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Original Article

Can Impairment Interfere with Performance by Women with Carpal Tunnel Syndrome According to International Classification of Function?

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ABSTRACT

Background: Carpal tunnel syndrome is the most prevalent compression neuropathy of upper extremity which, two of the most important risk factors of that are the female sex and manual works. In the model of international classification of function, disability and health, disease is an impairment, results in functional limitation. The goal of this study is to compare hand function of participants between various severities of carpal tunnel syndrome.
Methods: In a cross-sectional study, during 6 months period of time, 30 housekeeper women with carpal tunnel syndrome, with the mean age of 47.03 years, were selected through simple sampling. They were assessed for hand function, by Purdue peg board test and Boston questionnaire, after that a professional practitioner had performed Nerve Conductive Velocity (NCV) test and identified the severity of their diseases. Then the data were analyzed with SPSS software, by Kruskal-Wallis test.
Results: The mean of Purdue peg board test and Boston questionnaire scores in various clusters of carpal tunnel syndrome severity, were not different (P>0.05).
Conclusion: In this research, severity of electrodiagnostic findings of participants, with carpal tunnel syndrome, is not related to their performance and functional limitations.

Introduction

In 1980, World Health Organization established the International Classification Model of Functioning, Disability and Health (ICF). This model considers the relationship between impairment and function. According to this model impairment is a modified anatomical, physiological and psychological structure or function of the body that occur as a result of pathology. Functional limitation is the inability to perform routine tasks or roles and activities of daily routines, caused by impairment. It is noted that all the impairments may not lead to functional limitation or disability directly. Also, the limitations do not depend only on the type of impairment, but also on the type and requirements of the roles and activities [1-3].

Evidence have proposed that a person's activities are determined by body function and structure, in different areas, such as, meta cognition area by the ability of self-efficacy, individuals' goals or intentions and musculoskeletal area, such as muscle strength, range of motion and other examples [4].

In the disease condition, the patient's symptoms that induced by impairments, can impact the patients functional status and, alter the patient's activities of daily living, work capabilities and functioning, and leisure time. These changes depend on the severity of symptoms and may be different in patient by patient, because of, patient's preference to do those activities. Since the most important activity for a person, should be change and reduce at the

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last [5]. Regardless the mechanism, the activity limitation might mediate the patients participation restriction and limitation [6].

Carpal tunnel syndrome (CTS) is the most common entrapment neuropathy of the upper extremity. Compression of the median nerve in the carpal canal of the wrist results in reduced hand function for sensibility, dexterity, pinch, grip, also can impact body function, body structure, activity and participation in patients [7, 8]. CTS affects 1.8 per 1,000 population per year [9]. It occurs 3 to 4 times more in women than in men and also more in people aged 30 to 60 years of age [10].

The most common causes of CTS are pressure on a nerve from the surrounding muscles, interstitial fluid, direct pressure on the median nerve by external forces from repetitive movements and nervous ischemia [11, 12]. Risk factors for the progression of CTS are female gender, housework, repetitive movements of the wrist [13]. Housekeeping can be a predisposing factor for carpal tunnel syndrome [13, 14].

Individuals with CTS show symptoms at sensory distribution of the median nerve such as paresthesia (main symptom), pain, and weakness. Wrist pain, weakness in fingers, inability to lift objects strongly and frequent dropping of them are common complaints, especially when the disease becomes more advanced [10, 15]. These signs and symptoms can strongly affect a person's ability to perform activities of daily living [7)].

CTS assessment tools include provocation tests, sensory-motor tests, electrodiagnostic and functional tests. While there is an increasing prevalence of CTS, the advanced diagnostic method is the nerve conduction velocity [16]. Sensitivity of the nerve conduction velocity test (NCV) is 49% to 84% and its specificity is 95% to 99.9% [17]. Since in patients with CTS, in addition to sensory symptoms, motor function can also be impaired, it seems necessary to examine changes in patient's functioning.

Prior studies have yielded mixed results when examining the association between electrodiagnostic findings and patient reported symptoms and functions. Some studies have shown no association, others have shown strong associations [18] and still others have found associations between electrodiagnostic findings and measures of physical functioning, but not CTS symptoms [19]. Electrodiagnostic findings and patient CTS-related symptoms and function appear to be independent measures. Clinicians and researchers interested in CTS outcomes need to assess both. In addition, although the absence of a relationship between electrodiagnostic findings and patient symptoms may raise the question of the utility of electrodiagnostic findings in the work-up and treatment of CTS in some people's minds [20].

Considering the prevalence of CTS, its impact on performing the usual roles and activities of daily living, and also lack of evidence and controversy about the relationship between electrodiagnostic findings and patient's functions, This study was conducted to evaluate and compare the patient's functioning, Base on Purdue peg board test and Boston questionnaire, in mild, moderate and severe CTS classes according to NCV reported by physicians. Our primary hypothesis was that, there would not be significant differences in hand function of patients between different groups of severity.

Methods

In this cross-sectional study, the subjects were housekeeper women aged 30 to 60 years old who were diagnosed with CTS and referred to the Shiraz University of Medical Science teaching hospitals. To be included in the study, the subjects needed to be women, in the age of 30 to 60 years old, diagnosed with CTS by a physician who completed a NCV test because of their CTS sensory or motor symptoms (paresthesia, pain, etc.) and the NCV results had to be available for each person. The subjects were excluded if they had any systemic disease, wrist fracture, currently pregnancy, previous carpal tunnel surgery on the same extremity, and cognitive deficits. Additionally, they were excluded if they had not taken the NCV test or their demographic information for completing the questionnaires was not available.

The study instruments were neural conductive velocity test, Boston questionnaire, and Purdue pegboard test.

NCV test which is performed by a physiatrist shows the sensory and motor latency of the nerve [21]. Severity of the impairment was recorded in the NCV results as mild, moderate and severe, by the physician, according to the information in Table 1 [22, 23].

The Boston questionnaire is self-administered and is a well-recognized, validated outcome instrument specific for use in carpal tunnel syndrome. It has two sections, one assessing symptoms such as pain and paresthesia and the second analyzing function in terms of day-to-day tasks. A mean score was given for both symptom severity and functional status [24].

The Purdue pegboard was performed in order to assess hand function or hand dexterity. This test is designed to assess the fine motor skills and the validity of this test has been accepted over time. This test assesses speed and accuracy of the function of person's hand [1].

Also, to compare hand function and NCV results, the International classification model of Functioning,

Table 1: Classification of NCV findings to cluster of mild, moderate, severe

NCV findings	SDL[1]	S NCV[2]	**MDL[3]**	**M Amp[4]**	**CL[5]**	**C Amp[6]**
Severity of CTS						
Mild	>3.7	<40	>4.5	-	>2.4	<.5
Moderate	>4.5	<35	5.5>	.5<	2.8>	-
Severe	5.3>	30<	6.5>	-	3.2>	-

[1]SDL: Median Nerve Sensory Distal Latency, [2]S NCV: Median Nerve Wrist Sensory Nerve Conduction Velocity, [3]MDL: Median Nerve Motor Distal Latency, [4]M Amp: Median Motor Response Amplitude Compared To Other Hand, [5]CL: Median Nerve Compound Latency, [6]C Amp: Median Nerve Compound Amplitude Compared To Other Hand

Disability and Health was used as a basic frame for definition of impairment and functional limitation.

In this study, in order to take the tests, participants were referred to the occupational therapy part in rehabilitation school, after they had been diagnosed with CTS and a physician as one member of research team, who completed the NCV test and determined the CTS severity according Table 1.

For the ethical consideration, patients signed a consent form to participate in the study.

Hand function was evaluated by answering the Boston questionnaire and performing the Purdue pegboard test in the quite environment in occupational therapy part.

The scores of these two tests were calculated by the therapist and finally they were analyzed in SPSS 11.00 software. The distribution of data was normal so, independent t-test use to evaluate the scores of Boston questionnaire and Purdue pegboard test between participants with participants unilateral CTS and bilateral CTS, also between right and left affected limb.

Statistical Analysis

To compare the scores between three groups of severity, nonparametric Kruskal-Wallis test were used, although normality of data indefeasible, but the small sample size in each group of severity lead to use of nonparametric analysis in this stage. P value threshold for significant results was 0.05.

Results

Among 30 housekeeper women under the study with the mean age of 47.03 ±10, 9 had CTS only in their right hand, 7 only in their left hand, and 14 persons hand CTS in their both hands. Totally, 44 hands were assessed in this study. Some information of the participants is summarized in Table 2.

Boston questionnaire and Purdue pegboard test scores were not different between the group of participants who had CTS in one hand and those with bilateral CTS. Additionally, the scores of these two tests were not different in those with right hand laterality and the left. Results of the tests showed in Tables 3 and 4.

Table 2: Information of participants

Variation		Frequency/ Percent	Std.Deviation
Laterality	Right	37 Hands %84.1	_
	Left	7 Hands %15.9	
Affected Limb	One hand	16 Persons %36.4	_
	Both hands	14 Persons %63.6	
Severity of Impairment (NCV)	Mild	21 Hands %47.7	_
	Moderate	9 Hands %20.5	
	Severe	14 Hands %31.8	

Table 3: T-Test for scores between Right and Left hand affected

Variations	Tested limb	Mean	Std. Deviation	P value
Boston pain scores	Right	29.2917	8.08906	0.90
	Left	29.6000	8.63530	
Boston function scores	Right	19.1250	8.90194	0.27
	Left	16.5500	5.97781	
Purdue pegboard scores of both hands	Right	7.5000	2.20671	0.88
	Left	7.6000	2.23371	
Purdue pegboard scores of one hand	Right	5.3750	1.52693	0.95
	Left	5.4000	1.42902	

Table 4: T-Test for scores between one and both affected limb

Variations	Affected limb	Mean	Std. Deviation	P value
Boston pain scores	One	29.93	5.69	0.76
	Both	29.14	9.48	
Boston function scores	One	20.56	8.77	0.09
	Both	16.46	6.80	
Purdue pegboard scores of both hand	One	7.75	1.77	0.64
	Both	7.42	2.42	
Purdue pegboard scores of on hand	One	5.43	1.31	0.86
	Both	5.35	1.56	

As shown in Table 5, in order to compare the hand function between three cluster of the severity, the information of subjects with both hands affected and one hand affected, were analyzed by, nonparametric kruskal-wallis test. There was no significant difference in this comparison and the function was not matched with the severity of the impairment.

Discussion

The results showed that, participants with bilateral presentation of symptom and participants with unilateral presentation of symptom were same in Peurdo Pegboard test and Boston questionnaire. There were also no differences in function and performance of participants in different condition of mild, moderate and severe according to NCV findings. So the primary hypothesis of the research was confirmed by the results.

Galasso et al. found that, bilateral presentation of symptoms and low nerve conduction velocity were negative predictors of the quality of life of patients after surgery for CTS [25]. In the current research, we found no differences in functional performance between participants with bilateral presentation and unilateral presentation of symptoms. The difference in outcome measure, could have led to these different results. Because they use the SF36 questionnaire to evaluate the quality of life and activity of daily living, so bilateral CTS can make more difficulty in daily living than unilateral symptom.

According to ICF, there is a dynamic relationship between impairment and function. In this model, impairment is a change in one of the physiological, anatomical, or psychological systems occurring by pathology. Also functional limitation is defined as inability in tasks, roles and daily living activity resulted in impairment. As Naji and Wood have indicated, all impairments do not lead to functional restriction or disability directly [26]. In addition to impairment, there are many important factors that can induce functional restriction such as individual roles and motivation for participation, task demands and activity. Hence, impairment and injury alone cannot determine the amount of functional restriction. For example, absence of shoulder range of motion can lead to functional restriction for a worker in productive line but not for a typist [1-3]. As a result, in occupational therapy setting we need to a comprehensive, client reported measure of functional status for people with CTS more than, evaluation of sign and symptom of injury [27].

The current results might confirm earlier findings that functional outcome could be related to a comprehensive factors more than physiological properties or body function and body structure [20]. Horng et al. concluded that health-related quality of life in patients with low back pain depended on functional status and psychological factors more than simply the physical impairment. Therefore, the future interventions should focus more on the patient' functioning than, impairment, sign and symptom of disease [28].

Pollard et al. found no significant path between Impairment and participation in people with osteoarthritis [6]. Since we consider carpal tunnel syndrome as impairment and evaluate its intensity by nerve conductive velocity and the result of Purdue pegboard test as measurement of function, our result showed no differences between intensity of impairment and functional evaluation. Impairment is not the only cause of functional limitation. Psychosocial characteristic of patients and their roles can determinant factors of the limitations.

We recommend some points for future research, for example, Evaluation of participation limitation in roles, related to impairment and activity, use of other outcome measure to evaluate quality of life and considering psychosocial issue as factors that affect activity and participation limitation in a larger sample size, would make a more powerful results.

Practitioners have to evaluate the patients function, although Peurde Peg board and Boston questionnaire, are the instruments to evaluate the function well, but one of the limitations of the research was lack of Persian version of client-centered measures such as Flinn Performance Screening Tool**,** occupational profile, card sort and Patient Evaluation Measure questionnaires, that present functional status, better than those we used [24, 29-32]. Also if, we have some information about activity and participation status of patients, we could match our finding to ICF model of disability better than current results, so making a profile from activity and participation of patients by a qualitative research before, measuring functional status, could be useful.

Table 5: comparison of the scores between different groups of severity

Variations	Severity	N	Mean Rank	P value
Boston pain scores	Mild	21	22.60	0.45
	Moderate	9	18.22	
	Severe	14	25.11	
Boston function scores	Mild	21	23.67	0.84
	Moderate	9	21.78	
	Severe	14	21.21	
Purdue pegboard scores of both hands	Mild	21	21.40	0.62
	Moderate	9	26.11	
	Severe	14	21.82	
Purdue pegboard scores of one hand	Mild	21	19.48	
	Moderate	9	29.33	0.14
	Severe	14	22.64	

Conclusion

We conclude that a functional limitation in the CTS patients is not related to the severity of impairments and symptoms of the syndrome.

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