

Estudo comparativo das amplitudes de movimento da coluna cervical em idosos com diferentes níveis de aptidão física

Comparative study on the cervical range of motion in elderly individuals with different fitness levels

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RESUMO

Introdução: Este estudo tem como objetivo analisar e comparar as amplitudes de movimento (ADM) da coluna cervical em dois grupos de idosos com níveis diferentes de aptidão física. Métodos: Foram selecionados 40 voluntários assintomáticos com idade entre 60-75 anos e subdivididos pelo seu respectivo nível de aptidão física. Os voluntários então foram submetidos a mensuração de suas respectivas ADM pelo inclinômetro *Cervical Range of Motion* – CROM por um examinador que não tinha conhecimento prévio dos pacientes e seus respectivos grupos. Um teste de confiabilidade intra examinador foi realizado para avaliar a reprodutibilidade do examinador. Resultados: Foi observado que nos movimentos de flexão e extensão não houveram diferenças significativas entre os grupos avaliados. Os movimentos de inclinação lateral direita e esquerda e rotação direita e esquerda apresentaram valores de ADM estatisticamente significantes no grupo de voluntários ativos quando comparados com os sedentários. Conclusão: Conclui-se através deste estudo que o nível de atividade física pode ser um fator benéfico na preservação da ADM em idosos.

PALAVRAS-CHAVE

Amplitude de movimento, coluna cervical, idosos.

ABSTRACT

Introduction: The aim of this study was to analyze and compare the cervical range of motion (ROM) in elderly people with different fitness levels. Methods: Forty asymptomatic volunteers aged between 60-75 years old were recruited and classified based on their respective fitness level. The volunteers were then submitted to the measurement of cervical ROM with the *Cervical Range of Motion* (CROM) inclinometer by a blinded examiner. An intrarater reliability test was also performed to evaluate the examiner's reproducibility. Results: There were no significant differences regarding flexion and extension movements in both groups. The lateral right and left flexion and right and left rotation were statistically higher in the fitness group compared to the sedentary individuals. Conclusion: We concluded that the fitness level can be beneficial to preserve cervical ROM in elderly people.

KEYWORDS

Range of motion, cervical spine, elderly.

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Introduction

Several studies have demonstrated that the cervical column mobility decreases as the age increases¹⁻⁷. However, standardized range-of-motion (ROM) values for the cervical column in the elderly are not available to date in literature. A study classifies the decrease of flexibility as a “typical sign of senescence”⁸. This same study reports that flexibility depends more on the practice of physical activities than on age and/or gender, and adds that it is significantly higher in independent people.

The most frequent complaints of neck pain are associated with musculoskeletal problems⁹. The symptoms are due to several degenerative processes, direct trauma, or cumulative microtrauma of postural stress. The muscle mass reduction that occurs between 50-80 years of age is probably the result of the aging process of the neuromuscular system associated with the decreased level of physical activity¹⁰.

In a study with 150 healthy individuals¹¹, it was concluded that the passive ROM of the cervical column decrease with age, except for the rotation movement from a total flexion and that at some age ranges, women have higher ROM values. Additionally, the author states that there is no significant difference between the genders above 60 years of age regarding cervical ROM.

In a similar study, the authors also found a significant reduction of cervical ROM with aging, except for the movement of rotation in the flexed position of the neck. Despite the similarities regarding results, one of the studies³ used active movement, in opposition to the other¹¹, which was based on passive movements. But the capacity to perform activities of daily living depends more on the integrity of the active movement than of the passive one.

The cervical column ROM decreases consistently with age in practically all studies, and apparently there are no intrinsic influences that can decrease such progression¹. Additionally, there is a close association between cervical ROM restriction and neck pain⁹, thus rehabilitation professionals constantly use techniques that help to restore ROM through exercises, with good results¹². There is still no evidence in literature whether there is a factor based on life habits that can influence cervical ROM among the elderly with different levels of physical fitness.

Objectives

This study aims at analyzing and comparing cervical column ROM in two groups of elderly individuals, with different levels of physical fitness, in the sagittal, frontal and axial planes, as well as evaluating, when there are differences, whether the latter are related to the lifestyle of each group: the sedentary group and the group of individuals who practice regular physical activities.

Methods

In this study, the active movements of flexion, extension, lateral inclination and rotation in neutral position were measured to the

right and to the left of the cervical column, to assess whether there were differences between the studied groups.

Patients

The inclusion criteria included age between 60-75 years, presenting good cognitive, visual and auditive status, no previous history of cervical and/or neck region surgery, no pain at the cervical region in the previous month.

Forty individuals were selected and divided in 2 groups. *Group 1* consisted of 20 volunteers (60% males and 40% females) who practiced regular physical activity, i.e., who exercised from 30 to 60 minutes with moderate intensity at least 3 times a week, according to the American College of Sports Medicine¹³, whose mean age was 65.45 ± 3.94 years. *Group 2* consisted of 20 volunteers (40% males and 60% females) whose mean age was 69.11 ± 4.19 years, who were sedentary and lived in the metropolitan region of Belo Horizonte, state of Minas Gerais, Brazil. There were no statistical differences regarding demographic characteristics (age and gender) between the two groups analyzed.

The participants were advised on the nature of the study and informed that they could leave or refuse to participate at any moment. The study was approved by the Ethical Committee in Research of the Pontifícia Universidade Católica de Minas Gerais.

ROM measurement equipment

The equipment used to obtain the cervical column ROM was the *Cervical Range of Motion – CROM* (Figure 1). The CROM device is a system of inclinometers with gravitational reference capable of measuring the movements of the cervical column at the sagittal, frontal and axial planes, as well as protrusion and retraction. It consists of a plastic frame positioned as a pair of glasses with three fixed inclinometers⁶. An inclinometer evaluates the movements of flexion and extension, another measures lateral flexion and the last one measures the rotation with the help of two magnets placed on the shoulders of the individual being examined¹⁴. The advantages of CROM over the other methods of cervical column ROM measurement are, in addition to being easy to handle and use, there is no need to remove it from the individual's head to measure the movements at another plane¹⁵. The CROM margin of error has been assessed and estimated to be 0.5 degree¹⁵. Several studies¹⁵⁻¹⁹ have demonstrated a good interexaminer and intra-examiner reliability for CROM in active movements.

Measurement procedure and Data Recording

A standard procedure was used for all measurements. All volunteers signed a Free and Informed Consent Form after being advised on the nature of the study and agreeing to participate in it and answered a questionnaire that guaranteed his or her inclusion.

The measurements were performed by two individuals (examiner and instructor), both blinded to group allocation for each of the volunteers. The examiner's function was to position the device on the individual's head, read and record the data obtained. The instructor advised the individuals on the correct performance of movements and prevented the possibility of undesired compensations.



Figure 1.
CROM® (Cervical Range of Motion) device

The standard procedure consisted of: 1) the volunteer received information from the instructor on how to perform each movement before the device was placed on the head; 2) the volunteer was advised to sit on a standardized chair, always keeping the thoracic column supported by the back of the chair – without associated movements – with the hands against the thighs (90° of flexion of hip and knee) and the feet against the floor; 3) the examiner placed the CROM on the volunteer’s head; 4) the volunteer was advised to look at a fixed point ahead at the level of the eyes and wait the examiner’s command to perform the movements; 5) the volunteer was asked to perform each movement actively, at its maximum amplitude, whereas the examiner observed and recorded the values at the end of the amplitude; 6) during the movement performance, the volunteer’s shoulders were stabilized by the instructor’s hands; 7) the same movement was performed three times and the mean was obtained for the posterior analysis; 8) the verbal commands used before each movement were: for the flexion, “move the chin towards the chest”; for the extension, “move the head backwards with the mouth closed”; for the lateral inclination, “move the ear towards the shoulder”; for the rotation, “rotate the head keeping the eyes at the level of the initial fixed point”; 9) after three measurements were obtained for each movement (flexion, extension, right lateral inclination, left lateral inclination, right rotation and left rotation) the device was removed from the volunteer’s head.

Intra-examiner reliability:

The intra-examiner reliability test was used to assess the examiner’s reproducibility. Twenty healthy volunteers, students of Physical Therapy at PUC/Minas, were examined through active flexion, extension, left and right lateral inclination and left and right rotation movements of the cervical column, by a same examiner through repeated measurements with a 48-hr interval. The procedures in this pilot study followed the same ones applied in the main study, as explained above.

Statistical Analysis

Descriptive analyses of the sample were carried out by means and standard deviations. The analysis of intra-examiner reliability was carried out with the Intraclass Correlation Coefficient (ICC) type (2,1)²⁰.

For the comparison of the means before and after the procedures, normality tests of all the results were initially performed and all of the groups behaved positively within the normality tests, allowing the use of the Student’s *t* test for independent variables, for crossing between each of the groups.

Significance levels were set at $p < 0.05$. The statistical software SPSS 12.0 was used to perform the statistical tests.

Results

Table 1 shows the results of the intra-examiner reliability; excellent reproducibility indexes were observed in all tested movements.

Table 2 shows comparisons between the cervical column ROM in the sedentary group and the group that practiced physical activities. It can be observed that there was a significant difference in the bilateral movements of rotation and inclination, which did not occur in the movements of flexion and extension.

Table 1.
Intraclass Correlation Coefficient (ICC) values for the assessment of intra-examiner reliability.

Movement	ICC (2,1)
Flexion	0.93
Extension	0.92
Right Rotation	0.91
Left Rotation	0.91
Right Inclination	0.90
Left Inclination	0.88

Table 2.
Comparison of mean values of cervical column movements among the groups analyzed.

Movement	Mean of differences	t	p
Flexion	-3.66	-1.26	0.21
Extension	-7.10	-2.06	0.50
Right Rotation	-8.30	-2.36	0.02*
Left Rotation	-6.90	-2.36	0.02*
Right Inclination	-6.50	-2.75	0.009*
Left Inclination	-8.37	-3.00	0.005*

* $p \leq 0,05$

Discussion

The aim of this study was to compare the ROM of flexion, extension, right and left lateral inclination and right and left rotation between two groups of elderly individuals.

It was observed that, regarding the flexion and extension movements, there were no significant differences between the two assessed groups. The movements of right and left lateral inclination and right and left rotation presented statistically significant values when the sedentary group was compared to the group that practiced physical activity. As all of the procedures were carried out by a blinded examiner, regarding group allocation, and also that the groups were comparable concerning demographic characteristics and the margin of error of the device is lower than the means of the differences found in the measurements of the different groups, one can infer that the differences observed can be really attributed to the different levels of physical fitness in the groups.

The reliability experiment confirmed the high interexaminer reliability for the CROM device in all movements of the cervical column. In spite of that, possible errors can occur during its use, and among them the difficulty and lack of precision when reading the inclinometer, as well as the different levels of physical effort shown by the patients during measurements and the erroneous perception of the end of the movement by the individual¹. Another study¹¹ recommends the use of a chair with thorax fixation to minimize the involvement of the thoracic column during the total cervical ROMs. In this study, the stabilization of the thoracic column was supplied by the fixation of the shoulders by the instructor's hands.

The reduction of cervical ROM is multifactorial. The degenerative processes whether discal, bone and/or ligamentous must be taken into account, as well as muscle shortenings and disuse. With aging, the structure of the intervertebral discs degenerates and consequently, the mean fluid content and mean height of the disc decrease. This decrease in height brings the vertebrae closer, altering the biomechanical relations of the zygo-apophysary joints.

The closer proximity of the vertebrae produces an increase in the compression that will be applied to the joint surfaces²¹. This is only one of the several factors that alone could explain ROM restriction in the elderly.

The joints become less stable and less flexible with aging and the articular components (cartilage, ligaments, tendons and sinovial fluid) present structural and functional changes during the aging process. These alterations include the increase in the number of cross-links in collagen and elastin, thickening of the basal membrane and changes in the concentration of the hyaluronic acid, which will alter the metabolic activity and increase the resistance of the connective tissues. The final result is tissue rigidity and less articular flexibility. Usually, with the aging process, the sinovial membrane becomes more fibrous and the sinovial liquid presents evidence of decreased viscosity.

Normally, the hyaluronic acid helps in the regulation of tissue viscosity. Consequently, reductions in the secretion of the hyaluronic acid should reduce the efficacy of the joint movements and decrease joint flexibility. Additionally, the production of hyaluronic

acid is increased with exercise; therefore, a decrease in physical activity will negatively affect the production of hyaluronic acid, creating tissue restrictions and decreasing mobility²².

This study is the first to compare cervical ROM in individuals with different levels of physical fitness; the results of this preliminary study reinforce some hypotheses that other rehabilitation professionals always stated, even without the scientific evidence for them. It is mandatory that longitudinal studies with larger sample sizes be conducted in order to confirm the results of this study, as well as to investigate the causes of ROM restriction. Further studies are necessary in patients with cervical pain with different levels of physical fitness in order to verify whether sedentary individuals are more vulnerable than active ones.

Conclusions

We conclude, based on the results of the present study, that individuals with higher levels of physical fitness present a higher cervical column ROM and that the CROM is a viable and reliable alternative for the measurement of ROM in the cervical column.

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