalent in the primary teeth of the preterm and VLBW children, as a consequence of less prenatal development [10]. Moreover it was found that enamel hypoplasia increased the risk for dental caries [10,11].

Early infections such as syphilis and rubella as well as cytomegalovirus (CMV) can be associated with enamel hypoplasia in the primary and the permanent dentitions [12,13]. Infections after labor, such as measles, chickenpox, scarlet fever, and severe infections of the respiratory system were found related to enamel hypoplasia [14].

Severe gastroenteritis was found related to enamel defects, but it was not clear whether the reason was the high fever or the malabsorption [15].

Researchers found that hypoplasia was caused as a result of an insult to the ameloblasts in the matrix formation phase, while the opacity or hypocalcification were related to an insult during the late maturation phase [16]. Brogårdh-Roth *et al* showed an increased incidence of molar-incisor hypoplasia (MIH) among LBW children aged 10-12 years old [17].

Developmental enamel defects can affect esthetics and can expose the tooth to dental decay. Rajshekar *et al* found a relationship between preterm born children and LBW and increased risk for caries, compared to children born at term and in normal birth weight [18]. Another research reported a high incidence of dental caries in a group of Afro-American children born preterm [19]. Peretz and Kafka showed that babies born after maternal complications during pregnancy or babies who experience a traumatic birth must be considered to be at risk of developing baby bottle tooth decay (BBTD) when exposed to excessive bottle nursing[20].

Preterm and LBW children were found to have smaller mesio-distal and bucco-lingual cusps: Their cusps were measured 6-11% smaller than children born at term [21].

Diseases such as syphilis, scarlet fever and rickets were also associated with hypodontia, as were nutritional disturbances during pregnancy or infancy. Smoking during pregnancy, maternal medications, irradiation at an early age that may result in glandular and dental dysfunction are also implicated [22].

Our present work aimed to investigate the association between maternal and/or fetal complications during pregnancy/delivery and the occurrence of enamel defects and dental caries in the infant.

MATERIALS AND METHOD

A total of 2000 medical records of children aged 2 to 17 years, who underwent a dental examination at the department of pediatric dentistry in Tel-Aviv University between the years 1990-2012 were reviewed.

The following data was collected from the medical file: age, gender, birth week, birth weight, number of decayed, missing and filled teeth (total dmft/DMFT) in primary and permanent dentitions respectively, enamel defects (hypomineralization or hypoplasia in yes/no manner), abnormal number of teeth (hyperdontia or hypodontia in yes/no manner), abnormal tooth shape (tuberculated, peg shaped, microdontia, macrodontia, germination in yes/no manner).

In addition, information about maternal, fetal and neonatal complications was obtained. The following complications were recorded:

Maternal Complications	Complications due to underlying disease, preeclampsia, premature labor, cesarean delivery
Fetal Complications	Stillbirth, hypoxia and acidosis, malformations
Neonatal Complications	Hypoglycemia, hypocalcemia, hypoxia and acidosis, hypothermia, meconium aspiration syndrome, polycythemia, congenital malformations, sudden infant death syndrome
Long-Term Complications	Lower IQ, learning and behavior problems, major neurologic handicaps (seizure disorders, cerebral palsy, mental retardation), hypertension

A low birth-weight (LBW) infant is any live-born infant weighting 2500 grams or less at birth [1].

There are two further sub-divisions:

- Very low weight (VLBW) denotes a birth weight of less than 1500 grams.
- Extremely low weight (ELBW) denotes a birth weight of less than 1000 grams.

The present study included 300 children out of the initial 2000, whose records allowed all required information to meet the inclusion criterion: healthy children, who do not take medications.

The study was approved by the Helsinki Committee of Tel Aviv University.

Statistical analysis

The collected data were entered and analyzed by SPSS statistical software (Statistical package for the Social Sciences) 15.0 software (SPSS Inc., Chicago, IL, USA) using a number of statistical tests. T-test checked the relationship between birth week, the pregnancy progress, the events during birth, birth weight and the age of the child and total dmft/DMFT. Chi-square checked the proportion of the examined trait (hypomineralization, hypoplasia etc.) between the two groups, and correlations between the total DMFT and the age. The p-value of less 0.05 was considered statistically significant.

RESULTS

The ages of the children included ranged from 2 to17 years (mean 5.66±2.87 years), 139 girls and 161 boys (46.3% and 53.7% respectively). The numbers after the ± represent standard deviation. The experimental group consisted of 69 children out of the 300 who were a part of one or more of the following groups: preterm birth, LBW, high-risk pregnancy and high-risk birth.

- 176 children were under the age of 6 years old, and 124 children were 6 years old and older (41.3% and 58.7% respectively).
- The experimental group was composed of four sub-groups:
- 20 children (6.7%) were born preterm (before week 37). The mean age was 5.99±3.01 years, compared to 5.64±2.86 years in the group of children who were born on time.
- 21 children (7%) were born after high-risk pregnancy. The mean age was 5.95±3.75, compared to 5.64±2.8 years in the group of children who were born after a normal pregnancy.
- 25 children (8.3%) were born after high-risk birth. The mean age was 5.99±3.01 years, compared to 5.64±2.86 years in the group of children born after normal pregnancy.
- 29 children (9.7%) were born LBW (2500 grams or less). The mean age was 5.87±2.56 years, compared to 5.64±2.9 years in the group of children born with normal weight.
- 69 children (23%) were in one group at least (there were children who were in more than one group).
- 231 children (77%) did not belong to any of the test groups.

Tables 1 and 2 show the relationships between nature of pregnancy, nature of birth, birth weight, birth week, and age and total DMFT. No statistical significance was found between the experimental and the control groups.

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Table 3 shows the relationship between hypomineralization, abnormal tooth shape, abnormal number of teeth, hypoplasia and the nature of pregnancy, nature of birth, birth week and birth weight. Hypomineralization was significant more prevalent among children who were born preterm, compared to children born after week 37 (7 children, 35%, and 40 children, 14.5% respectively, p = 0.025). Hypomineralization was also significantly more prevalent among LBW children compared to children who were born with a normal weight (9 children, 31%, and 38 children, 14.3%, respectively, p = 0.03).

There were no statistically significant differences in abnormal tooth shape between children born after a high-risk birth and children born after a high-risk pregnancy, and between children born preterm and among LBW children. Also, there was no significant difference regarding abnormal number of teeth in these groups (there were 9 children found with hypodontia and 6 with hyperdontia), and hypoplasia.

Figures 1-3 provide a graphical illustration to the previous findings. Lines for 95% and 90% differences are shown.

Figure 1 shows a comparison between preterm and normal term birth children regarding hypomineralization, abnormal number of teeth, abnormal tooth shape and hypoplasia. A relationship between a preterm birth and hypomineralization was found. Birth before week 37 may increase the risk for hypomineralization (35% vs. 14.5%, 40/275 children vs. 7/20 children, P=0.025). A marginal significance is demonstrated regarding abnormal number of teeth.

Figure 2 demonstrates a comparison between LBW and normal birth-weight children regarding hypomineralization, hypoplasia and abnormal tooth shape. A significant correlation was found between LBW and hypomineralization: A weight of 2500 grams and less can increase a risk for hypomineralization. (31% vs. 14.3%, 9/29 children vs. 38/266 children, p = 0.03).

Figure 3 demonstrates a comparison between high-risk and normal pregnancy regarding abnormal number of teeth, abnormal tooth shape, hypomineralization and hypoplasia. A marginal correlation was found between high-risk pregnancy and an abnormal number of teeth. A high-risk pregnancy increases the risk for abnormal number of teeth (14.3% vs. 4.3%, 3/21 children vs. 12/277 children).

Table 4 demonstrates the correlation between age and total DMFT. No correlation was found between Total DMFT and age, therefore the incidence of caries did not increase with age.

DISCUSSION

Our study found no statistically significant association between LBW, high-risk pregnancy, high-risk birth, preterm birth and high Total DMFT. This is in line with a previous study which found no differences in the deft of 5 year-old children who were born preterm [23]. This is in contrast to a study that checked the incidence of caries among 1to 6 year-old children, born preterm and LBW compared to children born on time and with normal weight. This study found that preterm LBW children were at higher risk to develop dental caries [18]. Peretz *et al* found that children with early childhood caries (ECC) were more prone to developing future carious lesions compared to children with no ECC in the control group [24]. Hence, if such a difference existed between the two groups in the study, the need to focus on the prevention of this risk group would arise.

Table 1- The relationship between the nature of pregnancy & birth (normal/high-risk) and age and Total DMFT

	Birth	N	Mean	Std.Deviation	Std.Error Mean	P value
	Normal	275	5.5486	2.77296	.16722	
Age (y)	Risk	25	6.8879	3.67820	.75081	0.028
	Normal	274	6.4197	4.90747	.29647	
Total DMFT	Risk	25	6.2083	4.87210	.99451	0.0840
	Pregnancy	**N**	**Mean**	**Std.Deviation**	**Std.Error Mean**	**P value**
Age (y)	Normal	279	5.6389	2.79796	.16751	0.635
	Risk	21	5.9481	3.74977	.81827	
Total DMFT	Normal	278	6.4245	4.93566	.29602	0.800
	Risk	21	6.1429	4.31608	.94185	

Table 2- The relationship between birth weight (normal/low), birth week (normal/preterm) and age and Total DMFT

		N	Mean	Std. Deviation	Std. Error Mean	P value
Birth Weight						
Age (y)	Normal	271	5.6378	2.90277	.17633	0.675
	Low	29	5.8731	2.55614	.47466	
Total DMFT	Normal	271	6.4354	4.90752	.29811	0.736
	Low	28	6.1071	4.77912	.90317	
Birth Week						
Age (y)	Normal	280	5.6366	2.86192	.17103	0.590
	Preterm	20	5.9955	3.00746	.67249	
Total DMFT	Normal	279	6.3656	4.93654	.29554	0.606
	Preterm	20	6.9500	4.23612	.94723	

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Table 3- The relationship between hypomineralization, abnormal tooth shape, abnormal number of teeth and hypoplasia, and the nature of pregnancy, nature of birth, birth week and birth weight (Chi-square analysis).

		Children without	Children with	Total	p-value
Hypomineralization					
Pregnancy	Normal	232 (84.7%)	42 (15.3%)	274 (100%)	**0.349**
	Risk	16 (76.2%)	5 (23.8%)	21 (100%)	
Birth	Normal	228 (84.4%)	42 (15.6%)	270 (100%)	**0.568**
	Risk	20 (80%)	5 (20%)	25 (100%)	
Birth week	Normal	235 (85.5%)	40 (14.5%)	275 (100%)	**0.025**
	Preterm	13 (65%)	7 (35%)	20 (100%)	
Birth weight	Normal	228 (85.7%)	38 (14.3%)	266 (100%)	**0.030**
	Low	20 (69%)	9 (31%)	29 (100%)	
Abnormal tooth shape					
Pregnancy	Normal	266 (97.1%)	8 (2.9%)	274 (100%)	**0.154**
	Risk	19 (90.5%)	2 (9.5%)	21 (100%)	
Birth	Normal	260 (96.3%)	10 (3.7%)	270 (100%)	**1**
	Risk	25 (100%)	0 (0%)	25 (100%)	
Birth week	Normal	266 (96.7%)	9 (3.3%)	275 (100%)	**0.510**
	Preterm	19 (95%)	1 (5%)	20 (100%)	
Birth weight	Normal	257 (96.6%)	9 (3.4%)	266 (100%)	**1**
	Low	28 (96.6%)	1 (3.4%)		
Abnormal Number of Teeth					
Pregnancy	Normal	265 (95.7%)	12 (4.3%)	277 (100%)	**0.079**
	Risk	18 (85.7%)	3 (14.3%)	21 (100%)	
Birth	Normal	260 (96.7%)	9 (3.3%)	269 (100%)	**1**
	Risk	24 (100%)	0 (0%)	24 (100%)	
Birth week	Normal	266 (95.7%)	12 (4.3%)	278 (100%)	**0.070**
	Preterm	17 (85%)	3 (15%)	20 (100%)	
Birth weight	Normal	256 (95.2%)	13 (4.8%)	269 (100%)	0.647
	Low	27 (93.1%)	2 (6.9%)	29 (100%)	
Hypoplasia					
Pregnancy	Normal	231 (84%)	44 (16%)	275 (100%)	**1**
	Risk	18 (85.7%)	3 (14.3%)	21 (100%)	
Birth	Normal	230 (84.9%)	41 (15.1%)	271 (100%)	**0.254**
	Risk	19 (76%)	6 (24%)	25 (100%)	
Birth week	Normal	233 (84.4%)	43 (15.6%)	276 (100%)	**0.536**
	Preterm	16 (80%)	4 (20%)	20 (100%)	
Birth weight	Normal	227 (85%)	40 (15%)	267 (100%)	**0.191**
	Low	22 (75.9%)	7 (24.1%)	29 (100%)	

Table 4 – The correlation between age and total DMFT- no correlation found.

		Total DMFT	Age
Total DMFT	Pearson correlation	1	.086
	Sig. (2-tailed)		.138
	N	299	299

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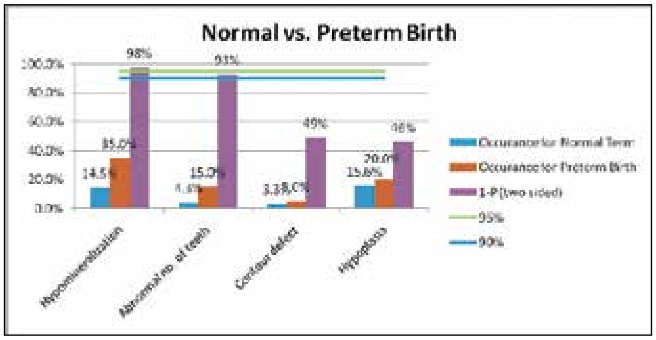
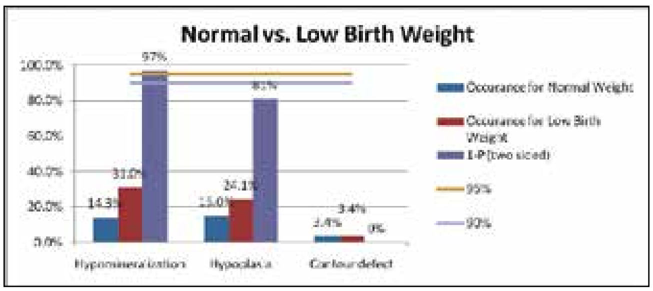
Figure 1: A comparison between preterm and normal term birth children regarding hypomineralization, abnormal number of teeth, contour defects* and hypoplasia (Chi-square).



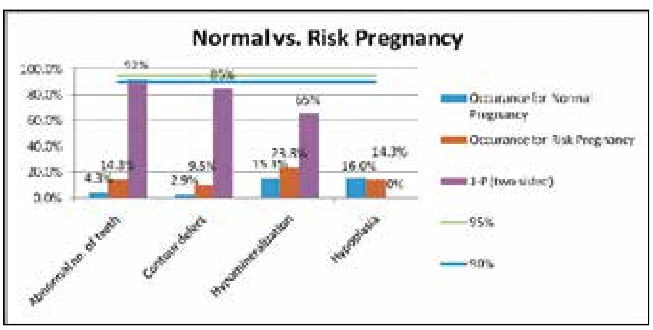
* "contour defect" represents abnormal tooth shape.

Figure 2: A comparison between LBW and normal birth-weight children regarding hypomineralization, hypoplasia and contour defects* (Chi-square).



* "contour defect" represents abnormal tooth shape.

Figure 3: A comparison between high-risk and normal pregnancy regarding abnormal number of teeth, contour defects*, hypomineralization and hypoplasia (Chi-square).



* "contour defect" represents abnormal tooth shape.

Statistical association was found between LBW (2500 grams or less) and high incidence of hypomineralization (31%). Additionally, statistical significance was found between preterm birth (before week 37) and high incidence of teeth hypomineralization (35%). This is in line with a study among 9 to11 year-old children: This study found enamel defects in the teeth of 36% of children born at term, compared to 84% of the children born preterm [25]. Another study about children born preterm and VLBW showed significantly high incidence of enamel defects in first permanent molars (21% in VLBW children compared to 11% in children born with normal weight) and lateral incisors (12% in VLBW children compared to 0% in children born with normal weight). The severity of enamel defects was higher as the pregnancy term decreased and as the birth weight was lower [26].

It is not surprising that preterm birth and LBW are found both related to hypomineralization. LBW is either caused by preterm birth or the infant being small for gestational or a combination of both. Both conditions may influence the development of the teeth [20].

In this study, hypodontia was more prevalent than hyperdontia. This is in line with the literature, where hypodontia is a more common finding, and the incidence in the permanent dentition is 3.5%-8%. Hypodontia is more common in females (1.5:1) and is less common in primary teeth (less than 1%) [27]. The prevalence of hyperdontia in the permanent dentition is 1% - 4%, and 0.2%–1.9% in primary dentition [28]. Abnormal number of teeth has a hereditary component, but there is also some evidence for viral infections and harmful events in the first trimester of pregnancy causing such anomalies [29]. Evans showed three cases of hypodontia in children that their mother had rubella in the first trimester[30]. Thoma suggested that scarlet fever among pregnant women could cause hypodontia [31]. Eidelman *et al* found the prevalence of hypodontia among 12-18 year-old Israelis to be 4.6% [32].

In our study, there was no statistical difference in the prevalence of hypoplasia found between the experimental and the control group. This is in contrast to studies showing that VLBW children demonstrated higher prevalence of hypoplasia [10, 11]. The reason for the difference could be related to differences in the inclusion criteria.

No association was found between LBW, high-risk pregnancy, high-risk birth, preterm birth and abnormal tooth shape. This is in contrast to a previous report which found that LBW and mother's health problems during pregnancy were related to primary teeth with small dimensions[33]. In our study, efforts to separate between the findings of the primary and permanent teeth were made, but unfortunately there was little information about primary teeth. Due to limited sample size, it was decided to focus on both phenomena without distinguishing between the two groups.

Our study faces a limitation: the small number of patients. This may have skewed the findings, and may account for the differences between our findings and other reports. Further studies on larger populations are needed to better understand the phenomena. Nevertheless, our findings may pour some light on an unanswered question regarding birth-weight, pregnancy term, pre-natal and natal complications and child's developmental disturbances and dental disease.

CONCLUSION

The present study demonstrated that preterm birth and LBW may, to some extent, predict hypomineralization in both primary and permanent dentitions. Furthermore, the study demonstrated that preterm birth and high-risk pregnancy may predict abnormal number of teeth in both dentitions.

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