



ISB 2013
BRAZIL

XXIV CONGRESS OF THE INTERNATIONAL
SOCIETY OF BIOMECHANICS

XV BRAZILIAN CONGRESS
OF BIOMECHANICS

INTER RATER RELIABILITY IN THORACIC AND LUMBAR ANGLES ANALYSIS USING THE FOTOGRAMMETRY

¹Alessandra Beggiato Porto, ²Celina Maria Quirino, ¹Tulio Bernardo Macedo Alfano Moura,
³Bruno Secco Faquin and ⁴Victor Hugo Alves Okazaki

¹Undergraduation Student of Londrina State University, PET scholarship

²Undergraduation Student of Londrina State University, Araucaria scholarship

³PhD student of Londrina State University

⁴Tutor and Professor of Londrina State University; email: porto_ale@hotmail.com.

SUMMARY

The most common postural deviations which occur in the spine can be quantified using the photogrammetry method. However, the reliability of the measures performed by an examiner can be compromised once this method depends on a specialized training. This study aimed to analyze the inter rater reliability using photogrammetry. For this, 29 volunteers, aged between 17 and 35 years old, were analyzed by 2 examiners (A and B) previously trained (30 hours of practice). The C7, T12 and L5 vertebrae were identified by palpation and external markers (5cm and 1cm² base) were attached on skin with double-sided tape. The photogrammetry was performed by each examiner, 3 sections of 3 photos of the participants, with 3 meters walking between each photo. The photos were taken in sagittal plan and orthostatic position, staring at a point in front at the eye's height. The images were transferred to a computer in which the 'x' and 'y' spatial coordinates of each marker were identified (PAINT software) to calculate the thoracic and lumbar angles (Microsoft Excel software). The results showed high reliability between the examiners for thoracic ($ICC=0.91$ with a 95% CI of 0.81→0.96) and lumbar ($ICC=0.89$ with a 95% CI of 0.74→0.94) angles. In the Bland-Altman test \bar{d} was -10.3° , 95% limits of agreement $-21.1^\circ \rightarrow 0.5^\circ$ for thoracic angles and $\bar{d} = -10.5^\circ$, 95% limits of agreement $22.5^\circ \rightarrow 1.4^\circ$ for lumbar angles. The results suggest that, with specialized training, the method of photogrammetry for the analysis of the thoracic and lumbar angles can be reliable.

INTRODUCTION

The postural assessment has been utilized by decades, both in clinical practice and in research, working as a diagnostic tool of the treatment planning and attendance [1]. There are some postural assessments methods, some of them are quite subjective that classify the postural deviation according to experiences in clinical analysis and sometimes cannot be applied in research [2]. In other hand, there are methods that can quantify the postural angles such as: flexicurve method, radiograph, and a method that is been used broadly nowadays, the photogrammetry [1].

The *American Society of Photogrammetry* defines photogrammetry as a reliable way to obtain information about objects and the environment by image measurements and interpretations, [3]. However, as this method depends on examiner's specialized training, the reliability of the measures performed by an examiner can be compromised. This study aimed to analyze the inter rater reliability using photogrammetry for the analysis of the thoracic and lumbar angles.

METHODS

Participated in this study 29 volunteers, 14 males and 15 females, aged between 17 to 35 years old. Weight and height were recorded and the BMI (body mass index) were calculated. It was included in the study only the participants that presented BMI normal (18.6 to 24.9 Kg/m²), according to the World Health Organization (WHO, 2000). The tests were performed in the Group of Studies and Research in Motor Development and Learning Laboratory (GEPEDAM) of Londrina State University. The procedures were explained to the participants and a consent term was signed.

The participants were asked to sit on a plastic stool (40cm). The men were without T-shirt and the women wore bikini vest on top. The procedures were performed by two examiners (A and B), previously trained (30 hours of practice). Firstly, the examiner A, identified the position of the C7 vertebral process, and then the process of each vertebra were palpated individually up to L5 vertebra. The C7, T12 and L5 vertebrae process were marked with a black eyeliner (AVON) and on these markers, external markers with a filament of 5cm and base of 1 cm², both made of cardboard, were attached to the participants' skin with double-sided tape (3M). After the C7, T12 and L5 vertebral processes were marked, the participant stood in orthostatic position, staring at a point in front at the eye's height. In sagittal plan, 3 photos were taken with a digital camera (OLYMPUS, 12 megapixel) that was placed 1,5m distance from the participant on a tripod of 1m height. After the photos were taken, the examiner A took off the external markers and cleaned the skin with a soft cotton and alcohol (70%, VEJA brand). Thus, the examiner B performed the same procedure and the examiner order was randomized

between the participants. The photos were transferred to the computer in which the 'x' and 'y' spatial coordinates of each marker were identified (PAINT software) to calculate the thoracic and lumbar angles (Microsoft Excel software). Figure 1 shows a subject with the markers and the thoracic and lumbar angles calculated. For statistic analysis, the ICC (intraclass correlation coefficient) was applied as well as the Bland-Altman test to check the variability between the examiners. It was adopted a significance of 5% ($P>0.05$).

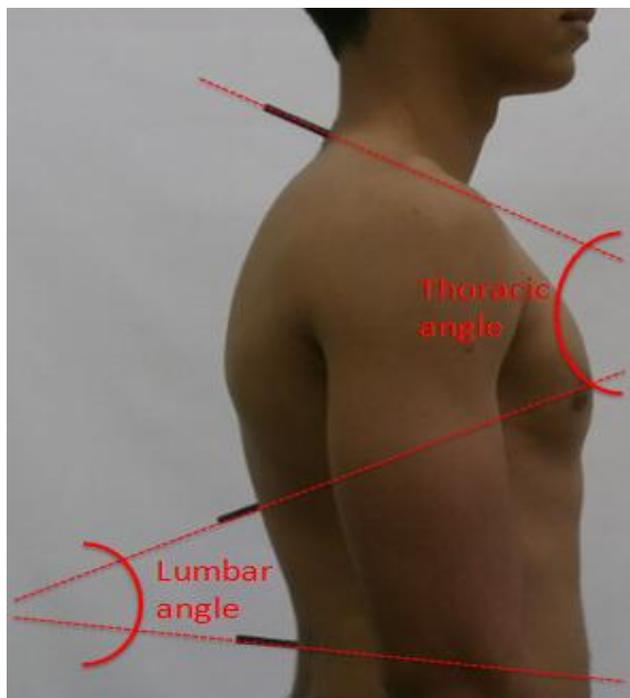


Figure 1: Thoracic and lumbar angles.

RESULTS AND DISCUSSION

The results showed high reliability between the examiners for thoracic ($ICC= 0.91$ with a 95% CI of $0.81\rightarrow 0.96$) and lumbar ($ICC=0.89$ with a 95% CI of $0.74\rightarrow 0.94$) angles. In the Bland-Altman test \bar{d} was -10.3° , 95% limits of agreement $-21.1^\circ\rightarrow 0.5^\circ$ for thoracic angles (Figure 2-A) and $\bar{d} = -10.5^\circ$, 95 limits of agreement $22.5^\circ \rightarrow 1.4^\circ$ for lumbar angles (Figure 2-B).

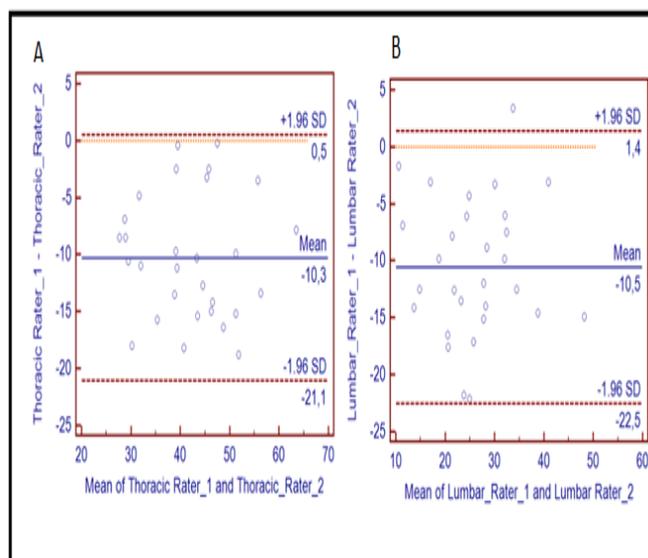


Figure 2: Limits of agreement of the Bland-Altman test for thoracic and lumbar angles.

The results showed that, even with few hours of practice provided to the examiners (30 hours), the method for the analysis of the thoracic and lumbar angle can be reliable. This may be explained by the proper training provided to the examiners and by the easiness of finding the vertebral process of the spine in the participants of the study.

CONCLUSIONS

The results suggest that, with specialized training, the method of photogrammetry for the analysis of the thoracic and lumbar angles can be reliable. Therefore, photogrammetry method can be an interest feature for posture analysis, specially due to its low cost, fast application, easy analysis and interpretation, and high accuracy and reliability.

REFERENCES

1. Iunes DH, et al. Confiabilidade intra e interexaminadores e repetibilidade da avaliação postural pela fotogrametria. *Rev. Bras. Fisioter*, São Paulo, Brazil, **9**:327-334, 2005.
2. Sarraf TA, et al. Diferenças entre medidas qualitativas e quantitativas durante testes de comprimento músculo-tendíneos dos flexores do quadril uni e biarticulares. *Rev. Bras. Fisioter*, São Paulo, Brazil, **9**:195-202, 2005.
3. Tommazelli AMG et al, Fotogrametria: aplicações a curta distância. FCT 40 anos, Perfil Científico Educacional, Presidente Prudente, Brazil, 147-159, 1999.
4. World Health Organization (WHO). Obesity: preventing and managing the global epidemic. Geneva: World Health Organization, 2000.