10.5005/jp-journals-10024-1272

ORIGINAL RESEARCH

The Effect of Denture Cleansers on Resiliency of Soft Lining Materials

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ABSTRACT

Aim: The present study was undertaken to determine the effect of denture cleansers on resiliency of soft liner.

Materials and methods: Two soft liners (Molloplast-B and Refit) and two denture cleansers (Clinsodent and Fittydent) were taken. Cylindrical aluminum dies were constructed of 12 mm length and 8 mm diameter at the ratio of 1.5:1. The samples are tested with Hounsfield tensometer.

Observation and results: Effect of both the denture cleansers on the lining materials was shown in the form of Graphs 1 and 2. The elastic recovery of Molloplast B in dry, Fittydent and Clinsodent is comparatively more than refit, but in control group the elastic recovery of both the material is almost equal.

Conclusion: Heat processed soft liners recover faster/better in a shorter time interval when compared to self-processed liners which takes longer time for the recovery. This time period is very important as the cushioning effect of the soft liner require an elastic recovery between the masticatory strokes.

Clinical implications: Greater the softness and better the elastic recovery of the denture soft liner, more effective would be its performance clinically. Silicon based material, such as Molloplast-B, rebounds quickly and would seem preferable to a material that is acrylic based. It is possible that, if the response is too slow or the elastic recovery is less, there may only be a partial recovery of the lining between the masticatory strokes. Progressive thinning of the lining materials might then occur resulting in a reduced cushioning effect.

Keywords: Soft liner, Resilient liner, Elastic recovery and compressibility of soft liner.

How to cite this article: Rao AK, Kumar S, Reddy NA, Reddy NS. The Effect of Denture Cleansers on Resiliency of Soft Lining Materials. J Contemp Dent Pract 2013;14(1):65-70.

Source of support: Nil

Conflict of interest: None declared

INTRODUCTION

The turn of the century with the introduction of velum rubber as a 'soft' liner, dentists have been arguing over the merits of resilient denture base lining materials. Most of the controversy stems not from their indications, but from the fact that an ideal material is not available and the inherent shortcomings of the materials often complicate the problem case.[1]

During normal function in dentulous subjects the vertical and lateral forces are directed or transmitted mainly to the periodontium, whereas in edentulous condition with complete dentures the mucous membrane is forced to accept these loads. These forces tend to compress or distort the mucosa to varying degree according to location, thickness and histology of mucosa. These forces vary in magnitude before being transmitted to bone. Thus, the denture bearing mucosa is forced to serve the same purpose as the periodontal ligament that provides support to natural teeth.[2]

Resilient liner may be defined as a soft elastic and resilient material forming all or part of the fit or impression surface of a denture.[9]

The impression surface of a denture base that is lined with a resilient material therefore should partially absorb and provide for a more advantageous distribution of imposed stresses to its basal seat.[3]

Denture along with the soft lining material should be thoroughly cleansed to prevent malodor, poor esthetics, accumulation of plaque, and calculus with its deleterious effects on oral mucosa. These materials have disadvantages related to their physical properties and their response to microorganisms. In use, their rheologic properties inevitably deteriorate.[2]

Careful handling of these liners can improve their serviceability. One factor that would influence the serviceability adversely is soaking cleanser used by the patient.

Chemical cleansing with the denture cleansers is suggested as first choice for plaque control with the soft

lining materials, since brushing is likely to damage the lining and ultrasonic treatment *perse* is not effective.

Commercial denture cleanser products are classified into alkaline hypochlorites, alkaline peroxides and dilute hypochloric acid types, as well as formulations containing abrasive particles. Home remedies often consist of Clorox bleach, vinegar and sodium bicarbonate.[5]

Although chemical cleansing has been considered an effective method to prevent *C.albicans* invasion and denture plaque formation, some types of denture cleansers have been reported to cause significant deterioration of lining materials in a relatively short time.[4]

Therefore, denture cleansers used for plaque control on lining materials should reduce microbiological contamination and have a minimum effect on the physical properties of the liner especially the resiliency.

The present study was undertaken to determine the effect of the denture cleansers on resiliency of soft liners.

MATERIALS AND METHODS

Molloplast-B was included in the study because its reported physical properties and clinical performance indicate that this soft liner is one of the successful of the currently available products and also it is heat processed silicone material.

Refit is relatively a new product and this study offers the possibility of testing and comparing it with Molloplast-B.

The denture cleansers Fittydent (tablet form) and Clinsodent (powder form) were chosen to represent the main types of commercially available preparations.

Specimen Preparation

Cylindrical aluminum dies were constructed 12 mm in length and 8 mm in diameter at the ratio of 1.5:1 (according to the specification of the Tensometer).

Molloplast-B Specimens

Dies were used to prepare mold space in dental stone into which molten wax was poured in the lower member of the flask. After the setting, separating medium was applied and the upper member of the flask was filled with dental stone. Once the stone is set, the flask is kept for dewaxing. Molloplast-B material was mixed and loaded into the mold, filling to excess. The flask was trial closed and kept for 30 minutes bench curing. The flask is then heat processed in a water bath for 2 hours according to the manufacturer's instructions. Postcuring, the specimens were retrieved and finished with a carbide bur.

Table 1: Denture soft lining materials used in the current study

Product (soft liners)	*Type*	*Manufacturer*
Molloplast-B	Heat-cured Silicone rubber	Detax. Germany
Refit	Self-cured acrylic resin	PSP. UK

Table 2: Chemical denture cleansers materials used in the current study

Clinsodent	Alkaline peroxide	Group pharmaceuticals
Fittydent	Alkaline peroxide	ICPA

Refit Specimens

The molds for Refit soft liner were prepared using the aluminum dies in putty material. Refit lining material was mixed according to the manufacturer's instructions, loaded into the molds of putty and allowed to set. After curing the specimens were removed, finished and tested for the elastic recovery and softness.

Control Group

Three control specimens were stored in a beaker containing 200 ml of tap water and changed daily. Three control specimens were stored dry.

Cleanser Group

For each immersion cleanser, fresh solutions of cleanser were prepared in 200 ml tap water taken in a beaker. Two tablets of Fittydent in one beaker and 2 capfuls of Clinsodent powder to 200 ml of tap water in another beaker. The chosen period of immersion was 8 hours which is the time period the denture is kept overnight in water. The cleanser treatments were undertaken three times a day for a period of 15 days.

Testing Procedure

The specimen was positioned between the two compression heads of Tensometer; mercury level set at zero and load was slowly increased. The load was increased up to 10 kg or 98 N. Both the compression and recovery release were denoted for each specimen and were plotted on a graph.

Assessment of Specimens

The specimens were assessed for the softness and elastic recovery. The way in which a soft material reacts to a compressive stress depends on two main factors; first is compressibility or softness of the material and it is clear that greater the compression under a given stress, the softer is the material. The second factor is the elastic recovery of material after the compressive stress is removed.

The actual values of softness and elastic recovery depend on conditions used during compressive loading. The compressions were designed so that, they are within the limitations of the Hounsfield Tensometer. All the compressions were undertaken at room temperature.

Softness/compressibility is calculated by: $\frac{a}{c} = \frac{mm}{N}$

Elastic recovery is calculated by: $\frac{b \times 100}{a}$ = % recovery

Where a = the distance from A to D
b = distance from D to C
c = distance from B to D (As shown in the graphs)

To make the measurements obtained from the curves more precise, two lines were constructed. These are shown by broken lines in the graph. This approach avoided the need to utilize the first part of the trace, which was considered to be unreliable because of the variation associated with play on the compression head. Both the above properties are important and have been calculated for the two soft lining materials both before and after treatment with the cleansers.

OBSERVATIONS AND RESULTS

The study was conducted on two soft lining materials and two commercially available denture cleansers. The objective was to see the effect of denture cleansers on the resiliency of these soft lining materials.

The resiliency was evaluated using Hounsfield Tensometer, after applying a load of 10 kg which is almost equivalent to the load applied while using dentures. The methodology was based on the basic procedure set forth by JC Davenport, HJ Wilson and Spence.

The effect of both the denture cleansers on the lining materials were evaluated and depicted in the Figs 1 to 8 and Graphs 1 and 2.

Description of the Graph

X-axis: Denotes compression/recovery
Y-axis: Denotes load applied in Newton.

The curve A to B denotes the compression and from B to C denotes the recovery phase. The line B to D shows the load applied in Newtons. The distance from A to D is denoted as 'a' and D to C is denoted as 'b' and the distance from B to D as 'c'.

Figure 1 denotes the compression and elastic recovery for Molloplast-B, untreated with the cleansers (dry specimens). The average values for softness and elastic recovery were 0.066 N/mm and 62% respectively.

Figure 2 denotes the compression and elastic recovery for Molloplast-B, which is the control group. The average values for softness and elastic recovery were 9.061 N/mm and 42% respectively.

Figure 3 denotes the compression and elastic recovery for Molloplast-B, which was treated with Clinsodent cleanser. The average values for softness and elastic recovery were 0.051 N/mm and 55% respectively.

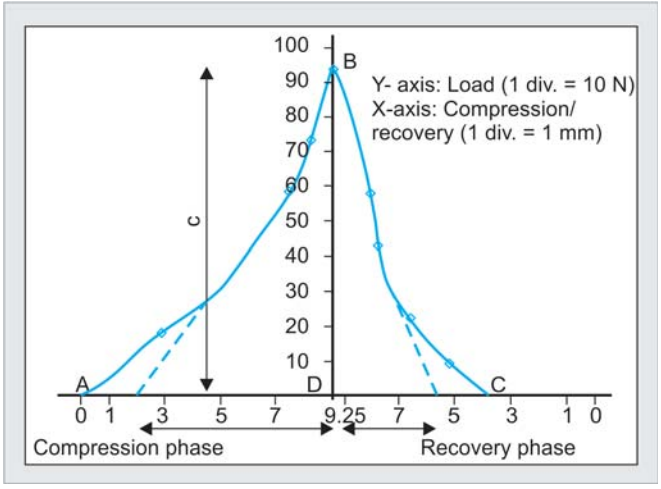


Fig. 1: Molloplast-B (before)

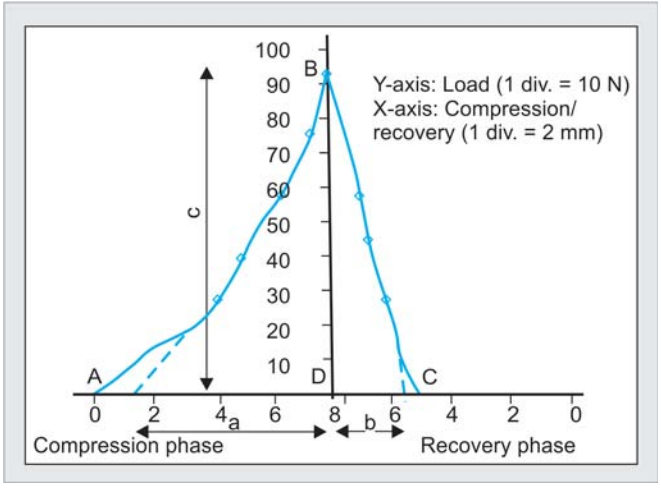


Fig. 2: Molloplast-B (control)

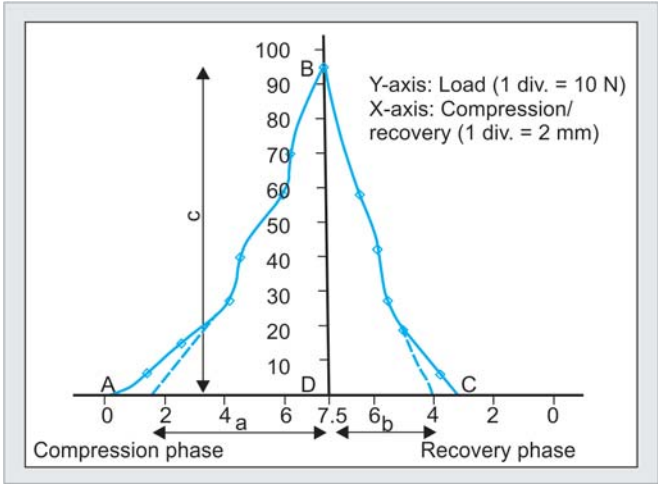


Fig. 3: Molloplast-B (Clinsodent)

Figure 4 denotes the compression and elastic recovery for Molloplst-B, which was treated with Fittydent cleanser (dry specimens). The average values for softness and elastic recovery were 0.04 N/mm and 58% respectively.

Figure 5 denotes the compression and elastic recovery for Refit, which was not treated with cleaners. The average values for softness and elastic recovery were 0.075 N/mm and 35% respectively.

Figure 6 denotes the compression and elastic recovery for Refit, which was the control group. The average values for softness and elastic recovery were 0.055 N/mm and 41% respectively.

Figure 7 denotes the compression and elastic recovery for Refit, which was treated with Clinsodent cleanser. The average values for softness and elastic recovery were 0.066 N/mm and 38% respectively.

Figure 8 denotes the compression and elastic recovery for Refit, which was treated with Fittydent cleanser. The average values for softness and elastic recovery were 0.062 N/mm and 35% respectively.

The effect of both the denture cleansers on the lining materials was shown in Graphs 1 and 2.

Graph 1 denotes the comparison of both the liners in relation to the softness or compressibility. Refit in all the groups, i.e. dry control, Fittydent and Clinsodent shows more compressibility than Molloplast-B.

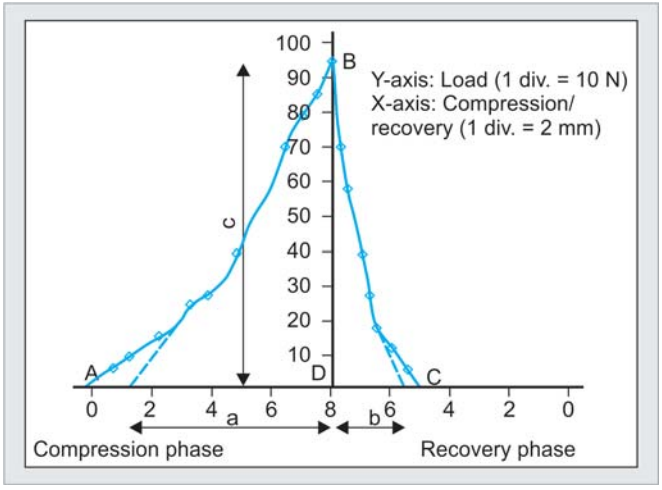


Fig. 6: Refit (control)

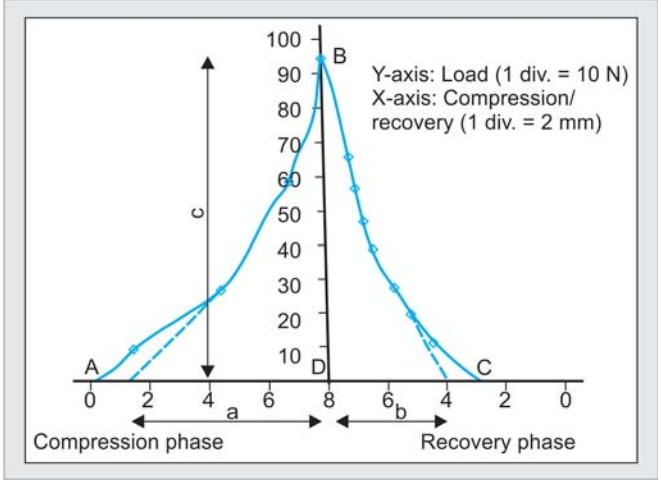


Fig. 4: Molloplast B (Fittydent)

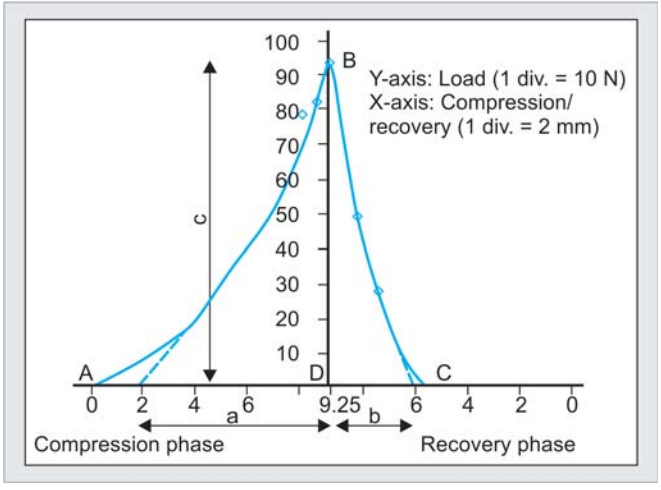


Fig. 7: Refit (Clinsodent)

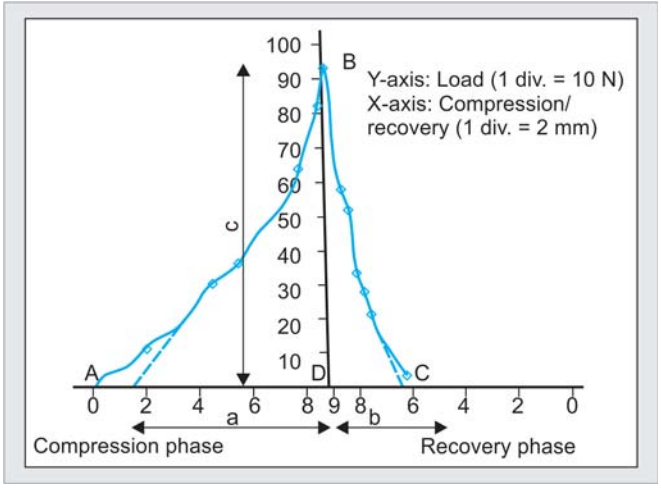


Fig. 5: Refit (before)

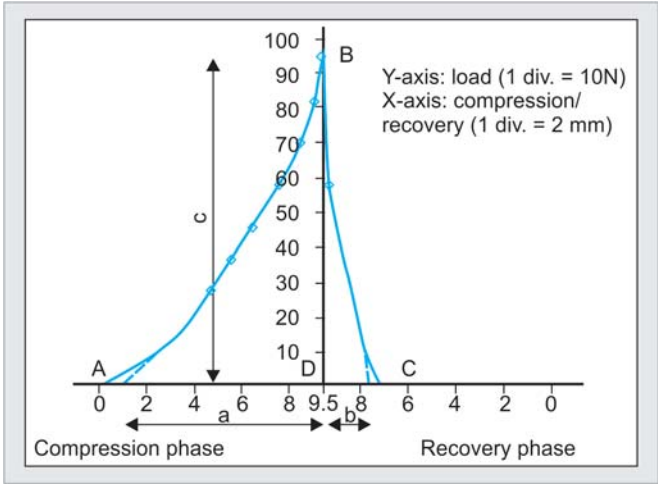
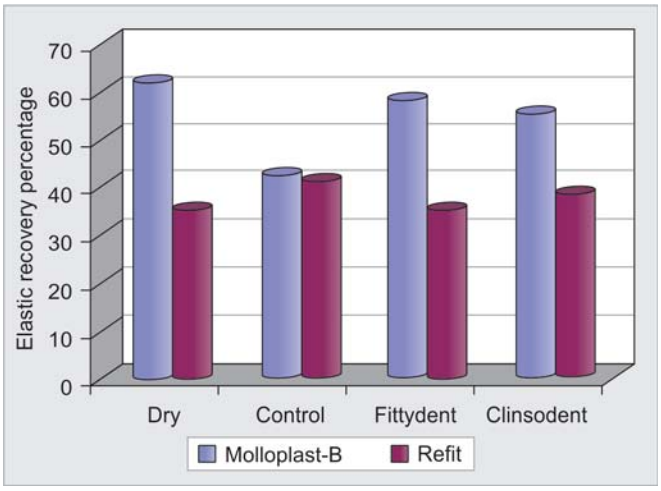
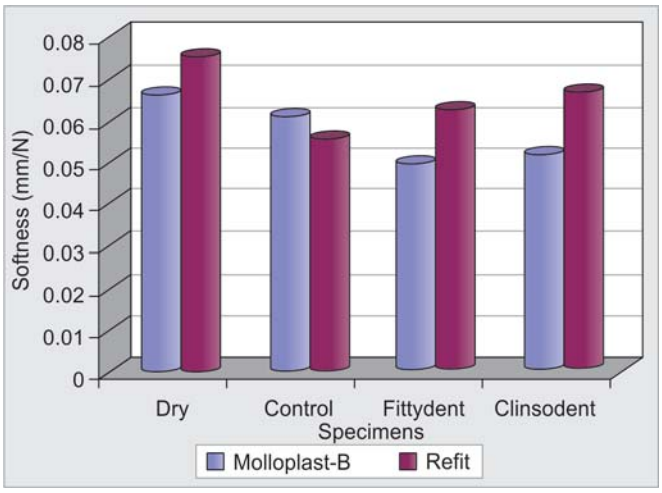


Fig. 8: Refit (Fittydent)



Graph 1: Elastic recovery



Graph 2: Softness/compressibility

Graph 2 denotes the comparison of both the liners in relation to the elastic recovery. The elastic recovery of Molloplast–B in dry, Fittydent and Clinsodent is comparatively more than Refit, but in control group the elastic recovery of both the materials is almost equal.

DISCUSSION

Makila and Honka 1979 in their article recommended the cleaning of linings by immersion in a denture cleanser and not by brushing since, brushing causes abrasion of soft lining materials and progressive thinning of the lining.

Hypochlorite immersion cleansers appear to be the most effective type for the removal of denture plaque according T Hutchins DW, Parker WA, in 1973. Schmidt WF and Smith DE in 1983 attributed clinical deterioration of soft linings to the use of hypochlorite solutions and thereby have recommended that they should not be used.[8]

In the present study alkaline peroxide cleansers with pH (9-11) were used to study their effect on softness and elastic recovery of the soft lining materials. Preliminary examination of the soft lining specimens indicated that Molloplast–B exhibited a rapid elastic recovery following compression whereas Refit (acrylic based) was slow in response.

Wright PS 1976 stated that in a clinical situation, a silicon based material, such as Molloplast-B, rebounds quickly and would seem preferable to a material which is acrylic based.[7] It is possible that, if the response is too slow or the elastic recovery is less, there may only bepartial recovery of the lining between the masticatory strokes. Progressive thinning of the lining materials might then occur resulting in a reduced cushioning effect.[8] In the present study, the elastic recovery of the specimens did not have any effect on both the soft lining materials, included in the study. Greater the softness and better the elastic recovery, more effective would be its performance clinically.[6]

Heat processed soft liners recover faster/better in a shorter time interval when compared to self-processed liners which takes longer time for the recovery. This time period is very important as elastic recovery is needed between the masticatory strokes for the cushioning effect of soft liners.[8] The present study indicates that heat processed softliners (Molloplast-B) recovers faster/better than the self-processed liner (Refit) and this may be advantageous clinically. Also, heat polymerized resilient denture liner Molloplast-B exhibited higher tensile bond strength regardless of thermocycling in similar studies.[9]

SUMMARY AND CONCLUSION

The present study was undertaken to evaluate the effect of denture cleansers on the resiliency of the soft lining materials. Two commonly available commercial denture cleansers were chosen and incase of soft lining materials two were chosen, Molloplast-B (Heat processed) and Refit (self-processing). The effect of denture cleansers on soft lining materials was tested by soaking specimens of each lining materials in each of the cleansers. Specimens were tested dry and in tap water (control) the testing procedure was same for both the lining materials and the results were analyzed.

From the results obtained it was concluded that:

1. Commercial denture cleansers (Fittydent or Clinsodent) did not have any effect on the resiliency of both the soft liners.
2. Self-processed (Refit) lining material was softer or more compressible than Molloplast-B after the cleanser treatment.
3. The elastic recovery of heat processed lining material (Molloplast-B) is better than self-processed material (Refit).

Based on the results even though there is little difference in softness or compressibility, there is significant difference in elastic recovery between the two lining materials.

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