

THE RELATIONSHIP BETWEEN PERIODONTAL DISEASE AND THE ATHEROSCLEROTIC CHANGES OF THE CAROTID ARTERY AND AORTIC VALVES

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SUMMARY:

Objective: During the last period several studies have shown that chronic infections, including the periodontal disease, predispose to cardiovascular disease. Our aim was to study the atherosclerotic changes located at the carotid arteries and the aortic valves, evidenced by echography, and periodontal changes measured with periodontal indicators, researching the possible connections between them. **Material and methods:** We selected 144 patients over 40 years, divided into two equal groups, according to the presence or the absence of subclinical atherosclerosis evaluated at the carotidian and heart level, each lot being divided into 3 subgroups according to the age (40 -55, 56-70 and over 70 years). We measured in these patients different oral hygiene and periodontal indexes (IHI, GBI, DMF) and we established the existing correlations. **Results:** There was a relation between the number of periodontal pockets, the indexes of oral hygiene and bleeding, the number of patients with total edentation and the presence of the lesions of subclinical atherosclerosis. We did not find a connection between this damage and the DMF index. **Conclusion:** This study suggests the evidence of a relationship between atherosclerosis and periodontal disease. The prevention and treatment of periodontal disease and oral health have a role in the atherosclerotic process and in the evolution of the cardiovascular diseases.

Key Words: periodontal disease, carotid atherosclerosis, aortic valve.

RELATIA DINTRE BOALA PARADONTALA SI MODIFICARILE ATEROSCLEROTICE CAROTIDIENE SI VALVULARE AORTICE

Rezumat:

Obiectiv: In ultimii ani au aparut mai multe studii care au demonstrat ca infectiile cronice, incluzand infectiile parodontale, predispun la boli cardiovasculare. Ne-am propus sa studiem modificarile aterosclerotice de la nivel carotidian si ale valvei aortice evidentiate ecografic si modificarile parodontale evaluate prin indicii parodontali, cercetand eventuale corelatii intre acestea. **Material si metodă:** Am selectat 144 de pacienți cu vârsta peste 40 de ani, împărțiți în 2 loturi egale în funcție de prezența sau absența aterosclerozei subclinice evaluate la nivel carotidian și cardiac, fiecare lot fiind divizat în 3 subgrupe în funcție de vârstă (40-55, 56-70 și peste 70 de ani). Am măsurat la acești pacienți diferiți indici parodontali și de igienă orală (IHI, GBI, DMF) și am stabilit corelațiile existente. **Rezultate:** Există o corelație între numărul de punji parodontale, indicii de igienă orală și de sângerare, numărul pacienților edentați total și prezența leziunilor de ateroscleroză subclinică. Nu s-a găsit însă o legătură între această afectare și indicele DMF. **Concluzie:** Lucrarea sugerează existența unei relații între ateroscleroză și afectarea parodontală, sugerând faptul că boala parodontală, prevenirea și tratamentul acesteia, respectiv sănătatea orală au un rol în procesul aterosclerotic și în evoluția bolilor cardiovasculare.

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INTRODUCTION

It was assigned an increasingly important role to the chronic infections in the pathogenesis of atherosclerosis (ATS). Chronic parodontitis, a destructive infection of the periodontal tissues caused mainly by the Gram-negative bacterias, *Porphyromonas gingivalis* being a major pathogen [1], was associated with coronary artery disease, stroke and most recently with subclinical atherosclerosis.

Clinical epidemiological and laboratory studies have documented that some infectious agents such as the hepatitis virus, the gram negative bacterias, the citomegalic virus, *Chlamydia pneumoniae*, *Helicobacter pylori* but also the periodontal infection have an influence on the onset of atherosclerosis and coronary events [2].

The INVEST study (Oral Infections and Vascular Disease Epidemiology) [3] investigated the hypothesis that periodontal infections predispose to an accelerated progression of the carotidian atherosclerosis (ATS) and an increased incidence of stroke, myocardial infarction and death of cardiovascular causes.

We considered important to study this possible link between the periodontal disease and atherosclerosis as it can provide the possibility of future therapies that act simultaneously on both disorders so that periodontal disease could become a new therapeutic option in the management of atherosclerosis [1].

MATERIAL AND METHOD

By performing carotid and cardiac ultrasound examinations, we selected a group of 72 subjects (men and women) aged over 40 years with atherosclerotic changes at the carotidian level – an increased intima-media report (RIM) and atherosclerotic plaques - and aortic sclerosis and stenosis (group A).

Control group (group B) was also represented by 72 subjects over 40 years in whom degenerative changes of the carotid artery and the aortic valves were not found at the ultrasound examination. The subjects of the two groups were divided into three subgroups according to the age: between 40-55 years, 56-70 years, and over 70 years. We excluded patients with chronic inflammatory diseases (e.g. rheumatoid arthritis, disseminated erythematous lupus, multiple sclerosis, psoriasis), whose role in the cardiovascular pathology is well known.

1. The echocardiographical examination of the carotid arteries

We used for the carotidian examination a color Doppler echograph Acuson CV 70. After we performed a global bilateral examination of the common carotid artery (ACC) and of the internal carotid artery and after the number, the size, the appearance and the location of atherosclerotic plaques was inventoried, we examined bilaterally in all subjects a fragment of 1 cm of the posterior wall of the ACC at 1 cm below the carotidian

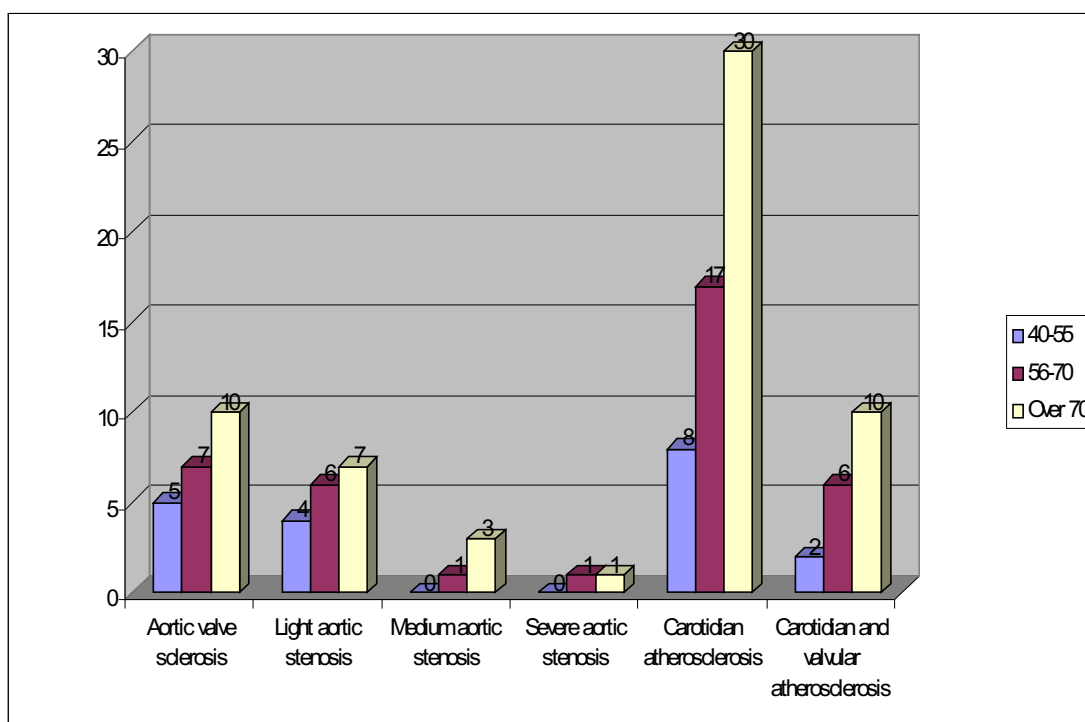


Fig. 1. Atherosclerotic changes correlated with age - group A

bifurcation, determining the intima-media report according to literature recommendations [4].

2. The echocardiographical evaluation of the aortic valves

Cardiac ultrasound examination was performed in TM, 2D, CW, PW modes and in the color mode. Thickening, hiperechogen areas of the body and of the free edge of cusps with commissural fusion and the stelar hole in systole were indexes that showed degenerative aortic valve changes. It was determined the maximum velocity (V max) of the aortic flow so that transvalvular V max (<1.5 - 2 m/s) along with morphologic changes identified the aortic valve sclerosis and a transvalvular V max > 2 m/s identified the aortic stenosis [5].

V max between 2-3 m/s labeled a mild aortic stenosis, V max 3-4 m/s showed a moderate aortic stenosis and V max >4 m/s indicated severe aortic stenosis. The maximum and medium gradients were automatically displayed by the echograph (6), the intensity of the severity being reported to the medium gradient.(Fig.1)

3. The oral examination

We used for the periodontal examination periodontal and exploratory probes. Periodontal measurements were made with or without the prophylaxy of bacterial endocarditis, depending on the echographic changes of the valves previously detected. It was performed the examination of the periodontal cover, the calculation of the bleeding and oral hygiene indexes, the examination of the periodontal support by measuring the probing depth (PD), the gingival retraction (gingival recession), the calculation of the attachment loss, the gingival bleeding index (GBI), the oral hygiene index (IHI) and the cavities intensity index (DMF), the first three indexes being marked in the periodontal chart.

Cavities intensity index, adnotated as DMF, represents the average number of decayed, missing and filled teeth per subject (D = decay, M = missing, F = filled) [10].

The periodontal bag is a space composed of: an apical portion (the epithelium - conjunctive attachment), a soft wall (the epithelium bag), more or less ulcerated, a hard wall (the dental root) and it has an opening to the oral environment.

The depth of the periodontal bag (probing depth or PD) is the distance between the free gingival margin and the bag and it is measured in mm with the periodontal probe.

The attachment level (probing attachment or PA) is the distance between the amelo- cementary junction (JAC) and the bag.

We probed three places (mezial, distal and median) of each tooth face (vestibular and oral) and we recorded the results in the observation sheet. Healthy places were considered as values of 2.5 - 3 mm.

Bleeding on probing remains the most objective way to highlight the gingival inflammation. In order to quantify the inflammation, we performed the Ainamo and Bay's gingival bleeding index GBI (11). The index evaluates the absence (-) or the presence of bleeding (+).

In order to identify the bleeding sites we used a chart that contains a square for each tooth; each dental side was represented by a triangle. We appreciated bleeding in 4 areas of each tooth: mezio - vestibular, centro-vestibular, disto - vestibular and centro - oral. We marked with "+" the presence of bleeding in the concerned gingival units. The medium value of the gingivitis was expressed in percentages.

The evaluation of the oral hygiene. We pointed out the bacterial plaque by painting the teeth with methyl blue 2%. After rinsing, the remaining colored sites (with plaque) were evaluated. Both the chart used to identify the plaque sites and the areas in which we evaluated this plaque were identical to those used for the gingival bleeding. We marked with "+" the presence of the plaque. The average score of the plaque was expressed in percentages (12).

THE STATISTICAL ANALYSIS OF THE DATAS

The statistical analysis of the datas was done using the arithmetic average (x), the average deviation (d), the standard deviation (SD), the standard error (ES) and the error (u) [13].

The result was considered significant when $u > 2$ ($p < 0.05$), very significant for $u > 2.5$ ($p < 0.01$), significantly high for $u > 3$ ($p < 0.001$) and insignificant for $u < 2$ ($p > 0.05$).

RESULTS

1. The number of teeth with periodontal pockets (more than 3 mm)

The first parameter taken into study was the number of teeth with periodontal pockets. In group A we observed a statistically significant difference in terms of the number of the teeth with periodontal pockets in men compared to women at all ages.

In the control group we noticed an increasingly higher number of periodontal pockets with aging, there were also statistically significant differences in men compared to women.(Fig. 2)

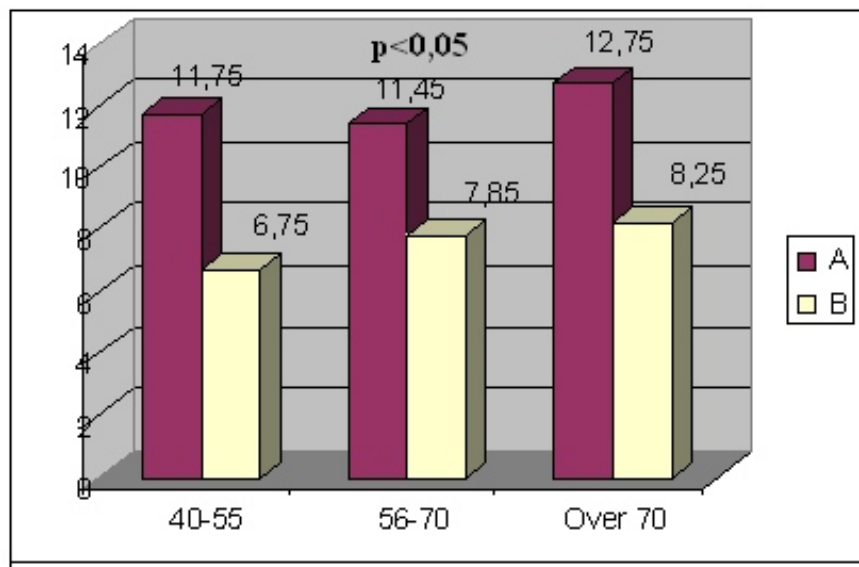


Fig. 2 The number of teeth with periodontal pockets: comparison between group A and group B

We observed the existence of a higher number of periodontal pockets in the group with subclinical atherosclerosis compared to the control group in all three age categories (40-55 years, 56-70 years and over 70 years).

2. The total number of missing teeth

The total number of missing teeth in the study group was related to age and was distributed in 4 categories (0-9, 10-19, 20-31 missing teeth and totally edentulous).

In the group with atherosclerosis, the highest number of totally edentulous people is located at more than 70

years, and the highest number of partially edentulous at the category of 40-55 years (20-31 missing teeth). People with tight aortic stenosis were all totally edentulous regardless of age.

In the control group there were no totally edentulous people, and the highest number of partially edentulous people was found at 56-70 years (10-19 missing teeth).(Fig. 3)

In group A we noticed a larger number of patients over 70 years with 0-9 missing teeth compared to group B and a larger number of totally edentulous in all persons over

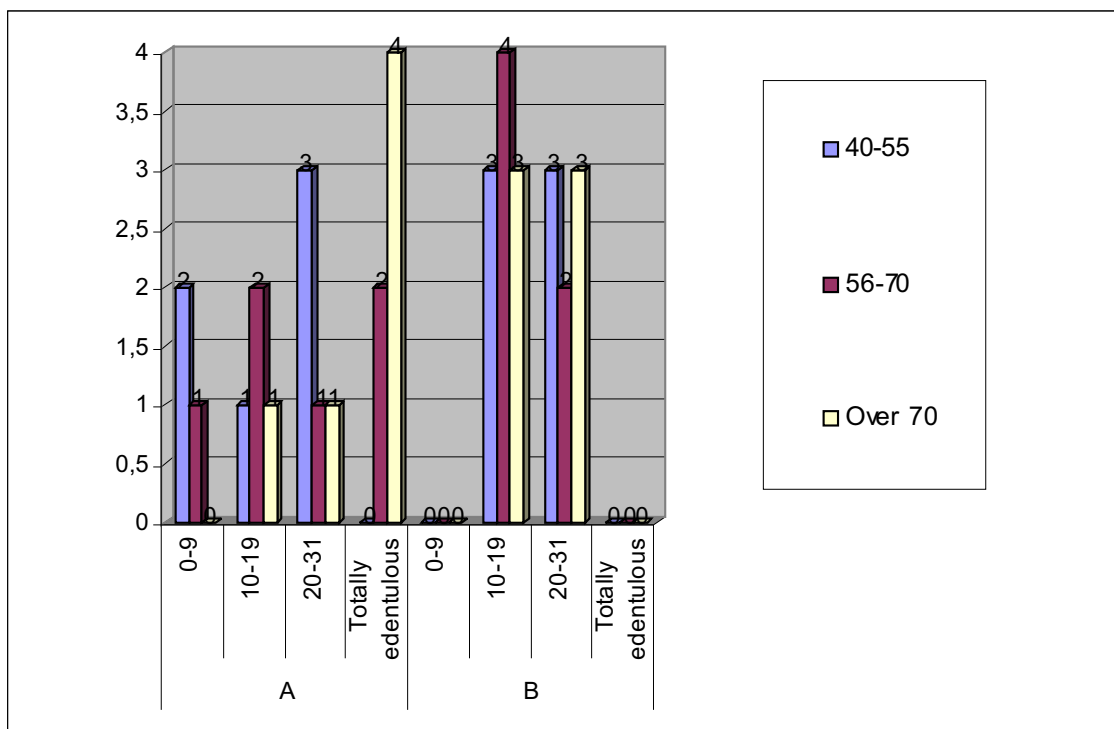


Fig. 3 The number of missing teeth: comparison group A-group B

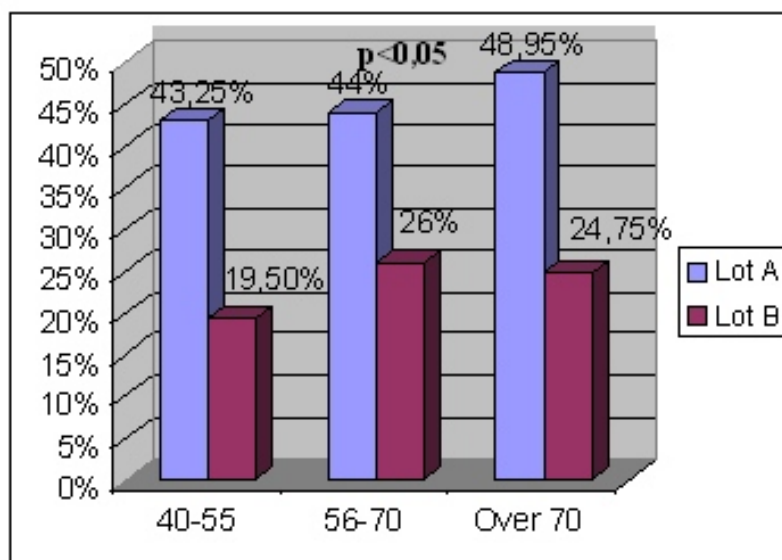


Fig. 4 GBI bleeding index: comparison group A-group B

56 years. But in the control group prevailed the persons with 20-31 missing teeth at ages of over 56 years, and with 10-19 missing teeth in all age groups.

3. Gingival bleeding index (GBI)

The gingival bleeding index was calculated by reporting the number of bleeding dental surfaces on probing to the total number of tooth surfaces of a patient and it was expressed as a percentage.

In group A, we observed statistically significant differences in men compared to women in the extreme age groups (40-55 and over 70 years), smoking and poor local hygiene being often met in this category. In the control group, unlike group A, women showed a higher GBI index than men in ages over 56 years.(Fig. 4)

Comparing the two groups, the GBI bleeding index showed significantly higher values in group A compared with the control group in all three age categories.

5. IHI plaque index

IHI plaque index was calculated similarly to the GBI index, the difference was that the areas taken into study were those who had dental plaque.

Similar to the GBI index, in group A the values of the IHI index were significantly higher in men in all three age categories.

In the control group, IHI index values were significantly higher in men at all ages, too.(Fig. 5)

Comparing the two groups, IHI plaque index presented higher values in group A compared with the control group in all three age categories.

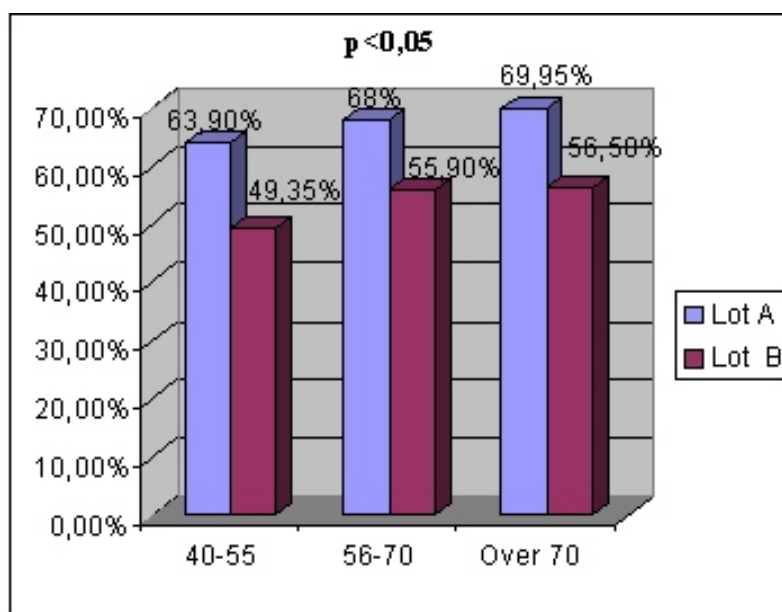


Fig. 5. Comparison group A-group B regarding the IHI plaque index

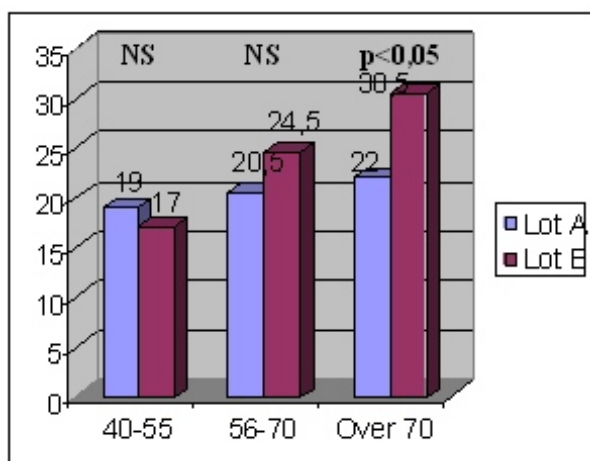


Fig. 6. DMF index: comparison between group A and group B

6. DMF index

Cavities intensity index, annotated as DMF, represents the average number of decayed, missing and filled teeth per patient.

Values of this index were similar in the group of people with atherosclerosis; there were no significant differences between the two sexes.

The control group showed significant differences of this index in males compared to females only in young people (40-55 years). (Fig. 6)

Regarding the DMF index, significant differences between group A and group B were found only in people over 70 years, in this category being also included the totally edentulous people, so we were unable to find a connection between the values of this index and the presence of atherosclerosis.

DISCUSSIONS

This work presents the results of a study involving 144 subjects, equally divided into two groups: patients with atherosclerosis and persons in whom this disease was not found. The atherosclerosis was demonstrated by revealing aortic sclerosis, degenerative aortic stenosis, increased RIM and the presence of the atherosclerotic plaques on the carotid arteries. We studied comparatively, on age subgroups, this connection between atherosclerosis at the carotidian and aortic valve level and the periodontal damage.

Regarding the number of teeth with periodontal pockets, in the group of people affected by atherosclerosis we found statistically significant differences in men compared to women in all age categories, most of them being smokers and having a poor oral hygiene.

In the control group we noticed an increase in the number of periodontal pockets with aging, being also significant differences in males compared to females.

We remarked the existence of a higher number of periodontal pockets in the group with atherosclerosis compared with the controls in all three age categories (40-55 years, 56-70 years and over 70 years).

Regarding the total number of missing teeth, in the group with atherosclerosis, the highest number of totally edentulous people is located at more than 70 years, and the highest number of partially edentulous at the category of 40-55 years (20-31 missing teeth). All subjects with tight aortic stenosis were all totally edentulous regardless of age.

In the control group there were no totally edentulous people, and the highest number of partially edentulous people is found in the age category 56-70 years (10-19 missing teeth).

In group A we noticed a larger number of patients over 70 years with 0-9 missing teeth compared to group B and a larger number of totally edentulous in all persons over 56 years. But in the control group prevailed the persons with 20-31 missing teeth at an age of over 56 years, and with 10-19 missing teeth in all age groups.

Regarding the GBI bleeding index, in the lot with atherosclerosis we observed statistically significant differences in men in the extreme age groups (40-55 years and over 70 years), compared to women. In the control group, unlike group A, women showed a higher GBI index than men in people over 56 years. Comparing the two groups, GBI bleeding index showed significantly higher values in group A compared to the controls in all three age categories.

When comparing the two groups, the results regarding IHI plaque index are similar to those obtained for GBI index, values were increased in men in both groups, regardless of age.

There were concerns about this issue in studies performed recently, too. The study of Buhlin and collaborators is based on the fact that a possible mechanism of association between periodontal disease and ATS may be bacteriemia, the penetration of bacteria, their products and proinflammatory cytokines from the chronic periodontal lesions in the bloodstream [11].

Another research is that of Grau and his collaborators. The study investigated the relationship between chronic infectious diseases and stroke [12].

Söder evaluated the involvement of the periodontal disease in the development of early ATS vascular lesions,

researching the involvement of the chronic infections as an atherosclerotic risk factor [13].

The conclusion of this study is that there is a link between systemic atherosclerosis (appreciated in this case at carotidian and aortic valve levels) and periodontal indexes, the common cause being the endothelial dysfunction, its role consisting in the initiation and the progression of both diseases. In periodontitis, the increased risk of atherosclerosis caused by the endothelial dysfunction is induced by inflammatory mediators or periodontopathogene bacterias derived from infected periodontal tissues [14].

CONCLUSIONS

1. Regardless the age, the group with subclinical lesions of ATS has documented a greater number of periodontal pockets compared to the control group.
2. In the group with subclinical atherosclerosis there was a larger number of totally edentulous patients aged over 56 years and a larger number of partially

edentulous (0-9 missing teeth) patients aged under 70 years. All subjects with tight aortic stenosis were totally edentulous.

3. Bleeding and plaque indexes were significantly higher in individuals with sub clinical atherosclerosis regardless the age ($p < 0.05$), with increased plaque index values in men.
4. DMF cavities index was not statistically significantly different ($p > 0.05$) between the two groups regardless of age and sex.

This study suggests the relationship between ATS and the periodontal disease, suggesting that periodontal disease, its prevention and treatment and oral health have a role in the atherosclerotic process and in the evolution of the cardiovascular diseases.

CLINICAL CASE

P.M., 52 years

IHI = 41, 96%

GBI = 37, 50 %



Fig. 7 The examination of the alveolo-dental arches (with the mouth opened)

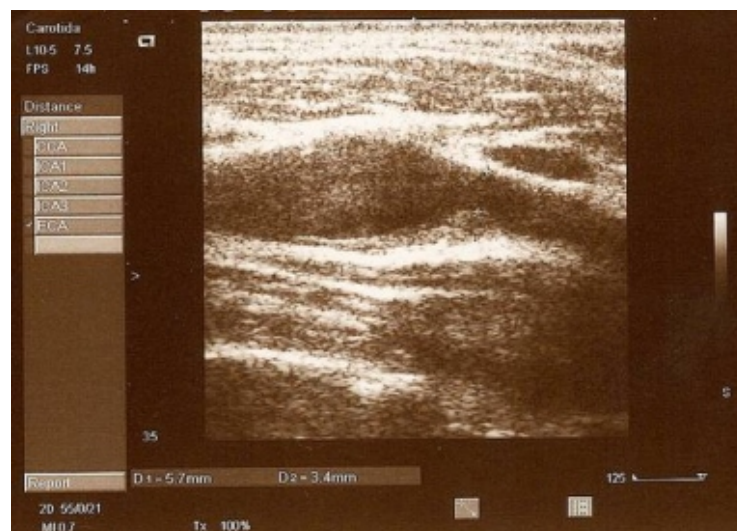


Fig. 8 Carotidian atheromatosis (common carotid artery bifurcation)

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