

Comparison of Penetration of *Candida albicans* in Two Denture Base Materials

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Abstract

Background: The use of removable complete dentures has been the main choice for the rehabilitation of completely edentulous patients. The denture wearers have to face the complications of this, especially the recurrent denture stomatitis. Denture stomatitis is an inflammatory condition affecting the oral mucosa. Out of the many reasons for this, one reason is the penetration of *Candida albicans* into the denture base. **Materials and Methods:** Heat polymerizing methyl methacrylate plates (PMMA) and plates using microcrystalline polymer were fabricated and then contaminated with *C. albicans*. These were surface disinfected, dried, and prepared for study on days 0, 7, 14, and 21 by fracturing each plate at the center. The surfaces were studied under the scanning electron microscope (SEM). **Results:** The PMMA plates showed the penetration of *Candida* on day 14, and the microcrystalline polymer plates showed the penetration of the organism on day 21. **Conclusion:** *C. albicans* penetrates the denture base differently which may be because of the nature of the polymer or due to the porosities in the denture base.

Keywords: *Candida albicans*, Polymethyl methacrylate, Microcrystalline polymer.

INTRODUCTION

The use of removable complete denture has been the main choice for rehabilitation of completely edentulous patients. Furthermore, there has been increase in the number of individuals with diabetes mellitus who are also complete denture wearers. The denture wearers must face the complications of this especially the recurrent denture stomatitis.^[1,2] Denture stomatitis is the inflammatory condition affecting the oral mucosa, characterized by inflammation and erythema of the oral mucosal areas covered by the denture.^[3]

One of the many reasons put forth in some studies is the adherence of *Candida albicans* the denture base. The formation and adherence of the candidal colonies to the intaglio surface of the denture base are considered as one of the major reasons for the recurrence of the candidiasis. The reasons may be the surface roughness that makes it easy for the attachment of the fungus^[4] and also the special features such as the mannoprotein cell surfaces and the presence of hyphae.^[5]

The present study aims to compare the penetration of *C. albicans* in two denture base materials with an objective to know the ability of the organism to penetrate the

different denture base materials to carry out the disinfection procedures to help prevent the recurrence of denture stomatitis.

MATERIALS AND METHODS

- Forty plates were fabricated in two different denture base materials each: Polymethyl methacrylate (PMMA) used routinely Meliodent™ and the other material resin-based microcrystalline polymer Karadent™ marketed by the Illusion laboratories.
- Strains of *C. albicans* (CA) – ATCC90028.
- Sabouraud's broth (SDA) – culture medium for *C. albicans*.
- Peptone growth medium.
- 2% chlorhexidine solution as a surface disinfectant.

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METHODOLOGY

Inclusion criteria

The following criteria were included in the study:

- *C. albicans* – proven microorganism causing denture stomatitis
- Commonly used denture base materials
- Sabouraud's agar – culture medium for *C. albicans*

Exclusion criteria

- Other microorganisms in the oral cavity which are not proven to be consistently associated with denture stomatitis were excluded from the study.

The 20 plates needed were fabricated from the polymethyl methacrylate (PMMA) according to the manufacturer's instructions. Here, Meliodent™ denture base material has been preferred as it is widely used denture base material. Furthermore, 20 plates were fabricated from resin-based microcrystalline polymer marketed – Karadent™. The ATCC90028 strain of *C. albicans* has been used in this study. The fungus was grown on the Peptone agar under room temperature conditions, in the microbiology laboratory.

After 24 h, the plates from the two materials were inoculated in this solution at 37°C. On the same day, one plate from each of the two jars was disinfected with 2% chlorhexidine (CHX) by placing it in sterile Petri dish for 1 h. Then, the solution was discarded and the plate was fractured at the center to check for the penetration of the fungus. The plates were sent for study under the scanning electron microscope (SEM). The same procedure was performed on the 7th, 14th, and 21st days after the inoculation in *C. albicans*.

RESULTS

All the samples were scanned under the scanning electron microscope (SEM) and the kilo voltage (kV) and the magnifications for all were kept same, 18 kV and 500x, respectively. After studying the two different materials under the SEM on the 0th, 7th, 14th, and 21st days (three samples of each type) for the penetration of the fungus, the following results were obtained:

On the 0th day, there was the absence of any fungal spore in both types of denture base materials. The same was observed on the 7th day after the incubation.

However, on the 14th day, the PMMA (Meliodent) showed the presence of fungal hyphae in two sample plates out of three (Figure 1).

The plates manufactured in MCP (Karadent) did not show any hypha or spore of the fungus on the 14th day after incubation. Three other sample plates of these materials went through the SEM on the 21st day after incubation (Figure 2). This time, the PMMA (Meliodent) sample showed presence of multiple spores in the captured view.

The plates manufactured in MCP showed the presence of hyphae on the 21st day (Figure 3).

The results obtained in the study are summarized in the Tables 1 and 2 that follow:

DISCUSSION

The etiology of denture stomatitis is considered to be multifactorial with the reasons being diabetes mellitus, poor denture hygiene, immunocompromised condition,^[6] and ill-fitting dentures causing microbial invasion under the denture base,^[7] also the continuous wearing of dentures causing opportunistic infections under the denture base,^[4] etc. This infection is characterized by inflammation of the mucosa usually involving the palatal mucosa under the denture,^[8] which may be painful or even asymptomatic.

The association of *Candida* with the recurrence of denture stomatitis has been discussed in many studies by the authors.^[4,6,9] The need for the study in different denture base materials is due to the increasing demand of dentures fabricated using different materials.^[1,2,10] The surface roughness, porosities in the denture base, and the hydrophobicity of the denture base material are some of the reasons put forth in some studies.^[12,11]

Table 1: Penetration of *Candida albicans* in polymethyl methacrylate

Days	Sample-1	Sample-2	Sample-3
0 th day	-	-	-
7 th day	-	-	-
14 th day	+	+	+
21 st day	+	+	+

Table 2: Penetration of *Candida albicans* in microcrystalline polymer

Days	Sample-1	Sample-2	Sample-3
0 th day	-	-	-
7 th day	-	-	-
14 th day	-	-	-
21 st day	+	+	+

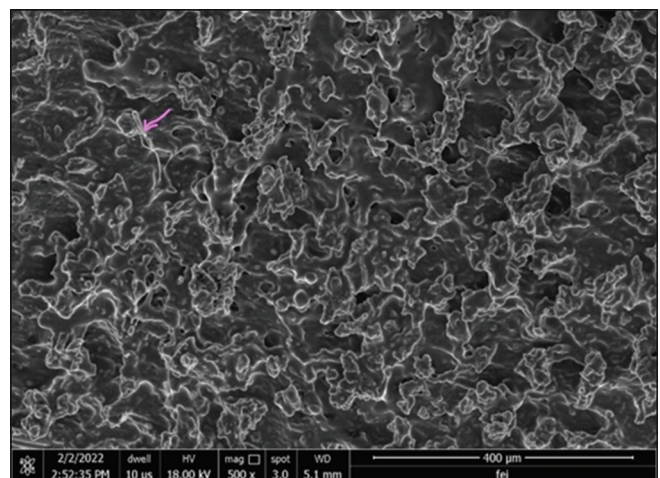


Figure 1: PMMA (day 14) – presence of fungal hyphae (pink arrow)

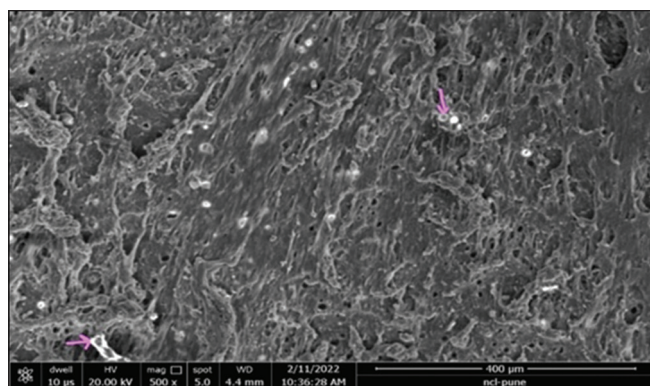


Figure 2: PMMA (day 21) – presence of spores (pink arrows)

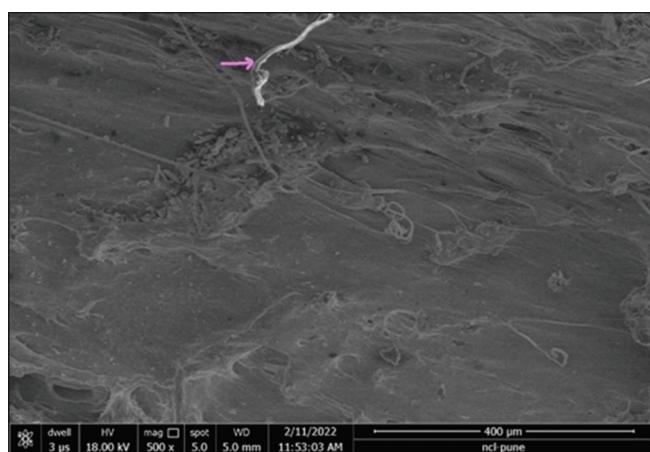


Figure 3: MCP (day 21) – presence of hyphae (pink arrow)

The fungus has specialized organs for attachment to the denture base.^[11] This results in the initial colonization, leading to the biofilm that is predisposed by the above-mentioned factors responsible for the increase in the number of the colonies. The surface cleaning of the dentures is not enough as far as this attachment and penetration of the organism are concerned. Hence, to understand the reason and carry out effective disinfection, we should know and understand the reason for recurrent denture stomatitis.

The scanning electron microscopy (SEM) was used to study the fungus, its attachment, and its penetration to the denture base.^[12] In the present study, we have used one magnification under the SEM to study and compare the

penetration of the fungus. This was done to keep a standard for the comparison.

CONCLUSION

As far as the materials and techniques used here, the conclusions can be summarized as follows

1. There is statistically significant difference in the penetration of *C. albicans* in two denture base materials in the specific time period of the study.
2. The structure of the material and the technique of fabrication of the denture base may be the cause for the difference in the penetration.

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