

Stair ascent/descent in adolescents with autism spectrum disorder

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Abstract

The aim of the study was to determine the age-related abnormalities of stair climbing in autism. Kinematical data were collected for 9 autistic individuals (4 of 6-8 years of age (children) and 5 of 11-12 years of age (adolescents)) and 9 control subjects (3 children and 6 adolescents). Subjects ascended and descended the one step laboratory stair always starting by right leg. Movement time of stairs ascent in autistic adolescents was longer than in control and they executed this motion with knee and hip less flexed than control adolescents. Autistic children ascended and descended stair faster than autistic adolescent. During stair descent autistic adolescents flexed hip less than control as well. Autistic children have larger amplitude of ankle joint plantar flexion than autistic adolescents during stair descent. Maximum knee flexion during stair ascent/descent was delayed in autistic adolescent in comparison to the control. Significant difference of movement coordination between children and adolescents with autism spectrum disorder indicates the importance of yearly rehabilitation program.

Introduction

Autism is a disorder defined by impairments in social reciprocity, verbal and nonverbal communication, restricted and repetitive behavior. There are also associated symptoms that are not part of this diagnosis but appear to be neurologically and clinically important elements of the syndrome. Abnormalities of motor coordination, posture and gait are among these (Minshew et al., 2004). Recently we have shown that the therapeutic manipulations aimed to normalize the muscle tonus in autistic adults decrease the body sway during standing on foam-rubber and frontal oscillation of the pressure center during standing with eyes closed (Talis et al., 2011). Being a common activity of daily life, stair climbing

initiation demands a voluntary control requiring to rise the foot higher than the step level and, after positioning it on the step ground, to balance on one leg until the contralateral leg reaches the ground. Because of the well-known age-related severity increase of neurological symptoms in autism and distal to proximal muscle tonus differentiation in neurological patients this study is aimed to determine the age-related abnormalities of stair climbing in autism.

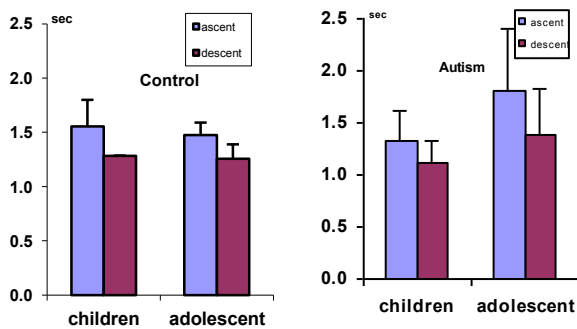
Methods

9 autistic (4 of 6-8 years of age (autistic children) and 5 of 11-14 years of age (autistic adolescents)) (Table) and 9 control individuals (3 of 6-7 years (children) and 6 of 10-13 years of age (adolescent)). Subjects ascended and descended one step laboratory stairs (10 cm height, 40 cm wide and 38 cm length) using the right leg at a self-selected pace. Kinematic recordings were collected from a 2-camera, three dimensional motion system ("Statokin", Moscow, Russia) at a sampling rate 50 Hz. Reflective markers (25 mm spheres) were placed on the right side of the body on: fifth metatarsophalangeal joint, lateral malleus, a point midway between the lateral epicondyle and lateral side of the fibula head, greater trochanter and acromion right. There were five events during each stair ascend (descend) identified: swing start, when the velocity of hip joint flexion raised up to 10% of its maximum (time - t0), maximum knee flexion (t1), maximum hip flexion (t2), stance start - maximum knee extension (t3) and stance end - the beginning of the contact of contralateral leg with the ground (t4). Ascent/descent movement time, inter-joint angles in sagittal and frontal planes were analyzed. Angles for each trial were expressed in the percentage of its value at t0. Three-five trials were averaged for each subject individually and these were then averaged to provide the group mean value and SD. Paired-samples t-tests were performed to determine possible significances.

Results

Cycle duration was greater during stair ascent compared to descent. Between subjects' variability and duration of ascent have a tendency to increase in autistic adolescent in comparison to autistic children (Fig. 1). During stair descent autistic adolescents

Fig. 1



exhibited significantly smaller ankle joint plantar flexion than age-matched control individual (Fig. 2). There was no difference in ankle joint plantar flexion during stair descent between autistic and control group of children. There was less hip abduction during stair ascent in both autistic groups in comparison to the age-matched control individuals (Fig. 3). The amplitude of hip joint change in frontal plane during stair descent was small and similar in all groups.

Fig. 2

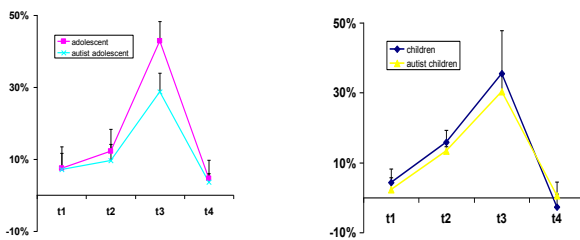
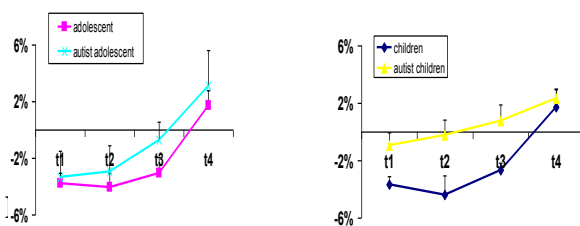


Fig. 3



The duration of stair ascent of adolescents in the present study was 1.48 ± 0.12 (mean \pm SD) and duration of stair descent 1.26 ± 0.13 s (Figure), being similar to healthy adult stair ascent/descent duration, reported by Protopapadaki et al., 2007 (1.45 ± 0.14 and 1.32 ± 0.14). Autistic adolescents in contrast to autistic children have tendency to execute stair ascent-descent motion slower than age-matched control individuals with larger inter-subject variability. Insufficient ankle joint plantar flexion during stair descent in autistic adolescents points out to the rigidity of distal muscles progressed with age. Less hip abduction during stair ascent in both autistic groups points out to the axial muscles abnormalities and indicates the importance of early rehabilitation programs.

Reference

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