ABSTRACT OF THE THESIS

Speech is measured as one of the primary outcomes of surgical correction in CLP. Acoustic, aerodynamic and perceptual methods have been used to analyze the speech in CLP. Scanty knowledge of acoustic and perceptual analyses of speech in CLP in general and specifically to the Indian context necessitated a study to investigate these attributes of speech in Kannada speaking children with congenital cleft palate in pre and post-operative conditions. Hence, the aim of the present study was to investigate the acoustic and perceptual characteristics of speech in children with CLP across pre and post-operative conditions and to compare the acoustic characteristics with the typically developing children.

The present study considered 14 Kannada speaking children with congenital unoperated cleft palate in the age range of five to ten years and they were considered as Group I. Further, group I was divided into two subgroups. They are group I (pre-operative condition) and group I (post-operative condition). The same children of group I who underwent surgical intervention were considered as Group I (post-operative). Age and gender matched 50 typically developing children (TDC) were considered as Group II (Control group). The test stimuli consisted of words, sentences, and conversational speech. The speech samples were audio-video recorded for acoustic and perceptual analyses. The collected speech samples were subjected to two types of analyses, which included acoustic and perceptual analyses. Recorded speech samples of children with CLP were subjected to auditory perception and spectrographic inspection by experienced Speech Language Pathologist (SLP) before the acoustic analyses. Selected audio-recorded speech samples of children with CLP were analyzed using Praat software version 5.3.35 (Boersma & Weenink, 2010) for calculating temporal and spectral parameters from waveform and wideband bar type spectrogram as a reference. Acoustic analyses were done for children with CLP (pre and post-operative condition) and typically developing children. Perceptual analyses of speech characteristics were done only in children with CLP using universal reporting parameters given by Henningsson et al. (2008). The perceptual analyses were done for articulation, resonances, and intelligibility.
Results revealed that children with CLP in the present study showed longer vowel duration, total duration, closure duration and voicing duration and higher $F_1$ in the pre-operative condition when compared to the post-operative condition. This may be due to the compensatory mechanism used by children with CLP in using the oral/pharyngeal muscles to achieve the normal oral production which can lead to longer duration. In the pre-operative condition, longer duration was observed for temporal parameters when compared to the post-operative condition. This may be due to an attempt to achieve the normal production, children with CLP in the pre-operative condition may prolong the vowel in the preceding position which could lead to longer VD, TD, and CD in the pre-operative condition. Children with CLP in the post-operative condition showed longer word duration, syllable duration, burst duration, and frication duration and higher $F_2$, $F_3$, B1, B2 and Lower $F_2$ onset was observed when compared to that of the pre-operative condition. This may be due to prolongation of the segmental duration as a purposeful feature used to compensate for damped sound energy. Higher spectral parameters observed may be due to abnormal use of the respiratory mechanism which may result in a stress-like emphasis on all the utterances or, it may be a combination of factors related to compensation and abnormal use of the mechanism to reach the feature of the target phoneme.

The analyzed temporal and spectral parameters for children with CLP and TDC were compared across groups. Children with CLP exhibited longer word duration, vowel duration, syllable duration, total duration, closure duration and affrication duration when compared to that of TDC. This may be due to the persistence of VPD and inability to sustain intraoral pressure due to nasal air emission in children with CLP which can lead to a longer duration in an attempt to rebuild sufficient intraoral pressure to produce the consonants. Results of the present study also indicated that children with CLP exhibited shorter VoD, burst, and frication duration compared to that of TDC. Children with CLP may not be able to sustain intraoral air pressure for a long time in the oral cavity leading to a shorter duration. It was also observed that voice onset time (VOT) for unvoiced consonants were found to be longer in children with CLP across condition than TDC. VOT for voiced consonants was found to be longer in TDC when compared to that of children with CLP in the pre and post operative conditions. Among spectral parameters,
higher F₁, F₂ was observed in children with CLP in the pre-operative condition when compared to TDC. This could be due to a pharyngeal constriction used by children with CLP in the pre-operative condition as a compensatory strategy which could have led to a higher F₁, F₂. Higher F₁, F₂, F₃ and F₂ onset frequency was observed in children with CLP in the post-operative condition when compared to that of TDC. This could be due to varying of the tongue height and jaw movement using the abnormal articulatory pattern to compensate for the target sound production which narrows the region of the oral cavity. Other spectral parameters such as B₁, B₂, and B₃ were found to be higher in children with CLP compared to that of TDC.

The perceptual analyses were done for analyzing articulation, resonances, and intelligibility in children with CLP across conditions. The results for articulation in the pre-operative condition indicated that articulatory errors were found to be greater in the pre-operative condition in children with CLP. The results also indicated that among words and sentences, the occurrences of the palatal stops were found to be greater followed by, glottal stops (ʔ) and pharyngeal stops/fricatives/affricatives. Among errors due to nasalization, nasal fricatives were found to be higher followed by weak oral pressure consonants (WOPC), substitution of nasal for oral consonants and nasalization of oral consonants. The articulatory errors of children with CLP in the post-operative condition included the occurrence of glottal stops (ʔ), palatal stops and pharyngeal affricates/fricatives. However, percentages of occurrences of compensatory articulatory errors reduced in the post-operative condition when compared to the preoperative condition. There was an improvement observed for errors due to nasalization in the post-operative condition. Statistical results revealed that there was no significant difference across stimuli and conditions in the articulatory errors and the articulatory errors due to nasalization except WOPC across conditions.

Among the resonance parameters, the overall degree of hypernasality reduced from ‘moderate’ in the pre-operative condition to ‘mild’ in post-operative condition. The results showed that the overall mean scores for hypernasality were found to be reduced in the post-operative condition for both words and sentences. The results showed that there was a significant difference across conditions for words and sentences and there was no
significant difference observed across the stimuli. The nasal air emission was found to be present even in the post-operative condition for words. Perceived nasality in individuals with CLP in the post-operative condition could be due to poor timing of velopharyngeal movements relative to the activity of other articulators and persistence of velopharyngeal dysfunction even after the surgical correction which could have lead to hypernasal speech. Speech intelligibility was assessed for speech understandability and speech acceptability. The results showed an overall improvement in the mean rating scores of speech understandability and acceptability from the pre-operative to the post-operative condition. Speech understandability and acceptability rating scores were found to be ‘moderate’ in the pre-operative condition and ‘mild’ in the post-operative condition. The results showed significant difference across conditions for speech understandability and speech acceptability.

To conclude, findings of the present study revealed that children with CLP showed improvement in some of the temporal, spectral and perceptual parameters after the surgical correction. However, not all the parameters indicated statistically significant improvement after the surgical correction. The findings of the study thus indicated that surgical correction alone may not be successful in improving parameters of speech. It also indicated the importance of speech therapy after the surgical correction in children with CLP.