Original Research Article

Dental changes in children undergoing orotracheal intubation: A longitudinal study

ABSTRACT

Aims: The aim of this study was to investigate the relationship between prolonged orotracheal intubation and the onset of oral abnormalities, such as dental enamel defects, in preterm infants.
Study design: This was an observational, prospective and analytical cohort study.
Place and Duration of Study: This study was conducted at the Neonatal Intensive Care Unit of University Hospital of Western Paraná (HUOP). The study was performed between December 2022 and July 2024.
Methodology: This was a prospective observational cohort study of 26 preterm infants, of whom 61.5% were boys and 38.5% were girls. The mean gestational age was 30.4 weeks, and the mean birth weight was 1,420.2 g. The infants were clinically monitored until eruption of the deciduous teeth, and data on neonatal factors, such as the time of intubation, and maternal factors, such as the type of delivery, were collected.
Results: Statistical analysis revealed that 26.9% of the babies had enamel defects, which affected mainly the maxillary incisors. There was a significant correlation between lower birth weight and longer duration of intubation, suggesting that lower birth weight babies tend to require longer ventilatory support, increasing the risk of enamel defects.
Conclusion: Prolonged intubation is a relevant factor for the development of dental abnormalities in preterm infants, highlighting the importance of early dental follow-up to prevent complications. Despite these limitations, such as the small sample size and the lack of standardized diagnostic criteria for these defects, further studies are suggested to deepen the understanding and improve preventive strategies for these children.

Keywords: Infant, premature; Intubation, intratracheal; Developmental defects of enamel; Pediatric dentistry.

1. INTRODUCTION

Newborns in critical condition face high risks of complications and mortality due to early termination of pregnancy, the immaturity of organs and difficulties in adapting to life outside the uterus.(Kusahara et al., 2020) These conditions impact child development, making the survival of these babies a challenge for neonatology and other areas of health.(Blackwood et al., 2021) In recent years, technologies in neonatal intensive care have significantly improved perinatal care, increasing the chances of the survival of these babies.(Rufach et al., 2021)

Orotracheal intubation (OTI) and mechanical ventilation (MV) are essential methods to aid breathing and reduce the morbidity and mortality of critically ill newborns. OTI is performed

quickly by inserting a tube into the trachea to facilitate MV.(Kumar et al., 2021) The success of this method requires appropriate equipment and precision to avoid excessive pressure on oral structures.(Apfelbaum et al., 2022)

However, dental studies indicate that OI may be a risk factor for oral problems such as enamel defects, palate changes and malocclusion.(Chinnappa & Ambareen, 2014; Kim et al., 2019) Thus, the role of pediatric dentists in ICUs, together with multidisciplinary teams, is essential for identifying and minimizing oral risks in vulnerable newborns.(Johnstone et al., 2010). Despite the importance of such care, few studies have comprehensively addressed the impacts of OI on dental development, especially in settings such as the University Hospital (HUOP) of UNIOESTE. The aim of this study is to fill this gap in knowledge and providing information to improve clinical practices and health policies aimed at the prevention and treatment of dental complications in neonates.

2. MATERIAL AND METHODS

2.1 Study design and Ethical aspects

This was an observational, prospective, and analytical cohort study. The research was approved by the Ethics Committee for Research on Human Beings of HUOP/UNIOESTE with opinion number 6.584.962, according to Resolution 466/12 of the National Health Council/MS, of December 12, 2012, which provides for the ethical aspects of research involving humans. The study was conducted between December 2022 to July 2024, and the approach was performed exclusively by the researcher, who has extensive experience in pediatric ICUs. Before the patients were approached, parents and guardians were informed about the purpose, participation and procedures to be performed. Initially, they received the necessary information about the study and its objectives, and if they agreed, they voluntarily signed the informed consent form that would meet all the fundamental ethical and scientific requirements of Resolution 462/2012 of the National Health Council. After approval of the study, the patients were selected according to the eligibility criteria.

2.2 Eligibility criteria

The sample included all children who received orotracheal intubation in the first month of life (neonatal period) and were admitted to the neonatal ICU of HUOP, and their parents or guardians signed the informed consent form and did not have negative attitudes with regard to the performance of the study. The exclusion criteria were as follows: children diagnosed with genetic syndromes or orofacial disorders; children intubated after the neonatal period; children admitted to this service but not intubated; children with tooth loss due to traumatic injuries and/or caries lesions; or children whose parents or guardians did not sign the informed consent form.

2.3 Catalog sheet and clinical examination

A catalog form was prepared to record data through anamnesis and clinical examination records, with data from the NB and the parents. The newborn data included sex (1-male; 2-female), race (1-white; 2-black; 3-brown; 4-yellow; 5-indigenous), weight and prematurity.

When the patients were intubated, they were followed once a week until discharge from the NICU. After discharge from the neonatal intensive care unit (NICU), the patient was examined at birth and after full eruption of all deciduous maxillary and mandibular incisors.

The clinical examination was performed exclusively by the researcher accompanied by a note-taker. Both wore mandatory PPE and followed biosafety standards. The newborns were attended at the Center for Attention and Research on Craniofacial Anomalies (CEAPAC) of the HUOP. They were examined seated in a dental chair in the dental sector of the CEAPAC. The examination was performed in accordance with the following system: lips, gums, palate (hard and soft), tongue, oropharynx, floor of the mouth and teeth, with the aid of a dental mirror under artificial light (reflector). Visual inspection was performed to determine the absence of dental sequelae. The exam was performed clockwise, starting from 52 to 62 and then from 72 to 82.

During the entire study period, the legal guardians received instructions with regard to oral hygiene (for themselves and the baby). The children identified as having oral abnormalities and/or in need of treatment and who were not the object of this study were referred to the Integrated Children's Clinic of the Undergraduate Dentistry Course of UNIOESTE or to the UBSs of the city of origin.

2.4 Training and calibration

In the training, details about the process of identification of the participants and the approach for conducting the anamnesis and analysis of medical records, codes and criteria for the clinical examination were addressed. To avoid intraexaminer disagreement, a single pediatric dentist (FCH) was responsible for the oral exams. The annotator was unique and trained. The examiner was considered reproducible after having a percentage of agreement considered substantial or almost perfect, i.e., a kappa coefficient or intraclass correlation coefficient above 0.60. (World Health Organization (WHO), 1993)

2.5 Statistical planning

All the data collected were checked by the researcher and tabulated in a Microsoft Excel spreadsheet (2010). Statistical analyses were performed via Jamovi software, version 1.2 (The jamovi project (2022). jamovi. (version 2.3) [Computer Software], which was retrieved from https://www.jamovi.org.

2.6 Research venues

The epidemiological data were collected from electronic medical records, and the clinical examination of the selected group of patients was performed at the neonatal ICU of HUOP and later at the Dental Clinic of CEAPAC, a center attached to the HUOP.

3. RESULTS

The collected data were stored in Excel tables (Microsoft, Excel, 2016®□). The following statistical treatment was performed on the data:

a) The distribution patterns of the quantitative data were evaluated via the Shapiro–Wilk test. Once this assumption was met, Pearson's correlation was performed. Correlations were considered statistically significant at the 5% level ($p<0.05$).

b) Qualitative data are presented in terms of absolute and percentage frequencies.

The sample consisted of 26 newborns, of which 61.5% were male and 38.5% female (Table 1).The discussion should not repeat the results, but provide detailed interpretation of data. This should interpret the significance of the findings of the work. Citations should be given in support of the findings. The results and discussion part can also be described as separate, if appropriate.

Table 1. Frequencies of sex of babies included in the study

SEX	Counts	% of Total	% accumulated
F	10	38.5%	38.5%
M	16	61.5%	61.5%

The mean gestational age of the newborns was 30.4 ± 3.1 weeks, with a mean birth weight of 1,420.2 ± 511.9 g. The mean period of intubation was 25.7 ± 25.5 days (Table 2).

Table 2. Data regarding gestational age, week in which the mother developed the disease, birth weight and period of intubation of the baby

	Gestational age	Gestational week at disease onset	Weight	Intubation period (days)
No.	26	17	26	26
Mean	30.385	24.118	1420.192	25.731
Standard deviation	3.125	11.056	511.923	25.452

There was a positive correlation between gestational age and infant birth weight ($r = 0.748$, $p < 0.001$). These findings suggest that the greater the gestational age is, the greater the birth weight, which is in agreement with the literature on fetal development.

There was no correlation between the gestational period in which the mother contracted any disease and the weight of the baby ($r = -0.045$, $p = 0.862$). This lack of correlation indicates that, within the sample, the presence of gestational diseases did not directly affect birth weight.

With respect to prenatal care, all mothers (100%) underwent the necessary follow-up, and most deliveries were by cesarean section (65.4%), whereas 34.6% were normal deliveries (Table 3).

Table 3. Data regarding the type of delivery of the babies included in the sample

TYPE OF BIRTH	Counts	% of Total	% accumulated
cesarean	17	65.4 %	65.4 %

TYPE OF BIRTH	Counts	% of Total	% accumulated
normal	9	34.6 %	100.0 %

Regarding the causes of preterm birth, the main factors identified were preeclampsia (19.2%), gestational diabetes (15.4%), and water rupture (7.7%). However, several other causes were responsible for prematurity, as shown in Table 4.

Table 4. Frequencies of causes of preterm birth

CAUSE PREMATURE LABOR	Counts	% of Total	% accumulated
broken bag	2	7.7 %	7.7 %
contractions	2	7.7 %	15.4 %
gestational diabetes	**4**	**15.4 %**	**30.8 %**
high-risk pregnancy	1	3.8 %	34.6 %
hypertension	2	7.7 %	42.3 %
hypertension, preeclampsia	1	3.8 %	46.2 %
urinary tract infection	1	3.8 %	50.0 %
do not know	2	7.7 %	57.7 %
preeclampsia	**5**	**19.2 %**	**76.9 %**
risk of miscarriage	1	3.8 %	80.8 %
rupture of membranes	**2**	**7.7 %**	**88.5 %**
fetal distress	1	3.8 %	92.3 %
pains	2	7.7 %	100.0 %

There was no significant predominance of gestational complications between the groups, with the most prevalent diseases being hypertension and preeclampsia (11.5%), followed by gestational diabetes (11.5%) and urinary tract infection (7.7%). Notably, 23.10% of the pregnant women did not experience any complications during pregnancy. All diseases and complications reported are expressed as percentages in Table 5.

Table 5. Percentages of diseases and complications presented by mothers during pregnancy

Diseases and complications	Percentage
preeclampsia	**11.50%**
gestational diabetes	**11.50%**
Hypothyroidism	3.80%

Diseases and complications	Percentage
Low blood pressure	3.80%
Vaginal candidiasis	3.80%
Severe scoliosis	3.80%
Urinary tract infection	**7.70%**
Syphilis and anemia, treated	3.80%
Depression	3.80%
Hypertension	**11.50%**
Fibroid	3.80%
Diabetes and hypertension	3.80%
No complications	**23.10%**

A total of 76.9% of the mothers reported using medication during pregnancy, 46.2% were unable to inform exactly which gestational period the medication was used, and the mean gestational period in which the medication was used was 25 ± 6.73 weeks. None of the mothers used systemic fluoride during pregnancy. The pharmacological classes varied greatly, as shown in Table 6.

Table 6. Frequencies of medications used by mothers during pregnancy

Which medications	Counts	% of Total	% accumulated
Aas, methyldopa, calcium, clobazam, leviraticetam, carbomazipine	1	3.8 %	3.8 %
Methyldopa, Puran T4	1	3.8 %	7.7 %
Puran T4	1	3.8 %	11.5 %
amoxicillin	1	3.8 %	15.4 %
antibiotic	1	3.8 %	19.2 %
benzethacyl/ferrous sulfate	1	3.8 %	23.1 %
insulin	1	3.8 %	26.9 %
methyldopa, magnesium sulfate, hydralazine	1	3.8 %	30.8 %
methyldopa/antibiotic	1	3.8 %	34.6 %
did not use	2	7.7 %	42.3 %
not included	4	15.4 %	57.7 %
paracetamol	1	3.8 %	61.5 %
to hold the baby	1	3.8 %	65.4 %
rapilex, paracetamol, insomnia medication	1	3.8 %	69.2 %
sertraline/ferrous sulfate	2	7.7 %	76.9 %
ferrous sulfate	2	7.7 %	84.6 %

Which medications	Counts	% of Total	% accumulated
vitamins	1	3.8 %	88.5 %
folic acid/vitamin complex	1	3.8 %	92.3 %
methyldopa	2	7.7 %	100.0 %

A total of 76.9% of the mothers reported using medication during pregnancy, 46.2% were There was a negative correlation between the gestational period of medication use and the duration of neonatal intubation ($r = -0.705$, $p < 0.001$). This result may indicate that the use of medication during pregnancy is associated with a lower need for prolonged intubation in the baby.

Among the newborns evaluated, the most prevalent neonatal complications were respiratory distress syndrome, which affected 50% of the sample, and prematurity associated with the hyaline membrane and perinatal infection in 7.7% of the cases (Table 7). Most children (80.8%) used antibiotics during the neonatal period (Table 8).

Table 7. Frequencies of prematurity and other neonatal complications presented by the evaluated babies.

Prematurity and others	Counts	% of Total	% accumulated
Prematurity + Hyaline Membrane	1	3.8 %	3.8 %
Prematurity + Hyaline Membrane + Respiratory distress syndrome	1	3.8 %	7.7 %

Prematurity and others	Counts	% of Total	% accumulated
Respiratory distress syndrome	4	15.4 %	23.1 %
does not refer	1	3.8 %	26.9 %
plagiocephaly	1	3.8 %	30.8 %
prematurity	1	3.8 %	34.6 %
prematurity + CPA at birth	1	3.8 %	38.5 %
prematurity + respiratory distress syndrome	3	11.5 %	50.0 %
prematurity + neonatal anoxia + respiratory distress syndrome	1	3.8 %	53.8 %
prematurity + severe neonatal anoxia + respiratory distress syndrome	1	3.8 %	57.7 %
prematurity/Respiratory distress syndrome	1	3.8 %	61.5 %
extreme prematurity + respiratory distress syndrome	1	3.8 %	65.4 %
extreme prematurity	1	3.8 %	69.2 %
extreme prematurity + respiratory distress syndrome	1	3.8 %	73.1 %
extreme prematurity + hyaline membrane + respiratory distress syndrome	1	3.8 %	76.9 %
extreme prematurity + hyaline membrane	1	3.8 %	80.8 %
prematurity, respiratory distress syndrome, Hyaline membrane, Perinatal infection, meningitis, chorioamnionitis	1	3.8 %	84.6 %
fetal distress	1	3.8 %	88.5 %
treated congenital syphilis	1	3.8 %	92.3 %
respiratory distress syndrome + hyaline membrane + preterm NB	1	3.8 %	96.2 %
respiratory distress syndrome of the newborn	1	3.8 %	100.0 %

Table 8. Antibiotic use

ANTIBIOTIC USE	Counts	% of Total	% accumulated
No	5	19.2 %	19.2 %
Yes	21	80.8 %	100.0 %

The correlations between the variables indicated that the duration of intubation was inversely correlated with birth weight (r=-0.477; p=0.014), suggesting that newborns with lower birth weights tend to require longer periods of intubation. In addition, gestational age was positively correlated with weight (r=0.748; p<0.001), which reflects the impact of prematurity on neonatal parameters (Table 09).

Table 9. Correlation between variables

		Gestational Age	Gestation period when the comorbidity occurred (Weeks)	In which period (Weeks)	Gestational period when the medication was use (Weeks)	Weight	Intubation period (Days)
Gestational age	Pearson's R gl p-value N						
Gestation period when the comorbidity occurred (Weeks)	Pearson's R gl p-value N	-0.055 15 0.833 17					
In which period (Weeks)	Pearson's R gl p-value N	0.760 8 0.011 10	0.352 7 0.353 9				
Gestational period when the medication was used (Weeks)	Pearson's R gl p-value N	-0.247 8 0.492 10	0.055 8 0.881 10	0.226 5 0.627 7			
Weight	Pearson's R gl p-value N	0.748 24 0.001 26	-0.045 15 0.862 17	0.443 8 0.200 10	0.083 8 0.819 10		
Intubation period	Pearson's R	-0.705	-0.018	-0.491	-0.028	-0.477	

(Days)	gl	24	15	8	8	24
	p-value	0.001	0.946	0.150	0.938	0.014
	N	26	17	10	10	26

With respect to enamel developmental defects (DDEs), 26.9% of the children presented dental alterations, with the maxillary incisors being the most affected. The children who presented with EDD had an average of two teeth affected, where most defects were observed in the maxillary central incisors. There was no statistically significant association between the use of antimicrobials by mothers and the occurrence of EDD in preterm infants (p=0.147).

4. DISCUSSION

Orotracheal intubation and changes in the dental enamel of newborns represent extremely important fields in pediatric dentistry; however, they are still rarely explored in the scientific literature. The lack of studies that directly address this topic highlights the urgent need for investigations that can clarify the impacts of this medical practice on dental development. Although orotracheal intubation is a widely used practice in neonatal intensive care units, especially in preterm infants and those requiring prolonged respiratory support, its effects on the development of dental tissues have been neglected as etiological factors of orofacial and dental changes. Available studies focus mostly on the systemic impacts of intubation, whereas potential dental damage, especially damage that occurs before the eruption of deciduous teeth, is still poorly investigated and undervalued.(Guisso et al., 2022; Sousa et al., 2022)

Therefore, there is a clear need to expand the knowledge and awareness of the orofacial impacts of orotracheal intubation, considering that this practice affects a significant population of newborns. The neglect of these changes can have consequences that go beyond aesthetics, influencing quality of life, having a negative emotional impact and compromising the social development of children. The increase in the number of studies addressing this topic will contribute to the creation of more effective preventive and therapeutic protocols aligned with the demands of this specific. (Melo et al., 2022; Miranda et al., 2021)

Developmental enamel defects, when associated with prolonged orotracheal intubation, can have considerable impacts on children's oral health and quality of life. Low birth weight and the use of mechanical ventilation are among the risk factors that can impair dental and orofacial development.(Cortines & Costa, 2016) Thus, the study is justified by the gap in the subject and the importance of investigating these changes to alert medical and dental teams about the risks involved, preventing and early treatment of these conditions when identified.

The study sample consisted of 26 preterm infants, of which 61.5% were males and 38.5% were females, with a mean gestational age of 30.4 ± 3.1 weeks (Table 2). The mean birth weight was 1,420.2 ± 511.9 g, reflecting the low weight pattern common in extremely preterm infants.(Merglova & Dort, 2020; Nascimento et al., 2024) Regarding the period of intubation, a mean of 25.7 ± 25.5 days was observed, indicating the need for prolonged ventilatory support in a significant part of the sample.

During the gestational period, 100% of the mothers who participated in the study underwent prenatal care. Preterm birth has a multifactorial origin and may be related to both the fetus, in cases of congenital malformations, and the pregnant woman. Maternal factors include the

consumption of alcohol, tobacco, illegal drugs, and liver disease, in addition to conditions such as placental abruption, preeclampsia, intra-amniotic infection, twin pregnancy, intrauterine growth restriction, bacterial colonization of the cervical canal, bleeding, and maternal age less than 17 years or more than 34 years.(Brandi et al., 2020) In the present study, the main causes of preterm birth were preeclampsia (19.2%) and gestational diabetes (15.4%), which are risk factors commonly reported in the literature.(Ferri et al., 2021) These results differ from previous studies that reported that the main causes of preterm birth were idiopathic, with 60% of children requiring OTI.(de Oliveira Melo et al., 2014; Passini et al., 2014) These factors reinforce the need for continuous monitoring of these mothers and their newborns, as these conditions are associated with neonatal and dental complications.

The results of this study indicated that 26.9% of the newborns had EDDs. These findings corroborate previous studies who reported that the prevalence of EDD varied between 13% and 45% in premature populations, (Halperson et al., 2022) and a systematic review that showed a positive association between preterm birth and the presence of enamel development defects.(Xu et al., 2022) A prolonged duration of intubation was correlated with birth weight ($r=-0.477$; $p=0.014$), suggesting that lower-weight infants tend to require longer periods of ventilation, increasing the risk of EDD. The teeth most affected by DDE in this study were maxillary incisors.(Park et al., 2024)

Studies have shown an association between medication use during pregnancy and the occurrence of EDD.(Bhatti et al., 2022; Collignon et al., 2022; Schüler et al., 2018) This condition was not observed in the present study because there was no significant correlation between the use of antimicrobials and the presence of EDD in the study population. This fact can be justified considering the variations in the various types of drugs used, as well as the lack of standardization in the reviewed studies. However, the high prevalence of antibiotic use among the studied neonates reveals the need for multiple independent investigations into the impact of these drugs on odontogenesis.

The results of this study reinforce the importance of the knowledge that pediatric dentists must have regarding the risks associated with orotracheal intubation in preterm infants, especially with respect to the development of EDDs. In addition to planning preventive care, pediatric dentists should advise medical teams and families about the possibility of dental changes resulting from intubation and prematurity. These interventions can minimize the aesthetic and functional impact of these changes, ensuring healthier oral development.

One of the main limitations of this study was the small sample size, which may have limited the detection of some significant associations. In addition, the absence of standardized criteria for the diagnosis of EDD in intubated children may have hindered the uniformity of findings. Another difficulty faced was the early diagnosis of EDD, which requires continuous and specialized follow-up and is not always available in clinical settings.

However, this study has relevant potential and is one of the first longitudinal investigations into the relationship between orotracheal intubation and enamel defects in preterm infants. The continuation of this work may contribute to the development of new preventive and therapeutic strategies, in addition to offering support for the creation of interdisciplinary protocols aimed at improving the oral health of this vulnerable population.

5. CONCLUSION

The results obtained in the study population revealed a significant association between prolonged orotracheal intubation and the development of dental enamel defects and indicated that prolonged use of antibiotics in the neonatal period was not correlated with

dental development disorders. It is important to emphasize the importance of the dentist's knowledge about the possible orofacial changes produced by orotracheal intubation, as well as the implementation of multidisciplinary care aimed at this target audience.

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