Periodontal parameters and oral hygiene in diabetic and nondiabetic adolescents in Zanjan

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Abstract

Background: Periodontal disease and diabetes mellitus are 2 most common encountered chronic diseases. The occurrence, appearance, and severity of the periodontium tissue conditions vary during adolescence. Also, there is controversy about the relationship between diabetes mellitus and increased periodontal disease breakdown during puberty. This study aimed to assess the periodontal parameters and oral hygiene in diabetic and nondiabetic adolescents in city of Zanjan.

Methods: In this case and controls study, 140 diabetic (case) and 140 nondiabetic (control) adolescents were compared. The participants were matched by age, sex, and socioeconomic status using the group matching method. Clinical attachment loss, periodontal pocket depth, gingival index, periodontal index, and bleeding on probing were measured for the 6 Ramfjord index teeth. Data were analysed using descriptive statistics, chi-square test, t test, and one-way ANOVA using SPSS version 18.

Results: The mean age of the diabetic and nondiabetic group was 16.7±1.6 and 17.1±0.30 years, respectively. Duration of diabetes was 2.15 ±0.86 years. Mean clinical attachment loss, periodontal pocket depth, gingival index, periodontal index, and bleeding on probing were measured for the 6 Ramfjord index teeth. Data were analysed using descriptive statistics, chi-square test, t test, and one-way ANOVA using SPSS version 18.

Conclusion: Both diabetic and nondiabetic adolescents had equally poor oral hygiene. Gingivitis and periodontitis indices were significantly poorer in diabetic patients.

Keywords: Diabetes Mellitus, Oral hygiene, Periodontal diseases, Health

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Introduction

Diabetes mellitus (DM) is the most common metabolic disorder and is among the most important public health dilemmas worldwide (1). There is a steady rise of DM in childhood, and the frequency of children diagnosed with DM approximately doubles every decade. This disease poses some complications, especially on oral health (2). DM causes several systemic disorders (retinopathy, neu-
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Periodontal disease (PD) is the sixth main complaint of diabetic patients. Presence of chronic diseases such as PD can negatively affect DM management (7). Evidence shows a mutual relationship between metabolic control of diabetes by eliminating bacterial infection in PD and increased severity of periodontitis due to inadequate control of DM (7, 8). Thus, assessment of oral hygiene (OH) status and periodontal health of diabetic patients is particularly important. Moreover, adolescents account for a large number of diabetic patients (9). While experiencing rapid biological and hormonal changes, adolescents are developing independence from parents. It is generally believed that DM is associated with development of psychological problems in adolescence (10).

During the puberty phase, there is an increase in growth hormone (GH) production, with subsequent raise in glucose release due to enhanced gluconeogenesis and glycogenolysis processes (11). As a result of psychological crisis following hormonal changes, this group of patients need more precise supervision and hygiene screening (12).

On the other hand, inflammation in children is different from that in adults because their immunological processes are deficient as the result of incomplete development of immune cells. Therefore, conversion of T to B lymphocytes is not performed adequately. To our knowledge, B lymphocytes produce the main portion of destructive cytokines in inflammatory conditions (13). As a result, destructive processes during inflammation, which are proportionate to the amount of dental plaque, do not progress as those in adults (14, 15). Moreover, due to the small number of plasma cells, chronic gingivitis in children is similar to the initial stage of disease in adults, which is nondestructive and nonprogressive (13).

However, although DM does not directly cause gingivitis and PD in children, there is controversy in this regard in the literature. Evidence shows that in diabetic patients, inflammatory response of the periodontal tissue changes to a proinflammatory condition (dental plaque). Also, studies have shown that formation of dental calculus in diabetics is higher than that in nondiabetics (1, 12, 14). However, Siudikienė et al indicated that despite standardization of samples in terms of OH, diabetic adolescents were more susceptible to dental calculus formation than nondiabetics (16). Tonetti et al showed that the global load of PD is considerable. Pattern of population growth, alteration of risk factors, and increased tooth retention will significantly increase the socioeconomic load of periodontitis (17). Thaper et al stated that DM affects all periodontal parameters, including bleeding on probing (BOP), periodontal pocket depth (PPD), clinical attachment level (CAL), and tooth loss. However, there is no evidence supporting higher risk of dental caries and PD in diabetic adolescents (18). Negrato CA et al and Tuleutaeva S et al reported that periodontal involvement among children with type 1 diabetes is inevitable (19, 20). Gupta et al and Ramesh et al could not find a correlation between DM and PD (21, 22). Pihlstrom and Buse indicated that there is not any vivid clinical trial that can answer all questions regarding ideal treatment for PD. It demonstrates ineffectiveness of nonsurgical periodontal therapy in reducing hyperglycemia in most patients diagnosed with type 2 diabetes (23). However, plaque accumulation and prevalence of gingivitis in diabetic adolescents and young adults were reported to be higher than in healthy individuals (24). However, Lopez et al showed that there was not any statistical difference in term of dental health status (25).

Periodontitis and diabetes are 2 most common encountered chronic diseases (1, 7). The occurrence, appearance, and severity of periodontal conditions is variable during adolescence (26). As a result of hormonal changes and psychological issues at the puberty phase, studies have shown contradictory relationship between blood glucose levels, periodontal condition, and oral health. In addition, the periodontium tissue is a common site for presentation of malignant and benign tumours. Some researchers reported cases such as medullary thyroid carcinoma and schwannoma which manifested in gingival mucosa of adolescent and young population. Thus, evaluation of periodontium is critical (27, 28). Therefore, it is crucial to make a comparison among periodontal indexes and oral health in diabetic and nondiabetic adolescents. This study was designed to assess periodontal parameters and oral hygiene in diabetic and nondiabetic adolescents in Zanjan.

Methods

In this case and controls study, 140 diabetic adolescents were randomly selected among those presenting to the Metabolic Disease Research Center in Zanjan, Iran, and constituted the patient group. The control group comprised of 140 nondiabetic adolescents randomly selected among those presenting to dental school.

Time was chosen as a randomization component. Any patient that was present in odd days of the week and met the inclusion criteria was selected as a case group until their number reached 140. Group matching method was used to adjust for age, sex, and socioeconomic effects in case and control groups. Those friend or family members that accompanied the cases were considered as controls if they met the inclusion criteria. Those individuals who completed medical and dental records and aged between 10 to 19 years and whose parents agreed to take part in the research were entered (29). The exclusion criteria were positive history of any systemic diseases such as epilepsy, Sjogren disease, dry mouth, malignancy, and immune system disorders. Moreover, patients under orthodontic or periodontal treatment, recent antibiotic therapy, those who experienced chemotherapy and radiotherapy or taking drugs with potential effect on periodontal tissue (phenytoin, cy-
explained weight loss) plus fasting glucose ≥ 126 mg/dL
(7.0 mmol/L), casual glucose concentration ≥ 200 mg/dL
(11.1 mmol/L), or 2-hour glucose (OGTT) ≥ 200 mg/dL
(11.1 mmol/L), and hemoglobin A1c (HbA1c) ≥ 6.5% (48
mmol/mol) (14, 30).

This study was done in accordance with the declaration
of Helsinki. Also, ethical approval was obtained from the
ethics committee of Zanjan University of Medical Sci-
ces, Iran (NO: 920217). The aim and procedures were
explained to all participants prior to the study. Parents of
diabetic adolescents also signed an informed consent. Data
were collected by clinical examination, reviewing patient files,
and filling out a questionnaire. The questionnaire and the
evaluation form had 2 parts. The first part asked about
demographic information, physical activity, orodental hy-
giene (dental flossing, tooth brushing, use of mouthwash),
and dental visits. Blood glucose level and its control were
also retrieved from patients’ files and recorded in the ques-
tionnaire (31, 32). The second part included periodontal
status and OH.

The gingival index (GI) was measured according to the
Silness and Loe (33). Also, BOP, CAL (34), periodontal
pocket depth (PPD), and periodontal index (PI) were mea-
sured according to the O’Leary’s index (35) around the 6
Rumford index teeth: (1) maxillary left central incisor, (2)
first premolar, (3) maxillary right first molar, (4) mandibu-
lar left first molar, (5) mandibular right central incisor, and
(6) first premolar (33-35). All patients were examined with
dental explorer, mouth mirror, and (Williams and WHO)
periodontal probe. Periodontitis severity was evaluated
based on average CAL and attachment loss (eg, distance of
CEJ and pocket depth). CAL parameter was categorized as
below: CAL ≤ 3mm (normal), 3 < CAL ≤ 4mm (mild), 4 <
CAL ≤ 5mm (moderate), and CAL > 5mm (severe) (31).

This was done to assess the prevalence of PD (20, 36).

Findings were analysed by chi-square test, descriptive sta-
tistics (central dispersion indices and frequency distribu-
tion), and independent t test via SPSS software (version 18,
SPSS Inc., Chicago, IL, USA). P value < 0.05 was consid-
ered significant.

### Results

In this study, a total of 280 adolescents, including 140
diabetics (69 males; 71 females) and 140 nondiabetics (70
males; 70 females) were evaluated. Of the participants, 139
(49.6%) were male and 141 (50.4%) were females. Dur-
ation of diabetes was also 2.15±0.86 years. The mean age
of the diabetic and nondiabetic group was 16.7±1.06 and
17.1±0.30 years, respectively.

The severity of gingival inflammation (BOP), the mean
PPD, and GI in diabetic adolescents were significantly
higher than in nondiabetic adolescents (p<0.001). On the
other hand, CAL was significantly higher in diabetic ado-
clescents than in control group (p<0.001). However, the
mean PI of the 2 groups was not significantly different
(p=0.182) (Table 1).

### Table 1. Comparing PPD, BOP, GI, and CAL between diabetic and nondiabetic adolescents

<table>
<thead>
<tr>
<th>Periodontal parameters</th>
<th>Diabetic adolescents</th>
<th>Nondiabetic adolescents</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PPD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severity of gingival inflammation (BOP)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low (0-0.24)</td>
<td>0</td>
<td>48 (35.6)</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>Moderate (0.25-0.74)</td>
<td>3 (2.3)</td>
<td>69 (51.1)</td>
<td></td>
</tr>
<tr>
<td>Severe (≥0.75)</td>
<td>129 (97.7)</td>
<td>18 (13.3)</td>
<td></td>
</tr>
<tr>
<td>GI</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Healthy (0-0.9)</td>
<td>42 (30.2)</td>
<td>105 (77.8)</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>Low (1-2)</td>
<td>78 (56.8)</td>
<td>29 (21.5)</td>
<td></td>
</tr>
<tr>
<td>Moderate (2.1-4)</td>
<td>17 (12.2)</td>
<td>1 (0.7)</td>
<td></td>
</tr>
<tr>
<td>Severe (≥4.1)</td>
<td>1 (0.7)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>CAL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Healthy (0-0.9)</td>
<td>2 (1.5)</td>
<td>2 (1.4)</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>Low (1-2)</td>
<td>38 (28.1)</td>
<td>124 (89.2)</td>
<td></td>
</tr>
<tr>
<td>Moderate (2.1-4)</td>
<td>93 (68.9)</td>
<td>13 (9.4)</td>
<td></td>
</tr>
<tr>
<td>Severe (≥4.1)</td>
<td>2 (1.5)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>PI</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td>1 (0.7)</td>
<td>3 (2.14)</td>
<td>0.183</td>
</tr>
<tr>
<td>Moderate</td>
<td>5 (3.6)</td>
<td>10 (7.14)</td>
<td></td>
</tr>
<tr>
<td>Weak</td>
<td>134 (95.7)</td>
<td>127 (90.71)</td>
<td></td>
</tr>
</tbody>
</table>

*: mean (SD), #: Frequency (%), &: Independent t test , ϵ:Chi-square test
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### Table 2. Comparing BOP between diabetic and nondiabetic adolescents controlling oral hygiene, blood glucose, control, and exercising

<table>
<thead>
<tr>
<th>Oral hygiene</th>
<th>Sample group</th>
<th>BOP in diabetic adolescents</th>
<th>BOP in nondiabetic adolescents</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Severity</td>
<td>Low</td>
<td>Moderate</td>
<td>Severe</td>
</tr>
<tr>
<td>Dental flossing</td>
<td>Yes</td>
<td>1 (0.8)</td>
<td>34(25.8)</td>
<td>25(18.5)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>2(1.5)</td>
<td>95(72)</td>
<td>23(17)</td>
</tr>
<tr>
<td>Blood glucose control</td>
<td>Daily</td>
<td>0</td>
<td>6(4.6)</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Weekly</td>
<td>0</td>
<td>13(9.9)</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Monthly</td>
<td>2(1.5)</td>
<td>53(40.5)</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Whenever I</td>
<td>1(0.8)</td>
<td>56(42.7)</td>
<td>-</td>
</tr>
<tr>
<td>Using mouthwash</td>
<td>Yes</td>
<td>1(0.8)</td>
<td>19(14.4)</td>
<td>11(8.5)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>2(1.5)</td>
<td>110(83.3)</td>
<td>37(27.4)</td>
</tr>
<tr>
<td>Exercising</td>
<td>Yes</td>
<td>0</td>
<td>30(22.7)</td>
<td>14(10.4)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>3(2.3)</td>
<td>99(75)</td>
<td>34(25.2)</td>
</tr>
<tr>
<td>Frequency of daily tooth brushing</td>
<td>Once Daily</td>
<td>0</td>
<td>48(36.6)</td>
<td>8(5.9)</td>
</tr>
<tr>
<td></td>
<td>&gt;Once Daily</td>
<td>1(0.8)</td>
<td>17(13)</td>
<td>22(16.3)</td>
</tr>
</tbody>
</table>
* #: Kendalls tau test, &: Chi_square test

Discussion

This study was unique as it was designed to compare the different severity and type of periodontal indexes, oral hygiene approaches, and physical activity of the adolescent population (N=280).

Some of the limitations to be mentioned are extensive exclusion criteria, lack of patient's cooperation, incompleteness of information in records, and homogenization of sex and social levels. In this study, diabetics and nondiabetics were significantly different in terms of severity of periodontal tissue inflammation determined by BOP. Similarly, Preshaw et al reported that diabetics had higher BOP than the nondiabetics (31). Moreover, Meenawat A et al reported that this index was significantly higher in type I diabetic patients (32).

In this study, similar to research of Patinomarin et al, CAL was significantly different in diabetic and nondiabetic adolescents (36). Also, the present study was in agreement with that of Grossi et al which showed that CAL had no significant correlation with the frequency of dental visits but had a significant correlation with blood glucose control.

The present study, in line with that of Patinomarin et al (36) and Preshaw et al (31), showed that the mean PPD in diabetic adolescents was significantly higher than that in healthy individuals. Thus, it seems that diabetic adolescents are at higher risk of PD progression compared to nondiabetics. There is some evidence supporting that diabetes has an adverse effect on periodontal status and PD has an adverse effect on controlling glucose level (19, 37).

Apoorva et al was much higher than that in this study (39). The severity of DM and PD is also indirectly corre-
lated with the factors affecting general health such as nutrition, quality of life, and OH (45).

Since this study has differences with previous studies in terms of number and age of patients, periodontal indices measured, study variables and ethnicity and race of patients, further studies with a larger sample size are required to assess some other indices to increase the generalizability of results to the entire population of diabetic adolescents (42).

Conclusion

All periodontal parameters (except PI) in diabetic adolescents were significantly greater than those in nondiabetics. Both diabetic and nondiabetic adolescents had equally poor oral hygiene.

In dental clinics with special focused care for patients with severe periodontitis, screening programs for diabetes should be available to identify new cases of diabetes early. This will prevent some severe complications and can benefit periodontitis therapy. Therefore, targeted oral health program should be developed for this population to promote public health.

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Conflict of Interests

The authors declare that they have no competing interests.

References

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