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ORIGINAL

Reliability and validity of angular measures through the software for postural assessment. Postural Assessment Software

R.M. Ruivo*, **P. Pezarat-Correia**, **A.I. Carita**, **J.R. Vaz**

Faculdade de Motricidade Humana, Universidade de Lisboa, Portugal

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KEYWORDS
Goniometry;
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Abstract
Introduction: Static posture analysis with the aid of specific software with images is beneficial for large-scale studies and facilitates the diagnosis, planning and follow-up of any physiotherapy treatment. Therefore, this study aimed to determine test–retest and inter-rater reliability and validity of computerized photogrammetry using the Postural Assessment Software (PAS) in relation to goniometry.
Materials and methods: Universal Goniometers were placed in a wall of the Lab, making it possible to obtain four angular measures. A digital camera was positioned on a tripod at a height of 147 cm and at a distance of three meters from the wall. A photo was taken with the four goniometers. Two more photos were taken, and the goniometer angles were changed within each photo, obtaining 12 different angular values. Each photograph was analyzed by the three raters using the Postural Assessment Software. Bland–Altman method was used to document the agreement between raters and between Goniometry and Postural Assessment Software.
Results: There were no statistical differences between the two evaluation methods: goniometry and PAS software. The Bland–Altman graph supported the strong consistency between methods, with an average difference equal to 0.06. The use of PAS software was also shown to be intra-rater reliable, with the three raters (A, $p = 0.17$; B, $p = 0.31$; C, $p = 0.17$) with no statistical significant differences between the first and the second measurement, and to have good inter-rater reliability with no statistical differences between raters.
Conclusions: Postural Assessment Software is an accurate and reliable method when compared to the goniometry.

PALABRAS CLAVE
Fiabilidad;
Fotogrametría;
Goniometría;
Postura;
Validez

Fiabilidad y validez de las medidas angulares con un programa para la evaluación postural. Programa informático de evaluación postural

Resumen
Introducción: El análisis estático fotográfico de la postura con la ayuda de software específico es práctico para estudios a gran escala y facilita el diagnóstico, la planificación y acompañamiento de cualquier tratamiento fisioterapéutico. El objetivo fue determinar tanto test-retest e

* Corresponding author.
E-mail address: rodrigo.ruivo@netcabo.pt (R.M. Ruivo).

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inter-calificadores fiabilidad y validez de la fotogrametría computerizado con el software de evaluación postural (SAP) en relación con goniometría
Materiales y métodos: Los goniómetros universales se pusieron en una pared del laboratorio, permitiendo la obtención de 4 medidas angulares. Una cámara digital se coloca en un trípode a una altura de 1,47 metros y a una distancia de 3 metros de la pared. Una fotografía fue tomada con los cuatro goniómetros y dos fotos más fueron tomadas cambiando los valores angulares de los goniometros entre cada foto, totalizando doce valores angulares diferentes. Cada fotografía fue analizada por los tres evaluadores utilizando el Software de Evaluación postural. Método de Bland–Altman se utilizó para documentar un acuerdo entre los evaluadores y entre Goniometría y Software de Evaluación postural.
Resultados: No hubo diferencias estadísticamente significativas entre los dos métodos de evaluación: goniometría y el software de SAP. La gráfica de Bland-Altman ratificó la fuerte consistencia entre los métodos, con una diferencia media igual a 0,06. El uso de PAS software también mostró ser fiable intra-calificadores (los tres evaluadores no presentaron diferencias significativas entre la primera y la segunda medición) y tener una buena fiabilidad entre evaluadores, sin presentar diferencias estadísticamente significativas entre ellos.
Conclusiones: Software de evaluación postural es un método preciso y fiable en comparación con la goniometría.

Introduction

Posture can be described as the positioning of all body segments at a given point in time[1] and it is an important health indicator.[2] Postural deviations and abnormalities are potential etiological factors in the pathogenesis of regional or widespread musculoskeletal disorders,[3,4] with several clinical pain syndromes such as neck pain[5,6] or chronic tension-type headache.[7] In this context, postural realignment is a goal often sought by physicians, dentists and physiotherapists and regular postural assessment is needed.

Most of the times the postural assessment is qualitative and subjective, depending on past experiences and personal interpretations, with a low intra- and inter-rater reliability, and abnormalities are identified only through visual inspection.[8] More strict procedures, with a quantitative postural assessment, are crucial and may help the physician to monitor treatment outcomes.[9] To perform these quantitative assessments there is an increasing number of tools, methods and software, such as photogrammetry, with Postural Assessment Software (PAS/SAPO) and goniometry.

The goniometry is a very widespread method in physiotherapeutic clinic to measure joint angles[10] and it is used to assess range of motion.[10,11]

In addition to this method, nowadays, recent technological advances have paved the way for a development of other highly reliable and applicable methods, such as computer-assisted systems for the analysis of posture photographs – photogrammetry.[2,12] This method of obtaining reliable information technology about physical objects and the environment, by means of recording processes, measurement and interpretation of photographic images has become widely used in the quantitative assessment of postural alignment, with the possibility of quantifying linear and angular measurements[8] and with the advantage of allowing the record of subtle postural changes and the interrelation between different parts of the human body, which are difficult to measure and register by other means.[8,13] Some specific software has been developed to assist posture assessment from digitalized pictures such as PAS/SAPO (Postural Assessment Software).[9]

This software has been developed to assist posture assessment from digitalized pictures and allows the measurement of distances and angles, it is easy to use and it is accompanied by scientific tutorials. It includes features of image calibration, zoom change, free point marking and corporal angles and distances measurements.[9] To confidently use all these advantages and measurement possibilities the instrument used has to be reliable, accurate and valid. To confirm these premises, we used the comparison with goniometry, the most common method in physical therapy practice with a good to excellent reliability.[14] Therefore, the present study aims to analyse the intra-rater and inter-rater reliability and the validity of computerized photogrammetry using the PAS in relation to goniometry. The hypothesis tested in this study was that a photography-based method with the aid of Postural Assessment Software would be more accurate and reliable compared with conventional goniometry.

Materials and methods

This study was conducted in the Laboratory of Motor Behavior of the Interdisciplinary Centre for the Study of Human Performance (CIPER), of the Faculty of Human Kinetics, Technical University of Lisbon.

Four Universal Goniometers (Enraf Nonius) were placed in a wall of the Lab, between two plumb lines. To mark the points, three metal pieces were used, with 89.5 cm distances in the vertical axis and 82.5 cm in the horizontal axis. One Canon Power Shot A4000 IS was placed on a tripod Manfrotto, model 055 CLB (height of 147 cm) and were positioned 3 meters away from the wall. Three styrofoam balls with 20 mm diameter were placed in Universal Goniometers (Enraf Nonius), in the fulcrum, in the centre of the movable ruler and in the centre of the fixed ruler. After this, an expert who regularly uses a goniometer placed four goniometers with the styrofoam balls in the panel, with different known