Chewing, Biting, Clenching, Bruxing and Oral Health

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How do we usually wean babies? We have available a wide selection of nutritionally balanced jars of baby foods and creative parents can blender their own selection of fruits and veggies. We spoon feed our babies trying to keep one eye on the amount of food consumed and one eye on keeping everything as clean as possible. When babies are teething and crying, we offer rubber rings, often cooled to be even more soothing. We have spill-free containers for food on the go, usually breakfast cereals, which become mushy once in the mouth. Then, for the majority of children in the US, it's mac-and-cheese, frozen snacks, potato chips, pancakes, pizza, fast-food, and maybe some healthy protein-packed smoothies.

By reducing chewing, modern weaning, eating habits, cultural preferences and the economy may have already accelerated the evolution of the human face and head, as described by several authors (Lieberman, 2011, Palmer 1998, Corruccini 1984 and 1990; see also Shaw, 2011), through a process called klinorynchy. This is a shift of the pattern of facial growth down and back, as opposed to forward, and with the incisors in front of the nose, as in ancestral humans. The klinorynchy pattern is reducing the optima oral volume for functions. Also, studies by Morquette et al. 2012; Westberger & Kolta, 2011; Lund & Kolta, 2006, indicated that the chewing pattern and the central pattern generator for chewing developed by trigeminal feedback circuits. The trigeminal connections activated during chewing are astounding, not just because they modulate the neuro-occlusal circuit, but because they also stimulate saliva production, bolus control, and trigger the swallowing, with trigeminal (V) in plexus with facial (VII) and glossopharyngeal (IX) cranial nerves, and in predisposing the digestive system by way of trigeminal (V) in plexus with the vagus (X) and the hypoglossus (XII) cranial nerves.

Weaning by baby food may actually slow down the establishment of chewing patterns, as suggested by several studies on animal models. An animal model study, using baby mice, by Suzuki et al, 2007, identified a major component of the muscle fibers, the Myosin Heavy Chains (MHC), as intensifying in the temporalis muscles. This indicates that the chewing muscle get stronger from suckling to chewing a more solid adult diet. Moreover, the supra hyoid chewing muscles, called anterior digastrics, change position and composition as the animal is weaned from milk to solid food (Okubo et al, 2006). Even the muscles of the tongue change between a liquid neonatal diet to a solid diet in mice during weaning, increasing the strength and speed of contraction of the tongue (Maejima et al, 2005). This requires the activation of genes regulating the myosin heavy chains (MHC), which are found in the tongue in higher density than before weaning. Not only do muscles change during weaning to prepare for chewing but salivary glands increase the output as well, as suggested by a study by Elewa et al, 2014, on goat kid's salivary glands before and after weaning.

Because of the epi-genetic influence of the environment on functions (Kutoba et al. 2003; Moss, 1997; see also Francis, 2011; Hallgrimsson & Hall,[***]), what we chewed during weaning and childhood may have an impact on facial bone growth, development and maintenance. Studies done on mice that were fed soft food, compared with a control group eating hard pellets, showed that the orofacial bone growth is indeed guided by chewing. A study by Mayropulous et al, 2010, indicates that masticatory changes have been shown to influence the quantity and quality of the alveolar bone during growth. That study was designed to investigate the effect of rehabilitating masticatory function on the morphology and the trabecular architecture of the mandibular alveolar

ABSTRACT

Studies published in the last decade suggest that chewing (or mastication) and other chewing-like activities such as biting, clenching and bruxing, are involved in regulating bone growth, development and maintenance, reducing stress, increasing attention, contributing to better cognition, stabilizing the temporomandibular joint (TMJ), flagging a possible obstructive sleep apnea (OSA), clearing the oral cavity and allowing the absorption of foods more efficiently. Chewing exerts a considerable force that normally is absorbed by teeth and bones but when it's disordered, it creates disharmony of the oral structures and functions. Therefore, mastication is an important and complex oral function involving the coordination of muscles and hard tissues such as bones and teeth, as well as nerves and saliva. The evolution of oral health is now intertwined with the devolution of the human face and is linked to reduced chewing in humans, which begins with the modern and Western-like weaning of babies. A new oral health paradigm, including physiologically and epigenetically appropriate weaning and chewing practices, is needed.

bone, after cessation of growth. Although the rehabilitation of masticatory function led to a significant improvement of alveolar bone architecture in adult rats, the negative effects of hypofunction were not totally reversed during the period under study. Similar results were found by Katsaros et al, 2006. Chewing is also involved in the health and function of the temporomandibular joint (TMJ), as its stability relies on the optimal tone of the chewing muscles masseters and temporalis. Not coincidentally, these are also muscles that provide postural stability to the jaw (Miles, 2007) and chewing muscles re-conditioning is frequently included in TMJ rehabilitation and reduction of facial pain (DeFelicio et al., 2011; Tartaglia et al., 2011).

Chewing and swallowing are clearly connected to proper digestion and the optimization of the digestive system, as the digestive system really begins at the mouth through mechanical break-down of food and the mixing of the food with saliva, which contains enzymes that break down carbohydrates and other large molecules. Kimura et al, 2006, analyzed the chewing and swallowing of 60 nursing home residents, 30 of them on g-tubes or ng-tubes. The results of the study indicated that there was a functional decrease in the autonomic system of those who were not able to chew and swallow, eventually compromising the functionality of the entire digestive system by decreasing motility and secretions, including saliva. Similar results were found by Lunding et al, 2008, who compared 14 subjects with dyspepsia to 14 healthy subjects. The subjects were asked to eat clear soup followed, or not, by sham chewing of gum and spitting out any saliva produced. Without sham feeding (chewing), functional dyspepsia patients had lower motility index than healthy volunteers. In functional dyspepsia patients, vagal stimulation by sham feeding improved antral motility in response to the soup. So, even "fake" (sham) chewing can be beneficial, as chewing is an intrinsic part of eating and bypassing the mouth by delivering food directly to the stomach or intestine seems to "confuse" the brain, which relies on the oral sensory system for feedback.

Biting is usually performed with the front teeth (incisors) acting like blades, shearing the food in small bites to then be chewed. Gnawing is also a type of biting, commonly seen in weaning babies biting at bread crust or an apple. However, biting is often used as a synonym for clenching, as it's the case of mouth guards used in sports. Two studies done on the performance of athletes wearing mouth guards suggest that some types of oral appliances facilitating biting or clenching can enhance athletic performance in humans, decrease stress, improve strength & endurance, increase concentration, accelerate muscle recovery by reducing lactate levels and improve airways opening (Roettger, 2009; Garner and McDivitt, 2009). If these appliances, by allowing biting or clenching, can facilitate positive outcomes on athletes at the top of their physical status, it's possible that clenching or biting, when not abused, can be very useful. Clearly, intensity duration and frequency play a role in enhancing performance without becoming a habit and a parafunction.

Our body has some 'frenemies" or perceived dysfunctions that temporarily serve a purpose, although in the long run, they do create more dysfunction. Clenching is considered an oral habit, and it's similar to gnashing and grinding, however, clenching seems to serve some purposes. It decreases stress level (Gomez et al. 2010; Hori et al. 2005), increases the Cerebral Middle Artery flow (Zhang et al. 2012; Hasegawa et al. 2007) and activates cerebral activity (Ilda et al. 2010). Clenching is also performed while bearing down or lifting weights. Any time a physical effort is needed, the teeth are clenched. That happens also during intense pain, in which clenching is accompanied by a breath hold, which increases the level of the CO2 and production of nitrous oxide, both pain-regulating molecules. Moreover, a study by Ilda et al., 2010, comparing cortical activation between light teeth clenching versus light fists clenching, suggested that the teeth clenching activated a much wider neurological area, implying a more complex cerebral activity, which seems to be in line with similar studies analyzing the relationships between clenching, chewing, biting and increased cognitive performance.

Bruxing has been also defined as gnashing or grinding, although the last two are present mostly during the day, while bruxing is a nocturnal activity. Bruxing is achieved by activation of the chewing muscles; masseters, temporalis and pterygoid, and, as mentioned earlier, these same muscles are involved in TMJ disorders and facial pain. Gnashing and grinding may persist because of the neuroplasticity of habits (see Robbins et al., 2008 for neuroplasticity principles), while bruxism is more often an important symptom of Obstructive Sleep Apnea (OSA) (Sjöholm et al., 2000). Currently, there are hundreds of published articles linking bruxism with sleep disorders although it's just one of the body's servo-systems to assist breathing. Bruxism is centrally regulated and there is a positive correlation between sleep-disordered breathing and bruxism (Lobbezoo & Naeije, 2001). During deep sleep, when there is oxygen desaturation due to OSA, bruxing the teeth is a mechanism to "wake up" the body and free the airways. Therefore, while controlling bruxism with oral appliances may protect the teeth, unless the real cause (sleep apnea) is addressed, bruxism will continue.

Bruxism is common in children as well: Simões-Zenari and Bitar, 2010, analyzed factors associated to bruxism in children from four to six years of age and they found that 55.3 percent of children had bruxism and 76 percent suffered from headaches. A significant improvement of bruxism happens after tonsillectomy and adenoidectomy (T&A) surgery (DiFrancesco et al., 2004). Although there are many signs and symptoms on sleep disordered breathing, the actual orofacial morphology in night bruxers does not differ from non-bruxers (Lobbezoo et al. 2001), therefore, clinicians need to investigate if bruxism is present (or not) in children, as well as adults. Although bruxism can be a health issue with its impact on teeth and TMJ, sleep disorders have far more serious consequences, having significant roles in diabetes, heart attacks, strokes, cancer, obesity, ADHD in children, behavioral issues, depression and more, which is widely documented in medical literature.

All the professionals working within and around the mouth have a role in promoting the natural physiological functions, which have been perfected over eons and have been keeping humans alive and in good health. The dental community already knows the benefits of chewing on the health of the mouth, and the epigenetic benefit that those forces transmit to the periodontal tissues, bones, teeth and saliva. As modern life pushes for more convenient forms of feeding, providing more calories than even before, chewing comes back as a simple function that slows down the eating process, so that less high-caloric food is consumed and so saliva has the time to break down complex molecules and pre-digest the food, making it easier to swallow and to digest. Chewing may also be the simple adjunct strategy that helps to reduce obesity, allergies, cavities, dental malocclusion, TMJ instability, facial pain, reduced saliva and much more. We should give chewing another chance. **OH**

BIO TO COME???

Oral Health welcomes this original article.

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