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Patients with severe jaw disharmonies pursue orthognathic surgery to address issues with esthetics, mastication and speech. Speech concerns are a primary motivator for surgery at UNC, with abnormal articulation hindering communication and profoundly impacting quality of life. Speech pathologies have been linked to severe malocclusions using qualitative assessments of small cohorts, but little quantitative data exists to correlate severity of speech distortion with degree of malocclusion. Furthermore, it is unknown whether surgical correction yields lasting improvement in articulation, as long-term follow-up data has rarely been collected. Despite this lack of data, patients undergo invasive jaw surgery in hopes of speech improvement. To address this knowledge gap, we will test the hypothesis that speech distortions correlate with severity of anterior-posterior and vertical jaw disharmonies, and that corrective surgery yields longterm improvement in speech.

First, we aim to quantitatively examine the relationship between underbite (class III) and open bite jaw disharmonies and speech distortion. We will collect surgical records paired with audio and lingual ultrasound recordings to quantitatively examine articulation distortions and tongue movements in disharmony patients and well-proportioned reference subjects. We hypothesize that when compared to reference subjects with ideal jaw proportions, patients with underbite or open bite have a difference in tongue posture and consonant acoustic properties, and that degree of jaw deformity correlates with severity of speech abnormality. Our preliminary data are consistent with this theory. This first aim will provide foundational quantitative data on speech and tongue patterns of disharmony patients.

Our second aim is a pilot study to assess short- and long-term effects of corrective orthognathic surgery on speech distortion in class III and open bite patients. We hypothesize that patients who undergo corrective surgery to achieve proportional jaws and occlusion will have normalization of tongue gesture and acoustic properties of stop (/t/ or /k/), fricative (/s/ or /f/), alveolar approximate (/r/), and affricate (/tʃ/) consonant sounds. To evaluate our hypothesis, we will collect surgical, audio and lingual ultrasound records of patients 1-month pre-operation and at 2-3 and 11-12-months post-surgery. Data obtained in the proposed year will serve as initial findings for continued grant recruitment, to collect long-term post-op data in a large cohort of disharmony patients over several years.

Results will provide critical insight into the complex interplay between craniofacial and vocal structures. Surgical followup data will inform evidence-based standard of care for disharmony treatment, while clarifying relationships between jaw position and speech.