Comparison of DMFT indexes between diabetic and non-diabetic patients

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ABSTRACT

Objectives: This report deals with a comparison of decayed, missing and filled teeth prevalence (DMFT index) in non-diabetic and diabetic patients.

Methods: The DMFT index were used in 28 male, 93 female control subjects and in 63 male, 92 female diabetic subjects.

Results: Pooling together all available data, no significant difference was found between the values recorded at the mandibular and maxillar level. In 28 male and 93 female control subjects, no obvious gender-related difference was observed, whilst the slope of the regression line relating the DMFT index to age was more elevated in 92 female than in 63 male diabetic subjects. When considering separately decayed, missing and filled teeth, significant correlations with age were always observed for missing teeth. Likewise, the sole consistent difference between control and diabetic patients consisted in a higher slope of the regression line relating the number of missing teeth to age in the latter patients.

Conclusion: Taken as a whole, our findings confirm that, in diabetic as distinct from non-diabetic patients, a less satisfactory tooth health status may prevail, at least for selected variable(s) such as the age-related prevalence of missing teeth.

KEY WORDS: Dental caries, DMFT index, diabetic patients

INTRODUCTION

Dental caries, also known as tooth decay, is a disease caused by bacterial sugar catabolism processes which damage tooth structure (enamel, dentin and cementum). Tooth decay is due essentially to the production of lactic acid under anaerobic glycolysis by bacteria (1-2), such as Streptococcus mutans and Lactobacilli, which cause damage in the presence of fermentable carbohydrates such as sucrose, fructose, and glucose as shown in many review articles (3-7). In this respect, many authors found higher glucose salivary levels in diabetic patients than in non-diabetics (8-14). The literature does not describe a consistent relationship between type 2 diabetes and dental caries. It was reported in different studies (15-21) that there are increased, decreased or similar prevalence of caries when comparing subjects with and without diabetes. Therefore, the aim of this study was to re-examine the severity of caries in diabetic patients using DMFT indexes.

MATERIALS AND METHODS

Non-diabetic patients (n = 125) and diabetic subjects (n = 162) were recruited from Istanbul Training and Research Hospital, Clinics of Internal Medicine, Istanbul, Turkey. The diabetic subjects were under routine control treatment. The DMFT (decay, missing, filled, teeth) index is used in this study and all subjects were analyzed by the same examiner. The statistical analysis was performed by t-tests and covariance analysis. The present research was conducted in full accordance with ethical principles, including the World Medical Association Declaration of Helsinki.

RESULTS

Control patients

Among the 125 control patients, 4 patients were recorded without information on their gender. The remaining 28 male control patients presented a mean age (47.3 ± 3.8 years) significantly higher (p < 0.01) than the remaining 93 female control patients (41.2 ± 1.3 years). The total number of affected teeth (taken as the sum of the maxillar and mandibular DMF total) displayed a highly significant positive correlation with age in both these 28 male (r = + 0.6992; p < 0.001) and 93 female (r = + 0.4747; p < 0.001) control patients. Covariance analysis revealed that both the slope and elevation of the regression line between these two variables failed to differ significantly, however, in male versus female control patients. Likewise, none of the teeth variables listed in Table 1 differed significantly in male versus female control patients.

No significant difference was observed between such variables when comparing the results recorded at the maxillar versus mandibular level. Incidentally, such was also the case in diabetic subjects. Pooling together all available data, the values recorded at the mandibular level averaged 87.3 ± 4.3 % (n = 861) of the mean corresponding values found at the maxillar level (100.0 ± 6.0 %; n = 861). Such a difference indeed failed to achieve statistical significance (p > 0.05).

When considering separately, at both the maxillar and mandibular levels, decayed, missing and filled teeth, significant correlations with age were observed for missing teeth whether in male (r = + 0.6356; n = 28; p < 0.001) or female (r = + 0.4921; n = 93; p < 0.001) subjects, and for filled teeth only in male control subjects (r = +
In a comparable situation was already observed in five out of the following values recorded with even numbers (12, 14, 16) a mean ratio of 47.1 ± 19.6% (n = 5; p < 0.06) as a rule, the number of dental defects yielded a Poisson-like distribution with zero as the most abundant number (Fig. 1). In the case of missing teeth, however, a bimodal pattern apparently prevailed with, in the maxilla and mandible, respectively, 11.2 and 8.0% of the individual numbers in the 12-16 range, which otherwise never entailed any decayed or filled teeth number (Fig. 1). The latter situation was also apparent in the case of the DMF total, with respective percentages of 20.0 and 12.8% in the maxilla and mandibula for the individual values in the same 12-16 range. Incidentally and as illustrated in the middle panel of Fig. 1, in the 11-16 range, the values recorded with odd number (11, 13, 15) averaged, at the maxillar and mandibular level, no more than 34.7 ± 15.3% (n = 6; p < 0.01 versus unity) of the following values recorded with even numbers (12, 14, 16). A comparable situation was already observed in five out of ten paired comparison made in the 1 to 10 range, with a mean ratio of 47.1 ± 19.6% (n = 5; p < 0.06 versus unity). The main age of the 162 diabetic subjects (56.1 ± 1.0 years) was higher (p < 0.001) than that of the 125 control patients (42.6 ± 1.3 years). The diabetic subjects included 63 male, 92 females and 7 patients recorded without information on their gender. Despite a comparable age (p > 0.0) in the 63 male (56.5 ± 1.6 years) and 92 female (56.1 ± 1.3 years) diabetic subjects, the total amount of affected teeth (taken as the sum of the maxillar and mandibular DMF total) displayed a higher mean value (p < 0.02) in female subjects (19.92 ± 0.95) than in male ones (16.16 ± 1.07). Covariance analysis indicated that the slope of the regression line between the two variables under consideration was not significantly different in male (0.3902) and female (0.3435) diabetic subjects, whilst the elevation of the regression line was indeed higher (F = 5.754; f = 1, 152; p < 0.025) in female than in male diabetic subjects.

When considering separately, at both the maxillar and mandibular levels, decayed, missing and filled teeth, significant positive correlations with age were observed for missing teeth whether in male (r = + 0.0864; n = 63; p > 0.1) or female (r = + 0.4890; n = 92; p < 0.001) diabetic subjects. Such was not the case for decayed teeth in either male (r = - 0.0684; n = 63; p > 0.1) or female (r = - 0.1119; n = 92; p > 0.1) diabetic subjects, as well as for filled teeth in either male (r = - 0.0062; n = 63; p > 0.1) or female (r = - 0.0698; n = 92; p > 0.1) diabetic subjects.

The distribution patterns for the number of diabetic subjects presenting a given number of dental defects were, as a rule, comparable to those illustrated in Fig. 1. The middle panel of Fig. 2 illustrates the rather flat distribution of missing teeth in female diabetic subjects.
control patients. Covariance analysis of the data relative to missing teeth in both the maxillary and mandibular locations indicated that the slope of the regression line, as a function of age, failed to differ significantly (F = 1.50; f = 1, 181; p > 0.1) in control patients and diabetic subjects, whilst displaying a higher elevation (F = 5.44; f = 1, 182; p < 0.025) in the latter subjects than in the former patients.

It should be mentioned that, in both male and female persons, the slope of the regression line relating the number of missing teeth at both the maxillary and mandibular locations as a function of age yielded a higher mean value in diabetic subjects (0.4047 ± 0.0024; n = 2) than in control patients (0.3030 ± 0.0034; n = 2), such slopes being virtually identical in male and female control patients, on one hand, and male and female diabetic subjects, on the other hand. As judged by the mean values just mentioned, the difference between control patients and diabetic subjects appeared, in this respect, statistically significant (p < 0.005).

Table 1. Experimental data (mean ± SEM)

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Control patients</th>
<th>Diabetic subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
<td>Location</td>
<td>Male</td>
</tr>
<tr>
<td>Age (years)</td>
<td>Maxillar</td>
<td>47.3 ± 3.8</td>
</tr>
<tr>
<td>Decayed teeth</td>
<td>Mandibular</td>
<td>1.18 ± 0.46</td>
</tr>
<tr>
<td></td>
<td>Both</td>
<td>0.76 ± 0.23</td>
</tr>
<tr>
<td>Missing teeth</td>
<td>Maxillar</td>
<td>3.89 ± 0.95</td>
</tr>
<tr>
<td></td>
<td>Mandibular</td>
<td>4.07 ± 0.92</td>
</tr>
<tr>
<td></td>
<td>Both</td>
<td>7.96 ± 1.79</td>
</tr>
<tr>
<td>Filled teeth</td>
<td>Maxillar</td>
<td>1.39 ± 0.38</td>
</tr>
<tr>
<td></td>
<td>Mandibular</td>
<td>1.25 ± 0.32</td>
</tr>
<tr>
<td></td>
<td>Both</td>
<td>2.64 ± 0.33</td>
</tr>
<tr>
<td>DMF total</td>
<td>Maxillar</td>
<td>6.46 ± 1.09</td>
</tr>
<tr>
<td></td>
<td>Mandibular</td>
<td>5.96 ± 1.00</td>
</tr>
<tr>
<td></td>
<td>Both</td>
<td>12.43 ± 2.34</td>
</tr>
<tr>
<td>Nr of subjects</td>
<td></td>
<td>(28)</td>
</tr>
</tbody>
</table>

**DISCUSSION**

Today, caries remain one of the most common diseases throughout the world. Even in most industrialized countries, dental caries still affects 60% to 90% of school-aged children and a majority of adults (22-25). The caries prevalence varies from one country to another in Europe, and, in each country, from one region to another. Two neighbouring regions may indeed display different impact of that disease as a function of economic, social, and cultural differences. Hence, in studies on this issue, geographical and socioeconomic characteristics have to be taken into account to avoid unwarranted bias (22). Considerable differences were indeed found in dental health attitudes and behaviour among patients from different countries and cultural groups (25). The present study deals with diabetic patients originating from the same area and examined in the same hospital of Istanbul, to prevent any geographical, social or economic bias.

Diabetes is a common disease with concomitant oral manifestations that impacts on dental care. Although many studies deal with a comparison between oral health status of diabetic and non-diabetic subjects, the different studies do not describe a consistent relationship between type I or type II diabetes and dental caries. They indeed report increased, decreased, or similar caries prevalence between those subjects with and without diabetes (15-21).

In this study, the majority of diabetic patients were type II diabetes, well-controlled and followed by doctors at the hospital, thus avoiding the influence of uncontrolled diabetes on dental treatment (26). Incidentally, no or a few difference(s) are observed between the two diabetes types concerning prevalence of caries and filling. Only the number of extractions and missing teeth differs from one type to the other (27).

The comparisons of the values between distinct studies are difficult because of differences in the concerned regions and patient’s age. For instance, we did not take into account root caries because radiographic material was not available. To cite another example, a regional difference might be attributable to the addition of fluor in water, affecting dental caries prevalence (28). Likewise, the age of subjects may affect the prevalence of tooth defect. In most previous studies, diabetic patients were rather younger than in the present study, in which covariance analysis of the relation between age and relevant indices was always performed. The DMF index was used in the present study. The World Health Organization (WHO) caries diagnostic criteria for decayed, missing, and filled teeth in epidemiologic surveys of dental caries, since they quantify dental healthy status based on the number of carious, missing, and filled teeth and tooth surfaces (29). In the present study, we only found statistically significant difference in the number of missing teeth between diabetic and non-diabetic patients, but, as a rule, not so for decayed or filled teeth, in good agreement with previous studies (16, 20, 30-32).

Several factors may affect oral health in diabetic subjects. In diabetics, a modification of the salivary flow (33) affects the buffer effect of the saliva and leads to a more frequent growth of yeasts than in non-diabetic subjects. If the buffer effect is no more efficient due to that lower flow, the decrease of pH enhances the accumulation of Streptococci mutans, implicated with Lactobacilli in dental caries (15), leading to destruction of alveolar ligaments. It has also been demonstrated that there is a higher glucose concentration in saliva in diabetic patients than in control subjects, this knowledge being recently extended to both unstimulated and stimulated saliva (14). The correlation between caries and dietary...
carbohydrates has been demonstrated several times (3-7, 34, 35), particularly in Arabian Gulf who consumed a mixture of marine diet with carbohydrates, resulting in increased caries prevalence (36). In the present study, however, diabetic patients were controlled with a sugar-free diet.

The role of fermentable carbohydrates cannot be ignored (3-7, 34, 35); snacking frequently with that kind of carbohydrates lets the pH drop frequently.

Nationwide surveys have demonstrated that diabetics and particularly poorly controlled ones have a significantly higher prevalence of a severe periodontitis (18, 37-39). Physiological mechanisms (compromised neutrophil functions, decreased phagocytosis and leukotaxis) have been implicated in the alveolar bone loss found in patients with diabetes (40). Miralles et al. (41) found a significant greater periodontal attachment loss in diabetic subjects. According to a review of the literature by Mattson et al. (26), diabetic patients may indeed be predisposed to periodontal disease based on the production of advanced glycation end products, which bind to receptors on specific cells such as monocytes, leading to microvascular complications (35). Yet, some studies have failed to confirm the relationship between diabetes and periodontal disease (42) while the findings of other investigators have supported it (39). Alteration in host response, subgingival microflora, collagen metabolism, microvasculosity, gingival crevicular fluid and heredity patterns seem to play a role in the periodontal status of diabetic subjects (17).

The major findings in the present study may be summarized as follows. First, only a trend towards a difference between the maxilla and mandible could be detected. Such a trend, i.e. a somewhat lower DMFT index at the mandibular level, may be accounted for by the presence of the parotid gland in vicinity of the maxilla, since its contribution to salivation is less important than that of submandibular salivary glands. Second, the most obvious difference between diabetic and control patients consisted in the difference in the slope of the regression lines relating the number of missing teeth to age, this finding being in good agreement with other studies (25, 32, 43, 44). According to some authors, however, aging does not influence tooth loss (39). Yet, age-associated diseases and malnutrition may compromise the ability of salivary glands to protect oral tissues (45). Moreover, prior studies have pointed to a higher sensitivity for periodontal disease in diabetic patients (46), a greater frequency of periodontitis in diabetics with altered salivary gland histology (45), increased in their size (47, 48) and, unexpectedly and conflictingly, in salivary flow (33, 49). As a matter of fact, verostoma is a frequent observed manifestation in diabetic patients (12, 50-52). In this study, no significant statistical difference was observed between control and diabetic patients for the filled teeth. This may be attributable, in part at least, to the fact that, especially in a poor social or educational context, periodontally compromised decayed teeth are often extracted rather than filled. Last, an unexpected finding consisted, in the diabetic patients, in a higher total number of affected teeth in female than in male subjects.

In conclusion, the major present findings are consistent with the view that, in diabetic as compared to non-diabetic patients, a less satisfactory oral status may prevail, as least for selected variable(s) such as the age-related prevalence of missing teeth.

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