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Impact of delivery mode on oral health

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ABSTRACT

The route of delivery influences the gut microbiota and the development of the immune system. At the moment of birth, cesarean section infants have a lower diversity of bacteria when compared to naturally born infants. The delivery mode does influence the oral cavity colonization of infants, but there is no relevant association with dental caries.

Keywords: delivery mode, cesarean, vaginal pregnancy, oral health, caries, microbioma

INTRODUCTION

The oral health and microbiome of the mother during pregnancy influence the fetus. The mother's periodontal disease increases the risk of preterm birth or preeclampsia or a low-weight birth of the infant [1]. The route of birth delivery and breastfeeding are important factors that impact the oral health of infants.

Compared to natural vaginal birth, infants born by cesarean section show a higher risk for disorders such as diabetes, obesity, and asthma. This is because their gut microbiota presents a lower diversity [2]. The infant delivered by natural birth inherits from the mother's intestinal flora in a percentage of 40% of gut microflora [3]. The colonization of the gut is a progressive and dynamic process that develops during life and follows a successive pattern.

During vaginal birth, the newborn takes over the component of the maternal microbiome to colonize the intestine.

A study of three-month-old infants born vaginally showed an increased density of bacterial taxa in their oral microflora. The baby's oral microflora is dependent on the way of birth, this can be modified by way of feeding or the use of the pacifier. In order not to have disturbing factors, the time of harvest immediately after birth is essential. Unlike newborns in the vaginal birth group, who have a flora consisting of Bacteroidetes, Firmicutes, and Actinobacteria, those born by cesarean section have Bacteroidetes, Firmicutes, and Proteobacteria. Compared to those born by cesarean section, the characteristic vaginal flora of newborns showed more Actinobacteria and Firmicutes and fewer Bacteroids and Proteobacteria [4].

The intestinal microbiome of infants born by cesarean section is less diverse, and as a result, there is a predisposition to developing in adulthood a number of diseases such as obesity, diabetes, celiac disease, and asthma. In order to reduce this risk, it is necessary the contact at birth with the maternal

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vaginal flora made by vaginal birth, with repercussions on the development of the immune system of these newborns [4,5].

Exposure to bacteria during delivery influences the microbiota of the infant. The natural delivery favors the contamination with the mother's vaginal and fecal bacteria different to the cesarean section where tegumentary bacteria and hospital environment is contacted [6]. The decreased variability of the microbial flora after the caesarian section persists for the first 7 years [6].

Dominguez-Bello et al. shown that microbes from the maternal vaginal area can be partially restored at birth in children born by cesarean section [7].

K. Pattanaporn et al., analyzing the early childhood caries in 350 Thai children, determined that a higher risk of *Streptococcus mutans* colonization in children was associated with mothers with high *Streptococcus mutans* or vaginal delivery [8].

For infants, the main factors that influence oral health are the medical history and parents' knowledge, feeding habits, attitude, and oral hygiene practice [9].

THE COLONIZATION OF INFANT'S MICROBIOTA

In the prenatal stage of microbiome achievement, the maternal microbes shape the epithelial and the innate immunity [1].

Pregnancy hormones permit oral bacteria or fragments to pass to the placenta directly or be transported by mothers' immune cells. The mother microbiota does not enter the fetus, but it educates the immune system for the last contact with bacteria [1]. The gut microbiota of infants is dominated by 5 phyla: Actinobacteria, Bacteroidetes, Firmicutes, Proteobacteria, and Verrucomicrobia [10]. The intestinal microbial flora plays an important role in the training and development of immunity. The gut-associated lymphoid tissue develops in parallel with gut microbiota. In the fetal intestine, the presence of 60 Peyer plaques was determined before week 30 of gestation, and they increase in number and enlarge in time, mainly after birth when the exposure to bacteria is significant [11]. Reduced diversity of gut microbial flora and a decreased number of Bifidobacterium and Lactobacillus are factors that increase the allergy risk and are associated with eczema and atopy in infants [1,12].

A recent integrative review investigated the influence of the route of delivery and microbiota in infants [1]. In natural-born infants, the microbiota is close to their mother's vaginal flora and have an increased number of Bacteroides, Bifidobacterium, and Lactobacillus species. In cesarean delivered infants in the first days of life, the microbiome contains a smaller variety of bacteria, such as Staphylococcus, Streptococcus and Clostridium species. When comparing the elective and emergency cesarean sections, the infants delivered by emergency interventions have similar microbiota to vaginally newborns [1].

The difference between oral microbiota related to the delivery modes are evident in the first 3-8 months of life, are still noticed at the age of 4-5 years and disappear at 7 years [1].

The vaginal delivery permits the vertical transmission of bacteria from the birth canal to the infant oral cavity, a higher number of immune cells and cytokines. In contrast, by the cesarean section, the microorganism exposure is reduced. Also, the natural delivery favors higher levels of stress hormones that influence the metabolism, blood pressure, thermoregulation, and even breastfeeding and the appetite for the first days compared to neonates delivered by cesarean section [1].

The colostrum content varies depending on the delivery mode. After a vaginal delivery, it has a higher antioxidative capacity and protein content [1]. In addition, the breast-feed components modulate the infant gut and oral microbiome.

The results of a study that compared the saliva microbiota at 2 days of age determined that in cesarean section - delivered infants, the bacteria count and the prevalence of species were lowered compared to the saliva of natural delivered children [13].

After birth, the infant's microbiome is enlarged by direct contact with the mother's skin and breastfeeding. Newborns born vaginally borrow from the mother's vaginal flora, while cesarean birth will cause a flora similar to that of the mother's skin [14]. Exclusively breast-fed infants have a reduced gut microbiome diversity, an increased quantity of Staphylococcus, Streptococcus, and Bifidobacterium [10].

Wilson et al showed that oral administration of maternal vaginal microbes did not cause a change in the intestinal microbiome of infants born by cesarean section. Transplantation of the maternal microbiota in infants born by cesarean section with immune deficiency requires maximum caution [15].

The delivery route, maternal health, diet and antibiotics, birth weight, gestational age at birth, breastfeeding or the feeding formula, genetic factors have consequences on the development of the infant gut microbiome. Other possible factors that may influence the baby's microbiome would be: the administration of probiotics and the intrapartum use of antibiotics [16].

INFANT ORAL MICROBIOTA

The first inoculation of oral bacteria is in connection with the birth moment. A large variety of bacteria is encountered in the first minutes of life by contact with the world by breathing, breastfeeding, and the surrounding environment. In the postpartum period, only a subgroup of the initial bacterial communities will colonize the oral cavity [17].

The first bacteria which colonize the oral cavity ("pioneer microorganisms") at 24 hours of life are from the group of Streptococcus (*Streptococcus salivarius*, *Streptococcus mitis* and *Streptococcus oralis*) and Staphylococcus. And the main source for it is the mother [9]. These bacteria modify the oral conditions by their metabolic products and, thus, favorise other species. The contact with food and the environment influences the oral microbiota. At 5 months of age, there is a great diversity of microorganisms in the oral cavity, and the most encountered bacteria are Streptococcus, Haemophilus, Neisseria and Veillonella [17].

Teeth eruption (deciduous dentition) brings a new surface for bacteria to adhere to dental surface. Streptococcus mutans start the colonization at this moment, although there are studies that found it on the soft tissue (lingual mucosa) [17].

The different species of microbiota have a tendency to adhere to different surfaces. Thus, Streptococcus species are detected in saliva, tongue, soft tissues, and supragingival area. The Actinomyces are found in the supra- and subgingival sites [18].

Fungal species (mainly Candida) may colonize the oral cavity from birth and through the first year of life with a variable rate of 40 to 82%. It appears that Candida is most frequent a transient colonization as it reduces with age (in older children, the rate of Candida colonization varies between 3 to 36%) [17].

Oral parasite colonization is present in infants with poor hygiene and low socioeconomic status and has a worldwide geographic distribution.

INFLUENCES ON EARLY CHILDHOOD CARIES

Early childhood caries (ECC) increase the burden of oral diseases, impacting public health and impressing the economic load [19].

The development of caries is influenced by multiple factors such as the presence of Streptococcus species, immaturity of the defense systems, and the behavioral patterns of the parents in connection to diet and oral hygiene [20]. The three species of Streptococcus play a role in the cariogenic activity in children are *S. mutans*, *S. sobrinus* and *S. salivarius* [21].

If Streptococcus species colonize the oral cavity in infancy, the dental caries risk appears.

A 2018 systematic review investigating the influence of delivery mode on the colonization of infants' oral cavities and ECC found changes related to oral colonization but the association with dental caries was not relevant [21].

A good oral hygiene and a non-cariogenic diet can offset this risk [22]. The prevention for early childhood caries is initiated by the new parents/caregivers.

CONCLUSION

The birth mode impacts the gut microbiome and has little impact on the oral bacteria, and low connection with early childhood caries.

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