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„Nasality" computer attachment in estimating nasality of children with impaired hearing system

INTRODUCTION

As a result of limiting or lack of hearing control of children with hearing defects voice disturbance, called audiogenic disphony, are arising and specific conditions, especially within larynx are strengthening. Nasality process is directly connected with tone and timbre of voice. This phenomenon is an after-effect of defective nasal resonance, which is hard to eliminate in case of hearing control lack. There are distinguished three forms of nasality: closed, opened and mixed [Pruszewicz 1992]. The nasality problem in case of children with impaired hearing system is very difficult to diagnose because in their phonological system nasal sounds very often don't exist, as opposed to the voiced (especially in groups of younger deaf children). In that case, for the obvious reason, there is no chance to talk neither about diagnosis, nor about existing of nasality process. To the research, which are presented in this paper, in intentional way was chosen a group of deaf children from primary school, which got nasal sounds in their phonological system. In presented paper were originally established currently in force phonatory standards of nasality exploiting [Pruszewicz 1992]. Hence toning of sound „m" like „b" or „n" like „d" in children voice was regarded as closed nasality. The only departure was connected with judging the correctness of nasal sounds „ę" and „ą", as inflectional in some phonological contexts, characteristic of children with hearing defects. The research have been performed on the strength of the abilities of computer attachment called Nasality Processor. It has got an input in the form of an electrode, which is put on the examinating person nose and is working like an accelerator. Thanks to this manner of collecting the speech signal when the air flow through the nose the clearly changeable red curve, signed with NxAcc, is visibleat the computer screen. Its amplitude depends on the speed of changes of velocity of exterior parts of the nose moves in a unit of time. If the sound is more nasal, then the corresponded with it amplitude of vibration is higher.

AIM OF THE RESEARCH

The research were carried out on the group of children from 1-6 special school classes, at the age of 7-13, with significant or deep, bilateral, hearing defect, which become deaf just

after or even before born. The aim of the research were establishing and exploiting of the nasality process and revelling of computer attachment Nasality usefulness in nasality diagnosis process.

MATHERIAL AND METHODS

The research material was a group of 88 children with significant (23%) or deep (77%), bilateral, hearing defects, receiver type, which are using hearing apparatus and learning at the special primary school. However the comparative group consisted of 25 healthy children, at the same age range as the deaf. Children were put to the test by means of special experimental equipment for the speech signal visualisation, consisted of two computer attachments Laryngograph Processor PCLX and Nasality Processor. The statements were remembered in computers memory and next put to the analysis by means of integrated system for speech tests Speech Studio and QAnalyses program. The test of nasality process was based on the analysis of NxAcc signal, for example showed in figure 1. This is a view of the statement ,,ma', which was said four times. In the figure there are clearly showed increased values of the amplitude curve, corresponded with the air flow through the nose during speaking. Similar studies were perfomed on patients with cancer of the glottis [Modrzejewski 1998].

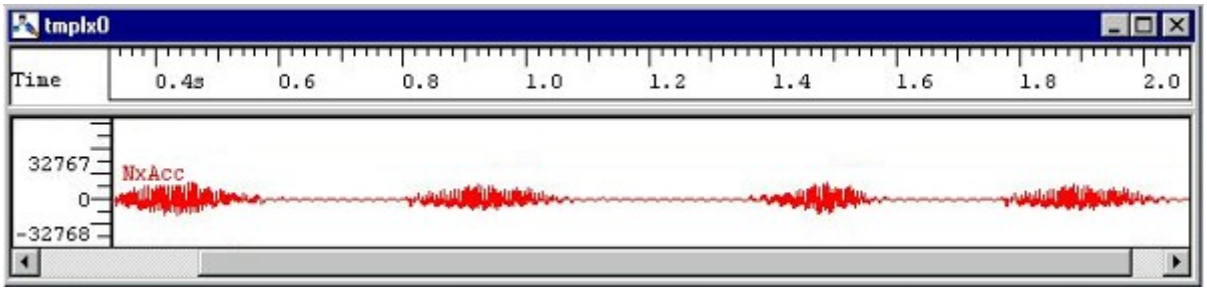

Figure 1. Computer view of four statements ,,ma", curve of nasal vibration changes in time NxAcc

Quantitative analysis of remembered statements was possible to carry out with use of QAnalyses program. The results were the speech profiles for each examination person, in shape of diagrams, called Speech Pattern Elements. For the statement ,,mama" it is showed for example in figure 2.

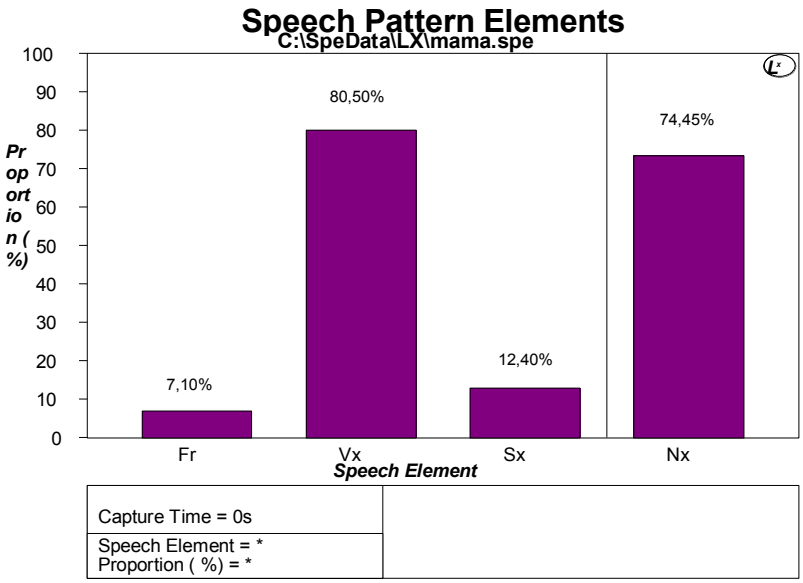

Figure 2. Component elements analysis of the statement ,,mama", speech profile

This diagram consists of two independent parts, separated with vertical dashed line. Three first elements called Fr, Vx, Sx showed proportions between voiced oral statement (Vx), silence (Sx) and friction (Fr) elements. In total it is 100% of the statement composition. Vx represents the participation of the phonation voiced parts of the statement, created as the result of periodic (or almost periodic) work of vocal folds during articulation of voiced sounds. Fr element describes the turbulence phenomena and results from it friction, which arises during forcing air t rough the narrow voice ditch when voiceless sounds are articulated. The very important element, which is visible in the diagram is Sx, called silence. It enables to judge possible irregularities in dynamic breathing, breaks for inhalations and participation of voiceless in the statement. The most important from the presented research point of view is information about air flow through the nose during speaking, possible to get from the speech profile, which is signed with Nx in figure 2. When the material used to the test is selected correctly, then on the basis of this information it's possible to specify the kind and range of nasality process, if it takes place.

RESULTS OF THE RESEARCH

Table 1 contains percentage results of the examination of nasality in the group of 88 children with significant or deep hearing defects, which have been achieved by means of integrated speech testing system Speech Studio. They revealed, that opened nasality appeared only in 2% cases, at the other group appeared closed or mixed nasality almost in equal proportions (45%). The lack of estimate occurred in 5%, when a child didn't make any articulated voice.

Table 1 Percentage results of the examination of nasality process in the group of children with Significant or deep hearing defects, n = 88

Nasality kind	Percent of children
Correct	5%
Closed	42%
Mixed	46%
Opened	2%
Lack of estimate	5%

Data showed in the next table have been received with use of an analysing program Qanalyses. Table 2 contains the averages values which have been achieved from the examination of speech elements, both deaf children and their hearing peers.

Table 2 Cental values of speech elements

	Phonation Elements (voiced)	Friction (voiceless)	Brakes during speaking	Air flow through the nose
Deaf children	42,07%	12,94%	44,99%	33,30%
Hearing children	75,02%	6,07%	18,91%	70,50%

The research, which have been performed, showed that during the same verbal material the air flow through the nose in case of deaf children was two times smaller (33,3%) than in case of healthy children (70,5%). Besides, the brakes during speaking appeared very often in case of deaf children. The inhalations took almost a half of time, which was meant for their realisation (44,99%). The same parameter in case of hearing children was two times smaller (about 19%). The research confirmed also that children with hearing defects have a tendency to voiceless voiced sounds. Phonation elements, that is voiced, amounted 75,92%, in case of hearing children, however only 42,07% in case of the deaf. From the research point of view, very important results have been achieved in case of air flow through the nose during speaking and amounted 33,3% for death children and 70,5% for the healthy. That goes to show, that closed or mixed nasality appeared in most cases.

CONCLUSIONS

The research made possible to establish, that the majority of children with impaired hearing system, have symptoms characteristic of closed or mixed nasality. Opened nasality or the lack of estimate is very rare. The diagnosed nasality had an active character and was caused with incorrect function of soft palate and with incorrect work of the clamping throath ring. Thanks to the preliminary research it was possible to plan and perform the process of nasality removing, on the basis of breath rehabilitation of voice and relaxation of flexed phonetic muscles. The research presented in this paper have included also the presentation of modern computer attachment Nasality Processor abilities, its usefulness in nasality diagnosis and revealed the use of this attachment in getting correct, shifted higher, location of sound. It enables to achieve an active work of head resonator and relieve larynx and vocal folds during speaking. It enables also to ensure the same form and timbre of vowels, at the first articulation phase. It is also very important to notice that all this elements and nasality, in a significant way affects communication of statement because of its influence timbre, tone and strength of voice. This elements are very important to achieve intelligible, correct speech and communicative statements. However they are very hard to work out in case of children with impaired hearing system.

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