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RESEARCH ARTICLE

RELIABILITY OF UPRIGHT POSTURE MEASUREMENTS IN MIDDLE GRADE SCHOOL STUDENTS

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ABSTRACT

Background: Changes in the lifestyle of school student are one of the most important factors for the postural problems that are developing in students. This study aims to find the reliabity of postural measurements within trial and across trial measurements.
Method: In this study, 97 middle grade school students (10- 11 years) were included. Photographs were taken in sagittal plane in 2 trial and 3 sessions which were assessed quantitatively and reliability was calculated.
Results: Postural measurements of upright position in both within trial and across trial were found to be significant reliable.
Conclusion: The study reveals significant intra subject reliability of upright postural measurements.

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INTRODUCTION

Posture is defined as the upright well balanced position of individual person (Fialka- Moser, 2010). Correct upright posture is considered to be an important indicator of musculoskeletal health (Maureen P Mc Evoy and Karen Grimmer, 2005). School going children have different environment in today's life because of increasing competition, advanced technology that children deal with, changes in sedentary life style so it is very important area to be looked at. Posture of middle school children is a very important area to be concentrated on because postural control which is required for maintaining the posture reachesadult maturity by 7–10 years (Maureen P Mc Evoy and Karen Grimmer, 2005; Woollacott, 1989) and also there are many predisposing factors which may have an adverse effect on posture such as carrying heavy backpacks (Deepali Nivrutti Hande, 2012; Federico Balague, 2012 and Simo Taimela, 1997), computer (Gillespie, 2006 and Sjan Mari van Niekerk *et al.*, 2008), growth spurt (Sjan Mari van Niekerk *et al.*, 2008), poor muscle strength, poor motor control, improper environmental conditions in school (Limon, 2004). Bad postural habits in school children can result in many complications such as back pain, neck pain, growing pain, postural deformities etc (Eduardo, 2001). Childhood and adolescence back pain is a consequence of bad posture. Its prevalence rate is 10% to 70 % (Mohammad Hoseinifar *et al.,* 2007).

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Researches show that the prevalence of back pain ranges up to 45% in adolescents (Kate, 2011). In recent years, research has shown that the incidence of LBP has increased among children and adolescents (Anna Ahlqwist, 2012). Hence postural screening and evaluation is an important aspect in school going children for prevention evaluation and treatment of primary and secondary musculoskeletal condition. Postural measurement has no standard approach to measureposture (Maureen *et al.*, 2005). Methods used commonly are qualitative method and quantitative method (Elizabeth Alves, 2010). Qualitative method is often objective and abnormalities are visually inspected, this form of qualitative assessment has low sensitivity as well as low intra and inter rater reliability. Quantitative method allows quantifying the postural measurements which helps to succinctly document. Reliability of any method used for measuring the postural measurements is very important. Intra subject reliability is important because it gives significant information about how consistent is the measurements for an individual within single session or multiple sessions. This study will give intra subject reliability of upright postural measurements in middle grade school students which can then further used for screening, evaluation and treatment purposes in middle grade school students and thus helpful in improving their quality of life.

MATERIALS AND METHODS

100 Students of 6th standard with mean age between 10 to 11 years participated in the study of which 3 were excluded. The included both male and female students. Study excluded

students with physical disabilities as per school list, any diagnosed history of recent musculoskeletal trauma (recent fracture, dislocation, sprain, strain, wounds etc), any bone or joint pain present currently, non cooperative subjects. Students with a known diagnosed history of congenital anomalies, any known diagnosed history of neurological disorders, any diagnosed systemic, connective and muscular disorder.

The subjects were instructed to stand comfortably in upright position over the floor marker placed on the ground and were instructed to look straight ahead at a pre-determined point on the wall. Reflective ball markers were then placed by adhesive double tape over right-sided lateral landmarks of the body i.e. lateral canthus of the eye, tragus of the ear, spinouts process of C7, greater trochanter and lateral malleolus. To allow for visualization of the marker placed on greater trochanter, the subject will be further instructed to flex his or her elbow and then move elbow slightly forward but still touching the body and with minimal shoulder movement.

Then photographs were be obtained by using a digital camera (Canon 14.1 Megapixel) attached to a tripod stand which will be placed at a distance of 2 m and in a direct line from the subject. The tripod stand was secured in the correct position on the floor by using floor markers, also to standardize subject placement and to ensure that the subject's right side was aligned perpendicular to the camera. The positions were checked prior to taking each photograph. Participants attended 2 session each consisting of 3 trials. 2 sessions were taken on 2 consecutive days in morning with same uniform. After each trial, subjects were instructed to move away from the testing position, walk around a small area and then return to same position where next trial will be taken. So in this manner 3 trails will be conducted in one session.

The anatomical markers were not moved between the photographs and their positions will be rechecked prior to second photograph to ensure that they are secure in place.

On the 2nd consecutive day 2ndsession was performed in which again markers were placed in similar manner but floor markers and tripod stand markers were not removed. After taking photographs, angles in the photographs were analyzed by using, Image analysis software (Image Tool UTHSCA Version 3.0,). Angles that were analyzed were trunk angle, neck angle, gaze angle, head on neck angle and lower limb angle given in table number 1 and statistical analysis was done by SPSS 20 software. ICC was calculated between taken within trial and across trial.

RESULTS

The study included 97 subjects of 6th standard with same age group between10-11 years with both gender. Aim of this study was to find reliability of postural measurements within trial and across trial First part was to calculate the reliability of postural measurement within trial for which mean and standard deviation was calculated for each of the two session in each trial for all 5 angles and were named as:-

S1T1- First session and first trial
S1T2- First session and second trial
S1T3- First session and third trial
S2T1- Secondsession and first trial
S2T2-Second session and second trial
S2T3- Second session and third trial

Mean and standard deviation was calculated of all angles and ICC was calculated among them to find the reliability of postural measurements within trial. Second part of the study was to calculate ICC across trial for which mean and standard deviation of each angle in two trials was calculated and labeled as

T1S- Mean of first trial
T2S- Mean of second trial

Mean and standard deviations of each of the 5 angles was calculated in 3 sessions of each of the 2 trials of different

Table 1. List of names of angles measured

Name of Angle	Method
Neck Angle	Angle between line passing from tragus of ear and canthus of eye horizontal line passing from tragus of ear
Gaze Angle	Angle between line passing from tragus of ear and canthus of eye and line from C7.
Head on Neck Angle	Angle between line passing through c7 and tragus of ear and line passing from head and neck.
Trunk Angle	Angle between the line drawn from greater trochanter and C7 and the straight vertical line from greater trochanter.
Lower Limb Angle	Angle between the line drawn from Lateral malleolus and greater trochanter and straight line from lateral malleolus.

Table 2. Mean and Standard deviation of angles measured

Variables	S1 (Session 1)			S2 (Session 2)		
	T1 Trial 1	T2 Trial 2	T3 Trial 3	T1 Trial 1	T2 Trial 2	T3 Trial 3
Neck Angle	26.9±7.8	26.8±7.9	26.9±7.8	27.3±7.8	27.6±7.9	27.3±7.7
Gaze Angle	12.1±8.1	12±8	12.3±8.2	14.1±8.7	13.8±8.6	14± 8.7
Head on neck Angle	-61.2±6.7	-61.4±6.7	-61.1±6.8	-62.3±7.4	-62.7±7.5	-63.1±7.4
Trunk angle	- 9.3±2.8	-9.7±2.9	-9.5±2.8	-9.8±2.6	-10.4±3.2	-10.1±3
Lower Limb Angle	-6.1±2.5	-6.3±2.6	-6.8±2.4	-5.8±2.5	-5.3±2.3	-5.6±2.5

Table 3. ICC values of within session and across session

Vari-able	Neck Angle		Gaze Angle		Head on Neck Angle		Trunk Angle		Lower Limb Angle	
	1st Session	2nd Session	1st Session	2nd Session	1st Session	2nd Session	1st Session	2nd Session	1st Session	2nd Session
ICC Within session	0.99	0.99	0.99	0.99	0.99	0.98	0.98	0.91	0.95	0.91
ICC across session	0.95		0.96		0.94		0.84		0.91	

angles are shown in Table number 2 and standard deviation of all angles ICC was calculated shown in Table number 3.

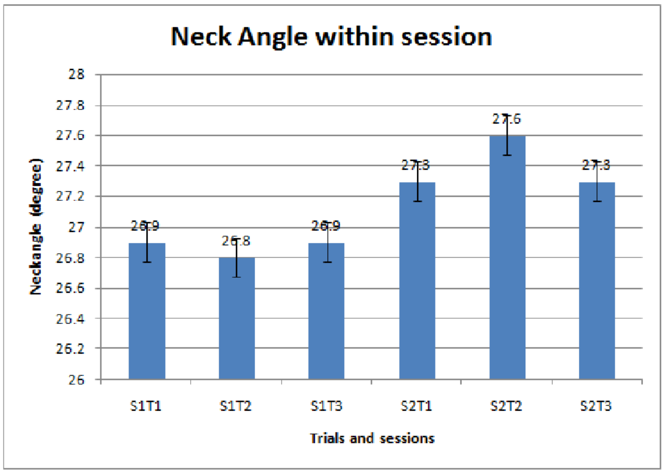
Reliability of postural measurements

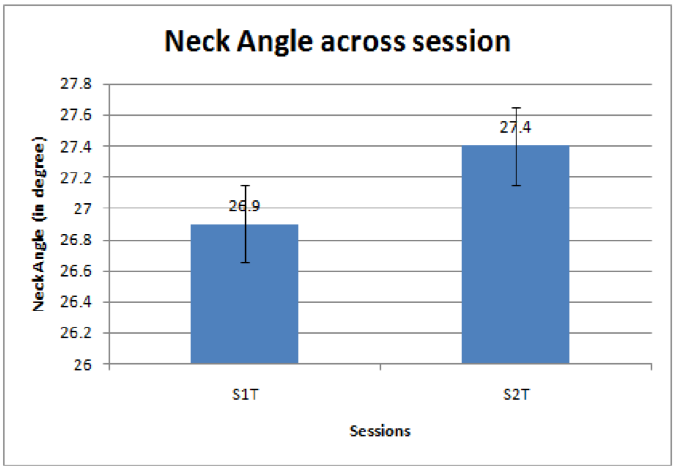
This study suggested that children's standing posture which was quantified by 5 angles in sagittal plane namely neck angle, gaze angle, head on neck angle, trunk angle and lower limb angle did not change significantly on repeated testing. ICC calculated for all 5 angles within session was in range from 0.91 to 0.99 and for across session was in range from 0.91 to 0.96 which shows that there was good reliability according to Wahlund classification (Elizabeth Alves *et al.,* 2010). The results in the study showed that negative values were obtained for 3 angles namely; head on neck angle, trunk angle and lower limb angle which are shown in table number 7 to 11. Negative values as per Cartesian coordinate system. The mean trunk angle value obtained were -9.8±2.7 and-10.1±3 indicating sway back posture which increases pelvic inclination angle. Sway back posture results in the spine bending back sharply at lumbosacral angle, this results in shifting of pelvis anteriorly thus causing hip to move in extension which results in tightness of hip extensors, lower lumbar extensors, and upper abdominals. The mean neck angle values obtained were 26.9±7.9and 27.4±8 on 2 consecutive days.

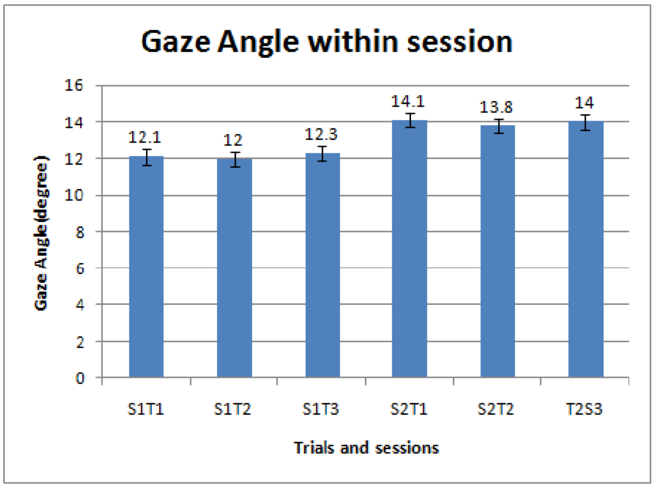
This angle is a measure of head and neck position in relation to trunk. This angle gives a measure of forward head position. A large neck angle reflects that head and neck are anterior to trunk which is referred as forward head posture in which head is positioned anteriorly and the anterior convexity is increased with the apex of lordotic cervical curve at a considerable distance from the LOG in comparison with optimal posture.

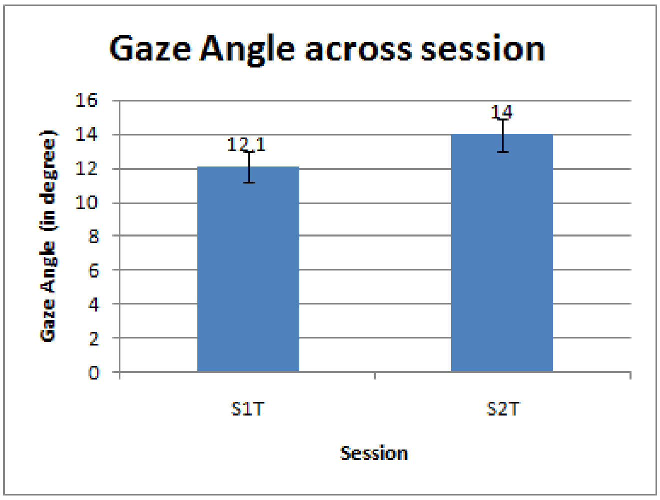
The constant assumption of forward head posture causes abnormal compression on posterior zygapophyseal joints and posterior portions of the intervertebral disks and narrowing of the intervertebral foramina in the lordotic areas of the cervical region. This angle is indicator of mid and lower cervical spine dysfunction. The mean gaze angle in 2 consecutive days was 12.1±8.1and 12.4±8.5. This angle indicates variation in line of sight. Head on neck angle values were-61.1±6.7 and -62.6±7 in 2 consecutive days. This angle reflects poking chin. A decrease in this angle results in poking chin. Mean values of lower limb angle was -5.8±2.5 and -6.4±3 on 2 consecutive days which suggests the position of hip in relation to base of support when an individual is standing. If this angle increases, it indicates that hip is anterior to base of support.

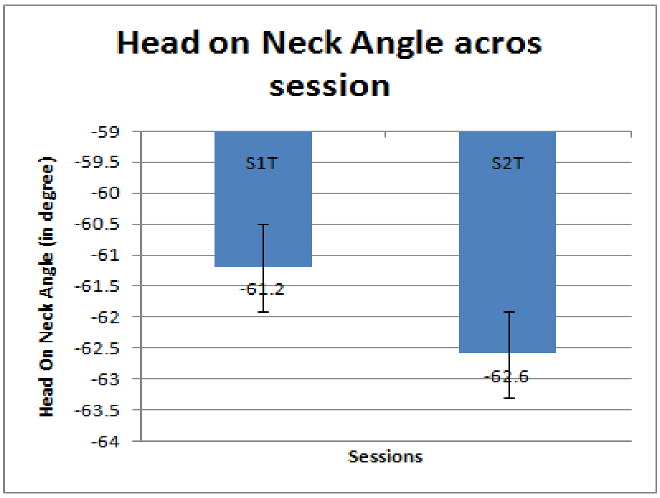
Graphical representation of mean and standard error of all 5 angles

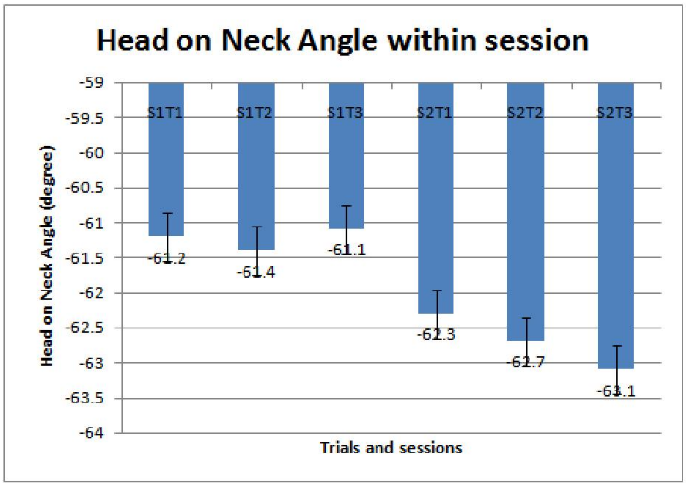


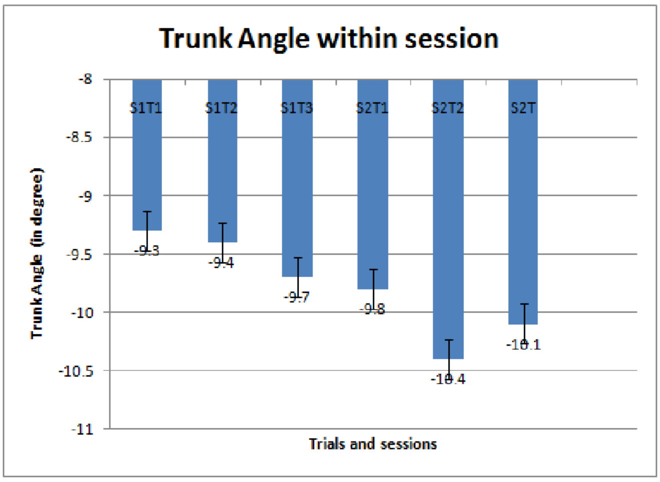


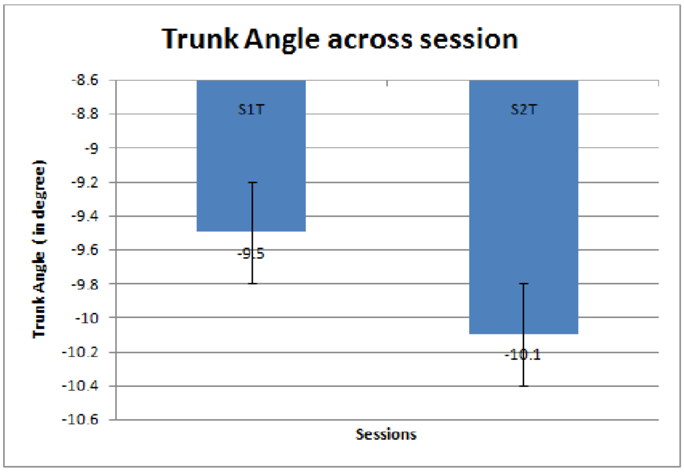


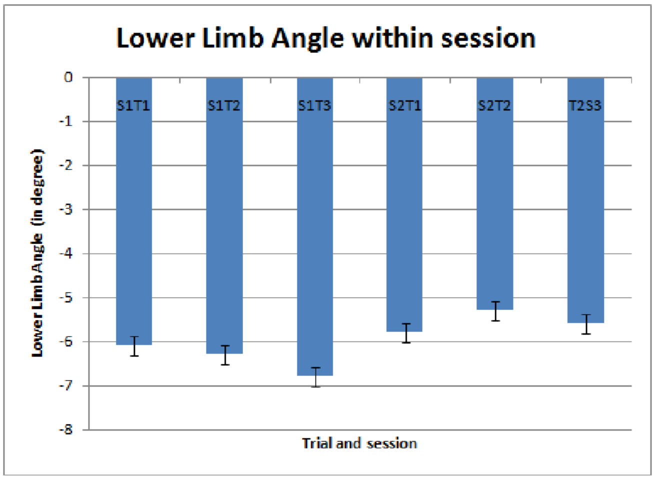


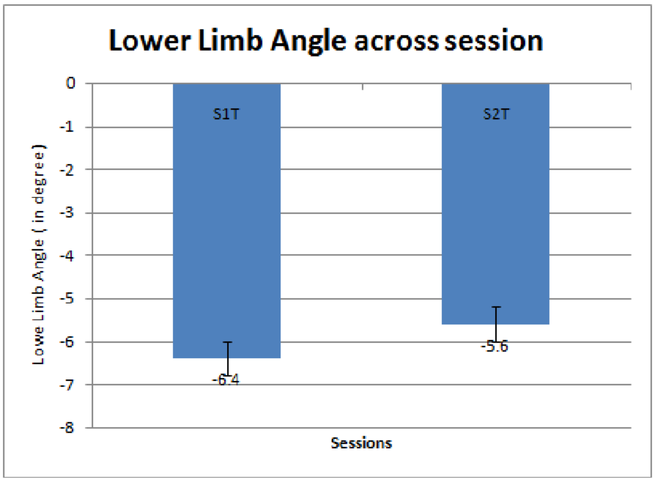












Conclusion

The study has revealed that on testing of repeatability of five postural angles of sagittal plane in middle standard school students, there was no significant effect of repeated testing. Postural measurements were found to be reliable in both within session and across session thus, postural measurements are reliable to be used by physical therapist in clinical practice for screening, diagnostic and prognostic purposes.

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Conflict of Interest

There was no conflict of interest in study. Source of funding This research was a self-funded research. Ethical Clearance Ethical clearance was taken by University level committee.

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