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Epidemiological Profile of the Cervical Lordosis in Patients of the East Zone in São Paulo Correlated with the Use of Electronic Devices

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Abstract

Objective: The study on the anatomy of cervical spine is extremely important to understand the changes caused by bad posture/ cervical movement in the sagittal plane during smart phone use. Currently, postural problems are recurrent, being considered public health issues, since a large part of the economically active population is affected by painful conditions, being temporarily incapacitated to work. The pains affecting the spine are a discomfort for different age groups. This study aimed to evaluate cervical spine or cervical spine alterations caused by the anterior head posture in the use of electronic devices.

Materials and Methods: The study included subjects randomly aged 18 to 60 of both genders, who, after agreeing to participate and signing the FICF, met the requirement of using electronic devices for more than 60 minutes a day, and underwent a clinical examination, with the application of the Roland Morris, Oswestry and analog pain scale questionnaires. After the initial evaluation, the patients underwent a cervical spine X-ray in profile with visualization from the occipital bone to T1, to calculate the values of Cobb angles, C2 Slop, C7 Slop and Harrison angle.

Results: This work included 106 patients, randomly selected at Santa Marcelina Hospital; 68 patients had complaints of cervical pain and 38 patients did not report the symptom. Of the 68 symptomatic patients, 42 were female and 26 were male; of the asymptomatic ones, 24 were female and 14 were male, with 62% of patients being female in both groups.

Conclusion: We concluded that the use of electronic devices for more than 60min / day may be directly related to pain in the cervical spine.

Keywords: Cervical Neck Pain; Cervical Spine; Text Neck

Introduction

The vertebral spine is a bone structure that plays an important role in posture, weight support, locomotion and protection of the spinal cord. It consists of vertebrae, intervertebral discs, muscles and vertebral ligaments **[1, 2]**.

The structural disposition of the vertebral spine components forms 4 physiological curves, divided into primary and secondary curves. The primary ones, or kyphosis, present less mobility and, as the very name says, they were the first to form during fetal life, not altering after birth. The secondary curves, or lordoses, develop after birth and, differently from the primary ones, are mobile. These curves, cervical and lumbar lordosis, thoracic and sacral kyphosis, are visualized in the sagittal plane and allow the spine to absorb the vertical compressive loading; the same occurs to the intervertebral discs, which also constantly undergo loading **[2, 3]**.

The spine is a target of degenerative processes, such as disc dehydration and loss of flexibility. These processes may

derive from old age, of mechanical forces (repeated and/or incorrect efforts and movements besides bad posture), of infections, of inflammatory processes and of traumas. However, ergonomic (postural) conditions more expressively and directly influence the structure of the vertebral spine and its degenerative processes **[4, 5]**.

In this context of structural alterations or not, it is important to discuss the cervical spine. Its unique anatomy provides great mobility and protection to the spinal cord. Only when it presents a certain degree of dysfunction is its importance for the daily activities noticed. It is composed of 7 vertebrae, 5 intervertebral discs and a broad set of ligaments located between the occipital bone and the thoracic vertebrae. The first (C1) and the second (C2) vertebrae, atlas and axis, respectively, from the upper cervical spine and are denominated atypical due to the structural anatomical difference. C1 has no body or spinous process, accommodating the occipital condyles in the upper part, allowing a degree of flexion and extension of the head by the atlanto-occipital articulation; and the peculiarity of C2 is the presence of the projected odontoid process of its body to the atlas foramen, allowing its rotation with the cranium. The 5 remaining ones are the typical cervical vertebrae composing the lower cervical spine. The discs between the vertebrae absorb the impact and disperse mechanical energy; these distributions or loads compose the biomechanics of the cervical spine **[6]**.

The ergonomic condition of the cervical spine has been currently discussed as well as its bad positioning, which causes pain conditions (cervical pain). This condition has increased with the increased use of digital devices, which offer different applications (email, WhatsApp, spreadsheet software, agendas), which are used for working and for social life, having as a consequence their daily and prolonged use **[7-9]**. According to Cisco VNI (Cisco® Visual Networking Index), a company that sells net/electronic equipment, the global number of digital devices was expected to be 2 billion in 2018;concurrently,a number of articular problems in the upper part of the spine have been reported **[10, 11]**.

One of the ergonomic alterations is the forward head posture- FHP. A new term has been used, "text neck", which correlates FHP with the use of mobile devices and lap-tops. As stated by Kapandji **[2]**, at every 2.5 centimeters the head bends forward, about an extra pound is added, involving head and neck muscles, responsible for these movements and for supporting the head. The great concern, according to Calliet **[3]**, is the possible loss of 30% of the pulmonary capacity due to FHP **[12-14]**.

Unfortunately, there is no concern on the part of the population about keeping an adequate posture; individuals do not observe themselves to try and improve it. Every year, between 11 and 14% of the economically active population presents functional limitation due to cervical pain. Hence, studies have been conducted to assess the balance of postural dynamics and spinal stress with the use of mobile devices, indicating the urgent need of guidance and of postural reeducation programs **[15-16]**.

Objective

The object of study was evaluating whether the use of electronic devices can be related to the presence of pain in the cervical region.

Secondary Objectives

Relating a minimum time of use of electronic devices with the presence of pain and verifying whether this use may be related to the modification of the sagittal balance of the cervical spine.

Materials and methods

The present work constitutes a descriptive study of the transversal type to assess the prevalence of alterations in the sagittal balance of the cervical spine in users of mobile devices. Both female and male patients aged between18 and 60 were included. After accepting to participate in the study and signing the FICF, they met the requirement of using the electronic device for more than 60 minutes/day. They were submitted to a clinical examination, with the application of two questionnaires about quality of life, namely Roland Morris and Oswestry, besides an analogical scale of pain. After the initial assessment, the patients underwent an X-ray examination of their cervical spine in profile, with visualization from the occipital bone to T1, to calculate the values of cervical lordosis of C1 to C7, assessing Cobb's angle (quantifying the degree of curvature in the coronal plane of scoliosis in an X-ray photograph of A-P incidence), and to assess the Slop angles of C2 and of C7 and Harrison angle.

We excluded patients off the age range for inclusion, patients withBMIover28, patients that had already undergone some surgery in the vertebral spine, patients not counting on enough cognition to respond to the questionnaires and patients having any neuromuscular condition that might influence his/her assessment.

Statistics

For a statistically significant project, 106patients were necessary, considering an 80%power and a5% significance when compared to the Roland Morris questionnaire on quality of life.

Results

106 patients were included, randomly selected at Hospital Santa Marcelina, all of whom filled in the FICF, and completed all the questionnaires. From the inclusion of patients, we can report the following data from the patients included, 68 presented complaints of cervical pain and 38 did not report the symptom. Out of these 68 symptomatic patients, 42 were

female gender and 26 male gender. Out of the asymptomatic patients, 24 were female gender and 14male gender, keeping a ratio of62% of the patients in both groups being female gender.

Assessing the pain condition with the time of mobile phone use, we could observe that the patients with a pain condition use the devices for a period longer than 60 minutes a day, whereas the patients without complaints of pain use the devices with an average smaller than that. In the distribution of the use of the devices, out of the patients without painful symptoms, 37 use mobiles, 3 use tablets and 12 use desktop computers. As regards the patients with a symptomatic condition, 66 individuals use mobiles, 1 uses a tablet and 20 use desktop computers, being that 97% of the patients use mobiles in both groups and an average of30% use desktops.

The perception of the forward head posture was a question asked to all the subjects of the research. 32 subjects of the group without pain and 62 subjects of the group with pain were observed to report this perception. In the assessment of the most widely used applications, in a decreasing order, greater use was observed of Whatsapp®, Facebook® and e-mail providers. The first application accounted for 68% of the time of mobile use, yet without a difference between the groups with and without pain.

When assessing the reason for using, we verify that 13 subjects of the group without pain use the devices for entertainment only, whereas 25 individuals use it both for working and for entertainment. The group with pain presented 13 subjects that use it for entertainment, whereas55 use it for working and for entertainment.

In the quantitative data assessment, the average age of the symptomatic patients was observed to be of 42 years, compared with the average of 40 years for the asymptomatic patients. When comparing the Roland Morris quality of life index, an average value is observed in the patients of the group with pain; however, in the patients that did not report pain in the neck, an average of5 points was observed.

Another questionnaire used was the Oswestry disability index, in which patients with pain had a 50% average of limitation due to the pain. The patients without pain presented a 30% disability index. The assessment of the angles in the X-ray photographs showed differences, as described in **(Table 1)**. However, both Cobb's and Harrison angles showed smaller values in the symptomatic patients.

	Without Pain			With Pain		
	Average	**SD**	**Median**	**Average**	**SD**	**Median**
Angle C2-C7 cobb	15	18	11	9	13	10
C2 Slop	11	7	11	12	9	11
C7 Slop	24	12	23	21	12	22
Harrison C2-C7	24	17	22	16	13	16

Table 1: Descriptive analysis of the quantitative attributes between individuals with and without pain in the neck assessed in the study including average, median and standard deviation.

Discussion

Our work evidences that out of the106 patients randomly chosen, 68 presented cervical pain, which was related to the use of electronic devices for more than 60 minutes/day. Damasceno **[4]**, in his project conducted with young people during their school term, did not find this relationship. In his project, he included subjects at different age ranges, and their main activity is labor, rather than solely educational.

We found decreased lordosisin patients with complaint of pain, and a higher value in asymptomatic patients, despite not presenting a significant statistical correlations describes Ling **[2]**.In Ling's study, for the asymptomatic patients, the average of cervical lordosiswas18º, being closer to the value of the asymptomatic patients in relation to those with pain.Ling[5]also assessed the Slop angle of C7 and observed an average of20º. As compared with that project, we obtained very close values from which it was not possible to make any correlation; yet Ling **[17-24]** affirms that in the case of Slop of C7, values causing concern are those over 40º, which were not found in any of outpatients.

The Slop of C2 plays an important role, since it serves to assess the relation of the upper cervical spine **[24]** with the alignment of the spine as a whole. The values found were very close, varyingfrom11ºto 12º.The study by Themistocles **[25]** evidenced that his asymptomatic patients had an average of18º, not very different from the patients studied herein. Assessing the values found, lordosis is observed to have a relation with the use of electronic devices, mostly mobile devices, with a decrease in the irangle the longer th**e** use of the electronic device. Yet the Slops of C2 and C7 did not demonstrate any relation with the use of the devices, since the values found were very close to the values in the literature, thus not allowing to establish any relation among the variables or in relation to the incidence of pain.

A second assessment of the cervical lordoses was employed, the one measured by the technique described by Harrison **[26-27]**. The values found in that research were different among the groups, with an insignificant statistical relation, with values of 16 for individuals with pain and 24 for patients without pain. In the literature, nevertheless, this value

may vary from14 to 38, demonstrating that even patients with a lower value are still within the limits of normality. We may here have the possibility of performing a more thorough analysis, yet only based on supposition, since our work shows a punctual situation. A better assessment would be possible if the study were to follow the two groups for a longer period to register that the patients that use electronic devices for longer periods present worse conditions, and if nothing is done to modify their daily routine, these angles would have their values decreased in a second assessment.

Individuals that work and use the devices for entertainment were observed to present a more intense painful condition than individuals who use it only for entertainment and these data were not analyzed in any other work. Yet Tsang **[28]** describes that the incidence of patients with pain in the cervical spine and shoulder is high inpatients that work in offices; physical activity shows to be necessary for improving the painful condition.

We also assessed that the incidence of pain in the cervical spine must be taken into consideration, seeing that 68 subjects reported this symptom. The patients assessed were randomly chosen and, as reported by Coen **[29]**, cervical pain is the fourth major cause of pain, among other causes leading a patient to seek emergency services,50% of whom requiring medical treatment and rehabilitation due to the risk of chronicity.

Although the study in question has been transversal, it shows the importance of cervical pain, since over50% of the patients presented the symptom. Yet we cannot subjugate this pain and its correlation with the use of electronic devices, especially when assessing people that use them for working, since their more intense use, together with a smaller dedication to caring for health, can be considered the causes for the condition in question.

The Oswestry calculator assesses quality of life and, even that instrument being much more often used for assessing the results of treatments, we here used it as a method for assessing the patients' experiences at the moment of assessment. Our results showed that it can be used for this purpose, because it showed that patients with pain present worse physical limitations. In a study with patients with cervical pain, Thiselman **[29]** used this instrument as a way of assessing the results of a treatment for cervical pain, corroborating its use for this condition. A point that called the attention was that even patients not reporting cervical pain, they presented a degree of clinical limitation. The inclusion of a question regarding pain in any region apart from the cervical spine could show a relation of another symptom or disease that could be correlated with pain in the cervical spine.

Conclusion

We concluded that the use of electronic devices, and its prolonged use (longer than 60 min/day), may be directly related to pain in the cervical spine. We also concluded that, although there is no statistically significant relation, patients that use electronic devices for more than 60 minutes a day and that present cervical pain present worse cervical sagittal balance.

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