



Original Article

Relationship between Quality of Life and Hypertonia in Young Adults with Spastic Cerebral Palsy

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ABSTRACT

Background: The complications associated with spastic cerebral palsy can affect the physical ability and quality of life of individuals suffering from this motor disorder. The aim of this study was to assess the relationship between quality of life and hypertonia in adults with spastic cerebral palsy.

Methods: In an analytical cross sectional study, 70 subjects with the diagnosis of spastic cerebral palsy from three Ra'ad Rehabilitation Goodwill complexes in Tehran and Karaj cities took part in this study through convenient sampling. The severity of spasticity and contracture of the knee flexors were measured by Modified Tardieu Scale. Also the quality of life was assessed through World Health Organization quality of life-BREF questionnaire. To analyze data, Pearson and spearman correlation coefficient were used.

Results: Participants of this study were 42.90% male, 57.10% female with mean age 26.24 ± 5 years. No correlation existed between quality of life with knee flexor muscles spasticity. However, psychological and environmental domains showed low correlations with knee extension range (respectively $r=0.26$ and $r=0.28$; $P<0.05$).

Conclusion: The influences of the mechanical component of hypertonia (contracture) on the quality of life are more prominent than neural factors such as spasticity.

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Introduction

Although Cerebral Palsy (CP) is a non-progressive disorder in brain development affecting movement and posture, its clinical signs and symptoms such as hypertonia, muscle weakness and locomotion change during development [1]. Nowadays, life expectancy of children with CP has increased dramatically and their mortality rate has significantly reduced. Hence, statistics indicate that approximately 80% to 90% of individuals with CP who have hypertonia [2] will survive into adulthood [3,4]. Both neural (spasticity) and mechanical (contracture) components of hypertonia are the major

contributing factors in developmental disabilities which affect everyday activities and social participation in CP population [5,6]. In addition, adults with CP face many challenges such as education, work and family life. They have to deal with problems of aging. Moreover, they are more susceptible to degenerative joints diseases, musculoskeletal pain, fatigue, joint deformities and functional mobility deterioration [7,8]. Andersson and Mattsson found that 35% of CP adults (aged 20 to 58 years) reported decreased walking ability; 63% of these participants were younger than 35 years [9]. Studies have shown that reduced joint range of motion, reduced balance, increased spasticity, deterioration of condition, muscle weakness, pain, and fatigue are possible causes of deterioration in the walking ability of adults with CP [9,10]. Due to these impairments not only functional abilities of individual with CP were decreased but also quality of life

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(QOL) of CP patients were affected [11]. QOL is defined as individuals' perceptions of their position in life, which may be influenced by cultural context, personal goals, expectations and standards [12]. Health Related Quality of Life (HR-QOL) focuses on those aspects of life and activity that are related to an individual's health status [13]. Although QOL and HR-QOL are both subjective assessments, QOL tools mainly measure health related problem domains such as environment [13]. Most research has been done on the relationship between HR-QOL and QOL with functional status of adults with CP. However a few studies have investigated the relationship between QOL and impairments in persons with CP. Akodu et al. reported significant relationship between spasticity and health related quality of life in CP patients [14]. The relative contribution of neural and non-neural components on the quality of life of adults with CP is not known. Since the influence of neural and non-neural components of hypertonia on function changes over time [15], determination of the association between the two components of hypertonia with QOL can promote the quality of rehabilitation in CP adults. The purpose of the present article was to investigate the relationship between quality of life and hypertonia, in young adults with spastic cerebral palsy in Tehran, Iran.

Methods

In an analytical cross sectional study, 70 participants with spastic cerebral palsy took part in this study through convenient sampling. Subjects were recruited from three Ra'ad Rehabilitation centers. Inclusion criteria were diagnosis of spastic CP by a physician, age between 20 to 40 years, and lack of any other neurological condition. Participants were excluded if they were taking anti spasticity drugs or had botulinum toxin type A injections within the past 12 months, had a history of using inhibitory plasters, fractures, sprain or strain injury of their legs in the past 6 months or severe cognitive impairment (Mini Mental state Examination Test (MMSE) <18). All assessments were completed during a single session and were performed in Ra'ad Rehabilitation centers. At the beginning, we asked the participants to sign the written informed consent forms before the commencement of data collection. To determine cognition status, the Persian version of MMSE test was employed [16]. Folestine et al. introduced MMSE as a brief test for assessing cognitive status of adults in 1975 [17]. MMSE consists of a variety of questions and has a maximum score of 30 points. In our study, the score of MMSE was obtained through self-report. In the next stage, demographic data including age, gender, height,

weight and marital status were obtained through patients' records. Hypertonia, defined as increased resistance to passive movement [18], was assessed by the Modified Tardieu Scale (MTS). This scale identifies the presence and severity of the neural component of hypertonia (spasticity) and also the presence and severity of the mechanical factors of hypertonia (contracture) [19]. MTS grades quality of muscle reaction into 5 levels (Table 1) and with MTS two joint angles (R1 and R2) are measured by a manual goniometer. R1 angle is the point in the joint range where a velocity- dependent catch or clonus was felt during fast velocity stretch. R2 angle defined as the passive joint range of movement following a slow velocity stretch. In this study spasticity of knee flexor muscles was measured as knee flexor muscles spasticity can greatly interfere with mobility. In adults with unilateral involvement the affected knee was tested while in those with bilateral involvement the more affected knee was tested. To test knee flexor muscles, subjects lied supine on an examination table with the hip flexed at 90° and the knee was allowed to flex fully by gravity. First, the knee was moved into the position of maximal extension with a very slow-stretching velocity and R2 value was measured with a goniometer; then, the knee joint was moved with a fast stretching velocity in the same direction and available range. The quality of muscle reaction was measured at the stretching velocity V3. When the grade of muscle reaction was determined to be two or more, movement was repeated to obtain an angle of catch or clonus (R1). The angle of muscle reaction (R1) was considered as the severity of spasticity and R2 indicated the amount of contracture. The quality of life was measured by the WHOQOL-BREF-Iranian questionnaire (20); it consists of 26 items and four QOL dimensions: physical health (7 items), psychological health (6 items), social relationships (3 items), and environmental health (8 items), with two overall QOL and general health items. To achieve score of each item a 5-point rating scale was used in which higher scores demonstrated better QOL. All scores were altered to a range of 0-100 [21]. Studies have shown good-to-excellent reliability and an acceptable validity of WHOQOL-BREF in various groups of participants in Iran [22,23]. The WHOQOL-BREF questionnaire was self-completed by our participants. The ethic committee of Tehran University of Medical Sciences and Health Services approved the study protocol.

Statistical Analysis

Analyses were done with SPSS 17 for Windows. Normal distribution of variables was tested with Kolmogorov-Smirnov test. In addition, the relationship between quality of life with spasticity and contracture were assessed using

Table 1: Modified Tardieu Scale

Quality of muscle reaction

- 0: No resistance throughout the course of the passive movement
- 1: Slight resistance throughout the course of the passive movement
- 2: Clear catch at a precise angle, interrupting the passive movement, followed by release
- 3: Fatigable clonus (<10 seconds when maintaining pressure) occurring at a precise angle
- 4: In-fatigable clonus (>10 seconds when maintaining pressure) occurring at a precise angle

Pearson's product moment correlation coefficient (r) and spearman's rank correlation coefficient. The correlation coefficients were explained according to Domholt [24].

Results

In a pilot study on 30 participants, the inter-rater reliability of spasticity and contracture angles showed strong correlation (ICC values were 0.88 and 0.93 respectively). Also, the intra-rater reliability of spasticity and contracture angles in 10 participants was investigated in two sessions over one week. The ICC values were 0.89 and 0.85 respectively. Demographic and clinical characteristics of 70 young adults with spastic CP are shown in table 2.

Of the 70 spastic CP participants who were investigated, 41 (58.60%) had spasticity in knee flexor muscles. No relationship was found between the severity of knee flexor muscles spasticity and the four domains of QOL or the two general items in these 41 subjects. However, Psychological and environmental health domains showed low correlations with knee extension range ($r=0.36$ and $r=0.33$ respectively; $P<0.05$) in these 41 individuals. Therefore, a higher knee extension range of motion (lower contracture) was associated with higher scores on psychological and environment health domains of QOL (Table 3).

Discussion

Our results showed that although spasticity was not correlated with QOL, contracture (R2) had a poor association with psychological and environmental domains of QOL. It is possible that factors such as adaptation of our study population to their condition

and having no experience of being healthy can be a reason for the lack of association between spasticity and physical, psychological, social and environmental aspects of QOL. Our findings are supported by a report from Dajpratham et al. who found no association between QOL and spasticity in the stroke population [25]. In contrast, Welmer et al. found a low correlation between the physical domain of HR-QOL and spasticity in the stroke population ($r<0.40$, $P<0.05$) [26]. They applied the SF-36 and Modified Ashworth Scale (MAS) to assess HR-QOL and spasticity of upper and lower extremities. Therefore, the differences between the findings of Welmer et al. and our findings could be due to differences in the measurement tools and culture and type of population. Also Akodu et al. demonstrated that personal care and mobility aspects of the HR-QOL are negatively affected by spasticity in patients with cerebral palsy [14]. This discrepancy could be due to differences in QOL measurement tools and/or people who completed QOL questionnaire. Furthermore, wiegerink et al. reported that young adults with CP had difficulties in their sexual relationship [27]. Our participants, however, did not report any problem in the social relationship, since they were single and most of them did not answer the sex item. Therefore, if all subjects had answered the sex item of the social aspect the result of the social domain might have been substantially different.

Another finding of our study was the poor relationship between contracture of knee flexor muscles and psychological and environmental domains of QOL ($r<0.36$). Knee flexor muscles contracture can interfere with mobility and ambulation. We could differentiate the neural component (spasticity) from the mechanical component (contracture) by the MTS scale. In other words, the R1 angle demonstrated spasticity and the R2

Table 2: Demographic and clinical characteristics of 70 young adults with spastic CP

Characteristics	
Age in year, mean (SD)	26.24 (5)
Height (cm), mean (SD)	162.79 (12.11)
Weight (kg), mean (SD)	56.52 (13.63)
Gender, n (%)	
Male	30 (42.9)
Female	40 (57.10)
Marital status, n (%)	
Married	0 (0)
Single	70 (100)
Presence of knee flexor muscle spasticity, n (%)	
With spasticity	41 (58.60)
Without spasticity	29 (41.40)

SD: standard deviation; n (%): number (percent)

Table 3: Correlations between QOL domains with spasticity and contracture in 41 individuals with spasticity in knee flexor muscles

WHOQOL-BREF	Physical health	Psychological health	Social health	Environmental health	Overall QOL	General health
Spasticity(R ₁)	R $-.12$	$.24$	$-.08$	$.15$	$-.08$	$.11$
	P $.43$	$.12$	$.59$	$.33$	$.92$	$.48$
Contracture(R ₂)	R $-.07$	$.26^*$	$.14$	$.28^*$	$.04$	$.03$
	P $.54$	$.02$	$.23$	$.01$	$.68$	$.79$

* $P<0.05$

angle showed range of motion. Our results confirmed the findings of previous studies indicating that the non-neural component or the mechanical factor of hypertonia is the major cause of residual disability [27].

These findings suggest that spasticity does not have a major impact on the QOL of adults with CP, therefore clinicians should emphasize more on mechanical factor, than neural component of hypertonia.

Future research should focus on the effects of other impairments (such as muscle weakness and impaired balance) on the QOL to determine which impairment is impacting the QOL.

In addition, studies with larger samples should be done on other age groups and other types of CP to identify any correlation between these variables and QOL. Likewise, the relationship between spasticity of other muscle groups in upper and lower limbs and QOL should be studied.

The main limitation of this study was that participants were selected according to sample of convenience and only from three Ra'ad Rehabilitation centers; therefore, people who did not attend these centers could not participate in our study which could affect the interpretation of the results. We cannot generalize our results to married adults with spastic CP.

Conclusion

Although spasticity is a common impairment in adult CP patients, it could not change the QOL of adults with spastic CP in our study. Contracture can probably affect the psychological and environmental domains of QOL.

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References

1. Svien LR, Berg P, Stephenson C. Issues in aging with cerebral palsy. *Topics in Geriatric Rehabilitation* 2008;24(1):40-26
2. Stanley F, Blair E, Alberman E. How common are the cerebral palsies. *Cerebral Palsies: Epidemiology and Causal Pathways Clinics in Developmental Medicine* 2000.22-39.
3. Roebroek ME, Jahnsen R, Carona C, Kent RM, Chamberlain MA. Adult outcomes and lifespan issues for people with childhood onset physical disability. *Developmental Medicine & Child Neurology* 2009;51(8):670-8.
4. Rapp Jr CE, Torres MM. The adult with cerebral palsy. *Archives of family medicine* 2000;9(5):472-466
5. Rang M SR, de la Garaz J. cerebral palsy. In : *orthopaedics* 1986.
6. Young RR. spasticity: a review. *Neurology* 1994;44(suppl 9):512-20.
7. Michelsen SI, Uldall P, Kejs AMT, Madsen M. Education and employment prospects in cerebral palsy. *Developmental Medicine & Child Neurology* 2005;47(8):511-7.
8. Opheim A, Jahnsen R, Olsson E, Stanghelle JK. Physical and Mental Components of Health-Related Quality of Life and Musculoskeletal Pain Sites Over Seven Years in Adults with Spastic Cerebral Palsy. *Journal of Rehabilitation Medicine* 2011;43(5):382-7.
9. Andersson C, Mattsson E. Adults with cerebral palsy: a survey describing problems, needs, and resources, with special emphasis on locomotion. *Developmental Medicine & Child Neurology* 2001;43(2):76-82.
10. Jahnsen R, Villien L, Egeland T, Stanghelle J. Locomotion skills in adults with cerebral palsy. *Clinical rehabilitation* 2004;18(3):309-16.
11. Sandstrom K AJ, Oberg B. Description of functioning and health and relation to a gross motor classification in adults with cerebral palsy. *Disabil Rehabil* 2004;26:1023-1031.
12. Group WHOQOL. The World Health Organization quality of life assessment: Development and general psychometric properties. *Social Science & Medicine* 1998;46:1569-85.
13. Davis E, Waters E, Mackinnon A, Reddihough D, Graham HK, Mehmet-Radji O, et al. Paediatric quality of life instruments: a review of the impact of the conceptual framework on outcomes. *Developmental Medicine & Child Neurology* 2006;48(4):311-8.
14. Akodu A, Oluwale O, Adegoke Z, Ahmed U, Akinola T. Relationship between spasticity and health related quality of life in individuals with cerebral palsy. *Nigerian quarterly journal of hospital medicine* 2011; 22(2):99-102.
15. Brown R, Brown P, Bayer M. A quality of life model: New challenges resulting from a six year study. in: Good, D(Ed), *Quality of life for persons with disabilities Cambridge:brookline Book*; 1994.39-56.
16. Foroughan M, Jafari Z, Shirin BP, Ghaem Magham Faraahani Z, Rahgozar M. Validation of mini-mental state examination (MMSE) in the elderly population of Tehran. *Advances in Cognitive Science* 2008;10((2)(38)):29-37.
17. Folstein MF, Folstein SE, McHugh PR. Mini-mental state: A practical method for grading the cognitive state of patients for the clinician. *Journal of psychiatric research* 1975;12(3):189-198.
18. O's Dwyer NJ, Adal L, Neilson PD. Spasticity and muscle contracture following stroke. *Brain* 1996;(119):1737-49.
19. Patrick E, Ada L. The Tardieu Scale differentiates contracture from spasticity whereas the Ashworth Scale is confounded by it. *Clinical rehabilitation* 2006;20(2):173.
20. Nedjat S, Holakouie Naieni K, Mohammad K, Majdzadeh R, Montazeri A. Quality of life among an Iranian general population sample using the World Health Organization's quality of life instrument (WHOQOL-BREF). *International Journal of Public Health* 2010:1-7.
21. Group TW. WHOQOL-Bref: introduction, administration, scoring and generic version of the assessment. WHO Geneva; 1996.
22. Nedjat S, Montazeri A, Holakouie K, Mohammad K, Majdzadeh R. Psychometric properties of the Iranian interview-administered version of the World Health Organization's Quality of Life Questionnaire (WHOQOL-BREF): A population-based study. *BMC health services research* 2008;8(1):61.
23. Yousefy A, Ghassemi G, Sarrafzadegan N, Mallik S, Baghaei A, Rabiei K. Erratum to: Psychometric Properties of the WHOQOL-BREF in an Iranian Adult Sample. *Community mental health journal* 2010;46(2).
24. Domholt E. *Rehabilitation research*. 3rd ed St Louis, MO: Elsevier Saunders; 2005.358.
25. Dajpratham P, Kuptniratsaikul V, Kovindha A, Kuptniratsaikul PS, Dejnuntarat K. Prevalence and management of poststroke spasticity in Thai stroke patients: a multicenter study. *J Med Assoc Thai* 2009;92(10):1354-60.
26. Welmer AK, von Arbin M, Holmqvist LW, Sommerfeld DK. Spasticity and its association with functioning and health-related quality of life 18 months after stroke. *Cerebrovascular diseases* 2006;21(4):247-53.
27. Wiegink DJHG, Roebroek ME, Donkervoort M, Cohen-Kettenis PT, Stam HJ. Social, intimate and sexual relationships of adolescents with cerebral palsy compared with able-bodied age-mates. *Journal of Rehabilitation Medicine* 2008;40(2):112-8.