Commentary

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Evidence of a Preventive Effect of Breastfeeding on Obstructive Sleep Apnea in Children and Adults

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adults, bottle feeding, breastfeeding, breastfeeding benefits, children, obstructive sleep apnea

For some time, breastfeeding has been recovering its space, which had been occupied by the use of bottle feeding. There are many reasons that mothers use formula, such as having premature children, having systemic diseases that prevent them from breastfeeding (HIV seropositive, for example), or anatomic changes such as inverted nipples, among others. However, the bottle is also used for parental convenience, giving "freedom" to mothers, permitting the control and sharing of infant feeding with others, and also allowing pediatricians to have an apparent regulation of infant feeding.

Breastfeeding has been proven to be far superior to artificial feeding in several ways. The nutritional and immunological superiority of mother's milk compared with formula is generally known, in addition to its effect on the psychological, cognitive, and intellectual development of the child (Bar, Milanaik, & Adesman, 2016; Papp, 2014; Victora et al., 2015), causing a lower rate of allergic and respiratory diseases (Hendaus, Jomha, & Ehlayel, 2016) and preventing orthodontic changes as well as changes to facial bones (Peres, Cascaes, Nascimento, & Victora, 2015; Peres, Cascaes, Peres, et al., 2015; Sánchez-Molins, Grau Carbó, Lischeid Gaig, & Ustrell Torrent, 2010).

The mother and the pediatrician have the power to decide the form of infant feeding, although the "facility" and the control provided by bottle feeding end up determining their choice despite their awareness of the many advantages of breastfeeding.

It has been proven that the baby bottle deforms the dental arches, reducing sagittal mandibular growth (Page, 2001; Sánchez-Molins et al., 2010; Westover, DiLoreto, & Shearer, 1989). Another change clearly observed, although less discussed, concerns transverse maxillomandibular development, especially in the maxillary bone. It has been demonstrated that the shorter the breastfeeding time, the greater the possibility that the child will develop posterior crossbite, a malocclusion typically due to transverse maxillary deficiency (Agarwal et al., 2014; Chen, Xia, & Ge, 2015; Limeira, Aguiar, de Lima Bezerra, & Camara, 2014; Viggiano, 2004). The most complete and extensive study of this type, conducted in 2010, clearly demonstrated that babies breastfed for more than 1 year have a 2.2% rate of posterior crossbite, as opposed to an incidence of 31.1% among babies who were never breastfed (Kobayashi, Scavone, Ferreira, & Garib, 2010).

As transverse maxillary deficiency continues to be considered a simple orthodontic change, the general perception will also be that this is a minor problem and the tendency will be to continue to favor the facilities of bottle feeding. However, transverse maxillary deficiency is intimately related to deficient nose breathing and consequent supplementary mouth breathing, involving a series of problems that greatly exceed crooked teeth. Due to the anatomy of the maxillary bones, transverse maxillary deficiency will result in a reduction of the nasal cavity, hampering the passage of air. This relationship can be easily observed on the basis of various studies that have demonstrated that transverse maxillary expansion increases the nasal cavity and reduces the resistance to the passage of air (Buck, Dalci, Darendeliler, Papageorgiou, & Papadopoulou, 2016).

Children who are mouth breathers suffer from a series of otorhinolaryngologic diseases such as otitis, rhinitis, sinusitis, and adenoid hypertrophy, among others. In addition, mouth breathing can induce changes in body posture, mainly with anteriorization of the head (Cuccia, Lotti, & Caradonna, 2008; de Oliveira Lima, Baraúna, Sologurem, de Tavares Canto, & Gastaldi, 2004; Tecco, Caputi, & Festa, 2007; Tecco, Festa, Tete, Longhi, & D'Attilio, 2005). Facial muscles are also affected, as is tongue posture (de Andrada e

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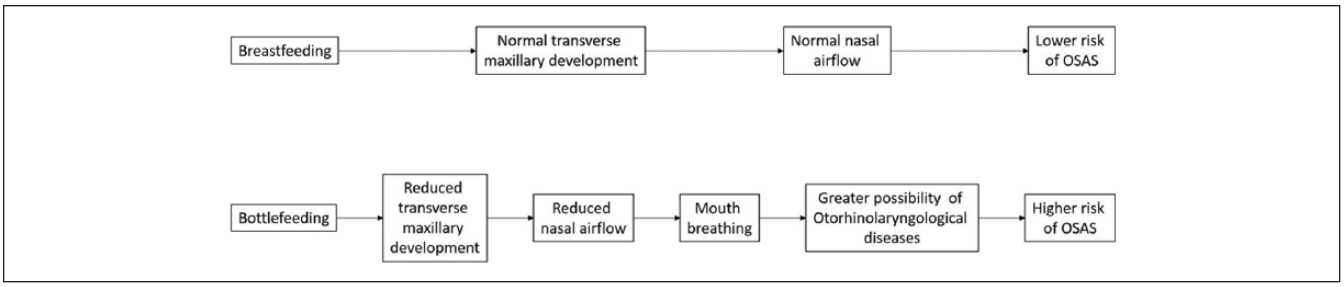

Figure 1. Breastfeeding, bottle feeding, transverse maxillary deficiency and childhood obstructive sleep apnea syndrome (OSAS).

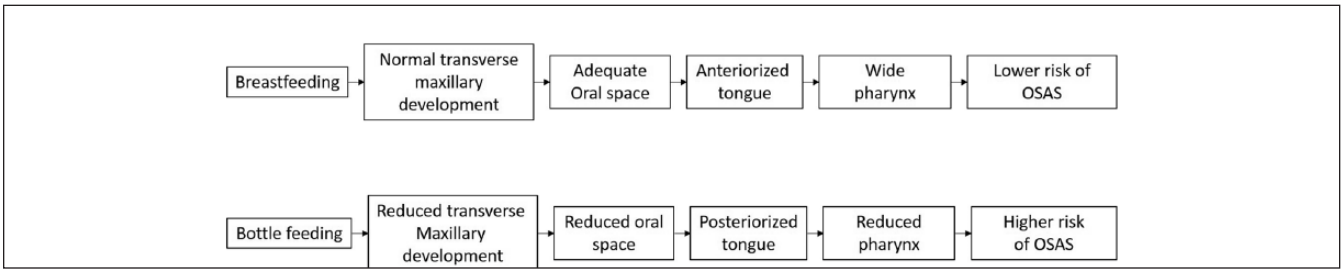

Figure 2. Breastfeeding, bottle feeding, transverse maxillary deficiency and adult obstructive sleep apnea syndrome (OSAS).

Silva, Marchesan, Ferreira, Schmidt, & Ramires, 2012; Nicolai & Limme, 1991; Souki et al., 2014).

These problems may not seem important to a layperson, nonmedical person, or parent, but they may have a clear association with obstructive sleep apnea (which most people do know about or have heard about). Thus, the present study intends to provide evidence of a strong relationship between use of a bottle and obstructive sleep apnea syndrome (OSAS) (Figure 1).

Children with OSAS usually have growth disorders (Katzenmeyer, 2002; Witmans & Young, 2011), nocturnal enuresis (Bseikri, Lo, & Guilleminault, 2015; Witmans & Young, 2011), and behavioral and learning disorders (Felcar, Bueno, Massan, Torezan, & Cardoso, 2010; Galland et al., 2015), and most of them are mouth breathers and have mandibular underdevelopment and transverse maxillary deficiency.

The importance of transverse maxillary deficiency in childhood OSAS is evident when treatments that promote transverse maxillary increase result in improvement or cure of these children. Studies have demonstrated that rapid maxillary expansion (a procedure consisting of nonsurgical separation of the hemimaxillae using a simple intraoral device) increases the transverse maxillary diameter, promoting a significant improvement of childhood OSAS, improving nasal airflow and various comorbidities related to mouth breathing (Abad & Guilleminault, 2009; Cistulli, Palmisano, & Poole, 1998; Eichenberger & Baumgartner, 2014; Guilleminault et al., 2011; Katyal et al., 2013; Ngiam & Cistulli, 2015; Palmisano, Wilcox, Sullivan, & Cistulli, 1996; Pirelli, Saponara, & Attanasio, 2005; Pirelli, Saponara, & Guilleminault, 2004, 2015; Villa et al., 2007; Villa, Rizzoli, Miano, & Malagola, 2011; Villa et al., 2015).

In adults, the comorbidities associated with OSAS are even more extensive, including arterial hypertension, infarction, cerebrovascular accidents, type 2 diabetes, and cardiac arrhythmias, among others (Al Lawati, Patel, & Ayas, 2009; Carneiro et al., 2008; Kato, Adachi, Koshino, & Somers, 2009; Khayat, Abraham, Patt, Pu, & Jarjoura, 2009; Patil, Schneider, Schwartz, & Smith, 2007; Phillips & Cistulli, 2006; Saruhara et al., 2012; Zamarrón, Valdés Cuadrado, & Alvarez-Sala, 2013). Behavioral changes and excessive daytime somnolence are some of the symptoms commonly reported (Johns, 1991; Ramar et al., 2015).

The relationship between transverse maxillary deficiency and OSAS is also observed in adults (Figure 2). In a recent study, persons with OSAS and transverse maxillary deficiency were submitted to surgically assisted rapid maxillary expansion, a procedure consisting of surgical separation of the hemimaxillae followed by further separation with an orthodontic appliance. This procedure is the same as that performed in children except for a previous osteotomy. The result was a 56.24% reduction of apnea and hypopnea and improvement of various polysomnography parameters (Vinha, Eckeli, Faria, Xavier, & de Mello-Filho, 2016), in addition to a 23.99% increase of the pharyngeal airway (Vinha, 2015). Other studies have also confirmed this improvement, although using different designs and smaller samples (Bach et al., 2013; Cistulli et al., 1998; Palmisano et al., 1996), in addition to a systematic review (Abdullatif et al., 2016).

Another important etiologic factor for OSAS in adults is deficient anterior mandibular growth (Costa e Sousa & dos Santos Gil, 2013) (Figure 3). In these cases, mandibular advancement alone or associated with maxillary advancement tends to eliminate OSAS (Faria et al., 2013). It should

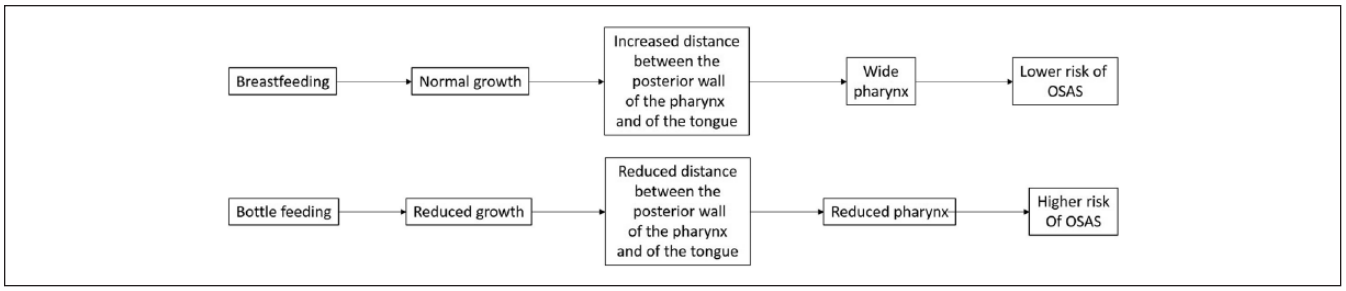

Figure 3. Breastfeeding, bottle feeding, anteroposterior maxillomandibular development and adult obstructive sleep apnea syndrome (OSAS).

be remembered that reduction of sagittal mandibular length may also be caused by the lack of breastfeeding, as described earlier.

It is clear that there are various other factors that may cause OSAS, but it is not the objective of this short text to discuss each one of them. Our objective was only to demonstrate that transverse maxillary deficiency and sagittal mandibular deficiency are also etiologic factors of OSAS (Johal & Conaghan, 2004; Seto, Gotsopoulos, Sims, & Cistulli, 2001).

Studies have demonstrated that 50% to 60% of all Brazilian children are mouth breathers (Felcar et al., 2010) and that childhood OSAS is their most severe complication. The incidence of OSAS among adults reaches 32.8% in the population of the city of São Paulo (Tufik, Santos-Silva, Taddei, & Bittencourt, 2010). On the basis of available data, an external factor is likely to account for such high incidence rates. The bottle may probably be one of these factors, if not the major one, that alters the development of facial bones, causing transverse and sagittal alterations in the maxillomandibular complex. Thus, we may state that transverse treatments of facial bone deformities or anteroposterior advancement proposed in order to eliminate or minimize OSAS restore the shape of the maxillary bones that were "deformed," likely caused by bottle feeding.

By inference and on the basis of a literature review, this study leads us to conclude that bottle feeding may cause OSAS since it has been confirmed that it reduces the transverse diameter of the maxilla and the anteroposterior length of the mandible. Other reports have also confirmed that when transverse correction of the maxilla is performed by means of orthodontic techniques in adults or children, the rates of sleep apnea are considerably reduced or affected persons (especially children) are even cured. The same reasoning can be applied to the anteroposterior correction of the maxillomandibular complex in adults. Thus, based on the evidence above, we can easily conclude that breastfeeding can be an important factor for the prevention of respiratory sleep disorders in both children and adults.

It is important to emphasize that the objective of this study was not to prove in a direct manner that the feeding bottle causes OSAS since the study was not designed for this purpose. Although the above evidence shows a strong association between bottle feeding and OSAS, we believe that it does not prove a causal relationship. Our review informs the parents and providers of this association. It shows that the benefits of breastfeeding in preventing otitis, sinusitis, and so on are not limited to the immune function alone but also avoid the anatomic modifications that have a lifelong/long-term effect on the infant.

According to this line of reasoning, breastfeeding becomes an important factor for the prevention of OSAS and of a host of respiratory problems and their consequences. Based on this premise, as mentioned earlier, the orthodontic changes caused by the feeding bottle gain a new dimension, no longer being a minor problem but becoming a major problem with very high personal costs for affected persons and their relatives. From this perspective, perhaps the balance will start leaning toward breastfeeding.

A new and important line of research arises from the viewpoint of breastfeeding, and stimulating a discussion of the advantages of breastfeeding over bottle feeding from this new viewpoint is also one of the objectives of this text. The form of infant feeding influences child development in various ways, although the option should not be based only on the solution of immediate problems and/or on the generation of facilities for the mother. The use of a feeding bottle may induce important complications, whether immediate or 5 or 50 years later.

Declaration of Conflicting Interests

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