

## A Comparative Study on Vowel Articulation in Malayalam Speaking Children Using Cochlear Implant

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**Abstract :** Hearing impairment (HI) at an early age, identified before the onset of language development can reduce the negative effect on speech and language development of children. Early rehabilitation is very important in the improvement of speech production in children with HI. Other than conventional hearing aids, Cochlear Implants are being used in the rehabilitation of children with HI. However, delay in acquisition of speech and language milestones persist in children with Cochlear Implant (CI). Delay in speech milestones are reflected through speech sound errors. These errors reflect the temporal and spectral characteristics of speech. Hence, acoustical analysis of the speech sounds will provide a better representation of speech production skills in children with CI. The present study aimed at investigating the acoustic characteristics of vowels in Malayalam speaking children with a cochlear implant. The participants of the study consisted of 20 Malayalam speaking children in the age range of four and seven years. The experimental group consisted of 10 children with CI, and the control group consisted of 10 typically developing children. Acoustic analysis was carried out for 5 short (/a/, /i/, /u/, /e/, /o/) and 5 long vowels (/a:/, /i:/, /u:/, /e:/, /o:/) in word-initial position. The responses were recorded and analyzed for acoustic parameters such as Vowel duration, Ratio of the duration of a short and long vowel, Formant frequencies (F<sub>1</sub> and F<sub>2</sub>) and Formant Centralization Ratio (FCR) computed using the formula  $(F_{2u}+F_{2a}+F_{1i}+F_{1u})/(F_{2i}+F_{1a})$ . Findings of the present study indicated that the values for vowel duration were higher in experimental group compared to the control group for all the vowels except for /u/. Ratio of duration of short and long vowel was also found to be higher in experimental group compared to control group except for /i/. Further F<sub>1</sub> for all vowels was found to be higher in experimental group with variability noticed in F<sub>2</sub> values. FCR was found to be higher in experimental group, indicating vowel centralization. Further, the results of independent t-test revealed no significant difference across the parameters in both the groups. It was found that the spectral and temporal measures in children with CI moved towards normal range. The result emphasizes the significance of early rehabilitation in children with hearing impairment. The role of rehabilitation related aspects are also discussed in detail which can be clinically incorporated for the betterment of speech therapeutic services in children with CI.

**Keywords :** acoustics, cochlear implant, Malayalam, vowels

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