



REVIEW ARTICLE

Early weaning: implications to oral motor development

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Abstract

Objective: this article aims at reviewing the relationship between early weaning and its consequences to oral motor development, focusing on the consequences to occlusion, breathing and children's oral motor aspects.

Sources: a literature review based on Medline database from the early 60's up to 2001 was performed taking into consideration the following topics: pediatrics, dentistry and speech language pathology.

Summary of the findings: based on this review of literature, we could verified that early weaning may lead to a proper oral motor development rupture, which may cause negative consequences to swallowing, breathing and speaking activities as well as malocclusion, oral breathing and oral motor disorders.

Conclusions: in addition to several benefits of breastfeeding, it contributes to a proper oral motor development and also avoids speech-language disorders, regarding oral motor system.

J Pediatr (Rio J) 2003;79(1):7-12: early weaning, breastfeeding, oral motor development, sucking, malocclusion, oral breathing.

Introduction

Breastfeeding, besides the nutritional, immunological, emotional and socioeconomic benefits that have been widely publicized in the literature,¹⁻¹⁰ also has positive effects in speech-language health, since it is related to the newborn's craniofacial and oral motor growth and development.^{11,12}

The literature has pointed out the importance of sucking during breastfeeding, since it promotes the proper development of speech organs as far as mobility, strength,

posture, and the development of breathing, chewing, swallowing, and articulation of speech sounds¹³ are concerned. Therefore, it reduces the presence of bad oral habits and several speech-language pathologies.^{11,14-19}

Suction pathophysiology

In the first months of life, oral motor development occurs through the movements made by the speech organs (tongue, lips, mandible, maxilla, cheeks, soft palate, hard palate, floor of the mouth, oral muscles, and dental arch) during the sucking function.

Sucking Mechanism

Through breast sucking in the first months of life, the newborn may properly develop the speech organs and the functions they perform.

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In order to carry out this purpose the newborn must suck harmoniously, with rhythm and strength,^{14,20} which includes adequacy to the following aspects: sucking and rooting reflex, lip seal, tongue and mandible movement, sucking/swallowing/breathing coordination, and sucking rhythm, i.e., alternate sucks with pauses. These movements allow a variation in the intraoral pressure, which are fundamental for the extraction and transport of milk.²⁰⁻²⁴

The sucking mechanism begins with the rooting reflex. This reflex is a precursor for the correct grasp, because when the lips and cheeks are stimulated, the child moves his or her face towards the stimulus, the mouth opens and the tongue is projected.^{20,22,24}

The correct grasp of the areola and nipple is essential for the correct movement of the oral structures during breastfeeding and the lower lip must be everted allowing the tongue to advance to the gum line.^{24,25} When the newborn sucks only the nipple, ineffective sucking takes place and there is a greater possibility of nipple fissures.^{24,26}

From the moment grasp of the areola occurs, the sucking reflex is triggered and the tongue and mandible movements begin. The function of the tongue is to perform anterior seal (adherence around the areola) and posterior seal (adherence against the soft palate and the pharynx), milk the areola, vary the volume of the oral cavity, and propel the food bolus.²³ It has an active participation during sucking, with three kinds of movement: anteroposterior displacement, cannulization (the lateral tongue borders are adhered to the palate forming a groove in its medial portion) and peristaltic movement (an elevation of the medial portion of the tongue to the lateral portion and elevation of its dorsum, carrying milk to the pharynx).

The mandible offers a stable basis for tongue movements, helps with the creation of intraoral pressure²³ and performs vertical and horizontal movements. The horizontal movement compresses the areola and consequently releases the milk.^{14,21}

In the first 4-6 months of the newborn's life there is no association between the movements of the tongue and the mandible; these structures perform the movement together.^{15,22,27} The movements of the tongue and the mandible are synchronized; furthermore, lips, mandible, cheeks and pharynx participate in sucking.²²

Initially, when the mandible rises, the tip and the dorsum of the tongue move upwards, compressing the nipple and the areola against the palate, so that the anterior part of the tongue adheres to the nipple, not leaving an empty space between the tongue, the hard palate, and the oral surface, while the posterior part performs the seal with the soft palate and with the pharynx.^{28,29} In this phase of the movement, the tongue is flat and an occlusive system is formed with the soft palate.^{11,14,15,21,27,30,31}

When the mandible moves downwards, the tongue makes a cannulized movement, causing the oral cavity to increase fast, resulting in negative pressure, which helps with milk

extraction. Therefore, milk occupies the space between the dorsum of the tongue and the palate.^{15,22,25,27-29,30,32-34}

Right after cannulization, the tongue begins peristaltic movements where the elevation of the mandible and the middle part and the dorsum of the tongue occurs.^{14,15,21,22,27,28,30} These movements (cannulization and peristalsis) occur through successive moments of positive and negative pressure in the oral cavity.^{11,14,15,27,29}

Oral Motor Development

The necessary sucking during breastfeeding causes appropriate oral motor development, promoting the correct establishment of the functions performed by the speech organs.

The newborn presents a few oral characteristics that facilitate breastfeeding. They correspond to the presence of fat tissue deposits in the cheeks (sucking pads), a small intraoral space, a retraction of the mandible allowing the tongue to fill up the entire oral cavity and perform its movement of extension and retraction, the non-dissociation between tongue and mandible movements, the proximity of palate/epiglottis, and nasal respiration. Through the sucking movement, the structures are developed causing the absorption of the sucking pads, the growth of the mandible and, consequently, the increase of the intraoral space, besides a greater possibility of tongue movement, which starts to alternate the anteroposterior movement with elevating and lowering movements. Another consequence is a greater dissociation of the movements of the tongue, lips, and mandible.^{14,15,31,35}

Carvalho³⁶ points out that while sucking his/her mother's breast, the child establishes the appropriate pattern of nasal respiration and correct tongue posture. He considers that during breast sucking, the muscles involved are being properly stimulated, increasing the tonus, and promoting the correct posture to perform the chewing function in the future.

In this regard, it is necessary to point out that oral motor development is reflected on craniofacial development, bone growth and dentition. Subtelny³⁷ emphasizes that the shape of the dental arch is influenced by forces exerted on the teeth through the muscles of the tongue, lips, and cheeks. For Garliner,³⁸ the movement of the teeth suffers influences from the soft tissues so that an imbalance may generate malocclusion. Bianchini³⁹ emphasizes that the bone tissue is influenced by all soft tissues in which it is inserted during growth.

The teeth and the other structures suffer pressure from forces originated in the muscles of the face and tongue during the functions of sucking, chewing, swallowing, breathing, and sound articulation, indicating the close relationship between the development of dentition and muscle activity. These muscular forces, when appropriate, promote a modeling action; however, in inadequate conditions, they may lead to undesirable anatomical and functional alterations.⁴⁰

Bönecker et al.⁴¹ emphasize that among neonates the mandibular division is vertically short and the chin prominence is incomplete. Stimulation during natural breastfeeding and, later, chewing, leads to the proper mandibular growth, establishing a harmonious relationship with the maxilla.

The proper oral motor development also influences the newborn's nutritional evolution, permitting proper food transition, so that the child can have the necessary conditions to receive the correct foods at the correct age,^{15,16} ensuring that the mobility and the strength of the muscles evolve properly.⁴²

Consequences of early weaning

Early weaning may lead to the interruption of proper oral motor development provoking alterations to the posture and strength of the speech organs and harming the functions of chewing, swallowing, breathing, and articulation of speech sounds. The lack of physiological sucking on the breast may interfere in the oral motor development, possibly causing malocclusion, oral respiration and oral motor disorders.

Straub⁴³ points out that artificial breastfeeding interferes with the functions of chewing, sucking, and swallowing and may lead to disorders of the orofacial muscles, resting position of lips and tongue, as well as alterations to the formation of the dental arch and palate.

Davies and Bell⁴⁴ verify in a longitudinal study carried out with 108 children the existence of a significant association between children who were bottle-fed and the presence of anteroposterior malocclusion, emphasizing that breastfeeding decreases the risk of this problem.

Carvalho³⁶ emphasizes that only breast sucking promotes the correct muscle activity. The baby bottle only fosters the work of the buccinator muscles and the orbicular of the mouth without stimulating other muscles, such as lateral pterygoid, medial pterygoid, masseter, temporal, digastric, geniohyoid, and mylohyoid muscles. The excessive work of the orbicular muscles may influence craniofacial growth, leading to narrow arches and lack of space for the teeth and tongue. It also induces dysfunctions related to chewing, swallowing, and articulation of speech sounds, generating bite disorders and malocclusions. Furthermore, sucking a pacifier does not require the protrusion and retraction movements of the mandible, which are important for correct mandibular growth.

A few authors⁴⁵ point out that during breast sucking the newborn better exercises the facial muscles. In addition, they have found out that in clinic patients who had an inadequate or nonexistent breastfeeding period, 33% presented swallowing disorders, and 34% speech-language disorders. When bottle-fed, the infant receives little oral motor stimulation, and the result is flaccidity of the perioral muscles and tongue, which leads to swallowing instability.

Frequently, there is dentofacial deformity, resulting in anterior or lateral open bite and respiratory disorders.

Just as occurs with the baby bottle, oral habits have a direct impact on the oral motor and craniofacial development, as well as on bone growth. The presence of oral habits affects the success of breastfeeding and that may cause early weaning as a consequence, or vice versa, i.e., with early weaning the child's sucking needs are not satisfied and the infant ends up acquiring habits of non-nutritious sucking, such as finger sucking and the use of pacifier, which produces malocclusion.⁴⁶

Some studies show a direct relationship between the use of the baby bottle and the presence of oral habits. Just like in bottle-fed children, the frequency of undesirable sucking habits is greater, and when weaning occurs there is a tendency for the establishment of finger or pacifier sucking.^{47,48}

A study carried out with 214 children demonstrated that among the children who used a pacifier, 31% were exclusively bottle-fed. On the other hand, among the children who did not use a pacifier, 58.8% were naturally breastfed for at least three months. Among the children who presented finger sucking, a different result was observed considering that 20.6% were naturally breastfed for three months or more and 13.1% were artificially breastfed.⁴⁹

Another study showed that children breastfed for at least six months presented a lower frequency of oral habits while bottle-fed children for over a year presented a tenfold risk of forming oral habits.⁵⁰

Ferreira and Toledo⁵¹ in a study carried out with 427 children aged between three and six years show that the longer the breastfeeding, the lower the occurrence of harmful oral habits, sucking habits, oral respiration, and bruxism.

Leite et al.¹³ describe that children who were breastfed have lower chances of acquiring non-nutritious sucking habits, which are commonly observed in children who were not breastfed.

A recent study carried out in 2001 with 150 children aged between one and seven years observed that most children who were exclusively breastfed for at least six months did not develop sucking habits. However, those who did, kept their habits for a shorter period, when compared to children who were not breastfed.⁵²

Malocclusion

Malocclusion may be less frequent in breastfed children, since dental development and occlusion may be related to the type of sucking. Nevertheless, as previously mentioned, the action of the orofacial muscles at rest on the functions of chewing, swallowing, breathing, and articulating sounds may occur inadequately and lead to this pathology.

For Garliner,³⁸ dental malocclusion is related to an oral motor imbalance, which quite often results from the use of baby bottles and non-nutritious sucking. Next, we are going

to mention the studies that showed the relationships between these aspects.

Labbok and Hendershop⁵³ studied the influence of breastfeeding in relation to malocclusion in children and adolescents, comparing three groups: those who were breastfed for six months or more, those who were breastfed for less than six months, and those who were exclusively bottle-fed. They concluded that breastfeeding offers some protection against malocclusion, but only when the child is breastfed for at least six months. Meyers and Hertzberg⁵⁴ also observed a greater frequency in the prescription of orthodontic treatment with the increase of exposure to the baby bottle.

Degano and Degano⁵⁵ report a lower incidence and severity of malocclusions in children who were breastfed comparatively to the ones who received artificial feeding.

Leite et al.¹³ verified a greater frequency of open bites or cross-bites among the children who had been early introduced to the use of the baby bottle, even in mixed feeding.

A few studies indicate that malocclusion is a result of oral habits, which, in turn, may be a consequence of the use of the baby bottle.

Among these studies, we have one carried out in Finland with 1,018 children, in which the early introduction of the baby bottle was followed by the prolonged use of the pacifier, by open bite and crossed bite.⁵⁶

Fagundes and Leite⁵⁷ in a literature review on breastfeeding and malocclusion concluded that the occurrence of anterior open bite is, to a certain extent, related to artificial feeding, and mixed or artificial feeding may lead to the establishment of deleterious oral habits.

The commonly observed deleterious oral habits are pacifier and finger sucking, which play an important role in the etiology of malocclusion. Non-nutritious sucking is strongly associated with the presence of malocclusion, especially posterior cross-bite, anterior cross-bite and dental protrusion.⁵⁰

It is important to emphasize that alterations to the shape of dental arches are also determined by the intensity, strength, and duration of the habit.⁴⁷

Ogaard et al.⁴⁶ in a retrospective study with 4,045 children verified that the use of the pacifier leads to cross-bite. Furthermore, they show that the use of the pacifier for two years produces a significant alteration to the maxilla, and its use for three years produces alteration to the mandible.

A few authors suggest finger sucking as one of the etiological factors of open bite.⁵⁸

Tomé et al.⁵⁹ point out that harmful oral habits may determine deviations in the dentoalveolar morphology.

Fayyat⁶⁰ carried out a study with 106 children aged between four and six years and concluded that among bad oral habits, finger sucking seems to be the one that mostly interferes in the occurrence of open bite.

Oral Respiration

The correct breathing pattern may suffer negative influences from early weaning. Breastfed infants maintain the resting posture of the occluded lips and nasal respiration. When early weaning occurs, the baby's posture of half-open lips is the most common one, facilitating oral respiration.

Leite et al.,¹³ analyzed 100 children aged between 2 and 11 years, and verified that bottle-fed ones exhibit an incidence of oral respiration 40% higher.

The child who is naturally breastfed in the first months of life has a greater possibility for becoming a nasal breather; likewise, the lack of breastfeeding may be one of the factors that contribute towards the development of oral or oronasal respiration.⁶¹

Oral motor disorders

Oral motor disorders correspond to the involvement of the breathing, chewing, and swallowing functions, and may be associated with other problems. These disorders may result from the use of baby bottles and from the habit of non-nutritious sucking, provoking changes to the breathing pattern and malocclusion.

The American Speech-Language-Hearing Association (ASHA)⁶² defines this alteration as the oral myofunctional disorder that includes abnormal anterior placement of the tongue and labial incompetence. It may include speech-articulatory disorders.

As Junqueira⁶³ points out, natural breastfeeding promotes proper stimuli to the tongue muscles, encouraging their strengthening and the consequent correct production of speech sounds, since speech alterations can be a result of the malfunction of oral structures.

Barbosa and Schonberger⁴⁵ verified among children who were not breastfed or who were weaned too early that 34% presented speech-articulatory alterations and 30% had swallowing disorders.

In a study with newborns, Cattoni et al.⁶⁴ verified that exclusive breastfeeding favors normal sucking, and mixed feeding induces sucking disorders, which may lead to the inefficiency of the child's oral motor pattern.

Besides early weaning, other factors may interfere in the establishment of oral motor patterns and dental occlusion⁴⁹ such as genetic factors, which are less affected by the work of the healthcare professional, and environmental factors.

Conclusions

Having in mind that early weaning brings consequences to oral motor development, occlusion, breathing, and to children's oral motor aspects, we have to emphasize the importance of breastfeeding. The encouragement of this practice and the proper sucking pattern is the basis for the prevention of speech-language disorders, as far as the oral motor system is concerned.

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