



Research Article

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Correlation between Modified Functional Reach Test and Transfer Activities of Daily Living in Individuals with Spinal Cord Injury- A Pilot Study

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Abstract

Background: The Modified Functional Reach Test (mFRT) is the tool to measure dynamic sitting balance, forward and lateral directions, developed for patients with spinal cord injury (SCI). In spite of being dynamic in nature, mFRT has not been studied for its ability to predict transfer domain of International Classification of Functioning, Disability and Health (ICF). Hence, the purpose of this study is to investigate the association between mFRT and sitting transfer domain of ICF. **Methodology:** Volitional effort of 10 patients with SCI was measured in centimeters with the help of mFRT by reaching in forward and lateral direction in sitting. Patients' ability to transfer oneself (d472) domain of ICF was evaluated using standard scoring format in terms of Capacity and Performance. **Results:** Data was analysed using Kendall's coefficient of concordance. A strong negative correlation ($\tau_b = -0.81, p < 0.05$) was found between forward reach and transfer domain of ICF and moderate correlation ($\tau_b = -0.71, p < 0.05$) was observed between Lateral reach test with Transfer oneself Domain. **Conclusion:** Strength of correlation indicates that patients are able to carryover the clinical effect of training into functional activities. However, considering the frequent use of lateral transfer during ADLs calls for stronger correlation and hence more focused training during rehabilitation.

Keywords: Spinal Cord Injury, Transfer Activities, Functional Reach, ICF.

INTRODUCTION

Balance is defined as ability to maintain control over upright posture during forward reach without stabilization. When body movement occurs, this ability allows an individual to maintain balance [1]. Since people with spinal cord injury have a poor sitting balance, are more prone to fall while doing transfer & balance being the most common factor which is crucial to reduce the fear of losing balance while sitting down for the SCI population. Sitting balance is not a functional activity, but to perform functional activities such as dressing, transferring, and eat in sitting position it is necessary to maintain or attain sitting balance. Biomechanically, to maintain postural control in sitting, specific trunk movements have to occur [2]. Trunk movements like rotations also play important role while maintaining balance. It is difficult to independent living to maintain balance while reaching for variety of objects both within and beyond arm's length. To improve sitting balance and prevent falls from sitting in patients with SCI, researchers develop the objective ways to check dynamic sitting balance.

Neurological disorders often cause sensory and motor impairments which in turn lead to poor balance function [3]. Impaired balance is one of the major causes of dependency and poor quality of life (QOL) in patients with neurological conditions [4]. Because motor-complete and non-ambulatory motor-incomplete SCI individuals mostly remain in the sitting position, mFRT is used for non-standing SCI population [5].

Lynch and associates in 1998 developed one measure, i.e Modified Functional Reach Test (mFRT) to assess sitting balance in individuals with spinal cord injury [6]. mFRT examined movement in two directions, forward and lateral reach while sitting. Other factors such as age and anthropometrics may show some impact over the limits of stability in sitting when reaching forward or laterally. Forward reaching in sitting is a challenging task to person's postural control and it is an indicator of proper sitting balance. mFRT is useful for detecting balance impairment. The SCI patients also find a difficulty to perform a transfer activities such as moving from one surface to another, sliding along a bench or moving from bed to chair without changing body position, hence the transferring oneself (d420) domain of icf can also be used as a outcome tool to assess the sitting dynamic balance along with mFRT. Recovery of sitting after spinal cord

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injury is important for individuals because sitting is a skill that is critical to independent living [2,7,8].

Furthermore, sitting ability has been shown to be use full prognosis indicator for outcome for this population [5,9]. The disability in reaching tasks arises not only from the impairment, but also from the tendency to adapt behavior to avoid the threat to balance [10]. Restoration of sitting balance is one of the goal of rehabilitation; however, the effect of sitting Balance training with spinal cord injury patient has not been specifically investigated [11].

Conducting studies exploring the psychometric properties and clinical application of the modified FRT would improve its usefulness. Balance training is often incorporated in rehabilitation protocol of patients with SCI. However, its carryover effect during daily activities is not investigated routinely. International Classification of Functioning (ICF) has included grading of activities in terms of Capacity and Performance, specifically during the daily activities in clinical and real life situations respectively. Hence purpose of the study is to find the correlation between MFRT and transfer activities of daily living in individuals with SCI using ICF.

MATERIALS AND METHODS

It was a pilot study conducted after taking ethical committee approval in which 10 SCI patients were recruited on the basis of purposive sampling technique. The present study was conducted among the patients of SCI admitted in the I.P.D and Neurophysiotherapy O.P.D at Vikhe Patil Memorial Hospital, Ahmednagar. Participants were screened as per the inclusion criteria; 20-50 years old age SCI people, both gender and who were able to sit independently. The participants were excluded if they were suffering from any additional musculoskeletal disorder of back or upper extremity which might interfere with the transfer oneself ability. Orientation was given regarding the purpose, procedure and benefits of the study to the patients. An informed consent was taken from all the participants before data collection.

To perform mFRT, while sitting in the chair, yard stick was mounted on the wall at the height of acromion level in the non-affected arm. Ask the patient to sit with Hips, knees and ankles positioned at 90 degree

of flexion, while keeping the feet flat on the floor. Instruction was given for leaning as far as possible with the closest fist in lateral and forward direction without rotation. The initial reach is measured with the patient sitting against the back of the chair with the upper-extremity flexed to 90 degrees. It is measured from the distal end of the third metacarpal along the yardstick. It consists of three conditions over three trials: 1. Sitting with the unaffected side near the wall and leaning forward 2. Sitting with the back to the wall and leaning right 3. Sitting with the back to the wall leaning left and centimeter was the unit used to measure the distance. If the patient is unable to raise the affected arm, the distance covered by the acromion during leaning is recorded. First trial in each direction is a practice trial and should not include in the final result. A 15 second rest break should be allowed between trials. Final score for lateral and forward reach was documented [6].

Transfer oneself (d420) domain of ICF was also performed by the patients to execute the task or action and involvement in life situation. This assessment tool was used to see how much difficulty does the patient have in the transferring oneself such as moving from one surface to another, sliding along a bench or moving from bed to chair, without changing the body position. This was graded accordingly; 0-no difficulty, 1- mild difficulty, 2- moderate difficulty, 3- severe difficulty, 4- complete difficulty, grade 8- not specified, 9-not applicable [12].

Data Analysis

Data was analysed by using the Kendall's rank order correlation coefficient, in which the mean values of forward, left and right lateral reaches were correlated with Mean value of transfer domain. As per the analysis tau value (Kendall's correlation coefficient) is between 0.5-1 which shows moderate to strong correlation between MFRT and transfer domain [13].

RESULT

The study was conducted among the 10 SCI patients, after performance of mFRT and transfer oneself domain of ICF, mean values of forward, left and right lateral reach was compared with the Mean values of transfer oneself, the data was analysed by using Kendall rank order correlation and comes A strong negative correlation ($\tau_b = -0.81$, $p < 0.05$) was found between forward reach and transfer domain and moderate correlation ($\tau_b = -0.71$, $p < 0.05$) was observed between Lateral reach test with Transfer oneself Domain.

Table 1: mFRT values in patients with SCI

Age/ Gen	Duration of SCI	Level of Injury	Modified Functional Reach Test Scoring (in cm)											
			Forward Reach				Left Lateral Reach				Right Lateral Reach			
			R1	R2	R3	Mean	R1	R2	R3	Mean	R1	R2	R3	Mean
32/M	2 Years	T7	5.08	6.35	7.11	6.73	4.57	4.57	4.57	4.57	4.06	4.06	4.57	4.31
23/M	2 Years	T7	3.81	3.3	2.54	2.92	2.54	3.04	2.54	2.79	2.54	3.81	2.54	3.17
45/M	12 Years	T8	12.7	13.4	13.97	13.68	13.97	15.24	15.24	15.24	12.7	13.97	13.97	13.97
21/M	4Months	T8	7.62	6.35	6.35	6.35	5.84	6.35	7.62	6.985	6.35	7.62	7.62	7.62
45/M	7Months	T9	6.35	7.11	7.62	7.365	5.84	6.35	7.11	6.73	6.09	6.35	6.85	6.6
48/M	1 month	T9	3.81	5.08	5.84	5.46	5.84	5.84	5.84	5.84	5.08	5.84	6.35	6.095
42/M	9Months	T8	3.81	3.4	6.5	4.95	2.45	3.05	3.6	3.325	2.45	3.05	3.8	3.425
47/F	9 Years	T8	9.05	10.11	11	10.55	8.05	8.07	8.05	8.06	8.03	8.07	8.07	8.07
36/F	5Months	T9	5.08	6.35	7.11	6.73	4.57	3.81	5.08	4.445	4.06	4.06	4.57	4.315
50/M	2 Years	T8	3.81	3.3	2.54	2.92	2.54	3.04	2.54	2.79	2.54	3.81	2.54	3.175
						6.76				6.07				6.07

(mFRT=Modified Functional Reach Test)

Table 2: Scores of Transfer oneself domain of ICF in patients with SCI

Age/gender	Duration of condition	Level of Injury	Transfer oneself domain of ICF	
			Capacity	Performance
32/M	2 Years	T7	2	2
23/M	2 Years	T7	2	2
45/M	12 Years	T8	2	2
21/M	4Months	T8	2	2
45/M	7Months	T9	2	2
48/M	1 month	T9	2	3
42/M	9Months	T8	2	2
47/F	9 Years	T8	1	1
36/F	5Months	T9	3	2
50/M	2 Years	T8	4	3

ICF= International Classification of Functioning

Table 3: Correlation of Transfer oneself domain and mFRT in patients with SCI using Kendall rank order Correlation coefficient

	Forward Reach	Left Lateral Reach	Right Lateral Reach
TRANSFER ONESELF ICF	-0.8	-0.7	-0.7
P value	0.034	0.0123	0.45
significances	Significant	Significant	Significant

DISCUSSION

The purpose of this pilot study was to investigate if there is any correlation between balance ability and transfer activities in patients with SCI. Forward (forward) reach had more strong correlation with than left and right lateral reach with transfer activities.

The strong correlation between mFRT and Transfer activities could be due to the fact that both concentrate on the dynamic limits of stability of sitting balance. However mFRT assesses stability limits without hand support whereas transfer activity is done with hand support [14].

Similar injury levels of patients in our study may have contributed the correlation. Individuals with Low thoracic injury or injuries below T8, have an intact abdominal muscle innervation and may have better sitting balance and may do better with transfer activities [15].

mFRT assesses proactive systems of sitting balance, when patient is asked to reach out in three directions. So does the transfer activity. Patient needs to estimate the distance between two surfaces, level of surfaces before making a transfer and accordingly prepare the body. This may have contributed to moderate to strong correlation [16].

There was no difference in capacity and Performance of the activity among patients included in this study. Capacity was assessed in the clinical setting with ideal set up. All patients were admitted in the hospital and hence their performance was measured in residential wards where they spend rest of the time except therapy time. The infrastructure in wards is in accordance with general patients which is neither very ideal nor very preliminary.

Comparatively, forward reach had higher value of correlation as compared to Lateral reach. This may be primarily because the rehabilitation training involves exercises in sagittal plane concentrating on flexion- Extension movement and related muscles whereas transfer activities primarily involves sideward movement in frontal plane [3,17]. Hence more exercises in frontal plane concentrating on lateral trunk movements should be incorporated in SCI rehabilitation program.

One of the limitations of this study is that Head-arm-trunk segment weight of patients was not taken into consideration while evaluating both parameters which may have an effect on transfer ability and dynamic balance.

CONCLUSION

This pilot study suggests that there is a strong negative correlation was found between forward reach and transfer domain and moderate correlation was observed between Lateral reach test with Transfer oneself Domain However larger sample size with different levels of SCI will be needed to confirm the same.

Conflicts of interest

None declared.

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None declared.

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