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All Limbs Lead to the Trunk

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Introduction

This poster describes the development of and the psychometric properties of the trunk scale that measures the voluntary motor ability in the thoracic and upper lumbar regions. The function of the trunk musculature has far reaching implications, particularly in persons with SCI, where postural control and voluntary movement are compromised to varying degrees. Precisely coordinated muscle actions must occur in the appropriate sequence, duration, and combination for the optimal movement function and maintenance of balance and posture during dynamic activities. Trunk mobility is required for nearly all mobility tasks, particularly transitional movements such as rolling, supine to sit, and sit to stand, as well as activities of daily living which involve upper extremity movements such as reaching. The muscles innervated by the thoracic and lumbar spine play key roles in body positioning and posture which are very important in conducting functional activities such as ambulation, reaching and activities of daily living (ADL)[1].

Methods

Participants: Data collected from a total of 863 individuals. Three hundred twenty five (325) observations of the trunk scale by the five contributing model centers is entered into the National SCI Database for the validity study; Five Hundred Fifty eight (538) observations from a collaborating network will be utilized for scaling the measure. There are also 60 able bodied controls that were included.

Inclusion Criteria: 1) cervical motor incomplete or thoracic SCI; 2) no mobility restrictions (i.e., no body jackets or collars) and no spinal instability precautions.

Thirteen Items: lumbar and thoracic trunk extension, right and left elevation of the pelvis, trunk flexion and right and left trunk rotation, sit to supine, supine to sit, sitting posture, sitting extension, sitting and standing balance. The total time for administering 10 to 15 minutes.

Dimensionality: the items of the trunk scale were analyzed with alpha factor analysis to test unidimensionality.

Reliability: Fifty six cases had two observations on the same day.

Construct Validity: Since there are no existing scales measuring trunk function in spinal cord injury for comparison to establish validity, construct validity must be developed. Validity hypotheses are offered to delineate the construct being measured by the trunk scale.

Dimensionality

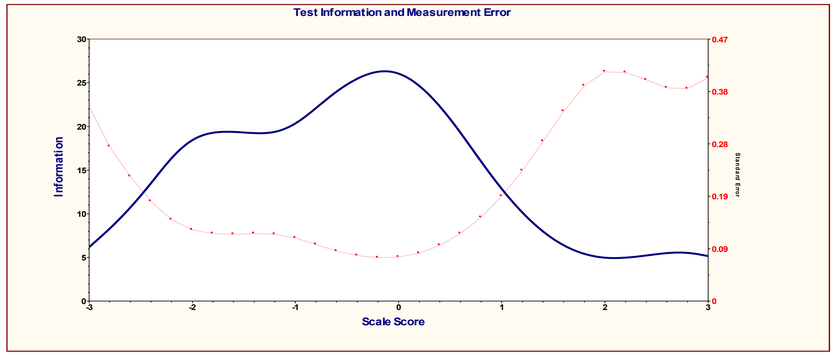
Factor analysis indicated that there a single dominate factor accounting for 55% of the variance contained in the 13 items. The single factor had a 4.85:1 ratio of the first to second eigenvalue; therefore this scale is deemed essentially unidimensional.

Trunk Scale Item Intercorrelations

	Extension Thoracic	Extension Lumbar	Elevation Pelvis Right	Elevation Pelvis Left	Trunk Flexion	Sitting Extension	Rotation Right	Rotation Left	Sit to Supine	Supine to Sit	Sitting Posture	Sitting Balance
Extension Thoracic	1											
Extension Lumbar	.895	1										
Elevation Pelvis Right	.313	.339	1									
Elevation Pelvis Left	.323	.353	.918	1								
Trunk Flexion	.401	.432	.582	.582	1							
Sitting Extension	.358	.371	.395	.360	.279	1						
Rotation Right	.406	.421	.548	.514	.799	.375	1					
Rotation Left	.404	.421	.561	.522	.801	.352	.965	1				
Sit to Supine	.442	.456	.422	.388	.706	.453	.714	.706	1			
Supine to Sit	.427	.427	.514	.489	.806	.342	.689	.691	.807	1		
Sitting Posture	.323	.294	.595	.582	.488	.473	.570	.540	.523	.430	1	
Sitting Balance	.473	.441	.588	.578	.523	.552	.546	.534	.620	.531	.754	1
Standing Ballance	.550	.516	.365	.360	.377	.372	.355	.340	.373	.376	.360	.540

Reliability

CTT indices of reliability are: standardized item alpha estimate of 0.92; Intra-rater reliability of ICC = 0.94 and inter-rater reliability of 0.92. Graded response model marginal reliability is 0.94. The Trunk scale showed a good fit to the Graded response model. The test information function and standard of error shows that the trunk scale items provide information from the on a wide range of ability levels. The information function peaked at 26.2 at -0.2 on the Theta scale, just under average performance.

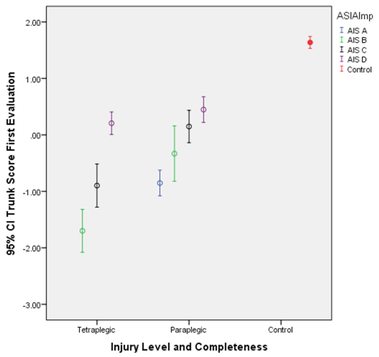


Validity

All of the construct validity hypotheses were confirmed. The table shows the hypotheses correlation coefficients and 95% confidence intervals for the variables utilized in the validity investigation. Additionally it was hypothesized that the trunk scale should distinguish between able bodied and SCI participants. The figure below shows that the mean MLE estimates with 95% confidence intervals for the trunk scale scores and level and extent of spinal cord injury. The scores clearly distinguish between able bodied and SCI participants.

Hypothesis	Result	Outcome
$r_{LT, TS} > r_{UEM, TS}$	.627 (.562, .684) > -.047(-.146, .053)	+
$r_{PP, TS} > r_{UEM, TS}$	.588(.519, .650) > -.047 (-.146, .053)	+
$r_{LT, TS} = r_{LEM, TS}$	.627 (.562, .684) = .696 (.641, .744)	+
$r_{PP, TS} = r_{LEM, TS}$	.588(.519, .650) = .696 (.641, .744)	+
$r_{Age, TS} = 0$	.098 (.-.002, .196)	+
$r_{Gender, TS} = 0$	-.044(-.056, .143)	+
$r_{BMI, TS} = 0$	.002 (-.098, .102)	+

LT = light touch, PP = pin Prick, TS = trunk scale, UEM = upper extremity motor, LEM = Lower extremity motor, BMI = Body Mass Index.



Conclusion

This study presents data that shows the trunk scale is a reliable and valid instrument for assessing a subject's control of the trunk musculature following SCI. The trunk scale is quick and easy to administer. More research is needed to more fully understand the metric properties of this instrument. For more information

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NIDILRR
National Institute on Disability, Independent Living, and Rehabilitation Research

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