ARTIGO ORIGINAL

SPIROMETRY AVALIATION OF CHILDREN AND TEENAGERS WITH HEARING IMPAIRMENT

AVALIAÇÃO ESPIROMÉTRICA DE CRIANÇAS E ADOLESCENTES COM DEFICIÊNCIA AUDITIVA

Naélka dos Anjos FERNANDES1, Alexsandra Marcilio Pereira RODRIGUES1, Daniela Lobato NAZARÉ2, Geraldo Roger NORMANDO JR.3, Valéria Marques Ferreira NORMANDO4

SUMMARY

Objective: this study analyzed the spirometric values in children and adolescents with hearing loss compared with the spirometric variables of a control group, and quantify the respiratory changes made on 13 volunteers’ deficient group. Methods: It employed the Student t test for independent samples and was considered the level α of 5%. The volunteers were diagnosed with hearing loss from moderate to profound. Participants with disabilities were evaluated by means of a form containing data regarding the clinical history to verify that they met the inclusion criteria of the study. The spirometry was performed with the use of a nose clip, demonstrations and encouraging voice in running the test. The values measured were vital capacity (VC), forced vital capacity (FVC), forced expiratory volume in one second (FEV1), Tiffenau index (FEV1/FVC), FEFmáx (FEF max), mean forced expiratory flow ( FEF 25% - 75%) and maximum voluntary ventilation (MVV). Results: statistically significant reduction of FEFmáx (p ≤ 0.05) of the hearing impaired group compared with the control group. For most spirometric parameters evaluated did not differ between groups. Conclusion: There is a relationship between hearing loss and spirometric parameters in children and adolescents, as 30.8% of the results obtained from these participants were biased standards obstructive, restrictive and moderate obstructive moderate.

KEY WORDS: Spirometry. Respiratory system. Hearing impairment.

INTRODUCTION

Hearing impairment is the most common sensoric disorder in humans (1,2). The World Health Organization (WHO) (3), estimated that in 2005 there were over 278 million people worldwide with moderate to profound hearing impairment, and about two thirds of this population lives in developing countries, ranking second among deficiencies. About four in every 1000 children are born with hearing impairment, ranking third among the deficiencies in the country (1,2,3,4,5).

Hearing impairment (congenital or acquired) is the loss or reduced ability to perceive normal sounds at any level that reduces the intelligibility of the spoken message for the accurate interpretation or for learning. It is considered deaf individuals whose hearing is not functional in ordinary life (5,6,7,8).

Deafness in children and adolescents has a huge impact on the community, whether from an economic standpoint, involving high costs in its detection and rehabilitation, is the psychosocial point of view, not only for oneself but also for its family and society in general (9,10,11).

The hearing impaired respiratory pattern is altered causing undue muscular effort during breathing and phonation, characterizing the respiratory difficulty in coordinating the production of speech (11,12). Zebrowski et al (2007), in a survey made by a group of 86 hearing impaired children and adolescents have shown that this deficiency during childhood and adolescence negatively affects the functional capacity of the respiratory system.

In addition, deaf children showed a decline in motor development, decreased coordination of movements, hypotonia, and decreased spirometric variables (13). According to the Guidelines for Pulmonary Function Tests (2002) and the American Thoracic Society (2007), spirometry is a test that measures the volume of air inhaled and exhaled flows and breathing, helping to prevent and to the diagnosis and quantification of possible respiratory disorders.

Therefore, by spirometry, it is believed that there is an increase of physical therapy to rehabilitate patients with hearing loss, and thereby expanding the therapeutic arsenal available to rehabilitate them. The physical therapist along with other health professionals (doctors, speech therapists, psychologists, nurses, etc.) may contribute to the social inclusion of that individual through an interdisciplinary team (15).

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Therefore, the aim of this study was to evaluate spirometric parameters in children and adolescents with hearing loss, quantify the respiratory disorders in children and adolescents with hearing impairment and to compare the spirometric values of the volunteers with hearing impaired spirometric values in the control group of healthy volunteers. It is hoped that disabled people who carry out the changes in spirometry values have collected, which possibly indicate a decrease in lung function when compared with normal values for age.

METHOD

This study was approved by the Ethics in Research of the University of Pará (CEP / UEPA) with protocol number 07/2009, respecting the Guidelines for Research Involving Human Subjects of the National Health Council (CNS Res 196 / 96).

The sample consisted of 13 children and adolescents with moderate to profound hearing impairment and 13 children and adolescents who had no hearing loss as the control group, attending the Speech Therapy Clinic of the University of Amazonia (Clifa / UNAMA) and the Institute of Education and Audio Communication- Felipe Smaldone. Children and adolescents in the control group were selected for convenience, subject to the inclusion and exclusion criteria described below, the prior interview. Parents or guardians of participants in this study volunteered, and signed the consent form.

For inclusion in the participants should submit a clinical diagnosis of moderate to profound hearing impairment and undergoing speech therapy. Among the exclusion criteria for both the control group as the study group were not suffering from respiratory diseases (Asthma, Bronchitis, cystic fibrosis, etc.). And had no respiratory and cardiovascular diseases in the last three weeks before the spirometric evaluation, failure kidney or liver disease, obesity and psychiatric disorders, since it is known that such conditions could alter spirometric values obtained in the examination, and thus influence the outcome.

Children and adolescents were evaluated for both sexes, aged 6-13, residing or not in Belém (PA). The evaluations were carried out from June 2009 to September of that year, at the Lung Clinic / Pulmocenter by prior appointment with the parents or guardians for minor participant in the research. At the time of spirometric evaluation, the subjects were relaxed, collaborative, smart, wearing light clothing, standing with head in neutral position.

Before and during the examination, communication with the child or adolescent was through standardized gestures, lip reading and the contribution of the parents or guardian, given that they already have a peculiar way of communicating with their children. Such procedures were performed in order to achieve not only greater understanding about the exam, but also the cooperation and trust by volunteers, thereby contributing to the reliability of the results of the assessment.

All the patients rested for about 5-10 minutes prior to testing, parents or guardians were questioned as to identify the child (full name, address, date of birth, place of birth), height and weight were observed in the lower Filizola ®.

During the test we used a nose clip to prevent air leakage through the nose and the volunteer was instructed to engage the lips on the mouthpiece of the spirometer. After a maximal inspiration, the patient was instructed to perform without interruption, a full exhalation, rapid and forced. For the faithful spirometry result, researchers have made statements with the aid of a plastic tube and vocal encouragement in performing the test.

The equipment used was properly calibrated and the environment in which evaluations were made was calm, with controlled temperature and luminosity. The examination was repeated to obtain reproducible values. When values were not obtained after eight attempts, the exams were suspended and rescheduled. The spirometer used was associated with the program Spiromatic 3.2 of Engelog ®.

The spirometric values obtained in tests of volunteers with hearing loss were compared to normal values observed in a control group of 13 children and adolescents with hearing loss between 6 and 13 years. The variables measured and compared between the groups were the values of vital capacity (VC), Forced Vital Capacity (FVC), forced expiratory volume in one second (FEV1), Tiffenau index (FEV1/FVC), forced expiratory flow (FEFmáx ), mean forced expiratory flow (FEF 25% -75%) and maximal voluntary ventilation (MVV). This research used the equation of Knudson et al (1983) for assessing the performance of the examination.

The evaluations were conducted by the researchers individually, lasting about 10 minutes in the presence of parents or guardians and
adolescents. After the assessment was distributed an educational brochure about some respiratory rehabilitation exercises, which were explained to the child and / or his guardian. According to the guidelines for pulmonary function tests of the Brazilian Society of Thoracic (2002), interpreting the examination should in many cases, also take into account the clinical data, as opposed to considering only numeric values and graphs to interpret tests. Therefore, this factor requires clinical and radiological information. Because of this, the test was interpreted by a specialist physician to ensure the diagnostic reading.

We applied descriptive and inferential statistical analysis. For analysis of statistical significance comparing the results of spirometry in the two study groups, we employed the Student t test for independent samples and is considered the alpha level of 5%. All tests were performed using statistical program BioEstat 5.0.

RESULTS

Regarding the description of groups with hearing impairment (n = 13) 46.2% were male and 53.8% females in the healthy control group (n = 13) were 61.5% male and 38.5% female.

The types of ventilatory disturbances produced by hearing impaired volunteers had normal parameters 69.2%, 15.4% showed obstructive parameters, 7.7% showed moderate obstructive parameters and 7.7% had moderate restrictive parameters.

<table>
<thead>
<tr>
<th>Spirometry</th>
<th>Hearing impaired</th>
<th>Healthy control</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average</td>
<td>DP</td>
<td>Average</td>
</tr>
<tr>
<td>CV (L)</td>
<td>94,7</td>
<td>18,7</td>
<td>95,3</td>
</tr>
<tr>
<td>CVF (L)</td>
<td>95,1</td>
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<td>94,6</td>
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<td>20,6</td>
<td>97,5</td>
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<td>FEF 25%-75% (L/s)</td>
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<td>34,3</td>
<td>98,5</td>
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<tr>
<td>VVM (L/min)</td>
<td>10,1</td>
<td>2,2</td>
<td>9,8</td>
</tr>
<tr>
<td>VEF1/CVF (%)</td>
<td>94,6</td>
<td>13,1</td>
<td>98,6</td>
</tr>
</tbody>
</table>

* Statistically significant difference (Student t test for independent samples, p ≤ 0.05).


It was observed that there is a relationship between hearing impairment and spirometric parameters in children and adolescents, as 30.8% of the results showed changes in values.
DISCUSSION

These results showed no statistically significant differences (Table 2), by Student t test on variables Vital Capacity (VC), Forced Vital Capacity (FVC), forced expiratory volume in one second (FEV1), Index of Tiffenau (FEV1/FVC), mean forced expiratory flow (FEF 25% -75%) and maximal voluntary ventilation (MVV).

These results differ from those observed by Jonsson & Gustafsson (2005), who underwent spirometry with 51 children and adolescents with hearing loss between 10-16 years of age and a control group comprised 82 children without hearing impairment. We analyzed the vital capacity (VC) and forced expiratory volume in one second (FEV1).

Thus, in terms of spirometry data, only the FEFmác was statistically significant (p ≤ 0.05), despite the values of FEV1 and FEV1/FVC deaf volunteers was reduced when compared with the group of healthy volunteers. Thus indicating a change less for the group of volunteers with disabilities - average 80.8 ± 20.6 - compared to the control group - mean 97.5 ± 19.1 - (Table 2).

The results of this study are consistent with the findings of Zwierzchowska & Zebrowski (2006), for in his comparative study with 72 children and adolescents with hearing impairment and 72 healthy children and adolescents, showed that subjects with hearing impairment showed a significant reduction PEF, so there is an influence of this deficiency on the value of PEF - FEFmác.

The FEFmác has the same clinical expression of the peak expiratory flow (PEF - Peak Flow). PEF has as one of the objectives of assessing the patient's peak flow, to examine with the utmost accuracy the degree of bronchial obstruction in various pulmonary diseases. So it is a very useful feature in pulmonology clinics for monitoring of pulmonary obstruction in consultas.

A major determinant of PEF are the strength and coordination of the expiratory muscles, especially the abdominals. Thus, the PEF is a flow-dependent parameter, is limited by force-velocity, which are characteristics of the expiratory muscles.

The reduction observed in FEFmác disabled participants of this study can be explained due to the limitations of oral language acquisition in these individuals, for the hearing impaired present deviation of some characteristics, such as breathing pattern characterized by the occurrence of expiration excessive use of air reserve and inspiration during speech, causing a major pneumo incoordination.

Cukier & Campbell (2005) also state that children and adolescents who do not use speech usually have a breathing "short", thus not completely fill the lungs by limiting the expansion of the chest cavity and causing a decrease in the strengthening of the muscles involved respiration (inspiratory and expiratory). Rodrigues (1997) also states that the hearing impaired have difficulty in managing the airflow, not synchronizing with the start of phonation onset of respiration, tending to expel air before speaking, which harms the coordination between breathing, existing use of air reserve and interruption of phrases with pauses at inappropriate times.

It is known that some parameters interfere with the establishment of standards for normal spirometry, such as sex, age extremes, ethnic and regional diversities, solo and group exhibitions to environmental factors, in short, anything that might influence lung function.

According to Silva (2007), tables of normality for spirometry proposals are based on heterogeneous populations and without standardized inclusion criteria in North America and Europe. Since the spirometers used in Brazil are usually imported, and included the equations of predicted normal values of the country of origin, these are the references used in the routine evaluation, especially the table of Knudson et al (1983).

This research used the equation of Knudson et al (1983) for assessing the performance of the examination. It is noteworthy that the scale of normalcy for children and adolescents has not yet been characterized for the profile of the Brazilian.

Therefore, it can link the use of spirometric reference to the results achieved by the study volunteers, supporting the research of Whittaker et al (2005), which alluded to the ethnic factors for the differences between lung volumes, especially given the strength of inspiratory muscles and lung compliance and chest, are predictive of changes in pulmonary physiology.

Given this fact, the results of this study can be explained by the reduced number of
volunteers participating in the study. The achievements of new studies guided by the relationship between hearing loss and lung function will be of great importance for the possible continuation of this line of research. This should be used methodological procedures more accurate and differentiated in order to clarify that the gaps and possible failures presented in this study, and especially about the aspects that can still be investigated.

CONCLUSION

It was found that there is a relationship between hearing impairment and spirometric parameters in children and adolescents, as 30.8% of the results obtained by these participants were biased to the standards obstructive, restrictive and moderate obstructive moderate although most participants with this deficiency show normal spirometry results;

Only variable FEFmáx statistical significance when comparing the hearing impaired group and the control group, despite the values of FEV1 and index Tiffenau deaf volunteers turned out to be small compared with the group of healthy volunteers.

RESUMO

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Objetivo: esta pesquisa analisou os parâmetros espirométricos em crianças e adolescentes com deficiência auditiva comparando-os com as variáveis espirométricas de um grupo controle, bem como quantificar os distúrbios ventilatórios apresentados em 13 voluntários do grupo deficiente. Método: foi empregado o teste t de Student para amostras independentes sendo considerado o nível α de 5%. Os voluntários apresentaram diagnóstico de deficiência auditiva moderada a profunda e foram avaliados por meio de uma ficha de avaliação para verificar se cumpriam os critérios de inclusão do estudo. Foi realizado exame espirométrico com a utilização de clípe nasal, demonstrações e incentivo vocal na execução do teste. Foram mensurados os valores de Capacidade Vital (CV), Capacidade Vital Forçada (CVF), Volume expiratório forçado de primeiro segundo (VEF1), Índice de Tiffenau (VEF1/CVF), FEFmáx (fluxo expiratório forçado máximo), Fluxo médio expiratório forçado (FEF 25%-75%) e Ventilação voluntária máxima (VVM). Resultados: redução estatisticamente significante do FEFmáx (p ≤ 0,05) do grupo deficiente auditivo quando comparado ao grupo controle. Para a maioria dos parâmetros espirométricos avaliados não houve diferença entre os grupos. Conclusão: há uma relação entre a deficiência auditiva e os parâmetros espirométricos de crianças e adolescentes, pois 30,8% dos resultados obtidos por estes participantes mostraram-se tendenciosos aos padrões obstrutivo, obstrutivo moderado e restritivo moderado.

DESCRITORES: Espirometria, Sistema respiratório, Deficiência auditiva.

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