Assessment of Hand Function in Post Stroke Patients Using 'Jebsen Taylor Hand Function Test'

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Abstract

Aim: After stroke, the majority of stroke survivors experience significant arm-hand impairments and a decreased use of the paretic arm and hand in daily life. The actual use of the affected hand in daily life performance depends on the severity of the arm-hand impairment and is associated with perceived limitations in participation. Severity of arm-hand impairment is also associated with a decrease of health-related quality of life, restricted social participation, and subjective well-being.Thus the study aims to assess the hand function using Jebsen Taylor Hand function test among patients post stroke.

Methodology: Hand function was assessed using the Jebsen Taylor Hand Function Test,which included seven tasks to be performed by the subjects.Hand function was assessed in 22 post stroke patients who had experienced the stroke event at least 6 months prior.

Results: Out of the seven activities performed by 22 patients,the time required for all the activities is given as follows (highest to lowest) –Writing, Simulated feeding, Small; common objects, Card turning, Checkers, Light; heavy objects, Large; light objects.

Conclusion: Overall the study showed that the writing activity required the most amount of time for all the subjects. The study also concludes that the time duration required is greater for the non-dominant hand compared to the dominant hand for all the above mentioned activities.

Keywords: *Stroke, Impairments, Hand functions, Hemiparesis, Jebsen Taylor Hand Function Test*

Introduction

Impaired hand function is one of the most frequently persisting consequences of stroke. Paralysis of the hand or upper limb occurs acutely in up to 87% of all stroke survivors. Some recovery of motor control after a stroke is typical, occurring most rapidly during the first 3 months and usually plateauing by 6 months. Yet, 40% to 80% of all stroke survivors have incomplete functional recovery of the upper extremity at 3 to 6 months post-stroke.[1]

Common upper extremity (UE) impairments after stroke include: paresis, loss of fractionated movement, abnormal muscle tone and/or changes in somatosensation. These impairments are a result of direct damage to the primary motor cortex, the primary somatosensory cortex, secondary sensorimotor cortical areas, subcortical structures, and/or the corticospinal tract.[2]

An essential issue in the assessment of the hand post stroke is how the presence of various impairments contributes to loss of hand function. Here, we use the term function to indicate the capacity to perform activities with the hand.[2] Paresis is the most important impairment causing UE functional loss. It is paresis

across the entire limb that leads to decreased UE function, and the severity of paresis at 3 or more weeks post-stroke that is the strongest indicator of present and eventual UE function.[2]

The hand has many functions, primarily sensation and prehension, with secondary functions of expression, gesture, communication, visceral (food to mouth), protection/ defence/ offence, hygiene, balance/ stabilization, contribution to body image, and thermoregulation, all playing an essential role in our everyday lives. Motor and sensory functions of the hand cannot be dissociated, making the hand an exceptional organ, with the ability to both seek and provide information.[3]

The majority of stroke survivors possess significant arm-hand impairments and decreased use of the paretic arm and hand in daily life after a stroke. The actual use of the affected hand in daily life performance is affected by the severity of the arm-hand impairment and is linked to perceived limitations in participation.

Numerous measures are readily available to clinicians for the evaluation of hand function post-stroke. Many of these measures have been thoroughly evaluated for reliability and validity at multiple time points post stroke. The measures can be generally divided into two categories:

1) Performance measures, where the clinician rates or times a series of UE actions that are performed by the patient, or

2) Self-report measures, where the clinician asks a series of questions about UE actions that are answered verbally by the patient or by proxy. The most frequently cited hand performance measures include the Action Research Arm Test (ARAT), Box and Blocks Test (BB), Chedoke Arm and Hand Activity Inventory (CAHAI), Jebsen-Taylor Hand Function Test (JTT), Nine-Hole Peg Test, and the Wolf Motor Function Test (WMFT). The most frequently cited self-report measures include the Stroke Impact Scale (SIS) and the Motor Activity Log (MAL).[2]

The Jebsen-Taylor Hand Function Test was developed to assess the use of the UE in everyday tasks. There are seven tasks that are tested: writing a sentence, card turning, lifting small objects, simulated feeding, stacking checkers, and picking up light and heavy cans. Each task is timed, and better performance is indicated by faster times. Age- and gender-based normative values on each test are available for comparison.[5]

Most recovery of hand function has been reported to occur during the first three months following stroke. Yet there is substantial evidence that recovery continues at a slower rate over a much longer, unspecified period (months or years).[4] Thus the study aims to assess the hand function using Jebsen Taylor Hand function test among patients post stroke.

Materials and Methodlogy

The study was approved by the Institutional Ethics and Research Committee at D.Y. Patil University. A cross-sectional study was conducted on 22 post stroke patients who had experienced the stroke event at least 6 months prior. The participants were screened based on the inclusion and exclusion criteria. Following that consent was obtained from the participants prior to the study and detailed explanation about the study was informed to all the participants. The participants demographic details were obtained and hand functions were assessed using Jebsen Taylor hand function test. The recorded results were analysed.

Data Analysis

The data collected from the participants was analysed. Descriptive statistics was performed for all the activities performed by the subjects separately for dominant and non-dominant arm and the amount of duration of hand function limitations post stroke in patients was analysed.

Results and Discussion

TABLE 1: Time duration of activities performed by the subjects using Jebsen Taylor Hand Function Test

DOMAINS	VARIABLES (time in seconds)	MEAN ± SD
Writing	Dominant Hand	49.38±6.04
	Non-dominant Hand	56.95±7.20
Card Tuning	Dominant Hand	13.00±2.25
	Non-dominant Hand	13.57±2.62
Small, Common Objects	Dominant Hand	13.72±2.72
	Non-dominant Hand	14.18±18
Simulated Feeding	Dominant Hand	13.85±2.62
	Non-dominant Hand	15.48±2.62
Checkers	Dominant Hand	12.94±2.24
	Non-dominant Hand	13.33±2.50
Large, Light Objects	Dominant Hand	11.51±2.79
	Non-dominant Hand	12.04±3.43
Large, Heavy Objects	Dominant Hand	12.2±2.95
	Non-dominant Hand	13.14±3.72

Inference:

Out of 22 subjects, 5 subjects completed the writing activity in 55-60 seconds using their dominant hand whereas8 subjects completed the activity in 55-60 seconds using their Non-dominant hand.For the Card Turning activity,17 subjects completed the activity in 10-15 seconds using their Dominant hand while15 subjects completed the activity in 10-15 seconds using their Non-dominant hand.17 subjects completed the Small,common objects activity in 10-15 secondsusing their Dominant hand while on the contrary14 subjects completed the activity in 10-15 seconds using their Non-dominant hand.In case of the Simulated feeding activity, 15 subjects completed the activity in 10-15 seconds using their dominant hand whereas 10 subjects completed the activity in 10-15 seconds using the Non-dominant hand.Out of 22 subjects,18 subjects completed the Checkers activity in 10-15 seconds using their Dominant handwhile 13 subjects completed the activity in 10-15 seconds using their Non-dominant hand.Amongst the 22 subjects,14

subjects completed the Large;light objects activity in 10-15 seconds using their Dominant hand while 13 subjects completed the activity in 10-15 seconds using their Non-dominant hand.10 out of the total 22 subjects completed the Large; heavy objects activity in 10-15 seconds, using their Dominant hand whereas 11 subjects completed the activity in 10-15 seconds and using their Non-dominant hand

Discussion

In the present study, we have included 25 post stroke participants with the mean age of 57.04±7.2. Jebson Taylor Hand Function Test was administered on all the subjects to assess the broad range of hand functions required for activities of daily living and to establish the amount of duration of hand function limitations post stroke in patients. The Jebson Taylor Hand Function Test is a performance-based quantitative evaluation based on patients' ability to perform seven tests, measured in time. Time is used as a measure of dexterity and efficiency of movement. Performance tests that focus on the *quality* of completing a series of tasks may be better than the *time* it takes to complete the tasks.[6]

Hand function can be evaluated with respect to impairment, which would include abnormalities in measures such as range of motion, grip strength, and other performance tests. Alternatively, hand function can also be represented by patient-rated disability, or limitations in physical activities, such as activities of daily living. The Jebsen Taylor Hand Function Test has been utilized in the literature as a measure of both impairment and disability.[7]

The study shows that there is a significant difference between the time duration of the dominant and non-dominant hand for each specific activity. The findings of the study are similar to the findings of a study done in 2016 by Greta Culicchia et al. As per the study, writing activity was considered to be most time consuming for all patients. Individuals tend to write in capital letters with their non-dominant hand and in cursive mode with the dominant hand, thus obtaining different results at different times. Moreover, the instructions do not require that the pen be held in any given way. [7]

The writing speed may also be influenced by the education level of each subject. In fact, it was observed that individuals with a lower education level had the tendency to look several times at the phrase as they wrote it, increasing the required time in which to accomplish the task.[7]

Among the seven items, only the third task, "picking up small common objects," is not statistically significant for either hand. This might be related to the fact that the grasp's strength is not relevant for those activities that require grasping and handling of small objects, whereas the control of the movements is the major factor involved in the accomplishment of tasks that require precise movements.[7]

A small scale study by Urbin et al (2015) reported similar results in a group of patients in sub-acute phase (6 months post stroke) comparable with the moderately and mildly affected group (6 months-1 year post stroke) as presented in this study. During the test, the intensity of unilateral arm-hand use on the affected side remains low. One year after stroke, patients with a moderately affected arm-hand function achieved and maintained a certain level of intensity of use of the affected hand in unimanual conditions. In contrast, De Niet et al., and Michielsen et al., found that chronic stroke patients (more than 1 year post stroke) hardly use their affected arm-hand unimanually.[8]

As per a study by Franck, Johan Anton et al (2019),in mildly impaired patients in the post-rehabilitation period, the non-affected hand is used about one and a half time more than the affected hand. In this same period, patients with a moderately affected hand used their non-affected hand about two and a half times more than their affected hand. In contrast, post stroke patients of duration greater than 1 year display a more equal Intensity-of-use between both hands.[9]

Progressions after a significant amount of time, post the stroke event can be explained by: 1) an increase of voluntary movements in flexion synergy in the proximal and/or distal part of the arm; 2) associated movements while moving or performing activities with the non-affected hand; and 3) performing bimanual exercises as learned to maintain the severely affected arm-hand pain free.[9]

Conclusion

As per the present study, functional activities required for daily living such as Writing a sentence, Card Turning, lifting small objects, Simulated feeding, stacking checkers and picking up light and heavy cans were assessed and it was observed that the writing activity required the most amount of time for all the subjects. The other activities performed needed almost similar amount of time, therefore no specific order can be followed to comment on the time duration of the activity. The study even concludes that the time duration required is greater for the non-dominant hand compared to the dominant hand for all the above mentioned activities.

Acknowledgement: I take this opportunity to express my sincere gratitude to those people without whose support and concern this project would not have been great success.

I am grateful to all my study subjects for co-operating with me in carrying out this study, as without them it would have been impossible to complete the project.

Conflict of Interest: Nil

Source of Funding: Self

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