

# Relationships between Sagittal Postures of Cervical Spine and Shoulder and Presence of Neck and Shoulder Pain in Adolescents

R. M. Ruivo, P. Pezarat-Correia and A. I. Carita

CIPER, Faculdade de Motricidade Humana, Universidade Técnica de Lisboa, Lisboa, Portugal

## 1 INTRODUCTION

Epidemiological studies have shown a high prevalence of spinal postural deviations in children and adolescents (Van et al., 2008), with a high self-reported upper quadrant musculoskeletal pain (UQMP) among adolescents (Diepenmaat et al., 2006). The shoulder and neck regions are becoming more and more cited in many references as the areas of greatest discomfort in adults and adolescents (Perry et al., 2008). The forward head posture (FHP) is a forward inclination of the head with the cervical spine hyperextension and is associated with shortening of the upper trapezius, the posterior cervical extensor muscles (suboccipital, semispinalis and splenni), the sternocleidomastoid muscle and the levator scapulae musculature (Lynch et al., 2010). Whereas the rounded shoulder posture (**RSP**), is a forward deviation of the shoulders, frequently associated with a protracted, anterior tilted and internally rotated scapula, and tightness of the pectoralis minor muscle (Wang et al., 1999). To study the misalignments outlined above, the photographic measurement of sagittal postures of cervical spine and shoulder is becoming more and more widespread, with plenty of studies confirming the high reliability of this method – photogrammetry. (Ferreira et al., 2010; McEvoy and Grimmer, 2005) To assist in the postural assessment from digitalized pictures, some specific software has been developed such as PAS/SAPO (Postural Assessment Software) (Ferreira et al., 2010).

## 2 OBJECTIVES

This study characterized the postural alignment of the head and shoulder in the sagittal plane of Portuguese adolescents, 15-17 years old, in natural erect standing. The relationships were also explored between three postural angles and presence of neck and shoulder pain. Gender differences were also considered.

## 3 METHODS

The study was conducted in 2 secondary schools in Portugal. 275 adolescent students (153 females and 122 males) ages 15-17 were evaluated. Sagittal head (HT), cervical (CV) and shoulder angle (SH), (figure 1) were measured with photogrammetry and PAS software.

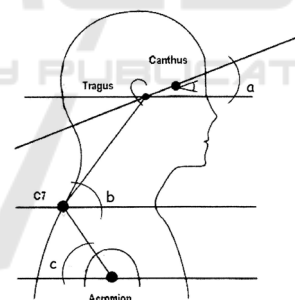


Figure 1: Adhesive marker placement and postural angle, a. sagittal head; b. cervical angle; c. shoulder angle.

Based on previous findings of (Yip et al., 2008) and (Diab and Moustafa, 2012), someone is considered to have FHP if the cervical angle is less than 50°. In what concerns shoulder angle, subjects with a RSP have a significant smaller shoulder angle when compared with normal subject. In a study of (Brink et al., 2009) with adolescents 15-17 years old, reported a mean shoulder angle value of 51° ± 17. We considered 52° as the reference angle for RSP.

American shoulder and elbow surgeons shoulder assessment (ASES) were used to assess shoulder pain whereas for headache assessment, students were requested to answer yes or no to the following question: do you regularly feel neck pain?

## 4 STATISTICAL ANALYSIS

All statistical analyses were made using specific software (SPSS version 20) and a statistical significance level of  $p < 0.05$  was defined.

The data were analyzed using descriptive statistics such as the mean, standard deviation, and percentage. In order to analyze differences in genders, and between patients with and without neck pain in the three postural angles, the ASES scores independent-samples t-test was applied. A chi-square test was used to assess the relationship between the forward head and cervical pain.

## 5 RESULTS

A separate preparatory study to confirm the inter and intra-rater reliability of computerized photogrammetry using the PAS was done with all ICC values reporting good and very good reliability.

Mean values of HT, CV and SH angles were  $17.26 \pm 6.7$ ,  $47.40 \pm 5.2$  and  $51.41 \pm 8.5^\circ$  respectively. 68% of the adolescents studied revealed protraction of the head whereas 58% of them had protraction of the shoulder. The boys showed a significant higher mean HT and CV angle than girls ( $18.7 \pm 7.07$  Vs  $16.15 \pm 6.04$ , and  $48.43 \pm 4.91$  Vs  $46.56 \pm 5.24$  respectively) and adolescents with neck pain revealed lower mean sagittal and cervical angle than adolescents without neck pain ( $15.3 \pm 6.3$  Vs  $18.5 \pm 6.5$ , and  $46.4 \pm 5.6$  Vs  $47.96 \pm 4.8$  respectively). An adolescent with forward head (FH) has 1.945 more chance to have headache than an adolescent without FH. Neck pain is more prevalent in girls with 52,9% of them self-reporting to feel neck pain regularly, contrasting with the 19% for the boys.

## 6 CONCLUSIONS

This data shows that forward head and rounded shoulder are common postural disorders in adolescents, especially girls. Neck pain is prevalent in adolescents, especially girls and is associated with forward head posture. Preventing and managing of upper quadrant musculoskeletal pain should be implemented in the early ages.

## REFERENCES

Brink, Y., Crous, L. C., Louw, Q. A., Grimmer-Somers, K., & Schreve, K. (2009). The association between postural alignment and psychosocial factors to upper quadrant pain in high school students: a prospective study. *Manual therapy*, 14(6), 647–53. doi:10.1016/j.math.2009.02.005.

Diab, A. a, & Moustafa, I. M. (2012). The efficacy of

forward head correction on nerve root function and pain in cervical spondylotic radiculopathy: a randomized trial. *Clinical rehabilitation*, 26(4), 351–61. doi:10.1177/0269215511419536.

Diepenmaat, a C. M., van der Wal, M. F., de Vet, H. C. W., & Hirasing, R. a. (2006). Neck/shoulder, low back, and arm pain in relation to computer use, physical activity, stress, and depression among Dutch adolescents. *Pediatrics*, 117(2), 412–6. doi:10.1542/peds.2004-2766.

Ferreira, E. A. G., Duarte, M., Maldonado, E. P., Burke, T. N., & Marques, A. P. (2010). Postural assessment software (PAS/SAPO): Validation and reliability. *Clinics (São Paulo, Brazil)*, 65(7), 675–81. doi:10.1590/S1807-59322010000700005.

Lynch, S. S., Thigpen, C. a, Mihalik, J. P., Prentice, W. E., & Padua, D. (2010). The effects of an exercise intervention on forward head and rounded shoulder postures in elite swimmers. *British journal of sports medicine*, 44(5), 376–81. doi:10.1136/bjism.2009.066837.

McEvoy, M. P., & Grimmer, K. (2005). Reliability of upright posture measurements in primary school children. *BMC musculoskeletal disorders*, 6, 35. doi:10.1186/1471-2474-6-35.

Perry, M., Smith, a., Straker, L., Coleman, J., & O’Sullivan, P. (2008). Reliability of sagittal photographic spinal posture assessment in adolescents. *Advances in Physiotherapy*, 10(2), 66–75. doi:10.1080/14038190701728251.

Van Niekerk, S.-M., Louw, Q., Vaughan, C., Grimmer-Somers, K., & Schreve, K. (2008). Photographic measurement of upper-body sitting posture of high school students: a reliability and validity study. *BMC musculoskeletal disorders*, 9, 113. doi:10.1186/1471-2474-9-113.

Wang, C., McClure, P., Pratt, N. E., & Nobilini, R. (1999). Stretching and Strengthening Exercises their effect on three-dimensional scapular kinematics. *Arch Phys Med Rehabil*. 80(8): 923-9.

Yip, C. H. T., Chiu, T. T. W., & Poon, A. T. K. (2008). The relationship between head posture and severity and disability of patients with neck pain. *Manual therapy*, 13(2), 148–54. doi:10.1016/j.math.2006.11.002.