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Effects of Intellectual Disability on Gross Motor Function and Health Related Quality of Life in Cerebral Palsy

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ABSTRACT

Objective: Cerebral palsy (CP) is a common developmental disorder which causes intellectual and motor disability, and affects quality of life. The aim of this study was to reveal the effect of intellectual disability (ID) on motor function and quality of life in CP.
Methods: Twenty-seven children with CP were divided into two groups as with or without ID. Motor function and health related quality of life was evaluated with Gross Motor Function Measurement–88 (GMFM-88) and Child Health Questionnaire-Parent Form 50 (CHQ-PF50) respectively.
Results: All dimensions of GMFM-88 and most of the dimensions of CHQ-PF50 were lower in children with ID compared to those without ID ($p<0.05$).
Conclusion: ID seems to have a disruptive effect on motor function and health related quality of life in CP. Adding approaches to improve the cognitive status to the CP rehabilitation program may be beneficial for motor function and quality of life.
Keywords: cerebral palsy, intellectual disability, motor function, quality of life

1. INTRODUCTION

Cerebral palsy (CP) is a common developmental disorder leading intellectual and motor disability in children (1). Intellectual disability (ID), which is being used instead of mental retardation in accordance with updated construct of disability recommended by WHO, covers social, cognitive, and adaptive deficits (2). Intellectual disability has a significant proportion (up to 60%) in CP cases and defined as impaired cognitive function and behaviour. 97.7% of severe disabled CP cases have been reported as having ID (3-5). The cerebral lesions causing CP affect the developmental process of various cognitive functions and usually lead ID. It has been reported that ID leads disability in daily activities, education and occupational processes in CP (6). In general, delay in the development of the central nervous system affects motor development in mentally disabled children (7).

Motor control, postural control, balance, and muscle tone abnormalities cause impairment of motor function in children with CP (8). These symptoms cause seconder musculoskeletal disorders like hip luxation, contractures, and scoliosis (9). Lower physical fitness, muscle strength and endurance; higher walking energy expenditure depending on gait abnormalities seen in children who have CP. Fatigue causes pain, functional disorders and limited quality of life in CP (10).

Mental, social, and physical satisfactions constitute health-related quality of life (HRQoL) (11-13). Children with CP have impaired functional and psychosocial HRQoL according to healthy ones (13, 14). It has been reported that severity of CP and motor function impairments affect physical HRQoL but not psychosocial (15, 16).

Motor function is known to be affected from cognitive status as well as sensorial systems (17). Cognition is also indicated as a factor affecting HRQoL in disabled children (18). However Wake et al. reported that cognitive impairment didn't affect the HRQoL of the children with CP (15). Therefore the literature is limited and the results are inconsistent about the motor function and HRQoL differences of children who have CP with and without ID. The objective of this study was to reveal the effect of ID on motor function and HRQoL in CP. Our hypothesis was that ID adversely affects motor function and HRQoL in CP.

2. METHODS

2.1. Participants

This cross sectional study was conducted by Bulent Ecevit University Faculty of Health Sciences Department of Physiotherapy and Rehabilitation. Twenty-seven children with CP (9 girls and 18 boys) from three different rehabilitation centres in Zonguldak, between 6-15 years of age, were

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included. Exclusion criteria were; history of operation within last 12 months, botulinum toxin A administration within last 6 months, and having no previous assessment about cognitive status.

The required permission was obtained from the Clinical Research Ethics Committee of Bulent Ecevit University (Protocol no: 2017-72-09/08). Participants (if applicable) and their parents were informed. 'Informed consent form' was signed by the participants (if applicable) and one of the parents of each participant.

2.2. Procedure

The demographic data of the participants were recorded according to the information received from the parents. Participants were divided into two groups as with or without ID on the basis of the Rehabilitation Research Center reports. All the assessments were performed at the research laboratory of the Bulent Ecevit University Faculty of Health Sciences.

2.3. Outcome measurements

Gross Motor Function Measurement – 88 (GMFM – 88)

This measurement has 5 dimensions (lying and rolling; sitting; crawling and kneeling; standing; walking, running and jumping) and 88 items. This measurement evaluates the rate of achievement of these activities. The higher score obtained from this measurement indicates better gross motor function (19). GMFM-88 assessment was performed by a physical therapist.

Child Health Questionnaire – Parent Form 50 (CHQ-PF50)

CHQ-PF50 measures HRQoL of children. This questionnaire contains 14 dimensions (including physical, psychosocial and parental aspects) filled by the parents. Score of the dimensions range from 0 to 100, and higher *score* indicates better HRQoL (20).

2.4. Statistical analysis

Data was evaluated using the SPSS 15.0 program for Windows (Statistical Package for the Social Sciences Inc.; Chicago, IL, USA). The significance level was set to $p<0.05$. The continuous variables were not normally distributed according to Shapiro–Wilk test. Mann Whitney U test was used to compare age, height, weight, BMI, GMFM-88 and CHQ-PF50 scores; Chi-square test was used to compare gender ratio between children with and without ID.

3. RESULTS

This study included 27 children with CP consisting of 13 with ID and 14 without ID. Demographic data are presented in Table 1.

Table 1: *Demographic features of the children with and without ID*

Demographic	Children without ID n = 14	Children with ID n = 13	p
Age (years) (mean ± SD)	10.71 ± 3.47	11.30 ± 3.49	0.583
Height (m) (mean ± SD)	1.42 ± 0.21	1.37 ± 0.21	0.756
Weight (kg) (mean ± SD)	41.57 ± 15.58	40.53 ± 14.20	0.943
BMI (kg/m^2) (mean ± SD)	20.23 ± 4.43	20.98 ± 3.45	0.830
Gender (M/F)	8 / 6	10 / 3	0.249

ID Intellectual disability, SD Standard deviation, BMI body mass index, F female, M male

All dimensions and total score of GMFM-88 were lower in children with ID compared to those without ($p<0.05$) (Table 2).

Table 2: *Comparison of GMFM scores between the children with and without ID*

		Children without ID n = 14 (mean ± SD)	Children with ID n = 13 (mean ± SD)	p
GMFM-88	**Lying and Rolling (%)**	97.61 ± 8.90	58.97 ± 41.72	**0.004***
	Sitting (%)	89.40 ± 27.47	33.07 ± 37.01	**0.001***
	Crawling and Kneeling (%)	85.37 ± 31.73	21. 97 ± 34.42	**<0.001****
	Standing (%)	81.13 ± 29.65	8.28 ± 16.28	**<0.001****
	Walking, Running and Jumping (%)	31.54 ± 12.07	2.56 ± 6.48	**<0.001****
	Total Score (%)	77.01 ± 20.88	24.97 ± 23.84	**<0.001****

ID Intellectual disability, GMFM-88 Gross Motor Function Measurement 88, SD Standard deviation
**p<0.05, **p<0.001*

Physical functioning; global health; role/social limitations – emotional/behavioural; role/social limitations – physical; general health perception; self-esteem; parental impact-emotional; parental impact-time; family activities and family cohesion dimensions of CHQ-PF50 were lower in children with ID compared to those without ($p<0.05$). No significant differences were found between children with and without ID in behaviour, bodily pain/discomfort, mental health, and change in health dimensions of CHQ-PF50 ($p>0.05$) (Table 3).

Table 3: *Comparison of CHQ-PF50 scores between the children with and without ID*

		Children without ID n = 14 (mean ± SD)	Children with ID n = 13 (mean ± SD)	p
CHQ-PF50	Global health	78.92 ± 19.72	52.30 ± 20.37	**0.003***
	Physical functioning	73.92 ± 25.22	15.69 ± 17.45	**<0.001****
	Role/social limitations – Emotional/ Behavioural	81.50 ± 24.33	27.92 ± 31.94	**<0.001****
	Role/social limitations – Physical	82.07 ± 27.40	21.53 ± 25.61	**<0.001****
	Bodily pain/ discomfort	92.85 ± 14.37	83.84 ± 25.34	0.375
	Behaviour	86.64 ± 9.96	76.53 ± 13.90	0.105
	Mental health	76.07 ± 12.73	65.84 ± 19.94	0.085
	Self-esteem	87.78 ± 16.90	51.84 ± 21.89	**<0.001****
	General health perception	75.92 ± 20.06	35.15 ± 13.75	**<0.001****
	Change in health	4.42 ± 0.64	4.25 ± 0.86	0.705
	Parental impact-Emotional	85.64 ± 18.31	43.46 ± 36.01	**0.002***
	Parental impact-Time	79.28 ± 26.76	49.92 ± 33.76	**0.025***
	Family activities	87.50 ± 19.21	66.07 ± 22.38	**0.012***
	Family cohesion	88.92 ± 14.16	74.61 ± 14.64	**0.019***

*ID Intellectual disability, CHQ-PF50 Child Health Questionnaire-Parent Form 50, SD Standard deviation. *p<0.05, **p<0.001*

4. DISCUSSION

This study aimed to reveal the effects of ID on gross motor function and HRQoL in CP. The results indicated that gross motor functions and most of the physical and psychosocial parameters of HRQoL were impaired in children with CP having ID compared to others.

Children with ID have lower physical and motor function capacity and inadequate occupational skills (6, 21). This depends on the developmental disability of the central nervous system as well as poor participation in physical activities of these children (22, 23). Delacy and Reid reported that cognitive impairment was more common in children with CP who have worse gross motor function levels (24). Hazneci et al. revealed that children who have CP with ID have lower GMFM scores compared to others without ID (25). The present study was consisted with the literature indicating ID is associated with impaired motor function in CP.

In the current study, general health, physical functioning, and physical role/social limitations scores of HRQoL, which are, concerning physical health was found to be lower in children with ID than in those without. Impaired motor function is known to affect physical HRQoL (15). ID may have a negative effect on physical well-being by disrupting motor function. Children with ID have learning disabilities so it's difficult for them to learn self-care skills or participate daily activities (26). This issue may contribute to reducing physical HRQoL.

Scores of some psychosocial health dimensions of the HRQoL consisting self-esteem, role/social limitations – emotional/ behavioural, and also parental impact, family activities and cohesion were poor in children with ID compared to those without ID according to the results of this study. Cerebral palsy is associated with limited social participation due to impairments of the motor and cognitive functions. Learning disabilities, communicational problems, emotional and behavioural issues due to cognitive impairment affect social participation in school and friendships adversely (6). So role and social limitations may be seen more in children who have CP with ID. Lower self-esteem score means reduced satisfaction of life concerning with capability, physical appearance, relationships and whole life in children with ID (27). Parents of the children with disabilities known to be have more emotional and psychosocial problems than those of healthy children (15). There are studies indicating parents of the children with CP or ID have psychosocial HRQoL problems due to restricted social relations, much time spent on caregiving, working life and financial difficulties (15, 28, 29). Conversely, Mugno et al. revealed that parents of the children with CP and ID had similar HRQoL scores to those of healthy ones (18). However, our study revealed that of the parents who have children with CP, those having children with ID have more psychosocial and family problems.

Pain and discomfort, behaviour, mental health and change in health scores of CHQ-PF50 were similar between children with and without ID in the present study. Pain is pervasive in CP and causes physical impairment, social and family problems (30). Our results indicates ID doesn't affect pain or discomfort in CP. Behavioural and mental problems seems more in children with CP compared to healthy peers and known to be associated with cognitive impairment (10). However the current study reveals similar results for behaviour and mental health dimensions of the HRQoL for children with and without ID. Change in health score was found to be similar for both groups. This result may depend on the general health improvement of all children participated in this study due to rehabilitation services.

This study revealed that physical and psychological parameters of the HRQoL except pain/discomfort, behaviour, mental health and change in health were impaired of the children who have CP with ID compared to those without. Previous studies reported that CP negatively affects HRQoL of the children (13, 15, 31). One of those studies pointed that ID doesn't have any significant effect on HRQoL outcomes in CP conflicting with the current study (15).

Researches show that the correlation of self-reports of children and their parents' proxy-reports is weak for the outcome measurements of health status (32). But conducting an evaluation of a self-reported HRQoL questionnaire in CP has some difficulties due to the cognitive impairments, so a parent reported questionnaire were performed to evaluate HRQoL in the current study. Also this study has a small

sample size. Studies with larger samples and more detailed measurements may be efficacious to achieve more objective results. These can be considered as limitations of the study.

5. CONCLUSION

ID was found to have a disruptive effect on motor function and HRQoL in CP. This finding supports the contribution of cognitive status to motor function and quality of life. Adding approaches to improve the cognitive status to the CP rehabilitation program may be effective for motor function and HRQoL. Future studies are needed to demonstrate the effects of cognitive and psychosocial rehabilitation approaches on motor function and HRQoL in CP.

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