THE INFLUENCE OF VARIOUS RISK FACTORS ON DEVELOPMENT AND PROGRESSION OF CHRONIC ADULT PERIODONTITIS

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Abstract: *Chronic periodontitis is a multifactorial disease, resulting from a complex interaction between pathogenic microbes, the host immune responses and genetics, but its progression can be influenced by various risk factors. Advanced age, gender, lifestyle and environmental factors are associated with development and progression of periodontal disease, and treatment of periodontitis can be highly influenced by their variation. Materials and methods: A total of 244 subjects, 111 males and 133 females, divided into 4 groups: control group, early generalized chronic periodontitis group, moderate generalized chronic periodontitis group and severe generalized chronic periodontitis group, were included in the study. Clinical periodontal parameters were recorded and statistical analysis, using SPSS version 25.0 was performed correlating age, gender, onset of chronic periodontitis and environment to clinical stage of the disease. Results: Significant differences were found analyzing correlation between clinical stage of the disease and age, environment and onset. No significant differences could be found correlating gender and presence of the disease. Conclusions: Certain factors can increase the risk and progression of periodontal disease and are important in the management of periodontitis patients. Age strongly influences the progression of periodontal disease although chronic periodontitis cannot be considered a natural consequence of aging, but rather an effect of different risk factors as a result of immune system senescence.*

INTRODUCTION

Chronic periodontitis is a multifactorial disease influenced by many risk factors.(1,2) Advanced age causes functional changes of the immune system, increasing susceptibility to chronic diseases.(3) Gender, lifestyle and environmental factors are associated with development and progression of periodontal disease. The influence of these factors on periodontal disease is a concern in research, given that development and treatment of chronic periodontitis depend on their variation. Chronic adult periodontitis is the most common inflammatory disease worldwide and affects oral health related quality of life.(4,5) Periodontal disease is at the moment a problem of most adults, affecting nearly 50% of middle aged and 60% of the elderly population.(6) Currently, it is estimated that the severe form of chronic periodontitis affects 5-20% of any population.(5)

Older people, on one hand, have several chronic conditions, on the other hand, economically and socially challenged elderly or those with disabilities are at increased risk of tooth loss. Periodontal disease is often associated with systemic diseases, several studies showing that these patients have an increased risk of developing chronic periodontitis. But there is a lack of consensus about the nature of these associations.(7) Although periodontitis is more common in adults, it is more aggressive when it occurs in children, adolescents or in young ages. In young individuals, the disease can develop as a result of local factors such as dental plaque, dental abnormalities or orthodontic forces applied on the teeth, or some systemic factors such as malnutrition, systemic diseases, hormones or smoking. Most cases of periodontitis among children occur as a manifestation of systemic diseases such as neutropenia, Down's syndrome, Papillon-Lefevre syndrome and leukocyte adhesion deficiency (LAD), which compromise the immune system's response to dental plaque and induce bone resorption and premature tooth loss.(8) Among systemic factors, the etiology of periodontal disease in adults includes qualitative and quantitative deficiencies of polymorphonuclear neutrophils, hormonal imbalance, immune deficiency, diabetes, stress and smoking.(9) Social isolation also contributes to the occurrence of the disease by neglected oral hygiene and lack of specific treatment of early disease symptoms.(10) Periodontal disease is primarily the result of behavioral and environmental influences, such as diet, oral hygiene, smoking, alcohol consumption and the presence of bacterial pathogens.(11)

Patients' medical history, age, gender, and genetics are risk factors for periodontal disease. Also individual behavior, such as smoking, is one of the most important risk factor in the development and progression of chronic periodontitis. On the other hand, studies show that gender is an important risk factor in the onset of periodontal disease and in particular male gender shows increased susceptibility to develop periodontal disease by smoking.(12)

Race and ethnicity is also an important risk factor, all races being affected by periodontal disease. However, a higher prevalence can be noticed among certain groups. Social and economic status such as low income or lack of education is also correlated with periodontal disease progression.(12)

Periodontal disease is the effect of combined risk factors. The term "risk factor" refers to personal behavior

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(smoking) or lifestyle, exposure to environmental factors or inherited characteristic, factors that are associated with periodontal health. Smoking is considered the main risk factor for periodontal disease progression.(9)

MATERIALS AND METHODS

Study population

Study subjects were selected from the department of General and Maxillofacial Surgery, Sibiu University Hospital, Romania, from March 2014 to September 2016. A total of 244 subjects (***n*** = 244; 111 males and 133 females) were divided into four groups, viz., control group (mean age 44,43 years), early generalized chronic periodontitis group (mean age 55,44 years), moderate generalized chronic periodontitis group (mean age 63,16 years) and severe generalized chronic periodontitis group (mean age 68,69 years). The purpose of the study was completely explained to each subject before entering the study and informed consent was obtained from each patient. Complete medical and dental histories were taken from all subjects. None of the patients were smokers and none of them underwent any nonsurgical or surgical periodontal treatment within the past 12 months. Selection of the patients was made according to the clinical and radiographic criteria proposed by the 1999 International World Workshop for the Classification of Periodontal Diseases. The subjects for sampling were selected at random from individuals scheduled for a routine oral examination. All patients presented clinical signs of periodontitis such as: halitosis, gingival recession, periodontal pockets or tooth loss in advanced stages of the disease. The clinical attachment loss (CAL) was measured, classifying the severity of the disease in slight: CAL 1-2 mm, moderate: CAL 3-4 mm and severe: CAL 5 mm or more. At the screening stage, to determine the clinical periodontal status, all subjects had a clinical periodontal examination, including the measurement of pocket depth and CAL, by one examiner. The early generalized chronic periodontitis group consisted of 48 patients, 23 females and 25 males (mean of 55,44 years). The moderate chronic periodontitis group consisted of 81 patients 52 females and 29 males (mean age 63,16 years). The advanced chronic periodontitis group consisted of 59 patients30 females and 29 males, (mean age 68,69 years). They had moderate to severe alveolar bone loss, CAL of ≥3 mm and probing depth of gingival sulcus (PD) of ≥ 4 mm, in multiple sites of all four quadrants of the mouth. The healthy group consisted of 56 patients, 28 females and 28 males, with a mean age of 44,43 years, who exhibited no CAL, PD of 1-2 mm, no clinical inflammation or sulcular bleeding and no radiographic evidence of bone loss. Chronic periodontitis was divided in four stages.

Stage 1 of chronic periodontitis included healthy patients with good oral hygiene, who showed no attachment loss, no visible radiographic bone resorption and no history of periodontal disease or tooth loss due to periodontitis.

Stage 2 of early generalized periodontal disease included subjects with> 30% of teeth affected, clinical attachment loss with probing depth of 1-2 mm associated with bleeding and bacterial plaque accumulation and minimal bone resorption.

Stage 3 of moderate generalized periodontal disease included subjects with> 30% of teeth affected, clinical attachment loss with probing depth of 3-4 mm associated with bleeding and accumulation of plaque and moderate bone resorption.

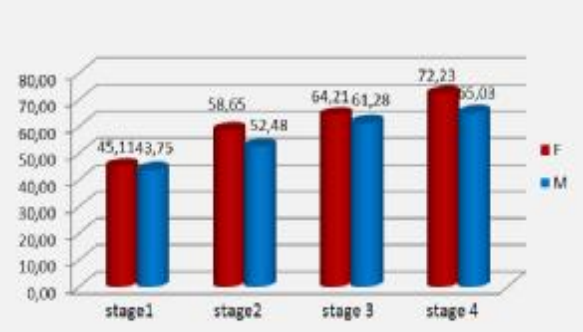
Stage 4 of advanced generalized chronic periodontitis included subjects with> 30% of teeth affected, clinical attachment loss with probing depth of 5-6 mm associated with bleeding and accumulation of plaque and severe bone resorption.

Statistical analysis

Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS), version 25.0, of which parametric statistical tests were performed. Fischer Test was used to analyse the correlation between mean ages of male and female genders and stage of the disease and the correlation between onset and clinical stage of the periodontitis. Distribution of healthy subjects and subjects with periodontal disease on age groups, comparison of age groups in different stages of periodontal disease and correlation between environment and stage of periodontitis were analysed using Likelihood Ratio test. P<0,05 was considered statistically significant for all tests.

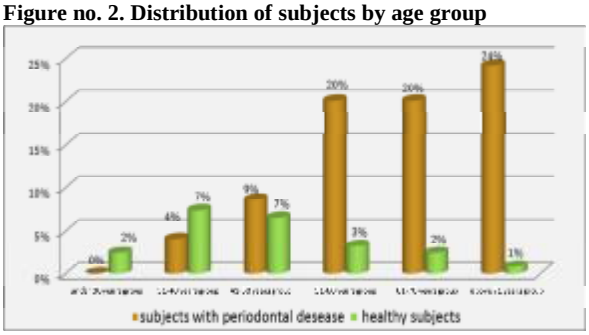
RESULTS

Figure no. 1. Mean ages of male and female subjects in different stages of the disease



The mean ages of the two genders correlated to the stages of periodontal disease show no statistically significant differences between healthy subjects (p=0,693) and subjects with moderate periodontal disease (p=0,300). There are statistically significant differences between the two genders in subjects with early chronic periodontitis (p = 0.043) and advanced chronic periodontitis (p = 0.022), meaning that the average age in this stages is significantly higher in women.

Figure no. 2. Distribution of subjects by age group

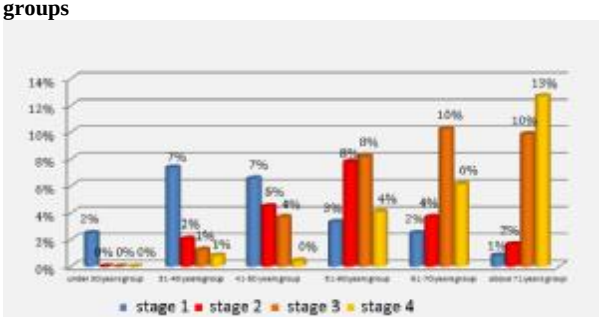


Distribution of subjects by age group shows that there are statistically significant differences (p <0.001) between healthy subjects and subjects with periodontal disease in different age groups which means that an extremely low number of healthy subjects can be found in 51-60, 61-70 and over 71 years age groups. The age group below 30 years did not reveal any patient with periodontal disease. The 30-40 years age group shows mostly healthy patients and in the 41-50 age group, the number of subjects with periodontal disease significantly increases.

There is a significant increase in the number of patients with periodontal disease and the major decrease in the number

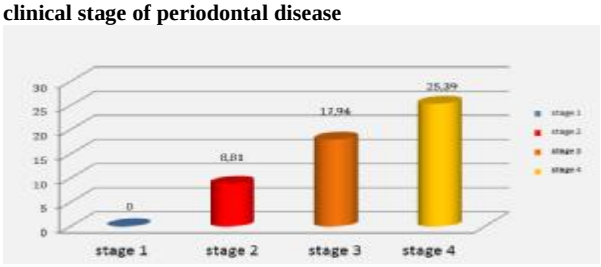
of healthy subjects along with increasing age.

Figure no. 3. Stages of periodontal disease in different age groups



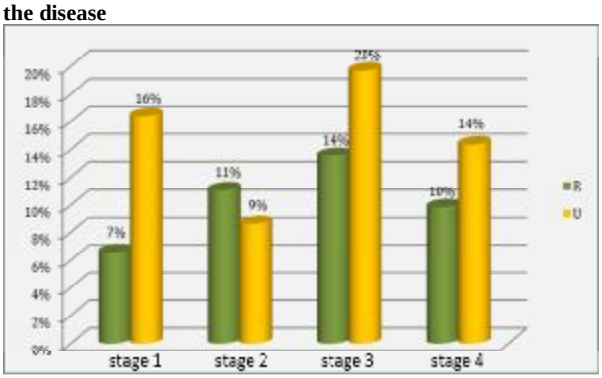
Distribution of the clinical stages of periodontal disease by age groups shows that there are no statistically significant differences between disease stages in each age group ($p = 0.135$ in 30-40 years age group; $p = 0.612$ in 41-50 years age group; $p = 0.072$ in the 51-60 years age group ; $p = 0.859$ in the 61-70 years age group and; $p = 0.251$ in the +71 years age group), but statistically significant differences can be observed between the age groups in the same stage of the disease.

Figure no. 4. Correlation between onset of periodontitis and clinical stage of periodontal disease



There is a statistically significant difference between onset and disease stage ($p < 0.001$), which shows that the more advanced the disease the earlier the onset was. Severe periodontal disease is frequent in advanced age. The period of time between the onset and clinical stage of the disease is significantly higher in subjects with advanced chronic periodontitis.

Figure no. 5. Correlation between environment and stage of the disease



Correlation between environment and clinical stage of the disease shows statistically significant differences ($p = 0.041$; $p < 0.5$) between urban and rural subjects, meaning that a high prevalence of moderate and severe form of chronic periodontitis can be seen in subjects from urban areas. Early stage of periodontitis is more frequent in rural areas. Urban environment has negative impact on periodontal health.

DISCUSSIONS

Local and systemic effects of periodontal infection are usually exercised over several years, usually among people of middle or advanced age, numerous epidemiological studies linking periodontal disease to age-related diseases such as diabetes, cardiovascular diseases, osteoporosis, respiratory disease, rheumatoid arthritis, certain cancers, kidney disease or mental illness.(7) Due to the influence of various comorbidities on periodontal health, this study aimed to exclude patients who presented diseases, with impact on oral health.

Gender differences between patients have played and continue to play major roles in the prevalence of periodontal disease and tooth loss. In many populations around the world, women show greater frequency of periodontal disease and tooth loss, due, apparently, to biological and social factors associated with female gender.(13) In the present study, between the group of healthy subjects and that of subjects with periodontal disease, gender distribution was homogeneous and without statistically significant differences ($p = 0.441$; $p > 0.05$). However correlations between mean ages of subjects with periodontal disease and gender show statistically significant differences ($p = 0.004$; $p < 0.05$; Fisher test) between female and male gender, highlighting the advanced age of occurrence of periodontal disease in female patients compared to male patients. On the other hand periodontitis presents increased occurrence among pregnant women, their periodontal health status being directly influenced by hormonal changes.(12) For this reason pregnant female patients were excluded from our study. The present study however shows an earlier onset of periodontitis in male patients, but no statistical significance between onset and gender.

Our study shows that occurrence of chronic periodontitis is strongly related to advanced age.

Periodontitis is more common among older than among young and middle-aged patients. It is assumed that the disease tends to be more prevalent among older people in the future, because many of these tend to preserve their own teeth until later in life.(14)

In the present study, subjects' distribution analysis by age reveals statistically significant age-related differences ($p < 0.001$), between healthy subjects and subjects with periodontal disease. There is a significant statistical difference ($p<0.001$) regarding age, between the chronic periodontitis group and healthy group, indicating that chronic periodontitis is more frequent in older patients.

The 51-60, 61-70 and over 71 years age groups contain a small number of healthy subjects. The age group below 30 years has not revealed any patients with periodontal disease. The 30-40 years age group has mostly healthy subjects and the 41-50 years age group shows reverse ratio, with predominance of subjects with periodontal disease. Data analysis shows that, the 41-50 years age group is the turning point regarding occurrence of periodontal disease, the number of patients with periodontal disease being much higher compared to healthy subjects in this group. There is a significant increase regarding the number of subjects with periodontal disease and a significant decrease in healthy subjects with advancing age.

Regarding chronic periodontitis, it has been concluded that, some loss of periodontal attachment and alveolar bone is expected in the elderly, although age alone in healthy adults does not cause a critical loss of periodontal support. Although a moderate decrease in alveolar bone and periodontal attachment is common in the elderly, periodontal disease severity is not a natural consequence of aging.(15)

The difference between clinical stage of periodontal disease in the age groups is statistically significant ($p<0,001$). Periodontal health status (stage 1) is present mainly in the 30-40

years and 41-50 years age groups and decreases with advancing age. Early periodontal disease (stage 2) occurs in 30-40 years age group. We observed an increase in the number of cases in the 51-60 years age group, followed by a decrease in the number of patients with early chronic periodontitis in the advanced age groups, 61-70 and over 71 years. Moderate periodontal disease (stage 3) occurs in the 41-50 years age group, increases with age and reaches a maximum frequency in the 51-60 years age group. Advanced periodontal disease (stage 4) occurs in the 51-60 years age group, being most frequent in the advanced age group, over 71 years. Data analysis shows that advanced stages of periodontal disease are consistent with older ages.

Chronic periodontitis is evident and therefore more frequent among older patients, collected data, indicating that aging causes functional changes to the immune system, that may increase susceptibility to chronic diseases such as periodontitis. Advanced clinical stage of periodontal disease proves to be consistent with age. However, aging itself cannot cause periodontal disease in the absence of periodontal inflammation. The prevalence and severity of periodontitis in old age simply reflects the cumulative effect of prolonged exposure to microbial challenge.(3) The study also shows statistically significant differences between periodontal disease onset and clinical stage ($p < 0.001$), which shows that advanced stages of the disease are consistent with early onset.

Our study shows that in addition to genetic factors, environmental factors are of great importance and can influence susceptibility to periodontal disease.(11) Some studies indicate increased prevalence of periodontal disease in industrialized areas population.(16) Other studies show an increased incidence of the disease in developing countries compared to developed areas.(5)

However, the present study shows statistically significant differences ($p = 0.041$; $p < 0.5$) in periodontal disease prevalence between patients from urban and rural areas. We observed an increased incidence of moderate and severe periodontitis in urban patients, showing that urban environment has negative impact on periodontal health.

We can conclude that certain factors can increase the risk and progression of periodontal disease and are important in the management of periodontitis patients. Gender differences in periodontitis patients were not found to be significant and occurrence of the disease equally in both genders most likely depends on the frequency of different risk factors. Females show advanced ages of occurrence of periodontal disease, while the disease occurs earlier in males. Age strongly influences the progression of periodontal disease.(5) Chronic periodontitis is not a natural consequence of aging, but rather an effect of different risk factors as a result of immune system senescence.(17) Urban environment has a significant influence on the occurrence and progression of periodontal disease and a negative impact on periodontal health. Although periodontal disease is mainly determined by bacterial, genetic and immunological factors, various risk factors can exert a significant influence on its progression.

REFERENCES

1. Khademi B, Hashemi SB, Ghaderi A, Shahrestani A, Mohammadianpanah M. Interleukin-13 gene polymorphisms at -1055 C/T and +2044 G/A positions in patients with squamous cell carcinoma of head and neck. Braz J Otorhinolaryngol. 2012 Oct;78(5):64-8.
2. Banjar W, Alshammari MH. Genetic factors in pathogenesis of chronic periodontitis. Journal of Taibah University Medical Sciences. 2014;9(3): 245-247.
3. Hajishengallis G. Aging and its Impact on Innate Immunity and Inflammation: Implications for Periodontitis. J Oral Biosci. 2014 Feb 1;56(1):30-37.
4. Kobayashi T, Ishida K, Yoshie H. Increased expression of interleukin-6 (IL-6) gene transcript in relation to IL-6 promoter hypomethylation in gingival tissue from patients with chronic periodontitis. Arch Oral Biol. 2016 Sep;69:89-94.
5. He CY, Gao XQ, Jiang LP. The impact of smoking on levels of chronic periodontitis-associated biomarkers. Exp Mol Pathol. 2016 Aug;101(1):110-5.
6. Chapple IL, Genco R. Working group 2 of joint EFP/AAP workshop. Diabetes and periodontal diseases: consensus report of the Joint EFP/AAP Workshop on Periodontitis and Systemic Diseases. J Clin Periodontol. 2013 Apr;40 Suppl 14:S106-12.
7. Özçaka Ö, Becerik S, Bıçakcı N, Kiyak AH. Periodontal disease and systemic diseases in an older population. Arch Gerontol Geriatr. 2014 Sep-Oct;59(2):474-9.
8. Alrayyes S, Hart TC. Periodontal disease in children. Dis Mon. 2011 Apr;57(4):184-91.
9. Khan S. Effect of smoking on periodontal health. Dis Mon. 2011 Apr;57(4):214-7.
10. Weyant RJ Social isolation may increase risk of periodontal disease Journal of Evidence Based Dental Practice. 2004;4(4):320-321.
11. Slayton RL. Genetics and environmental factors play important roles in the risk for periodontal disease and edentulism. Evid Based Dent Pract. 2006 Sep;6(3):238-9.
12. Clothier B, Stringer M, Jeffcoat MK. Periodontal disease and pregnancy outcomes: exposure, risk and intervention. Best Pract Res Clin Obstet Gynaecol. 2007 Jun;21(3):451-66.
13. Russell SL, Gordon S, Lukacs JR, Kaste LM. Sex/Gender differences in tooth loss and edentulism: historical perspectives, biological factors, and sociologic reasons. Dent Clin North Am. 2013 Apr;57(2):317-37.
14. Syrjälä AMH, Ylöstalo P, Knuuttila M. Periodontal status in Finnish elderly. Dental Abstracts. 2011;56(4):219-220.
15. Burt BA. Periodontitis and aging: reviewing recent evidence. J Am Dent Assoc. 1994 Mar;125(3):273-9.
16. Genco RJ, Jeffcoat M, Caton J Jr., Papapanou P, Armitage G, Grossi S, Johnson N, Lamster I, Lang N, Robertson P, Sanz M. Periodontal diseases: epidemiology and diagnosis. The Journal of the American Dental Association. 1998;129(Supplement):9-S-14-S.
17. Wu Y, Dong G, Xiao W, Xiao E, Miao F, Syverson A, Missaghian N, Vafa R, Cabrera-Ortega AA, Rossa C Jr, Graves DT. Effect of Aging on Periodontal Inflammation, Microbial Colonization, and Disease Susceptibility. J Dent Res. 2016 Apr;95(4):460-6.