

Comparative Analysis and Effect of Monopoly – Coating Agent on the Surface Roughness of Commercially Available Two Tissue Conditioners Subjected to Cleansing with Denture Cleanser After Immersing in Artificial Saliva – A Contact Profilometric In – Vivo Study

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Abstract

Purpose: In this in -vivo comparative study we aimed to conclude that silicone based and acrylic based tissue conditioner with applying monopoly coating agent has less surface roughness compare to silicone and acrylic based tissue conditioner without monopoly coating agent.

Result: In total 40 sample were evaluated within 4 groups. At 1- and 7-day interval surface roughness score of groups 2 were lower than control 1, control 2 and group 1. 0.311(p<0.05)

Conclusion: Two different tissue conditioner acrylic and silicone based has less surface roughness after applying monopoly coating agent. Monopoly coating agent reduces surface roughness and increase longevity of tissue conditioner.

INTRODUCTION

The term “soft liners” refers to a class of resilient materials used to reline denture base surfaces in contact with the occlusal stress-bearing oral mucosa. Liners can be either hard, usually made of poly methyl methacrylate or it can be resilient when plasticizers are added to the resin.^{1,2}

Tissue conditioners are used in the management of abused tissues underlying ill-fitting dentures, various types of functional impressions, contemporary relining of ill-fitting dentures as well as immediate dentures, and also for tissue conditioning during the implant process. Various recent research shows different types of tissue conditioners that can be used based on material type and multiple parameters to the smoothness and roughness of a denture.

The properties of the tissue conditioners are affected by the moist environment of the oral cavity, where ethanol and ester plasticizer are leached into the saliva and water is absorbed by the polymeric phase. The increased porosity of the tissue conditioners can lead to plaque accumulation, A chemical soaking technique is primarily the method of choice for geriatric patients and those with poor motor capacity.³

Many limitations have mentioned their use including difficult manipulation of resin in the mouth and its limited modelling compared to the modelling compound. On the other hand, modelling compounds are supposed to rapidly deteriorate intraorally, especially if used in conjunction with tissue conditioner materials. Another application of tissue conditioners along with modelling plastics is improving the adaptation of surgical obturators after maxillary resections. The surgical defects in these clinical conditions could be so large that the thickness of the lining material would affect the properties of tissue conditioners.^{5,6}

Among various physical properties of tissue conditioners, there can be limitations for tissue conditioners resulting from the effects of the oral cavity environment on physical properties which necessitate frequent replacement of the material. The ethanol and plasticizers leach into the saliva, which is then absorbed by the polymeric phase of the gel. It has been shown that over a period of 1 week, water sorption increased from 0.2 to 5.6 mg/cm, and

solubility ranged from 0.03 to 0.40 mg/cm for various commercial products. Loss of elastic properties required for the therapy, the usable period of TCs in the mouth cavity should be accordingly short. Surface-coated conditioners may provide an extended period of resiliency and a longer life under clinical conditions.^{7,8,9}

Tissue conditioners have rough surfaces which lead to accumulating various microorganisms which lead to denture stomatitis, for that reason many dentists prefer to place the denture into various denture cleansers. The solutions used for denture cleaning can be divided according to their chemical composition: alkaline peroxide, alkaline hypochlorite, acids, disinfectants, and enzymes. The enzymatic solutions, containing protease and mutants, can break down the salivary glycoproteins and bacterial polysaccharides of plaque.¹²

Different effervescent denture cleansers are available as tablets or powder. Fittydent are commonly used denture cleansers, as Fittydent is effective in decreasing *Candida albicans* adherence on denture base materials while Corega denture cleanser can remove light stains and loosen debris from denture base. However, denture cleansers may also cause reduce denture base strength and also it increases the roughness of the material.¹³

The longevity of tissue conditioner is short, from weeks to a month which necessitates frequent replacement. Several surface-coating agents (monopoly, palaseal, and fluorinated copolymer) extend the life of a temporary soft denture liner because they maintain the resilient characteristics, keep it clean and smooth, and decrease the incidence of microbial growth, however, the effect of monopoly coating on the surface roughness of a tissue conditioner subjected to the action of denture cleanser and disinfectant has not been documented. Coating agent (monopoly) was prepared by mixing chemically activated methyl methacrylate monomer and clear methyl methacrylate polymer. The mixture was composed of one part powder to 10 parts liquid. The powder and liquid were placed together in a glass beaker in a water bath at 55°C and stirred for 8–10 min until the mixture started to thicken.

Thus, based on the above-mentioned factors, various variables and parameters for a tissue conditioner this study was carried out to evaluate the effect of

monopoly coating on surface roughness of acrylic (VISCO GEL, DENTSPLY) and silicone-based (RELINER SOFT, GC) tissue conditioners subjected to artificial saliva and denture cleanser by evaluating roughness of acrylic and silicon based soft liner with and without monopoly coating.

MATERIAL AND METHODOLOGY

Material

1. Acrylic based tissue conditioner (Visco-gel, De Trey/ DENTSPLY, Weybridge, Surrey, United Kingdom) (Figure 1)
2. Silicone based tissue conditioner (GC reliner soft) (Figure 2)
3. Denture cleanser (Fitty Dent, Group Pharmaceuticals LTD., Mumbai, India) (Figure 3)
4. Acrylic Repair Material (DPI-RR Cold cure, The Bombay Burmah Trading Corporation, Ltd., India) (Figure 4)
5. Coating agent (Monopoly) (Figure 5)
6. Artificial saliva (Xerostat artificial saliva) (Figure 6)
7. Distilled water

Armamentarium

1. Rubber Bowl
2. Brush
3. Circular metal mold (Figure 7)
4. Glass slab and metal spatula

Equipment

Surface roughness tester, Mitutoyo.ISO 1997

Methodology

A. Source of data

This in vitro study will be conducted in the department of prosthodontics, Pacific Dental College and hospital, Debari (Udaipur).

B. Study Design

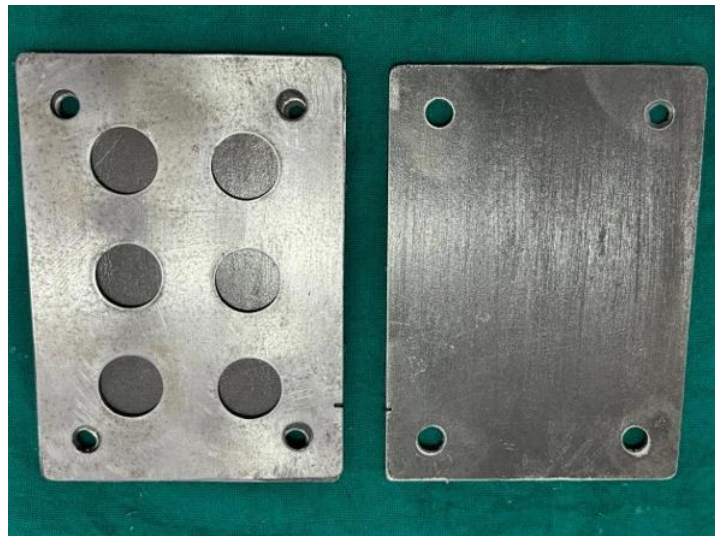
An experimental parametric in-vitro study will be conducted in the department of prosthodontics crown & bridge and Implantology, Pacific Dental College and hospital, Udaipur. The research design will be based on an experimental assessment of evaluation of two tissue conditioner agents with monopoly coating agent after immersed in artificial saliva, and denture cleanser.

C. Preparation of sample

1. A Metal mold of 2mm thickness and 20mm internal diameter was made and the specimens were prepared by mixing 3g (one measure) of powder of Visco-gel with 2.2ml (one measure) of liquid, for 30 seconds, and after 2 minutes, the Visco-gel was poured into the mold and was pressed for 2 hours. The specimens were removed and stored first into artificial saliva and then in denture cleanser. (Figure 2)



2. A metal mold of 2mm thickness and 20mm internal diameter was made and the specimens were prepared by mixing equal length of base paste and catalyst paste and mixed with plastic spatula and poured into metal mold and was pressed for 2 hours. The specimens were removed and stored first into artificial saliva and then in denture cleanser for 8 to 10 minutes.



D. Preparation of Monopoly coating agent:

Monopoly was prepared by mixing 200g of chemically activated methyl methacrylate monomer and 20g of clear dimethyl methacrylate polymer (1:10) in a glass beaker in a water bath at 55 C, (Figure 12) and stirred for 8-10 minutes until the mixture started to thicken. (Figure 13) The syrup-like liquid was then stored in a dark bottle at

overnight and was applied to the tissue conditioner specimens as they were completed.

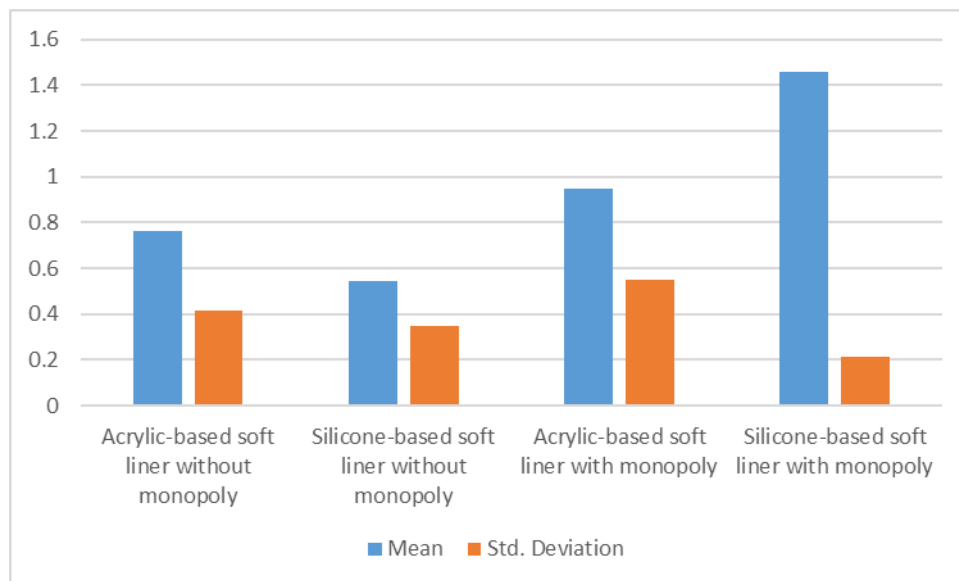
E. Grouping of samples

20 Disk shape specimen of visco-gel (Acrylic tissue conditioner) and 20 of GC- Reline soft (silicone tissue conditioner) were made and divided into four groups. (Figure 14,15)

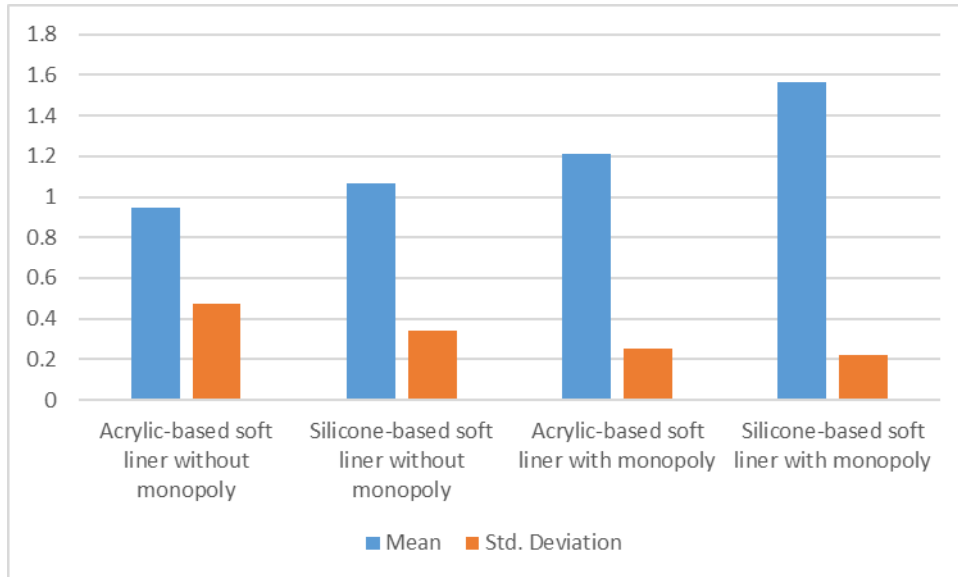
Control 1	ASL +AS+DC
Control 2	SSL+AS+DC
Group 1	ASL + MP+AS+DC
Group 2	SSL + MP+AS+DC

RESULT

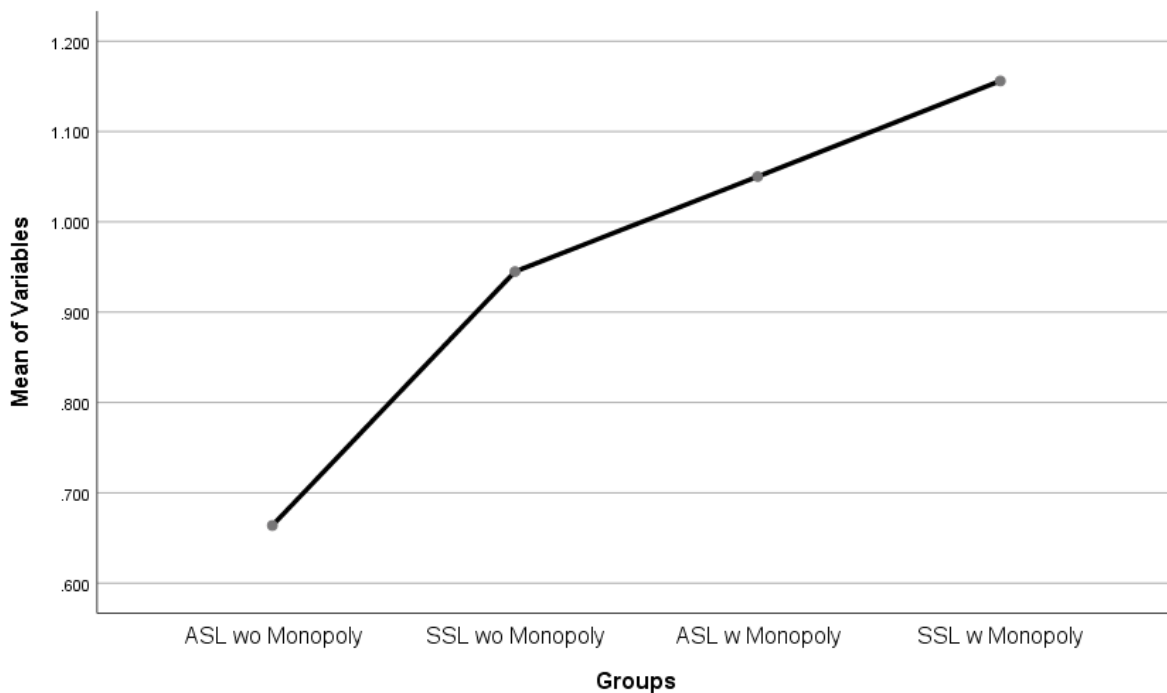
values for mean and standard deviation for all variables in study, where mean for Acrylic-based soft liner without monopoly was .763, Silicone-based soft liner without monopoly was .54490, Acrylic-based soft liner with monopoly was .950 and for Silicone-based soft liner with monopoly was .212 respectively.



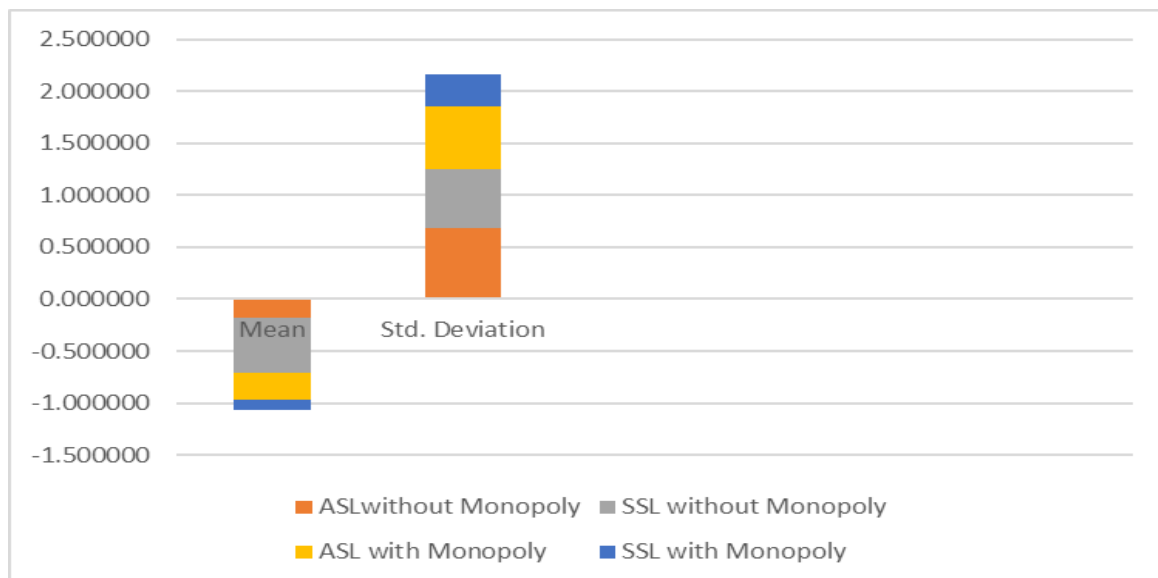
values for mean and standard deviation for all variables in study during 7th day, where mean for Acrylic-based soft liner without monopoly was .948, Silicone-based soft liner without monopoly was 1.0647, Acrylic-based soft liner with monopoly was 1.2092 and for Silicone-based soft liner with monopoly was 1.5627 respectively.



Comparisons of various study groups on day 1 and day 7 respectively, where obtained p value for both the groups on Day 1 and Day 7 were statistically significant on application of One way ANOVA TEST, WHICH SIGNIFIES there was a significant change between groups on day 1 and day 7 respectively.



Comparison of mean values among groups on day 1 and day 7, where obtained p value were statistically significant for all groups, on application of One way t-TEST, where Acrylic-based soft liner with monopoly has p-value 0.01 which is above other two groups among significant level.



DISCUSSION

Soft denture liners are generally classified into (a) Short term soft liners and (b) Long term soft liners⁹. The longevity of short-term soft liners or tissue conditioners may be, from a week to a month^{33,34}. Tissue conditioners have been used in managing patients with abused tissues underlying ill-fitting dentures, and in making functional impressions. It also serves as a “shock absorber” between the occlusal surfaces of a denture and the underlying oral tissues⁸⁰. One of the disadvantages of a tissue conditioner is that it gradually hardens and becomes rough with time, due to the leaching out of plasticizers and ethanol, affecting the mucosal health.

Surface roughness increases the area available for adhesion and provides niches in which microorganisms are protected from shear forces, thus giving microbial cells time to become irreversibly attached to a surface^{18,19}. Hence, it is essential to have a surface which is relatively clean and smooth to maintain good oral health.

Monopoly is a cost-effective method of extending the longevity of a tissue conditioner, which act as a barrier and minimizes the leaching out of the plasticizer, and ethyl alcohol, which results in fewer surface irregularities and keeps the surface area clean and smooth.³⁵ It has also been reported that coating tissue conditioners with monopoly can extend the life the tissue conditioner to a year³⁷ as it maintains the resiliency of tissue conditioner³⁸ and

seals the pores, preventing the entry of microorganisms.

Hence, the effect of surface coating on the surface roughness of tissue conditioners subjected to the action of denture cleanser and disinfectant was evaluated and compared with control groups, not coated with monopoly, for a period of 7 days.

In the present study specimens were prepared by mixing 3g (one measure) of powder of Visco-gel with 2.2ml (one measure) of liquid according to manufacturer’s instruction for 30 seconds and after 2 minutes, the visco gel was poured into the mold of 3mm thickness and 20mm internal diameter³⁵ and was pressed with a glass slab for 2 hours. The specimens were removed and stored in the sterile glass jar having distilled water. Specimens of 2mm thickness were prepared because a 2mm thickness of soft lining material is most suitable for improving the pressure distribution on supporting tissues under the denture. Silicon based soft liner GC reline soft mixed using equal length of Base paste and accelerator paste and mixed in glass slab using metal spatula and after proper mixing it will pour in metal mould of 2mm thickness and 20mm length and 20 sample are prepared.

40 disk shaped sample were prepared and divided in 2 groups in which 20 sample and divided in 10 of acrylic based soft liner (Visco-gel) and 10 of silicon based soft liner (GC Reline soft) without monopoly coating agent and other 20 in which 10 sample acrylic based soft liner (visco-gel) and 10 silicone

based soft liner (GC Reline soft) with monopoly coating agent .

The mean surface roughness values of the specimens not coated with monopoly was significantly higher than that of specimens coated with monopoly. These results were in accordance with the findings of Gardner³⁷ who reported that longevity of tissue conditioner can be extended up to 1 year, by coating the tissue surface with monopoly, and that the monopoly coating maintains the resilient characteristics and keep the surface clean and smooth decreasing the incidence of microbial growth.

The surface coated tissue conditioners retained their surface integrity, which may be due to reduced leaching out of the plasticizers. This test result is accordance with Hiroshi nikava who reported same significant result and stated that coating of monopoly coating reduced surface roughness of tissue conditioners and increase their long term use²⁸.

In the present study intergroup comparison also done and it shows that group 1 and group 2 when immersed in artificial saliva and followed by denture cleanser it shows the value from day 1 to day 7,⁴⁵ shows that group 2 has less surface roughness when compare with group 1 when the final test done on end of 7 day the roughness value shows that group 2 has very less value compare with control 1, control 2, group 1 and shows that silicone based soft liner with monopoly coating agent after immersed in artificial saliva and denture cleanser shows less surface roughness then silicone based soft liner without monopoly coating agent , acrylic based soft liner without monopoly coating agent and acrylic based soft liner with monopoly coating agent.

In the present study the surface roughness of the specimens from both the groups were greater than 0.76µm, indicating that there is a possibility for plaque accumulation, since 0.2µm is considered the threshold below which no further bacterial adherence can occur.

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