



Short Term Phonatory Stability Analysis in the Voice of Children With Cleft Lip And Palate

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ABSTRACT

Cleft lip and palate are birth defects. Children with cleft lip and palate may have problems with quality of voice. The present study compared the perturbation measures of voice (pre and post surgery) in children with cleft lip and palate. Each group included 15 children age ranged 3 to 12 years. They were asked to phonate vowels /a/, /i/, and /u/. Voice samples were recorded and analyzed by using PRAAT software. Results revealed significant difference in pre and post surgery voice in children with cleft lip and palate. This study also highlights the importance of speech therapy in children with cleft lip and palate.

KEYWORDS

Cleft lip and palate, quality of voice, perturbation

Introduction

Cleft of lip and palate (CLP) are split in upper lip and palate. Nasal cavity and oral cavity will not be separated due to presence of cleft which will affect the intra oral breath pressure. The presence of the CLP can also lead to abnormal voice quality. It is difficult to get true incidence and prevalence of CLP in India because of unavailability of national epidemiological data (Mossey & Little, 2002). In India, the prevalence was 27,000- 33,000 and incidence was 0.25-2.29 per 1000 live birth (Banerjee & Dhakar, 2013). Researchers reported that the incidence of voice problems is more in the cleft population compared to non cleft population.

Studies reported the presence of voice abnormalities such as hoarseness, breathiness, strained vocal quality, deviant pitch, reduced range of pitch and reduced loudness in individuals with CLP. Individuals with CLP will have feature of faulty phonation (Hess, 1959). The presence of phonatory disorders in individuals with CLP is not well comprehended. However, the phonation disorders are more common in CLP population than nonCLP (Marks, Baker, & Tardy, 1971).

The voice abnormality in children with CLP does not have sufficient Indian literature. Several researchers came up with perceptual studies of voice and a few on acoustic analysis of voice in adults with CLP, the acoustic analysis of voice in children with CLP is a less explored area of research. The lack of comparative studies on acoustic analysis of voice in pre and post operative group of children with CLP in India has paved way to the current study. Therefore, the objective of current study is to focus on the comparison between acoustical analyses results of individuals with pre and post operative CLP.

Methodology

A total of 30 participants were selected for the present study. The study included 2 groups: one group included children with unrepaired cleft lip and palate (URCLP), which represents pre surgery group and the other group, included same children with repaired cleft of lip and palate (RCLP), which represented post surgery group. Pre and post operative groups consisted of 15 children each.

Inclusion criteria

The children selected for the study were in the age range of 3 to 12 years. All the children in pre surgery group were having congenital CLP. The children in post surgery group were the same children who had undergone surgery for repair of cleft lip and palate. There was no gender specification for selection of subjects. All the participants were screened for oral peripheral mechanism and hearing. Auditory screening consisted of air conduction pure tones of 500, 1000, 2000 and 4000 Hz at 25 dB.

Exclusion criteria

Children with a history of neurological, psychiatric, endocrinological, gastric diseases, hearing loss, mental retardation and other syndromic symptoms that might alter voice performance or understanding of instructions during the evaluation were excluded from the study. Children with the complaint of irritated or pain in throat and children using prosthesis as a part of management of CLP were excluded from the study.

Stimuli and Procedure

Data collection started after obtaining verbal consent from the participant's parents. The participant's voice was recorded in quite room with the help of a head phone with microphone facility. The microphone was positioned 6cm far from the participant's mouth while recording the phonation and was connected to the computer (Acer, core i3, 4GB, windows7).

Initially, the sustained vowel production of /a/ was recorded followed by /i/ and /u/. The participants were asked to take a deep breath and produce the sustained vowel at a habitual frequency and intensity. They were asked to phonate each vowel (/a/, /i/, & /u/) three times, out of which best sample was taken for the analysis. The initial 2 seconds of voice samples (/a/, /i/, & /u/) were extracted for the acoustic analysis to avoid interference from other sources. The acoustic analysis was carried out using PRAAT software.

The PRAAT software (version 4.6.10) measures, which give information about aperiodicity, stability, noise and frequency levels of the voice signal, were used in the study. The follow-

ing measures were used in present study: the fundamental frequency (f0), jitter (local), jitter (local absolute), jitter (rap), jitter (ppq5), jitter (ddp), shimmer (local), shimmer (local, dB), shimmer (apq3), shimmer (apq5), shimmer (apq11), shimmer (ddp), noise-harmonic ratio (NHR), and harmonic-noise ratio (HNR). Statistical analysis of the data was carried out using SPSS software. MANOVA was used for comparing the values across the group.

Results and Discussion

The mean and standard deviation values of the participants are shown in Table 1. Table 1 represents the acoustic parameters which was measured and compared across the two groups (URCLP & RCLP). Statistical analysis was carried out using MANOVA to compare between the performances of URCLP & RCLP.

“Table 1 about here”

As a whole statistical finding suggested significant variation in fundamental frequency, jitter and shimmer parameters for individuals with URCLP during phonations. More number of jitter parameters were statistically significant than shimmer parameters. The significant variation was observed more for phonation of /a/. The jitter parameters-Jloc, Jabs were significantly varied for the phonation of vowels /a/, /i/ and /u/ whereas Jrap and Jppq5 were significantly varied only for phonation of vowel /a/. This abnormality may be because of presence of velopharyngeal insufficiency (D’Antonio , Muntz , Province , & Marish,1988).

Considering the shimmer parameters; significant variation was seen during phonation of /a/ for sloc and Sdda also during phonation of /i/ for Sapq3 and Sdda. Significant variation was also observed for NHR during phonation of vowel /a/. Harmonics to noise ratio was found to be significantly varied for phonation of /a/, /i/ and /u/. The reason for affected jitter and shimmer in individual with URCLP may be due to laryngeal tension. The URCLP may have the habit of using compensatory strategy for having borderline velopharyngeal function.

Some of the parameters are affected in voice of RCLP voice may be because of continuation of using compensatory strategy which was adopted before surgery. Voice parameters can also be affected in RCLP individual due to palatal surgery. Palatal surgery may lead to shortens of soft palate and velopharyngeal inadequacy and can change the velar length and thickness (Mora, Jankowska, Mora, Crippa, Dellepiane, & Salami, 2009). In addition, increased respiratory, muscular effort and hyper adduction on attempt to obtain closure of velopharyngeal valve in individuals with CLP tend to result in voice quality characterized by breathy, hoarse and soft voice (Kummer, 2008). The increased respiratory effort exhibited by individuals with CLP to achieve normal loudness in voice was observed by several researchers in individuals with cleft palate, as a cause for vocal abuse in these individuals (Warren, Dalton, Morr, & Smith, 1988). Moreover, a comparative study on acoustical analysis of voice between individual with CLP and normals revealed significantly greater voice perturbation measures in individual with CLP than normals (Zadac & Linville, 1988).

Surgical correction alone cannot change the quality of voice and compensatory behavior. Harding and Gurnwell (1998) also denoted that surgical correction alone cannot change the passive speech processes. Speech therapy is essential for change in voice quality and to modify the compensatory behavior. The present study suggests the importance of speech therapy after the repairing of CLP to correct the voice quality and compensatory articulatory behaviors.

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Table 1
Mean and standard deviation (SD) values of the URCLP and RCLP

Parameters Mean		URCLP		RCLP		P values
		SD	Mean	SD		
F0	a	281.74	44.69	239.35	27.67	<0.05
	i	298.16	43.59	255.63	30.80	<0.05
	u	301.07	42.37	254.82	32.19	<0.05
Jloc	a	.50	.25	.33	.11	<0.05
	i	.44	.30	.24	.12	<0.05
	u	.59	.42	.28	.11	<0.05
Jabs	a	11.64	4.96	14.42	6.91	<0.05
	i	13.72	7.55	8.57	3.03	<0.05
	u	13.93	6.75	8.83	2.03	<0.05
Jrap	a	.31	.15	.19	.06	<0.05
	i	.25	.18	.17	.15	>0.05
	u	.22	.17	.18	.12	>0.05
Jppq5	a	.38	.28	.20	.06	<0.05
	i	.27	.18	.18	.15	>0.05
	u	.21	.16	.18	.12	>0.05
Jddp	a	.80	.48	.56	.21	>0.05
	i	.71	.56	.45	.27	>0.05
	u	.66	.50	.52	.36	>0.05
Sloc	a	2.69	1.62	1.69	.63	<0.05
	i	1.47	.70	1.09	.54	>0.05
	u	1.22	.38	1.13	.40	>0.05
SdB	a	.23	.14	.24	.20	>0.05
	i	.13	.06	.12	.13	>0.05
	u	.16	.19	.12	.06	>0.05
Sapq3	a	1.52	.91	1.06	.40	>0.05
	i	.81	.38	.53	.26	<0.05
	u	.67	.21	.61	.23	>0.05
Sapq5	a	1.73	1.06	1.24	.56	>0.05
	i	.92	.39	.67	.45	>0.05
	u	.75	.24	.77	.26	>0.05
Sapq11	a	2.01	1.29	1.47	.63	>0.05
	i	1.15	.59	.88	.51	>0.05
	u	.91	.29	.92	.32	>0.05
Sdda	a	4.03	1.34	2.80	1.44	<0.05
	i	2.46	1.15	1.39	.63	<0.05
	u	1.99	.63	1.60	.61	>0.05
NHR	a	.08	.09	.01	.00	<0.05
	i	.04	.09	.01	.00	>0.05
	u	.02	.07	.01	.00	>0.05
HNR	a	14.86	6.58	21.54	5.31	<0.05
	i	20.80	7.72	28.27	6.23	<0.05
	u	28.18	5.27	23.64	3.24	<0.05

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