FEATURE

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Sleep Disorder Breathing: 9 Clinical Cranial Morphological Indicators for Dentists

By James Bronson, DDS

Abstract: Sleep disordered breathing (SDB) is a condition characterized by intermittent partial or complete airway obstruction that disrupts normal ventilation during sleep and normal sleep patterns.1 Approximately 10% of 6-8 year olds have SDB according to a Finnish study.2 There is no consensus on the definition of pediatric SDB, but clinically there is a spectrum of symptoms, in which the milder forms only have primary snoring and mouth-breathing, while the more severe forms have symptoms similar to the more defined entity obstructive sleep apnea syndrome (OSAS), i.e., intermittent breathing pauses (apneas), habitual snoring, snorts or gasps, disturbed sleep, and daytime neurobehavioral problems with impaired school performance.3 The impact of SDB on the growth and development of children may have detrimental effects on health, neuropsychological development, quality of life, and economic potential. 4 Understanding the parameters of early diagnosis and treatment are paramount to stemming this problem.

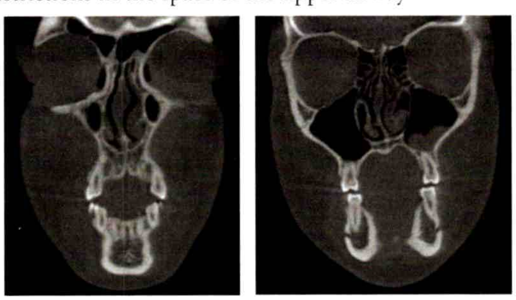
Key words: Sleep disorder breathing, SDB, sleep apnea, OSA, lingual frenum, retruded mandible, long face, hyoid bone, UARS, upper airway restrictions, high palate, crossbite, mouth breathing, tonsils

Nine Cranial Morphological Indicators of Sleep Disorder Breathing

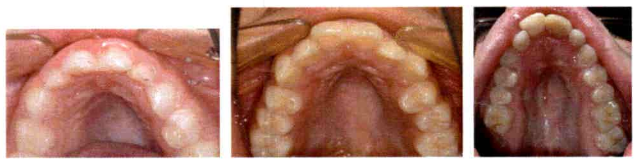
1. A retruded maxilla and/or mandible,[5] a long face height and restrictions in the space of the upper airway.[6,7]

2. A long face height[5,6]

3. Restrictions in the space of the upper airway[5,6]



4. Study model analyses demonstrated that OSA subjects differ significantly from control subjects in palatal height measurements.[6]



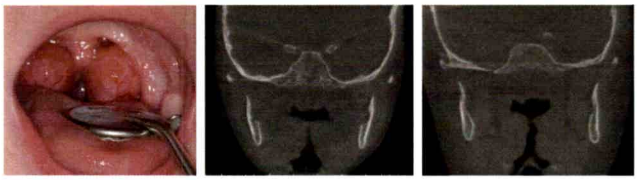
5. Crossbite and open bite malocclusions were associated with SDB, and may be predictive of SDB in children.[7]

6. Lingual frenulum … leads to a skeletal malocclusion, with the degree being influenced by the different levels of attachment of the frenum on the tongue.[8]

7. The vertical position of the hyoid bone is believed to be a predictor of obstructive sleep apnea (OSA).[9]

8. Mouth-breathing can influence craniofacial and occlusal development early in childhood.[10]

9. Enlarged tonsils, childhood OSAS (obstructive sleep apnea syndrome) usually stems from adenotonsillar hypertrophy. OSAS in infants is usually related to craniofacial anomalies.[11]



Sleep disorder breathing (SDB) is the current buzz around the medical community. In the July 23, 2012 edition of the *Fiscal Times* an article on "Sleepless in America" indicated that sleep is a $32.4 billion dollar business.

Dentist should be the first line of diagnosis for SDB, dentists see their patients more frequently than most pediatricians and internists. Understanding and recognizing the cranial morphological indicators of sleep disorder breathing and then treating or referring are paramount in stemming this ever increasing healthcare problem and expense

References

1. American Academy of Pediatrics. Clinical practice guidelines: diagnosis and management of childhood obstructive sleep apnea syndrome. *Pediatrics*. 2002;109:704–12.
2. University of Eastern Finland. "One in ten 6- to 8-year-olds has sleep-disordered breathing, Finnish study finds." ScienceDaily. *ScienceDaily*, 14 December 2012. <www.sciencedaily.com/releases/2012/12/121214085851.htm>.
3. Kaemingk KL, Pasvogel AE, Goodwin JL, et al. Learning in children and sleep disordered breathing: findings of the Tucson Children's Assessment of Sleep Apnea (tuCASA) prospective cohort study. *J Int Neuropsychol Soc*. 2003;9:1016–26.
4. Sanjeev, Kumar Verma, Sandhya Maheshwari, et al. Role of oral health professional in pediatric obstructive sleep apnea *Natl J Maxilloofac Surg* 2010; 1(1): 35-40.
5. Korayem MM, Witmans M, MacLean J, et al. Craniofacial morphology in pediatric patients with persistent obstructive sleep apnea with or without positive airway pressure therapy: A cross-sectional cephalometric comparison with controls. *Am J Orthod Dentofacial Orthop* 2013;144:78–85.
6. Johal A, Conaghan C. Maxillary morphology in obstructive sleep apnea: A cephalometric and model study. *Angle Orthodontist*, 2004; 74(5).
7. Fernando Rodrigues Carvalho' Débora Aparecida Lentini-Oliveira , Graziele Maria Missiano Carvalho, Lucila Bizari Fernandes Prado, Gilmar Fernandes Prado, Luciane Bizari Coin Carvalho' Sleep-disordered breathing and orthodontic variables in children—Pilot study: *International Journal of Pediatric Otorhinolaryngology* 2014; 78(11): 1965–1969.
8. Meenakshi S, Jagannathan N. Assessment of lingual frenulum lengths in skeletal malocclusion. *Journal of Clinical and Diagnostic Research*. 2014; 8(3): 202-204.
9. Pae, E-K, Blasius JJ, Jeffrey JJ, Blasius,Nanda, R. Heterogeneity in vertical positioning of the hyoid bone in relation to genioglossal activity in men. *Angle Orthodontist* 2004;74(3).
10. Mattar SE, Anselmo-Lima WT, Valera FC, Matsumoto MA. Skeletal and occlusal characteristics in mouth-breathing pre-school children. *J Clin Pediatr Dent* 2004; 28(4):315-8.
11. Ward SL, Marcus CL. Obstructive sleep apnea in infants and young children. *J Clin Neurophysiol*. 1996; 13(3):198-207.

Dr. Bronson graduated "Cum Laude" from Georgetown University School of Dentistry in 1983. He has General Dental Practices in McLean and Charlottesville, Virginia, and a practice limited to ALF (Advanced Light Force) Orthodontics and TMD therapy in Santa Cruz, CA. In 2013, Dr. Bronson founded The ALF Educational Institute, LLC (AEI) and is Director of Clinical Programs. The mission of AEI is to provide structured and certified education in the functions, actions, and designs of the ALF family of appliances, while emphasizing the need for combined cranial osteopathic treatment, orofacial myofunctional therapy, and orthodontics. Dr. Bronson is a Senior Certified Instructor IAO and international speaker.

Treating the cause of malocclusions, not the consequence

Photos/Provided by Dr. German Ramirez-Yañez

By German Ramirez-Yañez, DDS, MDSc, PhD

Extraction versus non-extraction treatment in orthodontics has been a matter of controversy since the beginning of the specialty. Edward H. Angle debated, "The best balance, the best harmony, the best proportions of the mouth in its relation to the other features require, in all cases, there shall be the full complement of teeth, and each tooth shall be made to occupy its normal position." Later, Tweed swung the pendulum toward extractions in the mid-1930s, reaching a peak in the United States during the '60s. However, added to a better understanding on the biology of the mouth and the physiology of various tissues in the cranio-cervico-mandibular system, the development of new techniques, insights in early treatment[1] and the probability of combining fixed and functional appliances[2] has swung the pendulum again to the side of non-extractions.

Today, there is a high prevalence of malocclusion (approximately 80 percent[3,4]), and dental extraction continues to be included in treatment plans. Extractions might give enough space for tooth alignment and third-molar eruption if present;[5] however, teeth are moved into a theoretical ideal position, which is not necessarily a natural nor a stable position. So, professionals treating malocclusion use a retainer at the end of active treatment (which needs to be in place for a long period), expecting that the cranio-cervico-mandibular system will adapt to this non-physiological situation. But this does not occur in most cases.

Relapse occurs when the patient discontinues use of his or her retainer because, although teeth are aligned, the muscles in the system continue to exert as much force as they had prior to treatment. Although it has been reported that a physiological force delivered by the facial and masticatory muscles may not affect the position of teeth,[6] in a situation where those muscles deliver a non-physiological force on the structures of the system, it will definitively affect the position of the teeth.[7]

As it was stated by Graber,[8] "In a fight between muscles and bone, bone loses." In other words, a muscular dysfunction present at the beginning of treatment, and not corrected during the course of treatment, will continue delivering non-physiological forces to the jaws and teeth, producing a relapse.[7]

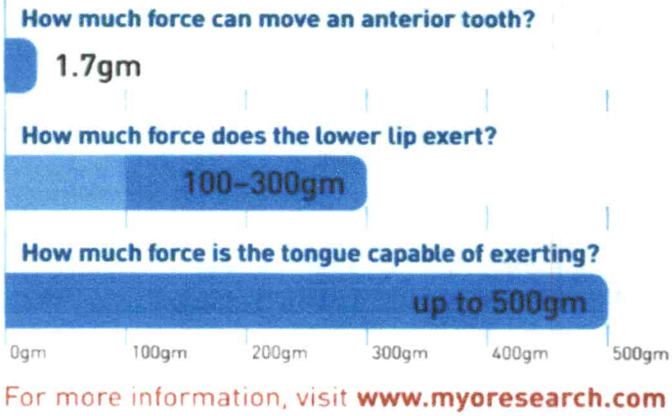
It is important to understand that fixed appliances were designed to move teeth but not to control and improve muscular activity in the masticatory, facial and tongue muscles.

Furthermore, brackets were not designed to improve nasal breathing. Also, only a few functional appliances produce that effect. Therefore, issuing a diagnosis that determines the factors causing the malocclusion — using a combination of various techniques to correct all factors involved — allows for better treatment to be performed, while significantly reducing the number of extractions required.

There is little justification for the profession to continue extraction-based orthodontics on its patients and then ask them to wear a retainer appliance or a bonded wire for long periods of time. The dental profession has to understand that the cranio-cervico-mandibular system is active and dynamic.

Moving teeth would be the ideal solution if we were working on a static system, but we are not. Treatment of malocclusion should deal with the causative factors, dysfunction and altered muscular force, as well as with the consequences: tooth misalignment. In this way, a stable result will be achieved.

Therefore, any treatment intending to correct a malocclusion must aim to improve oral function while reeducating the masticatory and facial muscle's activity during function — naturally positioning the teeth without extractions.



'Moving teeth would be the ideal solution if we were working on a static system, but we are not.'

References

1) Gianelly AA. Leeway space and the resolution of crowding in the mixed dentition. Semin Orthod 1995; 1: 188-194.
2) Ramirez-Yañez GO, Guarim J. Combining functional and fixed appliances to improve results in open bite treatment. Func Orthod 2007; 4-9.
3) Proffit WR, Fields HW Jr, Moray LJ. Prevalence of malocclusion and orthodontic treatment need in the United States: estimates from the NHANES III survey. Int J Adult Orthodon Orthognath Surg. 1998; 13:97-106.
4) Grando G, Young AAA, Vedovello Filho M, Vedovello SAS, Ramirez-Yañez GO. Prevalence of malocclusions in a young Brazilian population. Int J Orthod 2008; 19: 13-16.
5) Janson G, Putrick LM, Henriques JF, de Freitas MR, Henriques RP. Maxillary third molar position in Class II malocclusions: the effect of treatment with and without maxillary premolar extractions. Eur J Orthod 2006; 28: 573-579.
6) Van der Linden FPGM, Proffit WR. Orofacial Functions. Quintessence Publishing 2004.
7) Ramirez-Yañez GO, Farrell C. Soft tissue dysfunction: A missing clue when treating malocclusions. Int J Jaw Func Orthop 2005; 1: 483-494.
8) Graber TM. The three M's: muscles, malformation and malocclusion. Am J Orthod 1963; 49: 418-450.

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Early Treatment with the ALF Functional Appliance

By James M. Bronson, DDS; James Alexander Bronson, DMD

Abstract: *The aim of this study is to report five cases of children treated with an interceptive technique utilizing ALF (Advanced Light Force) functional orthodontic appliances in anterior and/or posterior cross bites in primary and early mixed dentition.*

Keywords: ALF;Crossbite correction;primary dentition;early mixed dentition;posterior unilateral crossbite correction;posterior bilateral crossbite correction;anterior crossbite correction;snoring;narrow airway;facial asymmetry

Introduction

A cross bite occurs in 7-17% of young children. Cross bites are can be posterior unilateral, posterior bilateral, or anterior. Posterior cross bites of dento-alveolar origin, a transverse discrepancy of the maxillo-mandibular relationship, are one of the most common malocclusions in the primary and mixed dentition. Cross bites in young children are often indicative of potential or actual mandibular facial asymmetries.[2] Consequently, the ideal time to correct a cross bite is as early as detected and in the primary dentition phase, if possible.[3,4] In anterior cross bites, the masticatory pattern of protruding the mandible and jumping into cross bite becomes fixed in the brain by about age 4.[5,6,7] Posterior cross bites that are left untreated in early childhood can lead to asymmetries in the temporo-mandibular joint (TMJ) and mandible.[1,8,9,10] Muscular imbalance in a unilateral cross bite situation encourages the mandible to become significantly longer on the non-cross bite side.[5,11] When a cross bite is found in the primary dentition and allowed to carry over into the permanent dentition, it is more difficult to treat.[12,13] However with early diagnosis and early interceptive treatment with the ALF functional appliance, it is possible to obtain the proper skeletal and dental alignments. The ALF appliance was developed by Dr. Darick Nordstrom in 1982 with input from osteopathic physicians, the purpose was to design an orthodontic appliance with a focus on cranial rhythm and movement, a "cranial friendly" approach.[14] The purpose of these case reports is to demonstrate the efficacy of the ALF appliance in the corrective treatment of cross bites in the primary and early mixed dentition.

Methods Materials

We describe five cases involving children in primary or early mixed dentition (mean age = 6 years) who had one or more types of dental cross bite. In each case, we carried out a full orthodontic work up that included the following: a medical and dental history, a thorough clinical evaluation, intraoral and extraoral photographs, diagnostic models of the teeth and gums, and a 3D cone beam CT scan (i-CAT). During the history the parents reported incidents of snoring, tooth grinding, and mouth breathing. In addition to the cross bites, the clinical evaluation revealed a class III tendency, facial asymmetry, cervical displacement, narrow airways, large tonsils in four cases, and an anterior tongue thrust or low tongue posture in all five cases. Each case was referred to an Osteopath for periodic osteopathic evaluation and an Oral Myologist for orofacial muscle toning and reeducation.

The ALF appliance was chosen in these five cases because each child had a myofunctional tongue posture problem, the ALF has minimal bulk, and the strategic placement of the omega loops encourages normal tongue oral rest posture position, instead of further impeding tongue placement as a conventional rapid palatal expander (RPE) would do. In addition, the light elgiloy wire does not over power the cranial mechanism as a screw driven conventional rapid palatal expander (RPE) or traditional fixed mechanics can do, and the ALF is a more comfortable appliance that doesn't tend to interfere with speech.

Using the workup findings, we designed an ALF appliance for each patient with an .025 yellow eligloy body wire; The cribs, and crescents were fabricated from .022 yellow eligiloy wire and soldered with a gold solder. The configuration utilized was three omega loops, two posterior loops and one anterior loop with crescents on the cuspids and cribs and crescent claps on the primary second molars. It should be noted that the ALF design specifically avoids restricting the premaxilla and palantine bones.[15] The basic ALF design usually cribs the molars, but activation places force vectors through the cuspid and premaxillary sutures, these in turn open the premaxilla releasing the maxillary and premaxillary sutural restrictions, and reducing the forces necessary to develop the maxillae. The

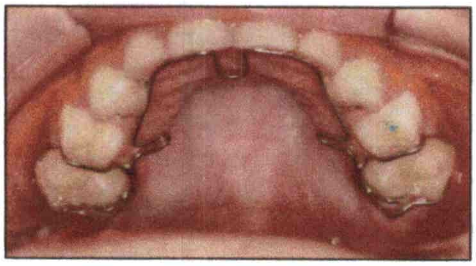


Figure 1: ALF for treatment in Primary Dentition.

ALF's use of composite ledges to selectively stabilize the body wire makes it a "fixed-removable" type appliance and facilitates force couples that increase tooth movement and enhance cranial motion.[14] The boundary between the premaxilla and maxilla can be discernible up to 5-years-of-age.[16]

At the delivery appointment(first post-workup visit), we passively seated and then retained the ALFs in the mouth using bonded resin composite ledges on the buccal surfaces of the second primary molars (E's) and the lingual of the primary canines (C's). Composite pad build ups just high enough to disclude the bite and clear the cross bite were placed on the mandibular first primary molars. This was done to allow the first molars to erupt into the proper position stabilizing the mandible.[12,13,17]

We scheduled the follow-up appointment (second visit) for four weeks after the delivery appointment. At that visit we removed, cleaned, and activated the ALF appliance's anterior omega loop using a bird beak light wire plier. This activation creates a slight forces in a transverse direction with emphasis in the direction of the posterior cross bite, if the cross bite is unilateral, or equal emphasis if a bilateral cross bite is present. We then reinsert the ALF to engage the previously placed composite ledges and scheduled another four week follow-up appointment.

At the third visit (4 weeks later) we removed and cleaned the ALF and further activated it, again in the anterior omega loop following the same technique as in the previous appointment. At this visit we additionally activated the posterior omega loops, bilaterally in the case of anterior cross bites. The bird beak light wire pliers were used to open the posterior omega loops.

The fourth and later visits followed the same protocol as the third visit. At each follow-up visit, we continually monitor growth and development in both the transverse dimension (anterior omega loop) and anterior-posterior dimension (posterior omega loops). For each case, we continued this sequence for several months until the cross bites cleared.

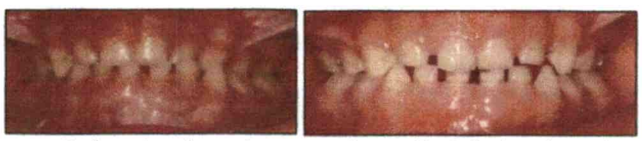
Case1: Left side posterior cross bite with an anterior component in the primary dentition of a 5 year old male.

Case2: Anterior Cross bite in Early Mixed Dentition in a 6-year-old male.

Case 3: Right Posterior and Anterior Cross bite primary dentition in a 5-year-old female.

Case 1: Left side posterior cross bite with an anterior component in the primary dentition of a 5-year-old male.

Decreased airway | Before treatment | 8 months into treatment



Before treatment | 8 months into treatment

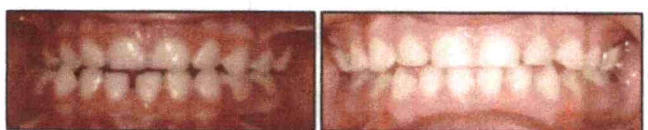
Case 2: Anterior cross bite in mixed dentition in a 6-year-old male.

Decreased airway | Before treatment | 15 months into treatment

Before Treatment | 15 months into treatment

Case 3: Right posterior and anterior cross bite in primary dentition in a 5-year-old female

Decreased Airway | Facial asymmetry | 8 months into treatment



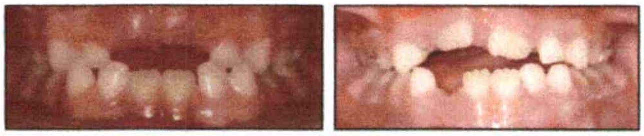
Before treatment | 8 months into treatment

Case 4: Anterior Crossbite in Early Mixed dentition in a 6-year-old female.

Case 5: An anterior and posterior cross bite in Early Mixed Dentition of a 6-year-old female.

Case 4: Anterior cross bite in the primary dentition of a 7-year-old female

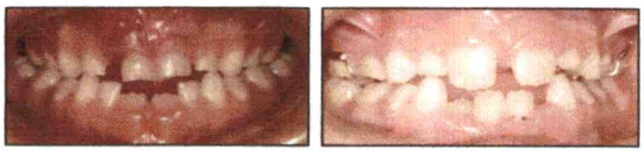
Decreased Airway | Before treatment | 3 months into treatment



Before treatment | 3 months into treatment

Case 5: Anterior and posterior cross bites in a 6-year-old female in early mixed dentition.

Decreased airway | Before treatment | 5 months into treatment



Before treatment | 5 months into treatment

Results

In all five cases, we diagnosed the cross bites at an early stage of growth and development and promptly initiated treatment with ALF appliances. All five children experienced favorable results in the correction of the cross bites using the ALF appliance as an interceptive appliance in the primary and early mixed dentition. In addition, whereas the baseline iCAT evaluation had revealed narrow airways, class III growth tendency, and cervical displacement in each case, the mothers of all the cases reported cessation of snoring and improved nasal breathing at night. Moreover, the photographic follow-up evidence indicates an improvement in midline discrepancy, head posture, and facial symmetry (see cases 1-5).

Conclusion

The ALF (advanced light force) appliance is effective for the correction of cross bites in primary and early mixed dentition cases. All five of our young cases demonstrated cross bite correction, facial symmetry improvement, and cervical posture improvement. Myofunctional retraining regimes have been recommended to the parents to maintain the corrections and continue to tone the orofacial musculature.[18] The parents reported an improvement in pretreatment snoring which may indicate that the ALF appliance could be an efficient appliance in the treatment of pediatric sleep disorder breathing. The current approach in the primary dentition is rapid maxillary distraction to open the narrow palate, decrease nasal resistance, and promote better facial growth, and then repeated 2 years later.[19]

References

1. Vadiakas GP, Roberts MW. Primary posterior crossbite: diagnosis and treatment. *J Clin Pediatr Dent* 1991 Fall; 16(1):1-4.
2. Lam PH, Sadowsky C, Omerza F. Mandibular asymmetry and condylar position in children with unilateral posterior crossbite. *Am J Orthod Dentofacial Orthop* 1999;115:569-75.
3. Thilander B, Wahlund S, Lennartsson B. The effect of early interceptive treatment in children with posterior crossbite. *Eur. J. Orthod.* 1984;6:25-34.
4. Thilander B, Lennartsson B. A study of children with unilateral posterior crossbite, treated and untreated, in deciduous dentition. *J. Orofac. Orthop.* 2002;63:371-83.
5. Huggare, J. Postural Disorders and dentofacial morphology. *Acta Odontol. Scand* 1998;56:383-6.
6. Sato C, Muramotob T, Soma K. Functional lateral deviation of the mandible and its position recovery on the rat cartilage during growth period. *Angle Orthod.* 2006;76:591-7.
7. Nakano H, Maki K, Shibasaki Y, Miller AJ. Three –dimensional changes in the condyle during development of an asymmetrical mandible in a rat. A microcomputed tomography study. *Am J. Orthod Dentofacial Orthop* 2004; 126:410-20.
8. Pinto AS, Buschang PH, Throckmorton GS, Chen P. Morphologcal and positional asymmetries of young children with functional unilateral crossbite. *Am J Orthod Dentofacial Orthop.* 2001;120:513-20.
9. Van Keulen C, Martens G, Dermaut L, Unilateral posterior crossbite and chin deviation: is there a correlation? *Eur J Orthod* 2004;26:283-8.
10. Zhu JF, Crevoisier R, King DL, Henry R, Mills CM. Posterior crossbite in children. *Compend. Contin. Educ. Dent.*1996;17:1051-4.
11. Nerder PH, Bakke M, Solow B. The functional shift of the mandible in unilateral posterior crossbite and the adaptation of the temporomandibular joints: a pilot study. *Eur. J. Orthod.* 1999;21:155-66.
12. Tsarapatsani P, Tullberg M, Linder A, Huggare J. Long term follow-up of early treatment of unilateral forced posterior cross-bite. Orofacial status. *Acta Odontol Scand* 1999;57:97-104.

13. Tullberg, M, Tsarapatsani P, Huggare J, Kopp S. Long term follow-up of unilateral forced posterior cross-bite with regard to temporomandibular disorders and associated symptoms. *Acta Odontol Scand* 2001;59:280-4.
14. Nordstrom D. The ALF appliance. *J. AAGO* 1999;17:20-24.
15. Smith G, Ashton, H. ALF appliance design conforms to functional cranial anatomy. *Functional Orthodontist* 1996; 13:29-32.
16. Lang, J. Clinical anatomy of the masticatory apparatus peripharyngeal spaces ISBN 978-13-799101-4.
17. Throckmorton GS, Buschang PH, Hayasaki H. Pinto AS. Changes in the masticatory cycle following treatment of posterior unilateral crossbite in children. *Am J Orthod Dentofacial Orthop* 2001;120:521-9.
18. Guimaraes KC, Drager LF, Genta PR, Marcondones BF, Lorenzi-Filho G (2009) Effects of oropharyngeal exercises on patients with moderate obstructive sleep apnea syndrome. *Am J Respir Crit Care Med* 179(10)962-966.
19. Pirelli P, Saponara M, De Rosa C, Fanucci E (2010) Orthodontics and obstructive sleep apnea in children. *Med Clin North Am* 94(3):517-529.

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Dr. James "Alex" Bronson is a 2012 graduate of Midwestern University, Arizona College of Dental Medicine. His interests lie in "Whole Body Dentistry", TMD treatment, Implant and Cosmetic Dentistry, Orofacial Myofunctional Therapy and ALF Transformational Orthodontics. Through Matscan Analysis, he has helped quantify the relationship between sway, posture, balance, and mandibular jaw position.