

AAO Foundation Award Final Report

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Secondary Investigators	
Award Type	Corporate Center Award
Project Title	Functional and Morphological Consequences of Early Orthodontic Treatment
Project Year	July 1999 – July 2002
Institution	Baylor College of Dentistry, Department of Orthodontics The Texas A&M University System Health Science Center
Summary/Abstract	<p>The center carried out prospective studies investigating whether patients with malocclusions have significant deficits in oral-motor function (<i>aMF</i>) and to develop new techniques that more reliably evaluate <i>aMF</i>. A statistical approach for evaluating chewing cycle kinematics was developed (Buschang, et al., 2000). This approach allowed, for the first time, statistical comparison of the entire 3-D chewing cycle envelope between groups or within groups before and after treatment. The new method was used to evaluate <i>aMF</i> before and after treatment for unilateral posterior crossbite (Santos-Pinto, et al., 2001; Throckmorton et al., 2001). These studies showed that correcting a cross-bite malocclusion did not eliminate deficits in <i>aMF</i>. The method was also used to examine how well incisor movements correlate with movements of the condyles (Travers, et al., 2000; Buschang et al., 2001), how opening and closing envelopes differ between the sexes (Lewis et al., 2001), and how head posture affects mandibular rest position (Tingey, et al., 2001). These studies demonstrated a complex relationship between condyle movements and incisor movements, indicating that better methods are needed for clinical evaluation of condylar motion. Finally, the new method demonstrated how certain experimental parameters (such as bolus size [Bhatka, et al., 2004], bolus hardness [Anderson, et al., 2001], and chewing rate [Throckmorton, et al., 2001]) affect chewing cycle kinematics. Results from these studies are being used to enhance the precision and reliability of future kinematic studies.</p> <p>In addition to chewing cycle kinematics, center studies looked for deficits in masticatory performance among orthognathic surgery patients (English, et al., 2002), using new techniques for precise measurements of occlusal contacts (Parkinson, et al., 2001; Owens et al., 2002). These studies demonstrated that patients with malocclusions suffer both subjective and objective deficits in their</p>

ability to break down food.

The center project also developed a technique for taking ultrasound measurements of the face, including 3-D volumetric measurements, that eliminates the distortion and compression of the ultrasound probe (Smith and Throckmorton, 2004). This new method should allow more reliable measurements of jaw muscle volumes, an important factor in forces affecting craniofacial growth.

The AAOF Center Award has directly and indirectly supported a large number of projects involving numerous collaborators. In addition to the principal investigators, four other faculty members and two post-doctoral fellows have collaborated on the various projects performed. The Center Award has also provided partial support of five orthodontic residents (master's) theses, eight dental student projects, and one PhD thesis. As shown below, the support of the AAOF has resulted in 15 published papers, 15 abstracts of presentations at national or international meetings, one manuscript in press, and three manuscripts submitted for publication. There are also a number of additional papers in preparation that will acknowledge the support of the AAOF.

Publications

a. Refereed Papers

Bhatka R, Throckmorton GS, Wintergerst A, Hutchins B, Buschang PH. Bolus size and unilateral chewing cycle kinematics. *Archs oral BioI* 2004; 49:559-566.

Albert TE Jr, Buschang PH, Throckmorton GS. Masticatory performance: a protocol for standardized production of an artificial test food. *J Oral Rehab* 2003; 30; 720-2.

Garcia-Morales P, Buschang PH, Throckmorton GS, English JD. Maximum bite force, muscle efficiency and mechanical advantage in children with vertical growth patterns. *Eur J Orthod* 2003; 25: 265-72.

Owens S, Buschang PH, Throckmorton GS, Palmer L, English JD. Masticatory performance and areas of occlusal contact and near contact in subjects with normal occlusion and malocclusion. *Am J Orthod Dentofac Orthop* 2002; 121: 602-609..

Anderson K, Throckmorton GS, Buschang PH, Hayasaki H. The effect of bolus hardness on masticatory kinematics. *J Oral Rehab* 2002; 29:689-696.

English JD, Buschang PH, Throckmorton GS. Does malocclusion affect masticatory performance? *Angle Orthod* 2002; 72:21-27.

Santos Pinto A, Buschang PH, Throckmorton GS, Chen P. Morphological and positional asymmetries of young children with functional unilateral posterior crossbite. *Am J Orthod Dentofac Orthop* 2001; 120: 513-520.

Throckmorton GS, Buschang PH, Hayasaki H, Santos-Pinto, A. Changes in the masticatory cycle following treatment of posterior unilateral crossbite in children. *Am J Orthod Dentofac Orthop* 2001; 120: 521-529.

Tingey EM, Buschang PH, Throckmorton GS. Mandibular rest position: a reliable position influenced by head support and body posture. *Am J Orthod Dentofac Orthop* 2001; 120:614-622.

Thompson DJ, Throckmorton GS, Buschang PH. The effects of isometric exercise on maximum voluntary bite forces and jaw muscle strength and endurance. *J Oral Rehab* 2001; 28:909-917.

Lewis RP, Buschang PH, Throckmorton GS. Sex differences in mandibular movement during opening and closing. *Am J Orthod Dentofac Orthop* 2001; 120: 294-303.

Throckmorton GS, Buschang PH, Hayasaki H, Phelan T. The effects of chewing rates on mandibular kinematics. *J Oral Rehab* 2001; 28: 328-334.

Buschang PH, Throckmorton GS, Travers KH, Hayasaki H. Incisor and mandibular condylar movements of young adult females during maximum protrusion and lateratrusion of the jaw. *Arch oral Bioi* 2001; 46: 39-48.

Buschang PH, Hayasaki H, Throckmorton GS., Quantification of human chewing-cycle kinemateics. *Arch oral Bioi* 2000; 45: 461-474.

Travers KH, Buschang PH, Hayasaki H, Throckmorton GS. Condylar kinematics in adult females I. Associations between incisor and condylar movements during maximum opening. *Arch oral Bioi* 2000; 45: 267-275.

b. Abstracts (papers presented at national and international meetings)

Buschang, PH, Gandini, L, Adolescent condylar growth and mandibular modeling association with rotation and displacement. J Dent Res. 245:813,2000

Owens, S, Buschang, PH, Throckmorton, GS, English, J, Interocclusal surface thickness in subjects with normal occlusion and malocclusion. J Dent Res, 499:2845, 2000

Ghandi, A, English, J, Throckmorton, GS, Buschang, PH, The effect of palatal expansion on bite force and muscle recruitment of open bite patients. J Dent Res, 527:3066,2000

English, J, Buschang, PH, Throckmorton, GS, The Effects of Malocclusion on Masticatory Performance, J Dent Res, 437, 2001

Albert, TE, Jr., English, J, Throckmorton, GS, Buschang, PH, the Effect of Palatal Expansion on Bite Force and Muscle Recruitment, J Dent Res, 1127,2001

Upatham, PK, Throckmorton, GS, Buschang, PH, Reliability of In Vitro Ultrasound Measurements of Human Masseter Volume, J Dent Res, 1524, 2001

Owens, S, Buschang, PH, Throckmorton, GS, English, J, Reliability of Estimating the Proximity of Posterior Occlusal Surfaces, J Dent Res, 1557,2001

English JD, Tran M, Buschang P, Throckmorton, G, Muscle Exercise effects on the early treatment of skeletal open bite malocclusions. J Dent Res 2002; 81: 33 (#0033).

Hodges A, Buschang P, Throckmorton G, Mandibular condyle movement during unilateral biting. J Dent Res 2002; 81: 383 (#3085).

Mikulencak D, Buschang P, Throckmorton G, Dumbrigue H, Reliability of estimating the proximity of posterior occlusal surfaces. J Dent Res 2002; 81: 462 (#3775).

Buschang PH, Throckmorton GS, Owens, S. English J. Masticatory performance, posterior occlusal contacts, and malocclusion. Am J Phys Anthrop 2002; Suppl34: 5051.

Moore C, Buschang PH, Throckmorton G, Wintergerst AM.

Chewing side preferences of young adults, J Dent Res 82 (Special Issue A) #0771, 2003

Bhakta R, Buschang PH, Throckmorton G, Wintergerst AM. Bolus size and chewing cycle kinematics, J Dent Res 82 (Special Issue A) #0772, 2003

Parks L, Buschang PH, Throckmorton G, Wintergerst AM. Kinematic changes during breakdown of artificial food, J Dent Res 82 (Special Issue A) #0773, 2003

Wintergerst AM, Buschang PH, Throckmorton G. How bolus characteristics affect intraindividual chewing cycle variability. J Dent Res 82 (Special Issue A) #0792, 2003 Books/Articles Reviewed

c. Manuscripts **In Press**

Wintergerst AM, Buschang PH, Throckmorton GS. Reducing within-subject variation in chewing cycle kinematics - a statistical approach. Arch Oral Biol

d. Manuscripts Submitted

Toro A, Buschang PH, Throckmorton GS, Roldan SR. Masticatory performance in children and adolescents with malocclusions. Am J Orthod Dentofac Orthop.

Throckmorton GS, Hodges A, Buschang PH. Position of the mandibular condyle during unilateral isometric bites. American Journal of Physical Anthropology.

Wintergerst AM, Buschang PH, Hutchins, B. Throckmorton GS. Effect of an auditory cue on chewing cycle kinematics. Eur J Oral Sci.