

AAO Foundation Award Final Report

Principal Investigator	R. Christian Solem
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Secondary Investigators	Sneha Oberoi
Award Type	AAOF Faculty Development Award
Project Title	Developing A 3D Diagnostic Model of Asymmetric Pubertal Jaw Growth
Project Year	2013-2014
Institution	University of Michigan
Summary/Abstract (250 word maximum)	<p>Objective: This study measured mandibular growth and remodeling in patients with craniofacial microsomia prior to surgical intervention utilizing a novel approach to mandibular registration, with the aim to improve predictions of future growth. Methods: Nine patients with Pruzansky/Kaban type I, IIA or IIB craniofacial microsomia presenting for orthodontic treatment prior to surgical intervention were identified. Separate populations consisting of patients with non-congenitally acquired mandibular asymmetry (n=10) and a cross-section of age and sex matched orthodontically treated controls (n=10) were selected. Three-dimensional growth of the mandible was measured in each individual using two or more serial cone beam computed tomographic (CBCT) time points obtained prior to surgical intervention. Longitudinal mandibular volumes were aligned using an automated, voxel-wise regional registration. Growth was measured using a spherical harmonic-based analysis (SPHARM) of the distances and vectors between corresponding points on the T0 and T1 surfaces. Initial asymmetry was quantified by creating mirrored mandibular volumes registered on a stable reference region. Results: The methods for registration of longitudinal and mirror image time points were first validated in the three groups. Distinct patterns of asymmetric mandibular growth were measured in each, with the craniofacial microsomia group having the most asymmetric growth in the transverse and coronal planes. Asymmetric mandibular growth was characterized by compensatory remodeling of the gonial angle and corpus, and torqueing of the condylar heads. Conclusions: Congenital anomalies of the craniofacial skeleton can impact the coordination of jaw growth, resulting in progressive facial asymmetry. In these cases, consideration for the asymmetric growth of the mandible can greatly improve orthodontic and surgical treatment strategies.</p>
Were the original, specific aims of the proposal realized?	Yes. Our first aim was to develop and validate a method to superimpose longitudinal mandibular volumes via automated regional registration. We tested and applied this method to quantify remodeling and growth in asymmetric mandibles. Our second aim

	was to quantify regional mandibular asymmetry. To this aim, we applied a mirror-image registration technique to measure asymmetry across the mandible in patients with craniofacial microsomia, dentofacial deformity and symmetric controls.
Were the results published? If not, are there plans to publish? If not, why not?	A manuscript has been drafted, and the results will be submitted to a journal as soon as they are completed. We anticipate an additional 3-6 months to complete the results and writing.
Have the results of this proposal been presented? If so, when and where? If not, are there plans to do so? If not, why not?	<p>Yes. The results were orally presented at the Moyers Pre-symposium at the University of Michigan in March 7, 2014. “Three Dimensions of Mandibular Growth and Displacement in Hemifacial Microsomia” <i>Christian Solem, School of Dentistry, University of Michigan</i> http://www.moyerssymposium.org/presymposium.</p> <p>They were also presented at the annual American Association for Dental Research meeting in Charlotte, NC in March 21, 2014.</p> <p>Quantifying Asymmetric Jaw Growth in Hemifacial Microsomia and Dentofacial Deformity. R.C. Solem, S. Oberoi, L.H. Cevidanes, J Dent Res Vol. 93 Spec Iss A:1052, 2014</p>
To what extent have you used, or how do you intend to use, AAOF funding to further your career?	AAOF has been implemental in providing the resources to support my research in craniofacial anomalies, particularly for my current project to purchase equipment and access to radiographic imaging tools. I hope to continue to receive the support of AAOF for my academic pursuits in the future.