Fungi Inhabiting the Oral Mucosa and Soft Material Lining the Obturator of Intraoral Post-surgical Prosthesis

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Background: Patients undergoing prosthetic treatment develop yeast-like fungi on their oral mucosa in 60~70% of cases. In patients treated for maxillary tumors the incidence of fungi increases.

Objective: To demonstrate the presence of *Candida* species by means of an imaging method with the use of scanning microscope picture. Using this method the authors wanted to investigate the adherence of *Candida* species to the surface of silicon elastomer and to evaluate their presence in the transverse section through the external lining of the post-surgical maxillary prosthesis obturator after the use of Silosept and Betadine.

Methods: The material comprised 25 patients who had undergone the maxillary surgery for various kinds of tumors. All the patients had prostheses with obturators which had been lined with a silicon material, Mucopren three weeks prior to examination. The patients were advised to use 2% Silosept solution for disinfection and 0.5% Betadine gel to apply for the night.

Results: The analysis of findings revealed the presence of fungi in the post-surgical cavity in 92% of the patients and on the prosthesis obturator in 96% of cases. The post-surgical section through the lining material revealed the presence of *Candida* species in 16% of patients, however this method does not allow an exact diagnosis of fungi.

Conclusion: Microscopic pictures demonstrated the 96% adhesion of *Candida* species to external silicon elastomer lining material. The presence of *Candida* in the transverse sections of the soft material was revealed in 16% of patients. Adherence to the base was found to be a causative factor favouring the persistence of inflammatory condition of the prosthesis bearing area.

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Key Words: *Candida albicans*, Neoplasms of maxilla, Prostheses with obturators, Soft-lining materials

INTRODUCTION

The majority of patients undergoing prosthetic treatment demonstrate the presence of yeast-like fungi on their oral mucosa[1~10]. Patients treated for maxillary tumors reveal increased incidence of fungi[11]. Own clinical observations as well as preliminary investigations demonstrated symptoms of post-surgical cavity inflammation due to *Candida* species commonly occurring in patients with removed maxillary tumor in whom the post-surgical

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wound was closed by means of an obturator in order to eliminate the passage between the oral and the nasal cavities.

In the above cases the development of the pathological process is associated with the adherence of pathogenic fungi to tissues contacting the prosthesis obturator. The contact affects the development of fungi both on the mucous membrane as well as on the prosthesis[12~15].

The cells of the fungus adhere permanently to the cells of the host's mucosa when they have on their surface adhesins corresponding to the receptors that are present on the host's cells. Their binding force depends on the amount and mutual affinity of the receptors and adhesins. Recently attention has been paid to the molecular aspect of fungal adhesion, and especially on the role of the host's plasma proteins and extracellular substances possessing adhesive properties. They include fibronectin, laminin, collagen, fibrinogen and complement components. The fungus cells have on their surface fine fibrillae consisting of glycoproteins; their presence was considered to be an indispensable prerequisite of adherence to the microorganism's cell. Mucous capsule secreted by the cells of the fungus contains polysaccharides and enzyme, it also plays an important role in penetration of the fungi into the host's infected tissue. Fungi which produce proteolytic enzymes, phospholipases and lysophospholipases, attack lipids and proteins of the cell membrane and lead to a disease. Toxins, which have high molecular weight, of glycoprotein character, inhibit the binding of neutrophils to fungi and play the role of adhesins.

Special attention has been paid to the significant role of adherence in the pathogenicity of *Candida* species as well as to the role of adhesins and their effect on the pathological processes in the oral cavity[16,17].

Since no data concerning mycological studies on adherence in patients operated on for maxillary tumors have been found in available literature, we found it useful to carry out such studies with the use of scanning microscope.

MATERIAL AND METHOD

The investigation involved a group 25 patients, including 8 women and 17 men, who had undergone excision of various maxillary tumors. The diagnosis, surgical procedures, and treatments were carried out at the Clinic of Maxillo-Facial Surgery, Medical University in Wrocław. Prosthetic treatment was carried out at the Department of Dental Prosthetics, Medical University in Wrocław and investigations under a scanning microscope − at the Electron Microscopy Laboratory of the Academy of Agriculture in Wrocław. Patients' detailed data have been presented in Table 1.

The most common reason for operation was carcinoma planoepitheliale with 12 patients, while chondrosarcoma and carcinoma adenoides cysticum was the reason of operation in 2 patients each. Single patients were operated on for melanoma malignum, adenoma monomorphicum, neurofibrosarcoma, adenocarcinoma as well as carcinoma sinonasale GII necroticans, carcinoma maxillae et nasi lat. dextri, carcinoma nasopharyngialae, carcinoma basocellulare and carcinoma planocellulare keratodes. Prosthetic restoration was made immediately after the surgical removal of the tumor and modified later. At the time of mycological evaluation, 6 patients had obturating plates (in one case made of acrylic, in the remaining five of thermoplastic material), consecutive 6 patients were provided with partial prostheses with obturators, including acrylic prostheses and three frame prostheses, and 13 patients had complete acrylic prostheses with obturators. Three weeks before taking swabs for examination of the post-surgical cavity, the obturator and a segment of the external surface of silicon under a scanning microscope, in 25 pa-

Table 1. The diagnosis, surgical procedures and treatments of the patients

No	Sex	Age	Years after surgery	Diagnosis*	Kind of prosthesis	Lining material
1	M	24	4	Chondrosarcoma	Complete prosthesis with obturator	Mucopren
2	M	68	19	Ca. planoepithelialae	Complete prosthesis with obturator	Mucopren
3	M	66	5	Ca. planoepithelialae keratodes	Complete prosthesis with obturator	Mucopren
4	M	77	6	Melanoma malignum	Complete prosthesis with obturator	Mucopren
5	F	45	12	Adenoma monomorphicum	Partial frame prosthesis with obturator	Mucopren
6	F	77	9	Ca. planoepithelialae metastaticum	Complete prosthesis with obturator	Mucopren
7	F	53	5	Ca. planoepithelialae keratodes	Complete prosthesis with obturator	Mucopren
8	M	53	6	Ca. sinonasale GII necroticans	Acrylic obturating plate	Mucopren
9	M	61	8	Ca. maxillae et nasi lat. dextri T-3, N-1, M-0	Complete prosthesis with obturator	Mucopren
10	M	58	12	Ca. planoepithelialae maxillae	Complete prosthesis with obturator	Mucopren
11	M	69	5	Ca. planoepithelialae keratoblasticum	Complete prosthesis with obturator	Mucopren
12	M	58	16	Neurofibrosarcoma	Partial acrylic prosthesis with obturator	Mucopren
13	M	46	8	Ca. adenoides cysticum (Cylindroma)	Partial acrylic prosthesis with obturator	Mucopren
14	F	47	11	Chondrosarcoma	Frame prosthesis with obturator	Mucopren
15	F	70	5	Ca. planoepithelialae	Complete prosthesis with obturator	Mucopren
16	M	73	5	Ca. planoepithelialae keratodes	Complete prosthesis with obturator	Mucopren
17	M	58	9	Ca. planoepithelialae	Complete prosthesis with obturator	Mucopren
18	F	42	3	Ca. nasopharyngialae	Ercodur obturating plate	Mucopren
19	F	68	3	Ca. planoepithelialae	Ercodur obturating plate	Mucopren
20	M	42	3	Ca. adenoides cysticum	Partial acrylic prosthesis with obturator	Mucopren
21	M	64	18	Adenocarcinoma	Complete prosthesis with obturator	Mucopren
22	M	72	8	Ca. basocellulare	Ercodur obturating plate	Mucopren
23	M	57	3	Ca. planocellulare keratodes	Ercodur obturating plate	Mucopren
24	F	56	3	Ca. planoepithelialae keratodes	Ercodur obturating plate	Mucopren
25	M	45	7	Ca. planoepithelialae keratodes papilomatosum	Frame prosthesis with obturator	Mucopren

*Ca.: Carcinoma

tients the obturator had been lined with Mucopren Soft silicon elastomer manufactured by Kattenbach − Germany. The patients were given 2% solution of Silosept manufactured by Kattenbach − Germany and they were instructed to disinfect the prosthesis once daily after the evening meal for 10 minutes and next wash it under running water. The patients were also given 0.5% gel − Betadine manufactured by Egis Pharmaceuticals Ltd. − Hungary and they were instructed to use it for the night after disinfection of the prosthesis with 2% solution of Silosept. The gel had to be applied onto the prosthesis obturator before placing it in the mouth. The patients were seen for follow-up after 21 days, when swabs from the post-surgical wound and prosthesis obturator were taken and silicon segments collected. Material from the swabs was incubated on Sabouraud agar with gentamicin and chloramphenicol (SGC) as well as on IDII medium manufactured by a French manufacturer BioMerieux. Silicon material was investigated under a scanning microscope.

Table 2. Fungi isolated from swabs and the scanning microscope findings

No	Swab findings: Fungi isolated from swabs after the use of Betadin and Silosept		Scanning microscope findings	
	From post-surgical cavity	From prosthesis obturator	External surface of the obturator silicon lining	Transverse section of the external silicon lining of the obturator
1	*Candida albicans* *Candida species* *Candida kefyr*	*Candida albicans* *Candida species* *Candida kefyr*	+	−
2	*Candida albicans* *Candida species* *Candida kefyr*	*Candida albicans* *Candida species* *Candida kefyr*	+	−
3	*Candida species* *Candida kefyr* *Candida tropicalis* *Candida lusitianae*	*Candida species* *Candida kefyr* *Candida tropicalis* *Candida lusitianae* *Candida guilliermondi*	+	+
4	*Candida albicans* *Candida species* *Candida kefyr*	*Candida albicans* *Candida species*	+	−
5	*Candida albicans*	*Candida albicans*	+	−
6	*Candida albicans* *Candida species*	*Candida albicans* *Candida species*	+	−
7	*Candida albicans* *Candida species*	*Candida albicans* *Candida species*	+	−
8	*Candida albicans* *Candida species*	*Candida albicans* *Candida species*	+	−
9	*Candida species* *Candida kefyr*	*Candida species* *Candida kefyr*	+	−
10	*Candida species* *Candida kefyr*	*Candida species* *Candida kefyr*	+	+
11	*Candida species*	*Candida species* *Candida kefyr*	+	−
12	*Candida albicans* *Candida species* *Candida kefyr*	*Candida albicans* *Candida species* *Candida kefyr*	+	−
13	*Candida kefyr*	*Candida kefyr*	+	−
14	*Candida albicans* *Candida species*	*Candida species* *Candida kefyr*	+	−
15	*Candida albicans* *Candida species*	*Candida albicans* *Candida species*	+	−
16	*Candida albicans* *Candida species* *Candida kefyr*	*Candida albicans* *Candida species* *Candida kefyr*	−	−
17	*Candida species* *Candida kefyr*	*Candida species* *Candida kefyr*	+	−
18	*Candida albicans* *Candida species* *Candida kefyr*	*Candida albicans* *Candida species* *Candida kefyr*	+	−
19	*Candida species* *Candida kefyr*	*Candida species* *Candida kefyr*	+	−
20	*Candida species* *Candida kefyr*	*Candida species* *Candida kefyr*	+	−
21			+	−
22		*Candida albicans* *Candida species* *Candida kefyr*	+	+
23	*Candida species* *Candida kefyr*	*Candida species* *Candida kefyr*	+	+
24	*Candida albicans* *Candida species*	*Candida albicans* *Candida species*	+	−
25	*Candida albicans* *Candida species*	*Candida albicans* *Candida species*	+	−

The aim of the work was to demonstrate the presence of the *Candida* species by means of imaging method using a scanning microscope picture. The authors wanted to evaluate the adhesiveness of *Candida* species to silicon elastomer surface and their incidence on the transverse section of the

Fig. 1. Intra oral picture − patient after resection of the maxilla.

Fig. 3. Intra oral picture − obturating plate within the oral cavity.

Fig. 2. Extra oral picture − obturating plate lined with silicon elastomer, Mucopren.

Fig. 4. *Candida* species.

external layer of post-surgical denture obturator of the maxilla after the use of Silosept and Betadin.

RESULTS

Detailed results and discussion of mycological investigations have been presented in Table 2.

The analysis of swabs taken on the 21st day after lining the prosthesis obturator with Mucopren silicon elastomer revealed the presence of fungi in the post-surgical cavity in 92% of patients and on the obturator in 96% of cases (Fig. 1~3). They were: *Candida albicans*, *Candida species*, *Candida kefyr*, *Candida tropicalis*, *Candida lusitaniae* and *Candida guilliermondi* (Fig. 4~8). As far as the post-surgical cavity is concerned, *Candida albicans* was isolated in 68% of cases, the same incidence − also 68% − being found on the prosthesis obturator; *Candida* species was isolated in the post-surgical cavity in 84% of cases while its incidence on the prosthesis obturator was found in 88% of cases. *Candida kefyr* was isolated in the post-surgical cavity in 56% of cases and on the obturator in 64% of cases. *Candida tropicalis* and *Candida lusitaniae* were found both in the post-surgical cavity as well as on prosthesis obturator in 4% of cases, while *Candida guilliermondi* was found only on the obturator in 4% of patients. Four percent of patients did not reveal the presence of any yeast-like fungi both in the post-surgical cavity

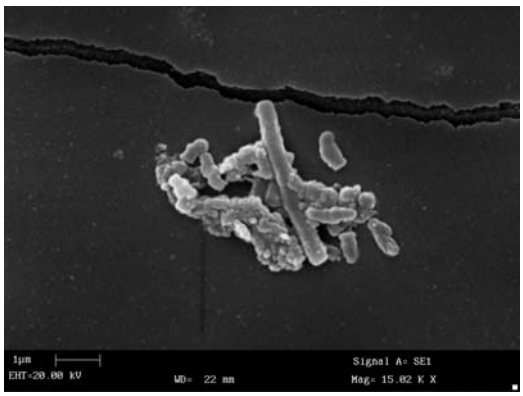

Fig. 5. *Candida* species.

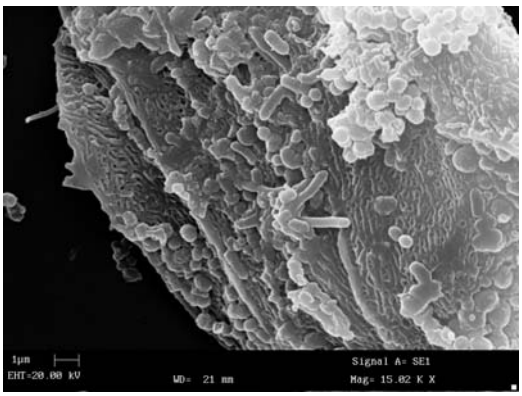

Fig. 7. *Candida* species.

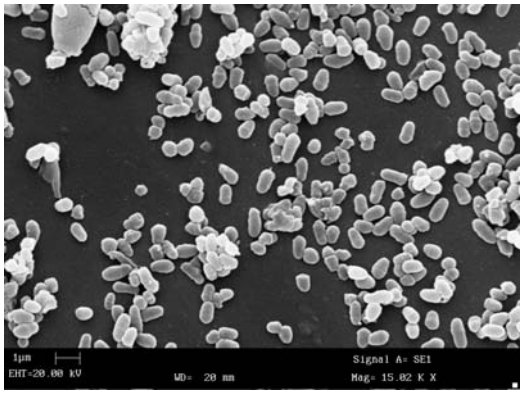

Fig. 6. *Candida* species.

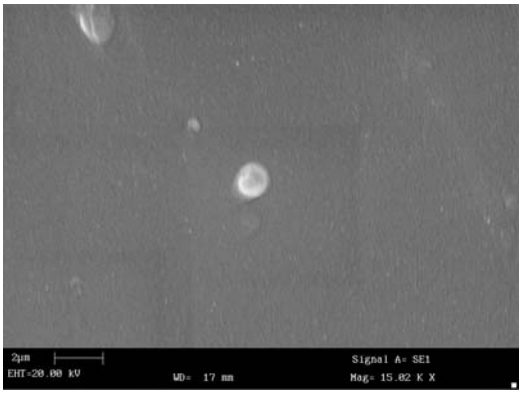

Fig. 8. Control area of the silicon elastomer Mucopren free from *Candida* (transverse section).

as well as on the prosthesis obturator. Investigation of the external surface of silicon elastomer under a scanning microscope revealed 96% adherence of the fungi to the bearing area, while transverse section through the soft material revealed the presence of fungi in 16% of cases. However this method does not allow exact diagnosis of the fungi.

DISCUSSION

Non-operated patients with acrylic prosthesis reveal the presence of fungi on their oral mucosa in 60~70% of cases. As shown in literature, the patients demonstrate increased temperature between the mucous membrane and the prosthesis plate as well as inflammatory conditions.

In our own investigations we found much higher incidence of yeast-like fungi in the post-surgical cavity as well as on the prosthesis obturator which was 92% and 96% respectively. We also demonstrated the presence of fungi on the transverse section through the soft lining. The growth of *Candida* species might have been due to decreased immunity of the organism resulting from administered cytostatic agents and radiotherapy. Alongside the increased incidence of yeast-like fungi, the patients developed persistent inflammatory condition around the post-surgical prostheses. This may be assumed to have been caused by the presence of fungi in the

post-surgical cavity, which were not eradicated despite the use of 2% Silosept solution and 0.5% Betadine gel.

CONCLUSIONS

Microscopic pictures revealed the presence of yeast-like fungi, which were adhering to Mucopren, the material lining the prosthesis obturator. Adherence of 96% of *Candida* species to the external layer of the silicon elastomer lining material may be considered as the reason of failure in trials of eradication of the fungi. Examinations under a scanning microscope revealed the presence of fungi on the transverse section of the soft lining material in 16% of cases. Adherence of the *Candida* species to the base may be a factor favouring the persistence of chronic inflammatory condition of the prosthesis bearing area.

REFERENCES

1. Spiechowicz E, Mierzwińska-Nastalska E. Grzybice jamy ustnej. Med Tour Press Int, Warszawa, 1998
2. Mierzwińska-Nastalska E, Gontel R, Popielarek R, Filewska M, Spiechowicz E, Skopińska-Różewska E. Aktywność metaboliczna granulocytów krwi w zakażeniach grzybiczych jamy ustnej. Prot Stom 1997; 47: 204-208
3. Dorocka-Bobkowska B, Jaśkowiak E, Włoch S, Pietkiewicz K, Byks H. Mykologiczne badania porównawcze jamy ustnej u użytkowników akrylowych protez płytowych w przebiegu cukrzycy. Prot Stom 1994; 44: 178-180
4. Rusinak-Kubik K, Mierzwińska E, Rolski D, Zubrzycki P, Kowalczyk W. Występowanie stomatopatii protetycznych i infekcji grzybiczej u użytkowników protez z terenu Warszawy − trzyletnie obserwacje. Prot Stom 1996; 46: 9-14
5. Dorocka-Bobkowska B, Jaśkowiak E, Pietkiewicz K, Włoch S. Wpływ cukrzycy na stopień adheracji *Candida albicans* do komórek błony śluzowej podłoża protetycznego. Prot Stom 1994; 44: 42-44
6. Wieckiewicz W, Baran E, Płonka B, Proniewicz A. Badania nad obecnością grzybów drożdżopodobnych na protezach szczęki z obturatorami i w jamach pooperacyjnych. Mikol Lek 1999; 6: 15-19
7. Kurnatowska AJ, Sosnowska E. Charakterystyka grzybów występujących w różnych stanach chorobowych jamy ustnej. Czas Stom 1981; 39: 891-895
8. Kurnatowska AJ, Raczyńska-Witońska G, Jankowska A. Zakażenia grzybami w okresach starzenia i wieku podeszłego. Otolaryngol Pol 1997; 51: 477-479
9. Kurnatowska AJ. Analiza kliniczna objawów niektórych chorób jamy ustnej a właściwości wyodrębnionych z jej ontocenozy szczepów grzybów. Rozprawa Habilitacyjna. AM Łódź, 1998
10. Dorocka-Bobkowska B, Włoch S, Mól A, Redzińska H, Byks H. Wrażliwość grzybów rodzaju Candida izolowanych w stomatopatiach protetycznych na leki przeciwgrzybicze. Prot Stom 1996; 46: 3-8
11. Darwazeh AM, Al-Refai S, Al-Mojaiwel S. Isolation of *Candida* species from the oral cavity and fingertips of complete denture wearers. J Prosthet Dent 2001; 86: 420-423
12. Abu-Eltheen KH, Abu Alteen RM. The prevalence of *Candida albicans* populations in the mouths of complete denture wearers. New Microbiol 1989; 21: 41-48
13. Tamamoto M, Miyake Y, Fujita Y, Suginaka H, Hamada T. Frequency and distribution of *Candida* species from denture wearers. Hiroshima J Med Sci 1986; 35: 39-43
14. Majewski S, Macura AB. The incidence of yeast-like fungi in denture wearers' oral cavities. Mycosen 1980; 23: 516-524
15. Williams DW, Lewis MA. Isolation and identification of *Candida* from the oral cavity. Oral Dis 2000; 6: 3-11
16. Sanchez-Sousa A, Tarrago D, Velasco J, Alvarez ME, Baquero F. Adherence to polystyrene of clinically

relevant isolates of *Candida* species. Clin Microbiol Infect 2001; 7: 379-382

17. Baran E. Zarys mikologii lekarskiej. Volumed, Wrocław, 1998