SEGMENTAL TRUNK AND HIP JOINT MOTION ANALYSIS DURING SIT-TO-STAND TASK IN STROKE PATIENTS

Thesis
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ABSTRACT

The purposes of this study were to evaluate the segmental trunk (including thoracic and lumbar spine) and hip joint movements during sit-to-stand task, and to assess balance in both stroke patients and healthy normal subjects. Thirty stroke patients and ten normal subjects participated in this study. Patients were divided into two equal groups according to the degree of spasticity of the affected lower limb measured by Modified Ashworth Scale. All subjects were assessed for balance by Berg balance scale and for the range of motion of thoracic, lumbar spine and hip joint by three- dimensional motion analysis system during sit-to-stand task. The results showed significant differences in balance score and in thoracic, lumbar spine and hip joint range of motion (during the two phases of sit-to-stand movement except the second phase for the hip joint) among the three groups. It was concluded that stroke patients had altered pattern of movements of thoracic, lumbar spine and hip joint during sit-to-stand task that appear in the form of increasing thoracic, lumbar spine and hip joint flexion during pre buttock lift-off phase and a longer sit-to-stand duration as compared to normal subjects.

Key words: stroke. sit-to-stand. segmental trunk. hip. three-dimensional motion analysis. balance.

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LIST OF ABBREVIATIONS

1/3 thigh:	At junction of the proximal one-third with the distal two-thirds of a line joining the apex of the greater trochanter and midpoint of the lateral knee joint line.
2-D:	Two dimensional.
3/4 thigh:	At the junction of the proximal three quarters and distal one-quarter of a straight line joining the apex of the greater trochanter to the midpoint of the lateral knee joint line.
3-D:	Three-dimensional.
ANOVA:	Analysis of variance..
A-P:	Antero-posterior.
ASIS:	Anterior superior iliac spine.
BBS:	Berg balance scale.
BOS:	Base of support.
BMI:	Body mass index.
C6:	Sixth thoracic vertebra.
C7:	Seventh thoracic vertebra.
Cm:	Centimeter.
COG:	Centre of gravity.
COM:	Centre of mass.
COP:	Centre of pressure.
EMG:	Electromyography.
FIM:	Functional Independence Measures.
Fig.:	Figure.
FSTS:	Forward sit to stand.
GIa:	Group Ia; mildly spastic stroke patients.
GIb:	Group Ib; moderately spastic stroke patients.
GII:	Group II; normal subjects.
GM:	Gluteus medius
HAT:	Head, arms and trunk.
ICC:	Intra class correlation coefficient.
Kg:	Kilogram.

Kg / m2:	Kilogram per meter square.
L1	First lumbar vertebra.
L4:	Forth lumbar vertebra.
LO:	Lift-off.
LSD:	Least Significant difference.
Lt :	Left.
m2:	Meter square .
MAS:	Modified Ashworth's Scale.
MCU:	Motion capture unit.
M-L:	Medio-lateral.
No.:	Number.
NSTS:	Normal STS.
PC:	Personal computer.
PSIS:	Posterior superior iliac spine.
QUA:	Quadriceps.
Q:	Qualisys.
r:	Pearson Correlation Coefficient.
ROM:	Range of motion.
Rt:	Right.
SD:	Standard Deviation.
S2:	Second sacral vertebra (the midpoint between the two posterior superior iliac spines.
sec:	Second.
SPSS:	Satistical package for social science.
STS:	Sit-to-stand.
SD:	Standard deviation.
T1:	First thoracic vertebra.
T4:	Forth thoracic vertebra.
T10:	Tenth thoracic vertebra.
TA:	Tibialis anterior.
TFL:	Tensor fascia lata.
yr:	Year.

CHAPTER I
INTRODUCTION

A cerebrovascular accident or stroke has been defined as the sudden onset of neurologic signs and symptoms resulting from a disturbance of blood supply to the brain. It was classified as either hemorrhagic or ischemic. Ischemic strokes can be subdivided into two major categories: those that result from thrombosis and those that result from an embolus, whereas hemorrhagic strokes including those that are caused by intracerebral hemorrhage, subarachnoid hemorrhage, and arteriovenous malformation (**Martin and Kessler, 2007)**. Approximately, 70 percent of all cerebrovascular accidents are due to ischemia, 20 percent are due to hemorrhage, and the remaining ten percent have an unspecified origin **(Reyson et al., 2001).**

Rising from a chair is performed many times daily and is important prerequisites to the achievement of many functional goals **(Chou et al., 2003),** as well as, maintaining independence in everyday life **(Eriks-rud and Bohannon, 2003)**. Inability to perform this essential activity may lead to dependence, institutionalization and even death in elderly subjects **(Janssen et al., 2002)**. This task requires some skills as coordination between the trunk and lower limbs, muscle strength, equilibrium and stability and it is often considered into clinical evaluation scales of different pathologies **(Galli et al., 2008)**. Following stroke, the ability to rise from a chair is reduced **(Roy et al., 2007)**. The most common reason concerned with the difficulty of rising from a chair in stroke patients is mainly related to difficulty in generating timing and sufficient force in the lower limb extensor muscles to propel the body mass vertically (**Carr and Shepherd, 1998).**

Although a seemingly simple task, sit-to-stand (STS) movement requires the coordinated interaction of linked body segments to transport effectively the body's centre of mass (COM) in a horizontal then vertical direction while maintaining balance over a small base of support, the feet. The basic kinematic include flexion of the trunk and hips to bring the COM forward, followed by bilateral extension of the lower limb joints and trunk extension to raise the body mass in a vertical direction over the feet **(Roebroeck et al., 1994).**

Trunk control requires coordinated interaction of the spine and hip and it is a prerequisite for independence in functional activities as STS transfer. Loss of trunk control is commonly observed in stroke patients. Impairment in trunk control may lead to increased risk of falls, visual dysfunction secondary to resultant head/neck malalignment, decreased independence in activities of daily living and decreased sitting and standing tolerance and balance **(Gillen and Burkhardt, 1998).**

Three dimensional (3-D) analysis system has been used as an accurate quantitative assessment of human movements in different degrees of freedom. It is as an objective method that can be used for studying the control and coordination of the trunk and lower extremity functions.

A major reason for the focus on trunk movement is that during the rehabilitation of people with neurological impairment, trunk alignment and