

Occurrence rate of oral *Candida albicans* in denture wearer patients

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Abstract

Purpose: The aim was to determine the fungi occurrence rate in the oral cavity of denture wearer patients in comparison to those without dentures.

Material and methods: The examinations were conducted in patients treated in two clinical departments of the University Hospital. Demographic data and those connected with basic diseases were collected and the evaluation concerning dentition and oral hygiene was performed. Samples for mycological examinations from the tongue dorsa, palatal mucosa, and mucosal surfaces of dentures were collected from patients with dentures while tongue and palate swabs were taken from those without dentures. For culture and identify of fungi standard methods were used.

Results: Dental and mycological examinations were performed in 95 patients, out of which 57 (60.0%) used complete or partial dentures and 38 (40.0%) had their own dentition (without dentures). Oral cavity revealed only growth of *Candida albicans* species, more frequently in patients with dentures (38/57; 66.7%) than in those without dentures (11/38; 28.9%) ($p=0.0003$). *C. albicans* statistically significantly more frequently was isolated in denture wearer patients with diabetes mellitus ($p=0.0207$) and without diabetes ($p=0.0376$) comparing to such groups of patients but without dentures. Among 32 patients with diabetes mellitus, 14 (43.8%) revealed *C. albicans*; this rate was comparable with 9/23 (39.1%) patients without diabetes ($p>0.05$). A similar analysis, conducted in 25 surgical patients with abdominal cancer and 15 – without – cancers, did not show statistically significant differences in the incidence rate of *C. albicans*; it

also concerned denture wearers (14/16; 87.5%) and non-wearing dentures (5/9; 55.6%) ($p>0.05$) with cancer. In 37 (64.9%) wearer patients denture stomatitis was observed, associated mainly with *C. albicans* infections (29/37; 78.4%).

Conclusions: 1) Mycological findings from the present study do not indicate that diabetes mellitus or advanced cancer has a significant effect on oral colonisation by *Candida albicans* or other species of *Candida* genus. 2) The occurrence rate of oral *Candida albicans* in patients with dentures (diabetic and non-diabetic, cancer and non-cancer patients) was higher than in patients without dentures ($p<0.05$).

Key words: oral *Candida albicans*, denture plaque, denture wearers, diabetes mellitus, denture stomatitis, oral hygiene.

Introduction

Candida is present in the oral cavity of almost half of the population and has been shown to be prevalent in people with diabetes mellitus as well [1-4]. Studies have shown a higher prevalence of *Candida* in diabetic versus non-diabetic individuals [1,3]. In addition, significantly higher prevalence of *Candida* infection in people with diabetes was reported [2]. *Candida* infection is also found commonly in denture wearers [5]. According to a survey of the literature on oral yeast (*Candida albicans* and other *Candida* species) isolations from subjects without signs of mucosal diseases the median carriage rate was 34.4% among healthy adults whereas it was 54.7% in hospitalized patients [6].

Candida infection (candidiosis or candidiasis) can occur as a side effect of medications such as broad-spectrum antibiotics, antihistamines, chemotherapy or radiotherapy. Other disorders associated with development of xerostomia include diabetes, drug abuse, malnutrition, immune deficiencies, and old age [4,7-9].

The manifestation of oral candidiosis (candidiasis) can occur in many different forms and include median rhomboid

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Table 1. Demographic characteristics and risk factors for oral *Candida albicans* in hospitalized patients

	Total	Denture wearers (n=57)	No-denture wearing (n=38)	p-value
Demographic data				
Age (years)				
Mean \pm s.d.		66.4 \pm 11.7	49.9 \pm 16.0	0.0000**
Range		40-83	19-76	
Number of patients	95/49*	57/38	38/11	0.0003
\leq 44 years	14/3	1/0	13/3	n.s.
45-54 years	23/10	12/7	11/3	n.s.
55-74 years	43/28	31/23	12/5	n.s.
\geq 75 years	15/8	13/8	2/0	n.s.
Gender				
Male	42/23	23/17	19/6	0.015
Female	53/26	34/21	19/5	0.0286
Oral status				
Oral hygiene status				
- good	29/10	16/7	13/3	n.s.
- fair	54/33	35/27	19/6	0.0028
- poor	2/8	6/5	6/3	n.s.
Tongue disorders	37/18	23/12	14/6	n.s.
Xerostomia	24/18	15/12	9/6	n.s.
Denture stomatitis		37/29	-	
Diabetic patients	32/14	19/12	13/2	0.0207
Non-diabetic patients	23/9	16/9	7/0	0.0376
Cancer patients	25/19	16/14	9/5	n.s.
Non-cancer patients	15/7	6/3	9/4	n.s.

* No. of patients/No. of *C. albicans*; ** comparison by Student's t-test

glossitis, atrophic glossitis, denture stomatitis (stomatitis prothetica), and angular cheilitis [4,10]. Usually, oral candidosis is associated with a high density of yeasts in the lesions [8,11]. Oral candidosis have been reported in 9% to 65% of the population [7,12-14]. These variations are far too important to be explained by demographic variations or socio-economic dissimilarities alone, but may be linked, in part, to differences in denture usage and hygiene habits as well as to underlying systemic predisposing factors [9,11].

Our previous studies have shown a high incidence of isolation of *Candida* spp. from oral cavities of patients with denture stomatitis (94%), healthy denture wearers (75%) and healthy people with their own dentition (41%) [15]. The aim of the present study was to assess the prevalence of yeast in the oral cavities of denture wearers and without denture patients with diabetes mellitus or abdominal cancer patients.

Material and methods

A total of 95 patients were evaluated in this study: 55 patients (32 with diabetes mellitus) admitted to the Department of Endocrinology, Diabetology and Internal Medicine and 40 patients treated in the II Department of General Surgery and Gastroenterology (25 with abdominal cancer). Each patient completed a medical and dental history and signed an informed consent document. All patients accepted an oral examination.

The patients were divided into two groups, according to the presence or absence of dental prosthesis (denture).

Samples were obtained by swabbing the oral mucosa (palatal mucosa and tongue dorsa) of all patients and the contiguous denture surfaces of patients with dental prosthesis. All oral specimens were placed on Sabouraud glucose agar. All isolated yeasts were identified with classic methods and carbohydrate assimilation patterns using commercial kit API 20C AUX (bioMérieux, ATB Expression) as a previously described [16].

The study protocol was approved by the Local Bioethics Committee of the Medical University of Białystok.

Statistical analysis

Student's t-test was used to analyse the differences between the means (shown as mean \pm s.d.). The Chi-squared test was used to analyse the differences between the frequencies in groups. Groups or subgroups were considered significantly different from each other if $P < 0.05$. All statistical calculations were performed using Statistica 6.0 for Windows.

Results

The prospective studies were performed in 95 patients treated in two inpatient departments, out of which, 57 (60.0%) used complete or partial dentures and 38 (40.0%) had their own dentition (patients without denture) (Tab. 1).

Table 2. Prevalence of oral *Candida albicans* and denture stomatitis in denture wearer patients

	Denture stomatitis		Newton types of stomatitis		
	No (n=20)	Yes (n=37)	I (n=25)	II (n=9)	III (n=3)
Demographic data					
Age (years)					
Mean \pm s.d.	63.1 \pm 11.69	67.51 \pm 11.13	62.5 \pm 10.77	64.2 \pm 12.29	78.3 \pm 8.1
Range	44-80	40-83	40-79	50-83	69-83
Number of patients	20/9*	37/29	25/19	9/8	3/2
Gender					
Male	6/3	17/14	11/8	4/4	2/2
Female	14/6	20/15	14/11	5/4	1/0
Oral status					
Oral hygiene status					
- good	16/7	0	0	0	0
- fair	4/3	31/24	24/18	5/5	2/1
- poor	0	6/5	1/1	4/3	1/1
Tongue disorders					
Xerostomia	7/1	16/11	13/8	1/1	2/2
	1/1	14/11	11/8	2/2	1/1
Diabetic patients	5/2	14/10	8/5	3/3	3/2
Non-diabetic patients	8/3	8/6	6/5	2/1	0
Cancer patients	4/3	12/11	9/8	3/3	0
Non-cancer patients	3/1	3/2	2/1	1/1	0

* No. of patients/No. of *C. albicans*

A total of 49 (51.6%) candidal strains from examined patients was isolated. In 35/49 (71.4%) patients *Candida albicans* strains were recovered from both in palatal mucosa and tongue dorsa. Oral cavity revealed only yeasts of *Candida albicans* species, more frequently in patients with dentures (38/57; 66.7%) than in those without dentures (11/38; 28.9%) ($p=0.0003$). *Candida albicans* statistically significantly more frequently was isolated in denture wearer patients with diabetes mellitus ($p=0.0207$) and without diabetes ($p=0.0376$) comparing to such groups of patients but without dentures (Tab. 1). Among 32 patients with diabetes mellitus (27 type 2 and 5 type 1), 14 (43.8%) revealed *C. albicans*; this rate was comparable with 9/23 (39.1%) patients without diabetes ($p>0.05$). A similar analysis, conducted in 25 surgical patients with abdominal cancer, and 15 non-cancer patients, did not show statistically significant differences in the incidence rate of *C. albicans*; it also concerned wearing dentures with cancer (14/16; 87.5%) and without dentures with cancer (5/9; 55.6%) ($p>0.05$) (Tab. 1).

Among putative risk factors evaluated, wearing denture patients (see above) and only older age (55-74 years: 28/43; 65.1% vs <44 years old: 3/14; 21.4%) ($p=0.01$) were associated with the most frequent isolated *C. albicans* (Tab. 1).

We also demonstrated that the presence of *C. albicans* was more frequent in denture-related stomatitis (29/37; 64.9% +ve vs 9/20; 45.0% -ve) ($p=0.0107$) (Tab. 2). The presence of denture-related stomatitis was assessed according to a modified version of Newton's classification [17]. The severity of the palatal inflammation was classified as: 1) no stomatitis, no evidence of palatal inflammation; 2) stomatitis Newton type I, petechiae dispersed throughout all or any part of palatal mucosa in contact with the denture; 3) Newton type II, macular erythema without

hyperplasia; or 4) Newton type III, diffuse or generalized erythema with papillary hyperplasia.

Statistical analysis showed that the frequency and the category of stomatitis between the risk factors was not significantly different ($p>0.05$), except for tongue disorders. Frequency of *C. albicans* present in patients with stomatitis and tongue disorders (mainly atrophic tongue) was significantly higher (11/16; 68.8%) than in free-stomatitis patients with tongue disorders (1/7; 14.3%) ($p=0.05$) (Tab. 2). Statistical analysis according to Newton types had shown no significant relation between stomatitis and number of detected yeast colonies (density as CFU) on dentures (denture plaque) and palatal mucosa and/or tongue dorsa (data not shown).

Discussion

Candidal infections are a major problem in the world, especially among the immunosuppressed people [2,4,7-9,11,13]. Furthermore, increased susceptibility to oral infections with *Candida* spp. has long been associated with diabetes mellitus [1-4,18-21], but the results remain controversial and contradictory [18-21]. In the present study 14/32 (44.8%) diabetic patients were found to carry *Candida albicans* in their oral cavity. This finding showed no statistical significance when compared with non-diabetic patients (9/23; 39.1%) ($p=0.7319$). A similar trend was observed by Kadir et al. [21] and by Sahin et al. [20].

Some investigators have demonstrated that candidal carriage is higher among diabetics wearing dentures [5,12,14,17]. In our study the frequency of oral candidal isolates was more common in 12/19 (63.2%) isolates in diabetic patients with denture

compared with 2/13 (15.4%) isolates in diabetic patients without denture ($p=0.0207$), but insignificantly related in age and sex distribution of both groups ($p>0.05$). Only *Candida albicans* was isolated in both diabetic groups.

Candida colonization in denture wearers, especially immunocompromised patients, can be disruptive to dental treatment and may be a barrier to patient health. The surface irregularities of acrylic resin are a factor in the entrapment of microorganisms, especially *Candida albicans*. Consequently, controlling the spread of fungal infection in risk patients who wear removable prostheses and who are more susceptible to fungal infections because of their immunosuppression is of critical importance. It is important in denture wearers with HIV infections [22] and diabetic patients [5,12,14,17-20,23,24] or advanced carcinoma [23,24].

Oral fungal infections frequently develop in individuals with advanced cancer, especially in the patients receiving palliative care for advanced malignant disease. Bagg et al. [23] showed that patients with advanced cancer have demonstrated a high incidence (51%) of oral colonization with non-*C. albicans* yeasts, many of which had reduced susceptibility to fluconazole and itraconazole (e.g. 72% resistant *C. glabrata*).

The oral yeast carriage in 66% of patients with advanced cancer by Davies et al. [24] were observed. The frequency of isolation of individual species was: *Candida albicans*, 46%; *C. glabrata*, 18%; *C. dubliniensis*, 5%; others, <5%. Oral yeast carriage was associated with denture wearing ($p=0.006$) [24]. In our study also a high isolation frequency (76% or 87.5% for denture wearers) was observed, but only one species, *Candida albicans*, from patients with abdominal cancer.

Our results also show that in denture-related stomatitis (denture stomatitis), the presence (colonization/infection) of *Candida albicans* on the denture is probably linked to extensive inflammation. In addition, the isolated *Candida* spp. associated with dentures are related to the poor hygienic condition of the prostheses, to the long time of the usage, wearing dentures at night and to the modifications of the hard supporting tissues [17,19]. In contrast, denture stomatitis was observed in healthy and diabetic or advanced cancer groups with almost the same frequency [15,17,19,23,24].

Whether *C. albicans*, alone or with other organisms, is involved in onset or development of denture related stomatitis remain to be determined.

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