



Original

ARTÍCULO EN INGLÉS

## Study of relationship between osteoarthritis, postural changes and osteoporosis in postmenopausal women

O. Matos<sup>a</sup>, J.C. Bassan<sup>a,b</sup>, C.E. Orsso<sup>a,b</sup>, F. Gabriela<sup>a</sup>, S.K. F. Sprenger<sup>a</sup> and W. Ribeiro<sup>a,b</sup>

<sup>a</sup>Laboratorio de Investigación Bioquímica y Densitometría. Universidad Tecnológica Federal de Paraná. Curitiba. Brasil.

<sup>b</sup>Programa de Pós-Graduação em Engenharia Biomédica. Mestrado Profissional - PPGEb. Curitiba. Brasil

*History of the article:*  
Received: April 1, 2012  
Accepted: September 19, 2012

*Key words:*  
Osteoporosis.  
Osteoarthritis.  
Postmenopausal.  
Postural changes.

*Palabras clave:*  
Osteoporosis.  
Osteoartritis.  
Postmenopausia.  
Cambios posturales.

*Correspondence:*  
O. Matos.  
Laboratorio de Investigación Bioquímica  
y Densitometría.  
Universidad Tecnológica Federal de Paraná.  
Avenida Sete de Setembro, 3165, CEP 80230-901  
Curitiba. Brasil.  
E-mail: osleim@utfpr.edu.br  
osleimatos@hotmail.com e

### ABSTRACT

**Objectives.** To verify the relationship between postural changes, osteoarthritis, and bone mineral density in women with osteoporosis in a research group of participants in this area.

**Methods.** Seventy four Brazilian women aged 50 years or older with osteoporosis sent to Clinical Hospital were assessed. After anamnesis the subjects were evaluated in posture with a postural framework. The experimental protocol consisted of two groups: control group (without postural changes) and study group (with postural changes).

**Results.** The age average in the study group was greater than in the control group. In the joint changes, 65 subjects showed osteoarthritis in some part of the body. In the whole group assessed, 19 showed change in posture and all of them have osteoarthritis too.

**Conclusion.** This research showed that posture changes are direct relationship with advanced age. It concluded that posture assessment is essential to prescribe the most objective and efficient exercise program, with understanding of the biomechanical incidence forces, but not forgetting to strengthen the muscles to maintain the corporal posture.

© 2013 Revista Andaluza de Medicina del Deporte.

### RESUMEN

#### Estudios de la relación entre osteoartritis, las alteraciones posturales y osteoporosis en mujeres posmenopáusicas

**Objetivos.** Verificar la relación entre los cambios posturales, la osteoartritis y la densidad mineral ósea en mujeres con osteoporosis en un grupo de investigación de los participantes en esta área.

**Métodos.** Se evaluó a setenta y cuatro mujeres brasileñas de 50 años o mayores con osteoporosis en el Hospital Clínico. Después de anamnesis las mujeres fueron evaluadas respecto a la postura con una cuadrícula postural. El protocolo experimental consistió en dos grupos: grupo control (sin cambios posturales) y el grupo de estudio (con los cambios posturales).

**Resultados.** El promedio de edad en el grupo de estudio fue mayor que en el grupo control. En los cambios en las articulaciones, 65 mujeres mostraron osteoartritis en alguna parte del cuerpo. En todo el grupo evaluado, 19 mostraron un cambio en la postura y todas ellas tenían osteoartritis también.

**Conclusión.** Esta investigación mostró que los cambios posturales tienen relación directa con la edad avanzada. Concluye que la evaluación de la postura es esencial para prescribir el programa de ejercicios más objetivo y eficiente, con la comprensión de las fuerzas biomecánicas de incidencia, pero sin olvidar fortalecer los músculos para mantener la postura corporal.

© 2013 Revista Andaluza de Medicina del Deporte.

## Introduction

Osteoporosis is a common bone disease characterized by reduction in this structure and by weakening the bone and increasing the risk of fracture<sup>1</sup>. Osteoporosis is a systemic disorder that affects micro and macro structure, increasing the risk of fall<sup>2</sup>. Studies have shown that the decrease in postural control can be a risk factor for elderly falling probably due to motor sensory changes influencing the reaction speed and promoting the unbalance and falls<sup>3</sup>.

Osteoarthritis is defined as a failure of joint cartilage caused by mechanical factors, genetic, hormonal, and metabolic bone, which lead to an imbalance between the synthesis and degradation of joint cartilage and subchondral bone. Osteoarthritis causes the softening, fibrillation, ulceration and loss of the cartilage to articulate, sclerosis of the subchondral bone, osteophyte formation and subchondral cysts. The osteoarthritis is the disease to joint more prevalence and it is the main cause of functional incapacity in the senior. In the moment, there is no known cure for the osteoarthritis and the objective of the treatment is the improvement of the pain, of the function and of the life quality related to the health, minimizing, whenever possible, the therapeutic toxicity<sup>4</sup>.

The main objective of this research was to study the relationship between the posture, osteoarthritis, and bone mineral density in women with osteoporosis in the study group (PEFO- Physical Exercise Program for Osteoporosis -).

## Methods

The experimental protocol consisted of two groups: control group (without postural changes) and study group (with postural changes). The variables were evaluated with history, physical and postural assessment before starting the exercise program.

This research is characterized by descriptive study<sup>5</sup>. All that can be drawn is that there is (or not) a determined association between two or more traits or performance.

This survey was conducted in Curitiba, Paraná, ( Brazil ) in Federal Technological University of Paraná (UTFPR), with subjects from Physical Exercise Program for Osteoporosis (PEFO).

Seventy-four women aged between 50 and 81 years, mean age  $62.8 \pm 6.7$ , participants of the research group were assessed using the methods mentioned above. The participants of this study were verbally and formally informed of its risks, benefits, and goals, approving the consent form. As inclusion criteria, the subjects who had clinical evidence exams (frontal and anterior/posterior X ray) or visually presented a significant change in the postural exam and also had a medical history of osteoporosis. A postural framework and plumb line were used for postural examination, besides exercise mats to test muscle length.

The estimation for osteoporosis was obtained by Dual-energy X-ray absorptiometry (DEXA), considered the gold standard for diagnosis and determination of bone mineral density (BMD). According to the World Health Organization (1994)<sup>6</sup> definition of osteoporosis and osteopenia is for white women:

Normal = T-score equal to or exceeding  $-1.0$  SD.

Osteopenia = T-score between  $-1.0$  and  $-2.49$  SD.

Osteoporosis = T-score equal to or less than  $-2.5$  SD.

The software SPSS 20.0 along with PEFO database were used to cross-check the data. Descriptive analysis was performed, average and stan-

dard deviation, and statistical analysis was carried out to study the independent T-score.

This project was showed to and approved by the ethics committee.

## Results

Statistical difference was observed in regards to age difference, where the study group presented higher ages ( $67.2 \pm 5.7$ ) than control group ( $62.8 \pm 6.7$ ) (table 1). It was also observed that the lumbar spine densitometry average of the individuals without postural changes presented a greater bone rarefaction. To group without postural changes ( $-1.8$  and  $-1.9$ ), the average for bone mineral density showed great than study group ( $-1.2$  and  $1.7$ ).

The control group showed densitometries mean values higher than study group, and the minimum values to lumbar and hip represented higher degrees of osteoporosis, what raised simultaneously the mean for standard deviation of the group.

The figure 1 showed the sample for this study, where from the 74 subjects evaluated, 65 showed osteoarthritis or rheumatic disease with joint compromising in some part of the body. From the total assessed, 19 subjects have postural changes and all associated to osteoarthritis or rheumatic disease.

The values show that, for both the lumbar spine and hip, the subjects of the control groups presented higher values of bone rarefaction when compared with subjects with some type of postural change, although both of them presented mean values of osteopenia. In comparison between groups, the spine mean shows a significant difference ( $p = 0.041$ ). A comparison between the groups in the variable age, also have a significant difference ( $p = 0.012$ ).

## Discussion

Osteoporosis is a multi-factorial systemic syndrome and, by having many interfering factors in bone health, more effective forms of treatment are still arguable.

Clinical diagnosis and densitometry directs the clinician to more accurate results of the bone health, but the more detailed evaluation of the patient concerning to physical questions is not much appreciated. This is attributed largely to the lack of knowledge of the physician or from a multidisciplinary team who evaluates physically the patient so others physical components can be correlated to one possible interference in the bone component.

A study presented that the thoracic kyphosis angle is directly related to body posture and, consequently, to bone mineral density of the el-

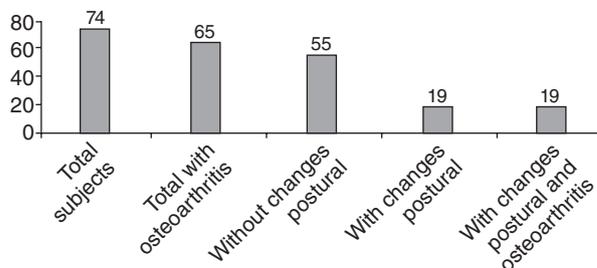


Fig. 1. Number of subjects with postural changes and osteoarthritis.

**Table 1**  
Variables for study group and control group

Variables	Study Group (with postural changes)	Control Group (without postural changes)	p
N	19 ± 5.7	55 ± 6.7	0.523
Age (years)	67.2 ± 5.7	62.8 ± 6.7	0.012*
Spine Mean (T-score)**	-1.2 ± 1.4	-1.8 ± 1.1	0.041*
Hip Mean (T-score)***	-1.7 ± 0.5	-1.9 ± 0.7	0.188

\* Statistically significant difference ( $p < 0.05$ ); \*\* For spine mean, T-score means the average of L1,L2,L3,L4 (lumbar spine). \*\*\* For hip mean, T-score means the average of the neck of femur, ward's triangle and trochanter.

derly people<sup>7</sup>. In that research, the measure of joint problems associated with posture change was found in 65 individuals from 74 (about 90%). From the 19 subjects evaluated with postural change, 100% has osteoarthritis associated to it. This data corroborates researches that indicate the posture evaluation as fundamental to the prescription of physical exercises. It is precisely the physical and postural evaluation that may indicate the best program option which wants to be introduced, defining itself in this way if the overburden will be on the bones or, indirectly, through muscular shape.

The physical evaluation of the patient determines the most appropriate exercise program to the bone health improvement, considering that post menopausal and elderly women have, mostly, joint and muscular problems associated<sup>8</sup>. If it has not been associated with needs of the patient, the exercises program may improve the bone density and interfere in another more limiting pathologies. The exercises at closed kinetic chain are appropriated to the bone resistance while exercises at open kinetic chain are more indicated to those individuals with joint and postural involvement, being the muscular strength the aim to indirect bone strength. Several studies how Ting-Kuo Chang et al (2010), showed about exercise program to osteoporosis and osteoarthritis. To Chang the effects of treadmill exercise on bone mass have been studied extensively, but there is a lack of evidence about its influence on joint cartilage change<sup>9</sup>.

For other authors, the exercises at closed kinetic chain move several joints simultaneously with the distal end of the fixed or supported member, whereas in open kinetic chain, the burdens are more centered at certain segment having free hands with or without burden<sup>10</sup>.

Despite research not having found strong relation between postural changes and the measure of bones' demineralization, the association of the changes with other pathologies is well clarified. The loss of muscle mass that occurs at the elderly phase is an interfering factor in the postural changes<sup>11</sup>.

To Allen and Morelli (2011), the exercise program to Osteoarthritis can be aerobic and resistance training and Major muscle groups should be included in resistance programs, to include chest, back, shoulders, arms, abdomen, and legs<sup>12</sup>. Both aerobic exercise and resistance training have been shown to decrease disability, and improve painful symptoms in patients with osteoarthritis. Ashe and Khan (2004) describe about integration of specific programs for muscle strengthening with aerobic conditioning is important to achieve optimal results in patients with musculoskeletal conditions such as osteoarthritis and osteoporosis<sup>13</sup>.

The postural change that occurs with aging and increases the incidence of the falls is also proven in research, where neuromuscular and anthropometric alterations are associated to explain them<sup>14</sup>.

To Carter et al (2002), participants in the exercise program experienced improvements in dynamic balance and strength, both important determinants of risk for falls, particularly in older women with osteoporosis<sup>15</sup>.

Based on the sample assessed, the postural changes are directly linked to the older age group. The joint changes found in physical assessment were relevant and are present in all subjects who have postural changes. It follows therefore, that it is essential to carry out a physical and postural assessment in groups of subjects with osteoporosis or osteopenia, which covers not only the mechanical action on the bones, but also the strength of muscle structures to maintain body posture without compromising the joint structures. This way, even if the change is localized, a more holistic view should be paramount to the total body balance.

### Conflict of interest

The authors declare that they have no conflict of interest.

### References

- Burke TN, France FJR, Meneses SRF, MenesesII SFR, CardosoII VI, PereiraIII RMR, et al. Postural control among elderly women with and without osteoporosis: is there a difference? São Paulo Med J. 2010;128:219-24.
- Cultrera P, Pratelli E, Petrai V, Postiglione M, Zambelan G, Pasquetti P. Evaluation with stabilometric platform of balance disorders in osteoporosis patients: A proposal for a diagnostic protocol. Clinical Cases in Mineral and Bone Metabolism. 2010;7:123-5.
- Melzer I, Benjuya N, Kaplanski J. Postural stability in the elderly: a comparison between fallers and non-fallers. Age Ageing. 2004;33:602-7.
- Camanho GL, ImamuraII M, Arendt-NielsenIII L. Gênese da dor na artrose. Rev bras ortop [online]. 2011;46(1):14-7.
- Thomas JR, Nelson JK, Silverman SJ. Métodos de pesquisa em atividade física. Porto Alegre RS: Artmed; 2007.p.103.
- Assessment of fracture risk and its application to screening for postmenopausal osteoporosis. Report of a WHO Study Group. World Health Organ Tech Rep Ser. 1994;843:1-129
- Regolin F, Carvalho G. Relationship between thoracic kyphosis, bone mineral density, and postural control in elderly women. Rev bras fisioter. 2010; 14:464-9.
- Matos O, Lopes SDJ, Martínez OJ, Castelo-Branco C. Effect of specific exercise training on bone mineral density in women with postmenopausal osteopenia or osteoporosis. Gynecol Endocrinol. 2009;25(9):616-20.
- Chang TK, Huang CH, Huang CH, Chen HC, Cheng CK. The influence of long-term treadmill exercise on bone mass and articular cartilage in ovariectomized rats. BMC Musculoskeletal Disorders. 2010;11:185.
- Araújo RC, Tucci HT, Andrade R, Martins J, Bevilacqua-Grossi D, de Oliveira AS. Reliability of electromyographic amplitude values of the upper limb muscles during closed kinetic chain exercises with stable and unstable surfaces. Journal of Electromyography and Kinesiology. 2009;19:685-94.
- Steven F, Kraemer W. Designing Resistance Training Programs. Hardback. 1997.
- Allen J, Morelli V. Aging and Exercise. Clin Geriatr Med. 2011;27:661-71.
- Ashe MC, Khan KM. Exercise prescription. J Am Acad Orthop Surg. 2004; 12(1):21-7.
- Matsudo SM, Matsudo VKR, Neto TLB. Impacto do envelhecimento nas variáveis antropométricas, neuromotoras e metabólicas da aptidão física. Rev Bras Ciên e Mov. 2000;8(4):21-32.
- Carter ND, Khan KM, Heather A, McKay, Petit MA, Waterman C, et al. Community-based exercise program reduces risk factors for fall sin 65- to 75-year-old women with osteoporosis: randomized controlled Trial. CMAJ. 2002;29:997-1004.