Promoting oral health among type 1 and 2 diabetics from Iassy, Romania

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Summary

Objectives: **The goals of this study were to assess oral health behaviors, access to dental care, need for improved health education, metabolic control, and periodontal status in diabetics attending the Diabetes and Nutrition Clinic at "Sf.Spiridon" Hospital in Iassy. Methods: 408, type 1 and 2 diabetic patients aged 20-89 (57,11±SD10,85) years (52,6% female) attending an outpatient diabetic clinic were examined. All patients filled in structured questionnaires and were clinically examined. Clinical periodontal examination included identification of visible plaque and the presence of calculus. The questionnaires used were focused on self-treatment, self-prevention, and self-diagnosis of oral diseases, utilization of dental services, and patients' knowledge and attitudes towards oral health.**

Results: **Women reported brushing their teeth more frequently and differences in plaque and calculus indices were significantly lower than those of men. Self-reported good oral condition was strongly associated with frequent dental visits and less plaque and calculus. A significant association was found between frequent dental visits and reduced amount of calculus. General health behavior was significantly associated with diet behavior (r=0.174). Diet behavior of females was better than males. Perceived fatigue was negatively associated with oral health behavior (r=-0.160). The prevalence of severe periodontal disease was 90.6%. Oral hygiene status was significantly associated with mean probing pocket depth (r=0.36) and mean periodontal attachment loss (r=0.327). Glycemic levels were significantly associated with mean probing pocket depth (r=0.202) and mean periodontal attachment loss (r=0.180). Subjects with a longer history of diabetes (>5 years) had significantly deeper mean probing pocket depth ($p<0.05$), higher mean periodontal attachment loss ($p<0.01$) and more missing anterior teeth ($p<0.025$). Significantly better oral health indicators were found among younger patients.**

Conclusions: **Adults with diabetes should benefit from comprehensive oral self-care, and more attention is needed for improving the quality and outcome of their oral hygene habits. Key words: health promotion, periodontal disease, diabetes, health behavior.**

Key words: **oral health, diabetes, prevention, periodontal disease, risk evaluation**

Introduction

Periodontal diseases are bacterial infections of the tissues surrounding and supporting the teeth. Gingivitis, an inflammation of the soft tissues only, can progress to periodontitis, where destruction of connective tissue attachment and alveolar bone can eventually lead to tooth loss. Diabetes mellitus is a chronic metabolic disorder that affects more than 100 million people worldwide [1]. In 1993, periodontal disease was identified as the sixth complication of dia-

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betes, and in the 1997 report of the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus, periodontal disease was referred to as one of the pathologic conditions often found in adults with diabetes.

Medical complications commonly associated with diabetes include renal disease, retinopathy, neuropathy, peripheral vascular disease, and coronary heart disease [1]. The oral health complications reportedly associated with diabetes include tooth loss, gingivitis, periodontitis, and oral soft-tissue pathologies [2]. Because patients with diabetes are at an increased risk of developing oral diseases, reliable and up-to-date information regarding oral health behaviors and perceptions in diabetic populations is needed to develop effective prevention strategies that are useful for dental practitioners.

The prevalence and severity of medical and oral health complications may depend on the specific type of diabetes assessed. Approximately 10 to 20 percent of all patients with diabetes mellitus have type 1 diabetes. These patients usually are diagnosed before they are 21 years of age, have rapid onset of symptoms and are virtually unable to produce insulin. Type 2 diabetes mellitus—the most common category of diabetes—often is associated with obesity and is characterized by slow onset of symptoms, usually in patients older than 40 years of age [1].

The association between diabetes and periodontal diseases has been recognized in the dental literature for many decades [3,4]. Indeed, multiple studies have demonstrated that the prevalence, severity, and progression of periodontal disease are significantly increased in patients with diabetes. Furthermore, longitudinal studies have shown that severe periodontal disease in diabetic patients at baseline is associated with poor metabolic control and other diabetes complications at follow-up.

The goals of this study were to assess oral health behaviors, frequencies of dental care, need for improved health education, metabolic control, and periodontal status in diabetics attending the "Sf.Spiridon" Hospital Diabetes Clinic in Iassy.

Materials and Methods

The study was of cross-sectional design with a convenient sample frame of 408. The recruitment period was from 15 October 2006 to 20 April 2007. An estimated sample size of at least 200 subjects was required to secure an adequate sample power for the study. The Faculty of Dentistry, University of Iassy, and "Sf.Spiridon" Hospital Diabetes Clinic had approved the protocol. Prior verbal and written consent has been obtained during the inclusion of the subjects for this study. Because patients wearing complete dentures may perceive a reduced need for regular dental care, we excluded 32 edentulous diabetic patients from the analyses. The study population consisted of 193 male and 214 females the age range was 20 to 89 years. Data collection consisted of both clinical and behavioral or subjective parameters. There was no selection based on diabetes status, because the purpose was to recruit a heterogeneous study population with sufficient variation. As part of a dental and periodontal examination, our 408 subjects with type 1 and 2 diabetes completed a questionnaire regarding their oral health attitudes, behaviors, and knowledge. The periodontal clinical parameters included probing pocket depth and probing attachment levels. In addition, medical clinical parameters such as fasting blood glucose, glycated hemoglobin levels, and body mass index were measured. The oral health evaluation took place in a separate room than the medical examination; the room was equipped with a portable dental chair and a side-mount dental examination light. A trained dental examiner performed a full-mouth coronal and root caries examination and a split-mouth periodontal examination.

DEMOGRAPHICS FOR DIABETICS SUBJECTS	
DEMOGRAPHIC	DIABETIC SUBJECTS
Sex Female Male Total	193 214 407
Age (Years) Mean± Standard Error Range	57,11±10,85 20-89
Household Month Income Less than € 100 Between € 100 – 150 Between € 150 – 300	52,3 21,4 22,1 4,2
Educational Level Primary School (age 7-11) Gymnasium (age 11-15) High School age 15-19) College Masters and PhD	19,9 24,8 40,3 12,5 2,5
Marital Status	74,4

Table 1. DEMOGRAPHICS FOR DIABETIC SUBJECTS

Oral examination protocol included the dental examination - recording of missing teeth, existing carious lesions, and dental restorations, based on clinical observation using a dental mirror and explorer and the periodontal examination using a manual periodontal probe. Probing depth was defined as the distance between the gingival margin and the bottom of the pocket to the nearest whole millimeter and the location of the gingival margin, the distance between the cementoenamel junction and the gingival margin to the nearest whole millimeter. The distance was deemed no readable whenever the cementoenamel junction was obscured by dental restorations or was impossible to identify. Assessment of oral health behaviors: during the initial subject interview that took place immediately before the oral examination, we reviewed demographic data and medical and dental histories, with the subjects. Demographic data included age, sex, weight, height, and marital status as shown in Table 1. Subjects also were asked to report their household incomes and highest levels of education on the questionnaire. From subjects' medical histories, we obtained information regarding recent medical care, medications, hospitalizations, and significant medical complications (hepatitis, epilepsy, and so forth). Specific oral health questions addressed most recent visit to the dentist; oral hygiene habits (frequency of brushing and flossing). We asked all subjects about their current and lifetime histories of cigarette use. We asked about alcohol consumption (beer, wine, and mixed drinks). Diabetes-related variables: the following information related to the cases' diabetic state was collected from medical records: 1) Type of diabetes, duration (years since diagnosis), 2) Height and body weight,

for calculation of BMI 3) Insulin regimen oral hypoglycemic medications, and any other medications 4) Laboratory data, including measurements of glycemia and HbA1c (A1C) and lipid profiles. After the oral health examination, the subjects underwent assessments for possible medical complications of diabetes. These assessments included a physical examination, an electrocardiogram, blood and urine analyses, and an evaluation of renal, neurological, retinal, and cardiovascular functions.

Correlation coefficients were used to assess the associations between the selected health behavior, medical, metabolic, and periodontal parameters. Non-parametric tests (Mann-Whitney, Kruskal-Willis test) were used to assess the associations since the data was not normally distributed. In addition to correlation coefficients, statistical analysis has been performed to assess the variations among the selected health behavior, medical, metabolic, and periodontal parameters for age, sex, and metabolic control to identify the statistical significance of those variables.

Results

The dental items included the frequencies of tooth brushing, dental visiting, and interdental cleaning.

Regarding oral health behavior, women reported brushing their teeth more frequently and differences in plaque and calculus indices were significantly lower than those of men. Self-reported good oral condition was strongly associated with frequent dental visits and less plaque and calculus (r=0,625). A significant association was found between frequent dental visits and reduced amount of calculus (r=0,225). General health behavior was significantly associated with diet behavior (r=0.176). Diet behavior of females was better than males. Perceived fatigue was negatively associated with oral health behavior (r=-0.160). The prevalence of severe periodontal disease was 90.6%. Oral hygiene status was significantly associated with mean probing pocket depth (r=0.36) and mean periodontal attachment loss (r=0.323). Glycemic levels were significantly associated with mean probing pocket depth (r=0.202) and mean periodontal attachment loss (r=0.180). The diabetic subjects were diagnosed at a mean of 57,11 years of age (± 10,85 years, standard error, or SE) and had an average duration of disease of 9,29 years (± 6,53 years SE). Subjects with a longer history of diabetes (>5 years) had significantly deeper mean probing pocket depth ($p<0.04$), higher mean periodontal attachment loss ($p<0.01$) and more missing anterior teeth ($p<0.025$). Significantly better oral health indicators were found among younger patients.

At the time of the oral examination, 98,2 percent of the diabetic subjects had developed at least one diabetic medical complication. Prevalence rates for the medical complications were 29,2 percent with retinopathy, 96,3 percent with neuropathy, 19,7 percent with nephropathy and 16,5 percent with peripheral vascular disease.

Table 2 provides results of the oral health behavior questionnaire. The percentages of diabetic reporting currently smoking cigarettes (34,4 percent) or having ever smoked cigarettes (19,9 percent) were different.

Subjects' oral health perceptions, health attitudes and the responses oral health knowledge questions are shown in Table 3. Although these subjects believed that their dentists were aware of their having diabetes, few (17%) recognized that their oral health might be affected by the disease or that they should follow proper oral hygiene procedures and obtain routine dental care.

Discussions

The proper management of diabetic patients in dental practice is extensively discussed in textbooks and dental journals [5].

ORAL HEALTH BEHAVIORS OF DIABETIC SUBJECTS	
ORAL HEALTH BEHAVIORS OF DIABETIC SUBJECTS	DIABETIC SUBJECTS (%)
Tobacco Use Never Smoked Former Smoker Smokes < 10 per day Smokes >= 10 per day	45,7 19.9 10,3 24,1
Alcohol Use Strong Alcoholic Drinks Light Alcoholic Drinks	6,6 43,2
Tooth Brushing Frequencies In the morning After Lunch Before Sleeping	94,1 6,6 32,7
Use a Fluoridated Toothpaste	94,6
Use Mouthwash	13,8
Use Dental Floss Once Per Day	3,7
Ever Had Professional Tooth Cleaning or Scaling	49,9
Dental Care	4,7

Table 2. ORAL HEALTH BEHAVIOR OF DIABETIC SUBJECTS

ORAL HEALTH PERCEPTIONS AND ATTITUDES OF DIABETICS SUBJECTS	
Variables	DIABETIC
Rating of Overall Oral Health of Teeth, Gingivae and Oral Cavity Excellent Good Fair Unacceptable	 1,7 14,0 43,7 40,5
Have You Ever Had a Painful or Unpleasant Experience at the Dentist? Yes	 64,6
Do You Feel that Oral Health Status Affects Your Social Relationships? Yes	 45,0
Do You Think It has Importance for You to Maintain a Good Oral Heath Status as Long as Possible? Yes	 96,3
Would You Have Any problem with Wearing a Denture? Yes	 33,7
Reasons for Avoiding Dental Care Fear and Anxiety Financial Problems Lack of Time Others	 5,75 74 5 15,25

Table 3. ORAL HEALTH PERCEPTIONS AND ATTITUDES OF DIABETICS SUBJECTS

Emphasis is placed on recognizing symptoms in undiagnosed patients, making treatment modifications related to their medical complications, scheduling dental appointments, timing meals and insulin doses in relation to dental treatment, aggressively treating acute infections and managing medical emergencies (that is, hypoglycemic reactions). Oral pathologies that are more frequently seen in diabetic patients also have been described. However, long-term management strategies for preventing and delaying the progression of periodontal disease and tooth loss in high-risk patients such as those with poorly controlled diabetes have only recently been considered [6].

In Romania, diabetic patients visit physicians' offices and emergency rooms and are hospitalized more frequently than nondiabetics did. As a function of medical complications and disabilities, diabetic patients often are underemployed or retired. Daily diabetic management is inconvenient and requires a significant time commitment for glucose monitoring, drug administration, regular exercise, and frequent visits to the physician. These financial and time burdens have been reported previously for patients with type 1 and 2 diabetes and may be, in part, the reason that these patients previously have been reported as avoiding routine dental visits [7]. An equally important consequence is that the additional financial burden of dental treatment may adversely affect a diabetic patient's dental treatment decisions, such as electing to have dental extractions rather than more expensive restorative care. The results of our study regarding health priorities support the conclusion that competing financial and time commitments, rather than dental fear and anxiety, may explain the inadequacy of routine care in this diabetic patient population. An association between diabetes and early tooth loss and edentulism has been reported in the scientific literature [2,4,7,8]. The consequences of periodontal disease and subsequent tooth loss not only are important considerations for the quality of life of patients with diabetes, but they may affect significantly overall health by compromising patients' ability to maintain healthy diets and proper glycemic control. The associations and linkages between oral infections and serious systemic diseases such as diabetes conclude that oral health and general health are inseparable [9].

Cigarette smoking is an established risk factor for developing periodontal disease in both healthy and diabetic patients. The risk of developing periodontal disease is significant for patients with type 1 and 2 diabetes who smoke [10]. Cigarette smoking is the most important risk factor for periodontal disease that can be prevented through oral health promotion programs. It has been reported that dentists have underused tobacco cessation counseling, with only 24.1 percent of patients who smoke receiving cessation advice from their dentists. Considering the impact of smoking on the progression of periodontal disease in healthy and diabetic patients, dentistry's role in tobacco counseling should be re-emphasized.

Additional prevention strategies such as periodontal maintenance programs have been shown to be effective in preventing progression of periodontal disease [11]. Patients having known risk factors for periodontal disease, such as smoking and diabetes, also may require more frequent maintenance visits at shorter intervals. The lack of sufficient undergraduate dental education and practitioner continuing education may be barriers to incorporating promoting health programs as part of routine dental care [12]. Although many efforts have been made to improve educational opportunities, increased attention to this important aspect of clinical practice is needed. Rigorous glycemic control has become the primary medical strategy for managing and preventing diabetic complications. The Romanian Diabetic Association promotes recommen-

dations for diabetic patients to normalize blood glucose values greater than 7.9 percent, and both medical and oral health complications are likely to occur less frequently in the future [13]. Although glycemic control has improved in recent years, particularly for patients with the most poorly controlled diabetes (those with glycated hemoglobin values greater than 126 mg/dl), the recommendations to "normalize" glucose levels are difficult, if not impossible, to achieve by the majority of diabetic patients. This can be noted in the current study, where the mean glucose value of the diabetic subjects was 190 mg/dl (± 61mg /dl, SD). This trend toward improvement in metabolic control requires significant changes in diabetic patient compliance and is likely to affect oral health. With tight glycemic control, glucose levels are more likely to fall below normal levels, and patients' risk of experiencing hypoglycemia will increase [12]. The symptoms of acute hypoglycemia range from impaired motor coordination and cognitive dysfunction to seizures and coma. Since these adverse results may be more likely to occur during the stress of dental treatment, practitioners should be prepared to recognize and manage this medical emergency [14]. The oral health complications resulting from diabetes, however, probably will be less common as glycemic control strategies and technologies are promoted. There is preliminary evidence that periodontal infections may contribute to the problems of glycemic control. Rigorous, ongoing clinical investigations designed to determine if improvement in glycemic control occurs after periodontal disease therapy will define this possible interaction more clearly. Goals are to promote oral health, improve quality of life, improve access to care by overcoming barriers, and eliminate oral health disparities [15,16,17].

Conclusions

Current research has shown that diabetes is a risk factor for impaired oral health. It is known that diabetic patients have higher rates of tooth loss, periodontal disease, and soft-tissue diseases than do nondiabetic patients. This survey of an adult population of diabetic subjects found that they frequently were unaware of the oral health complications of their disease and that they avoided regular dental care because of the cost. Prevention of these oral health sequelae—tooth loss, periodontal disease and soft-tissue disease—depends on education and health promotion strategies such as early diagnosis, proper oral hygiene and diet, rigorous glycemic control measures, and smoking cessation counseling. Increasing the proportion of people with diabetes who have at least an annual dental examination is an objective of the National Institutes of Health's Healthy People 2010 [12]. Annual dental examinations may benefit these patients by improving the likelihood that oral disease will be diagnosed early. Dental practitioners have an opportunity and the responsibility to educate diabetic patients about the oral complications of diabetes and to promote proper oral health behaviors that limit the risks of tooth loss, periodontal disease, and oral soft-tissue pathologies. Information on oral health complications should be included in clinical training programs. Oral and diabetes control programs in state health departments should collaborate to promote preventive dental services, and the oral examination should be listed as a component of continuous care association's standards of medical care for diabetic patients. Diabetes mellitus affects people of all ages, and its prevalence has been increasing. Providing safe and effective oral medical care for patients with diabetes requires an understanding of the disease and familiarity with its oral manifestations. The goal of therapy is to promote oral health in patients with diabetes, to help prevent and diagnose diabetes in dental patients receiving routine care and to enhance the

quality of life for patients with this incurable disease.

As clinical implications, dentists have an opportunity and the responsibility to promote good oral health behaviors such as regular dental examinations, proper oral hygiene, and smoking cessation that may significantly affect the oral health of their diabetic patients [16].

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