

Comparison of the Levels of the Theory of the Mind between Students with Cerebral Palsy and Healthy Students in Isfahan

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Abstract

Introduction: Students suffering from cerebral palsy have fewer experiences that involve their communication and interaction as a result of their motor speech disorders compared with their healthy peers. Social cognition, specifically the theory of mind, might also be affected in these students. The purpose of this study was to investigate the states of the theory of mind in children with cerebral palsy in Isfahan city. **Methods:** In this study, 40 students with cerebral palsy (mean age of 10.9±1.88 years) and 40 healthy students (mean age of 10.6 1.35 years) matched for age and sex were selected by a simple non-randomized sampling method. The variables of the theory of mind were examined by a “38-question theory of mind test” and a “reading the mind in the eye test”. An independent t-test was used to compare the levels of the theory of mind between the two groups. **Results:** The results of this study showed that the cerebral palsy group earned lower scores than the healthy group in the 38-question tests of the theory of mind ($P=0.000$) and the reading the mind in the eye test ($P=0.039$). **Conclusions:** The students with cerebral palsy were at a lower level than their healthy peers in most variables of the theory of mind. So, it seems this defect is one of the problems associated with the brain damage in these students and requires more special assessments and treatments in these patients’ group.

Keywords: Cerebral Palsy, Social Cognition, Theory of Mind

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Introduction

Cerebral palsy (CP) is the most common disability in childhood (1). This non-progressive disorder is caused by various reasons before, during, or after birth in an immature brain (2). It often causes the posture and movement impairments during a child’s growing and evolving (1) associating with sensory, cognitive, communicative, behavioral, and seizure disorders (3). It may also affect all aspects of the child’s development and growth at the various stages of the life cycle (1). People suffering from cerebral palsy usually experience less intentional and spontaneous communication in their environment compared with their normal counterparts due to the motor speech disorders. Thus, their social interactions are significantly reduced following this less experience (4).

Social cognition is one of the most important issues in interpersonal relationships which provides all the skills needed for a child to understand others’ wishes, emotions, and feelings (5). Therefore, successful social relationships require the existence of a special mechanism for understanding the others’ inner states and processing their mental states. Additionally, the theory of mind is a metacognitive ability that plays an important and crucial role in the development of social cognition (6). Generally, the theory of mind in healthy students grows from age 1 to 9–11 (7). The theory of mind refers to mental states, beliefs, tendencies, intentions, deception, joking, lying, awareness of others and one as well as knowing that others’ beliefs can be different from ours. The full function of the theory of mind causes an individual to attribute beliefs and desires to others and predict their behavior in order to understand their

goals and intentions. Therefore, the theory of mind is considered as the forerunner of social perception and the basic needs to engage an individual in cooperative (and competitive) social activities (8).

Investigations have shown that factors such as imitation, pointing, imagery games, social games, intentional communication (9), active memory (10), processing capacity, and language play a crucial role in improving theory of mind (11). Researchers believe that the theory of mind affects problem-solving skills, executive processes (12), self-concept (13), social adequacy, interpersonal skills of emotions (14), understanding of ambiguous images (15), community-friendly behaviors and empathy and sympathy (8, 16).

Students with cerebral palsy have some significant problems in speech, language (17), cognition and memory (18), spontaneous communication, play, and social participation (19). Considering the key role of these factors in the development of theory of mind, it has been suggested that students affected by cerebral palsy have some defects in the theory of mind (19).

A few studies have been carried out on the defects of theory of mind which demonstrated students with cerebral palsy have defects in the theory of mind compared with their healthy counterparts due to significant problems with speech and language skills (17) as well as spontaneous or intentional communication which has made these issues difficult for them to understand false beliefs and jokes (3, 20). Most researches in this area has been conducted on a number of disorders such as autism (19), mental disabilities (21), deafness, and schizophrenia (22). A study on possible defects of the theory of mind in students affected by cerebral palsy has not been performed in Iran so far; therefore, investigating students' level with cerebral palsy on theory of mind can provide more comprehensive therapeutic goals to serve these students. Therefore, the aim of this study was to compare the states of the theory of mind in students with cerebral palsy and normal students in Isfahan city.

Materials and Methods:

Participants and Study Protocol

This was a case-control study in which 40 students with cerebral palsy aged eight to 14 years old including 13 quadriplegic students, 24 diplegic, one hemiplegic, and two ataxia recruited from the Exceptional Physical Schools in Isfahan were included. We also included 40 healthy students matched with the cerebral palsy students according to their age and sex. The inclusion criteria for cerebral palsy group were the diagnosis of cerebral palsy recorded in the medical records of students, the normal hearing and vision ability, the lack of seizures in the past and present, verbal intelligence at least 70, the ability for understanding the instructions

and questions of tests, the absence of diseases associated with cerebral palsy like metabolic diseases, and not using some certain medicines which may affect the results of the study such as anti-seizure or *anti-anxiety medicines*. The inclusion criteria for healthy (control) group was normal students without any neurological, psychological, cardiac, pulmonary, renal, skeletal, muscular, and other diseases mentioned in the past and present. The exclusion criteria for the both group was the lack of cooperation in completing the test steps (19). The current study received an ethical code (IR.MUI.REC.1395.2.185) from the Musculoskeletal Disorders Research Center. In this study, the test condition was first explained to the parents, and then the included students were asked to fill out a consent form. The first step was to complete the demographic information questionnaire conducted through an interview. After that, the Wechsler verbal intelligence test (WISC) was applied to each student and evaluated for a minimum score of 70. Finally, the levels of the theory of mind for both groups were examined by the "38-question theory of mind" and "reading the mind in the eye tests". The total testing process took about 180 minutes for each person and was performed in one day. The subjects were rested between each test to avoid their tiredness.

Measurement tools

38-Question Theory of Mind Test

The main form of this test has 78 questions designed by Steer Neman (23) to evaluate the theory of the mind for normal students as well as those with a generalized developmental disorder aged five to 12 years old. In the present study, a 38-question form was used in an interview form. This test includes the questions which the subjects were asked after submitting images and stories by an examiner. This test consists of three subscales. 1: The basic theory of mind: the first level of the theory of mind related to the recognition of emotions and falsification. 2: The initial presentation of the theory of real mind: the second level of the theory of mind which involves the perception of a false belief. 3: The more advanced dimensions of the theory of mind: This is the third level of the theory of the mind which includes the perception of the joke and the secondary false belief. The participants's answer to each question is scored as 1 (if correct) and zero (if false). The reliability of the test was calculated through re-examination, Cronbach's alpha, and validity coefficient of the scorers. The test-retest reliability varied from 0.70 to 0.94, and all coefficients were significant at Cronbach's alpha level of 0.01. The internal consistency of the test was calculated using Cronbach's alpha for the whole test and for each of the first, second, and third subscales, respectively, 0.86, 0.81, and 0.81 (24).

Reading Mind in the Eye Test (RMET)

This test is known as a neuropsychological test of mind-reading

Table 1. Demographic data (number, gender, and mean age $\pm$ standard deviation)

Subjects	Number	Mean (SD)	Gender		Grade of education					
			Female	Male	First	Second	Third	Fourth	Fifth	Sixth
Healthy	40	10.6 (1.35)	20	20	0	4	2	15	6	13
Cerebral Palsy	40	10.9 (1.88)	20	20	0	5	18	9	3	5

Table 2. Comparison of mean(SD) of mind theory variables and significance level between children with cerebral palsy and healthy children

Subjects	38-question theory of mind test				Reading mind in the eye test	
	First level (false belief)	Second level (identification of emotions and feelings)	Third level (joke understanding)	Total	Recognition of emotions and feelings	
Healthy	19.425 (0.812)	12.62 (0.735)	2.87 (0.204)	34.8 (2.44)	10.375 (2.414)	
Cerebral Palsy	17.87 (2.209)	10.925 (2.188)	1.975 (1.86)	30.775 (4.428)	9.1 (2.976)	
Significance level	<0.001**	<0.001**	<0.001**	<0.001**	0.039 *	

* $P \leq 0.05$; ** $P \leq 0.001$

design by Baron Cohen *et al.* (25). The revised version of this test consists of 36 questions (26), which includes photographs of the eyes of male and female artists. With each question, four descriptions of the mental state (a target state and three deviant modes with the same emotional value) are presented. Respondents are asked to select the words which are the best descriptor of the mind or the owner's sense of the eye by only using the visual information. Regarding the scoring, the score 1 is assigned to each correct answer ranging scores from 0 to 36. A score less than 22 represents a low mind reading, a score of 22–30 indicates a moderate mind-reading, and a score higher than 30 is associated with a high mind-reading (27). In most studies carried out on the mind-reading ability of patient or healthy volunteers, this neuropsychological test has been used, which have represented the validity of this test in studies related to the mental perception. In a study, Cronbach's alpha coefficient of this test was 0.72 and its re-test reliability coefficient for a sample size of 30 students in two weeks was 0.61 (20).

Statistical Analysis

In the present study, the Kolmogorov-Smirnov test (K-S) was used to evaluate the normality of the data, and then an independent t-test was applied to compare the levels of the theory of mind between the two groups of cerebral palsy and healthy students. The data were analyzed in SPSS (Version 16, SPSS Inc. Chicago, IL). $P \leq 0.05$ was considered as the significance level.

Results

In this study, the variables of the theory of mind were analyzed in two groups of cerebral palsy (40 subjects) and healthy (40

subjects) students. The mean age, grade of education, and gender for both groups have been reported in Table 1. Based on the results of the Kolmogorov-Smirnov test (K-S), the parameters related to the theory of mind and the reading mind showed a normal distribution. A comparison of the levels of the theory of mind between the two groups showed a significant reduction in both the 38-question theory of mind and reading mind in the eye tests for the cerebral palsy in comparison of healthy group (Table 2).

Discussion

The purpose of this study was to compare the variables of the theory of mind between two groups of cerebral palsy and healthy students. The findings of this study showed that cerebral palsy group significantly had the lower scores at all levels of the theory of mind including false belief, emotion, and joke recognition than the healthy group. The results also indicated that the cerebral palsy group obtained significant lower scores than the healthy group for the theory of mind through the eyes.

Movement disorders and difficulties in spontaneous and intentional communication can result in some defects in the theory of mind, which has made it hard for affected individuals to understand the false beliefs and the jokes. Students suffering from cerebral palsy usually have a lot of difficulties in conversational experiences thereby disrupting access to the others' mental states of. Investigations have also demonstrated that joking skill comprises only 8% of adult interpersonal conversations. However, students with cerebral palsy are much weaker than normal students in this regard and can realize only some signs of a joke (2). Caillies's research showed that

students with cerebral palsy acquire the functional abilities at a slower rate compared with normal students; functional capabilities not only include language, emotions, memory, performance, and the theory of mind but also include the real meaning of the speaker's words (2). Based on the findings of Li *et al.* study, students suffering from cerebral palsy have less experience of their environment since the motor speech disorders result in the reduction of students' potential in social communication. Furthermore, cognitive impairments including active memory are associated with the social problems, and consequently associated with theory of mind problems in students with cerebral palsy (19). Disrupting social skills of students with multiple disabilities, especially those with cerebral palsy, face them with multiple personality and emotional defects which makes this issue hard for them to be adapted to their environment. The link between social development and motor growth has caused physical and motor activities to play a significant role in facilitating social growth (20). So, the probable cause of this result in the present study and a previous one can be that motion and non-motorized deficits in students with cerebral palsy affect the ability of these individuals to move, communicate, solve problems, and socialize, thereby, reducing their participation in leisure activities (28). Considering the significant role of these cases in the development of the theory of mind, it is believed that students with cerebral palsy have a defective theory of mind.

Limitations: Despite our efforts, controlling the interfering variables such as previous student training was not possible.

Suggestions: It is suggested to further examine the level of social participation of these students in order to determine the impact of the levels of theory of mind on their social performance.

Conclusion

The present study showed that the students suffering from cerebral palsy had lower levels of the theory of mind, which include false beliefs, emotions and feelings, cognition, and joke perceptions in comparison with the healthy peers. Hence, the evaluation and curing of these deficits can be an important part of the rehabilitation programs of these individual's.

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