Comparative Study on the Posture of Individuals with and without Cervical Pain

S.R.G.P. Galera[1], L.F.C. Nascimento[2], E.C.M. Teodoro[1], and J.E. Tomazini[1]

[1] Graduate student. São Paulo State University. Campus of Guaratinguetá., Brazil
[2] Department of Medicine – University of Taubaté. Taubaté, Brazil

Abstract — **Posture can be defined as the overall position and spatial orientation of the human body and its members relative to each other. The study of posture can be applied either static, with the subject standing still. Objectives: to identify and quantify the static posture alignment of individuals who were either symptomatic or asymptomatic for cervical pain. Methods: A cross-sectional study was carried out on subjects with cervical pain and individuals with no complaints of pain. The procedure consists in placing markers on specific points. Several views, following the protocol of the Posture Assessment software, regarding the measurement of angles (in degrees) and differences in lower leg lengths (in centimeters). Angles were analyzed through the comparison of averages between the groups using test *t* Student, (alpha=5%). Results: There enrolled 27 subjects. There were differences in horizontal alignment of head (3.37x1.33), acromia (2.60x1.18), iliac spines (2.91x0.67), vertical alignment of head (25.70x18.26) and in length of lower limbs (1.36x0.75) in respect to cervical and asymptomatic subjects. Conclusions: Was possible identify and quantify the static posture alignment of individuals with and with no cervical pain. The data obtained suggest the presence of asymmetry in all the symptomatic individuals studied. The data obtained suggest the presence of overall asymmetry in all the symptomatic individuals studied.**

Keywords— **posture, assessment, spinal column, cervical pain.**

I. Introduction

As the support for the body, having to withstand considerable impact and load, the spine is generally involved in bodily disorders of a postural nature [1]. Posture can be defined as the overall position and spatial orientation of the human body and its members relative to each other [2].

Human posture has been studied in its biomechanical aspects. Structural and functional disorders cause imbalances and compensatory behavior that could cause important alterations. The study of posture is applied, which can be either static or dynamic [3]. Static posturography addresses erect, undisturbed posture, with the subject standing still [4].

To quantify posture assessment methods, a large number of diagnostic instruments have been used in the physiotherapy field, such as the isokinetic dynamometer and computerized posturography. These devices are currently considered the most precise, objective manner to perform posture assessments [5]. Photography is a common and quite effective procedure, as it allows analysis through the recorded image. Thus, visualization becomes more detailed, with a lower margin of error, which cannot be said for methods that depend upon the subjectivity of the evaluator.

The aim of the present study was to identify and quantify the positioning of body segments of subjects with cervical pain in an erect posture from the anterior, posterior, right lateral and left lateral views and compare these subjects with asymptomatic individuals using posture assessment software.

II. Writing the paper

A. Methods

A cross-sectional study was carried out with individuals who were either symptomatic or asymptomatic of spine cervical pain. Subjects were divided into two groups: asymptomatic individuals and those with cervical pain. The following were the inclusion criteria for the two groups: sufficient cognitive level to understand the procedures, following orientations, and answer questions related to patient history; no use of prosthetics or braces; no lasting effects of any accident that cause limitations in active movement; and no history of neurological disease or syndrome.

The following materials were used: Digital camera; tripod; polystyrene passive markers; blackboard; white chalk; non-extendable millimeter scale; digital scale (Filizola);

O. Dössel and W.C. Schlegel (Eds.): WC 2009, IFMBE Proceedings 25/IX, pp. 131–134, 2009.
www.springerlink.com

plumb line marked with two polystyrene balls. The protocol for the subject history was provided by the SAPO postural assessment computational software program, available at http://sapo.incubadora.fapesp.br.

Following the localization of the anatomic demarcation points, subjects were photographed in anterior, posterior, right lateral and left lateral views. Small polystyrene foam balls cut in half were used as markers. The balls were previously prepared with double-face adhesive tape and placed over the specific anatomic points. A blackboard was used in order to assure the same base in the four photographs. Subjects positioned themselves freely atop the blackboard for the first photograph and the outline of their feet was traced. Subjects were instructed to position themselves directly upon the same mark for the subsequent photographs. The camera was positioned three meters from the subject. A plumb line marked with two polystyrene balls place one meter apart was used for the calibration of the photo.

Anatomic points were marked on the head, trunk and lower limbs. The choice of anatomic points was made based on criteria regarding relevant clinical analyses. Such points were chosen for their importance to scientific research and for the possibility of minimizing errors in localization through knowledge regarding palpatory anatomy [6].

The photographs were transferred to a computer using a USB interface and analyzed on the *SAPO* program. These points are part of the computational program employed. As the present study did not take into consideration the sides referring to the inclinations of the segments, the angle measurements were considered in module.

Analysis of variance (Test *t* Student) was used in the statistical analysis for the comparison of averages between the two groups. Data were compiled on the Microsoft Excel and Epi-Info 6.04 software programs.

B. Results

Twenty-seven subjects participated in the study, 13 (48%) with neck pain and 14 (52%) with no complaints of pain. Thirteen subjects (48%) were male and fourteen were female (52%). The age of the participants ranged from 35 to 55 years, with an average of 40,42 years of age. Tables 1 and 2 display the results of the ANOVA test.

In the anterior view, horizontal alignment of the head was different between the two groups (p = 0.004). In the trunk region, the angle measurement between the two acromia and the two anterior superior iliac spines exhibited the greatest significant difference between the groups (p < 0.001). Subjects with cervical pain exhibited difference in length between the lower limbs when compared to the other group (p<0.04). There was a significant difference between groups regarding the vertical (p = 0.04) and horizontal (p = 0.07) alignment of the head in the right lateral view. All subjects with cervical pain exhibited forward lean from the center of gravity. No significant difference between groups was observed in the posterior and left lateral views.

Table 1: Average angle values in degrees, assessed in the anterior and posterior views, with respective standard deviation (sd) for 27 subjects pertaining to the cervical pain (CA) and asymptomatic (AA) groups.

Anterior view	**CA (sd)**	**AA (sd)**
Head		
Horizontal alignment of head #	3.37 (1.72)	1.33 (1.19)
Trunk		
Horizontal alignment of acromia	1.89 (1.14)	1.05 (1.11)
Horizontal alignment of anterior superior iliac spines#	2.60 (1.59)	1.18 (0.70)
Angle between the two acromia and the two anterior superior iliac spines#	2.91 (1.78)	0.67 (0.48)
Lower limbs		
Frontal angle of lower right limb	3.55 (2.54)	2.45 (1.98)
Frontal angle of lower left limb	2.97 (2.05)	2.37 (2.18)
Difference in length of lower limbs (R-L)	1.36 (1.29)	0.75 (0.46)
Horizontal alignment of tuberosity of tibias	3.29 (3.11)	2.77 (1.93)
Right Q angle	23.63 (9.46)	19.26 (12.84)
Left Q angle	18.47 (11.24)	19.70 (11.52)
Posterior View		
Trunk		
Horizontal asymmetry of scapula in relation to T3	13.76 (13.15)	16.20 (14.71)
Lower limbs		
Right leg/hindfoot angle	7.32 (5.63)	9.58 (6.87)
Left leg/hindfoot angle	10.71 (5.39)	12.97 (8.10)

p-value <0.01

Table 2: Average angle values in degrees, assessed in the right and left lateral views, with respective standard deviation (sd) for 27 subjects pertaining to the cervical pain (CA) and asymptomatic (AA) groups.

Right Lateral View	CA (sd)	AA (sd)
Head		
Horizontal alignment of head (C7)	44.21 (4.99)	47.19 (3.40)
Vertical alignment of head (acromion) #	25.70 (5.31)	18.26 (7.47)
Trunk		
Vertical alignment of trunk	6.11 (3.26)	5.68 (2.67)
Angle of hip (trunk and lower limb)	11.22 (4.91)	11.47 (3.94)
Vertical alignment of body	1.01 (1.25)	1.26 (0.83)
Horizontal alignment of pelvis	15.45 (21.41)	11.25 (6.39)
Lower limbs		
Angle of knee	6.21 (3.97)	4.52 (2.67)
Angle of ankle	86.80 (4.05)	86.63 (2.04)
Left Lateral View		
Head		
Horizontal alignment of head (C7)	46.27 (2.93)	45.66 (4.05)
Vertical alignment of head (acromion)	21.61 (7.63)	21.87 (7.91)
Trunk		
Vertical alignment of trunk	4.70 (2.72)	3.99 (2.67)
Angle of hip (trunk and lower limb)	11.52 (4.03)	10.69 (4.28)
Vertical alignment of body	2.08 (1.25)	2.52 (1.19)
Horizontal alignment of the pelvis	10.21 (4.82)	11.21 (7.84)
Lower limbs		
Angle of knee	5.61 (3.75)	5.96 (3.51)
Angle of ankle	85.52 (2.18)	85.80 (2.82)

p-value < 0.01

C. Discussion

The present study evaluated individuals who were either symptomatic or asymptomatic of spinal cervical pain from a postural perspective according to the angles obtained from the posture assessment program. The same methodology was used for all subjects and applied by the same evaluator. This minimized the margin of error of the results and enabled the obtainment of a single standard of assessment, as intra-evaluator reliability is greater than inter-evaluator reliability [7].

The SAPO postural assessment computational software program was used to determine the coordinates of the anatomic points marked in photographs by the passive markers and to perform the measures of the angles analyzed. This program also offers scientific tutorials and the creation of a databank. It is easy to use and offers image calibration functions, which help to correct any errors that may have occurred during image capture as well as a zoom feature, simultaneous visualization of various photos, *Wizard* support protocol, manual or default point demarcation, and the measuring of angles and distances [6]. The measurement protocol provides reference values for some measurements, but the values obtained from symptomatic subjects were compared to the group without pain (control group), which exhibited values close to the references provided by the program for many angles.

The anterior assessment of the horizontal alignment of the head revealed values other than zero in the entire sample of the group with cervical pain; exhibited significant differences in comparison to the asymptomatic individuals. It can be stated that all the cases with spinal cervical pain exhibited alterations in the horizontal alignment of the head for one of the two sides. This deviation may be related to muscle shortening on the side corresponding to the alteration, linked to symptoms of pain [8,9].

In the trunk region, the angle formed by the acromia and anterior superior iliac spines exhibited deviations in subjects with cervical pain when compared to asymptomatic subjects. Chronic musculoskeletal pain is considered the major cause of posture alterations in various segments of the spinal column [10].

The two groups exhibited differences in the right lateral view for the vertical and horizontal alignment of the head. In the case of the subjects with cervical pain, the entire sample exhibited forward lean from the center of gravity. One of the most common problems found in individuals with cervical pain is the forward lean posture of the head. This posture places the head in front of the line of gravity and may generate different problems of a postural nature, including pain [11].

Another point observed is an overall bilateral asymmetry in the subjects from the two groups studied. As Ferreira [6] also found, the results of the present study demonstrate that there is a standard of similarity for postural alignment among the subjects. Nonetheless, it cannot be affirmed that postural symmetry is this standard. This proves that the evolution of deviations and compensation mechanisms obeys the individuality of the subject and presents globally throughout the body. Human posture control is a complex function that includes components such as the detection of movement as well as voluntary coordinated control and muscle reflex response [12], thereby justifying the need to study posture through an analysis of the entire body [13].

Despite some possible limitations, such as the fact that the incorrect localization of anatomic points may generate measurement errors as well as the fact that some measurements are vulnerable to anthropometric characteristics and

the evaluation method, the present study allowed the discussion of the results to have an objective, less personal focus. From the analysis of the data regarding the variables used, it was possible to identify and quantify the positioning of body segments according to situations of pain located in the cervical region. The data obtained proved satisfactory, without the need to complement the study with more sophisticated, costly methods. Significant differences were also found between the three groups studied with regard to the measurements of the angles evaluated.

III. Conclusions

Was possible identify and quantify the static posture alignment of individuals with and with no cervical pain. the data obtained suggest the presence of asymmetry in all the symptomatic individuals studied. the data obtained suggest the presence of overall asymmetry in all the symptomatic individuals studied.

References

1. Occhipinti E, Colombini D. (2000) Aging at work and musculoskeletal disorders. Med Lav 4: 342-353.
2. Massion J, Woollacott MH. (1996) Posture and Equilibrium. In: Bronstein A. M., Brandt T., Woollacott MH, eds. Clinical Disorders of Balance, Posture and Gait. London: Arnold Publishers. 1-19
3. Mochizuki, L, Amadio, AC. (2003) Aspectos biomecâncios da postura ereta: a relação entre o centro de massa e o centro de pressão. Rev Port de Ciênc do Desporto 3: 77-83.
4. Collins JJ, Deluca CJ. (1993) Open-loop and closed-loop control of posture: a rondon-walk analysis of center-of-pressure trajectories. Exp Brain Res 95: 308-318.
5. Clark S; Rose DJ; Fujimoto K. (1997) Generalizability of the limits of stability test in the evaluation of dynamic balance among older adults. **Arch Phys Med Rehabil** 78: 1078-1084.
6. Ferreira EAG. (2005) **Postura e controle postural: desenvolvimento e aplicação de método quantitativo de avaliação postural.** 80f. Tese (Doutorado em Ciências) Faculdade de Medicina da Universidade de São Paulo, 2005.
7. Fedorak C; Ashwoth N; Marshall J; Paull H. (2003) Reliabitity of the visual assessment of cervical and lordosis: How good are we? **Spine** 16: 1857- 1859
8. Borghouts JA, Koes BW, Bouter LM. (1998) The clinical course and prognostic factors of non-specific neck pain: a systematic review. Pain. 77: 1-13.
9. Sobel J; Sollenberger P; Robinson R; Polatin P; Gatchel R. (2000) Cervical non-organic signs: a new clinical tool to assess abnormal illness behavior in neck pain patiens. A pilot study**. Arch Phys Med Rehabil.** 81: 170-175.
10. Manchikanti L, Staats PS, Singh V. et al. (2003) Evidence- based practice guidelines for interventional techniques in the management of chronic spinal pain. Pain Physician.[http://www.asipp.org/documents/Guidelines%202003.pdf].
11. Gross A, Aker P, Goldsmith Ch, Peloso P. (2007) Withdrawn: Physical medicine modalities for mechanical neck disorders. Cochrane Database Syst Rev**.** 3: CD000961.
12. Fransson PA; Johansson R; Hafstrom A et al. (2000) Methods for evaluation of postural control adaptation. Gait Posture 12: 14-24.
13. Descatha A, Roquelaure Y, Evanoff B, et al. (2007) Predictive factors for incident musculoskeletal disorders in an in-plant surveillance program. Ann Occup Hyg**.** 3: 337-344.

Author: Sandra Regina De Gouvêa Padilha Galera
Institute: Department of Mechanics – Sao Paulo State University
Street: Av. Ariberto Pereira da Cunha, 333 – 12.516-410
City: Guaratinguetá
Country: Brazil
Email: sandragalera@vivax.com.br