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Postural control in children, adolescents and adults with Down syndrome

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KEYWORDS

Down syndrome;
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Abstract

Introduction: Postural control is considered the basis for the development of motor skills in people with DS. Therefore, the analysis of postural control could guide the rehabilitation of these patients.

Objective: To analyse the postural control in children, adolescents and adults with Down syndrome (DS).

Material and methods: A case-control study. The sample was composed of twenty-two children aged 6–11 years old (10 DS, 12 TD), twenty-three adolescents between 12 and 18 years old (11 DS, 12 TD), and twenty-four young adults 19 and 25 years old (12 DS, 12 TD). Postural control was measured on a force platform in condition of open eyes (OE) and closed eyes (CE) where the centre of pressure (COP) variables were calculated. People with DS and typically developing (TD) were compared.

Results: No significant differences were observed in children. In adolescents and adults the COP variables were significantly higher in the groups with DS in OE and CE ($P < 0.05$). In people with DS there were no significant differences between children, adolescents and adults in any of the COP variables. In people with TD significant differences when comparing children, adolescents and adults ($P < 0.05$).

Conclusions: Individuals with DS have a deficit of postural control and low development of this skill as the individual matures in age.

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PALABRAS CLAVE

Síndrome de Down;
Control postural;
Balance postural

Control postural en niños, adolescentes y adultos con síndrome de Down

Resumen

Introducción: El control postural se considera la base del desarrollo de habilidades motoras en personas con síndrome de Down (SD). Por ello el análisis del control postural podría orientar su rehabilitación.

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Objetivo: Analizar el control postural en niños, adolescentes y adultos con SD comparativamente con los que presentan un desarrollo típico (DT).

Material y método: Estudio de casos y controles. La muestra fue compuesta por 22 niños entre 6 a 11 años de edad (10 SD; 12 DT), 23 adolescentes entre 12 y 18 años de edad (11 SD; 12 DT), y 24 adultos jóvenes entre 19 y 25 años de edad (12 SD; 12 DT). El control postural fue medido sobre una plataforma de fuerza en situación de ojos abiertos (OA) y ojos cerrados (OC) calculándose las variables del centro de presión (COP).

Resultados: En niños, no hubo diferencias estadísticamente significativas. En adolescentes y adultos las variables del COP fueron significativamente mayores en los grupos con SD en OA y OC ($p < 0,05$). En personas con SD no hubo diferencias significativas entre niños, adolescentes y adultos en ninguna de las variables del COP. En personas con DT se observaron diferencias significativas al comparar rangos etarios ($p < 0,05$).

Conclusiones: Las personas con SD presentan un déficit del control postural y un bajo desarrollo de esta habilidad a medida que van madurando en edad.

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Introduction

Down syndrome (DS) is a chromosome disorder caused by the presence of an extra copy of chromosome 21.¹ That children with DS are characterised by delayed motor development and difficulty in performing functional motor tasks is well known.² Children with DS present hypotonia, ligamentous hyperlaxity, delayed latency in muscle activation and deficits in posture control.³ These motor area problems continue until adult life.⁴

Various authors believe that postural control is the basis for the development of motor skills in individuals with SD.⁵⁻⁷ Postural control is considered a complex motor skill derived from the interaction of multiple sensorimotor processes to control the body in space.⁸ This includes an interaction between the sensory system, the central nervous system (CNS) and the motor system. Maintaining postural control depends on the sensory systems and their ability to integrate the information in the CNS to generate a motor response appropriate for the environmental requirements.⁹ There are disagreements as to sensory input to postural control due to the physiological maturation of these systems. Some studies indicate that the sensory systems mature between 7 and 10 years of age, when the response patterns are similar to those of adults.^{3,10,11} Other authors suggest that sensory system maturation is reached around the age of 14–15.⁹ In individuals with typical development (TD), it has been established that as individuals grow, postural control gradually improves and reaches its most advanced development point in the early stages of adult life.^{10,11} This has not been researched in individuals with DS.

The universally accepted method for quantifying postural control is through centre of pressure (COP) (the same acronym is used in Spanish and English) displacement using a force platform that senses postural oscillations.¹² From COP measurements, variables such as displacement area, velocity and medial-lateral (ML) (side-to-side) and anterior-posterior (AP) (forward-backward) components.¹²

The greater the value of these variables, the worse the postural control. Children and adolescents with DS have been shown to have poor postural control.^{5-7,13-15} In adults with DS, few studies have focused on alterations in this motor skill.⁵ In Latin America, there are no studies analysing postural control in individuals with DS.

The purpose of this study was to analyse postural control in children, adolescents and adults with DS.

Method

This was a case-control observational study. The sample was non-probabilistically selected and based on convenience. All the participants with DS and the minors with TD were authorised by their legal guardians by informed consent. The adults with TD read and signed an informed consent voluntarily.

Participants

The sample consisted of 22 children between 6 and 11 years old (10 DS; 12 TD), 23 adolescents between 12 and 18 years old (11 DS; 12 TD), and 24 young adults between 19 and 25 (12 DS; 12 TD). Both the participants with DS and those with TD had to be able to understand simple instructions and walk independently. The following were exclusion criteria for both groups: musculoskeletal lesions, lower limb surgery, pain in any part of the body at the time of evaluation, vestibular disorders, uncorrected visual disorders and use of technical aids for walking.

Procedure

Postural control was measured with a 40 cm × 40 cm ArtOficio force platform (Artoficio Ltda., Santiago, Chile). The data were acquired with a sample rate of 40 Hz. Igor Pro software version 5.01 (WaveMetrics Inc., Oregon, USA) was

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