

Influence of Infant Feeding on Dental Development - A Literature Review

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Abstract

Infant feeding has been known to influence the development of the dental arches as well as occlusion. Breast feeding and bottle-feeding may alter the orofacial environment and have varying effect on oral musculature function. Subsequently this may impact the craniofacial and dental development. Whilst breast feeding is known to have an overall positive effect on the oro-facial complex, bottle feeding negatively impacts the oral architecture. However, the current literature on the subject has some shortcomings. Thus, the purpose of this review was to analyze the existing scientific literature to determine the influence of breast feeding and bottle feeding on dental development. Issues with the evidence on the subject have been highlighted and the mechanics and process of feeding have been discussed.

Keywords: Breast Feeding; Bottle Feeding; Nursing; Dental Development; Occlusion; Dentition; Malocclusion

Introduction

The development of the cranio-facial complex, including the dental arches and facial muscles, results from the interaction between genetic and environmental factors [1,2]. Infant feeding has been known to influence the development of the dental arches as well as occlusion. Several reports have suggested that non-nutritive sucking, usually in the form of dummies or pacifiers and thumb sucking may be responsible for some forms of malocclusion of infancy including open bite and posterior cross-bite [3-6]. However, there is still a definite need to better understand the association between early life feeding, sucking habits and subsequent consequences on oro-facial development. Also, it is clear that breast feeding and bottle feeding involve different oro-facial muscles, possibly leading to different effects on the growth of maxilla and the dental arches [7-9]. Thus, it is essential to evaluate the role of breast feeding and bottle feeding on the oral cavity architecture and the influence on other processes such as acquisition of early speech [10].

Breast milk provides all the nutrients that a newborn requires in the first six months of life [11,12]. The World Health Organization recommends exclusive breast feeding up to 6 months of age, followed by continued breast feeding along with appropriate complementary foods up to two years of age or beyond [13]. Breast-feeding promotes nasal breathing from proper use of the sucking function, where the lips remain completely in contact with the mother's breast and the nose is stimulated to initiate inspiratory and expiratory movements [14]. This kind of breathing creates air pressure in the maxillary sinus which in turn expands the limits of the sinus thus stimulating growth of the maxilla [15].

Apart from the positive effects on the oro-facial complex, breast feeding has been found to be beneficial in other studies of linguistic and cognitive development [16]. The development of coordinated breathing, chewing, swallowing and speech articulation has been shown to be associated with breastfeeding. It is suggested that breastfeeding promotes mobility, strength, and posture of the speech organs including lips, tongue, maxilla, mandible, cheeks, soft palate, hard palate, dental arch and floor of mouth. In order for speech development to occur, the child must suck with consistent rhythm and strength. Movements while sucking can cause absorption of the sucking pads and growth of the mandible thus resulting to increase of intra-oral space [10]. Further, breast feeding helps in the development of clear speech in males and improved tonal quality and reading ability in both males and females [16]. Also, studies have shown that breastfeeding protects normal dentition [6,17,18].

Bottle feeding, allergic rhinitis, nonnutritive sucking habits and bad habits have been associated with dentomaxillofacial anomalies and malocclusions in the primary dentition [19,20]. In a study involving 202 Brazilian children it was observed that 53% of bottle-fed children presented myofunctional alterations and hypotonicity of the tongue [21]. With the use of artificial nipples, there is lack of palatal support from the tongue and increased activity of the cheeks. The dynamics between the influence of the tongue and that of the cheeks is upset, resulting in a broader mandibular arch [22]. Alteration of the oral motor development brought on by bottle feeding may negatively affect mastication, deglutition, breathing and speech-sound articulation, as well as promote malocclusion [23]. Nutritive and nonnutritive sucking habits namely bottle feeding and pacifier use, are associated to an atypical swallowing pattern and tongue thrusting, which may be related to the development of malocclusions such as posterior crossbite [19,22]. Significant association is found between children who were bottle fed and presence of antero-posterior malocclusion. Contrary, sucking only during breastfeeding promotes correct muscle activity, and proper development of the oral motor structures, subsequently decreasing the risk of getting this type of malocclusion [16].

Thus, it is prudent that the clinician understands the mechanics and the muscular processes involved during breast feeding and bottle feeding to evaluate the effects of these on the oro-facial complex.

Process of breast feeding

Infant feeding takes place by the rhythmic pumping action known as 'suckling'. In the first few days after birth, the lips are not readily poised. Nevertheless, a primitive rooting reflex exists and when the child is nursed, it turns the head naturally to the breast [24]. In breastfeeding, the baby pulls and sucks the nipple into the mouth. Part of the areola is also held in the mouth and the nipple is held as far back as the junction of hard and soft tissue palates [24]. The lips form a seal and the mouth cavity is enlarged as the jaw moves. The whole of the lower jaw is raised and lowered alternately with a rocking motion. The tongue is protruded and remains in contact with the lower lip throughout. As the jaw is lowered, the body of the tongue moves downwards and forward. This motion has been described as "a boat rocking upon waves". The nipple is considerably extended and taken well back into the mouth, and the squeezing action is completed by the contraction of the floor of the mouth [25,26]. The movement of the tongue is described as a peristaltic, rolling motion [7]. This produces a low or negative pressure in the oral cavity, which facilitates the passage of milk from the nipple, although the oxytocin-induced milk let-down reflex triggered by touch receptors in and around the nipple is sufficient to give a flow of milk [27]. The upward movement of the mandible with upward and backward movement of the body of the tongue increase pressure in the oral cavity and forces the contents into the upper part of the pharynx, initiating relaxation and then contraction of the pharyngeal constrictors. The mandible is held in position by the masseter muscle and the medial pterygoid muscles while the tongue movements are a combination of intrinsic muscle contractions to change the shape of the tongue with the geniohyoid and genioglossus muscles controlling the general position. Thus, the process of suckling during breast feeding is a coordinated effort which not only maintains the airway [27,28] but also exerts a positive influence on the oro-facial complex.

Process of bottle feeding

Bottle-feeding differs from suckling in breastfeeding. Teat and dummies vary in terms of size, shape, the material that they are made from, compressibility, elasticity and flow rates. The milk flow depends on the diameter of the teat's hole [26,29]. All these factors influence the action used to suck from the teat or dummy and its behavior during sucking process. It does not have let down reflex and the child has to exert positive pressure on the teat with the tongue against the upper tooth pad [26,27].

Incidence of breast feeding and bottle feeding

Children of industrialized western countries are more likely to use pacifiers and to feed using a bottle than children in developing countries. Over the last few decades, use of bottles and pacifiers has increased approximately 75% to 79% in the West [30-32]. In non-industrialized countries such as Tanzania and Zimbabwe, pacifier use and finger sucking are less common [32]. This finding has also been associated with families with lower social economic status. A study conducted in Santiago, Chile reported 28% of breastfed and 52% of non-breastfed children used pacifiers [33]. They also found that 88% of the time, mothers were more likely to use pacifiers without a specific reason for their use [33]. Thus, it is apparent that whether a child is breast or bottle fed depends on both cultural and economic factors [34].

Discussion

It is clear that, breastfeeding and bottle-feeding may alter the orofacial environment and have varying effect on oral musculature function. Subsequently this may impact the craniofacial and dental development. However, the significance of early signs of anomalies in developing malocclusion remains largely unresearched. The major drawback of studies addressing this question has been limited by being retrospective [35]. Several mechanisms by which bottle feeding might contribute to the development of malocclusion have suggested. Straub [36] highlighted the marked differences between the mechanics of infants sucking at bottle and breast and hypothesized that bottle feeding predisposes to both abnormal swallowing and finger sucking, which in turn can produce malocclusion. A direct tropic effect of altered sucking mechanics on the growing facial bones of the infants, an increased tendency toward abnormal swallowing pattern, and an increased prevalence of nonnutritive habits either finger sucking or pacifier have also been suggested to predispose to development of malocclusion [37,38]. Hellman [39] was amongst the first few to suggest an association between bottle-feeding and malocclusion, although the data upon which this conclusion was made do not include sufficient number of controls to achieve statistical significance.

Likewise, other studies have found positive correlation between bottle-feeding and discrepancies in cranio-facial growth or malocclusion [23,40-42]. Pottenger and Krohn [40] in their retrospective cohort study of 327 infants found that bottle fed infants had reduced malar growth compared with breastfed infants. Malar growth was found to increase with increased duration of breast-feeding. Infants that had been breastfed for more than 3 months had the best malar growth. A population based retrospective cohort study with 9698 children aged between 3 and 17 years demonstrated that bottle fed children were 1.84 times more likely to have malocclusion than children who were breast fed. It was estimated that 44% of malocclusion in the population was due to bottle-feeding [23].

Davis and Bell [42] conducted a single-blind longitudinal study involving 108 children to measure the strength of association between feeding experiences in the first year of life and subsequent occlusal outcomes. Feeding methods from birth were documented during postnatal visits and monthly well baby visits. The feeding methods were categorized as exclusively breast-fed, breastfed and bottle-fed in combination or exclusively bottle-fed. The age at which solid food foods were introduced was also recorded. Clinical examination included recording of orthodontic variables such as molar relationship, canine relationship, crowding, rotation, displacement, crossbites, overjet, overbite and congenital malformations. They found a strong association between exclusive bottle feeding and overjet. Further, breast-feeding was associated with lowered risk of antero-posterior mal-relationships.

Contrary, there have been a few studies that found no association between the type of feeding and malocclusion [44-46]. In fact, Moss and Picton [43] reported that breast fed children were found to have more malocclusions than those fed by bottle. Likewise, Humphreys and Leighton [44] reported no significant difference in frequency of bottle feeding among children with antero-posterior malocclusion as compared to controls in a survey of 2711 children in Britain aged 2 to 5 ½ years. In a longitudinal study involving 122 infants between 6 weeks and 18 months of age, no association was found between bottle feeding and malocclusion at 18 months [45]. Comparisons of the absolute and percentage changes in the maxillary and mandibular arch parameters indicated no significant differences were present between the different groups at the end of the 18 month period. However, the breast-fed infants showed the least amount of relative change in maxillary arch length and palatal depth suggesting need for further follow up to obtain conclusive results [45].

Further, Legović and Ostrić [46] in their retrospective cohort study found no association between bottle-feeding and malocclusion at 3 years. However, the breast fed group in the study contained both infants who were partially breastfed and exclusively breastfed infants. This misclassification could have led to bias towards detecting no association between bottle-feeding and malocclusion. Although the aforementioned discussion suggests that there are no significant differences in the number of malocclusion between breast fed and non breast fed children, it has been found that breast-feeding encourages correct inter-maxillary relationship [46]. Additionally, a trend of association between bottle-feeding and the need for orthodontic treatment has also been demonstrated [38]. Also, breast feeding for 6 - 12 months seems to have a preventive effect against open bite in the primary dentition, and exclusive bottle feeding appears to be a risk factor for mesial bite [47]. Nevertheless, future longitudinal studies on the subject with a large sample size are required to affirm the conclusion.

Issues with available evidence

Growth and development can be controlled by various factors and hence it is rather difficult to point on a single cause that produces a particular effect. This is a major drawback for studies addressing the effects of infant feeding on the development of oro-facial complex as it involves multi-factorial causes and effects. Also, malocclusion and normal occlusion are not always definite and distinguishable entities, particularly in the early stages of dentofacial development; thus making it difficult to define the role of infant feeding in their etiology. Another issue with the subject is the lack of longitudinal studies describing the changes in the dental arches in infants fed with different modes. Further, there is no measurement of intensity or duration of breast-feeding. In most studies partially breast fed infants are classified together with exclusively breastfed infants. Use of bottle even among breastfed children interferes negatively with oral facial development [21]. This makes the breast-fed and bottle fed groups leading to bias in studies towards detecting no differences between the groups in terms of rates of malocclusion [26].

In majority of studies there is no control group of exclusively breastfed infants who have not used dummies. Often, the inclusion and exclusion criteria are not clearly described. There is no consideration of confounding factors such as use of dummies and age of introduction of solids [26].

Some studies tend to establish an association between the type of feeding and the 'need of orthodontic treatment'. 'Need for orthodontic treatment' is a broader classification than malocclusion; for example, traumatic loss of primary tooth and the subsequent need for a space maintaining appliance might appear as 'need for treatment' even if the child had a perfect occlusion [26]. Therefore 'the need of orthodontic treatment' might not represent the 'malocclusion' in its association with the type of feeding. Often, generalizations are frequently made inappropriately. The term 'association' is used to describe the relationship between two variables and the term 'causality' is normally used to describe the relationship of causes and the effects they produce [48]. However, some studies extrapolate the result of association as the causation and vice versa.

Conclusion

Thus, it is evident that the existing literature does have shortcomings in terms of the quality of research. Nevertheless, it can be concluded with a fair degree of certainty that breast feeding has an overall positive effect on the oro-facial complex whilst bottle feeding negatively impacts the oral architecture. Future research needs to be carried out with careful attention to the methodology and research design.

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