

Original Article

Oral mucosal disorders and diabetes: diagnostic and prevention

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Abstract

The main goal of this study is to estimate the impact of diabetes on oral health, especially on the oral mucosa. The prime directive is to compare the clinical features of three different oral diseases (oral lichen planus, burning mouth syndrome and oral candidiasis) in diabetes and non-diabetes patients. A total of 96 patients were enrolled in subgroups age and gender-matched. The clinical data were collected from the medical records in order to be analyzed and compared. The rate of oral atrophic lesions was slightly increased in diabetic patients with oral lichen planus compared to non-diabetics. A higher proportion of smokers in diabetes patients with candidiasis were found compared to non-diabetes patients. Clinical type 1 burning mouth syndrome was the most frequent in diabetes patients compared to non-diabetics. In conclusion, the diabetes and the oral mucosal disorders have a bidirectional link.

Keywords: oral mucosa, diabetes, diagnosis, prevention.

Introduction

An interesting pattern of diabetes is its bidirectional connection with oral health. The influence of diabetes on periodontal tissue, salivary glands functionality, oral mucosal disorders, taste alterations and caries is well known [1].

The oral condition of diabetic patients can range from mild to severe depending on some risk factors such as hyperglycemia, the treatment used or the time between disease development and diagnosis [2]. Glycemic metabolism disorders, including slightly increased glycemia levels, can affect the oral cavity, especially in the oral soft tissue. On the other hand, any oral disease with a local or systemic inflammatory response can also affect the blood sugar level.

Moreover, pain and mobile or missing teeth can make the patient switch to a soft/suboptimal diet, which can increase chances for future diabetes or lead to poor control if it already exists [3].

Many studies [2–4] have analyzed the influence of diabetes on oral health by highlighting the morphological damage of oral mucosa, which can lead to function failure, infection or both.

There are some destructive biological processes in diabetes that produce molecular changes, such as loss of oxidative balance, the harmful activity of anti-oxidant agents or enzymes and the overproduction of free radicals and proteins glycation. All of the above can cause cytological exfoliation, keratinization delay, dehydration, aging and inflammation. The progressive glycation of proteins, lipids and nucleic acids from



the vascular components leads to poor perfusion of tissues and a decreased rate of cell turnover, which can explain the delay in the epithelial keratinization process, the morphological alterations or cellular genotoxic damage [3].

The prevalence of oral disorders such as tongue lesions (fissured tongue, coated tongue, migratory glossitis), denture stomatitis, and diabetes are somehow related [5]. The most common oral diseases (or signs) associated with diabetes are gingivitis, periodontitis, dry or burning mouth syndrome, taste disturbances, oral erythema, Candida infection, oral lichen planus, dental caries and halitosis [2–6].

Verhulst *et al.* showed an improvement in the quality of life of diabetic patients who benefited from an oral care-specific protocol [7].

This research aims to evaluate and compare in a case-control clinical study the clinical-pathological findings of oral mucosa in diabetic and non-diabetic patients.

Material and methods

Study design and patients

A total of 96 patients who attended the Clinical Unit of the Oral Pathology Department, Faculty of Dentistry, Carol Davila University of Medicine and Pharmacy, Bucharest, were included in this retrospective case-control study.

We selected diabetic and non-diabetic patients with one of the three major oral diseases: oral lichen planus (OLP), burning mouth syndrome (BMS) and oral candidiasis (OC). The diagnostic criteria were: the presence of oral and histopathological signs for OLP [8]; the features of chronic pain or burning sensation without an oral or general cause for BMS [9]; clinical signs and positive culture for OC [10]. All diabetic patients were receiving treatment at the time of the dental and oral examinations.

According to Lamey and Lewis [11], BMS was classified in the following clinical forms: BMS type 1 – no symptoms upon awakening with daily progression and maximum intensity in the evening; BMS type 2 – continuous symptoms, daily progression; and BMS type 3 – intermittent symptoms in unusual areas.

The clinical forms led to 4 main types of OLP: keratotic (reticular or plaque-like lesions), atrophic (atrophy with or without keratosis), erosive-ulcerative (erosions or ulcers in association or not with atrophy

and keratosis) and bullous (ulcers, bullae, atrophy and keratosis).

The patients were divided into 6 groups in order to compare the impact of diabetes on oral health: group 1 – OLP and diabetes, group 2 – OLP and non-diabetes, group 3 – BMS and diabetes, group 4 – BMS and non-diabetes, group 5 – OC and diabetes and group 6 – OC and non-diabetes. The patients' selection for control groups (group 2, 4 and 6) has been made by matching the age and gender of group 1, 3 and 5.

The diagnosis of diabetes was based on the American Diabetes Association guidelines [12]: plasma glucose criteria (the fasting plasma glucose value, the 2h plasma glucose value during a 75g oral glucose tolerance test) or the hemoglobin A1C criteria. The hemoglobin A1C test measures the average blood glucose for the past two or three months and its level is linked to diabetes complications [13].

Clinical data collection

Personal and medical data such as gender, age, smoking status (smoker/non-smoker), prevalent diseases (diabetes), the reasons for the medical visit and the oral lesions features (location, clinical forms) were collected from the medical records.

Statistical analysis

The data were entered into a computer using version 24 of SPSS software (SPSS Inc., Chicago, IL, USA). The Chi-Square test was used to compare clinical forms of OLP and BMS in both categories, diabetes and non-diabetic patients.

Results

Out of 96 patients with oral diseases, 84 were female. The mean age was 61 (± 10.19) years and the overall range was from 35 to 84. Half of the patients had diabetes. There were 14 patients with OC (12 women and 2 men), 30 with BMS (24 women and 6 men) and 52 with OLP (48 women and 4 men).

The mean age of patients with OLP was 62 years. 15% of group 1 and 8% of group 2 were smokers. 46% of patients in both groups, 1 and 2 had stinging sensations. The pain was reported in 27% of the patients from group 1 and 23% in group 2.

Both groups (77% in group 1 and 81% in group 2) had OLP lesions on both sides of the buccal mucosa (Table 1).

Table 1: OLP lesions in group 1 and 2.

Lesion type	Group 1 Diabetic patients (n=26)	Group 2 Non-diabetic patients (n=26)
Reticular lesions	25 (96%)	26 (100%)
Keratotic plaques	8 (31%)	5 (19%)
Atrophy	13 (50%)	11 (42%)
Erosions and ulcers	7 (27%)	7 (27%)
Desquamative gingivitis	9 (35%)	11 (42%)

Group 1 presented a higher frequency of lesions on the dorsal lingual surface (58% in group 1 vs. 27% in group 2) and floor of the mouth (12% in group 1 vs. 4% in group 2). A percentage 12 of patients from group 1 had skin lesions, compared to 8% in group 2. Lesions from the labial mucosa were found only in group 1, in a proportion of 12%. Gingival lesions were present in about half of the individuals in both groups.

The keratotic form of OLP was the most prevalent clinical form (Table 2) in both groups (Figures 1 and 2) and had the least severe symptoms compared to other OLP forms. The non-diabetic OLP patients presented more cases of atrophic OLP (38.46%) compared to diabetic patients ($p=0.000$).

A number of 30 BMS patients were included in group 3 (BMS and diabetes) and 4 (BMS and no-diabetes). Each group consisted of 15 patients – age and sex-matched, 12 women and 3 men. The mean age of these patients was 64 years. The symptoms reported were burning sensation (47% – group 3 and 33.33% – group 4) and dry mouth (40% in both groups). A higher proportion of patients with altered taste was observed in group 4 (47%) versus only 13% in group 3.

The BMS affected mostly the tongue (80% of both groups). The entire dorsal tongue surface was affected in 47% of patients of group 3 and 53% of patients of group 4 and the partial tongue surface in 33% of group 3 and 27% of group 4. The clinical types of BMS are shown in Table 3. Type 1 of BMS was the most frequent in group 3 compared to group 4 – 73.33% vs. 53.33% ($p=0.000$).

A number of 14 patients suffering from oral candidiasis (OC) were included in our study. Group 5 had

7 patients with OC and diabetes (6 women and 1 man) and group 6 contained 7 non-diabetic patients with OC (6 women and 1 man). The mean age of the OC patients was 58 years. A higher proportion of smokers was found among OC patients with diabetes (46.2%) compared to non-diabetics (33.3%). OC lesions were frequently found on the tongue (71% in group 5 vs. 86% in group 6), followed by the hard palate (43% in group 5 vs. 57% in group 6) and commissural mucosa (43% in group 6 vs. only 14% in group 5). The most frequent clinical form of OC was the chronic atrophic type (all patients in group 5 and 85% in group 6). Denture stomatitis was observed in 3 patients in group 5 (42.85%) and 2 patients in group 6 (28.57%) (Figures 3 and 4).

Discussion

Half of the individuals included in this study have diabetes, the study groups being age and sex-matched in order to be relevant for the analysis. Comparing the clinical characteristics of the three oral mucosa disorders in diabetic and non-diabetic patients, we did not detect important differences. However, atrophic OLP seems to be more present in non-diabetic patients and type 1 of BMS in diabetic patients.

Some studies discovered that periodontal diseases, periapical lesions, xerostomia and taste disturbances are more prevalent in diabetic patients [14]. Other studies found that some oral disorders have a significantly higher risk in diabetic patients and even a negative impact on diabetes [1, 15].

Table 2: Analysis of OLP clinical forms in diabetes and non-diabetes patients.

Clinical form of OLP	Keratotic	Atrophic	Erosive Ulcerative	Bullous
Group 1 (OLP and diabetic patients) (n=26)	13 (50%)	4 (15.38%)	5 (19.23%)	3 (11.53%)
Group 2 (OLP and non-diabetic patients) (n=26)	10 (38.46%)	10 (38.46%)	4 (15.38%)	2 (7.69%)



Figure 1: Keratotic OLP lesions in diabetic patients.



Figure 2: Keratotic OLP lesions in non-diabetic patients.

Table 3: Analysis of clinical types of BMS.

Clinical type of BMS	Type 1	Type 2	Type 3
Group 3 BMS and diabetes patients (n=15)	11 (73.33%)	1 (6.66%)	3 (20%)
Group 4 BMS, non-diabetic patients (n=15)	8 (53.33%)	4 (26.66%)	3 (20%)

OLP is a chronic autoimmune disease associated with other diseases such as type B or C hepatitis, hypertension, thyroid and metabolic diseases [16]. Even though the biological connection between OLP and diabetes is not completely known at present, a link between them was still reported [16]. A meta-analysis about OLP and diabetes led to contradictory results due to the heterogeneity of diagnostic criteria as well as differences in research methodologies, especially in choosing study groups [17].

Although more intense clinical signs were reported in OLP patients with diabetes by Gorsky *et al.* [18], no major differences were observed in our study.

BMS is a complex, multifactorial disease with a specific clinical approach. As diabetes can frequently cause burning sensations of oral mucosa, blood glucose testing is included in the current investigations of BMS. Moreover, Orliaguet and Misery consider BMS a neuropathic pain caused by central or peripheral neuropathy [19]. We found type I of BMS more frequent in

diabetes patients (73.33%). In this form, the symptoms are present daily and intensity rises in the evening when it reaches a maximum.

Diabetes patients, especially those with poor glycemic control, smokers and denture wearers, have a high risk for oral fungal infections [1, 20]. Vitkov L *et al.* detected a strong correlation between increased candida density and risk for diabetes in patients with a body mass index below 25 kg/m² [21]. Al-Maweri SA *et al.* reported a statistically significant higher prevalence of denture stomatitis in diabetic patients [22]. We found in our OC groups a higher proportion of smokers in diabetes compared to non-diabetes patients as well as a slightly higher number of cases with denture stomatitis (42.85% in people with diabetes vs. 28.57% in non-diabetics).

Including all the above, it is obvious that diabetes patients need an improved dental hygiene assessment and treatment. Daily oral hygiene is crucial. Patients need to brush their teeth twice a day using antibacterial



Figure 3: Denture stomatitis in diabetic patients.



Figure 4: Denture stomatitis in non-diabetic patients.

toothpaste and to use dental floss. Regular dental check-ups are recommended, as well as local fluoride applications and nonsurgical periodontal therapy [23].

The small sizes of subgroups may be the main limitation of our study.

Conclusion

Although there are no major differences between oral mucosal disorders in patients with and without diabetes, diabetes is a risk factor for some oral disturbances and some oral disorders can stimulate the progression of diabetes.

Conflict of interest

The authors declare no conflict of interest

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