Research article

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Associations between bone retraction, lost teeth, and metabolic syndrome. A cross-sectional study in dentistry patients aged over 60 years

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Abstract

Introduction. In Italy, the number of elder is growing and people over 70 may be a problem in public health on present and next years. [ISTAT 2019]

Methods. In this paper we analysed 150 patients aged 60÷99 by medical and instrumental examinations. Results. We analysed all data patients into three age groups: "A" patients aged 60÷69 years; "B" patients aged 70÷79 years, and "C" patients aged 80÷99 years.

Conclusion. This is the first study carried out on old and very old dentistry patients. Our people sample showed lost teeth, and bone retractions more than 6 millimetres associated with unilateral and/or bilateral carotidal plaques. They also suffered for many other pathologies connected with cardiovascular system. In our paper, we showed these specific aspects more in "B" subjects than in "A" and "C" elder patients. ***Clin Ter 2021; 172 (5):e442-447. doi: 10.7417/CT.2021.2356***

***MESH* Key words**: *D010518 = Periodontitis; D024821 = Metabolic Syndrome; D005853 = Geriatrics*

Introduction

Periodontal diseases are most diagnosticated and treated pathologies in every age of human life. It is a bacterial disease of tooth support tissue. If untreated, symptoms are worsening in time and include gingivitis, progressive alveolar bone retraction until tooth loss and edentulism if the treatment is not instituted. The exuberant inflammatory response to pathogens is the main responsible of destruction of periodontal tissue. The persistent inflammation causes dissemination of bacteria and inflammation factors in the bloodstream promoting the atherosclerotic process and vascular plaque. [Gaetti-Jardim E Jr et al., 2009; Lamster IB et Pagan M, 2017]

Periodontitis shows many differences in the presentation and evolution of the disease with different severity of clinical expression triggered by bacterial infection. One of main sign of periodontal diseases is alveolar bone loss that can be detected and quantified using radiography. The individual reaction is determined by genetic and systemic conditions like metabolic disorders, smoking and high stress level. [Kornman KS, 2008]

The activation of inflammatory factors and antibodies against bacteria into the gingival sulcus, may cause the destruction of periodontal connective tissue. In absence of appropriate therapy, periodontal bacteria and pro-inflammatory c factors enter the bloodstream producing a chronic low-level systemic inflammation. This new status and increased oxidative stress contribute to increased insulin resistance and MS. [Gurav AN, 2014]

Clinicians developed many classifications to organize effective treatment of their patients in relation to periodontitis aetiology and pathogenesis. [Highfield J, 2009; American Academy of Periodontology, 2015; Walter C et al., 2019]

In the last decades, there was an increase in the percentage of the population aged over 65. The increase of elder people contributed to the growth of prevalence and incidence of periodontal diseases. [De Angelis F, Manzon L. et al., 2018]

On the same time, more than one hundred papers investigated the relationship between periodontal disease and metabolic pathologies. [Darby I, 2015; Xian-Tao Zeng et al., 2016; Hongmei Yang et al., 2017; Nascimento GG et al., 2018; Cabanillas Balsera D et al., 2019; Segura-Egea JJ et al., 2019]

Moreover, the metabolic syndrome is of interest in many elder illness pathogeneses. In fact, MS is a multifactorial disorder characterized by hypertension, diabetes, dyslipidemia, abdominal obesity, and it is recognized the main atherosclerotic process promoter [Eckel RH et al. 2005; Lamster IB et Pagan M 2017; Nascimento GG et al. 2019]

Many studies show a bidirectional relationship between periodontitis and metabolic syndrome due to the chronic systemic low inflammatory status, oxidative stress and insulin resistance. The risk for periodontitis increases with the number of MS symptoms. The endothelial dysfunction resulting from the impaired glucose homeostasis due to

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periodontitis, could promote vascular atherosclerosis with consequent decreased periodontal blood flow and nutritional deficiency in time. [Gurav AN, 2014; Lamster IB et Pagan M, 2017; Abdalla-Aslan R, 2019]

Rationale and clinical revelance

The objective of this paper is detecting associations between alveolar bone retraction and dental loss (considered as expressions of a long-standing periodontitis over the years) and MS in a cohort of elderly.

The innovation of our paper consists in clinical data about very old patients (also over 80). On the contrary, the literature considers only young or adult people (never over 60-70). Our study is the first analyzing a large sample of very old people with dental problems.

The secondary goal reached is the criticisms revealed in classification of periodontitis in patients with many lost teeth.

Material and methods

Study protocol was organized in respecting of Helsinki Declaration and Ethical Committee approved it. After a physician explanation, all patients read, understood, and signed a written information consensus.

On years 2016-2018, all afferent patients (over 60 years) to the dentist ambulatory for elderly in the Department of Geriatric Dentistry (Policlinico "Umberto I" - Roma, Italy) were screened for inclusion.

Exclusion criteria: edentulous patients, or patients undergoing radiotherapy or chemotherapy.

All patients underwent to physical and medical examinations, routine blood analysis, orthopantomography (OPG), echo-color-doppler (ECD) of the bilateral epiaortic vessels.

OPG image is a valid alternative to intraoral radiograph for evaluating periodontal conditions. But it is less efficient in diagnosis than standard radiograph. On the same time, OPG is a good mass screening method that require low radiation, timesaving, and low cost. [Saberi BV et al., 2017]

On OPG we measured the number of lost teeth and the measure of dental bone retraction (in millimetres) about each tooth. The alveolar bone loss was evaluated as "normal" (less than 4 mm); "moderate" (4-6 mm) or "severe" (more than 6 mm) as described by Müller HP, et al., 2005.

ECD showed presence (or not) of fibrous/calcific plaques in unilateral/bilateral epiaortic vessels.

Data were collected into a Microsoft Access 2017 database and they were analysed by Epi-Info 7 programs [CDC and NIH, 2020 version 7.2.4.0]. Statistical analysis estimated descriptive statistics, frequencies, and significance in group differences. Statistical significance "between" and "within" groups was calculated on continuous variables. An analysis of variance (ANOVA) was performed to test the equality of means between groups for continuous variables, including Bonferroni and Newman-Keuls pairwise mean comparison tests. Chi-square Yates corrected test was used for non-continuous variables by Statcalc and Analysis programs. A p level less than 0.05 was considered significant, and 95% confidence intervals were also calculated.

Results

The study was performed on 150 elderly patients (99 females plus 51 male). All subjects were divided into three age groups:

- 47 "A" patients (30 females plus 17 male) aged 60÷69 years.
- 68 "B" patients (43 females plus 25 male) aged 70÷79 years.
- 35 "C" patients (26 females plus 9 male) aged 80÷99 years.

See table 1 for details about anthropometric, anamnestic, OPG values and ECD data.

In all groups, stratification by sex did not showed statistically significant differences in all analysed variables.

All subjects had not statistically significant differences between groups in stratification about height and BMI. We did not find statistically significant differences between groups in mean bone retraction (see table 1 for details).

People in "C" group had a mean weight value less than other groups. The difference was statistically significant (p=0,0015 - Kuskall-Wallis H = 12,9962 with two degrees of freedom). See following table for details.

Age group		Weight (kg)	
	Obs	Mean	Std Dev
A	47	71,1	13,9
B	68	70,8	12,5
C	35	61,7	13,3

The analysis of each symptoms/signs about metabolic syndrome did not show statistically significant differences in HDL-cholesterol and triglycerides pathological level between groups.

"C" group patients were less affected by MS than "A" or "B" group patients (3 subjects vs 8 or 10 people, respectively. See table 1 for details).

Subjects in group "B" showed blood pressure higher than other subjects in groups "A" or "C". The difference was statistically significant (p<0,05 – Chi-square Yates corrected = 4,0404). See table 2 for details.

We had 29 diabetic patients (19% of sample) divided into:

- group "A" (10 subjects aged 60-69).
- group "B" (15 subjects aged 70-79).
- group "C" (4 subjects aged 80-99).

Into group "A", diabetic patients lost a mean double number of teeth than no diabetic people. The difference was statistically significant (p<0,001 - Kuskall-Wallis H = 12,4308 with one degree of freedom). See table 3 for details.

Table 1. All enrolled patients stratified by age group.

Age Group	**"A" 60 ÷ 69 years old**	**"B" 70 ÷ 79 years old**	**"C" 80 ÷ 99 years old**	
Sex	30 F + 17 M	43 F + 25 M	26 F + 9 M	
Mean Age (years ± SD)	65 ± 3	74 ± 3	86 ± 4	P < 0,0001
	Mean value ± S.D.			
Height (cm)	165 ± 9	163 ± 9	160 ± 9	
Weight (kg)	71± 14	71 ± 13	62 ± 13	P=0,0015
BMI	26 ± 4	26 ± 4	24 ± 4	
	Number of patients (percent inside group)			
Hypertension	24 (51%)	49 (72%)	23 /66%)	
Diabetes	10 (21%)	15 (22%)	4 (11%)	
Obesity	8 (17%)	15 (22%)	3 (9%)	
Cholesterol HDL	10 (21%)	9 (13%)	4 (11%)	
Hyper triglycerides	5 (11%)	8 (12%)	6 (17%)	
Metabolic Syndrome	8 (17%)	10 (15%)	3 (9%)	
	Mean value ± S.D.			
Lost teeth	7 ± 6	8 ± 5	11 ± 7	P=0,0109
Bone retraction	4,8 ± 1	4,8 ± 1	5,0 ± 1	
Retraction >6 mm	11	10	3	P < 0,01
PLAQUES	Number of patients (percent inside group)			
Right - Fibrous	1 (2%)	17 (25%)	12 (34%)	P=0,0001
Right - Calcific	7 (15%)	22 (32%)	12 (34%)	
Left - Fibrous	2 (4%)	12 (18%)	9 (26%)	P=0,0150
Left - Calcific	8 (17%)	22 (32%)	12 (34%)	
Unilateral	8 (17%)	9 (13%)	3 (9%)	P=0,0003
Bilateral	5 (11%)	32 (47%)	21 (60%)	

The differences in number and type of carotid plaques was statistically significant. People in "A" group had less plaques than "B" or "C" group (see table 1 for details and statistically significant levels in between groups differences).

Table 2. Results about mean teeth out and mean bone retraction. Data stratified by age groups and presence/absence of hypertension.

	Patients without hypertension			**Patients with hypertension**		
Age group	"A"	"B"	"C"	"A"	"B"	"C"
(#)	23	19	12	24	49	23
Teeth out mean ± S.D.	6 ± 5	8 ± 5	12 ± 8	9 ± 7	8 ± 5	11 ± 6
Bone retraction mean ± S.D. (mm)	4.5 ± 1.2	5.0 ± 1.2	5.0 ± 1.0	5.2 ± 1.1	4.8 ± 1.0	4.8 ± 1.0

Table 3. Results about mean teeth out and mean bone retraction. Data stratified by age groups and presence/absence of diabetes.

	Patients without diabetes			**Patients with diabetes**		
Age group	"A"	"B"	"C"	"A"	"B"	"C"
(#)	37	53	31	10	15	4
Teeth out mean ± S.D.	6 ± 6	7 ± 5	12 ± 7	12 ± 5	10 ± 4	11 ± 8
Bone retraction mean ± S.D. (mm)	4.6 ± 1.2	4.7 ± 1.0	4.9 ± 1.0	5.6 ± 1.0	5.4 ± 0.9	4.9 ± 0.9

Discussion

Present study shows significant statistical differences in comparing mean bone retraction measures and number of lost teeth between patients age-groups.

At the same time, we did not find significant statistically differences in comparing mean bone retraction measures with the presence of atherosclerotic plaques in epiaortic vessels or with metabolic syndrome.

Only diabetic patients had more lost teeth than non-diabetic patients. This aspect is due to metabolic and microcirculatory compromising in gingival tissue.

These clinical aspects may not seem in accordance with other scientific paper, but in our study, we probably had a statistic positive bias. Most of the dental work in the scientific literature considers patient samples no older than 70 years. Conversely, we had very old patients (group C was aged 80 ÷ 99) and they were in better health status than other same age people. In fact, in our sample, the cardiovascular diseases prevalence is lower than in Italian population. [ISTAT, 2018]

So, it is possible to speculate that our patients, who came to our hospital without a caregiver despite their advanced age, had few health problems and they may think to dental cure as one of their primary goal?

Anyway, our paper is important for the wide age range examined in our patients' sample. Our results suggest a next specific study about lost teeth and a research for a new specific methodology for valuating bone retraction and well understanding dental versus health problems in very old subjects.

Conclusions

The metabolic syndrome (MS) (also called insulin resistance syndrome or syndrome X) is due to the presence of five signs/symptoms. In a patient, more than three signs/symptoms are associated with increasing risk for cardiovascular diseases (CVD). Many studies have reviewed an association between MS and periodontitis only in young and adult people.

These metabolic disorders can negatively influence periodontium or periodontal disease treatment. Many studies, sometimes contrasting, showed the presence of periodontal pathology with atheromatous plaques in adult patients (under 65 years old) with chronic periodontitis.

Our results do not show association between periodontal and metabolic diseases. The same aspect is highlighted by the American Heart Association, where many observational analysed studies do not demonstrate correlations between periodontal disease and metabolic syndrome or CVD. On other hands, periodontal disease can contribute to CVD with sharing multiple risk factors as diabetes mellitus, and age, and periodontal interventions prevent heart disease or stroke or modify the clinical course of CVD. [Lockhart PB et al. 2012]

There was no single paper, neither systematic reviews nor meta-analysis to associate periodontal disease in over 70 years old patients. Present paper is the first considering periodontitis and MS in old (aged 70-80) and very old (aged over 80) patients versus adult subjects (aged 60-65). [Daudt LD et al. 2018; Srivastava MC et al. 2019]

Most of the medical practitioners do not consider the association between periodontal and metabolic diseases. However, the influence of periodontal disease on diabetes, CVD, and obesity can provide a useful guidance to practitioners. Only the practitioners' collaboration with dentists may reach oral and overall health in patients.

Limitation of the study

In this study, we encountered some problems due to present methodology for calculating bone retraction. In fact, present procedures for calculating bone retraction are inadequate and they do not consider lost teeth. For these reasons, we propose further studies to develop a new methodology for assessing the health state of the dentition in the elderly that takes into account bone retraction and missing teeth.

Conflict of interest

On behalf of all authors, the corresponding author states that there is no conflict of interest. In specific, the authors have stated explicitly that there are no conflicts of interest in connection with this article.

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Ethical approval

The current research was approved in advance by the ethical committee of the Policlinico "Umberto I" (Rome, Italy) where the study was conducted.

Informed consent

ll patients read an informed consent. After receiving explanations of any kind from medical personnel, they approved and signed a written consent.

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