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Relationship between Spasticity, Gross Motor Function, and Quality of Life in Children with Spastic Cerebral Palsy

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Abstract.
BACKGROUND: Cerebral palsy (CP) is a complex disordercausing functional deficits that develop inchildren with CPowing to the associated physical, cognitive, and social impairments eliminatetheir capacities to perform their assignedsocial roles that leading to major decreaseathealth-related quality of life.
OBJECTIVE:to investigate the relationship between spasticity, gross motor function,and qualityof life in children with spastic CP.
DESIGN: cross sectional study.
SETTING: out- patient clinic of faculty of physical therapy, Cairo University.
PATIENTS AND METHODS: Forty-fivechildren with spastic CPparticipated in this study. Spasticitywas evaluated based on themodified Ashwarth scale. Gross motor functionwas evaluated by gross motor functional measures,whilethequality of life was evaluated bythe pediatric quality of life inventory.
MAIN OUTCOME MEASURES: spasticity, gross motor function and quality of life.
SAMPLE SIZE: 45 patients met inclusion criteria.
RESULTS: There was a strong negativecorrelation between spasticity andgross motor function.Additionally,there was a strong negative correlation between spasticity and the quality of life but there was strong positive correlation between gross motor function and the quality of life.
CONCLUSION: The findings highlight the importance of measuring spasticity and gross motor function in children with CP. Therelation between spasticity and the level of motor function with quality of life could serveasan evidence for the usefulness of therapeutic interventions.
LIMITATIONS: small sample size.
CONFLICT OF INTEREST: none.

INTRODUCTION

Cerebral palsy (CP) is a complex childhood disordermanifested by a motor disability caused by a static, non-progressive lesion in the brain[1].The incidence of CP is within the range of 1.5–2.5 per 1000 live births. In premature births and extremely low-birth weights, this range elevates to 40–100 per 1000 live births[2].The classification system issued by the American Cerebral Palsy Academy is still a commonly utilized system nowadays: four motor types have been classified as spastic, dyskinetic, ataxic, and hypotonic[3].Spasticity is a consequence of neuromuscular disorders that affect thequality of life ofthose affected by it[4].Spasticity can result in functional problems associated with daily living activities (ADL), such as gait, feeding, washing, toileting, and dressing. Over time, spasticity may also cause problems, such as muscle pain or spasms, trouble moving in bed, difficulty with transfers, poor seating positions, impaired ability to stand and walk, dystonic posturing muscle, contracture leading to joint deformity, bony deformations, joint subluxation, or dislocation and diminished functional independence[5].Irrespective ofthe additional developmental difficulties that affect individuals with CP as a result of impairment of the developing central nervous system, the hallmark of these conditions is a disorder in the development of gross motor function[6].Abnormal motor control may be further impaired by features that are associated with CP. Resulting limits in movement and posture cause activity limitations and are often accompanied by disturbances of sensation, deep perception, and other sight-based perceptual problems and cognition problems[7]. The severity of the limitations in gross motor function among children with CP is highly variable such that some children with CP walk independently with or without assistive devices, whereas others use battery-powered wheelchairs or are transported by an adult[8].The GMFM measures “activity”according to thedefinition of the International Classification of Functioning, Disability, and Health.For a comprehensive assessment of a child with cerebral palsy, the GMFM should be part of list of measures with other psychometrically sound tools to ensure compliance withall aspects of the International Classification of Functioning, Disability, and Health are covered[9].Evidence on the reliability and validity of GMFM scores has been reported[10, 11, 12].TheWorld Health Organization (WHO) provided this definition for quality of life (QOL) asthe way an individual perceives his/her own state within the context of one's culture and value system[13].Health-related QOL can be defined as “how well a person functions in their life and his or her perceived well-being in physical, mental, and social domains of health.”

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[14]. Functioning refers to an individual's ability to carry out some predefined activities,[14, 15] while well-being refers to an individual's subjective feelings[14].The measurement of QOL is a relevant health indicator as it provides information on how the clinical condition affects the patient's life and directs public policies aimed at improving QOL[16].The National Policy on Health Promotion (PNPS) emphasizes the search for equity and proposes the promotion ofQOL and the reduction of health risks related to conditioning factors,including theway of life, working conditions, housing, environment, education, leisure, culture, access to goods, and essential services[17]. The most commonly applied physiotherapy techniques for CP patients are based on the reduction of impairments and improvement of function.However,boththefunctional status and QOL of CP patients are affected[18].

The purpose of the present article was to investigate the relationship between spasticity, gross motor function, and QOL in children with spastic CP. We hypothesized that there will be a strong relationship between spasticity, gross motor function and QOL in children with spastic CP.

MATERIALS AND METHODS

The study was conducted between September 2019 and December 2019. An informed consent form and agreement was obtained from the parents for participation of their children in the study. This study was performed according to the Code of Ethics of the World Medical Association (Declaration of Helsinki) for experiments involving humans. It was approved by the Ethics Review Committee of the Faculty of Physical Therapy, Cairo University, Egypt (NO.P.T.REC|012|002549). Forty five participants participated in the current study who were diagnosed withspastic CP with agesthatranged from 5 to 7 years old from both gender. These participants were selected from the outpatient clinic of faculty of physical therapy at Cairo University. They were enrolled in this study if they adhered to the following inclusion criteria a) clinical diagnosis of spastic CP,andb) spasticity grades 1 and 1+ according to the modified Ashworth scale[19].participants were excluded from the study if they hada) fixed contractures or deformities of the spine, upper, or lower extremities,b) visual or respiratory disorders,c) hadanepilepsy or seizure disorder that was resistant to treatment, ord) had orthopedic surgery owing to pathology and Botox injections duringthe 12 monthsthat preceded the study.Spasticity was assessedby the modified Ashworth scale. All children selected for this study were affected by spasticity classified with grades 1 and 1+.[19]. Gross Motor Functional Measurement-88 (GMFM-88):GMFMis a standard criterion-referenced test designed to assess changes in gross motor function in children with CP was used in this study[20]. The total number of items was88 with five dimensions: lying and rolling, sitting, crawling and kneeling, standing, and walking, running, and jumping. A 4- point Likert scale was used to score each item. Acceptable reliability of the GMFM scores has been reported for children with CP [21].Health-related QOL was used to assess Quality of Life (HRQOL) of children by using the pediatric quality of life inventoryTM (PedsQLTM) 4.0 generic core scale thatwas developed to measure HRQOL in healthy children and adolescents and those with acute and chronic health problems. PedsQLTM 4.0 is reliable, feasible, and valid, and was used to measure the health outcome of the pediatric population, as it facilitates risk assessment and tracking of community health[22]. The Arabic version of PedsQLTM 4.0 was considered to have satisfactory psychometric properties according to a Jordanian study conducted by Arabiat et al.[23]. A user agreement was signed with the MAPI Research Institute, Lyon, France, prior to the use of the questionnaire. The PedsQLTM 4.0 generic core scale was designed to be appropriate for ages of the children. In children older than 4 years, it included parallel child self-reports and parent proxy reports (age ranges 5–7, 8–12, and 13–18 years), and consisted of 23 items. Moreover, in children aged between 2 and 4 years, a parent proxy report was used, and consisted of 21 items. The scale was applied, and was analyzed according to the PedsQLTM administration guidelines. The children were asked to report problems regarding physical functions (8 items), emotional functions (5 items), social functions (5 items), and school performance (5 items) that had arisen duringthe month that preceded the study. The item responses were measured based on a five-point rating scale,and consisted of 0 (never a problem), 1 (almost never a problem), 2 (sometimes a problem), 3 (often a problem), and 4 (almost always a problem), and yielded a total score valueof 100, 75, 50, 25, or0. The higher score indicates ahigher QOL, better health, or a higher level of function. The PedsQLdemonstrated good internal consistency and validity in large samples of children with acute and chronic health conditions, as well as in healthy children and adolescents[24].

Health-related QOL. The PedsQLTM 4.0 generic core scale was explained to all children and their caregivers who ensured theconfidentiality of their information. In the present study, the questionnaires were distributed among the parents of children who filled out the questionnaires in the presence of the investigator. One questionnaire was given to each participant and the investigator completed the questionnaire with respect to the ethical principles for those patients who were illiterate.

Data Analysis:

Statistical Package for Social Sciences (SPSS) computer program (version 20 windows) was used for data analysis. P value ≤0.05 was considered significant**.** Numerical data were explored for normality by checking the distribution

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data using tests of normality (Kolmogorov-smirnov and shapiro-wik tests). Spearman's rank correlation was used to detect the significant correlation between spasticity, peds QL, and GMFM.

RESULTS

Spearman's rank correlation was used to detect the significant correlation between spasticity, peds QL, and GMFM shown in tab 1.

Table 1. Correlation between different parameters in spastic children

Variables	Spasticity	Gross Motor Function Classification System(GMFM)	Peds Quality of Life (QOL)
Spasticity	–	**−0.816* (strong negative) P= 0.000 (significant)**	**−0.840* (strong negative) P= 0.000 (significant)**
GMFM	**-0.816* (strong negative) P= 0.000 (significance)**	–	**0.883* (strong positive) P= 0.000 (significance)**
Peds QL	**−0.840* (strong negative) P= 0.000 (significance)**	**0.883* (strong positive) P= 0.000 (significance)**	**_____**

DISCUSSION

As CP is a multifaceted disorder.As there is conflicting evidence for how motor impairments relate to each other and to functional activities, this study was performed to describe relationships between spasticity, gross motor function and QOL in children with spastic CP. To examine these relationships, we applied measures that werecommonly used in children with CP. There was a strong negative correlation between spasticity andgross motor function. Additionally,there was strong negative correlation between spasticity and QOL, but there was strong positive correlation between gross motor function and QOL in children with spastic CP. Thus,results indicated a complex relationship between spasticity,gross motor function, and QOL. Therefore, the impact of child development needs to be addressed when assessing QOL in children.Information about QOL maybe useful to evaluate the effect of interventions on the overall well-being.Measures of QOL may be used to predict the future status of individuals with an illness or condition,and could thus be used as better indicators compared withfunctional outcome assessments in children with CP who attend school[25].QOL is often the most important outcome of treatment for chronic conditions such as CP. The negative emotional feeling resulting from the disability may be prevented or reduced if QOL issues are considered in the management of children with CP[26].Our findings are supported by a report from Welmer et al. who found a correlation between the physical domain of HRQOLand spasticity in stroke patients[27].In contrast, Dajpratham et al. found no association between QOL and spasticity in stroke patients[28].The differences between these findings and our finding could be attributed to differences in the measurement tools, culture, and type of population.In addition,Akodu et al. demonstrated that personal care and mobility aspects of the HRQOL are negatively affected by spasticity in patients with CP[29].

Our findings were also in agreement with other studies that showed that CP children with better gross motor functioning perceived a higher physical QOL[30,31]Furthermore,Vanderslot et al. showed a positive relationship between the level of motor function and the physical aspects of the HRQOL[32].

By contrast, Dehno et al. showed that the level of motor function could not alter the QOL[33].The severity of disability is considered as one of the main factors that affect the functional status in both children and adults with CP[34]. It seems that the adult perception of QOL is discordant with the severity of their disability. In addition, Vargus-Adams and KO found that lower GMFCS levels were associated with lower physical health scores[35,31]. The main factors that affect the children with theQOLin CP arethelow levels of health and socioeconomic levels compared withhealthy peers. In addition, the main factors that affect their parent's QOLincludethedifficulty in accessing

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rehabilitation services, low levels of socioeconomic status, and their children's disability. However, there is not any relationship between the severity of disability and their parent's QOL[36].

There are limitations to this study. Firstly, the sample size wassmall.Thus, further research needs to include more children with CP to increase the statistical power and clinical meaning of the present study findings. A second limitation is related to the age range of the study sample. It is possible that a period of 9 years of motor development providesan important contribution to QOL changes.Therefore, an additional study should be conducted to evaluate the effect of age. Finally, this study did not consider the role of parental factors, such asstress. In future studies, it is thus necessary to study the QOL of children with CP based on considerations of theparental status.

CONCLUSION:the relation between spasticity and the level of motor function with quality of life could be an evidence for the usefulness of therapeutic interventions.

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DISCLOSURE STATEMENT

No author has any financial interest or received any financial benefit from this research.

CONFLICT OF INTEREST

The authors state no conflict of interest.

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