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# Angle Position of Shoulder and Head in Sitting Position: Relationship with Pain

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***Authors' contributions***

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## ABSTRACT

**Aims:** The study aims to verify the relationship between the positioning of the shoulder and the cervical spine in sitting posture in university agents associating it with musculoskeletal pain.
**Methodology:** To carry out this study, the evaluation of the prevalence of musculoskeletal pain using a recall record was used and the projection angle of the head and shoulder in the sitting position was quantified. The selected group is made up of university agents from UNICENTRO who agreed to participate in the research.
**Results:** The results show the main change in the shoulder angle in men with pain in the left shoulder, the other measures do not show significant changes between people with and without pain.
**Conclusion:** The values obtained for the angular variables (shoulder angle and head angle, measured with passive markers in the ear, cervical spine (C7) and acromion) evidenced in this study demonstrated that some university agents presented postural dysfunctions related to poor posture in their work environment in relation to the correct posture described in the literature.

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## 1. INTRODUCTION

Although many symptoms are associated with work-related musculoskeletal disorders, one of the most notable is pain, which can progressively worsen and progress to loss of function. Pain and loss of function can persist for years and, in some cases, become untreatable. Thus, the adoption of measures to control these dysfunctions becomes essential, both in social and economic terms [1].

Regarding posture, one of the most observed practices is when the head tilts more than 30 degrees forward, so the neck muscles are strained to maintain this posture, and they start to cause pain in the neck and shoulders, so the head should be kept as close to the vertical position as possible [2]. Prolonged sitting combined with an awkward posture might contribute to the increased risks of developing spinal pain. Maintaining an upright sitting posture is thus often suggested, especially nowadays when people spend longer periods in the sitting posture for occupational or leisure activities [3].

This practice is very common among professionals who work in higher education institutions, since nowadays most of them need microcomputers in their daily activities, and in the future they may develop some type of repetitive strain injury (RSI) or work-related musculoskeletal disorders (WMSD) due to the sitting position for a long period of time [4]. The overload imposed by this position is gradually being felt by all parts of our body, then pain, tingling, heaviness in the back, neck, legs, arms and hands begin [5].

In view of the above, this study aimed to investigate the prevalence of pain related to the occupational environment in university agents, analyzing the positioning of the shoulder with the cervical spine in the sitting posture.

## 2. MATERIALS AND METHODS

The research presents a cross-sectional correlational study, being approved by the Ethics Committee in Research with Human Beings of Universidade Estadual do Centro-Oeste - UNICENTRO, under opinion nº 857663. First, the total number of university agents working on the Santa Cruz and CEDETEG campus of the State University of the Midwest was surveyed. Thus, at the beginning of the research, the university had 300 university agents.

The research was carried out at the university agents' workplace, and all those who agreed with the evaluations to be made were invited to participate. At the beginning of the evaluation, the university agent signed the informed consent form, giving consent to participate in the research. Then, the university agent was asked to complete a questionnaire to assess the prevalence of musculoskeletal pain, using the questionnaire proposed by Corlett and Manenica [6]. Next, anthropometric data of body mass (kg) and height (cm) were collected by means of a record to obtain BMI (body mass index in kg/m$^2$). The angular variables evaluated were the shoulder angle and the head angle, measured with passive markers in the ear, cervical spine (C7) and acromion [7].

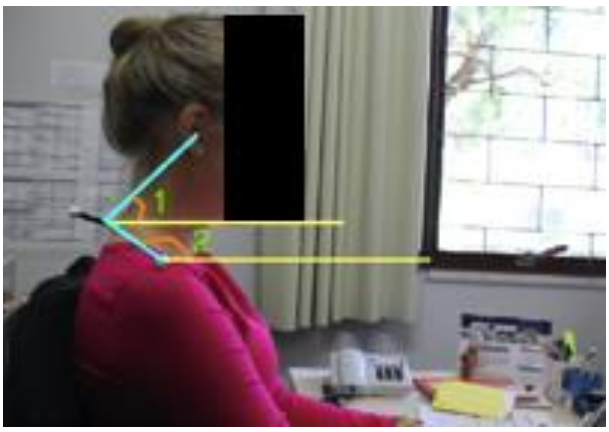


**Fig. 1. Position of markers in the sagittal plane**
*1: Head Angle Position; 2: Shoulder Angle Position*

At the end of the research, data were collected from 71 university agents (42 men and 17 women). Unvaluated agents were excluded for such reasons: they refused, were on leave, were on vacation, were not found at their jobs, worked outside the municipality, did night work and did not work at UNICENTRO anymore.

Through these data, the analysis will be made using descriptive statistics with mean and standard deviation. For inferential analysis, Student's t-test for independent variables was used. All analyzes will be performed using SPSS software version 20, with a significance level of $p < 0.05$

## 3. RESULTS AND DISCUSSION

The study shows that the fact that the patient has some changes in the body would not immediately present the presence of pain in certain regions, this pain may appear more in the future. There were no significant differences in most results, only in the change in the shoulder angle in men with pain in the left shoulder.

Neck pain was highly prevalent among adults in Saudi people, as 347 of 443 participants (78.3%) experienced neck pain, while 96 (21.7%) did not suffer from neck pain. There was a significant relationship between the most common physical positions while using electronic devices and reading and the prevalence of neck pain ($p = 0.015$). The most common position accompanied by neck pain was the sitting position compared to the positions of lying, walking, or standing [8].

According to the study by Szeto et al. [9]., patients demonstrate an increase of only 10% of anterior head in sitting posture during work but there were no significant changes in posture. The results of some other studies and according to the literature show that workers tend to put their heads and necks forward, keeping their shoulders protruding and elevating, thus altering this region. In Iranian office workers, high thoracic and craniovertebral angles were positively correlated with the presence of neck pain only in working position ($p < 0.05$), thus, office employees had a defective posture while working and that the improper posture was more severe in the office employees who suffered from the neck pain [10].

**Table 1. Relationship between the position of the shoulder and the head with the appearance of musculoskeletal pain in the neck**

| | | Neck Pain | Mean | SD* | p** |
|---|---|---|---|---|---|
| **Women** | **Shoulder Angle (º)** | With (24) | 147.3 | 16.8 | 0.106 |
| | | Without (5) | 160.9 | 15.3 | |
| | **Head Angle (º)** | With (24) | 46.8 | 19.4 | 0.335 |
| | | Without (5) | 56.5 | 24.4 | |
| **Men** | **Shoulder Angle (º)** | With (32) | 154.9 | 13.9 | 0.222 |
| | | Without (10) | 149.1 | 9.4 | |
| | **Head Angle (º)** | With (32) | 49.3 | 15.9 | 0.326 |
| | | Without (10) | 55.7 | 22.7 | |

** standard deviation; ** Level of significance: p >0.05; Student's t-test for independent variables*

**Table 2. Relationship between the position of the shoulder and the head with the appearance of musculoskeletal pain in the right shoulder**

| | | Neck Pain | Mean | SD* | p** |
|---|---|---|---|---|---|
| **Women** | **Shoulder Angle (º)** | With (24) | 151.4 | 16.9 | 0.233 |
| | | Without (5) | 141.3 | 16.6 | |
| | **Head Angle (º)** | With (24) | 46.1 | 20.6 | 0.175 |
| | | Without (5) | 59.7 | 14.9 | |
| **Men** | **Shoulder Angle (º)** | With (32) | 153.9 | 12.7 | 0.657 |
| | | Without (10) | 151.3 | 16.5 | |
| | **Head Angle (º)** | With (32) | 50.1 | 17.9 | 0.496 |
| | | Without (10) | 55.4 | 16.2 | |

** standard deviation;** Level of significance: p >0.05;Student's t-test for independent variables*

**Table 3. Relationship between the position of the shoulder and the head with the appearance of musculoskeletal pain in the left shoulder**

| | | Neck Pain | Mean | SD* | p** |
|---|---|---|---|---|---|
| **Women** | **Shoulder Angle (º)** | With (24) | 150.6 | 17.7 | 0.497 |
| | | Without (5) | 144.2 | 13.0 | |
| | **Head Angle (º)** | With (24) | 46.5 | 20.3 | 0.193 |
| | | Without (5) | 60.8 | 16.5 | |
| **Men** | **Shoulder Angle (º)** | With (32) | 155.8 | 13.5 | 0.021 |
| | | Without (10) | 144.1 | 4.5 | |
| | **Head Angle (º)** | With (32) | 49.1 | 17.8 | 0.208 |
| | | Without (10) | 57.9 | 15.9 | |

** standard deviation; ** Level of significance: p >0.05; Student's t-test for independent variables*

Following the idea of the same author, it is shown that the head-forward posture involves a combination of upper cervical extension and lower flexion and the absolute exposure of the head segment when the worker sees the computer screen.

The average values for the position of the protruding head are 28.5º, neutral position 52º and retraction 62.1º, while the position of the protruding shoulder is 131.1º, neutral 98.1º and retraction 67.5º [11]. According to this classification proposal, male university agents are close to the protrusion and shoulder value and between the neutral position and the protrusion of the head. University agents have these same characteristics. In this way, the position of the shoulder and head are altered in relation to the best possible position for the sitting posture, understanding that the neutral position is the most recommended.

Christensen et al. [12], studied participants, seated at a workstation without backrest, completed four, 15-min typing tasks: A)Upright with forearm-support; B)Upright without forearm-support; C)Slumped with forearmsupport; D)Slumped without forearm-support. The date demonstrate that task caused pain irrespective of posture with some causing larger changes than others, slumped without forearm-support was the worst posture anlysed.

The treatment of sitting posture was studied by Ma et al. [12]. These findings indicate a significant difference between the two groups (control vs altered posture in work), demonstrating the effectiveness of a sit–stand desk in reducing sedentary behavior and improving workers' health and productivity. Each participant in the intervention group received a personal sit–stand desk that allowed them to switch between sitting and standing positions and set their desk height freely during work hours.

## 4. CONCLUSION

Better posture in the workplace reduces stress related to postural dysfunction and problems triggered by poor posture, in addition to improving well-being as well as your professional performance.

The values obtained for the angular variables (shoulder angle and head angle, measured with passive markers in the ear, cervical spine (C7) and acromion) evidenced in this study demonstrated that some university agents presented postural dysfunctions related to poor posture in their work environment in relation to the correct posture described in the literature. Thus, it is suggested that the height of the computer should be changed together with the furniture and the correct posture.

## CONSENT

As per international standards or university standards, Participants' written consent has been collected and preserved by the author(s).

## ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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