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Original Article

Physiotherapy Section

Inter-rater Reliability of Posture Pro 8 Software Analysis in Upper Body Dysfunction: A Prospective Study

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ABSTRACT

Introduction: Postural compensatory movement impairment is the most common musculoskeletal problem in all age-related population. Upper body dysfunction is a new terminology of movement impairment where the subjects have discomfort in either the neck, shoulder, or upper back region mainly due to poor postural adaptation. Varying postural analysis methods are in practice; however, photography of subjects on posture software analysis is very rarely used. The literature on using this postural analysis software is also not adequately available.

Aim: To evaluate inter-rater reliability of the Posture pro 8 software for measuring the postural changes from digital photos of subjects with upper body dysfunction.

Materials and Methods: This study has a prospective cross-sectional study design and obtained ethical consent from the Institutional Ethical Committee before participants enrolment. Sixty participants of both sexes (28 males and 32 females) with neck, shoulder, or upper back problems for more than three months participated in this reliability study. The lateral-view photos of the participants in a relaxed standing posture were taken. Postural evaluations of the photos of the participants were performed by three observers with a repetition after a week. In this study, postural abnormalities of the participants were evaluated by the three observers using the Posture pro 8 software.

Results: Inter-rater reliabilities were calculated using Intraclass Correlation Coefficients (ICC). ICC value of 0.774 and 0.972 were found to be in the range of acceptable to excellent between the observers.

Conclusion: Postural evaluations of the participants with upper body dysfunction using the Posture pro 8 software were found to be reliable and repeatable. The present method was an easy and non-invasive method and may be utilised by researchers who are in search of an alternative method for postural assessments.

Keywords: Dysfunction, Musculoskeletal problem, Posture analysis

INTRODUCTION

One of the hallmarks of a healthy musculoskeletal system is maintaining the correct upright posture. The Posture Committee of the American Academy of Orthopaedic Surgeons defines good posture as the balance of the musculoskeletal system that protects the supporting structures of the body against injury or progressive deformity, irrespective of the body position [1]. The increase in incidence rate with gradual rise in the cost of musculoskeletal injuries leads to an increase in research studies investigating ways to maintain correct upright posture. In previous studies, several methods for performing more accurate postural assessments such as X-ray scanners and computerised photographic systems [2,3] were used. Due to radiation side effects, the X-ray method of imaging is avoided in the extended study literature. Even though, the 3D motion analysis is a rational and results in images good in quality, it is too expensive method and occupies more space. Therefore, it is not used very often [4]. The photographic posture analysis method enables angular calculations using anatomical reference points and is a digital, more objective measurement method, whereas other methods such as observational analysis using the line of gravity and flexible ruler are considered as basic and observational measurement methods [5,6]. Photogrammetry is a widely used non-invasive technique for postural evaluation and, in the future, will be more useful for healthcare professionals and researchers in the field of postural assessment [7]. In general, this method allows a concise and exact quantitative evaluation by recording subtle changes in posture [8], and reliability studies of photographic manual posture analysis have been performed only on normal subjects. The accuracy of photographic method of posture analysis has been recommended in the health care practice with evidence [9]. The present study aimed to investigate the inter-rater reliability of the participants with upper body dysfunction using Posture Pro 8 software. In this study, we sought to address whether the postural evaluation by the three observers will be more reliable and correlate with each observer using the Posture pro 8 software.

MATERIALS AND METHODS

This is a prospective double-blinded cross-sectional study with a sample size calculated from average value of population participated in previous studies [3]. The study was conducted for five months (August 2016 to January 2017). Participants were randomised (60 participants) in equal proportions to three groups using random numbering methods, stratified by age and sex. After explaining the procedure and its benefits, an informed consent was taken from the participants (35-55 years). Subjects with recent trauma, poor balance and neurological problems were excluded from the study. An Institutional Ethics Committee approval was obtained. Participants were randomly allocated into three groups for the time convenience of participants (each group with 20 participants). Each participant in the three groups was given a prior appointment slot at the outpatient orthopaedic department, and erect standing sagittal plane photographs have been taken by a three investigators using a digital camera. Photographs were taken at a distance of 2 m, who were educated about the Posture pro 8 software one week before the posture analysis of the participants took the photos using the software. In the present study, the Posture pro 8 software was used as it was

simple and cost-effective. The participants were positioned 2 m away from the camera mounted on a tripod at a height of 115 cm. The same distance was maintained between the camera and the participant, by marking the point for the subjects to stand on and the tripod fixed on to the floor. The participants were informed before the evaluation and stood in a relaxed standing position barefoot. The lateral-view photos of the participant's affected side were taken. The photos of all the participants were separately taken by a three investigators. The posture number value may vary from one to five mild changes in posture, five to 10 moderate changes and >10 severe posture changes in subjects with upper body dysfunction (nearing to the numerical value of zero represents normal posture) was calculated using the posture analysis software by immediately pointing the three areas of the participant's photo exactly over the earlobe, shoulder tip, and greater trochanter which were a standard protocol of landmarks used for sagittal view analysis. We have bought this Posture pro 8 software which was newly developed by the National Posture Institute, United States. The software can be installed in any version of laptop or computer, and the images of participants were uploaded in that software; the bony landmarks of the upper body of images had been clicked by the three investigators in a separate session. This software will calculate the postural deviation of the participants as degrees, which is converted into posture number values within a few seconds [10]. This posture number was categorised such that nearing to the posture number zero is set to be normal posture. In the clinical settings, the posture number value of participants can be shown visually on the software analysed image which will give them an idea of abnormal posture and for the researcher it will be a good outcome measure tool. Rousson V et al., stated that both intra and inter-rater reliabilities depend primarily on the training of the raters [11]. Three investigators repeated the evaluation of the participants posture one week later for test-retest analysis using the Posture pro 8 software. Inter-rater reliabilities of the three investigators were calculated using ICC.

McEvoy MP and Grimmer K utilised the photographic method in their research study as a tool to assess the posture [12]. Pausic J et al., explained very clearly in their research study the method of postural analysis that was followed in our postural evaluation study [13].

STATISTICAL ANALYSIS

Test-retest and inter-rater reliabilities were calculated using ICC, and a p-value <0.05 indicated statistical significance.

RESULTS

In the present study, 60 volunteer middle-aged adults (28 males and 32 females) with an age range of 35–55 years were included and evaluated using photographic posture analysis. The demographic data of the participants are presented in [Table/Fig-1]. Excellent correlations were observed between two evaluations of the same observer on the same photograph in terms of the posture number of upper body deviation (ICC varied between 0.774 and 0.972) [Table/Fig-2].

Characteristics of participant	Baseline data (n=60)
Male/Female	28/32
Age (years)	49±4
Height (cm)	162.4±5
Weight (kg)	67.0±5.2
Body Mass Index (kg/m^2)	22.4±2.3

[Table/Fig-1]: Demographic characteristics of the participants.

DISCUSSION

In the present study, the inter-rater and test-retest reliabilities of the photographic posture analysis using the Posture pro 8 Software for the evaluation of upper body deviation were investigated with a group of adults as participants and were found to be reliable, confirming the hypothesis of our study. The study had 60 participants and the evaluation of the upper body deviation using the Posture Pro 8 software, the inter-rater reliability (ICC>0.972) and test-retest (ICC>0.774) reliability values were in the range of acceptable to excellent. In the future, this study result can be used as a reference, and the researchers can also consider this software for the evaluation of postural deviation. The photographic method that is used as a measurement of spinal alignment is further recommended for its simplicity, cost effectivity, and possibility of creating a database to document postural ability [14]. Even though photogrammetry is recognised as a valid and reproducible instrument for monitoring treatment progression, in both clinical practice and research, the trial studies based on this tool are very less [15]. Ferreira EA et al., classification of inter-rater and intra-rater correlation was followed as a reference in this study ICC values are grouped into four categories with ICC less than 0.70 as non-acceptable, between 0.71 and 0.79 as acceptable, between 0.80 and 0.89 as very good and greater than 0.90 as excellent [3]. In this study, the ICC values found for the test-retest and inter-rater reliability of upper body deviation were categorised as "acceptable" or "excellent", showing that the Posture pro 8 software analysis method is reliable. McEvoy MP and Grimmer K measured the reliability, in their study of 38 participants with an age range of 5–12 years, and obtained the ICC values of 0.93 and above [12]. Perry M et al., calculated reliability values in volunteers with an age range of 13–17 years and obtained inter-rater and intra-rater reliability values of 0.40–0.75 and 0.75–0.90, respectively [4]. Pausic J et al., assessed the consistency of manual and auto photo analysis method by measuring the angles and found the results with evidence support for both the methods [13]. The postural problems are more frequent and painful, which may have a negative impact on the quality of life in adulthood, leading to musculoskeletal problems [16]. Therefore, postural surveys of adults are of great importance and the subjectivity of the present measurement methods being costly and requiring an equipment that is difficult to carry is among the difficulties of conducting postural surveys of a healthy population. The interpretation and analysis of a 3D posture evaluation require proper training and adequate laboratory space [17]. Even though the computer based software is a success in the scientific community, the photographic method provides a value of 2D quantification of the body, and true postural changes may be concealed by the plane assessed [18]. Perry M et al., stated that the observer experience in marking the pointed landmarks, position of the camera and participant's position could affect the reliability of photographic posture analysis and it is simple, cost-effective method of posture assessment [4]. Pausic J et al., included only the male participants in their study [13]. It was observed from the results that the reference points used for postural evaluation in the present study was reliable and repeatable. According to Dunk NM et al., the marking of the vertical line is inaccurate compared to biological references because the innate error that occurs when measuring the vertical line is added to the error sustained when measuring the anatomic markers, thus influencing the results [19]. In addition, Lunes DH et al., found similar results when assessing global posture while standing [20]. The method was shown to be reliable and may be used as a substitute photographic posture analysis method in

Posture Number	Investigator 1 (mean±SD)		Investigator 2 (mean±SD)		Investigator 3 (mean±SD)		ICC1	ICC2
Upper body deviation	Test value	Retest value	Test value	Retest value	Test value	Retest value	0.774	0.972
	19.4±4.9	19.4±5.4	19.4±4.7	19.3±4.8	20.1±4.2	19.5±4.5		

[Table/Fig-2]: Inter-rater and test-retest reliabilities of the investigators.
ICC-Intraclass correlation coefficients

extensive field surveys because it is more economical and convenient in terms of both availability and application. We concluded that inter-rater reliability was high. Study by Niekerk SM et al., obtained similar results when pictures were used for assessment of head, shoulder, and chest positions [21].

LIMITATION

Both the paediatric and geriatric population were not considered for this study.

CONCLUSION

Postural evaluation using the Posture pro 8 software was found to be reliable and repeatable. Posture pro 8 software would be an easiest and non-invasive technique of posture assessment which can be used by many researchers in future studies. This new postural analysis tool may improve the healthcare practice by facilitating the analysis of varying posture deviations for both upper and lower body dysfuctions.

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