International Journal of Zoology and Applied Biosciences ISSN: 2455-9571
Volume 11, Issue 5, pp: 240-245, 2026
https://doi.org/10.55126/ijzab.2026.v11.i05.030 http://www.ijzab.com

Review Article

DIETARY HABITS AND CRANIOFACIAL ONTOGENY: THE ROLE OF PROCESSED FOODS IN MANDIBULAR GROWTH RESTRICTION

Swathi S, *Sathyakumar M, Magesh KT, Aravindhan R, Sivachandran A, Swaathi R, Richa Singh, Nivedhidha M

Department of Oral Pathology and Microbiology, SRM Kattankulathur Dental College and Hospital, Faculty of Medicine and Health Sciences, SRM Institute of Science and Technology, Kattankulathur, Chengalpattu, 603 203. Tamil Nadu, India.

Article History: Received 5th June 2026; Accepted 22nd August 2026; Published 30th September 2026

ABSTRACT

Significant changes in human mandibular morphology have been linked to modern dietary modifications. This narrative review discusses the association between consumption of processed food and craniofacial development. Archaeological records indicate significant anatomical differences between hunter-gatherer and agrarian societies. Those alterations were boosted by later industrial food preparation. Ultra-processed foods, always soft in texture, need less chewing and do not provide appropriate mechanical stimulation for normal maxillofacial osseous and muscular development. Experimental studies have shown certain cellular mechanisms such as altered bone metabolism, disruption of the osteoblastic-osteoclastic balance, and differential response between mandibular and maxillary structures. Clinical research in paediatric populations supports lower interdental space and increased prevalence of malocclusion in children with mostly soft, processed meals. The relative influence of genes or environment is still debated, however there is compelling evidence that craniofacial development is malleable and responds to mechanical pressure.

Keywords: Ultra-processed foods, Industrial food preparation, Orthodontics, Mechanical pressure, Clinical research.

INTRODUCTION

It has been demonstrated that modern people eating processed agricultural foods differ in jawbone shape from hunter-gatherer societies, with agricultural populations often having smaller mandibles (Von Cramon-Taubadel, 2011). This anatomical shift represents a continuation of evolutionary processes that are still ongoing in modern populations. Comparative studies of pre-industrial and post-industrial populations have shown that changes in the size and shape of the mandible are closely related to the increased use of processed foods (Von Cramon-Taubadel, 2011). Recent research indicates that children whose diets consist mainly of ultra-processed foods have smaller jaws and display poor mandibular development (Fujita & Maki, 2018). These morphological abnormalities are attributed to the fact that ultra-processed foods have soft consistencies, which demand low masticatory effort, resulting in insufficient stimulation of maxillofacial muscle and osseous structures (Kono *et al.,* 2017). Therapeutic ramifications of this phenomenon, which Tim Spector (Fujita & Maki, 2018) has called a "epidemic of jaw shrinkage", are not limited to aesthetics. Such developmental changes are thought to account for the higher incidence of dental crowding, malocclusion, and poor bite alignment among contemporary populations (Von Cramon-Taubadel, 2011). Studies from the Catholic University of Valencia have shown that children who regularly consume soft ultra-processed foods are more likely to suffer from tooth crowding and poor jaw development (Kono *et al.,* 2017). The purpose of the study is to investigate the evolutionary tendencies of the structural changes of the maxillofacial area in the history of man, to identify the correlation between the texture of food and development, and to investigate the biological systems that regulate these changes. This review considers the clinical observations from paediatric studies and discusses the relative importance of environmental and genetic factors in the growth of the jaw.

*Corresponding Author: Dr. M. Sathyakumar, Professor, Department of Oral Pathology and Microbiology, SRM Kattankulathur Dental College and Hospital, Kattankulathur, Chengalpattu, 603 203. Tamil Nadu, India. Email: sathyakm@srmist.edu.in.

MATERIALS AND METHODS

We present a narrative review based on evidence from several disciplines including evolutionary anthropology, palaeopathology, animal experimental studies and paediatric clinical research. The review draws on archaeological data, controlled dietary intervention studies in animal models and observational studies in human paediatric populations. Craniofacial morphology of different dietary periods was analysed and compared with experimental studies of bone metabolism, cellular signalling pathways and masticatory function. The relationship between the consistency of the diet and the maxillofacial development was understood based on clinical evidence of interdental spacing, prevalence of malocclusion, and orofacial functional measures.

RESULT AND DISCUSSION

Important dietary transitions in the evolution of the human lineage are marked by large changes in the architecture of the jaw. Such morphological changes are well documented in the archaeological record, and there are obvious differences between ancient and modern crania. Hunter-gatherer societies possessed strong mandibles adapted to dealing with mechanically demanding diets like tough meats, fibrous plant foods, seeds and nuts. These mandibles were long and narrow, providing enough space for complete dental eruption, including third molars. The authors described the populations as “an almost perfect harmony between their lower jaws and teeth” (Pinhasi *et al.,* 2015). A key moment was the agricultural revolution, some 12,000 years ago. The evolution of farming practices resulted in cultivated grains and processed plant foods that required less chewing effort. An analysis of 292 archaeological samples from the Levant, Anatolia, and Europe between 28,000 and 6,000 years ago showed important structural variations correlated with the advent of agriculture (Pinhasi *et al.,* 2015). There is evidence that early agricultural populations did not just evolve smaller jaw structures in concert. The mandible underwent "a complex series of shape changes commensurate with the transition to agriculture" (Pinhasi *et al.,* 2015). Hunter-gatherers had longer and more protrusive mandibles, while agriculturalists acquired shorter and broader variants of the mandible (Von Cramon-Taubadel, 2011). These morphological alterations were promoted by the availability of increasingly processed, mechanically soft meals throughout industrial food processing. Middle Age skulls had less dental crowding than mediaeval and modern skulls (Silvester *et al.,* 2021). In the 18th and 19th centuries, mechanised factories creating standardised, processed foods revolutionised food production (Kahn *et al.,* 2020). The industrialisation of milling technologies brought about major changes in the content and texture of bread. Mediaeval bread was made from coarse combinations of grain which included all of the grain components, and the loaves were hard and mechanically demanding. In the late 19th century, advances made fluffy white bread from refined flour available to all social classes (Lieberman, 2007). The effects of these alterations are seen in modern populations where malocclusion is present in one in five of the population (Pinhasi *et al.,* 2015). Japanese demographic studies have shown an increase in the prevalence of malocclusion from Early Jomon hunter-gatherer cultures (22.2%) to the agricultural Yayoi period (48.8%) (Emes *et al.,* 2011).

Reductions in jaw dimensions and posterior placement provided extra space in the oral cavity allowing for secondary resonator function for speech production (Lieberman, 2007). As humans evolved, the midface was shortened and the vertical supralaryngeal vocal tract was lengthened, producing a 1:1 ratio between the horizontal and vertical portions necessary for sophisticated vocalisation. These changes consisted of a constriction and lengthening of the pharynx with a posterior displacement of the tongue. Chewing is a high-stress activity (~1.4 Hz, 1.2-1.7 cycles of chewing per second), whereas talking is a mandibular activity at far higher frequencies of 3.5-6.5 syllables per second (Daegling & David, 2012). Therefore, speech may burden the mandible 3 to 5 times more than mastication, which may affect the patterns of bone growth. These anatomical changes had conflicting effects: they may have allowed for human speech capacities but also paved the way for dental crowding and malocclusion as modern diets diverged from those to which human populations had evolved adaptive responses. Ultra-processed foods as they are eaten today are very different from ancient diets, not just in terms of nutritional composition, but also in their basic physical properties. These meals are consistently soft, a significant departure from the mechanical requirements of traditional food sources.

The forces applied to the teeth and jaws in mastication are the basic stimuli for normal growth of the maxilla and mandible. Ultra-processed foods require minimal chewing and therefore do not adequately stimulate the maxillofacial musculature and the supporting bone structures (Von Cramon-Taubadel, 2011). This reduced mechanical loading triggers a cascade of developmental changes. A Spanish pilot study of 25 children aged between three and five years found that children whose diet consisted primarily of soft foods had less interdental space in the lower jaw (Von Cramon-Taubadel, 2011). These gaps are important for new permanent teeth to come in. Insufficient space causes the teeth to crowd together and malocclusion. It has been experimentally demonstrated that feeding juvenile rabbits on a soft pellet diet for 8 to 20 weeks leads to changes in the distribution of minerals in the mandibular structures (Grünheid *et al.,* 2011). The general concentration of minerals was similar to controls but the distribution pattern was much more heterogeneous (Grünheid, 2011). The results suggest that even small reductions in chewing demands can produce large changes in the trajectories of bone growth.

Mastication is realised by the action of many biological mechanisms that have an important role for the correct growth of the jaw. Chewing mechanical stress directly stimulates osteogenesis, improves the development of facial muscles and helps in appropriate teeth alignment (Inoue, *et al.,* 2019). Foods that are difficult to masticate provide resistance similar to mechanical loading in other musculoskeletal systems. These principles are directly demonstrated in laboratory research. In mice fed tougher food consistencies, higher mastication frequency and growth of masseter muscle has been observed (Song *et al.,* 2025). The mechanical pressure to jawbone structures stimulated the osteocytes to boost the synthesis of IGF-1, a major growth factor that promotes bone formation (Song *et al.,* 2025). These biological responses are mediated through well-known cellular signalling pathways. Mechanical stress produced by mastication activates T-cells in the structures of the jawbone, which is involved in bone remodelling processes and stimulates the release of cytokines in the periodontal tissues (Simione *et al.,* 2018). This leads to greater bone growth in areas that are sufficiently stimulated by chewing.

The maxillofacial structures undergo a key period of development during early childhood. Clinical observations reveal that children whose diets are made up largely of liquid nutrients (e.g., juice and milk products), semi-solid foods (e.g., yoghurts and pureed fruits), or commercially prepared infant meals acquire much less inter-dental spacing than children ingesting more solid food consistencies (Inoue, *et al.,* 2019). These tight spaces do not provide enough room for the permanent teeth to come in, which causes crowding. The introduction of solid foods has developmental functions beyond nutrition. Foods that need to be chewed more encourage the development of dental, mandibular, and related muscle structures (Liu *et al.,* 2024). The introduction of solid consistencies should be gradual, in keeping with the development of oromotor abilities for crushing and grinding (Liu *et al.,* 2024). Oral anatomic development and functional demands for processing food should be consistent to be ready for solid food introduction (Liu *et al.,* 2024). As Professor Tim Spector describes, modern youngsters are often eating mostly soft, processed meals from their early days of growth, the equivalent of eating "baby food for their whole lives" (Von Cramon-Taubadel, 2011). It has been shown that experienced people modify their mastication patterns according to the textural qualities of the food. More resistant food predicts faster jaw motions, stronger bite forces, and more chews per bolus (Liu *et al.,* 2024). During the critical phases of development, children need appropriate exposure to a variety of food textures to acquire these adaptive masticatory skills.

Bone cellular and molecular changes provide evidence in detail for the effect of dietary consistency on craniofacial structure. Specific biological processes are activated in experimental animal models when the demands on the masticatory system fall below the ideal level. Controlled dietary studies have demonstrated direct effects of food consistency on mandibular osseous development. Laboratory rats fed with a soft diet demonstrated significant losses in mandibular bone mass and mineral density (Fujita & Maki, 2018). These changes are due to disordered bone metabolism, in which the balance between osteoblastic production and osteoclastic resorption is disturbed after dietary adjustment. Studies of dietary intervention demonstrate that these changes are reversible. Increased intake of tougher foods has been demonstrated to restore normal bone turnover patterns disturbed by consumption of soft diet (Fujita & Maki, 2018). These findings offer therapeutic promise for treating under-developed mandibular structures. In tests on mice with caloric restriction, there are simultaneous decreases in mandible bone mass and increases in bone marrow adipose tissue (Haghanifar, 2017). The reason behind this is decreased mitochondrial ATP synthesis with increased formation of reactive oxygen species (Haghanifar, 2017). These metabolic shifts steer bone marrow stem cell differentiation from osteoblastic to adipocytic lineages. The consistency of food differently impacts maxillofacial bones. Research has shown that powdered diets have more dramatic impacts on the trabecular bone architecture in the mandible compared to maxillary structures (Fujita & Maki, 2018). Thus, alveolar osteopenia is more extensive in the mandibular areas when the masticatory strain is reduced (Fujita & Maki, 2018). The differential response is caused by anatomic changes in trabecular distribution. Areas distant from the periodontal ligament in the mandible had increased trabecular density compared to the maxilla (Fujita & Maki, 2018). Differential responses to masticatory pressures occur as changes in mechanical stimulation are transmitted through periodontal ligament structures to alveolar bone.

The midpalatal suture is a crucial developmental location that reflects the impact of food texture on craniofacial development. In 98% of cases, ossification at this suture occurs posterior to anterior (Boo Gordillo *et al.,* 2024). Bone formation normally increases with age, but chronological age is a poor predictor of developmental stage (Boo Gordillo, *et al.,* 2024). Mechanical forces are needed for suture formation. In certain people, open sutures have been seen which are related to reduced functional muscle forces, frequently due to tooth loss or continuous use of a soft diet (Boo Gordillo, *et al.,* 2024). Growing rats on a hard diet showed typical cartilaginous ossification with discrete growth plate structures with cellular proliferation and matrix calcification (Fujita & Maki, 2018). Rats fed powdered diets had thinner cartilage cell layers and loss of cartilaginous areas (Fujita & Maki, 2018). Reintroduction of hard foods following periods of soft diet reactivated chondrocyte growth and improved membranous ossification in previously impaired bone structures (Fujita & Maki, 2018). These results show that the midpalatal suture is able to adjust to changes in mechanical demand during development.

Recent studies in the paediatric population show clinical corroboration of nutritional factors affecting maxillofacial growth. A controlled pilot study of 25 children aged 3-5 years was undertaken in Spain comparing mandibular measures and eating trends. Children on liquid and semi-solid diets had considerably less interdental space in the lower arch than children on solid food diets (Fujita *et al.,* 2024). Such interdental gaps are important lodging places for the eruption of permanent teeth. The study also found moderate relationships between terminal plane measures and breastfeeding duration (Fujita *et al.,* 2024). The amount of fluid taken in each week was inversely related to overjet, quantifying the relationship between consistency of diet and dentofacial development (Fujita *et al.,* 2024). Clinical records indicate a high prevalence of malocclusion, which is defined as incorrect occlusal connections between opposing tooth arches, among populations with processed dietary consistencies. This link is associated with the relationship of masticatory function and osteogenic stimulation of the maxillofacial tissues (Fujita & Maki, 2018). The diet based on ultra-processed foods does not give sufficient mechanical stimulation of the craniofacial muscle, which results in reduced bone development (Fujita & Maki, 2018). According to clinical practitioners, these developmental defects affect respiratory function, speech articulation and overall oral function besides aesthetic consideration. Whether these changes are evolutionary adaptations or patterns of reaction to environmental change is still a question of professional consensus (Von Cramon-Taubadel, 2011).

The tongue pressure measures are clinical indicators of maxillofacial development. Controlled studies have shown direct correlations between maximal tongue pressure and masticatory performance in children aged 6–12 years (Fujita & Maki, 2018). This association has been reported in young adult populations (Fujita & Maki, 2018). A detailed study of 180 patients showed that better masticatory performance was associated with better dental status, higher BMI values and higher tongue pressure (Nelson, 1999). Dental status and tongue pressure were the main determinants of masticatory efficiency in young adults (Nelson, 1999). The results of this study suggest that adequate lingual function and masticatory activity act synergistically to provide optimal maxillofacial development during childhood. The contribution of inherited and environmental factors to the development of the mandible is still a topic of scientific discussion. Orthodontists have long believed that malocclusion has a primary genetic aetiology and during consultations, they commonly tell patients "malocclusion is most often hereditary". This is the case throughout government health websites and orthodontic offices (Silvester *et al.,* 2021). Anthropologists emphasise the role of environmental factors, particularly the reduction in mechanical demands of the diet (Hersberger-Zurfluh, 2024). The variance is partly due to methodological differences: orthodontists tend to look at familial clusters where hereditary patterns dominate, while anthropologists study community level trends which show environmental influences (Hersberger-Zurfluh, 2024). Twin studies support both sides. Certain mandibular features such as total mandibular length (74%), gonial angle (76%), and bony chin prominence (64%) at 12 years are found to be strongly heritable (Al-Obaidi, *et al.,* 2025). However, the environmental factors explain 10-84% of the variability in transverse growth at different embryonic stages (Shah *et al.,* 2024).

Tongue placement and functional patterns have a profound influence on mandibular development. The greater the tongue pressure, the higher the chewing performance in children (Fujita & Maki, 2018). Orofacial myofunctional therapy (OMT), a structured exercise program that targets the muscles of the neck and face, has become a popular therapeutic intervention for modification of tongue thrust and abnormal swallowing patterns (Shah *et al.,* 2024). Neuromuscular re-education is clinically efficacious. Therapy for tongue thrust treatment results in improved swallowing mechanics, oral breathing patterns, and resting postures of lips and tongue (Shah *et al.,* 2024). The exercises in straw drinking involve the combined action of the muscles of the lips, cheeks, and tongue (Shah *et al.,* 2024). The consistency of the diet is simply one factor in mandibular growth. Soft tissue factors such as lip inadequacy and tongue protrusion exert strong effects on occlusion (Tsolakis *et al.,* 2023). Interventions that are effective must go beyond dietary changes to tackle these issues. Bone growth takes place in a complex functional environment including muscular strength, bone dimensions, and craniofacial proportions (Tsolakis *et al.,* 2023). Environmental forces should be considered in conjunction with orthodontic treatment methods for successful correction of mandibular anomalies (Tsolakis *et al.,* 2023).

CONCLUSION

The study of maxillofacial development shows a large amount of evidence that diet has an influence on the jaw morphology of modern humans. Human populations are known to have undergone changes in mandibular anatomy as a result of the transition from hunter-gatherer to agricultural to processed food consumption. Ultra-processed meals result in lower masticatory demands, which do not provide appropriate mechanical stimulation to facilitate healthy jaw development. Because of the soft quality of these foods, the maxillofacial musculature is not stimulated enough and the osseous growth is inadequate. The clinical indications include increased prevalence of dental crowding, malocclusion and malaligned bite in modern populations. The underlying biological mechanisms are connected to the disturbance of the equilibrium between bone synthesis and bone resorption processes. The studies demonstrate a clear response of the maxilla and mandible to the reduction of masticatory strain, the mandible being generally more impacted. Studies on children demonstrate lower interdental spacing in youngsters on mostly liquid and semi-solid diets which is inadequate for eruption of permanent teeth. The relative contributions of genes versus environment constitute an important field of inquiry. While many mandibular features are highly heritable, a large proportion of the variation in craniofacial development can be explained by environmental factors. Treatment should be comprehensive, focusing on food patterns and functional issues such as tongue position and orofacial muscle function. The recorded change in the shape of the human jaw reveals the plasticity of craniofacial development to environmental forces. By understanding the association between food texture and maxillofacial growth, dietary advice can be given to encourage optimal development. The challenge is to reconcile modern food processing with the mechanical demands for optimal growth of the jaw in modern populations.

ACKNOWLEDGMENT

The authors express sincere thanks to the Head of the Department of Oral Pathology and Microbiology, SRM Kattankulathur Dental College and Hospital, Faculty of Medicine and Health Sciences, SRM Institute of Science and Technology, Kattankulathur, Chengalpattu for the facilities provided to carry out this research work.

CONFLICT OF INTERESTS

The authors declare no conflict of interest

ETHICS APPROVAL

Not applicable

FUNDING

This study received no specific funding from public, commercial, or not-for-profit funding agencies.

AI TOOL DECLARATION

The authors declare that no AI and related tools are used to write the scientific content of this manuscript.

DATA AVAILABILITY

Data will be available on request

REFERENCES

Ahmed, M. K., Ye, X., & Taub, P. J. (2016). Review of the genetic basis of jaw malformations. *Journal of Pediatric Genetics, 5*(4), 209–219.

Al-Obaidi, S., Papageorgiou, S. N., Saade, M., Caradonna, K. M., Kantarci, A., Will, L., & Motro, M. (2025). Influence of genetic and environmental factors on transverse growth. *European Journal of Orthodontics, 47*(2), cjaf003.

Boo Gordillo, P., Marqués Martínez, L., Borrell García, C., & García Miralles, E. (2024). Relationship between nutrition and development of the jaws in children: A pilot study. *Children, 11*(2), 201.

Corruccini, R. S. (1999). *How anthropology informs the orthodontic diagnosis of malocclusion's causes*. Lewiston, NY: Edwin Mellen Press.

Daegling, D. J. (2012). The human mandible and the origins of speech. *Journal of Anthropology, 2012*, 201502.

Emes, Y., Aybar, B., & Yalcin, S. (2011). On the evolution of human jaws and teeth: A review. *Bulletin of the International Association for Paleodontology, 5*(1), 37–47.

Fujita, Y., & Maki, K. (2018). Association of feeding behavior with jaw bone metabolism and tongue pressure. *Japanese Dental Science Review, 54*(4), 174–182. doi:10.1016/j.jdsr.2018.05.001

Fujita, Y., Ichikawa, M., Hamaguchi, A., & Maki, K. (2018). Comparison of masticatory performance and tongue pressure between children and young adults. *Clinical and Experimental Dental Research, 4*(2), 52–58.

Grünheid, T., Langenbach, G. E., Brugman, P., Everts, V., & Zentner, A. (2011). The masticatory system under varying functional load. Part 2: Effect of reduced masticatory load on the degree and distribution of mineralization in the rabbit mandible. *European Journal of Orthodontics, 33*(4), 365–371.

Haghanifar, S., Mahmoudi, S., Foroughi, R., Mir, A. P. B., Mesgarani, A., & Bijani, A. (2017). Assessment of midpalatal suture ossification using cone-beam computed tomography. *Electronic Physician, 9*(3), 4035–4041.

Hersberger-Zurfluh, M. A., Motro, M., Kantarci, A., Will, L. A., Eliades, T., & Papageorgiou, S. N. (2024). Genetic and environmental impact on mandibular growth in mono- and dizygotic twins during adolescence: A retrospective cohort study. *International Orthodontics, 22*(1), 100842.

Inoue, M., Ono, T., Kameo, Y., Sasaki, F., Ono, T., Adachi, T., & Nakashima, T. (2019). Forceful mastication activates osteocytes and builds a stout jawbone. *Scientific Reports, 9*(1), 4404.

Kahn, S., Ehrlich, P., Feldman, M., Sapolsky, R., & Wong, S. (2020). The jaw epidemic: Recognition, origins, cures, and prevention. *BioScience, 70*(9), 759–771.

Kiliaridis, S. (1995). Masticatory muscle influence on craniofacial growth. *Acta Odontologica Scandinavica, 53*(3), 196–202.

Kono, K., Tanikawa, C., Yanagita, T., Kamioka, H., & Yamashiro, T. (2017). A novel method to detect 3D mandibular changes related to soft-diet feeding. *Frontiers in Physiology, 8*, 567.

Lieberman, P. (2007). The evolution of human speech: Its anatomical and neural bases. *Current Anthropology, 48*(1), 39–66.

Liu, L., Le, P. T., DeMambro, V. E., Feng, T., Liu, H., Ying, W., Baron, R., & Rosen, C. J. (2025). Calorie restriction induces mandible bone loss by regulating mitochondrial function. *Bone, 190*, 117326.

Pinhasi, R., Eshed, V., & von Cramon-Taubadel, N. (2015). Incongruity between affinity patterns based on mandibular and lower dental dimensions following the transition to agriculture in the Near East, Anatolia and Europe. *PLoS ONE, 10*(2), e0117301.

Shah, S. S., Nankar, M. Y., Bendgude, V. D., & Shetty, B. R. (2021). Orofacial myofunctional therapy in tongue thrust habit: A narrative review. *International Journal of Clinical Pediatric Dentistry, 14*(2), 298–303.

Silvester, C. M., Kullmer, O., & Hillson, S. (2021). A dental revolution: The association between occlusion and chewing behaviour. *PLoS ONE, 16*(12), e0261404.

Simione, M., Loret, C., Le Révérend, B., Richburg, B., Del Valle, M., Adler, M., Moser, M., & Green, J. R. (2018). Differing structural properties of foods affect the development of mandibular control and muscle coordination in infants and young children. *Physiology & Behavior, 186*, 62–72.

Song, Y., Jiao, Y., Liu, Y., & Guo, L. (2025). Role of masticatory force in modulating jawbone immunity and bone homeostasis: A review. *International Journal of Molecular Sciences, 26*(10), 4478.

Tsolakis, I. A., Verikokos, C., Perrea, D., Perlea, P., Alexiou, K. E., Yfanti, Z., Lyros, I., Georgaki, M., Papadopoulou, E., & Tsolakis, A. I. (2023). Effects of diet consistency on rat maxillary and mandibular growth within three generations—A longitudinal CBCT study. *Biology, 12*(9), 1260.

von Cramon-Taubadel, N. (2011). Global human mandibular variation reflects differences in agricultural and hunter-gatherer subsistence strategies. *Proceedings of the National Academy of Sciences of the United States of America, 108*(49), 19546–19551.