The effects of a Course of Selected Corrective Exercises on the Rate of Scoliosis Curvature and Spinal Pain in Adolescents with Mental Disability

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**Abstract**

People with mental disability who are suffering from scoliosis and other physical abnormalities also have some problems of psychological and physical aspects. The aim of this study was to evaluate the effect of 12 weeks of selected corrective exercises on the rate of scoliosis curvature and spinal pain in mentally retarded adolescents (adolescents with mental disability). The study was a quasi-experimental research with a control group. The research subjects included 40 male student adolescents with mental disability that were randomly divided into two control (n = 20) and experimental (n = 20) groups. To assess the degree of scoliosis curvature and spinal pain, the anteroposterior radiograph of the spine (Cobb method) and pain Visual Analog Scale were used, respectively. Scoliosis screening was performed by tests, including checker board, plumb line, the distance of hands to the ground on either side and Adam's forward bend test. The experimental group subjects participated in corrective exercise program for 12 weeks (3 times per week). The single-factor analysis of covariance (ANCOVA) was used to analyze the data (P ≤ 0.05). Statistical analyses were performed with SPSS software, Ver 20. Considering that in the Cobb measuring method and visual analogue scale of pain measurement, the lower scores show better situations, the results indicated that the scores (degrees) of scoliosis curvature rate in post-test in comparison to the pre-test of the group receiving corrective exercises reduced compared with the control group, and have significantly improved (P ≤ 0.05). However, the scores of experimental group spinal pain in the post-test in comparison to the pre-test, though reduced, but were not statistically significant (p= 0.744). The present study showed that the use of corrective exercises in people with mental disability can reduce the amount of scoliosis curvature and be helpful in correcting physical abnormalities. Therefore, it is recommended to perform these exercises as an effective method on exceptional children.

**Keywords:** Mental retardation (mental disability), Scoliosis, Pain, Corrective exercises

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Introduction

Based on individual differences, there have been always people in the society with significant differences regarding mental and physical aspects compared to normal healthy individuals. One of these vulnerable segments includes those due to their special physical and mental situations need special care and education. Some of these people are mentally retarded adolescents.

According to Piaget, the concept of mental retardation is the failure of operational capacity of an individual. Reaching a point of compatibility, the child achieves balance, when s/he has compatibility and mental capacity together; thus, mental retardation is considered failure caused by stop at operational level (1). According to American Association on Mental Retardation, mental retardation is a moderator on general performance of intelligence, which is significantly lower than average and simultaneously associated with some defects in adaptive behavior that has appeared during growth and development period (2 & 3). Based on Kirk classification system of education, the people with mental disability are divided into three groups:

A. Educable and mild (IQ between 50 and 79)
B. Trainable and average (IQ between 50 and 79)
C. Supportive or quite dependent and severe (IQ less than 29) (3 & 4)

Scoliosis is the lateral deviation and rotation of a series of vertebrae from the middle line of the spine. It usually appears before the age of 14 and its prevalence is equal to 1.9% (5). In a classification system, scoliosis is classified in two structural and non-structural types. In structural scoliosis, it is defined as irreversible lateral curvature of spinal column associated with constant rotation in vertebrae so that the vertebral bodies are rotated toward the convexity surface of the curvature and acanthoid processes are placed in the opposite side. In the non-structural scoliosis, the lateral curvature of spine is reversible and has a situational or dynamic nature. There are no structural or rotational changes in the spine (6, 7).

People with mental disability who are suffering from scoliosis and other physical abnormalities also have problems of psychological and physical aspects, such as pain, decreased mobility of the spine, early fatigue, sleep disturbances, etc. There are several ways to reduce such problems. One method with rapid and holistic growth in its practices and methods over the years includes corrective exercises. Corrective exercises are introduced as a known attempt that partly resolves the abnormal physical conditions such as back
kyphosis, scoliosis and lordosis through coordination of agonist and antagonist muscles and by strength and stretching exercises (8). The subject of study in corrective and curative movements is to evaluate the "balance of human physical structure and providing movements and recommendations for its improvement and efficiency" (9). Physical exercises have been recently considered as a form of corrective and remedial approaches by researchers and practitioners and have been seriously used for almost three decades systematically in treatment of patients with a variety of spinal abnormalities, including idiopathic scoliosis (8, 10). Hastings et al. (2014) reported in a case study the successful correction of neuromuscular scoliosis without spinal surgery through exercises in a man who was suffering from left neuromuscular scoliosis (45° Cobb angle) after a collision with a motor vehicle (11). In a review article, Fusco et al. (2011) studied 21 studies that had used physical exercises for scoliosis therapy; among them, 7 studies had reported the exercises ineffective, while 14 studies had reported physical exercise an effective method in improvement of lateral curvature of spinal cord and reduction of the Cobb angle (12). Morningstar and Joy (2006) reported that 8 weeks of corrective exercises decreased the degree of scoliosis in study samples in different age groups (13). Information on the effectiveness of corrective exercises on scoliosis curvature and spinal pain of adolescents with mental disability is limited; thus, in the present study, the researchers used functional tests to evaluate the impact of selected corrective exercises on the curvature of scoliosis and spinal pain in adolescents with mental disability.

**Methodology**

This was a quasi-experimental study with a pre-test and post-test quasi-experimental design with control group. The research subjects included 40 educable mentally retarded male student adolescents in the age range of 10 to 15 years old that their non-structural scoliosis screening test results were positive. They were selected randomly from students of special schools of Pars Abad city and randomly assigned to two groups:

Control group (N = 20; mean age: 12.20 ± 1.01 years; height: 151.26 ± 3.49 cm; weight: 44.46 ± 2.94 kg; IQ 60.73 ± 4.09)

Experimental group (N = 20; mean age: 12.06 ± 1.09 years; height: 151.73 ± 2.68 cm; weight: 43.73 ± 2.73 kg; IQ 59.60 ± 3.68)
All students with mental disability of special schools of Pars Abad city had an IQ between 50 and 70 (educable). These students had been introduced to these schools by assessment experts of Exceptional Children Organization through filing cases after performing assessment tests in common schools and specialized psychometric tests (including Wechsler, Godynafand Leitner IQ tests). Thus, first, according to the cases of students, information such as records of diseases and cardiovascular disorders, orthopedic disabilities, history of surgery and medication use were collected, and accordingly, the samples with such features were excluded from the study. Then, among the rest, a number of students that their non-structural scoliosis screening test results were positive formed a population from which the studied sample was selected randomly. Consent to participate in the study was taken from the subjects parents.

Visual analog scale of pain was used for spinal pain assessment. The pain VAS is the most widely used tool for measuring pain in the world. In addition to validity and reliability, the most important feature of this tool is ease of use. This tool is a 10-cm measure that its leftside (zero) indicated no pain and its right side (10) represents the most severe pain (14). The rate of scoliosis curvature was obtained from anteroposterior radiograph of the spine (Cobb method). In this method, the angle between the two vertical lines drawn on the tangent lines of the first and last vertebrae forming the arc was measured using a protractor on the radiograph (15). Scoliosis screening was performed by tests, including checkerboard, plumb line, the distance of hands to the ground on either side and Adam's forward bend test. The experimental group subjects participated in the corrective exercise protocol for 12 weeks, three sessions a week, each session lasting 45 minutes. The control group subjects had no specific physical and sports activity during this period, not even a physical education curriculum. After 12 weeks and in the post-test stage, the scoliosis angle and spinal pain of the students were again assessed, and required information was collected. The single-factor analysis of covariance (ANCOVA) was used to analyze the data (P ≤ 0.05). Statistical analyses were performed with SPSS software, Ver 20.

**Results**

Descriptive information about the scoliosis curvature and spinal pain in the pre-test and post-test stages of samples is given in the following charts.
In Table 1, the ANCOVA results are clearly shown. As is clear in the table, the sum of squares of the independent variable is equal to 18.267, leading to the test F value of 35.776, which is significant at 1% level. In other words, the difference is significant between control
group and the experimental group of corrective exercises on the scoliosis curvature rate, even after adjusting for the effect of pre-test. Based on the scores mean of experimental and control groups in the post-test, one can conclude that the selected corrective exercises have a significant impact on the curvature rate of scoliosis in adolescents with mental disability.

Table 2: Results of the posttest analysis of covariance of spinal pain in adolescents with mental disability

<table>
<thead>
<tr>
<th>Source of changes</th>
<th>Sum of squares</th>
<th>Degree of freedom</th>
<th>Mean of squares</th>
<th>F value</th>
<th>Significance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test</td>
<td>26.300</td>
<td>1</td>
<td>26.300</td>
<td>70.428</td>
<td>.000</td>
</tr>
<tr>
<td>Group (independent variable)</td>
<td>.225</td>
<td>1</td>
<td>.112</td>
<td>.373</td>
<td>.744</td>
</tr>
</tbody>
</table>

In Table 2, the ANCOVA results are clearly shown. As is clear in this table, the sum of squares of independent variable is equal to 0.225, leading to the F test value of 0.373, which is not significant at 1% and 5% levels. In other words, the difference between the control and experimental groups on pain level is not significant after adjusting the effect of pretest. According to the experimental and control groups scores at post-test, we can conclude that selected corrective exercises have no significant impact on spinal pain rate in adolescent with scoliosis.

**Discussion**

Scoliosis is one of the most common and abnormal deformation of spinal column in children, adolescents and adults, which includes the lateral and rotational deviation of a set of vertebrae from the midline of spinal axis (7). According to DSM IV-TR, mental retardation is a condition in which a person's intelligence functioning is significantly below the average level that simultaneously leading to destruction of patient's adaptive behaviors, while the onset of the disorder is before the age 18. These people lack or have deficiency in skills expected at any age group (16). The physical Status of mentally retarded children is typically poor, associated with pain and situational abnormalities, and they do not have much physical vitality. The current research was done to evaluate the effectiveness of selected corrective exercises on the rate of scoliosis curvature and spinal pain in mentally retarded adolescents. The results showed no significant differences between two experimental and control groups regarding the rates of scoliosis curvature and spinal pain in the pre-test. However, in the posttest, the rate of spinal curvature in the experimental group significantly improved.
compared to the control group. This is probably a result of the improved balance of performance equilibrium of body muscles, especially the muscles located on the posterior surface of the body, or the so-called Posterior Chain Muscles (PCM) (17, 18). This effect can be attributed to the nature of physical exercises, which in this study, were employed in the form of regular corrective exercises protocol, appropriate number and type of corrective exercises, the required cooperating in the proper implementation of exercises by subjects and available proper facilities during the training period. This finding is consistent with the research results of Hastings et al. (2014), Fusco et al. (2011), Negrini et al. (2008), Govoya (2008), McIntyre et al. (2008), Mark and Timothy (2006) and Morningstar and Joy (2006) that have reported the curvature correction of scoliosis by corrective exercises significant. However, there are studies that have obtained results inconsistent with our study, including the studies of Hasanvand et al. (2012), Khoshbakhti (2000), and Doormala et al. (2003). Perhaps, using different exercises program, different quality of doing exercises and individual differences between subjects are the reasons for inconsistency of these studies with the current research.

Another result based on findings indicated a reduction in the experimental group spinal pain after twelve weeks of selected corrective exercises compared to the initial pain level, which was not statistically significant. Perhaps the members of the target group have not done the corrective exercises correctly and accurately, or may be, the subjects have not correctly and accurately answered the visual analogue scale. Even, it is possible that the selected corrective exercises have not been proper to reduce pain. In this regard, no research was found on examining the impact of corrective exercises on spinal pain level. However, Ghanjal (2009) and Petcharaporn et al. (2007) have examined the relationship between spinal abnormalities (scoliosis) and the pain in this area through separate studies and reported a significant relationship between pain in back areas and scoliosis based on their findings, which is approximately close to the present study results (19 and 20).

**Conclusion**

Based on our results, we can say that selected corrective exercises significantly reduced the curvature rate of scoliosis in students with mental disability, although these exercises had no significant effect on spinal pain rate. According to the results of this research and other studies, if the physical education programs of these people are well-designed and implemented by a compassionate teacher associated with examining their physical
abnormalities in them followed by taking necessary measures, a significant improvement would occur in the lives of these people.

References


