

Original Research

Assessment of effect of *Thymus vulgaris*, plant extract and commercially available denture cleanser on the flexural strength and surface roughness of denture base resin

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ABSTRACT:

Background: Insufficient cleaning by the elderly patients who are under long-term hospitalization, or those who have poor dexterity allows pathogenic microbiota to multiply on dentures, thus serving as a niche for disseminating infections. The present study was conducted to assess the effect of *Thymus vulgaris*, plant extract and commercially available denture cleanser on the flexural strength and surface roughness of denture base resin. **Materials & Methods:** 45 heat polymerizing denture base material samples were divided into 3 groups with 15 samples each. Samples were immersed in Group I in distilled water(control); group II in Thyme essential oil solution denture cleanser and group III in Fittydent denture cleanser for a simulated overnight 8hours immersion for 180 days. The samples were evaluated for increase in surface roughness and flexural strength. **Results:** The mean maximum flexural strength in group I was 97.2 MPa, in group II was 87.4 MPa and in group III was 105.3 MPa. The difference was significant ($P < 0.05$). The mean increase in surface roughness in group I was 0.03 μm , in group II was 0.03 μm and in group III was 0.05 μm . The difference was significant ($P < 0.05$). **Conclusion:** Thyme essential oil denture cleanser was superior in preserving the surface properties of denture base resins in comparison to commercially available denture cleanser.

Key words: denture base resins, flexural strength, Thyme essential oil

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INTRODUCTION

Oral health and general well-being of the patient is affected by edentulism. The placement of denture produces huge changes in the oral environment and adversely affects the integrity of the oral tissues. The patient experiences reduced chewing efficiency and denture-related oral lesions such as angular cheilitis, traumatic ulcer, and denture stomatitis.¹ The majority of the patients wearing partial and complete denture leaves the dental office with next to no learning about cleaning and maintenance of dentures. This happens because of inability of the clinicians to teach their patients regarding availability and accessibility of various denture-cleaning techniques and aids.² Among various methods, mechanical cleansing with a soft denture brush and water is considered an effective method for denture hygiene that contributes to a healthy mucosa as a denture bearing tissue

surface.³ Insufficient cleaning by the elderly patients who are under long-term hospitalization, or those who have poor dexterity allows pathogenic microbiota to multiply on dentures, thus serving as a niche for disseminating infections. In such situations, chemical denture cleansers can be an alternative to maintain denture cleanliness.⁴ An ideal denture cleanser must be biocompatible, bactericidal, and fungicidal, harmless to the structure of denture, should effectively remove organic and inorganic deposits, and should be easy to use. Plant extracts have been playing a useful role for centuries and are a well-established source for novel antimicrobial compounds. *Thymus vulgaris* has been used extensively in traditional medicine.⁵ The present study was conducted to assess the effect of *Thymus vulgaris*, plant extract and commercially available

denture cleanser on the flexural strength and surface roughness of denture base resin.

MATERIALS & METHODS

The present study comprised of 45 heat polymerizing denture base material samples which were fabricated and divided into 3 groups with 15 samples each. Samples from each group were immersed in their respective denture cleanser solution. Group I in

distilled water(control); group II in Thyme essential oil solution denture cleanser and group III in Fitty-dent denture cleanser for a simulated overnight 8 hours immersion for 180 days. The samples were evaluated for increase in surface roughness and flexural strength using Tally-surf Surface Profiler and Instron Universal Testing Machine respectively. Data thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

RESULTS

Table I Distribution of patients

Groups	Group I	Group II	Group III
Denture cleanser	Distilled water	Thyme essential oil	Fitty-dent denture cleanser
Number	15	15	15

Table I shows distribution of samples in various groups based on denture cleanser solution. Each group had 15 samples.

Table II Assessment of maximum flexural strength

Groups	Mean (MPa)	P value
Group I	97.2	0.01
Group II	87.4	
Group III	105.3	

Table II, graph I shows that mean maximum flexural strength in group I was 97.2 MPa, in group II was 87.4 MPa and in group III was 105.3 MPa. The difference was significant (P< 0.05).

Graph I Assessment of maximum flexural strength

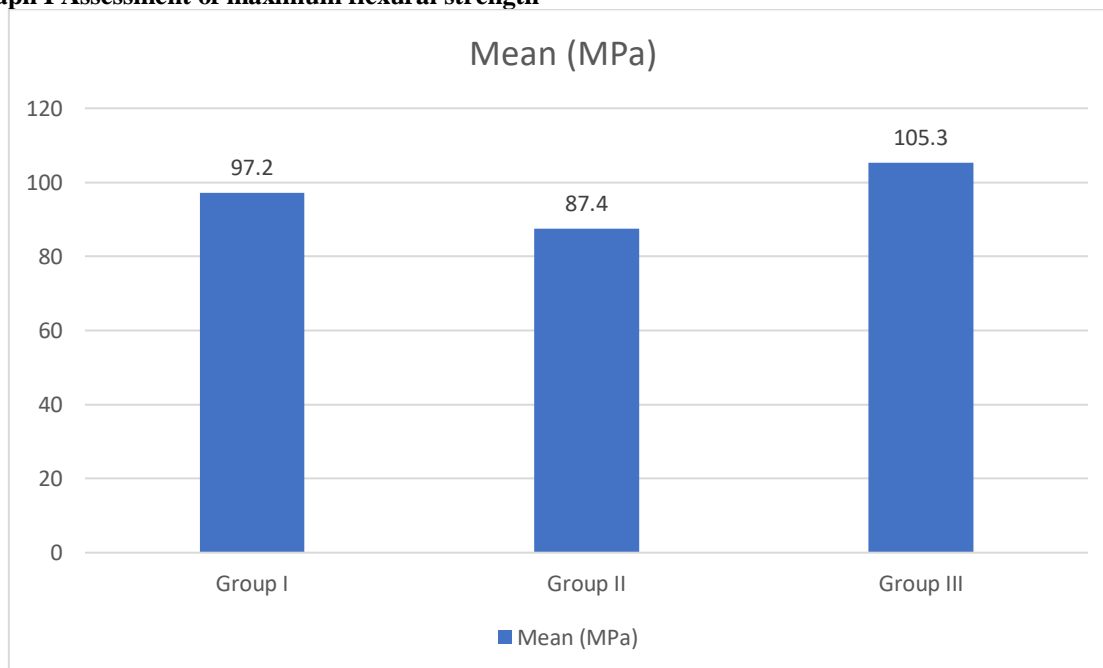
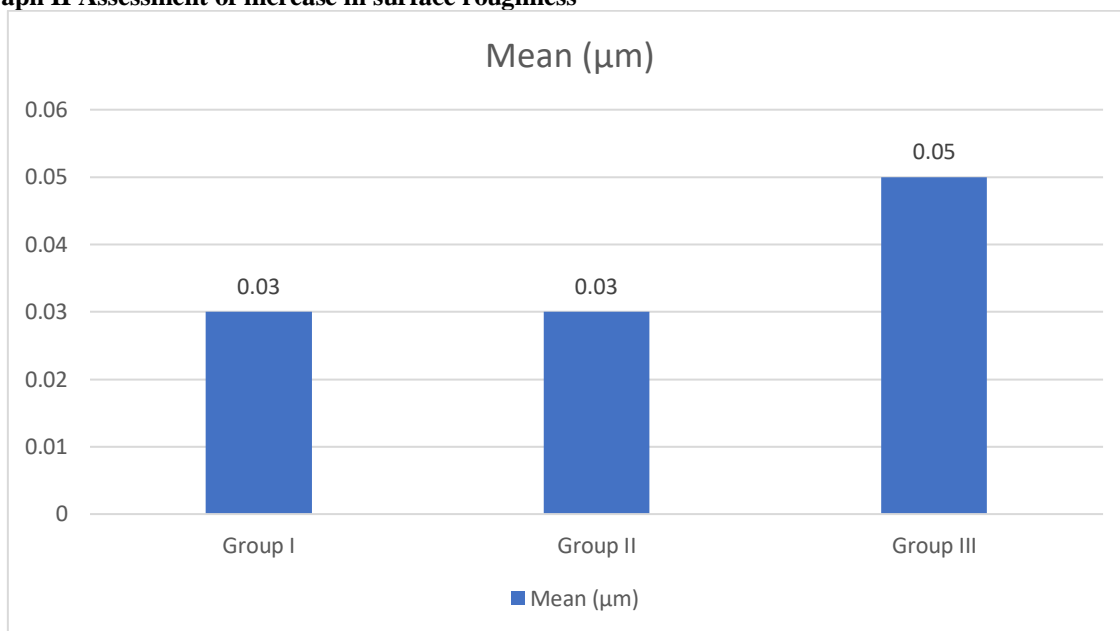


Table III Assessment of increase in surface roughness

Groups	Mean (µm)	P value
Group I	0.03	0.05
Group II	0.03	
Group III	0.05	

Table II, graph I shows that mean increase in surface roughness in group I was 0.03 µm, in group II was 0.03 µm and in group III was 0.05 µm. The difference was significant (P< 0.05).

Graph II Assessment of increase in surface roughness



DISCUSSION

Mechanical methods were utilized in conjugation with magnetic stirrers, agitators, sonic vibrators, and ultrasonic devices, yet at same time failed to demonstrate total adequacy in cleaning dentures.⁶ This led to use of the chemical cleansers as adjunct to mechanical cleaning methods. Chemical cleaners are available in form of creams, pastes, gels, solutions, and tablets. They may include one or combination of various chemical agents such as sodium hypochlorite, enzyme, chlorhexidine, alkaline peroxidase, and diluted acids as the immersion medium for denture cleaning.⁷ Studies comparing various plant extracts have shown that thyme essential oil is a potent antimicrobial agent against *Candida albicans* and thus be used for denture cleansing. The extract or oil derived out of this wonder plant works therapeutically to treat sore throat, tonsillitis, bronchitis, gum diseases, rheumatism, whooping cough, upper respiratory congestion, and arthritis.⁸ The present study was conducted to assess the effect of *Thymus vulgaris*, plant extract and commercially available denture cleanser on the flexural strength and surface roughness of denture base resin.

We found that mean maximum flexural strength in group I was 97.2 MPa, in group II was 87.4 MPa and in group III was 105.3 MPa. Namala et al⁹ included a total of 90 heat polymerizing denture base material (Trevalon, Dentsply) samples which were fabricated and divided into 3 groups with 30 samples each. Samples from each group were immersed in (Group A- Distilled water(control); Group B- Fitty-dent denture cleanser; Group C- Thyme essential oil solution denture cleanser). The samples were evaluated for increase in surface roughness and flexural strength. Thyme essential oil solution group showed minimal increase in surface roughness (ΔRa)

with values comparable to that of the control group which had the least increase in surface roughness and Fittydent group showed significant increase in surface roughness. For flexural strength, statistically significant difference was observed among the three groups with Fittydent group showing the highest flexural strength followed by control group and Thyme essential oil solution group. However, the decrease in the flexural strength was not of clinical significance.

We found that mean increase in surface roughness in group I was 0.03 µm, in group II was 0.03 µm and in group III was 0.05 µm. Puri et al¹⁰ compared the effect of using three commercially available denture cleansers on surface color, surface roughness, and flexural strength of heat-cured resin. A total of 80 rectangular heat-cured acrylic specimens were fabricated and all were immersed in denture cleansers over a period of 6 days in which 30 immersions were performed. Then the physical properties of the heat-cured resin were tested using portable colorimeter, universal testing machine, and surface analyzer. The paired t test was done to compare the before and after immersion values for color, surface roughness, and flexural strength in denture cleansers. The post hoc test was performed to make multiple comparison among different groups. All heat-cured resin bases presented with changes in color, surface roughness, and flexural strength to some extent when immersed in all the three denture cleansers. The values of change in color, surface roughness, and flexural strength were higher when immersed in Clinsodent as compared to all other groups.

Sato et al¹¹ in their study concluded that no significant difference is seen in flexural strength for different immersion periods of 15 min and 8 h for a simulated 30-day use. Purnaveja et al¹² concluded that the solvent present initially penetrates into the

intermolecular polymer network and causes expansion of the intermolecular spaces due to water sorption in acrylic resin materials, facilitating leaching out of the intrinsic pigments and penetration of extrinsic colorant in denture cleaning solution which can also cause color change. This could be the probable cause that the acrylic resin used in the study tends to change color as a result of leaching out of the coloring material from the acrylic surface with long-term immersion in distilled water. Later opacity of acrylic resin occurs as a result of monomer leaching out and water getting absorbed on to the surface. Chemical denture cleansing methods are often used in addition to physical cleaning methods to maintain the denture cleanliness and hygiene. Geriatric patients with severe debilitating conditions, impaired manual dexterity, and neuromuscular dysfunction tend to depend entirely on the chemical methods for denture maintenance. Traditional chemical denture cleansers, although being effective antimicrobials, are being replaced with natural plant extracts due to the developing resistance shown by microbes against them.

CONCLUSION

Authors found that thyme essential oil denture cleanser was superior in preserving the surface properties of denture base resins in comparison to commercially available denture cleanser.

REFERENCES

1. Tan H, Woo A, Kim S, et al. Effect of denture cleansers, surface finish, and temperature on molloyplast B resilient liner color, hardness, and texture. *J Prosthodont* 2000;9(3):148–155.
2. Nikawa H, Hamada T, Yamashiro H, et al. A review of in vitro and in vivo methods to evaluate the efficacy of denture cleansers. *Int J Prosthodont* 1999;12(2):153–159.
3. Nikawa H, Hamada T, Yamashiro H, et al. Effect of denture cleansers on direct soft denture lining materials. *J Prosthet Dent* 1994;72(6): 657–662.
4. Quirynen M, Bollen CM. The influence of surface roughness and surface-free energy on supra-and sub-gingival plaque formation in man. A review of literature. *J Clin Periodontol* 1995;22(1):1–14.
5. Williams DW, Lewis MAO. Isolation and identification of candida from the oral cavity. *Oral Dis ISRN Dentistry* 2011. 1–7.
6. Ural C, Sanal FA, Cengiz S. Effect of different denture cleansers on surface roughness of denture base materials. *Clin Dent Res* 2011;35(2):14–20.
7. Bollen CM, Lambrechts P, Quirynen M. Comparison of surface roughness of oral hard materials to the threshold surface roughness for bacterial plaque retention: a review of the literature. *Dent Mater* 1997;13(4):258–269.
8. Harrison Z, Johnson A, Douglas CW. An in vitro study into the effect of a limited range of denture cleaners on surface roughness and removal of *Candida albicans* from conventional heat-cured acrylic resin denture base material. *J Oral Rehabil* 2004;31(5):460–467.
9. Namala BB, Hegde V. Comparative evaluation of the effect of plant extract, *Thymus vulgaris* and commercially available denture cleanser on the flexural strength and surface roughness of denture base resin. *J Indian Prosthodont Soc* 2019;19:261-5.
10. Puri D, Dhawan P, Madhukar P, et al. An Evaluative In Vitro Study of the Effect of the Three Commercially Available Denture Cleansers on Physical Properties of Heat-cured Resin. *Int J ProsthodontRestor Dent* 2020;10(1):26–31.
11. Sato S, Cavalcante MR, Orsi IA, ParanhosHde F, Zaniquelli O. Assessment of flexural strength and color alteration of heat-polymerized acrylic resins after simulated use of denture cleansers. *Braz Dent J* 2005;16:124-8.
12. Purnaveja S, Fletcher AM, Ritchie GM, et al. Color stability of two self-curing denture base materials. *Biomaterials* 1982;3(4):249–250.