

Candida Albicans and *Staphylococcus Aureus* in Obturators Used for Rehabilitation of Maxillary Defects

SUMMARY

Objective: The purpose of the study was to evaluate *Candida albicans* and *Staphylococcus aureus* colonization in the maxillary defect, internal surface of prosthesis, nasal cavity and saliva of patients with oronasal obturator prosthesis (OP).

Method: 18 (12 male and 6 female, mean age 52.6 years), with oronasal OP, already attending the routine control. Microbiological analysis was performed using conventional culturing methods.

Results: None of the patients were suffering from any subjective complains, while 9 of them (50%) had diffuse erythema of the defect area. The patients' mean duration time of prosthesis wearing was 3.8 years (between 1-14 years). 13 patients (72.2%) have been wearing their prosthesis 24 hours per day. *C. albicans* were detected in 10 (55.5%), 11 (61.1%) and 11 (61.1%) of the samples from the maxillary defect area, OP and saliva, respectively. *S. aureus* were detected from 8 nasal cavity samples (44.4%), simultaneously the saliva samples of these patients were also positive for *S. aureus*, except 1. Both *C. albicans* and *S. aureus* were detected in 4 (22.2%) of the saliva samples.

Conclusion: We suggested that the patients with oronasal OP must be educated for cleaning their prosthesis and they also should be checked microbiologically semi-annually.

Keywords: Obturator prosthesis; *Candida albicans*; *Staphylococcus aureus*

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Introduction

Maxillary defects are result of the congenital malformation, trauma, and surgical treatment of benign and malignant tumours. Postsurgical maxillary defects predispose the patient to hyper nasal speech, fluid leakage into the nasal cavity, impaired masticator function, and in some patients, various degrees of cosmetic deformity². The oral disabilities are minimized or eliminated almost immediately with obturation. The primary aim for treatment of maxillary defects with obturator prostheses (OP) is closure of the defect area and separation of the oral cavity from the sinus and nasal cavities^{14,22}. Therefore, OP restore the functions of mastication, deglutition and speech and provide the satisfactory appearance.

Most commonly used materials for fabrication of OP is polymethyl methacrylate. The primary disadvantage of polymethyl methacrylate is that microorganisms find excellent conditions for growth on the surface¹⁸. Pores, cracks, and structural defects formed by the release of gases during the polymerization process offer microorganisms the opportunity to initially adhere to the surface of the denture base material and, subsequently, penetrate into the denture and persist in the interior of the OP¹¹.

The composition of microbial flora of denture plaque resembles that of dental plaque, but with an increased number of *Candida* species¹⁹. Most manifestations of oral candidiasis are in fact associated with the formation of *Candida* biofilms on surfaces of prostheses. Candidial

colonization and subsequent biofilm formation on denture materials may lead to stomatitis²⁵.

Candida albicans is the most common opportunistic fungal pathogen in the oral cavity²⁷. The incidence of intraoral *Candida* species varies from 20% to 50% in a healthy edentulous population²⁴ and up to 75% in a population wearing dentures³². Multiple factors may predispose to oral candidial infections, such as malignancies⁴, dentures⁵, smoking¹, broad-spectrum antibiotics²⁹, dietary factors¹⁰, immunosuppression²¹ and xerostomia²⁸.

Staphylococcus aureus is frequently isolated from healthy individuals and causes a variety of diseases in humans. The external nares are almost certainly the main reservoir of *S. aureus*^{12,15}, but little is known about its presence in the oral cavity. Although it is considered to be transiently resident in the oral cavity^{8,23,31}, these may be continuously provided from the nasal cavity. Nasal bacteria may be transmitted through an oronasal fistula to the oral cavity, and it may be able to survive in the oral environment in patients with cleft lip and palate³⁵.

The purpose of the study is to evaluate *C. albicans* and *S. aureus* colonization in the maxillary defect, internal surface of prosthesis, nasal cavity and saliva of patients with oronasal obturator prosthesis because of the possible cross-contamination.

Material and Methods

Patient Selection

18 patients (12 male and 6 female, mean age 52.6 years) already attending the routine control at Istanbul University, Faculty of Dentistry, Department of Maxillofacial Prosthodontics, were selected in this study. The patients had been using OP who underwent maxillectomy due to some reasons, such as malignancy or had cleft palate. Age, gender and medical history of all patients were recorded. Patients were questioned about smoking habits and about their OP for duration and cleaning periods. Intraoral examinations were performed for oral mucosal lesion presence. Exclusion criteria included acute infections, antimicrobial therapy within the previous 4 weeks, insufficient oral hygiene, diabetes mellitus, leucopenia, viral infection, and the abuse of analgesics or antipsychotic drugs. Because no intervention was undertaken or drug administered, only informed consent of the patients was obtained. According to the Helsinki declaration, a witness assisted the patients before signing the informed consent form.

Microbiological Investigation

Microbiological examinations were performed at the Department of Microbiology. The presence of *C. albicans*

in the maxillary defect, internal surface of the prosthesis and in the saliva and furthermore *S. aureus* in the nasal cavity and saliva were investigated.

Samples from the nasal cavity, maxillary defect and internal surfaces of OP were taken by a sterile cotton swabs and transferred into a vessel with 1 ml saline solution and mixed 20 sec for homogenization by means of a Vortex mixer.

Paraffin stimulated saliva samples were taken for 5 minutes. Aliquots of 0.1 ml samples were 10-fold serially diluted and plated onto Mannitol Salt Agar (Acumedia Manufacturers Inc, Baltimore, Maryland) for staphylococci and onto Sabouroud Dextrose Agar (Oxoid Ltd, Basingstone, UK) for yeasts and incubated aerobically at 37°C for 48 hours.

The typical colonies of the saliva samples were enumerated and calculated as cfu/ml. *C. albicans* isolates were identified by the germ tube test; while *S. aureus* isolates were identified by DNase test performed using DNase test agar (Difco Lab, Detroit MI 48232-7058, USA).

Methicillin resistance was detected with disc diffusion method on Mueller Hinton agar (Merck KgaA, 64271, Darmstadt, Germany) plates with 4% NaCl using 1µg oxacillin discs (Oxoid Ltd) according to Clinical and Laboratory Standards Institute (CLSI).

Results

Characteristics of patients were shown in table 1. The patients had not any other systemic disease except their tumour. The reasons of wearing prosthesis were various malignant tumours in the maxilla (83.3%), cleft palate (11.1%) and arterio-venous malformation (5.5%). 7 patients (38.8%) were treated with radiotherapy (RT) and 4 patients (22.2%) with chemotherapy (CT). 4 patients (20%) were smoking. The patients' mean duration of wearing their prosthesis was 3.8 years (between 1-14 years). 13 patients (72.2%) have been wearing their prosthesis 24 hours per day. The mean cleaning frequency was 2.11 times per day (between 1-3 times).

C. albicans were detected in 10 (55.5%), 11 (61.1%) and 11 (61.1%) of the samples from the maxillary defect area, prosthesis and saliva, respectively. *S. aureus* were detected from eight nasal cavity samples (44.4%), simultaneously the saliva samples of these patients were also positive for *S. aureus*, except 1. All *S. aureus* strains were MSSA. None of the patients were suffering from any subjective complains, while 9 of them (50%) had diffuse erythema in the defect area. Both *C. albicans* and *S. aureus* were detected together in 4 (22.2%) of the saliva samples.

Table 1: Characteristics of patients with used obturator

Patient	age	gender	pathology	RT	CT	Smoking (pieces/ per day)	Duration (year)	Duration (hour/per day)	Cleaning period (times/per day)	C. albicans		S. aureus		Lesion	Treatment*	
										defect	obturator	Saliva (cfu/ml)	nasal Saliva (cfu/ml)			
1	60	m	Epidermid ca	+	+	10	14	24	3	+	+	2x10 ³	+	1x10 ⁴	+	1
2	50	m	Epidermid ca	-	-	-	3	24	1	+	+	1.4x10 ³	-	-	-	2
3	48	f	Cleft palate	-	-	-	1	24	2	+	+	1x10 ⁴	-	-	-	2
4	50	m	Cleft palate	-	-	-	3	24	2	+	+	1x10 ⁴	+	1x10 ⁴	+	1
5	65	m	Epidermid ca	+	-	20	16	24	2	+	+	1x10 ⁴	+	1x10 ⁵	+	1
6	56	m	Epidermid ca	-	-	-	4	16	3	+	+	2x10 ⁴	-	-	+	1
7	59	m	Adenocarcinoma	-	-	-	1	24	1	+	+	1x10 ⁴	-	-	+	1
8	40	m	Epidermid ca	-	-	-	7	24	3	-	-	-	-	-	+	1
9	37	f	Epidermid ca	-	-	-	2	24	1	-	-	-	-	-	+	1
10	31	m	Chondrosarkoma	+	+	-	4	24	2	-	-	-	-	-	-	2
11	60	f	Epidermid ca	+	+	-	3	24	2	-	-	-	+	6x10 ⁵	+	1
12	41	f	Arteriovenous malformation	-	-	-	3	14	1	+	+	4x10 ²	-	-	-	2
13	51	m	Beningn tumor	-	-	1	1.5	24	3	-	-	-	-	-	-	2
14	60	m	Epidermid ca	+	-	6-7	1	24	3	+	+	1x10 ⁴	-	-	-	2
15	75	f	Epidermid ca	+	-	-	5	24	3	+	+	3x10 ³	-	-	+	1
16	57	m	Cleft palate	-	-	-	1	24	2	-	+	2x10 ³	+	8x10 ²	-	2
17	67	m	Epidermid ca	+	+	-	6	16	2	-	-	-	+	-	+	1
18	48	f	Epidermid ca	-	-	-	2	24	3	-	-	-	+	4x10 ⁵	-	2

RT:radiotherapy, CT: chemotherapy,

*1: Itraconazole capsules 100 mg daily and 0.12 %chlorhexidine gluconate and 0.15%benzidamin HCl mouth wash and meticulous cleaning during the 15 days

2: 0.12 %chlorhexidine gluconate and 0.15%benzidamin HCl mouth wash and meticulous cleaning during the 15 days

Discussion

Most patients with acquired maxillary surgical defects can be restored to close to normal function and appearance. Oral candidiasis is a frequent oral lesion in those patients using dental prostheses. Most manifestations of candidiasis are in fact associated with the formation of *Candida* biofilms on surfaces of prostheses³⁶. Biofilms in denture plaque represent a protective reservoir for oral microbes⁷. Candidial colonization and subsequent biofilm formation on denture materials are important in the development of denture stomatitis²⁰.

At least 70% individuals with clinical signs of denture stomatitis exhibit fungal growth, and this condition most likely arises from yeast colonization of the

oral mucosa, combined with bacterial colonization²³. In our study, it has been observed in 10 (55.5%), 11 (61.1%) and 11 (61.1%) the samples from the maxillary defect area, prosthesis and saliva, respectively. This confirms that *C. albicans* may easily colonize at OP because of the relation between sinus and nasal cavities and oral mucosa. An unfavourable situation for prosthetic rehabilitation by the OP occurs when the size of a defect is so large that it overwhelms the remaining structures that stabilize prosthesis over the defect. Instability of the obturator results in air and fluid leakage through the nasal cavity and thereby compromises function^{17,30,37}.

Tuna et al³⁴ found *S. aureus* colonization in 53.1% and 40.6% of the children with oronasal fistula in the saliva and nasal samples, respectively and they showed that bacterial transmission was proven for large oronasal

fistulas and a correlation was found with *S. aureus* counts in the saliva of children with cleft lip and palate. In our study, *S. aureus* was detected from 44.4% of the nasal samples; simultaneously, the saliva samples of these patients were also positive for *S. aureus*, except 1.

In our study, 4 (36.4%) of the 11 *C. albicans* positive saliva samples were also positive for *S. aureus*. Yeast may play a synergistic pathogenetic role with opportunistic bacterial pathogens in oral mucosal infections⁹. *C. albicans* and *S. aureus* are among the leading pathogens and are often co-isolated from sites of infection. Some investigations demonstrated the presence of synergistic interactions between these species as they co-exist in a biofilm and even on denture surfaces^{6,13,33}. The *C. albicans* and *S. aureus* biofilms are more resistant to antimicrobial treatment than planktonic cells, individually^{16,26}. So it is important to brush the biofilms on dentures, while the denture cleaning may play a role in reduction of such microorganisms.

In conclusion, *C. albicans* and *S. aureus* may easily colonize OP due to the relation between nasal and oral cavities. Our results suggest that the patients with OP prosthesis must be educated for cleaning their prosthesis and they also should be checked microbiologically semi-annually.

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