Postural Mechanical Alterations In The Cervical Region Of University Students During The COVID-19 Confinement
Postural Mechanical Alterations In Confinement Period

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Abstract — **Due to the confinement imposed by SARS-CoV-2, social, work and academic activities have changed. Particularly, students pass a long time in front of a screen, leading to postural problems. For this reason, the main objective of this study was to identify postural mechanical alterations at the level of the cervical spine, through postural evaluations and the use of x-rays during the time of confinement. An analytical, prospective, cross-sectional, and observational study was carried out, 73 students were recruited to perform postural analysis using POSTURE SCREEN software and X-rays, which were examined using radiological markings with the RadiAnt DICOM System. The results of the study showed that the most used technological tools were the laptop in 45.2% (33 cases), the cell phone in 28.8% (21 cases) and the desktop computer in 26% (19 cases). The average number of hours students spent in front of the screen was 8.37±1.42 hours, 35.6% (26 cases) spent about 10 hours in front of a screen per day, 9.6% (7 cases) 9 hours, 20.5% (15 cases) 8 hours, 24.7% (18 cases) 7 hours, 9.6% (7 cases) 6 hours. According to the analysis of radiological markings in the cervical region, it was observed that 63% (46 cases) presented a decrease in the angle of cervical lordosis, in 17.8% (13 cases) it was observed elevated, while 19.2 (14 cases) had no alterations. In conclusion, we can mention that university students during confinement presented a decrease in the angle of cervical lordosis due to screen time**

Keywords: Prolonged posture, cervical hypolordosis, neck pain,

I.- INTRODUCTION

The pandemic caused by SARS-CoV-2 has caused isolation as a consequence of measures taken in order to reduce its spreading. Worldwide, this confinement generated a modification in the routine of the population. Work and academic activities are now carried out from home, which has contributed to an increase in a sedentary lifestyle among the population (1, 2). The World Health Organization (WHO), in 2002, coined sedentary lifestyle as "little exaltation or movement". On the other hand, it has been reported that a sedentary lifestyle decreases postural stability and imposes an additional restriction on balance control, which limits the speed and precision with which movements can be performed (3,4,7).

Postural balance relies on different mechanisms lying in the sensory, perceptual and motor systems, integrations programmed and organized at them, to a large extent, lead to the learning process of humans (15, 16). There is postural damage derived from prolonged posture, which is reflected directly in the spine. Among the harmful postural conditions, the following stand out: disc degeneration, annular fibrous cracks, bulging, herniated disc, intraosseous hernia or Schmorl hernia, etc. (9,10,13) Poor physical activity, and eating habits affect the body and are also related to posture problems (12,14).

Mexican students, regardless of age or grade level, sit for at least, 6 to 8 hours. If we also consider the isolation consequence of COVID-19, we can estimate that the time they remain inactive probably adds up to more than 12 hours a day. Therefore, students have a higher probability of developing a sedentary lifestyle, which, at the same time, will lead to overweight and subsequently to various degrees of obesity associated, among other things, with postural problems (5,6,8). For this reason, we believe that it is absolutely necessary to carry out evaluations in student populations of young adults under confinement, in order to detect mechanical-postural anomalies in their cervical area, and thus achieving preventive and corrective interventions, thus the objective of the present study is to identify postural mechanized alterations at the level of the cervical spine, through postural evaluations and the use of x-rays in the student population, in an age range of 20 to 30 years under confinement.

II.- MATERIALS AND METHODS

An analytical, experimental, longitudinal, and prospective study was performed. A self-controlled group without any clinical symptoms of disease was employed in the study, 2 AP Transoral and lateral radiographs were taken of the cervical spine of all members.

Then, the medical record of each member was created using a format of the clinic 'Clínica Integral de la Universidad Estatal del Valle de Ecatepec (UNEVE)', which included the ID badge of the patient, informed consent, current medical issues, results of additional diagnostic studies performed beforehand, previous therapy treatments, physical exploration, assessment of movement range, findings related with vertebral subluxation, orthopedic tests, osteotendinous reflexes, dermatomes, presumptive diagnosis, and prognosis.

To perform the posture analysis with the program 'POSTURE ANALYSIS (US Version 1.8), the patients were placed in independent scales, one scale per leg. According to what is stated in the software evolution protocol, briefly, the patient must keep their sight in a fixed point in the front in order to put their head in a neutral position, then take a picture 2 meters away with the application; one from the front and another one from the side. Finally, a picture of the scales showing the weight of the left and the right sides is taken. The program guides the user to mark the anatomic points (eyes, nose, shoulders, iliac crests, knees, and ankles). Finally, the program automatically displays the results, pointing out the inclinations in centimeters and the rotations in degrees. Then, standard instructions are given to the patients to prepare for taking diagnostic images (X-rays). The protocol was carried out in the facilities of the 'Clinica Integral Universitaria' at UNEVE, using a fixed X-ray equipment. Once the transoral AP and Lateral Cervical radiological views were obtained, we continued with the use of the RadiAnt DICOM System (US Version 2021.2), a medical image reader for Windows.

The radiological markings were obtained with the use of this software, and then, from these and using the measurement tools of the length program we calculated the structural measurement of the body, providing measurements in centimeters or millimeters and the angle to determine its angulation at the intersection of the lines.

The following markings were measured: A) Yochum and Rowe (Lordosis Angle), which evaluates load distribution in the cervical region in angles with normal values between 35 and 45 degrees, taking the lines that mark the vertebral bodies from C1 to C7 as reference, thus determining the tension in the anterior cervical ligament, anterior disc, and muscular structures. B) Gravitational line. A vertical line is drawn, starting from the apex of the odontoid process of C2. The superior epiphyseal plate of C7 is divided into three parts. Normally, this line should fall in the anterior third of the epiphyseal plate. If the line falls outside this third, this is a sign of abnormality. C) Depth measurement. It has a normal value of 12 millimeters although these measurements fluctuate from 7 to 17 millimeters. A vertical line is drawn starting at the posterior aspect of C2 and finishing at the lower posterior corner of C7. The distance between the line and the posterior edge of C4 is then measured. D) Angle of Atlas, its normal values go from 18 to 24 degrees. Two points are drawn in the central area of the tubercles of C1, and then they are joined with a line. E) Harrison's angle normal values range from 4.5 to 10 degrees. This to assess the reliability of global and segmental alignment determination, considering

the vertebral bodies of C1-T1. The angles created were two global Cobb angles of two lines (C1-C7 and C2-C7), segmental Cobb angles from C2 to C7. F) AP Transoral. It evaluates the lateral masses of Atlas to determine if the head exhibits any rotation of the left or right side. In time, this can cause slight compression of the carotid arteries due to the presence of head rotation. Then, the normal condition would be for the head to remain in a neutral position. G) Angle C2. It takes the back arch of Atlas as reference, which should be found in the gap between the occipital and the C2 process. If extended, this should modify the curve in the neck. Therefore, if the cervical spine presents a rectification and if Atlas is in extension, then by assessing the marking, the cervical region or the lordosis will result in a normal value.

III.- RESULTS

73 undergraduate students recruited and tested during the COVID-19 pandemic were included, of them, 72.6% (53 cases) were women and 27.4% (20 cases) were men. The average age was 20.74±2.22 years, with a minimum age of 18 years and a maximum of 26 years. No significant differences were observed in the average age in relation to sex ($p>0.05$). Only 1.4% (1 case) presented a chronic-degenerative disease, 41.1% (30 cases) of the students reported neck pain. A face-to-face questionnaire was applied to students to learn information related to online study during the COVID19 pandemic.

The types of technological tools most frequently used were personal computer in 45.2% (33 cases), cell phone in 28.8% (21 cases) and desktop computer in 26% (19 cases). The average number of hours that students spent in front of the screen was 8.37±1.42 hours, 35.6% (26 cases) spent around 10 hours in front of a screen per day, 9.6% (7 cases) 9 hours, 20.5% (15 cases) 8 hours, 24.7% (18 cases) 7 hours, 9.6 % (7 cases) 6 hours. According to the analysis of the radiological markings of the students at the cervical level, it was observed that 63% (46 cases) presented a decrease in the angle of the cervical lordosis, in 17.8% (13 cases) an elevation was observed, and 19.2 (14 cases) had no alterations. In relation to the gravitational line, it was observed that in 97.3% (71 cases) it was anterior and only 2.7% posterior. Regarding the depth line, it was observed that 91.8% (67 cases) presented hypolordosis, 2.7% (2 cases) hyperlordosis, and 5.5% (4 cases) were normal. Harrison's angle was observed to be decreased in 42.5% (31 cases), increased and normal in 28.8% (21 cases), respectively.

Regarding head rotation, the highest frequency was observed to the right in 56.2% (41 cases) and to the left in 43.8% (32 cases). The C2 angle was elevated in 100% of the cases

No differences were observed in the average hours spent in front of the screen in relation to cervical pain, however, students who used a laptop are the ones who reported pain most frequently in 56.7% (17 cases), followed by those who used cell phones in 26.7% (8 cases), and finally those who used a desktop computer by 16.7% (5 cas as radiology marks, which digitize the vertebral bodies of ($p>0.05$), nor in relation to diagnoses of cervical mechanopostural disorders ($p>0.05$). The type of device was not related to the presence of cervical pain ($p>0.05$).

Table 1. The relationship of gender with the result of the evaluation of mechanopostural alterations of the cervical spine of the undergraduate students included in the study

Evaluation and Diagnosis	Sex		P -value
	Feminine n=53	Male n=20	
Yochum and Rowe (Angle of Lordosis)			
Normal	17% (9)	25.0% (5)	0.72
Diminished	64.2% (34)	60.0% (12)	
High	18.9% (10)	15.0 % (3)	
Gravitacional line			
Posterior	1.9% (1)	5.0% (1)	0.46
Anterior	98.1% (52)	95.0% (19)	
Depth measurement.			
Normal	5.7% (3)	5.0% (1)	0.06
Hipolordosis	94.3% (50)	85.0% (17)	
Hiperlordosis	.0% (0)	10.0% (2)	
Harrison angle			
Normal	26.4% (14)	35.0 % (7)	0.68
Diminished	45.3% (24)	35.0% (7)	
High	28.3% (15)	30.0% (6)	
Digastric Line (AP Transoral)			
Left head rotation	47.2% (25)	35.0 % (7)	0.35
Right head rotation	52.8% (28)	65.0% (13)	
C2 angle			-
High	100% (53)	100% (20)	

Table 2. Relation between cervical pain with the evaluation and diagnostic of mechano-postural alterations of the cervical portion of the spine..

Evaluation and Diagnosis	Cervical Pain		P-Value
	YES n=30	NO n=43	
Yochum and Rowe (Angle of Lordosis)			
Normal	16.7% (5)	20.9% (9)	0.07
Diminished	53.3% (16)	69.8% (30)	
High	30.0% (9)	9.3 % (4)	
Gravitacional line			
Posterior	6.7% (2)	.0% (0)	0.08
Anterior	93.3% (28)	100.0% (43)	
Depth measurement.			
Normal	10.0% (3)	2.3% (1)	0.07
Hipolordosis	83.3% (25)	97.7% (42)	
Hiperlordosis	6.7% (2)	.0% (0)	
Harrison angle			
Normal	30.0% (9)	27.9 % (12)	0.93
Diminished	40.0% (12)	44.2% (19)	
High	30.0% (9)	27.9% (12)	
Digastric Line (AP Transoral)			
Left head rotation	46.7% (14)	41.9 % (18)	0.68
Right head rotation	53.3% (16)	58.1% (25)	
C2 angle			
High	100% (30)	100% (43)	-

IV.- DISCUSSION

Health is a state of physical, social and mental well-being. There are several factors that can cause an alteration of this state, among them are the occupational risks and within these, the bad postural habits, which are adopted unconsciously from an early age.

The pandemic caused by the SARS-CoV-2 virus has severely impacted the health and economic sectors of the word. The virus was first isolated from a patient on January 7, 2020, and to this day efforts to control its propagation are still active (6). One of the measures was to stay-at-home, thus, the teaching methods were also modified; students have to use electronic devices to be in contact and continue with their school activities, this has been one of the strongest factors for the increase in sedentary lifestyle (3).

A sedentary lifestyle is a public health problem specially alarming in young people; the population in schools is particularly vulnerable to this problem. Students spent a great part of the day sitting, thus, adopting a more sedentary lifestyle, because physical activity is severely decreased (4). The lack of movement causes various muscle imbalances, and these in turn trigger back pain. Due to the increasing incidence of musculoskeletal diseases and fatigue, efforts in preventing them from the occupational perspective have been proposed (1).

It has been reported that not having the computer monitor located in front of the operator is a major risk factor for specific neck pain and lower back pain in female workers using computers. This information can enable the development of possible preventive strategies and new insights for designing appropriate workstations (12,13,15).

The results of this study indicate that the Maastricht Upper Extremity Questionnaire (MUEQ) has satisfactory reliability (8). This cervical sagittal balance is important for the maintenance of the neutral posture of the head and horizontal gaze. The degenerative changes in the cervical spine that occur with aging can alter the cervical sagittal balance, which can lead to chronic neck pain and predispose to various pathologies of the cervical spine prematurely. (5, 6).

To evaluate the reliability of the determination of global and segmental alignment, it is necessary to implement the use of imaging studies validated by a measurement system, such as radiological markings, which digitized the vertebral bodies of C1-T1. One of the markings that was used in our analysis is the Harrioson angle, as the literature mentions the posterior tangent method has a lower standard measurement error than the four-line Cobb methods (12). The result was a decrease in the normal value of the angle by 43% in women and 35% in men, due to instability in the facet joints and musculature in the posterior region, especially for patients with cervical lordosis of less than 10° (14), causing tension in the anterior cervical ligament, anterior disc and muscle structures this may be indicative of ante projection of the head. (10,11,12).

This coincides with the results obtained with the markings the gravitational line and the measurement of depth. (Depth measurement.). Since in a percentage of 83 to 97% of patients suffer greater stress (weight of the head) in the above elements such as the vertebral body and the intervertebral disc.

This is due to the positioning in extension of the first cervical vertebra. There are reliability studies showing that inter- and intra-examiner reliability is sufficient to measure lateral and rotational displacements of C1 within +/- 1 degree. This amount of error allows an objective analysis of upper cervical X-rays to detect changes in the angular positional relationships of radiographic images of the order of those already seen clinically. (15)

Thus, it can be concluded that the relationship of cervical pain is caused by tension in the anterior cervical ligament, anterior disc and muscle structures as it is indicative of ante projection of the head. This generating a response to pain in a percentage of 93%

No differences were observed in the average number of hours spent compared to screening in relation to cervical pain (p>0.05), nor in relation to diagnoses of cervical postural mechanical disorders (p>0.05). Our results coincide with what was reported in the study In relation to a study conducted in 2018 where they were obtained as a result that it did not show an association between the text neck and neck pain in young adults aged 18 to 21 years in the use of mobile phones.

The findings challenge the belief that neck posture during mobile phone texting is associated with the increasing prevalence of neck pain. (9). Fact that coincides in our study where those who used cell phones in 26.7% (8 cases). However, students who used a laptop are the ones who reported pain most frequently in 56.7% (17 cases).

However, our results show that students who used a laptop were the ones who reported pain most frequently in 56.7% (17 cases), followed by those who used cell phones in 26.7% (8 cases), and finally those who used a desktop computer in 16.7% (5 cases). In the relationship of gender with the result of the evaluation of postural mechanical alterations of the cervical spine of graduate students, it shows that women tend to present more postural and mechanical alterations, this factor is probably due to the anatomical difference of the pelvic bones, or the force of gravity that involves weight of the bust, this that was not taken into account in this research.

V.- CONCLUSION

With the results obtained we can mention that college students during confinement presented a decrease in the angle of cervical lordosis due to screen time. Plus, employing a laptop is associated with more pain symptoms compared to cell phones. Finally, females tend to present more postural mechanized alterations, compared to the males.

VII.- REFERENCES

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