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Original Research

A comparative evaluation of antimicrobial efficacy of commercially available three types of denture cleanser

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Abstract

Background: This study was conducted for a comparative evaluation of antimicrobial efficacy of commercially available four types of denture cleanser.

Material and methods: In this study, the antimicrobial efficacy of three types of denture cleaning agents was assessed. The agents used were named Viclean (Group D1), Clinsodent (Group D2) and Fittydent (Group D3). The control group comprised of distilled water. A custom metal mold was created to produce wax plates with consistent dimensions of 15 mm × 15 mm and a thickness of 1.5 mm, which were subsequently transformed into heat-cured acrylic resin samples. The mold featured a square window measuring 15 mm × 15 mm and a thickness of 1.5 mm, designed to replicate the thickness of standard dentures.To facilitate the process, the metal mold was coated with a thin layer of petroleum jelly and positioned on a glass slab that had also been treated with petroleum jelly. Molten modeling wax was poured into the mold's window, and a second glass slab, similarly coated with petroleum jelly, was promptly placed on top of the metal mold. The molten wax was allowed to solidify without disturbance. Once fully hardened, the top glass slab was carefully slid off the metal mold, followed by the removal of the metal mold from the first glass slab, allowing for the extraction of the wax sample.Fungal cells adhering to acrylic resin surfaces of samples (Group D1) were fixed with formaldehyde. Samples along with yeast cells adhered to them were examined and the total number of colonies formed over sample was counted by microscopy. Now the samples were immersed in freshly prepared denture cleanser solution, D1 for 8 h. After 8 h, again samples were examined and total number of colonies remaining on sample was counted. The same procedure was performed using denture cleansers D2 and D3. For the control group, samples were immersed in distilled water for 8 h.

Results: Control solution showed almost no change in number of count pre- and post-treatment. Denture cleanser solution D2 on the other hand showed highest reduction in the number ofcounts.Among three denture cleanser solution, D1and D2 showed a greater decrease in percent OD when compared with D3.

Conclusion: Control solution showed almost no change in number of count pre- and post-treatment. Denture cleanser solution D2 on the other hand showed highest reduction in the number ofcounts.Among three denture cleanser solution, D1and D2 showed a greater decrease in percent OD when compared with D3.

Introduction

Denture stomatitis is a prevalent inflammatory disorder affecting individuals who wear dentures. The presence of microbial plaque on the tissue surfaces of dentures plays a crucial role in the development of this condition. Research involving cultures and smears has revealed a significantly elevated presence of Candida species in the denture plaque of patients suffering from denture stomatitis.[1]

Among the various strains, Candida albicans is the most frequently associated yeast with this condition. In the oral cavity, the majority of microorganisms that colonize and cause infections do not exist as isolated cells; instead, they form intricate microbial communities, often encased in a matrix of exopolymeric substances and adhering to both living and non-living surfaces. These structures are known as "biofilms." [2]

The maintenance of denture hygiene is often hindered by the inherent limitations of denture materials and the manual dexterity challenges faced by wearers. To prevent denture stomatitis, particularly forms not related to denture trauma, it is essential to implement

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effective denture cleaning practices that eliminate Candida from their surfaces.[3]

This study was conducted for a comparative evaluation of antimicrobial efficacy of commercially available four types of denture cleanser.

Material and methods

In this study, the antimicrobial efficacy of three types of denture cleaning agents was assessed. The agents used were named Viclean (Group D1), Clinsodent (Group D2) and Fittydent (Group D3). All the groups had 30 samples each. The control group comprised of distilled water. A custom metal mold was created to produce wax plates with consistent dimensions of 15 mm × 15 mm and a thickness of 1.5 mm, which were subsequently transformed into heat-cured acrylic resin samples. The mold featured a square window measuring 15 mm × 15 mm and a thickness of 1.5 mm, designed to replicate the thickness of standard dentures.To facilitate the process, the metal mold was coated with a thin layer of petroleum jelly and positioned on a glass slab that had also been treated with petroleum jelly. Molten modeling wax was poured into the mold's window, and a second glass slab, similarly coated with petroleum jelly, was promptly placed on top of the metal mold. The molten wax was allowed to solidify without disturbance. Once fully hardened, the top glass slab was carefully slid off the metal mold, followed by the removal of the metal mold from the first glass slab, allowing for the extraction of the wax sample.Fungal cells adhering to acrylic resin surfaces of samples (Group D1) were fixed with formaldehyde. Samples along with yeast cells adhered to them were examined and the total number of colonies formed over sample was counted by microscopy. Now the samples were immersed in freshly prepared denture cleanser solution, D1 for 8 h. After 8 h, again samples were examined and total number of colonies remaining on sample was counted. The same procedure was performed using denture cleansers D2 and D3. For the control group, samples were immersed in distilled water for 8 h.

Results

Table 1: Comparison of efficiency of sample solution before and after treatment

Group	Treatment with denture cleanser	Mean	N	SD	SEM
Control	Before treatment	19.65	30	5.56	1.14
	After treatment	19.55	30	5.62	1.15
D1	Before treatment	24.56	30	9.47	1.55
	After treatment	14.25	30	7.54	1.22
D2	Before treatment	27.69	30	9.23	1.47
	After treatment	6.84	30	7.51	1.14
D3	Before treatment	28.21	30	9.56	1.45
	After treatment	21.10	30	9.68	1.59

Control solution showed almost no change in number of count pre- and post-treatment. Denture cleanser solution D2 on the other hand showed highest reduction in the number ofcounts.

Table 2: Percentage Optical Density of cell suspension over a period of time

Time interval (minutes)	Percentage Optical Density		
	Group D1	Group D2	Group D3
05	77.23	79.21	83.55
30	70.21	65.17	79.53
60	64.87	53.14	61.24
90	51.23	49.77	50.29
120	49.01	42.03	49.08

Among three denture cleanser solution, D1and D2 showed a greater decrease in percent OD when compared with D3.

Discussion

Prostheses are designed to substitute for lost body parts and to restore the functions that may have been impaired due to the absence of a part or organ. To enhance their effectiveness, it is crucial to prioritize the care and maintenance of prostheses, which includes ensuring they remain hygienic. Insufficient home care can significantly undermine the clinical outcomes of even the most carefully crafted denture prostheses, regardless of the quality of materials and techniques used. When dentures become stained or accumulate tartar, it is advisable to employ straightforward chemical or physical cleaning methods using specialized cleaners.

Denture cleansers operate through either chemical or abrasive mechanisms. Chemical cleansers can include alkaline hypochlorites, alkaline peroxides, and diluted acids. Hypochlorites are particularly effective due to

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their capacity to dissolve the organic matrix that facilitates tartar formation. The alkaline peroxide category consists of powders and tablets that, when mixed with water, create an alkaline hydrogen peroxide solution. These products often contain oxygen-releasing agents such as sodium perborate or sodium percarbonate, along with an alkaline detergent like trisodium phosphate; the release of oxygen bubbles from this solution provides a mechanical cleaning action on loosely adhered contaminants.[4]

Immersion cleaners are advised to be utilized for a minimum duration of 20 minutes, or ideally overnight when feasible. This method of cleaning is particularly recommended for patients who do not wear their dentures during the night. Consequently, an 8-hour immersion period was selected for the evaluation of these cleaning products. The attachment of microorganisms to a surface is a critical step for their colonization. Numerous studies have investigated the adhesion of C. albicans to denture acrylic resin, which is linked to the presence of commensal opportunistic pathogenic yeast associated with denture-induced stomatitis. Dentures can act as reservoirs for infection, and any surface irregularities may enhance the retention of microorganisms even after cleaning.[5,6] While various studies have assessed the impact of denture cleansers and disinfectant solutions on the initial adherence of Candida to denture base materials, there has been limited research on how these cleansing agents affect mature biofilms of Candida, which are known to exhibit greater resistance to antimicrobial agents and chemical cleaning methods.[7] This study was conducted for a comparative evaluation of antimicrobial efficacy of commercially available four types of denture cleanser.

Control solution showed almost no change in number of count pre- and post-treatment. Denture cleanser solution D2 on the other hand showed highest reduction in the number ofcounts.Among three denture cleanser solution, D1and D2 showed a greater decrease in percent OD when compared with D3.

Dhamande MM et al (2012)[8]compared and evaluated Candida removing effects of three most commonly available varieties of commercial denture cleansers from heat polymerized acrylic resins. They compared and evaluated Candida lytic effects of denture cleansers. They assessed the effect of time on ability of denture cleansers in reducing Candidal biofilm. A specially designed metal mold was fabricated to obtain wax plates of uniform dimensions which were used to fabricate heat cure acrylic resin plates. A square-shaped window of dimension 15 mm and thickness of 1.5 mm was provided in metal mould to simulate thickness of denture base. All samples used in this study were prepared using this mould. Candida albicans colonies were then cultured on this acrylic resin plates by colonization assay. Yeast removing test for samples was performed using microscope and yeast lytic test was performed using photo colorimeter. Denture cleanser D2 showed the highest Candida removing activity when compared with cleansers D1, D3, and control solution. Denture cleansers D2 showed increased yeast lytic ability when compared with denture cleansers D1, D3, and control solution. More time span shared a definite influence on yeast lytic ability of denture cleansers. The effect of cleansing agents on removal of colonized yeasts particularly fungal biofilm from acrylic resins was assessed for clinical implications. The observation indicated superior performance of cleanser D2 when compared with D1 and D3 even though they all belong to same chemical group of alkaline peroxide. The increased effectiveness may be due to presence of sodium lauryl sulphate in formula of D2.

Conclusion

Control solution showed almost no change in number of count pre- and post-treatment. Denture cleanser solution D2 on the other hand showed highest reduction in the number ofcounts.Among three denture cleanser solution, D1and D2 showed a greater decrease in percent OD when compared with D3.

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