Acoustic features of voice of children with motoric disorders

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Abstract

The sample of this research were seven children with neuro-motoric disorders (of both sexes-3 girls and 4 boys). Acoustic analysis of voice parameters, representing variables in this research (fundamental frequency, jitter, shimmer, harmonic to noise ratio as well as maximum duration of the vowel /a/) has been made by using EZ Voice Plus program for voice analysis. The results of correlation matrix obtained by Statistica for Windows Ver.4.0 show significant negative correlation between frequency of laryngeal tone and jitter, and HNR and jitter. Acoustic analysis of the phonation of the vowel /a/ of this group shows great deviation of the voice from the normal, which points to the problem of non-development of voice quality in motoric disorders group mainly resulting from neglected therapy of speech and voice.

Key words: jitter, shimmer, fundamental frequency, harmonic to noise ratio, voice quality, cerebral palsy, acoustical analyses

1. Introduction

Aronson [1] said that voice disorder characterised by distorted voice quality, pitch and intensity and determined by age, sex or cultural group. Voices of children with cerebral palsy are hoarse, vary and tense [2]. Phenomenon like “antiresonans” or absorbed air energy, because of loss of energy through open nasal tract, characterised voices of children with dysarthria [3]. According to Kent et al. [4] acoustical characteristics of dysarthria indicate problem of time control in duration of speech segments. Zwirner and Barnes [5] found out significant higher values between dysarthric and control group in Fo variability and they think that impairments of muscle control including laryngeal function, should be evaluate differ than disorders of upper air transmission like tongue, mouth, velum and jaw. They agree that dysarthria is a speech disorder of motoric control caused by central or peripheral neurological system including respiratory, phonation and jaw problems [6,7]. Motoric disorders among children population are manifested in different ways in the field of speech-linguistic ability.
There is a small number of researches in Croatia on the disorders at the level of speech expression, i.e. on the analysis of the quality of the voice of this population.

2. Methods

The sample of this research were seven children from special institutions with neuro-motoric disorders (both sexes-3 girls and 4 boys). Acoustic analysis of voice parameters, representing variables in this research (fundamental frequency, jitter, shimmer, harmonic to noise ratio as well as maximum duration of the vowel /a/) has been made by using EZ Voice Plus program for voice analysis. The results of correlation matrix obtained by Statistica for Windows Ver.4.0.

3. Results

The results of correlation matrix obtained by Statistica for Windows Ver.4.0 show significant negative correlation between frequency of laryngeal tone and jitter, and HNR and jitter (Table 1). Acoustic analysis of the phonation of the vowel /a/ of this group shows great deviation of the voice from the normal.

Table 1.
Inter - correlation between acoustic parameters (3 girls and 4 boys)
Marked correlation is significant at p < .05000

<table>
<thead>
<tr>
<th></th>
<th>FOHZ</th>
<th>JITTER%</th>
<th>SHIMMDB</th>
<th>HNRDB</th>
<th>MAXA</th>
</tr>
</thead>
<tbody>
<tr>
<td>FOHZ</td>
<td>1.00</td>
<td>.86</td>
<td>-.64</td>
<td>.51</td>
<td>.40</td>
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<tr>
<td>JITTER</td>
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<tr>
<td>HNRDB</td>
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<td>-.76</td>
<td>-.64</td>
<td>1.00</td>
<td>.52</td>
</tr>
<tr>
<td>MAXA</td>
<td>.40</td>
<td>-.44</td>
<td>-.54</td>
<td>.52</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Legend:
FOHZ – fundamental frequency in Hz
JITTER% - jitter percent
SHIMMDB – shimmer in dB
HNRDB – harmonic to noise ratio in dB
MAXA – maximal duration of vowel “a”

MAVEBA 2001, Firenze, Italy
FOHZ. Higher value of jitter indicates lower fundamental frequency and opposite, especially in group of boys (Figure 1).

Fig. 1. FOHZ and jitter results distribution

Obtained results show significant negative correlation between JITTTER and HNRDB parameter. Higher HNR indicate smaller frequency deviations. Greater jitter with higher presence of noise is characteristic of all vowel productions of 7 children, especially in voices of boys with cerebral palsy (Figures 2 and 3).

Fig. 2. HNRDB and jitter results distribution

These research show higher values of Fo, obtained in 3 girls with cerebral palsy, than in boys (Figures 3 and 4).

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4. Conclusion

Acoustic analysis of the phonation of the vowel /a/ of this group shows great deviation of the voice from the normal, which points to the problem of non-development of voice quality in motoric disorders group mainly resulting from neglected therapy of speech and voice. Boone considers pathological phonation shorter than 5 sec [8]. For this population, it must be taken explanation of vowel production performances as a short and very hard to produce with small amount of energy. Wit et al. [9] said that this kind of phonation task is a strong way for identification of spastic dysarthria. Higher values of Fos (see Figures 3 and 4), in reference to the age and sex of the questioned, seem to point mainly to the hypertension of vocal mechanisms for voice phonation and to a significant deviation of the higher noise presence from the normal. The last one indicates neurological disorders and functional dysphonia. We hope we will motivate professionals from practice, with this kind of research, to make better speech and voice therapy strategies in developing voice quality of this population.

References