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# Perturbation In Voice Of Children With Cleft Lip And /Or Palate.

Aiswarya Liz Varghese[1*] Dr.Jayashree S.Bhat[2]

1. Assistant Professor,Department of Audiology and Speech Language Pathology.Kasturba Medical College.Mangalore 575001.India
2. Professor and Head of the Department.Department of Audiology and Speech Language Pathology. Kasturba Medical College.Mangalore 575001.India

* E-mail of the corresponding author: aiswarya.varghese@manipal.edu

**Abstract**

Occurrence of phonatory deviancies is not uncommon in children with congenital cleft lip/palate. However, very few researchers have observed and reported the nature of these deviancies. Present study aimed at analyzing perturbation measures in the voices of children born with cleft lip and/ or palate. Perturbation related measures of the Voice samples of 40 children with clefts were analyzed using VAGHMI software and compared with the age and number matched group of children without any cleft. Mean jitter and shimmer values were found to be higher in the pre and post-operative cases of cleft lip and/ or palate when compared to the controls, though not statistically significant. Operative measures too did not lead to any significant changes in the Perturbation related voice parameters in children with cleft. Present study highlights the lack of sensitivity possessed by Perturbation measures in correlating the perceptual phonatory deviancies in voice of children with repaired and unrepaired cleft lip/palate.

**Key words:** Cleft lip and palate, jitter, shimmer, perturbation

## 1. Introduction

Speech is a unique human faculty. Unlike many other motor activities, speech requires a complex blend of actions in synchrony to produce even the simplest response. Speech is produced with the combined action of the respiratory, phonatory, articulatory and resonatory subsystems. Any structural or functional anomalies in any of these systems can result in the disruption of smooth production of speech.

Children born with cleft lip and/ or cleft palate are at a risk for communication disorders, which include resonance, articulation, voice and expressive language disorders (Peterson-Falzone, Hardin-Jones & Karnell, 2001). The impact of a cleft may be evident even during the early vocalizations of babies before surgical management and may persist long after an adequate oropharyngeal mechanism has been established.

Faulty phonation is an important attribute of the speech of individuals with cleft (Hess, 1959). The occurrence of phonatory disorders in individuals with clefts is not well understood, because of several variables. However, the phonation disorders are more common in this population than in noncleft individuals (Marks, Baker, tardy, 1971).

McWilliams, Bluestone, Musgrave, (1969) concluded that children with cleft who demonstrate velopharnygeal inadequacy may well be at risk for hoarseness related to vocal hyperfunction. They provided evidence for this vocal deviation with the evidence of bilateral vocal fold nodules. In another study, McWilliams, Lavorato, and Bluestone (1973), suggested that faulty valving may be the cause for the voice problems experienced by children with cleft. Their subjects showed no evidence of vocal nodules.

It is in the light of these observations that this study has been designed. Most of the evidences of vocal pathology in cleft lip and/or palate children have been derived from perceptual methods of evaluation. Such subjective data do not throw a light on the underlying pathology. Also, subjective methods do not follow a standardized format. These considerations are taken care of through an objective assessment. Acoustic analysis offers the opportunity to observe the speech patterns resulting from simultaneous and sequential interactions of phonation, resonance and articulation as these occur in real time speech production.

Perturbation measures are regarded as indicators of abnormal vocal fold vibrations, which result in changes in the quality of voice. These measures are reflected on two parameters namely, jitter and shimmer. Jitter is the cycle-to-cycle

 

variability of period duration of the acoustic signal coming from voice production. Shimmer is the cycle-to-cycle variability of period amplitude of vocal fold vibration. Both these measures indicate the micro-instability in vocal fold movements. The empirical basis for the sensitivity of these parameters has been extensively studied in populations with vocal pathologies (Wolfe V, Fitch J, Cornell R' 1995). But the same is lacking in the cases of cleft lip and/ or palate. Thus, this study aims at comparing the perturbation measures in children with cleft to that of children without cleft, employing an acoustic paradigm.

Aim of the study:

To analyze perturbation measures in the voices of children born with cleft lip and/ or palate both pre- and post-operatively and compare the results with those of age and sex matched normal children. The following comparisons were made:

a) voice data of control group with the preoperative data of children with cleft lip and/or palate
b) voice data of control group with the postoperative data of children with cleft lip and/or palate
c) preoperative and postoperative voice data of children with cleft lip and/or palate

**Method**

Participants:

The participants for the study were chosen from a multi-disciplinary hospital, within the state of Karnataka, in India.

Clinical group:

This group comprised of 40 children (males & females), aged between 0 and 10 years who were born with either unilateral or bilateral cleft lip, cleft lip and palate or cleft palate alone. This group was again sub-divided into 16 pre-operative cases and 24 post-operative cases. Children younger than 1 year of age were grouped separately. Children with associated syndromes were excluded from the study. The time lapse between the time of surgery and the post-operative voice analysis was not taken into consideration.

Control group:

The control group subjects were selected by random sampling. The control group consisted of 40 typically developing children less than 10 years of age, they were age and sex matched with the study group. The exclusion criteria considered were speech language and hearing disorders.

Materials used:

Speech stimuli used were either /cry/ or vowel /a/. Vowel vocalization was the stimulus in children above the age of 1 year and natural cry was the stimulus in others, i.e. children below or equal to 1 year of age.

Procedure:

Recording: Children below the age of 1 year were either seated on the mothers lap or placed on a table. Those above 1 year of age were seated on a chair and asked to imitate the experimenter, who demonstrated the vowel vocalization. A microphone compatible with the software was used for the recording. This was placed 15 cm away from the oral cavity. The recording was done in a sound treated room.

Acoustic analysis: A non-invasive method of voice analysis using a computer software program named 'Vaghmi (Voice and Speech System, Bangalore)' was uitilised for the data collection. This is a standardized software used for objective analysis of voice, in India. The vocal parameters that were analyzed were jitter and shimmer. Jitter (Hz) is defined as an index of instability in the laryngeal waveform, usually measured as the cycle- to-cycle variation in the fundamental period. Shimmer (dB) is defined as an index of instability in the laryngeal waveform, usually measured as the cycle- to-cycle variation in the amplitude of successive glottal cycles.

Statistical analysis: The raw data were subjected to statistical analysis using ANOVA method.

**Results and Discussion**

The jitter and shimmer values for both the study and control groups were computed and the following comparisons were made:

 

a) voice data of control group with the preoperative data of children with cleft lip and/or palate

The differences in the mean for measures of jitter and shimmer between the control and preoperative cleft group are as shown in Table 1 and Table 2 respectively. As can be seen, there were no statistically significant differences between the groups for both the measures.

**Table 1: Mean values of difference in jitter between control and preoperative cleft groups**

| Age | Jitter(Control Group) | Jitter (Pre-Operative Group | Difference(Mean) | p value (0.05) |
|---|---|---|---|---|
| ≤ 1 year | 21.57 | 27.54 | –5.97 | 0.61 |
| > 1year | 15.17 | 18.03 | –2.86 | 0.62 |

**Table 2: Mean values of difference in shimmer between control and preoperative cleft groups**

| Age | Shimmer(Control Group) | Shimmer (Pre-Operative Group | Difference(Mean) | p value (0.05) |
|---|---|---|---|---|
| ≤ 1 year | 0.8 | 1.83 | -1.03 | 0.29 |
| > 1year | 0.59 | 0.82 | -0.24 | 0.64 |

b) voice data of control group with the postoperative data of children with cleft lip and/or palate

The differences in the mean for measures of jitter and shimmer between the control and postoperative cleft groups are as shown in Table 3 and Table 4 respectively. As observed, there were no statistically significant differences between the groups for both the measures.

**Table 3: Mean values of difference in jitter between control and postoperative cleft groups**

| Age | Jitter(Control Group) | Jitter (Post-Operative Group | Difference(Mean) | p value (0.05) |
|---|---|---|---|---|
| ≤ 1 year | 21.57 | 55.47 | -33.90 | 0.49 |
| > 1year | 15.17 | 28.64 | –13.48 | 0.00 |

 

**Table 4: Mean values of difference in shimmer between control and preoperative cleft groups**

| Age | Shimmer(Control Group) | Shimmer (Post Operative Group | Difference(Mean) | p value (0.05) |
|---|---|---|---|---|
| ≤ 1 year | 0.8 | 9.5 | -8.70 | 0.30 |
| > 1year | 0.59 | 0.75 | -0.16 | 0.66 |

*c) preoperative and postoperative voice data of children with cleft lip and/or palate*

No statistically significant difference was seen in the mean jitter and shimmer values between the pre-operative and post-operative groups (p = 0.192). These are as shown in Table 5 and Table 6 respectively.

**Table 5: Mean values of difference in jitter between preoperative and postoperative groups**

| Age | Jitter(Pre-Operative Group) | Jitter (Post-Operative Group | Difference(Mean) | p value (0.05) |
|---|---|---|---|---|
| ≤ 1 year | 27.54 | 55.47 | -27.93 | 0.12 |
| > 1year | 18.03 | 28.64 | -10.61 | 0.09 |

**Table 6: Mean values of difference in shimmer between preoperative and postoperative groups**

| Age | Shimmer (Pre-Operative Group) | Shimmer (Post-Operative Group | Difference(Mean) | p value (0.05) |
|---|---|---|---|---|
| ≤ 1 year | 1.83 | 9.5 | -7.67 | 0.46 |
| > 1year | 0.82 | 0.75 | 0.07 | 0.89 |

From the results, it was seen that:

- Within the control group, jitter values were higher for the children below the age of 1 year than in the older age group. Cry is the outcome of complex interactive play of different frequencies with many variations within a short period of time. Thus, it results in higher perturbation values (Fuller, Keete, Curtin, 1994).
- The difference between the controls and pre-operative groups with regards to the mean jitter values was not significant statistically. The children with cleft lip and / or palate had shimmer values, which were higher than those of the control group, but the difference was not statistically significant. There was a trend of children of lower age group (<1 years) having higher shimmer values. This again can be correlated to the difference in the stimulus type used.
- Mean jitter and shimmer values were found to be higher in the post-operative cases of cleft lip and/ or palate when compared to the controls, though not statistically significant. A possible explanation for high values for the same

 

could be the hyperfunctional use of voice by children in order to compensate for the lack of vocal loudness. Bzoch (1979), has provided evidence for the same. He summarized that the voice of children with cleft are characterized to be weak and aspirated. Thus there is a lack of adequate loudness while speaking.

- No statistically significant difference was seen in the mean jitter values between the pre-operative and the post-operative groups. The jitter values were noted to be higher in the post-operative cases. There was no significant difference seen in the shimmer values between the two groups. But mean shimmer was higher in the post-operative lower age group (<1 year). Again, it was observed that the shimmer values were lower after surgical correction in the higher age group (>1 year), though the difference between the two was not significant.

From the above findings it is difficult to conclude that the perturbation measures are sensitive to the vocal disorders seen in children with cleft lip and/or palate. There are instances of jitter being more sensitive a measure than shimmer, though these are not statistically significant. It is also interesting to note that these measures vary depending on the stimuli used. Another finding to be noted is the evidence of higher perturbation values in the post-operative cases. All these indicate the need for further research, keeping in mind the limited number of participants considered in this study.

## Conclusions

Acoustic analysis of voice gives us an opportunity to further compare the normal from the abnormal voice. The parameters studied were perturbation measures of jitter (Hz) and shimmer (dB). The voice analysis was done using the software 'Vaghmi Speech and Voice Systems'. The study aimed at comparing these vocal parameters in normal and children with cleft lip &/ palate. From the results of the study it is concluded that it is difficult to establish whether perturbation measures of, jitter and shimmer are sensitive in tapping the abnormal laryngeal functions evidenced as hoarseness of voice in the cleft population. The fact that only two perturbation parameters were considered may be attributed to the above finding. And further research has to be undertaken, given the various interesting findings highlighted in the study. These would be of diagnostic and therapeutic value in the handling of children and adults with cleft lip and/ or palate.

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