Original Research Article

"Comparative evaluation of the amount of sorption and solubility seen in soft liner with herbal and commercially available denture cleanser - an invitro study"

ABSTRACT

Aims: the aim of the current study is to gauge the quantity of sorption and solubility seen in the soft denture liner with herbal (neem) and commercially (clinsodent) available denture cleanser.
Study design: cross sectional study.
Place and Duration of Study: Department of Prosthodontics Sharad Pawar Dental College And Hospital between February 2021 and July 2021.
Methodology: 52 samples of heat cured acrylic resin of circular shape were prepared using a stainless steel mould. The resilient liner was applied to all the samples using a denture adhesive. All samples were then desiccated for 24 hours to get a stable or conditioned weight W1. The samples will then be divided into 2 groups namely: Group A (clinsodent group) and the Group B (herbal denture cleanser group). All the samples were immersed daily in cleanser for 8 hour and then transferred to artificial saliva for rest 16 hours of the day. Solutions of artificial saliva and denture cleanser was changed daily for the entire period of study that is 7 days. Later, all the test samples were removed from saliva, wiped dry, weighed for saturated weight W2. - After desiccating again for 24 hours the samples were again assessed for renovated weight that is W3.
Results: with respect to sorption and solubility it was found that the clinsodent group exhibited greater percentage of sorption when compared to the neem denture cleanser group after a period of 7 days, P-values of 0.0001,S.
Conclusion: it can be established that the solubility and sorption values of clinsodent group were higher the herbal denture cleanser group. Overall, neem in the form of denture cleanser performed better than clinsodent.

Keywords: commercially available denture cleanser, herbal denture cleanser, sorption, solubility,

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1. INTRODUCTION (ARIAL, BOLD, 11 FONT, LEFT ALIGNED, CAPS)

Any efficacious complete denture management syndicates standard procedures, effective patient understanding, patient training, and fluency with all conceivable treatment choices in order to deliver supreme contentment to patient(1). There exists a variety of materials for constructing and relining dentures(2). Denture liners have been an integral part of the ancient as well as modern day dentistry with its chief role in the area of removable prosthodontics. The word soft liners speaks of a class of resilient constituents that are acclimated to reline the undersurface of the denture bases which are in proximity with the occlusal load bearing surface of the oral mucosa(3). These materials play a major

protagonist in reestablishing the state of health in those denture bearing areas that are inflamed as a result of excruciating occlusal burden, particularly in individuals where the alveolar ridges exhibit resorption, are knife edge and reveal bony undercuts(4). Likewise soft liners are also advocated in oral atmosphere exposed to the conditions such as bruxism and xerostomia(5). Due to the presence of cross linked amorphous polymers, the former behaves like a cushion for the denture bearing mucosa thereby aiding in engrossment and redistribution of the occlusal load(6).

Soft liners are broadly classified into two groups- 1. Long term soft denture liners and 2. Short term short denture liners or the tissue conditioners. According to their make up the long term soft liners can either be 1. Silicon based or 2. Acrylic resin based(7). The aforementioned are further divided into heat polymerized or self polymerized(5). Apart from the benefits offered by these materials they do bargain a good amount of shortcomings during its clinical use which can be visualized in the form of color variations, surface irregularities, porosities, loss of resilience as a consequence of leaching out of the plasticizer and most importantly the problems associated with the sorption and solubility. The latter mentioned inadequacies are brought about as a result of deviations in the structure and properties of the material that consequently leads to problems such as engorgement, distortion, supporting the growth of candida albicans and stress induced bond failure at the junction of liner and denture attachment(6) (8).

Soft liners not only encounter alterations because of oral environment but also are affected by the procedures that are used to clean them. With the daily cleaning measures these materials tend to leave behind its solvable ingredients into its surrounding medium which is termed as solubility. These liners also allow the liquid present in its vicinity to diffuse within them, thus inhabiting the spaces and the voids within its polymeric structure(9) (10). Hence the purpose of the current study was to gauge the quantity of sorption and solubility seen in the soft denture liner with herbal (neem) and commercially (clinsodent) available denture cleanser.

2. MATERIAL AND METHODS / EXPERIMENTAL DETAILS / METHODOLOGY (ARIAL, BOLD, 11 FONT, LEFT ALIGNED, CAPS)

The armamentarium required for the study were a measuring jar for heat polymerizing polymer and monomer, mixing jar, wax knife, lacron's carver and metal mould with clamps. Materials required were artificial saliva, Commercially available denture cleanser (clinsodent), herbal denture cleanser (neem), long term chairside soft liner (mollosil), Polymethyl methacrylate, Pumice and Sandpaper.

2.1Methodology-

2.1.1 Fabrication of the mould- A stainless steel mold was fabricated. Two flat steel slates were used. In between these two metal slates a two piece mold with circular aperture of measurements 3 mm x10 mm was prepared for fabrication of the specimen.

2.1.2 **Fabrication of the samples-** 52 specimens in the shape of a circle were prepared via metal mold as shown in figure 1. Petroleum jelly was used as a separating medium in the mold. The powder and liquid of the heat cure denture base resins were manipulated as recommended by manufacturer and was packed within the mold with cellophane sheets interposed between the inner and outer mold covering plates. After the trial closure, the excess material and the cellophane sheets will be removed and the mold was then placed in an acrylizer with a temperature of 70°C up to 1 hour, and subsequently raised to 90°C for 2 hours for polymerization of denture base material. After the final curing specimens with obvious porosities were discarded.

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Figure 1- acrylic discs

2.1.3 **Application of the soft liner to the prepared specimen-** soft liner will then be mixed in an appropriate ratio of base and the catalyst paste and will be applied to the prepared samples. A denture adhesive will be used to bond the soft liner to the heat cure denture base resin as shown in figure 2 and 3. All samples were then desiccated for 24 hours to get a stable or conditioned weight W1. The samples will then be divided into 2 groups.

Group A- Clinsodent denture cleanser group

Group B- Herbal denture cleanser (neem) group

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Figure 2- relining material

Figure 3- soft liner bonded to acrylic resin

2.1.4 Preparation of denture cleanser

Clinsodent- The denture cleanser solution was prepared in accordance with manufacturer's commendation using 5mg of Clinsodent powder in 300 ml water; composition – Sodium perborate + Sodium lauryl sulphate; pH11.

Herbal denture cleanser- Neem (azadirachta indica) leaves were used as an herbal denture cleanser. The decoction of neem leaves was prepared in the ratio of 1:4 (leaves: water), that is 25 leaves can be used in 100 ml of water. For the study purpose 100 gm

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neem leaves were added to 400 ml of water and were boiled till the contents were reduced to 1/4th in amount. After cooling it down, the liquid thus obtained was strained out, which was later used in the form of an herbal denture cleanser. Preservatives were added to prevent the degradation of the prepared decoction.

2.1.5 **Procedure for immersion**- All the samples were immersed daily in cleanser for 8 hour and then transferred to artificial saliva for rest 16 hours of the day. Solutions of artificial saliva and denture cleanser was changed daily for the entire period of study that is 7 days as shown in figure 4. Later, all the test samples were removed from saliva, wiped dry, weighed for saturated weight W2.

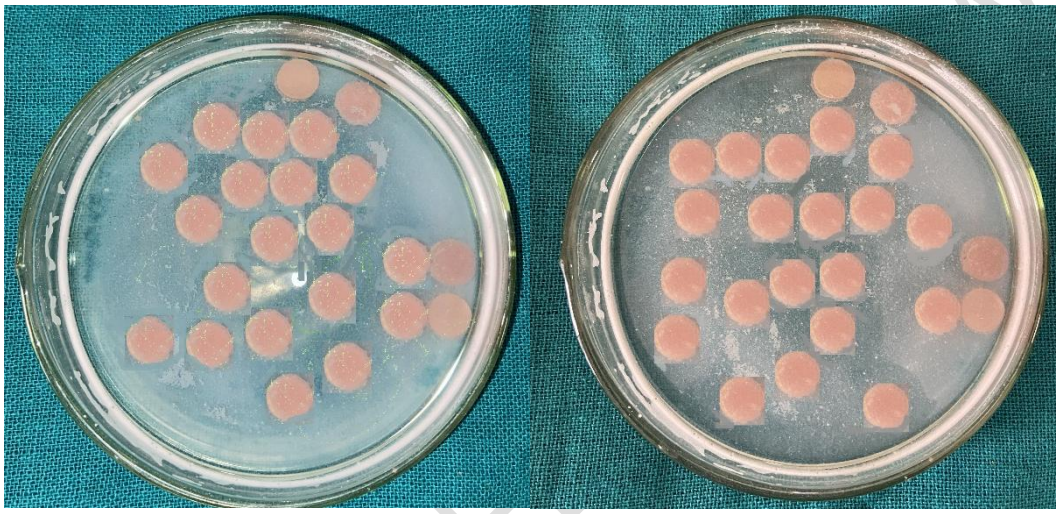

Figure 4- samples immersed in neem and clinsodent

2.1.6 **Weighing** - After desiccating again for 24 hours the samples were again assessed for renovated weight that is W3. An automated weighing apparatus with a precision of upto two decimal points of milligram was conditioned to weight the samples as shown in figure 5. Sorption and solubility formula given by ADA specification-12

Formula for Sorption- W2-W1 (mg) / surface area of disc
Formula for Solubility- W1-W3 (mg) / surface area of disc
Surface area of disc – 2 pr (h +r) = 2 x 3.14 x 0.1 (10+3)- 8.16mm^2

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Figure 5- weighing of the samples

3. RESULTS AND DISCUSSION

Statistical analysis was done by using descriptive and inferential statistics using student's paired and unpaired t test and software used in the analysis was SPSS 27.0 version and $p<0.05$ is considered as level of significance.

The mean values of sorption and solubility of both the denture cleanser were compared in the tabular form using descriptive statistical measures. The samples were immersed in the clinsodent and the neem containing denture cleanser for 8 hours during the entire period of the study.
Table 1 shows the comparison between the clinsodent and the neem denture cleanser group with respect to sorption and it was found that the former group exhibited greater percentage of sorption when compared to the latter after a period of 7 days.
Table 2 depicts the comparison between the clinsodent and the neem denture cleanser group with respect to solubility and it was found that the former group exhibited greater percentage of sorption when compared to the latter after a period of 7 days.

Table 1: Comparison of Sorption in group A (clinsodent) and group B (neem)

	Group A		Group B		t-value	p-value
	Mean	SD	Mean	SD		
Sorption	6.14	0.13	3.68	0.55	21.98	0.0001,S

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Graph 1: Comparison of Sorption in group A (clinsodent) and group B(neem)

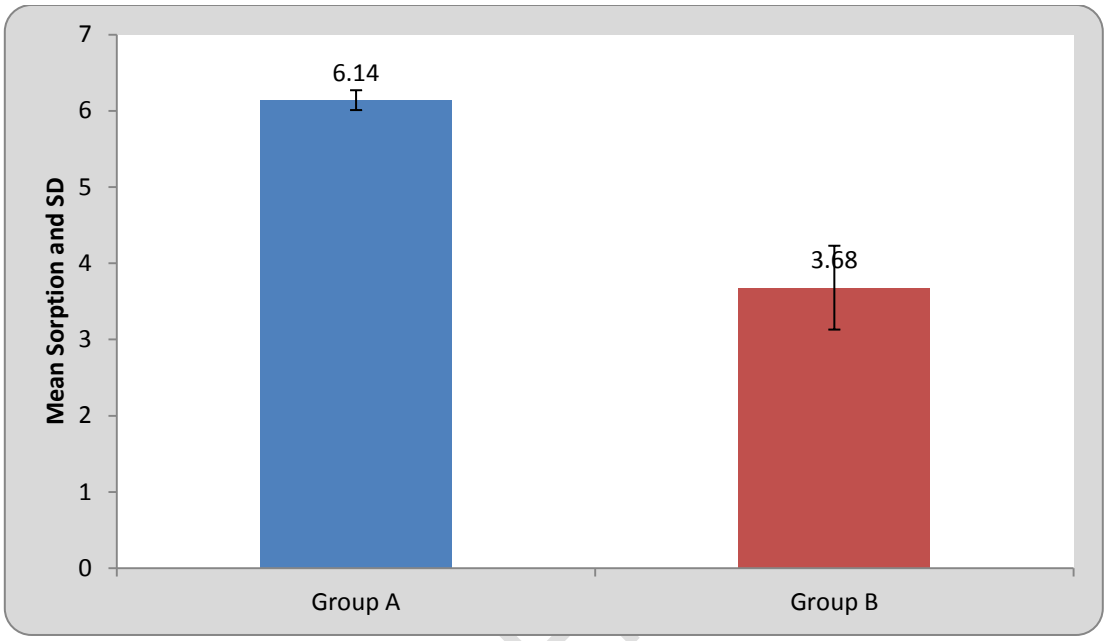
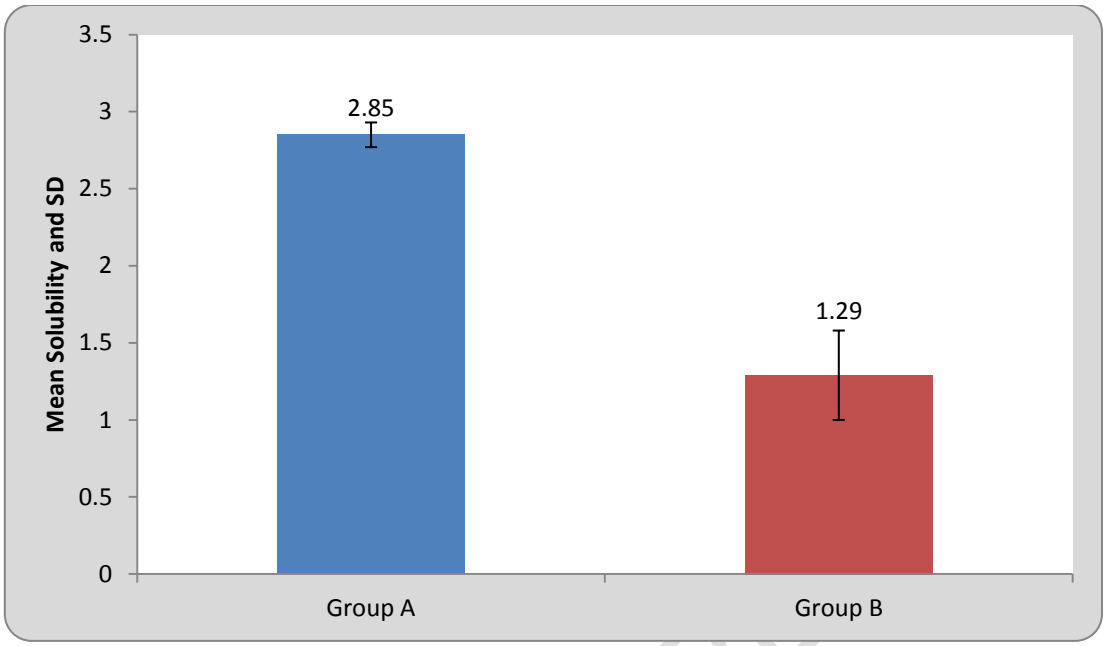


Table 2: Comparison of Solubility in group A (clinsodent) and group B (neem)

	Group A		Group B		t-value	p-value
	Mean	SD	Mean	SD		
Solubility	2.85	0.08	1.29	0.29	25.91	0.0001,S

Graph 2: Comparison of Solubility in group A (clinsodent) and group B (neem)



Discussion-

Soft liners have been extensively used in the arena of dentistry to reform the surface of the prosthesis that is in connexion with soft tissues of the oral environment.(3) They not only aid in conditioning the traumatized tissues but also an interim or permanent cushion like effect. They are polymeric in nature and have glass transition temperature that is below the mouth temperature. Long term soft liners are therapeutically intended for those patients who are unable to put up with the traumas prompted by the dentures.(11)

Revised American Dental Association Specification No. 12 for denture base polymers have mentioned that an upsurge in the mass of the polymer should not be more than 0.8 mg/cm2 of surface following immersion in water for seven days at 37± 1 C when sorption is taken into consideration. However the reduction in the mass of the polymer shall not be more than 0.04 mg/cm2 of surface once verified bestowing to the specifications with respect to solubilty.(12)

As stated by ojah et al in his study where anti candida efficacy of commercially available denture cleanser cleanser and herbal denture denture cleanser in the form of neem was evaluated it was found that the reduction in the mean Candida count of both Denture cleanser and Neem was statistically similar. (13)

In the present study the amount of sorption and solubility seen in soft liner with herbal and commercially available denture cleanser was evaluated. Overall the herbal denture cleanser performed better than the commercially available denture cleanser. The reason for choosing neem in the current study can be owed to the fact that it exhibits anti-fungal properties thus prevents the denture stomatitis which compromises the mucosal surface beneath dentures. Neem is also a potent anti-inflammatory agent, affects adhesion, cell surface hydrophobicity, reduces biofilm formation, is nontoxic, inexpensive, easy to use, and readily available which is in validation with the study conducted by Polaquini et al.(14)

On the other hand clinsodent powder when used a denture cleansing agent possess antibacterial activity unlike neem which possess both antifungal activity as well as the antibacterial properties. The consistent usage of commercially accessible denture cleaning product have some shortcomings such as deterioration of acrylic dentures and assimilation of these products leads to esophageal burns, inflammation of the epiglottis, pharynx, and extensive gastrointestinal ulceration.(13)

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A study was conducted by mansoor et al on the sorption and solubility of denture lining materials which were immersed in distilled water, an alkaline denture cleanser and citric acid denture cleanser. It was established that the over-all worsening of the lining material augmented with time of contact when used with the cleansers.(15)

4. CONCLUSION

In the present study, synthetic saliva was schooled to mimic the natural saliva. Nevertheless, it did not take account of the dynamic and 24-hour disparities of normal saliva which comprises of diet being consumed, microorganisms and supplementary figures as well as the acid base changes affecting the pH of the saliva. Other than the above mentioned variations customized oral settings also play an important role. Thus the drawback of the study.
Contained by the limitations of the present study it can be established that the solubility and sorption values of clinsodent group were higher the herbal denture cleanser group. Overall, neem in the form of denture cleanser performed better than clinsodent.

CONSENT (WHERE EVER APPLICABLE)

Not applicable

ETHICAL APPROVAL (WHERE EVER APPLICABLE)

Not applicable

COMPETING INTERESTS DISCLAIMER:

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

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