Relationship between motor and mental age in children with Down syndrome

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Abstract:

Objectives: Down syndrome (DS) is the most common multiple congenital anomaly syndrome associated with a developmental disability. Children with Down syndrome have delay in both motor and mental age. This study carried out to explore relationship between mental and motor age of children with DS.

Methods: A cross-sectional study was conducted on 60 participants with DS (5 to 7 years old) using randomized method of sampling based on inclusion and exclusion criteria.

Mental and motor age of participants was measured by Peabody Developmental Motor Scales and Goodenough Draw A Man Test.

Results: test result was analyzed for total, gross and fine motor age and mental age. Results were interpreted by the statistical method of pearson correlation analysis. There was significant correlation between mental age and total motor age based on pearson correlation coefficient (r = 0.93).

Conclusions: Results of the study showed that there were strong positive correlations between gross, fine and total motor age, and mental age of children with Down syndrome and suggest the hypothesis that simultaneous utilization of motor and mental practice through rehabilitation programs is more effective than mere practice.

Key Words: Children, Down Syndrome, Mental age, Motor age

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Introduction

Down syndrome (DS) is the most common multiple congenital anomaly syndrome associated with a developmental disability. The incidence of this syndrome is one per 800 - 900 live births (1, 2). Children with Down syndrome experience delays in all domains of development (3). People with Down syndrome have a wide variety of physical and functional disabilities (4).

The motor skills of children with down syndrome as reported in many studies that indicated specific deficits in aspects of movement such as timing (5), balance(5, 6) and coordination as well as physiological aspects such as muscle tone and strength(6).

Physical impairments that may contribute to the delayed acquisition of gross motor skills include muscle hypotonia, increased flexibility in joints, decreased strength, and short arms and legs. Congenital heart defects, chronic upper respiratory infections, and ear infections can limit endurance and balance (7-10).

The development of motor skill proficiency through childhood and into adolescence is slower for those with Down syndrome and in some areas their persistently make slow progress that is below their mental age (11).

Individuals with Down syndrome tend to have a lower than average cognitive ability, often ranging from mild to moderate developmental disabilities (4, 11).

Fine motor skills are delayed and often lag behind gross motor skills and can interfere with cognitive development. The development of fine motor skills in Down Syndrome usually follows the same pattern as in the typically developing children. It may take a bit longer to achieve fine motor goals for children with Down Syndrome (11-13). These skills will also generally develop a bit later than in "typical" children (9, 14). Some of the possible causes of delay in the development of fine motor skills in Down Syndrome include: hypotonia (low muscle tone), loose joints and ligaments, hand shape (hands are smaller and fingers are shorter than typical), decreased cognitive skills (making it more difficult for the child to reason things out and to learn to coordinate his movements) (8, 9, 15).

Down syndrome have mental retardation in the mild (IQ 50–70) to moderate (IQ 35–50) range, with individuals having Mosaic Down syndrome typically 10–30 points higher (16).

Cognitive development in children with Down syndrome is quite variable. It is not currently possible at birth to predict the capabilities of any individual reliably, nor is the number or appearance of physical features predictive of future ability (11, 17, 18).

Intelligence is considerd as ability of problem solving, adaptation and learning from experience, and is correlated with children‘s rate of information processing and cognitive development. The theory of multiple intelligences that proposed by Howard Gardner , focused on Bodily-kinesthetic skills as an aspect of intelligence (19).

Motor and perceptual development in childhood are completely integrated and result in inter relating system; on the other hand, all voluntary movements include an element of perception and motor development result in expansion of perceptual development (20, 21).

Motor behavior scientists believe that motor skills acquisition is consequence of learning process (20, 22). Problem solving ability and rate of information processing (factors related to intelligence) are considered as very effective factors in motor learning(21, 23).

Furthermore, Child attains ability of locomotion to environment through acquisition of motor skills ability, and develops his/her own perceptual and mental ability (23).

Therefore, Based on whatever it has already been noted, relationship between intelligence (mental age) and motor (motor age) can be important issue to study; whereas children with Down syndrome have delay in both motor and mental age, this question states that whether there is relationship between motor and mental age of children with Down syndrome or not.

This is regardable that knowledge about this problem can be helpful to goal setting and planning of rehabilitative interventions for this group of children (simultaneous use of mental and motor tasks in educational and therapeutic sessions).

Material and Methods:

Participants of present cross-sectional study were 60 children (male = female) with down syndrome that refered to rehabilitation centers in University of Social Welfare and Rehabilitation Sciences, iranian Down Syndrome Association, Ahang rehabilitation center and Mehravaran clinic.

Children were eligible to take part in this research if they were between the ages of 5 to 7 years . Inclusion criteria ensured that only children who had received a diagnosis of DS, and exclusion criteria was severe or deep mental retardation, severe cardio-pulmonary diseases and orthopedic disorders. Simple random sampling used to selection of participants.

Mental and motor age of participants were measured by Peabody Developmental Motor Scales and Goodenough Draw A Man Test. Data were analyzed using Statistical Package for Specific Science (SPSS). Kolmogorov - Smirnove test was used for determination of distribution, and Pearson correlation test was utilized to data analysis.

Results:

The information about measures of central value and dispersion of study sample is summarized in table 1.

Table 1: Characteristics of participants (n=60)

Variables	Mean	Variance	Standaed deviation
Mental age	44.37	29.24	5.41
Gross motor age	46.13	40.19	6.34
Fine motor age	43.40	35.08	5.92
Total motor age	44.77	33.20	5.76

Table 2 illustrates Pearson correlation coefficient of study variables; It shows significant correlation between mental age and gross motor age (pearson correlation coefficient (r) = 0.80) , which indicates a strong positive correlation between them, in addition, it displays significant correlation between mental age and fine motor age (pearson correlation coefficient (r) = 0.95) , which indicates the more strong positive correlation between them, moreover, it represents significant correlation between mental age and total motor age (pearson correlation coefficient (r) = 0.93) , which indicate a strong positive correlation between them.

Table 2: correlation between motor and mental age

Variables	Pearson correlation Coefficient (r)	Tr	V
Mental age Gross motor age	0.80	7.18	%۶۴
Mental age Fine motor age	0.95	16.18	%۹۰/۲۵
Mental age Total motor age	0.93	13.38	%۸۶/۴۹

Discussion:

Findings of present study demonstrate statistically strong relation between motor and mental age of children with down syndrome. The resean for the close association of overal mental and motor development is not clear. It may reflect that the control of motor skills is largely a cenrtal nervous system activity and that brain functions play a central role in motor development in the same way as they do in cognitive development. It could be that both mental and motor development is delayed by similar differences in brain processes. one of these differences could be speed of information processing in the brain. Another could be the ability to establish learned programmes in the brain (5, 8, 14, 15, 24).

Attempts to explain the pattern of perceptuo-motor impairment in DS are many and varied. In the general population of individuals with mental retardation, the relationship between level of cognitive impairment, as measured by IQ, and motor competence has been explored in numerous studies (6, 22, 25, 26).

Since reported correlations rarely exceed 0.5 (leaving 75% of the variance in motor performance to be accounted for), there is now very little interest in pursuing this relationship further. In an exclusively DS sample, a slightly higher correlation between mental age and motor performance has been reported but this finding has not been replicated (6).

Harris(1981) in light of her research findings which have demonstrated not only a deceleration in the rate of both mental and motor development, but also a consistent superiority in mental performance over motor performance among down syndrome infants(24).
Snow et al.(1994) have reported that there is direct relationship between intelligence and motor disabilities that the findings of present study support it.
Findings of Hosbuchi (1995) showed that there is no relationship between walking age of children with Down syndrome and their intelligence at 7 years old, whereas it is different from findings of our study that might be due to decline in IQ of children with Down syndrome through increasing of their age. On the other hand if they had measured IQ in walking age, they would have found probably different results (11).

One American study charted the progress of 15 children with Down syndrome who were 7 to 10 years old. Their s findings show the close relationship between the mental and motor progress. For the reader interested in the data the correlations between the fine motor and gross motor skills and mental age are both 0.64 and statistically highly significant (8, 15).
A study of teenagers also showed a close link between motor skills and mental age (27).

In conclusion, our results suggest the hypothesis that simultaneous utilization of motor and mental practices through rehabilitation pragroms is more effective than mere practice.
As we have already noted, the fact that this was a cross-section, rather than longitudinal study means that our findings must be interpreted with caution.

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