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Postural control assessment in students with normal hearing and sensorineural hearing loss[☆,☆☆]

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KEYWORDS
Motor skills;
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Abstract
Introduction: Children with sensorineural hearing loss can present with instabilities in postural control, possibly as a consequence of hypoactivity of their vestibular system due to internal ear injury.
Objective: To assess postural control stability in students with normal hearing (i.e., listeners) and with sensorineural hearing loss, and to compare data between groups, considering gender and age.
Methods: This cross-sectional study evaluated the postural control of 96 students, 48 listeners and 48 with sensorineural hearing loss, aged between 7 and 18 years, of both genders, through the Balance Error Scoring Systems scale. This tool assesses postural control in two sensory conditions: stable surface and unstable surface. For statistical data analysis between groups, the Wilcoxon test for paired samples was used.
Results: Students with hearing loss showed more instability in postural control than those with normal hearing, with significant differences between groups (stable surface, unstable surface) ($p < 0.001$).

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Conclusions: Students with sensorineural hearing loss showed greater instability in the postural control compared to normal hearing students of the same gender and age.

PALAVRAS-CHAVE
Destreza motora;
Doenças vestibulares;
Desempenho psicomotor;
Postura;
Surdez

Avaliação do controle postural em escolares ouvintes e com perda auditiva sensorioneural

Resumo
Introdução: Crianças com perda auditiva sensorioneural podem apresentar instabilidades posturais, possivelmente provocadas pelo acometimento do sistema vestibular em virtude da lesão na orelha interna.
Objetivos: Avaliar a estabilidade do controle postural em escolares ouvintes e com perda auditiva sensorioneural e comparar os dados entre os grupos, considerando os gêneros e as faixas etárias.
Método: Estudo de corte transversal, que avaliou 96 escolares de ambos os gêneros na faixa etária entre 7-18 anos, sendo 48 ouvintes e 48 com perda auditiva sensorioneural. A avaliação do controle postural foi realizada por meio da Escala de BESS (*Balance Error Scoring System*) que avalia o controle postural em duas condições sensoriais: superfície estável (SE) e superfície instável (SI). Para a análise estatística dos dados entre os grupos, foi utilizado o teste de Wilcoxon de comparação de médias para amostras pareadas.
Resultados: Os escolares com perda auditiva demonstraram maior instabilidade no controle postural que os ouvintes, apontando diferenças significativas entre os grupos na SE e SI (($P < 0{,}001$).
Conclusão: Os escolares com perda auditiva sensorioneural demonstraram maior instabilidade no controle postural, em comparação com os escolares ouvintes do mesmo gênero e faixa etária.

Introduction

In the first years of life, children develop a vast repertoire of motor skills such as dragging, crawling, walking, and eventually running; however, in order to develop all these motor skills, an improvement of postural control is required.[1] Around 12 months of age, the child learns how to stay in a standing position, acquires the ability to stay in this position without any help or support and, thus, can further explore the environment around it, making the achievement of the postural control a milestone in any child's mental development.[2]

Postural control has been described as the ability of the individual to remain comfortably in a standing position, keeping his/her body posture stable and aligned, even when suffering disruptions stemming from the external environment.[3] For a satisfactory postural control, is necessary that those sensory systems responsible for its regulation present a seamless integration and regulation.[4]

The main sensory sources responsible for the regulation of postural control are the visual, somatosensory, and vestibular systems.[5] The contribution of each of these to the regulation of postural control occurs selectively, when the central nervous system increases the activity of a system that will prove most useful at the time, reducing the activity of the others, for the regulation and/or maintenance of body posture in a particular task or posture.[6,7] If there is any change in any of these sensory systems, the regulation dynamics of postural control can appear uncoordinated and consequently impaired.[8,9]

Due to the anatomical proximity of the structures responsible for auditory and vestibular functions, it is common to find associated changes in both systems, in the case of involvement of the inner ear. Thus, it is reasonable to assume that children with sensorineural hearing loss also demonstrate vestibular disorders.[10] Furthermore, studies have shown that the hypoactivity of the vestibular system is a frequent finding in otoneurologic evaluations of children with sensorineural-type hearing loss.[11–13]

Children with sensorineural hearing loss appear to show sensory changes from the vestibular system, probably due to inner ear damage. Because the vestibular system is one of the sensory systems responsible for regulating the postural control, these children may present instabilities in the regulation of this control, or this regulation may be uncoordinated,[14] when compared to listeners. Based on the above considerations, the aim of this study was to assess the postural control of normal hearing students and their counterparts with sensorineural hearing loss and compare data among groups, considering gender and age group in the sample and the degree of hearing loss in students with hearing impairment.

Methods

This was a cross-sectional study conducted between July and December of 2012. To determine the sample size, a preliminary survey was conducted jointly with the administration of the Centro de Reabilitação e Educação Especial Rotary, a school focused on teaching children and adolescents with special needs, in order to identify the number of students with sensorineural hearing loss enrolled in the age group targeted by this study, as well as those who met the inclusion and exclusion criteria.

Thus, it was observed that the possibility of matching the children according to gender and age would be possible for 48 students, since there was a predominance of one gender and of some age groups, making it difficult to increase the study sample. The same amount of students was set to form the group of listeners, pairing both groups. Thus, 96 volunteers participated in this study, with 48 listeners (LG) and 48 with sensorineural hearing loss (SHLG), aged between 7 and 18 years.

The inclusion criteria in the study for both groups were: being regularly enrolled in one of the schools collaborating with the present research, an informed consent signed by the parent or guardian, and age between 7 and 18 years. In addition„ the following also were inclusion criteria for SHLG: clinical diagnosis of sensorineural hearing loss, an audiometry performed in the last six months, and proficiency in Brazilian Sign Language (Língua Brasileira de Sinais – LIBRAS). This last criterion was used to ensure that the commands related to the demands of the methodology would be understood by all students. It is noteworthy that all children evaluated had access to LIBRAS teaching in their educational institution.

The exclusion criteria for LG were: presence of any hearing complaint, neurological, physical, visual, or mental disability, and a discrepancy >2 cm in the lower limbs, obtained through a real measurement test and an apparent lower limb measurement, previously held by the evaluators. The exclusion criteria for SHLG were: any associated disability and a discrepancy >2 cm in the lower limbs, obtained through a real measurement test and an apparent lower limb measurement, previously held by the evaluators.

For data acquisition of the inclusion and exclusion criteria of this study, the information reported by parents of students during the interview with the researchers was considered, together with data obtained from the student's school record, which were provided to the researchers by the schools administration.

The volunteers were recruited from a convenience sequential sample matched by gender and age group, selected through an allotment conducted by their teachers, who were blinded to the study characteristics. The allotments were held in the classroom environment, with the presence of all students and researchers of this study.

The listeners were recruited from the Escola Duque de Caxias, targeted to the normal-hearing public; the students with hearing loss were recruited from Centro de Reabilitação e Educação Especial Rotary, targeted to students with special needs. Both schools belong to the state education network, have a similar profile and are located in the city of Caruaru, Pernambuco, Brazil.

Table 1 Balance Error Scoring System (BESS) scale scoring, which ascribes 1 point for each error.

Errors
Raise hands above the iliac crests
Eyes open
Take a step forward, stagger or fall
Move the hip in flexion or abduction of more than 30°
Remove the toes or heel off the ground
Staying out of test position for more than 5 s

The procedures preceding the testing and evaluation of postural control were previously explained orally by researchers to volunteer listeners; to volunteers with hearing loss received the explanation in LIBRAS by one of the researchers, who is an interpreter in LIBRAS.

For data acquisition, the students underwent an assessment of postural control, performed always by the same researcher, individually, in a private room of the school, using the Balance Error Scoring System (BESS) scale,[15] which assesses the stability of postural control in two sensory conditions:

a Stable surface: Tests performed on the ground.
b Unstable surface: Tests performed on a foam block.

The BESS scale[15] comprises six stages, lasting 20 s each, which are conducted with the suppression of the visual field (eyes closed). For the test application, the students were placed upright on the ground, in an demarcated area, wearing light clothing (shorts for males and shorts and tops for females), barefoot, without any external support for foot or ankle; arms positioned along the body, with hands on the iliac crests, standing with eyes closed during all stages of the evaluation, as described below:

- Step 1: static posture on both legs, with feet parallel and together on the ground;
- Step 2: static posture on the lower non-dominant limb on the ground (the hip that does not sustain weight was flexed between 20° and 30° and the knee was flexed between 40° and 50°);
- Step 3: static posture with one foot ahead of the other on the ground, with the non-dominant lower limb positioned behind the dominant leg, with toes touching the heel.

After finishing the first three steps, the volunteer rested for 1 min and the steps were repeated; this time with the child standing on a block of foam measuring 60 cm × 60 cm × 10 cm.

According to the BESS scale,[15] postural stability is measured according to the amount of body sway, regarded as 'errors' on the scale, that occurred during the permanence of the volunteer in each of the steps, as described in Table 1. For each body sway, the evaluator adds 1 point during the evaluation; thus, the higher the score, the less postural stability of the volunteer in this test. The performance of the postural control is considered according to the average of the three steps performed on the ground and of the other three steps performed on the foam block. Thus, the larger

Table 2 Characterization of the studied sample.

Groups	Listeners		Hearing loss		p
	n	(%)	n	(%)	
Volunteers	48	(100)	48	(100)	–
Gender					
Female	24	(50)	24	(50)	–
Male	24	(50)	24	(50)	–
Age, years (mean)	12.5 ± 3.5	(100)	12.5 ± 3.5	(100)	–
Handedness					
Right-handed	45	(93.7)	41	(85.4)	0.181[a]
Left-handed	03	(6.3)	07	(14.6)	
Degrees of hearing loss:					
Mild to moderate	–	–	04	(8.3)	–
Severe to profound	–	–	44	(91.7)	

[a] Pearson's chi-squared test.

the amount of sway showed by a child during testing, the lower its stability in terms of postural control.

The postural control assessments were recorded by a Nikon® Coolpix P-500 camera, positioned on a Digipod® TR-650an tripod, positioned 1 m from the ground and 3 m from the child. The postural control performance of the students was analyzed and scored by two researchers at the same time. After the assessment of postural control in SHLG, data were collected on the degrees of hearing loss obtained by audiometry tests brought by the student' parent or guardian, or by the audiometric results posted in the student's school record, given to the researchers by the school administrator.

To define the degree of hearing loss, the criteria of the British Society of Audiology were followed,[16] by which hearing loss can be classified into four grades, according to the thresholds of decibels (dB) achieved, as follows: mild (25–40 dB), moderate (41–70 dB), severe (71–95 dB), and profound (thresholds above 95 dB). Students presented varying degrees of hearing loss: sometimes bilaterally, or of one ear in relation to the other. However, when different grades were perceived in the same individual, they always varied within the 'mild and moderate' or 'severe and profound' level. Thus, some reports supplied with the student's audiometry exams registered loss grades as 'light to moderate' and as 'severe to profound'. Therefore, the 'light and moderate' and 'severe and profound' nomenclatures were used to categorize the sub-groups of the 'hearing loss' variable in the present study.

Data regarding handedness of students and degrees of hearing loss were expressed as frequency percentage; and for our statistical analysis, the Pearson chi-squared test was used, when necessary.

Data for assessment of postural control were expressed as mean and confidence interval of the means, analyzed through the Wilcoxon test for comparison of means for paired samples, for the comparisons between the two groups. For the analysis of the sub-groups in SHLG, the Mann–Whitney test was used. Statistical significance was set at $p < 0.05$ and SPSS version 18.0 was used for data analysis.

This study was approved by the Ethics Committee in Research of the Associação Caruaruense de Ensino Superior (CEP/ASCES), according to the final document n. 114/2010 and to Resolution 196/96 of the Conselho Nacional de Saúde.

Results

The data relating to the characterization of the evaluated groups are shown in Table 2. Statistically significant differences were observed in the results of the assessment of postural control between the groups, with higher means in SHLG, showing greater instability in postural control, both on the stable ($p < 0.001$) and on the unstable ($p < 0.001$) surface, as shown in Table 3.

The same was observed when the genders were considered between groups, both on the stable and unstable surfaces ($p < 0.001$), according to data presented in Table 4.

When evaluating the postural control according to age, in all age groups studied a greater instability in postural control in SHLG was observed, both on the stable (7–10 years, $p = 0.001$; 11–14 years, $p < 0.001$; and 15–18 years, $p = 0.009$)] and on the unstable (7–14 years, $p < 0.001$; 15–18 years, $p = 0.008$) surface. In SHLG, a reduction of the instability in postural control was observed with advancing age, both on the stable and unstable surfaces, according to data shown in Table 5.

When considering the performance of postural control and the degree of hearing loss, it was observed that students with mild and moderate grades showed better stability in postural control, when compared to those with severe and profound grades, in all categories evaluated. However, these differences were observed only for the steps performed in the stable surface ($p = 0.005$), according to Table 6.

Discussion

In the present study, significant differences were observed between the performance of postural control of the evaluated students. The group with hearing loss presented

Table 3 Mean and confidence interval values for performance of postural control of students listeners and with sensorineural hearing loss of the sample ($n = 96$).

	Listeners ($n = 48$) Mean (CI)	Hearing loss ($n = 48$) Mean (CI)	p
Double support (ground)	0.00 (0.00; 0.00)	0.77 (0.28; 1.26)	0.001[a]
Single leg support (ground)	2.79 (2.41; 3.17)	5.16 (4.47; 5.86)	<0.001[a]
Foot ahead of the other (ground)	0.31 (0.06; 0.56)	3.70 (2.96; 4.45)	<0.001[a]
Mean (ground)	1.03 (0.88; 1.88)	3.21 (2.68; 3.74)	<0.001[a]
Double support (foam)	0.02 (−0.02; 0.06)	2.73 (1.61; 3.84)	<0.001[a]
Single leg support (foam)	4.31 (4.31; 4.60)	7.40 (6.80; 8.00)	<0.001[a]
Foot ahead of the other (foam)	1.50 (1.05; 1.95)	6.20 (5.30; 7.10)	<0.001[a]
Mean (foam)	1.94 (1.74; 2.14)	5.45 (4.65; 6.23)	<0.001[a]

CI, Confidence interval.
[a] Wilcoxon's test for comparison of means for paired samples.

greater instability in postural control, compared to listeners.

In this context, the results obtained in this study corroborate those of Derlich et al.[17] who evaluated the postural control of children (listeners and with hearing loss) through a force platform, with and without the use of a foam block, and reported that the performance of postural control of the children assessed showed significant differences; and that the group with hearing loss had greater postural instability, as was also observed in the present study.

Derlich et al.[17] also reported that, during assessments on the unstable surface, their results showed significant differences between groups, with a greater sway on postural control in those children with hearing loss, most commonly in the medial-lateral direction, whereas no differences between the groups were noted on the rigid surface. These results differ from the findings of the present study, where students with hearing loss showed differences in postural control on both stable and unstable surfaces. An explanation for this finding may be the fact that all stages of BESS scale were performed with visual guidance suppression. This also refers to the influence of other systems responsible for the regulation of postural control, since when it is not possible to use the visual system, the somatosensory and vestibular systems are those most required for the maintenance of postural stability.

Similarly, Sousa et al.[18] analyzed the postural control of 100 children, 43 with hearing loss and 57 listeners, aged between 7 and 10 years, using a force platform. The authors observed differences between the analyzed groups; and the group with hearing loss demonstrated more fluctuations in postural control in all tests evaluated, as was also noted in the present study.

Also according to Sousa et al.,[18] the position with feet together and eyes closed was the most sensitive to detect differences between groups. These findings are in

Table 4 Mean and confidence interval values for performance of postural control of students listeners and with sensorineural hearing loss according to gender ($n = 96$).

	Female			Male		
	Listeners ($n = 24$) Mean (CI)	Hearing loss ($n = 24$) Mean (CI)	p	Listeners ($n = 24$) Mean (CI)	Hearing loss ($n = 24$) Mean (CI)	p
Double support (ground)	0.00 (0.00; 0.00)	0.62 (−0.2; 1.27)	0.042[a]	0.00 (0.00; 0.00)	0.91 (0.14; 1.70)	0.011[a]
Single leg support (ground)	2.95 (2.38; 3.55)	5.25 (4.30; 6.20)	<0.001[a]	2.62 (2.10; 3.15)	5.08 (4.00; 6.18)	0.002[a]
Foot ahead of the other (ground)	0.50 (0.70; 0.93)	3.41 (2.26; 4.57)	<0.001[a]	0.12 (−0.13; 0.38)	4.00 (3.00; 5.01)	<0.001[a]
Mean (ground)	1.15 (0.91; 1.40)	3.10 (2.31; 3.90)	<0.001[a]	0.92 (0.71; 1.11)	3.33 (2.55; 4.11)	<0.001[a]
Double support (foam)	0.00 (0.00; 0.00)	2.25 (0.70; 3.80)	0.007[a]	0.42 (−0.04; 0.13)	3.20 (1.51; 4.90)	0.002[a]
Single leg support (foam)	4.45 (4.00; 4.90)	6.87 (5.60; 7.75)	<0.001[a]	4.16 (3.76; 4.57)	7.91 (7.09; 8.74)	<0.001[a]
Foot ahead of the other (foam)	1.75 (1.06; 2.43)	5. 60 (4.12; 7.05)	<0.001[a]	1.25 (0.62; 1.88)	6.83 (5.68; 8.00)	<0.001[a]
Mean (foam)	2.07 (1.75; 2.38)	4.90 (3.75; 6.05)	<0.001[a]	1.82; (1.56; 2.07)	6.00 (4.90; 7.10)	<0.001[a]

CI, confidence interval.
[a] Wilcoxon's test for comparison of means for paired samples.

Table 5 Mean and confidence interval values for performance of postural control of students listeners and with sensorineural hearing loss according to age group ($n = 96$).

	7–10 years			11–14 years			15–18 years		
	Listeners ($n = 16$) Mean (CI)	Hearing loss ($n = 16$) Mean (CI)	p	Listeners ($n = 16$) Mean (CI)	Hearing loss ($n = 16$) Mean (CI)	p	Listeners ($n = 16$) Mean (CI)	Hearing loss ($n = 16$) Mean (CI)	p
Double support (ground)	0.00 (0.00; 0.00)	1.94 (0.61; 3.26)	0.011[a]	0.00 (0.00; 0.00)	0.31 (−0.01; 0.63)	0.059[a]	0.00 (0.00; 0.00)	0.06 (−0.07; 0.20)	0.317[a]
Single leg support (ground)	3.56 (2.80; 4.31)	5.62 (4.08; 7.16)	0.014[a]	2.37 (1.73; 3.01)	5.68 (4.55; 6.81)	0.001[a]	2.44 (1.92; 2.95)	4.20 (3.17; 5.20)	0.014[a]
Foot ahead of the other (ground)	0.25 (−114; 0.61)	5.37 (4.00; 6.74)	0.001[a]	0.37 (−0.17; 0.92)	3.75 (2.87; 4.63)	0.001[a]	0.31 (−0.15; 0.78)	2.00 (0.80; 3.20)	0.019[a]
Mean (ground)	1.27 (0.97; 1.56)	4.31 (3.10; 5.52)	0.001[a]	0.91 (0.63; 1.20)	3.25 (2.70; 3.80)	<0.001[a]	0.91 (0.68; 1.15)	2.10 (1.40; 2.76)	0.009[a]
Double support (foam)	0.00 (0.00; 0.00)	5.50 (3.21; 7.78)	0.002[a]	0.00 (0.00; 0.00)	1.62 (0.10; 3.14)	0.026[a]	0.07 (−0.07; 0.20)	1.06 (−0.36; 2.50)	0.144[a]
Single leg support (foam)	4.81 (4.25; 5.37)	8.62 (7.61; 9.63)	0.001[a]	4.00 (3.44; 4.55)	7.31 (6.38; 8.24)	<0.001[a]	4.12 (3.70; 4.55)	6.25 (5.21; 7.30)	0.003[a]
Foot ahead of the other (foam)	1.75 (0.90; 2.60)	8.62 (7.56; 9.70)	0.001[a]	0.88 (0.17; 1.57)	6.25 (5.26; 7.23)	0.001[a]	1.87 (1.00; 2.74)	3.75 (2.00; 5.51)	0.058[a]
Mean (foam)	2.18 (1.80; 2.56)	7.58 (6.24; 8.92)	<0.001[a]	1.62 (1.30; 1.96)	5.06 (4.14; 6.00)	<0.001[a]	2.02 (1.70; 2.35)	3.70 (2.46; 4.91)	0.008[a]

CI, Confidence interval.
[a] Wilcoxon test for comparison of means for paired samples.

agreement with the results obtained in the present study, since all the reviews were performed with the suppression of the visual field.

Furthermore, De Kegelel et al.[19] investigated the reliability of the measurement of postural stability in children (listeners and with hearing loss) aged between 6 and 12 years, with the use of a force platform, clinical tests and scales. The authors concluded that clinical tests and scales are as reliable for the detection of postural instability in this population as the force platform, thus making reliable the findings of the present study.

Besides the data between groups, in this study some variables were also analyzed in isolation; one of the most important findings was observed in the variable 'age group'. The purpose of using a large age range was to observe the evolution of postural control with age, since such data are scarce in the literature. The results showed an increase of postural control due to lower oscillation exhibited over time in SHLG, although there remained differences between groups, as shown in Table 5. This suggests that interventions in this population should occur in childhood and also in adolescence, and that they can be incorporated in the school environment.

Another relevant finding was observed when the performance of postural control and the degrees of hearing loss were considered. Students with mild to moderate degrees of hearing loss had greater stability in postural control than students with severe and profound grades in all categories evaluated, indicating statistical differences only for the evaluations performed on the stable surface. One explanation for this finding may be based on the results of studies that sought to assess the function of the vestibular system in children with hearing impairment. Guilder et al.[20] reported that children with severe and profound degrees of hearing loss often showed hypoactivity of the vestibular system. Similarly, Lavinsky[21] stated that children with profound degree of hearing loss showed high incidence of vestibular dysfunction. Such data could explain the findings of the present study regarding the variable 'degree of hearing loss', considering that 91.5% of children with hearing loss in this study had severe and profound grades.

Possible repercussions of instability in postural control could befall on body posture. Recently, Olszewska et al.[22] evaluated the posture of children with hearing loss and concluded that changes in body posture in this group are quite common. Similarly, Melo et al.[23] reported in their study that, among the children evaluated, students with hearing loss had a higher incidence of postural changes in the spine, compared to listeners.

Based on the present results, the involvement of the vestibular system appears to be a detrimental factor for a proper and satisfactory postural control, as reported by Plata.[9] This fact may alter the regulation of postural control in children with hearing loss, making them more prone to postural instability, when compared to listeners of the same gender and age.

This occurs mainly because other studies also have reported that vestibular dysfunction is a frequent finding in otoneurologic reviews of children with sensorineural hearing loss.[24–27] Thus, it is valid to suggest that all children with a clinical diagnosis of sensorineural hearing loss should

Table 6 Mean and confidence interval values for performance of postural control of students listeners and with sensorineural hearing loss according to degree of hearing loss ($n = 48$).

	Mild/moderate ($n = 04$) Mean (CI)	Severe/profound ($n = 44$) Mean (CI)	p
Double support (ground)	0.25 (−0.54; 1.04)	0.82 (0.29; 1.35)	0.843[a]
Single leg support (ground)	2.00 (−0.25; 4.25)	5.45 (4.76; 6.14)	0.002[a]
Foot ahead of the other (ground)	1.00 (−2.20; 4.20)	3.95 (3.20; 4.70)	0.031[a]
Mean (ground)	1.09 (−0.73; 2.89)	3.41 (2.87; 3.95)	0.005[a]
Double support (foam)	1.25 (−1.14; 3.63)	2.86 (1.65; 4.07)	0.787[a]
Single leg support (foam)	5.75 (3.03; 8.46)	7.54 (6.92; 8.16)	0.106[a]
Foot ahead of the other (foam)	3.00 (−0.89; 6.90)	6.50 (5.56; 7.43)	0.031[a]
Mean (foam)	3.33 (0.52; 6.14)	5.63 (4.81; 6.45)	0.125[a]

CI, Confidence interval.
[a] Mann–Whitney's test.

undergo an examination of the vestibular system, regardless of age and gender, even in the absence of vertigo or dizziness.[28]

It is worth noting that this study did not assess the function of the vestibular system in hearing children, since the computed vectoelectronystagmography exam is very expensive, not available in the public health network of this city. Moreover, this project did not have any funding, and this was a limitation to any conclusion regarding the involvement of the vestibular system.

A major contribution of this study was to provide data on the stability of the postural control of children with hearing loss, in relation to age and degree of hearing loss. To the best of the authors' knowledge, there are no studies in the literature on Medline/Pubmed in the period of 1966–2013; Lilacs: 1982–2013; and Cinahl: 1937–2013, that have observed such a relationship.

It is concluded that children with sensorineural hearing loss presented greater instability in postural control when compared to listeners of the same gender and age. In addition, students with hearing loss of severe and profound grades demonstrated greater instability in postural control, compared to students with mild and moderate degrees.

This condition may be related to the involvement of the vestibular system due to damage to the inner ear, which can interfere with the performance of some motor skills of children that depend on an appropriate postural stability to be executed (such as walking, running, and jumping), and may be negatively influencing their physical fitness and/or sports practice.

In this sense, Hartman et al.[29] analyzed the motor performance of 42 children with hearing loss and their participation in sports activities, compared to a sample of listeners. Children with hearing loss had greater limitation when compared listeners in manual skills (62%), ball skills (52%), and body balance skills (45%). The authors emphasized that improving such motor skills could positively contribute in the school context and in sports practice of these children.

This leads to the reflection on the importance of awareness of health professionals who deal with this group of people, such as otorhinolaryngologists and speech therapists, as well as those who work with children's motor behavior, given that this topic is still unknown for many of these professionals.

Thus, the authors emphasize the need for prevention programs targeted to school health enhancing the practice of specific physical exercises, early detection of risk factors for the emergence of postural instability, and periodic sensorimotor reviews and specific interventions.[30]

All these performances are attributions of physical therapy, which reflects the importance of integrating physical therapists in the school environment.[31] These interventions could be incorporated into the day-to-day of schools, of institutions providing services to this population, and in multidisciplinary teams, in order to adapt and/or enhance the postural stability and quality of life of children and adolescents with sensorineural hearing loss.

Conclusion

Children with sensorineural hearing loss presented more instability in postural control than listeners of the same gender and age. Students with hearing loss of mild and moderate degrees showed greater stability in postural control than those with severe and profound degrees.

Conflicts of interest

The authors declare no conflicts of interest.

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