Effect of denture cleansers on surface roughness and softness of autopolymerizing soft denture relining material

Original Article

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ABSTRACT

Purpose of Study: To evaluate and compare the effects of two denture cleansers on surface roughness and softness of two autopolymerizing soft denture relining material. **Materials and Methods:** Sixty specimens of PMMA denture base material were relined with acrylic (Coe-Soft) and silicone relining material (Ufigel-P). These specimens were immersed in cleansers (Clinsodent, Fittydent) and water for eight hours at room temperature. For the remaining 16 hours they were stored in artificial saliva at 37°C for 60 days. Readings for surface roughness and softness were taken at the end of day 1, 15, 30 and 60 and statistically analyzed using 't' test and ANOVA. **Results:** Surface roughness of both the test and control groups of acrylic relining material increased with time. For the same treatment protocol, no significant difference was seen within and between the silicone liner groups. Softness of both test and control groups of acrylic lining material decreased with time. Slight decrease in softness was seen in all the silicone liner groups. Acrylic relining material exhibited more changes in surface roughness and softness than silicone relining material at all time intervals. **Conclusion:** Within the limitations of this in vitro study, specimens immersed in the powder form of cleansers showed more changes in surface roughness and softness than the tablet form. These changes were more with acrylic relining material than silicone relining material.

KEY WORDS: Denture cleansers, soft denture relining materials, surface roughness, softness

INTRODUCTION

Soft liners are the materials which act as an intermediary between soft tissues and hard prosthesis in existing compromised situations. They are also useful in treating patients with ridge atrophy, bony undercuts, knife edged ridges, congenital and acquired oral defects, xerostomia dentures opposing natural dentition, modify transitional prostheses in implant surgeries etc.[1]

Denture cleansing procedures should be meticulously followed as relining materials are more prone to candidial infection.[2]

Methods to control plaque
1. Mechanical plaque control
2. Chemical plaque control
3. Proper denture wearing habits

Mechanical plaque control like brushing is not advisable because it can damage the resilient lining material. Thus, chemical soaking technique is the method of choice. Ideally, a cleanser should be effective without causing detrimental effect to the denture base and lining material.[3]

Denture cleansers can cause (a) loss of soluble components and plasticizers, (b) absorption of water or saliva by resilient lining material. These processes can lead to weight changes and influence properties of the material.[4] Thus the selection of denture cleansers should be considered to avoid or minimize changes in properties of resilient material.

MATERAILS AND METHODS

Denture liners selected for the study:

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Code	Materials	Type	Manufacturer
A	Coe Soft	Acrylic liner	GC Corporation, USA.
S	Ufigel- P	Silicone liner	VOCO,Germany
C1	Fittydent	Tablet	Group pharmaceuticals
C2	Clinsodent	Powder	ICPA

Water (C3) was used for control group and artificial saliva for storage of specimens.

Preparation of Acrylic Resin Specimens

Two metal plates of 98x68x10mm dimension and accurate fit were fabricated. A metal ring of internal diameter 44mm and 3mm height was placed on the lower metal plate which acted as a spacer for wax. [Figure 1] Molten wax was poured into this ring and the upper metal plate placed on top of the ring. The pattern was retrieved after the wax hardened. The wax patterns were then flasked using conventional techniques. Heat cured denture base acrylic resin was packed in dough stage and polymerization was carried out following manufacturer's instructions (30 min at 65°C /159°F followed by boiling for 30 min).

Relining Acrylic Specimens

A metal ring of 41mm internal diameter and 3mm height, smaller in diameter than the acrylic specimen, was placed on the lower metal plate. Three "V" shaped grooves were made on the ring for the excess liner material to flow. The prepared acrylic resin specimen was placed over the ring after packing the liner material.

Packing of Acrylic Relining Material

The acrylic relining material was mixed according to recommended powder / liquid ratio (11gm/8ml) for 30 seconds and packed into the metal ring with a cellophane sheet as a separator between the ring and metal plate. The prepared acrylic resin specimen was placed over the ring. The upper metal plate was placed on top of the acrylic resin specimen. The relining material was allowed to polymerize for eight minutes. Thirty acrylic resin specimens were relined in this manner with coe soft acrylic soft denture liner.

Packing of Silicone Relining Material

Adhesive was applied to the surface of acrylic resin specimen and left for a minute. Equal length of catalyst and base paste of relining material was mixed for 30 seconds and packed into the metal ring and placed over the lower metal plate with a cellophane sheet as a separator between the ring and the metal plate. The prepared acrylic resin specimen was placed over the ring. The upper metal plate was placed and the whole mold was placed in a pressure pot. This pressure pot was kept in hot water bath, where the temperature was maintained between 40°C-45°C, for 15 minutes. After polymerization the specimen was allowed to cool for 20 minutes. Thirty acrylic resin specimens were relined in this manner with Ufigel P silicone soft denture liner.

Preparation of Denture Cleanser Solutions

Cleanser solutions were prepared daily by adding one tablet of fittydent or one tablespoon powder of clinsodent to 100ml of water.[5]

Storage of Specimens

Ten specimens of each liner were immersed in these two cleanser solutions. Water was used as control group. [Figure 2] For the first 24 hours the specimens were kept in artificial saliva. Then they were immersed for eight hours in cleanser solutions, daily, for a period of 60 days at room temperature. After eight hours the specimens were rinsed under water thoroughly. There was no mechanical brushing or rubbing of the specimens. For the remaining 16 hours the specimens of all groups were placed in artificial saliva for 60 days at 37°C in an incubator.[6]

Testing of Specimens

The specimens were subjected to softness and surface roughness test at the end of 1 day (D1), 15 days (D2), 30 days (D3), and 60 days (D4).

Surface roughness was analyzed with Perthometer[7] and softness was measured using Shore A Durometer.[8,9]

RESULTS

An increase in surface roughness of acrylic liner specimens is seen from day one to 60, with a significant difference within and between the test (AC1, AC2) and control (AC3) acrylic liner groups after 15, 30 and 60 days. Highest mean surface roughness is noted with AC2 group followed by AC1 and AC3. No significant change is observed in surface roughness between and within the test (SC1, SC2) and control (SC3) silicone liner groups from day 1 to 60; there is a decrease in softness of all acrylic liner groups. Lowest softness is observed in AC2 group followed by AC1 and AC3 groups.

There was a very slight decrease in softness of all the silicone liner groups from day one to 60; a significant change was noted only on day 15 and day 60. At all intervals, acrylic-lining materials showed higher surface roughness and softness than silicone liners in all the groups. [Figure 3]

DISCUSSION

Surface Roughness

Increase in surface roughness might be related to possible loss of soluble components such as plasticizers leaving empty spaces. Probably, with

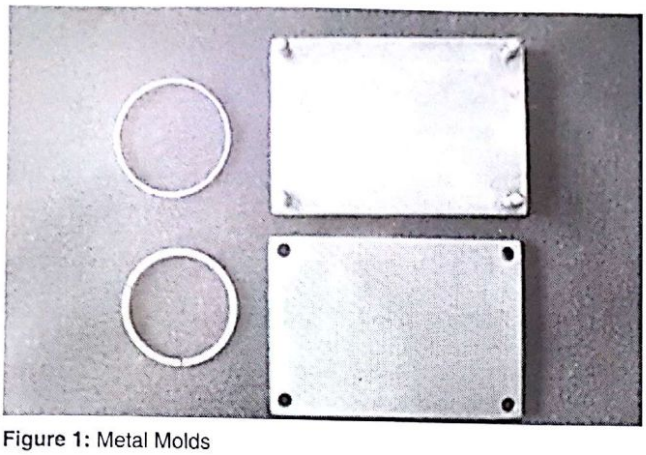

Figure 1: Metal Molds

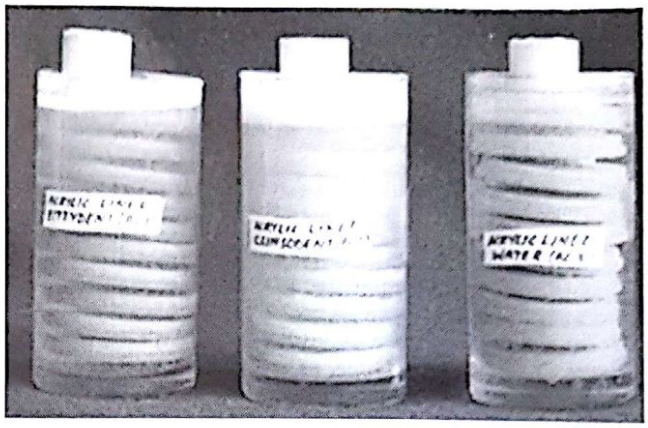

Figure 2: Specimens Immersed in Different Solutions

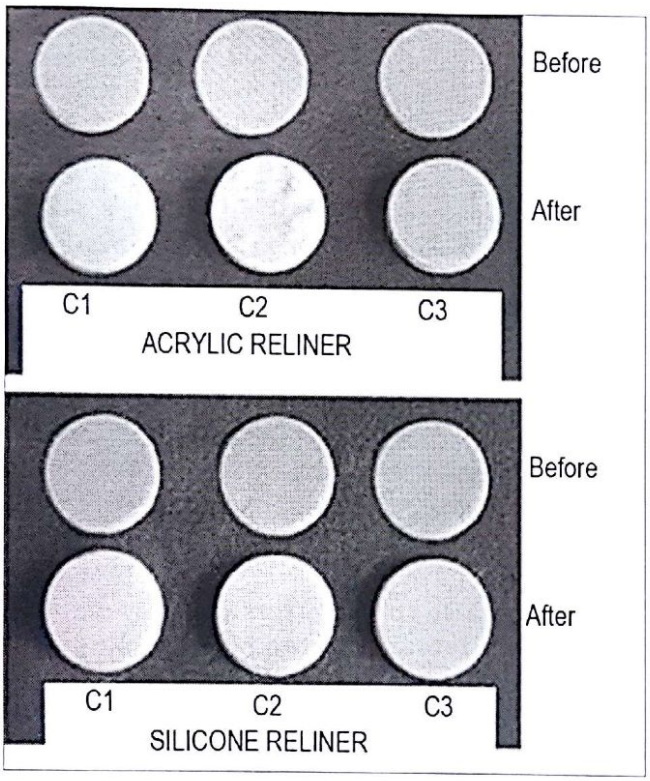

Figure 3: Specimens before and after Immersion

time, these bubbles or empty spaces increased in size resulting in craters. Surface disturbances can also be related to porosity within the lining. Air is entrapped during mixing and it appears that some of the cleansers cause the bubbles to increase in size – with some eventually reaching the surface.[2] Quantitative difference in cleanser formulations and / or pH of the solutions apparently influence the effect of cleansers on properties of the liners. This might be one of the reasons for the difference in surface roughness between the test groups.[10]

The difference in surface roughness between acrylic and silicone liners might be accounted by the difference in chemical composition and chemistry of these materials. It was hypothesized that oxygenation in strongly alkaline solutions is the damaging factor. Peroxide content is one of the possible damaging factors and other components or pH of cleansers affect surface properties of soft liners.[6]

Softness

Plasticizers in the liquid are responsible for lowering the glass transition temperature and maintaining softness. A three-fold sequence of events including ethanol loss, water adsorption and loss of plasticizer hardens lining material and limits its usefulness. The balance between these processes affects both resilience and dimensional stability of the material.[4] The release of cured or soluble products would subject the patient to unknown substances of undetermined biologic reactivity.[11]

Silicone rubbers do not contain plasticizers; they contain fillers. Water can be absorbed into the soft lining material and other constituents may be leached out.[8] The water uptake of elastomeric materials is dependent on water-soluble components and/or hydrophilicity of the matrix leading to the formation of solution droplets. These processes are likely to change the physical properties of the material with time.

CONCLUSION

Within the limitations of this *in vitro* study it can be said that denture cleansers might affect some of the physical and mechanical properties of soft liner materials. As these solutions can cause significant deterioration on soft denture liners, the compatibility between materials should be considered to avoid or minimize alteration of properties.

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