Journal of Advanced Medical and Dental Sciences Research

@Society of Scientific Research and Studies **NLM ID:** 101716117

Journal home page: www.jamdsr.com doi: 10.21276/jamdsr Indian Citation Index (ICI) Index Copernicus value = 100

(e) ISSN Online: 2321-9599;

(p) ISSN Print: 2348-6805

Original Research

Effectiveness of microwave disinfection of complete dentures on the treatment of candida related denture stomatitis

¹Sahil Sarin, ²Sipra Salaria

¹Associate Professor, Department of Prosthodontics, Dasmesh Institute of Research and Dental Sciences and Faridkot, Punjab, India;

²Assistant Professor, Department of Oral Medicine and Radiology, Dasmesh Institute of Research and Dental Sciences and Faridkot, Punjab, India

ABSTRACT:

Background: To study the effectiveness of microwave disinfection of complete dentures on the treatment of candida related denture stomatitis. **Materials & Methods:** A total of 40 subjects were included in the study, with ages ranging from 30 to 80 years. The selection criteria focused on individuals who exhibited mycelial forms of Candida spp. either on the palate or their upper dentures during the initial assessment. The study participants were categorized into four distinct groups. Observation of the slides was carried out using bright field microscopy. The data collected was subsequently subjected to analysis using the SPSS software. **Results:** Group 1, which served as the control group, exhibited no noticeable improvement. Conversely, groups 2 and 3 demonstrated significant progress, as no mycelial forms of Candida were detected in any of the smears from these groups after 30 days of treatment, indicating a 100% improvement rate. **Conclusion:** Microwave disinfection of complete upper dentures was effective for the treatment of Candida-related denture stomatitis.

Keywords: Microwave disinfection, denture, candida, denture stomatitis.

Received: 12 September, 2022

Accepted: 15 October, 2022

Corresponding author: Sipra Salaria, Assistant Professor, Department of Oral Medicine and Radiology, Dasmesh Institute of Research and Dental Sciences and Faridkot, Punjab, India

This article may be cited as: Sarin S, Salaria S. Effectiveness of microwave disinfection of complete dentures on the treatment of candida related denture stomatitis A. J Adv Med Dent Scie Res 2022;10(11):120-124.

INTRODUCTION

Denture stomatitis (DS) is a common recurring problem of the denture wearers. The aetiology of the disease includes infection, trauma and probably a defect in the host defense mechanism.¹ Fungal species of Candida have high affinity for adhering to and colonizing acrylic surfaces which is considered the first step in the pathogenesis of DS. Therefore, the presence of Candida species on dentures is considered a major factor in the development of this infection. ^{2,3}The effective removal of denture plaque by brushing requires a certain degree of manual dexterity which is commonly compromised in the elderly. In addition, the irregularities and porosities present on the acrylic resin surface may also contribute to penetration of micro-organisms into dentures, making it difficult to clean them by brushing.⁴ Microwave irradiation and immersion in chemical solutions have been recommended for denture disinfection. However, the effect of these procedures on the surface characteristics of denture base and reline resins has not been completely evaluated.⁵ Since it was first introduced to sterilize dental instruments in 1985, microwave irradiation has been studied to detect its effectiveness and its influence on physical properties of complete denture materials.⁶ In order to overcome the problems occurring with chemical disinfection, microwaves were suggested as a low-cost, quick, efficient, and chemical free alternative. Microwaves are a type of electromagnetic energy with wavelengths close in frequency to television transmissions and

aircraft radar. It is very important to note that microwave heating is an energy conversion and differs greatly from heating in a conventional oven.⁷ The exact mechanism of destruction of the microwaves has yet to be fully understood. Some studies claim that the irradiation of the microorganisms is directly of thermal character, while others claim that non thermal effects may play a significant role. ^{8,9}The effective removal of denture plaque by brushing requires a certain degree of manual dexterity which is commonly compromised in the elderly. In addition, the irregularities and porosities present on the acrylic resin surface may also contribute to penetration of micro-organisms into dentures, making it difficult to clean them by brushing.⁴ Microwave irradiation and immersion in chemical solutions have been recommended for denture disinfection. However, the effect of these procedures on the surface characteristics of denture base and reline resins has not been completely evaluated. ⁵ Since it was first introduced to sterilize dental instruments in 1985, microwave irradiation has been studied to detect its effectiveness and its influence on physical properties of complete denture materials.⁶However, microwaving may negatively affect denture resins, liners or teeth due to the material heating after irradiation. The water starts to boil after approximately 1 minute and 30 seconds and remains at this temperature until the end of the pre-set disinfection time, a phenomenon that may have negative effects on denture related materials' physicalmechanical properties.¹⁰ In order to moderate the cumulative distortion produced by the excessive heat, some researchers even suggested the combination of tablets containing alkaline peroxide and enzymes with microwave irradiation, thus achieving faster disinfection and less heat compared to the use of microwaves alone.¹¹ Hence, this study was done to evaluate the effectiveness of microwave disinfection of complete dentures on the treatment of candida related denture stomatitis.

MATERIALS & METHODS

A total of 40 subjects were included in the study, with ages ranging from 30 to 80 years. The selection criteria focused on individuals who exhibited mycelial forms of Candida spp. either on the palate or their upper dentures during the initial assessment. The presence of these mycelial forms in the samples is indicative of a fungal infection. Cytological smears were taken using a No. 31 metal spatula from both the palatal surface of each maxillary denture and the corresponding erythematous tissue (which includes the palatal mucosa of the hard palate and the area of the maxillary alveolar ridge). The collected material from both the denture and the palate was spread onto glass slides and fixed in a solution of ether and alcohol in a 1:1 ratio for a duration of 30 minutes. Subsequently, staining was performed using periodic acid-Schiff stain to reveal the presence of Candida spp. cells. The study participants were categorized into four distinct groups. The first group served as the control, while the second group consisted of patients whose upper dentures were subjected to microwave treatment (650 W / 6 min). In the third group, patients received the treatment administered in group 1, along with the topical application of miconazole three times daily for a period of 30 days. The fourth group received the antifungal therapy introduced in group 3.Observation of the slides was carried out using bright field microscopy. Furthermore, detailed dental and medical histories of the participants were documented. The data collected was subsequently subjected to analysis using the SPSS software.

RESULTS

A total of 40 patients were included in the study and were divided into groups, each consisting of 10 subjects. Group 1, which served as the control group, exhibited no noticeable improvement. Conversely, groups 2 and 3 demonstrated significant progress, as no mycelial forms of Candida were detected in any of the smears from these groups after 30 days of treatment, indicating a 100% improvement rate. In the case of group 4, while mycelial forms were still evident on the denture at the conclusion of the treatment, there was a slight reduction compared to the initial state. Additionally, within group 4, mycelial forms persisted on the palate but at a reduced level of approximately 30% when evaluated at the end of the treatment period.

		Mycelial forms				
		Palate			Denture	
Groups	Period	Absence	Presence	Absence	Presence	
Group 1 (control	Day 0	7(70%)	3 (30%)	0 (0%)	10 (100%)	
group)	Day 30	7 (70%)	3 (30%)	0 (0%)	10 (100%)	
Group 2	Day 0	3 (30%)	7 (70%)	0 (0%)	10 (100%)	
	Day 30	10 (100%)	0 (0%)	10 (100%)	0 (0%)	
Group 3	Day 0	3 (30%)	7 (70%)	0 (0%)	10 (100%)	
	Day 30	10 (100%)	0 (0%)	10 (100%)	0 (0%)	

Table: effectiveness in the groups

Group 4	Day 0	7 (70%)	3 (30%)	0 (0%)	10 (100%)
	Day 30	7(70%)	3 (30%)	1(10%)	9 (90%)

DISCUSSION

Denture stomatitis is commonly seen on the palatal mucosa of the upper jaw, is more prevalent in female patients, and is considered to be a benign lesion.¹² However, the mucosa under mandibular dentures is protected by salivary flow, so it is hardly affected.¹³ Buccal and labial mucosa which are in direct contact with the denture base might exhibit denture stomatitis. ¹⁴Denture stomatitis or Candida-induced denture stomatitis is a multifactorial condition. ¹² There is an interaction between a number of predisposing local and systemic factors. Local risk factors which are associated with denture stomatitis are dry mouth, local trauma from an ill-fitting denture, poor denture hygiene, continuous denture wearing, carbohydrate-rich diets, and acidic salivary pH in addition to smoking.¹⁵Poor oral hygiene and the continuous use of dentures were found to be the most significant risk factors for developing denture stomatitis. ¹⁶ Hence, this study was done to evaluate the effectiveness of microwave disinfection of complete dentures on the treatment of candida related denture stomatitis. In the present study, a total of 40 patients were included in the study and were divided into groups, each consisting of 10 subjects. Group 1, which served as the control group, exhibited no noticeable improvement. Conversely, groups 2 and 3 demonstrated significant progress, as no my celial forms of Candida were detected in any of the smears from these groups after 30 days of treatment, indicating a 100% improvement rate. A study by Neppelenbroek KH et al, the effectiveness of microwave disinfection of maxillary complete dentures on the treatment of Candida-related denture stomatitis was evaluated. Patients (n = 60) were randomly assigned to one of four treatment groups of 15 subjects each;Control group, patients performed the routine denture care; Mw group: patients had their upper denture microwaved (650 W per 6 min) three times per week for 30 days; group Mw Mz: patients received the treatment of Mw group in conjunction with topical application of miconazole three times per day for 30 days; group Mz: patients received the antifungal therapy of group Mw Mz. Smears and cultures of palates and dentures of the groups Mw and Mw Mz exhibited absence of Candida at day 15 and 30 of treatment. On day 60 and 90, few my celial forms were observed on 11 denture smears (36.6%) from groups Mw and Mw Mz, but not on the palatal smears. Miconazole (group Mz) neither caused significant reduction of palatal inflammation nor eradicated Candida from the dentures and palates. Microwaving dentures was effective for the treatment of denture stomatitis. The recurrence of Candida on microwaved

dentures at follow-up was dramatically reduced.¹⁷ In the present study, the case of group 4, while mycelial forms were still evident on the denture at the conclusion of the treatment, there was a slight reduction compared to the initial state. Additionally, within group 4, mycelial forms persisted on the palate but at a reduced level of approximately 30% when evaluated at the end of the treatment period. Another study by Aslanimehr M et al. in this experimental study, sixty sterilized dentures were divided into six groups of 10 dentures each. The dentures in Groups 1 and 6 served as negative and positive controls, respectively. The dentures disinfected with microwave irradiation (650 W, 3 min) and glutaraldehyde (2%, 10 min) exhibited no evidence of fungal growth after 48 h of incubation and also no turbidity in the TSB containers after 7 days of incubation. However, the dentures disinfected using the mechanical method and Corega tablets exhibited turbidity after 7 days and fungal growth after 48 h that was significantly more than that in the two other methods (P = 0.000) and less than that in the positive control group (P = 0.000). The differences between mechanical cleaning and cleansing tablet were not significant (P = 0.017). Microwave irradiation (650 W, 3 min) and 2% glutaraldehyde completely disinfected the dentures contaminated with C. albicans in the short term and long term.¹⁸ Santos Sousa TM et al, All included studies reported significant reductions in Candida counts and the frequency of denture stomatitis of groups subjected to microwave disinfection of dentures and topical antifungal therapy with nystatin. Significative differences between treatments were only detected for Candida quantification in the palate, within 90 days follow-up period (SMD = 0.47, 95% CI = 0.02-0.91). Meta-analyses did not show any further differences between treatments (p > .05), considering the Candida quantification in dentures and the frequency of clinical signs of denture stomatitis. The certainty of the evidence was considered as low, according to GRADE approach. Microwave disinfection of complete dentures can be considered as efficient as antifungal therapy for the treatment of denture stomatitis. However, further well-designed studies are necessary to confirm such evidence.¹⁹ Sartori et al., ²⁰ submitted denture bases to microwave disinfection (690W for 6 min in 500 mL of distilled water) and compared them to bases that had previously been chemically disinfected with a 100 ppm active chloride solution. They stated that bases disinfected with microwaves after a period of time did not fit to their casts, unlike bases immersed in chloride solutions. In addition, Goncalves et al., reported that microwave irradiation (650 W for 6 min in 200 mL of water for 7

times) revealed significant differences in the linear dimension of denture bases.²¹ Senna et al. observed significant linear distortion when the dentures were submitted to 36 cycles of microwave irradiation at 900 W for 3 min in wet environment. Nevertheless, they reported that 6 cycles of microwave irradiation at 450 or 630 W for 3 min caused no significant alternations. ²²Webb et al. showed that microwaves were more effective than sodium hypochlorite in disinfecting dentures. ²³ Moreover, in a study by Banting and Hill, microwave irradiation proved more effective than chlorhexidine in delaying recontamination of denture surfaces with C. albicans and infection of soft tissues.²⁴ Furthermore, Mima et al. found that microwaves inactivate C. albicans, Pseudomonas aeruginosa, Bacillus subtilis, and S. aureus in 3 min.²⁵ Furthermore, Buerger et al. reported that disinfection using microwaves had the maximum effect when combined with immersion in water and followed by the use of 1% sodium hypochlorite for 10 min.²⁶

CONCLUSION

Microwave disinfection of complete upper dentures was effective for the treatment of Candida-related denture stomatitis.

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