Inter-rater reliability of Electronic Head Posture Instrument (EHPI) for measuring Cranio-vertebral angle in young adults

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ABSTRACT

Purpose: Forward head posture and degree of anterior translation of head can be assessed using Cranio-vertebral angle (CV angle). Recent literatures use Electronic Head Posture Instrument (EHPI) to measure CV angle without exposing the patient to X-ray. **Objective and Study design:** This observational study was cross-sectionally designed and aimed to find out the reliability of Electronic Head Posture Instrument (EHPI) in measuring Cranio-Vertebral Angle of young adults. **Methods:** 100 apparently healthy young adults were assessed for the CV angle by two Physiotherapy student investigators who are skilled in measuring CV angle using EHPI in two separate sessions of 20 minutes gap with the same instrument. The measurements of CV angle by the two investigators were documented and taken for statistical analysis. **Results:** The mean difference in the Cranio-Vertebral Angle between the two measurements was 0.46 (+/-) 0.79. The inter-class correlation coefficient for inter-rater reliability of Cranio-Vertebral Angle (CV Angle) by Electronic Head Posture Instrument (EHPI) was 0.925, with the corresponding $P=0.001$. **Conclusion:** The study results exhibit a significant strong positive correlation between the two measurements supporting a high reliability of EHPI in measuring CV Angle.

KEY WORDS: Electronic Head Posture Instrument, Non-specific neck pain, Forward Head Posture, Anterior Head Translation, Cranio Vertebral Angle.

Introduction

The use of smartphones for games and surfing internet rather than communication is obvious. Young generation uses smartphones at very early age. This makes alterations in head on neck posture [1]. Forward head posture (FHP) is the most adopted posture of young adults those who spend more time on smartphones, laptops or personal computers [2, 3]. Various ailments of head, neck and shoulder like myalgia, migraines, cervicogenic headache are expected out of FHP in young age [4-6].

Severity of symptoms is directly proportional to the time spend on smartphones [7]. The centre of the gravity was shifted as the head moves forward. To compensate for this shift in the centre of the gravity, upper body drifts backward and shoulders slump forward so that the head is placed anterior to the trunk [8, 9]. It pre disposes the individuals towards pathological conditions like temporomandibular disorders, vertebral bodies disorders, soft tissues length and strength alteration, or even scapula and shoulder dyskinesis [6, 10].

Because of these associated problems, assessment of head posture has become increasingly gaining the importance in clinical practices. It helps in evaluating and designing treatment regimens for patients with neck pain. The biomechanical variation due to forward head posture can be best predicted by measuring the Cranio-vertebral angle [11]. It is the angle formed by a horizontal line drawn by through the spinous process of the seventh cervical (C7) vertebra and a line joining the spinous process of C7 vertebra with the tragus of the ear [12,13].

Some studies used lateral photographic imaging to measure CV angle [11,12]. Herman et al compared the CV angle obtained by assessing the anterior translation of head in lateral cervical radiographs with the measurement of Electronic Head Posture Instrument (EHPI) in patients with mechanical neck pain and suggested EHPI as a valid tool to assess cervical posture [13]. Exposing the patients to radiation need a hospital setup and inconvenient to use in all places. Measuring CV angle by EHPI scale is accurate to one decimal place and the Electronic sensor reads the angle automatically [14,15]. This study focuses to estimate the Inter-rater reliability of Electronic Head Posture Instrument (EHPI) in measuring CV angle of young adults. We hypothesize that the measurements of EHPI accurately represents the CV angle.

Materials and Methods

This observational cross-sectional study was carried out in the Department of Physical Medicine and Rehabilitation, RMMCH at Annamalai University, Chidambaram. The samples were recruited through non-probability sampling method and their informed written consent was obtained. Inclusion: apparently healthy young adults, aged between 20-30 years, both gender. Exclusion: history of neck and back pain for at least 12 months, Visual deficits, diagnosed balance disorders, musculoskeletal pathologies, displayed functional & structural scoliosis, Excessive thoracic kyphosis.

100 subjects were assessed for their CV angle by two physiotherapy students who were skilled in measuring CV angle using EHPI at two separate sessions. The sessions were apart by 20 minutes of the same day. Both the skilled assistants were unaware of other's data. The two measurements were documented separately and taken for further statistical analysis of inter- rater reliability.

Procedure of measuring CV angle using EHPI

CV angle was measured by the electronic head posture instrument, an electronic angle finder mounted on a transparent plastic base and a tripod camera stand. The C7 spinous process was palpated and identified and an adhesive pin marker was attached over its midpoint of the most prominent part. The participant was then asked with his/her left shoulder in front of the EHPI.

Another pin marker was fixed at the tragus of the ear. Participants were instructed to stand/sit comfortably with his/her weight distribution evenly on both feet and keep the eyes looking straight forward. A virtual line was drawn between the two pin markers from midpoint of the tragus to C7 [13].

Statistical analysis

Descriptive statistics in terms of mean, standard deviation of CV angle measured by rater-1 and rater-2 was made. The mean difference in the CV angle obtained from two assessments was analyzed using interclass correlation co-efficient method. The statistical analysis was made using Statistical Package for Social Sciences –SPSS Version. 21.

Results:

To satisfy the purpose a sample of 100 young adults were recruited. Among them 52 were males and 48 were females. Their CV angle were statistically analysed and the following results were drawn.

Table 1: Descriptive statistics of CV angle.

CV angle	Mean	SD
Rater 1	46.67	2.33
Rater 2	47.13	2.42
Difference in CV Angle	0.46	0.79

(CV angle values were in degrees)

It was observed from table 1 that, the mean value of CV angle measured by rater one was 46.6 degrees and rater two was 47.13 degrees. The mean difference in the Cranio-Vertebral Angle between the two measurements was 0.46 (+/-) 0.79 degrees.

Table 2: Reliability of EHPI in measuring Cranio-vertebral angle.

<i>Cranio – vertebral angle</i>	<i>Inter-class correlation coefficient</i>	<i>p-value (<0.05)</i>
Head posture instrument	0.925	0.001

P <0.005 is significant.

It is inferred from table 2, that the inter-class correlation coefficient for inter-rater reliability of Cranio-Vertebral Angle (CV Angle) by Electronic Head Posture Instrument (EHPI) was 0.925, with the corresponding p = 0.001.

Discussion

Poor head posture is generally accepted as one of the causes for neck pain because poor postural awareness and habitual poor postural may result in greater loading and the supporting structure and may cause sensitization and pain currently, upright posture evaluation is recommended as part of the comprehensive physical examination of the cervical spine. However, head posture is difficult concept to capture, which is usually assessed subjectively or by complicated procedures. A clinically convenient, reliable and valid assessment tool for head posture needs to be developed.

The present study evaluated the inter-rater reliability of measuring cranio-vertebral angle using electronic head posture instrument (EHPI) by two well trained physiotherapists. A total of 100 samples satisfied the selection criteria were included and they were assessed CV angle using EHPI and recorded. The result of the study showed a high positive correlation between the two measurements. The obtained results coincides with Hermam mun, et.al who found that the good reverse co-relation ($r = 0.72$) between the EHPI measurement of CV angle and radiological measurement of AHT and supported that head posture assessment should be included in the clinical assessment for patients with neck or upper back pain [13]. The study done by Yip et al concluded that CV angle correlated negatively with neck pain questionnaire and NPRS score and recommend the clinicians to pay special attention to patients with smaller CV angle as they were prone to higher pain intensity and neck disability [8].

The present study was limited to young adults and healthy population. Further studies on various neck disorders and comparing the CV angle obtained in EHPI with angle formed in X-ray can be carried out.

Conclusion

There was a significant strong positive correlation of 0.925 was observed between the two measurements of Cranio-vertebral angle assessed using Electronic Head Posture Instrument. The mean difference in the two readings was 0.46 degrees which was negligible. The result signifies the reliability of Electronic Head Posture Instrument to assess the CV angle. Therefore, the study recommends the use of EHPI by Physiotherapists to assess the CV angle without complex instruments at any type of clinical setup.

Ethical Approval

The study protocol got ethical clearance from the Institutional Human Ethics Committee, Rajah Muthiah Medical College, Annamalai University.

Source of support - Self.

Conflict of interest – None

Acknowledgement

We would like to acknowledge Dr. Dhanpal Singh, Professor & Head, PMR - RMMCH for his constant support and all our participants those who willingly participated in the study.

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