Anthropologist, 13(1): 43-46 (2011)
PRINT: ISSN 0972-0073 ONLINE: ISSN 2456-6802
DOI: 10.31901/24566802.2011/13.01.08

Assessment of Postural Stress among Inmates of Old Age Home in India

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KEYWORDS Total Range of Motion. Shoulder External/Internal Rotation. Gross Spinal Flexion

ABSTRACT The present study was conducted to appraise postural stress among inmates of old age homes in Kumaon region of Uttarakhand State of India. Twenty per cent elderly people (N=60) were selected from an old age home (Geeta Kutir), for the study. Goneometer was used for the postural stress measurements. The findings depicted that using electric switch board was most stressful in shoulder external rotation. Picking an article from the upper shelve of cupboard was more stressful in cervical extension movement than in cervical flexion movement (picking articles from lower shelve of cupboard). Using lower shelves were much more stressful than that of using storage spaces (middle shelves) in gross spine movement. It is recommended that the electric switch boards and other articles should be placed according to the principles of ergonomics. It can be concluded that neglect of ergonomic principles brings inefficiency and pain to the elderly people in the workplace. This research therefore, highlights the essential key factors that should be considered as the main criteria when designing the old age home.

INTRODUCTION

The aging process modifies normal postural alignment, and flexed posture commonly increases with age. Posture arises from the functional demands of vision, reach, manipulation, strength and endurance and is constrained by the geometric relationship between the person's own anthropometric and the layout of workplace. Hand and arm posture, while using upper shelves of the storage spaces, are frequently mentioned as a risk factor for upper extremity musculoskeletal disorders. Haslegrave (1994) reported that posture is as important for the performance of tasks as it is for promoting health and minimizing stress and discomfort during work. Barbaccia (1995) stated that the musculoskeletal dimensions, mechanical performance, flexibility of joints, muscle strength, bone composition are all important factors in the physiological system and changes occur in these with ageing. Arthritis, Heart disease, Diabetes, Difficulty with vision and Hearing are more common in older people. These problems with muscles and joints, as hip fractures really contribute to a decrease in activities of daily living. Of the various anatomical structures, the cervical muscles and filamentous structures are very susceptible to injury. A forward head position and rounded shoulders have been implicated in the development or perpetuation of craniomandibular disorders. According to Barton (1992), by the age of 65, 90 per cent of the population has radiological evidence of cervical spondolysis due to poor posture at work. Cervical spine degradation is a potential cause of neck pain because of the mechanical changes which occur as a result of age related degenerative processes. Grozdanovic (2002) noted that "muscular loading during upper limb intensive work has been linked to the development of chronic muscle problems in the shoulder…" Two common stresses to shoulders are extreme shoulder flexion that occurs in long reaches, and static shoulder loading that occurs when people have to work with their arms elevated. It is essential to review the comfort ability level provided by the old age home in India.

MATERIAL AND METHODS

Purposive sampling design was chosen to select the samples due to the reason that not much research work has been carried out in this area. The present study was conducted in Kumaon region of Uttarakhand State, India. Twenty per cent out of the total elderly people (N=60) ,were randomly selected from the old age home (Geeta Kutir) of Haridwar District, located in the Garhwal region of Uttarakhand State, India. Goneometer was used for the postural stress measurements. The Dualer IQ measure spine ranges of motion using dual inclinometers. The primary and secondary sensors are only connected when used for dual inclinometer measurements, such as spine Range of Motion (ROM). In dynamic mode, it automatically records the furthest end point (greatest range of motion) for each movement. For the measurement of shoulder flexion, single inclinometer is used in Dynamic/ Static mode. Turn the primary sensor on position. Press the Dynamic/Static button to display the static mode (symbol). Place the inclinometer on a flat surface, such as a wall, or on the subject and press the start/stop button to establish 0. Attach the primary sensor to the upper arm with a strap. Have subject stand with arm down and shoulder in neutral position. Have subject flex the shoulder maximally; press the start/stop button to record the angle. For the measurements of shoulder external rotation, attach the primary sensor to the forearm with a strap. Have subject stand or sit with shoulder abducted to 90 degrees, elbow flexed to 90 degrees, and upper arm in neutral rotation. Have subject externally and internally rotate the shoulder. For taking measurement with the subject seated and cervical spine in neutral, place the secondary sensor in the sagittal plane at T1 and primary sensor in the sagittal plane on the calvarium. Make sure the sensors do not slip during flexion and extension. If slippage occurs the primary sensor can be positioned above the ear using strap now subject flex and extend cervical spine. For the measurements of gross spinal flexion place, both primary and secondary sensors on a wall and press the start/stop button to establish 0. With the subject standing upright in a neutral position, knees straight and weight equally on both feet. Press the Dynamic Static button to display the Dynamic/Static mode. Place the primary sensor at T1 and the secondary sensor over the sacral mid point in the sagittal plane and have the subject flex forward maximally record angle. Dualer IQ simultaneously measures and display provides T1 ROM (primary sensor), Sacral ROM (secondary sensor) and Total Range of Motion (ROM) with each flexion. The Total ROM value is the difference in angle between the Primary and Secondary inclinometers. It is produced by subtracting the secondary movement value from the primary movement value. The normal range of shoulder external rotation = zero to 90 degree and shoulder forward flexion = zero to 180 degree. The normal range of cervical flexion/extension = zero to 45 degree as per the impairments rating.

RESULTS AND DISCUSSIONS

The findings in Table 1 depicted that using electric switch board was most stressful in shoulder external rotation. Consistent to these findings as the number of work cycles with awkward postures (duration of severe flexion or abduction is 10% or more of the work cycle) increased, also the risk of shoulder disorders increased (Punnett et al. 2000). Bonde (2001) recently published a study on shoulder disorders and postural stress and concluded that severe shoulder flexion or abduction is predictive of chronic or recurrent shoulder disorders. Picking article from upper shelve of cupboard was more stressful in cervical extension movement (Table 2) than from lower shelve in cervical flexion movement. McEvoy (2005) reported that the cervical angle is the measure of the forward-head position, which is a useful clinical marker of mid/ lower cervical spine posture. In their comprehensive review, Ariens et al. (2000) reported a relationship between neck pain and neck flexion,

Table 1: Upper extremities shoulder external rotation/flexion

Type of activity	*Primary sensor (º) mean repetitions*			*Total range of motion*	*Deviation*
	Ist	*IInd*	*IIIrd*	*Mean (º)*	*(360º- ROM value)*
External Rotation					
1. Opening/closing door latches	45º	44º	42º	43.6º	316.4º
2. Opening/closing window	23º	29º	25º	25.6º	334.4º
3. Using electric switch board	62º	64º	60º	62.0º	298.0º
4. Using platform for keeping articles	43º	38º	37º	39.3º	320.7º
5. Using T.V./music system	36º	39º	41º	38.6º	321.4º
Shoulder Flexion					
6. Using platform for keeping articles	58º	47º	55º	53.3º	306.7º
7. Using lower shelve of cupboard	65º	75º	72º	70.6º	289.4º
8. Picking articles from floor	105º	105º	109º	106.3º	253.7º

arm force and abducted arm posture. Many studies focus on risk factors of neck and shoulder disorders, both areas simultaneously. In addition, the dividing line between the neck and shoulder area is ambiguous (Kuorinka et al. 1987; Sluiter et al. 2001). Moreover, kyphosis and compensative cervical and lumbar spine hyperlordosis can cause pain due to ligaments and muscles impairment (Ryan 1994). Spinal flexion was measured for using storage spaces of the lower and the middle shelves in the room. Using lower shelves were much more stressful than that of using storage spaces (middle shelves) in gross spine movement (Table 3). Consistent to these findings, increased flexed posture has been associated with less independence when performing activities of daily living and reduced physical performance, such as impaired balance, reduced postural control and slower walking, as well as the risk of falling (Balzini 2003). There are few studies that investigate methods to improve flexed posture, and especially the relationship with the multiple impairments associated to flexed posture (Katzman et al. 2007). In the literature, several studies have reported the use of goniometers, inclinometers, electrogoniometers and photometric techniques (Dunk et al. 2004). Pringle (2003) reported a systematic review of published research, which reported on sitting posture measurement tools, nine relevant papers describing only three measurement approaches (goneometer, inclinometer and flexi curve). Unfortunately, few measures for this spinal section are reported in the literature. Least fatigue occurs when body can be kept in balance, that is, when there is the least demand on muscular system to keep the body upright. It can be concluded that neglect of ergonomic principles

Table 2: Upper extremities cervical flexion/extension

Type of activity	*Primary sensor (°)*		*Secondary sensor (°)*		*The difference in angle total ROM (°)*		*Deviation (180°- The difference in angle ROM value)*
	Repetitions	*ROM value*	*Repetitions*	*ROM value*	*Repetitions*	*ROM value*	
Cervical Flexion							
Picking articles from cupboard	I^{st}	38°	I^{st}	28°	I^{st}	10°	170°
(lower shelves)	II^{nd}	36°	II^{nd}	27°	II^{nd}	9°	171°
	III^{rd}	44°	III^{rd}	39°	III^{rd}	5°	175°
Mean		39.3°		31.3°		8°	172°
Cervical Extension							
Picking articles from cupboard	I^{st}	30°	I^{st}	1°	I^{st}	29°	151°
(upper shelves)	II^{nd}	25°	II^{nd}	1°	II^{nd}	24°	156°
	III^{rd}	25°	III^{rd}	3°	III^{rd}	22°°	158°
Mean		26.6°		1.6°		25°	155°

Table 3: Gross spinal flexion range of motion while using storage spaces

Type of activity	*Repetitions*	*Primary sensor (°)*	*Repetitions*	*Secondary sensor (°)*	*Repetitions*	*The difference in angle total ROM value (°)*	*Deviation (180°- The difference in angle ROM value)*
Using storage spaces	1	133.3°	1	129.0°	1	4.3°	175.7°
(Lower shelves)	2	137.3°	2	132.3°	2	5.8°	174.2°
	3	135.8°	3	130.1°	3	5.6°	174.4°
	4	137.1°	4	133.1°	4	4.0°	174°
	5	137.8°	5	133.5°	5	4.5°	175.5°
	6	140.5°	6	134°	6	6.1°	173.9°
Mean		136. 96°		132°		5.05°	174.95°
Using storage spaces	1	121.1°	1	119.3°	1	1.8°	178.2
(Middle shelves)	2	121°	2	119.5°	2	1.5	178.5
	3	111.1°	3	109.1°	3	2°	178°
	4	111.3°	4	109.6°	4	1. 7°	178.3°
	5	102°	5	99.8°	5	2.2°	177.8°
	6	107.3°	6	105.3	6	2°	178°
Mean		112. 3°		110. 43°		1. 87°	178.13°

brings inefficiency and pain to the elderly people in workplace. This research therefore, highlights the essential key factors that should be considered as the main criteria when designing the old age homes.

CONCLUSION

Hand and arm posture while using upper shelves of the storage spaces is frequently mentioned as a risk factor for upper extremity musculoskeletal disorders. The electric switch boards, designing of lower shelves are needed to be redesigned ergonomically to avoid mis-match between human body dimensions and the placement of frequently deal with these crucial areas. Although it was stressful but found to be in normal ranges in impairments rating. From the foregoing study it is observed that the elderly people faced difficulties to utilize electric switch board, picking article from upper shelve of cupboard and using lower shelves. It can be concluded that neglect of ergonomic principles brings inefficiency and pain to the elderly people in workplace.

RECOMMENDATIONS

It is recommended that the electric switch boards and other articles should be placed according to the principles of ergonomics. Ergonomic design is a way of considering design options to ensure that peoples' capabilities and limitations are taken into account. Along with gerontechnology, it would help reduce the effects of age-related impairments with technological devices thus, improving the home environment. This research therefore, highlights the essential key factors that should be considered as the main criteria when designing the old age home.

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