OSTEOPOROSIS, TOOTH LOSS AND FUNCTIONAL DENTITION IN ELDERLY WOMEN: A CROSS-SECTIONAL STUDY

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Palavras-chave: Osteoporose. Saúde Pública. Doenças Periodontais. Perda de Dente. Idoso.

RESUMO

Objetivos: O objetivo deste estudo foi investigar se a osteoporose é um indicador de perda dentária e de falta de dentição funcional em idosas. **Métodos**: Um estudo transversal envolvendo mulheres com mais de 60 anos foi realizado na Odontoclínica Central da Marinha, Rio de Janeiro, Brasil. Dados demográficos e médicos foram obtidos através de entrevistas individuais. Os dentes naturais foram contados no exame oral. Mulheres com um ou mais dentes foram divididas em dois grupos: com e sem osteoporose. O número de dentes naturais foi comparado entre os grupos, com controle para tabagismo e diabetes mellitus. A associação entre a dentição funcional e a osteoporose foi avaliada por meio de odds ratios (OR) e seus respectivos intervalos de confiança de 95%. **Resultados**: Dentre 360 idosas cadastradas no banco de dados, 256 tinham registro de exame oral. Os grupos foram compostos por 55 mulheres com osteoporose e 201, sem. A prevalência de doenças crônicas e tabagismo foi semelhante entre os grupos. O número médio de dentes para mulheres com osteoporose foi significativamente menor do que as que não tinham a doença (14,69 ± 7,69 versus 18,19 ± 7,20, p = 0,002), permanecendo significativo após o ajuste para possíveis fatores de confundimento. Mulheres sem osteoporose tiveram maior chance de apresentar dentição funcional do que as outras (OR = 2,10, IC 95% [1,21-3,66], p = 0,006). **Conclusão**: A osteoporose foi um indicador de perda dentária e de ausência de dentição funcional na população estudada.

Keywords: Osteoporosis. Public Health. Periodontal Diseases. Tooth Loss. Aged.

ABSTRACT

Objectives: The objective of this study was to investigate whether osteoporosis is an indicator of missing teeth and lack of functional dentition in elderly women.**Methods**: A cross-sectional study involving women aged more than 60 years was performed at the Brazilian's Navy Dental Center (*Odontoclínica Central da Marinha)*, Rio de Janeiro, Brazil. Demographic data and general health status information of the group were obtained through individual interviews. In addition, the number of natural teeth was recorded in oral examination. Women presenting at least one tooth were divided in groups presenting or not osteoporosis. The number of natural teeth was compared between groups, with adjustment for smoking and diabetes *mellitus*. The association between functional dentition and osteoporosis was evaluated using odds ratios (ORs) and their respective 95% confidence intervals. **Results**: Data on oral examination were available for 256 of the 360 elderly women registered in the database. The groups were composed by 55 women with osteoporosis and 201 not presenting osteoporosis. The prevalence of chronic diseases and smoking, was similar between groups. The mean number of teeth for osteoporotic women was significantly lower than in those without this disease (14,69 ± 7,69 *versus* 18,19 ± 7,20, p= 0.002), remaining significant after adjustment for potential confounders. Women without osteoporosis exhibited greater chance to present functional dentition than those with osteoporosis (OR = 2.10, 95% CI [1.21 to 3.66], p =0.006). **Conclusion**: Osteoporosis was an indicator for tooth loss and lack of functional dentition in the studied population of elderly women.

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INTRODUCTION

Oral health is considered a relevant component of general health. An integrated health approach is fundamental to tackle the needs of the population.[1] The current interest on the influence of osteoporosis on oral health is evident.[2,3]

Osteoporosis is a systemic skeletal disease characterized by low bone mass. It is considered the most common metabolic disorder at older age and a serious worldwide epidemic.[4,5] This disease has also been pointed as a risk factor for periodontal disease and tooth loss.[6-8]

Tooth loss is associated with adverse oral health-related quality of life (OHRQoL). One of the most immediate and important functional consequences of tooth loss is the reduction in chewing ability.[9] Reduced dental arches that preserve basic functions, such as chewing, speaking and esthetics, are characterized as functional dentition. The World Health Organization (WHO) considers functional dentition when individuals present no less than 20 teeth throughout life, with no need for tooth replacement.[10] Natural teeth shall be preferred over artificial teeth and ensure greater satisfaction in comparison to tooth replacements.[9]

Some authors demonstrated an association between osteoporosis and tooth loss.[11-16] However, the literature is not conclusive on this issue. [17-18] These inconsistent findings might result from differences in sample sizes, age of the participants, gender, socioeconomic *status*, educational level, as well as different study designs. Thus, the association between tooth loss and osteoporosis should be further explored. The aim of this study was to investigate whether osteoporosis is an indicator of low number of natural teeth and lack of functional dentition in a population of elderly women.

MATERIALS AND METHODS

Study design

This was a cross-sectional study involving a population of 1629 patients assisted by the Preventive Dental Service at the Brazilian's Navy Dental Center (*Odontoclínica Central da Marinha/OCM*), Rio de Janeiro, Brazil, between June 2016 and December 2017. The OCM is a military institution that is a specialized health care dental center for patients referred from primary health care in need for advanced dental treatment. Although OCM is designated to perform specialized health care, the Preventive Dental Service is also responsible for primary dental care, including basic periodontal therapy and oral hygiene instruction. Militaries on service, veterans and their dependents are entitled for health care and treatment at OCM, in Rio de Janeiro, Brazil.

Participants

Patients who attended the Preventive Dental Service for the first time between June 2016 and December 2017 were included in the study. Those who were on maintenance periodontal treatment were excluded. Women aged 60 years or more, with one or more natural teeth were eligible for the present study. Completely edentulous individuals are not referred to the Preventive Dental Service. This study was approved by the Research Ethics Committees of the Hospital Naval Marcílio Dias, register 78923017.6.0000.5256, and was in accordance with the Declaration of Helsinki ethical principles.

Data collection

Data was obtained through individual interviews about general health conducted by trained and blinded examiners, as part of the routine procedure of the Preventive Dental Service in the first dental appointment.

Demographic data included age and military situation (on service, veteran or dependent). The social and clinical data were collected regarding being a smoker, overweight, and presenting diabetes *mellitus* (DM), and osteoporosis. Overweight was considered if the body mass index (BMI) was greater than or equal to 25.0. BMI was defined as the weight (in kilograms) divided by the height squared (in meters).

The number of natural teeth was counted on clinical examination. Functional dentition was considered absent when there were less than 20 natural teeth, and present when there were 20 or more teeth.[9]

Numerical data were: age (in years), body mass index (BMI) and number of natural teeth.

Data Analysis

A descriptive analysis was performed for demographic, social and clinical data. The frequencies of the categorical variables and means (± standard deviation) of the numerical variables were obtained for the two groups of elderly women.

The mean number of teeth was compared between women who presented or not osteoporosis. A stratified analysis was performed in order to explore whether smoking and diabetes *mellitus* influenced this relationship. Additionally, the association between functional dentition and osteoporosis was evaluated using odds ratios (ORs) and their respective 95% confidence intervals.

Statistical differences between groups were evaluated using the chi-square test for categorical variables, and Mann Whitney for continuous variables, with a significance level of 5%. All data processing and analyses were performed using the software SPSS version 21.0 ("*Statistical Package for the Social Sciences*", SPSS Inc., Chicago, USA).

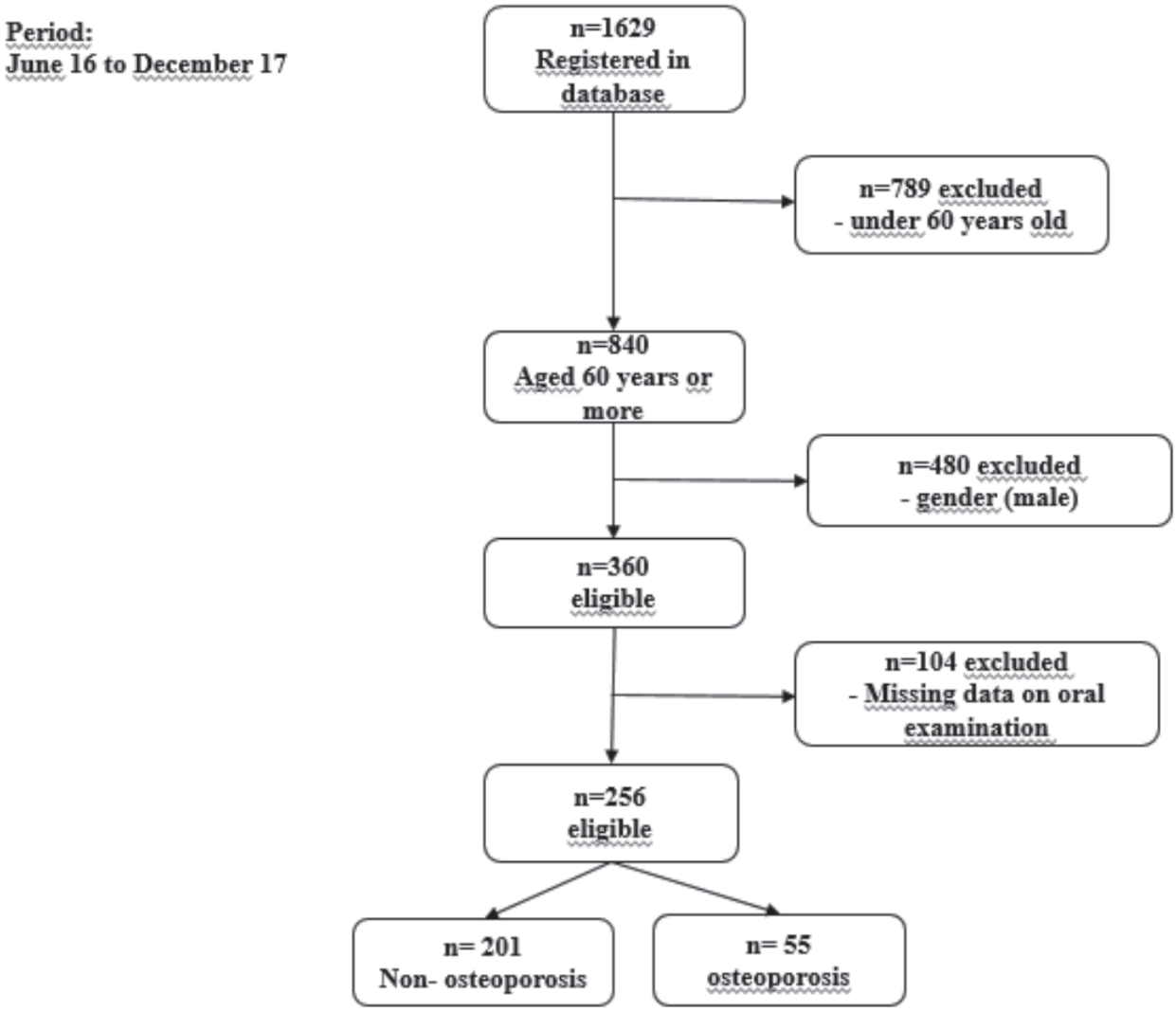

Fig.1 *Flow chart of the sample selection.*

RESULTS

There were 1,629 registered patients in the database of the Preventive Dental Service from June 2016 to December 2017. From the 360 elderly women registered in the database, there were data on oral examination available for 256 of them. These women composed the two groups: non-osteoporosis (n=201) and osteoporosis (n=55). Figure 1 shows a flowchart of the participants.

The descriptive statistics results are presented in Table I. The prevalence of smokers and individuals with chronic diseases, such as diabetes *mellitus* and hypercholesterolemia did not differ between groups.

The comparisons between groups of elderly women (with or without osteoporosis) and the stratified analysis are shown in Table II. Women with osteoporosis showed a significant lower number of teeth than those without osteoporosis (14,69 ± 7,69 *versus* 18,19 ± 7,20, p= 0.002). This association remained significant after adjustments for diabetes *mellitus* and smoking.

Table III shows the results on the association between osteoporosis and functional dentition. Women who did not present osteoporosis were more likely to present functional dentition than the women with osteoporis (OR = 2.10, 95% CI [1.21 to 3.66], p =0.006). Adjustments for diabetes mellitus and smoking were not performed because these conditions were not confounders, as observed previously.

***Table 1**: Descriptive analysis of the sample, according the two groups.*

Characteristics	Groups			
	Total	Non-osteoporosis	Osteoporosis	p
Age	68.44±6.24	68.11±6.01	69.64±6.82	0.15
Diabetes mellitus	56 (21.9)	44 (21.9)	12 (21.8)	0.99
Smoking16	(6.3)	14 (7)	2 (3.6)	0.53
Hypercholesterolemia	70 (27.3)	57 (28.4)	13 (23.6)	0.61
Overweight	140 (61.1)	113 (62.1)	27 (57.4)	0.62
Body Mass Index	26.81±4.88	26.78±4.71	26.92±5.55	0.92
Number of teeth	17.44±7.44	18.19±7.20	14.69±7.69	0.002

p value*: *significance level d" 0,05; Mann-Whitney test for continuous variables and Qui-square for categorical variables; SD: standard-deviation. Data expressed as mean ± SD or absolute number (%).*

***Table 2**: Comparison between the mean number of teeth after adjustments for DM and smoking.*

	Non-Osteoporosis	Osteoporosis		
		Total	Excluding	
	n = 201	n = 55	*DM* n = 43	smoking n = 53
Number of teeth (mean ± SD)	18.19±7.20	14.69±7.69	15.49±7.72	14.92±7.71
p		0.002*	0.035*	0.005*

***Note**: * p value: significance level d" 0.05; Mann-Whitney test*
DM: diabetes mellitus*; SD: standard deviation*

***Table 3**: Odds ratio (OR) and confidence interval for the association between non-osteoporosis and functional dentition.*

	Women with functional dentition (n=107)	
	Non-Osteoporosis	Osteoporosis
Functional Dentition: n (%)	93 (86.9)	14 (13.1)
Odds Ratio (Confidence Interval)	2.10 [1.21 to 3.66]	
p	0.006*	

***Note:** * p value: significance level d" 0.05*

DISCUSSION

The present results involving 256 postmenopausal women who had similar clinical and demographic characteristics, suggest that the number of natural teeth was lower in women with osteoporosis than those without this disease. Additionally, neither diabetes *mellitus* nor smoking, influenced this finding.

These results are in accordance with previous studies.[11-16] Our study sample was composed only by elderly women, because the effects of osteoporosis seem more meaningful in this population.[19] Studies involving young populations and perimenopausal women, where osteoporosis is less prevalent, are more likely to not show such association.[20] May et al.[21] did not find the same association of this paper. This can be explained because, in the present study, the number of teeth was clinically counted, while the other was based on self-reporting of tooth loss in elderly women.[21]

Elderly women from the non-osteoporosis group presented similar mean number of teeth as the whole amount of individuals aged over 60 years registered in database (respectively, 18.19 ± 7.20 and 18.03 ± 7.68; data not shown). This information highlights the possible negative role of osteoporosis on tooth retention.

One possible link between osteoporosis and tooth loss is the simultaneous systemic and alveolar bone resorption. The reduced systemic bone mineral density may have a negative effect on the jawbone quantity and quality.[13] It was reported that women with osteoporosis have a higher risk of tooth loss, and may undergo greater alveolar bone resorption after tooth loss, compared with healthy women of the same age range.[22] Results of a meta-analyses showed that women with osteoporosis and osteopenia present greater periodontal attachment loss when compared to women with normal bone mineral density.[8] A strong body of literature supports the relationship between osteoporosis and periodontal attachment loss or tooth loss. Periodontal disease remains one of the most common causes of tooth loss among adults.[23]

Tooth loss may reduce functional capacity of chewing and biting, self-esteem and social relationships.[24] It was postulated that tooth loss may be a predictor of shortened longevity and that greater retention of teeth may contribute to a longer lifespan. Oral well-being and functioning are crucial for quality of life.[6] Data from the 2013 National Health Survey revealed that the loss of 13 or more teeth was more frequent (67.4%) among individuals aged 60 and older.[25] The SB Brasil 2010 has shown that the mean number of missing teeth in individuals aged 65 to 74 years was 25.4.[26]

WHO points that the relative increase in the percentage of older people (65–74 years) who have a functional dentition is a relevant indicator to be used in the evaluation of oral health.[21] In 2003, the prevalence rate of functional dentition among Brazilian adults was 54%.[27] There is a need to improve oral health of status of adult population, by increasing the amount of people with functional dentition.[24] The occurrence of osteoporosis may possibly make this goal more difficult to be reached, as our study showed that the presence of functional dentition was lower among elderly women with osteoporosis, when compared to non-osteoporotic women .

Some limitations must be considered when interpreting our findings. One of them is the possible role of information bias on the findings since smoking and comorbidities, like diabetes *mellitus* and osteoporosis were self-reported conditions. We did not have information on the use of medications for osteoporosis, which may improve periodontal *status* and, possibly, prevent tooth loss caused by periodontitis.[28,29] Another point is the lack of information on the reasons for tooth loss. Although periodontal disease is the main cause of tooth loss at older ages, other factors contribute to human tooth loss, like dental caries, access to dental services, education level, among others. Moreover, the sample was selected in a convenience way. This sample may not represent the general elderly population, since edentulous women were excluded and all participants have access to dental care service. Finally, our findings limit the causal inference between osteoporosis and tooth loss because of the cross-sectional design. Prospective studies are necessary to confirm whether osteoporosis is a risk factor for tooth loss. These studies should investigate the causes of tooth loss and examine whether they are correlated to systemic bone mineral density, controlling for the use of antiosteoporosis drugs.

Risk factor researches aim to move closer to the direct causes of the diseases, and to prevent or reduce the risk at the population and individual levels.[30] There are some clinical implications associated to the results of the present study. Preventive strategies are fundamental for reaching advanced ages with functional dentition and good oral health. As part of the multiprofessional health care team, the dentists should be aware of systemic risk factors for oral health, like osteoporosis, contributing to patients' knowledge about their systemic skeletal condition. Once having the diagnosis of osteoporosis, women should initiate the management and treatment of the disease as soon as possible in order to minimize the negative impact of the condition on teeth supportive tissues.

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