



ORIGINAL ARTICLE

Electromyographic analysis of ankle muscles in young adults with Down syndrome before and after the implementation of a physical activity programme based on dance

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KEYWORDS

Electromyography;
Postural control;
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Standing position;
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Abstract

Introduction: People with Down syndrome have difficulties in postural control and exhibit differences in the displacement of their centre of pressure and in muscle activity compared with the general population. Previous research has shown that centre of pressure displacement is less depending on visual conditions in people with Down syndrome, although improved balance has been observed following specific physical activities based on dance. The aim of the project was to assess the effect of a dance-based physical activity programme on muscle activity in young adults with Down syndrome.

Material and methods: Eleven participants with Down syndrome and eleven participants without Down syndrome as the control group followed an 18-week dance programme. Surface electromyography was used to assess ankle muscle activity before and after completion of the programme in open and closed eyes conditions.

Results: We observed a higher level of muscle activation in Down syndrome group. They showed minor differences between different visual conditions than control group. No significant differences were seen in pre- and post-training in Down syndrome group. Nevertheless, less differences were observed between both groups after training than before.

Conclusions: Although no significant differences were observed in Down syndrome group after training, differences between groups were decreased. These could be related to some postural adaptations. In the future, it will be interesting to increase the sample and also analyze the position of centre of pressure in relation to feet.

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PALABRAS CLAVE

Electromiografía;
Control postural;
Síndrome de Down;
Posición vertical;
Danza

Análisis electromiográfico de los músculos del tobillo en adultos jóvenes con síndrome de Down antes y después de la implementación de un programa de actividad física basado en la danza

Resumen

Introducción: Las personas con síndrome de Down tienen dificultades de control postural, y muestran diferencias en cuanto a desplazamiento de su centro de presión y a su actividad muscular, en comparación con la población general. La investigación previa ha reflejado que el centro de la presión de desplazamiento es menos dependiente de las condiciones visuales en las personas con síndrome de Down, aunque se ha observado una mejora del equilibrio tras la realización de actividades físicas basadas en la danza. El objetivo del proyecto fue valorar el efecto de un programa de actividad física basado en la danza sobre la actividad muscular en adultos jóvenes con síndrome de Down.

Material y métodos: Once participantes con síndrome de Down y 11 participantes sin síndrome de Down, como grupo control, siguieron un programa de danza de 18 semanas de duración. Se utilizó electromiografía de superficie para valorar la actividad del músculo del tobillo antes y después de la finalización del programa, con los ojos abiertos y cerrados.

Resultados: Observamos un nivel superior de activación muscular en el grupo de síndrome de Down, que reflejó unas diferencias menores entre las diferentes condiciones visuales que el grupo control. No se observaron diferencias significativas previas y posteriores al entrenamiento en el grupo síndrome de Down. Sin embargo se observaron menores diferencias entre ambos grupos tras el entrenamiento, en relación a la situación previa al mismo.

Conclusiones: Aunque no se observaron diferencias significativas en el grupo síndrome de Down tras el entrenamiento, sí se observó un descenso de las diferencias entre los grupos. Estas podrían guardar relación con ciertas adaptaciones posturales. En el futuro, sería interesante incrementar la muestra, y analizar también la posición del centro de presión en relación a los pies.

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Introduction

People with Down syndrome (DS) often have joint laxity and low muscle tone.^{1,2} Motor development and motor reactions are slow, making it more difficult to adapt to the environment during the execution of various motor tasks³ because of difficulty when controlling postural adjustments.⁴⁻⁶ Researchers have also found differences between people with and without DS when analysing centre of pressure (COP) In general, DS subjects showed higher values for the COP displacements than control subjects (rootmeansquare; mean velocity; sway area and rotational frequency), except for RMS with closed eyes.⁷ Also, when comparing the static standing balance between adolescents with and without DS, it was observed that the values for the anterior-posterior, medial-lateral, sway path and velocity of the COP with OE and CE in the DS group were higher, except for the medial-lateral displacement of the COP with closed eyes.⁸

Most authors agree that people with DS have reduced ability to maintain stable posture compared to those without DS.^{9,10} The reasons for decreased postural stability and balance in people with DS are not yet clear. Some authors suggest that the lack of postural control in groups of people with intellectual disabilities (ID) is related to the coexistence of vestibular anomalies,⁷ slow response^{5,11} and sensory impairment.^{12,13} We must take into account that an important part of the people with DS also has an ID coexisting with some of these associated factors.

In previous studies comparing different visual conditions, the authors of this study have observed that young people with DS show a poor postural control in standing position. Differences with control group (CG) were more evident in opened eyes than in closed eyes condition. When changing conditions, control group increased their anteroposterior displacement in closed eyes versus opened eyes, but SD group did not do it.¹⁴ Other authors have similarly suggested that people with DS use their muscles differently in dynamic conditions such as walking. Toddlers with DS showed significantly wider step width than their peers without DS. Toddlers with DS improved the rhythmicity of their muscle burst, sustaining longer bursts but timing remained inconsistent. Decreased inter-burst interval and increased muscle burst duration in toddlers with DS may assist in leg control via stabilizing their lax joints.¹⁵ No group differences (DS versus TD children) on stiffness or on lower limb's co-contraction indices (CCI's) during stance phase were observed but children with DS showed greater CCI during swing.¹⁶ In static conditions such as maintaining a standing position, some authors observed higher muscular activity in adults with DS versus CG. Adults with DS might perform preprogrammed contractions to increase joint resistance and compensate for inherent joint instability occurring for quick and unpredictable perturbations.¹⁷ Responses in children with Down syndrome showed no adaptive attenuation to changing task conditions. Onset latencies of responses in children with Down syndrome were significantly slower

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