Research on the synergism of smoking and periodontal disease in patients with rheumatoid arthritis and diabetes

PhD Thesis

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Publications, presentations related to the subject of the thesis

Emese Battancs, Dorottya Gheorghita, Szabolcs Nyiraty, Csaba Lengyel, Gabriella Eördegh, Zoltán Baráth, Tamás Várkonyi, Márk Antal

Periodontal Disease in Diabetes Mellitus : A Case-Control Study in Smokers and Non-Smokers

DIABETES THERAPY , 14 p. (2020)

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Mark Antal, *Emese Battancs*, Marta Bocskai, Gabor Braunitzer, Laszlo Kovacs

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A periodontális betegség súlyossága korábban dohányzó rheumatoid arthritises betegeknél – bizonyíték a dohányzás hosszú távú hatásáról Paper: 7 (2017)

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Introduction

Periodontal conditions and systemic diseases influence each other. The most investigated conditions are cardiovascular diseases, rheumatoid arthritis (RA) and diabetes mellitus (DM). Other studies showed relationship with hypertension, osteoporosis, psoriasis, pulmonary diseases, and complications in pregnancy and around delivery.

The aim of our study is to evaluate the relationship between systemic diseases, including diabetes mellitus and rheumatoid arthritis, and periodontal disease (PD). We investigated the effect of smoking on diabetes, rheumatoid arthritis, and periodontal disease.

In the literature, clear connection points can be found between these diseases and several articles have tried to investigate the effect on each other. Same mediators, factors linking diseases and smoking have been described: inflammatory cytokines (TNFα, Il-1, IL-6, IL-8, IL-12), reactive oxygen species (ROS), RANK/RANKL are acting bone modeling, osteoclast activity, various proteolytic enzymes (MMPs) and natural killing cells (NKs) of lymphoid origin.

It is obvious that inflammatory processes are performed via the same routes and mediators when systemic diseases we reviewed,

periodontal disease and smoking are present. Thus it seems clear that these conditions closely affect and aggravate each other.

Aims of the study

Questions regarding the RAs research:

Can smoking play a trigger role in the development and exacerbation of periodontal inflammation in patients with rheumatoid arthritis? To test this, we measured the incidence and severity of periodontal inflammation in smokers and non-smokers.

Is there a relationship between rheumatological factors and the periodontal status?

We hypothesized that the periodontal status of patients with no smoking history would be significantly poorer than that of healthy controls.

In case of diabetes, we hypothesized that the periodontal status of patients with DM with no smoking history would be significantly poorer than that of healthy non-smoking controls, and the periodontal status in the former would be further exacerbated by smoking.

We aimed to find out if periodontal status is different in patients with type 1 and type 2 diabetes.

We aimed to investiagte, the relationship between glycemic control and periodontal disease.

Materials and Methods

In case of RA, a total of 73 participants were enrolled into the study. Participants of the control group came for regular lung screening, and they had no systemic diseases. RA patients were compared to the control group. Mean age and gender frequency were almost equal in the two groups.

In case of diabetes mellitus a total of 128 participants were included in the study, DM patients were compared to age and gender-matched controls.

Smoking habits were evaluated by using a self-administered questionnaire. We identified non-smokers and former smokers in the RA study, in case of diabetes we investigated smoker and non-smoker groups.

We used the staging proposed by Fernandes and colleagues. Periodontal status of the patients was assessed by a full oral examination, where probing depth: PPD, bleeding on probing: BOP, clinical attachment loss: CAL, and the amount of plaque were evaluated.

Depending on the presence and severity of periodontal disease, four groups were classified based on the clinical parameters mentioned above: healthy, early, moderate and severe periodontitis.

From a rheumatological point of view, the following indices and laboratory values were recorded: IgM rheumatoid factor seropositivity and levels (RF), anti-citrullinated peptide antibody (ACPA) seropositivity, disease activity score (DAS28-ESR), and the health assessment questionnaire disability index (HAQ-DI). Data on the conventional and biological disease modifying anti-rheumatic drug (DMARD) and corticosteroid therapy of the patients were also recorded.

We investigated type 1 and type 2 diabetic patients (T1D, T2D). Control of diabetes was estimated by the average of the last three

hemoglobin A1c (HbA1c) levels. Patients were assigned into 3 groups: well, moderately and poorly controlled.

Written informed consent was obtained from each participant.

The study was approved by the Regional Research Ethics Committee for Medical Research at the University of Szeged, Hungary (144/2014-B/001, accepted 2014, modified in 2019).

Statistical analysis

For the statistical comparison of the study and control groups, SPSS 21.0 (IBM, USA) was used. Continuous variables were described as mean ± SD, and categorical variables were characterized by frequency analysis. For hypothesis testing, one-way ANOVA (with Tukey's post-hoc pairwise test), Kruskal-Wallis ANOVA or multinomial logistic regression was used, depending on the sample characteristics and the hypothesis to be tested. The general significance limit was set at $p= 0.05$, but this was modified for multiple comparisons.

Results

Our RA study design was to identify smoking and non-smoking groups, but our patients turned out to be non-smokers. We managed to find only a few (8 in total) smoker RA patients; therefore, study parameters were modified.
The majority of our patient sample consisted of non-smokers and former smokers.

No significance was found in any of the rheumatological indices between former smoking and non-smokers. However, seropositivity for RF increased the odds of the moderate stage to 1.65, and that of the severe stage to 2.51.

The periodontal status and CAL in both control groups falls into the healthy and early stages, in the patient groups the situation is just the opposite.

81% of the patients who used to smoke (former smokers) were classified as having moderate or severe PD.

Severe periodontitis is most likely to occur in RA patients with a history of smoking.

In case of DM, the pairwise comparisons showed a significant difference in severity of PD between the smoker control and non-smoker control groups ($p = 0.027$) and between the non-smoker control and smoker-diabetic groups ($p = 0.000$); the difference between the non-smoker diabetic and smoker diabetic groups was nearly significant ($p = 0.052$).

The lowest frequency of severe PD was found in the non-smoker control group (15.6%) and was peaking in the smoker diabetic group (62.5%).

No one in the two smoker groups was classified as having good periodontal health.

The stages of PD followed a normal distribution in the healthy, non-smoking controls, smoking seemed to cause a shift toward the middle of the severity spectrum, and when smoking was combined with DM a marked shift toward the most severe stage was observed.

Patients in the smoker diabetic group had significantly fewer teeth (mean ± SD: 16.0 ± 7.9) than subjects in the non-smoker control group (20.7 ± 5.6) at $p = 0.02$. Patients with T1D had significantly more teeth than patients with T2D (22 ± 6.5 vs. 16.2 ± 7.7; $p = 0.01$).

There was no significant association between the type of diabetes (T1D or T2D) and periodontal status ($\chi^2 = 6.190$, $p = 0.103$). There was also no significant association between diabetes control and the severity of PD ($\chi^2 = 15.503$, $p = 0.078$).

Discussion

An interesting question is why we only found 8 currently smoker RA patients. This may be because patients are informed about the harmful effects of smoking that aggravate their arthritis and therefore quit.

The relationship between periodontitis and rheumatoid factor could not be proven, perhaps due to the small number of elements.

The presence of RA itself is enough to significantly increase the odds that the patient will develop a more severe stage of PD. In this term, our hypothesis was correct.

The main finding of this study, is that the former smoker RA patients had the highest and significant odds ratio for the severe stage of PD.

In case of diabetes, smoking caused a shift toward the middle of the PD spectrum, and when smoking was combined with diabetes, a marked shift toward the most severe stage could be seen. Smoking damages periodontal tissues in both local and systemic ways. Smoking-induced periodontal inflammation always being the more severe type, while DM has a slower detrimental effect on the periodontium being less aggressive.
This is supported by the fact that a smoking diabetic patient has significantly fewer teeth than the non-smoking control group.
T2D may be more damaging to the periodontium than T1D, as reflected by the mean number of teeth and the relatively higher prevalence of the most severe stage in participants with T2D. A possible explanation for the lower teeth number in T2D is that T2D was over-represented, and mean the age is 14 years higher than in T1D.

It would appear that there is an effect of glycemic control on PD, but this effect is statistically non-significant.

The main finding is that smoking is the major detrimental factor for the periodontium, and if it is associated with diabetes, further exacerbations can be expected.

Conclusions

In this thesis, we investigated the relationship between systemic diseases (rheumatoid arthritis and diabetes mellitus), periodontal disease and smoking. Based on both studies, it can be concluded that the main factor, which is responsible for the aggravation of periodontal disease is smoking and previous smoking. However, it can also be stated that systemic diseases have a negative effect on periodontal status and its severity. It is important to emphasize the local and systemic harmful effects of smoking and to place special emphasis on the importance of smoking cessation. Dentists also have a great responsibility to find out about the patient's current general health before starting a periodontal treatment and to provide the patient adequate, targeted therapy.

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