Evaluating Impacts of Orthognathic Surgery on Velopharyngeal Function and Speech in Class III Dentofacial Disharmony Patients with Repaired Cleft Lip and Palate

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Patients with dentofacial disharmonies (DFD), including those with repaired cleft lip and palate (DFD+CLP), seek jaw surgery to address issues with esthetics, mastication and speech. Articulation pathologies are a significant motivator for orthognathic surgery, and impact quality of life, development and self-esteem. Our preliminary data indicate that surgical correction yields speech normalization in Class III DFD subjects (no CLP), but pre-operative distortions and post-operative articulatory changes are poorly characterized in Class III DFD+CLP patients. As providers, we are unable to give evidence-based recommendations as to whether our interventions will address speech concerns in our high need DFD+CLP patients.
Importantly, velopharyngeal insufficiency (VPI) with hypernasality are common sequelae of orthognathic LeFort1 surgery in Class III DFD+CLP patients. Treatment for VPI requires additional surgery for DFD+CLP patients who have undergone a lifetime of operations, but surgeons and speech pathologists are unable to accurately predict who will develop post-op VPI for patient counseling. A VPI risk profile is needed to guide patients in deciding whether to pursue maxillary surgery and to inform accurate post-op expectations. As a major center, we are positioned to evaluate velopharyngeal (VP) function in patients pre- and postoperatively, to identify factors predictive of VPI. To address these knowledge gaps, we propose the following aims. First, we aim to identify factors predictive of VPI in DFD+CLP patients through evaluation of VP function before and after orthognathic surgery. We will collect non-invasive perceptual and aerodynamic (pressure-flow) data on VP function in Class III DFD+CLP patients (N=40), at their 1-month pre-operation (T0) and 3-month (T1) and 12-month (T2) post-surgery visits. We hypothesize that DFD+CLP patients who present with a larger VP gap (>5mm^2) and/or aberrant pressure-flow timing (<50 ms between peak nasal airflow and peak pressure) will have a significantly increased incidence of VPI post-operatively compared to patients with a smaller VP gap (≤5mm^2) and normal pressure-flow timing (≥50ms). Results will provide for a rapid, clinically feasible VPI risk assessment to guide Oral and Maxillofacial Surgeons in pre-op patient counseling. Second, we propose assessing orthognathic surgery's effects on articulation in Class III DFD+CLP patients. We will collect surgical, audio and video records of DFD+CLP patients (enrolled in Aim 1) at their pre-surgery (T0) and post-op (T1 and T2) visits; data will also be collected from well-proportioned Class I reference controls (N=80 total: 40 Class III DFD+CLP and 40 Class I controls, consecutively enrolled). We hypothesize that Class III DFD+CLP patients who undergo corrective surgery to achieve proportional jaw relationships will have significant normalization of acoustic properties of stop (/t/ or /k/), fricative (/s/ or /ʃ/ -"sh"), and affricate (/tʃ/ - "ch") consonant sounds; to test this, we will first measure how Class III DFD+CLP patients' speech compares to Class I controls, as we anticipate finding significant differences in pre-op acoustic properties, consistent with preliminary data. Data will reveal how speech is impacted by Class III DFD+CLP and how articulation changes post-operatively to guide treatment recommendations and potentially reveal functional benefits of orthognathic surgery. Findings will serve as preliminary data for NIH grant recruitment to launch a multi-center, longitudinal study of speech and VP function in surgical DFD+CLP patients. This proposal utilizes state-of-the-art technologies to provide long-term surgical outcome data to inform evidence-based care for patients with DFD+CLP, while clarifying the complex relationships between jaw position, VP function and speech.