



Evaluation of Sorption, Solubility of Silicone and Acrylic Denture Liners – An in Vitro Study

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ABSTRACT:

Sorption and solubility of liners is encountered during clinical use resulting in loss of resiliency. Ufi Gel (silicon based) and Permasoft (acrylic based) were investigated. Soft liner discs were fabricated for testing water sorption and solubility. Sorption and solubility were tested after 3 months of storage in distilled water. Silicone based liner showed lower water sorption and solubility.

1. Introduction

Soft denture liner materials are applied to the intaglio surface of dentures. They have a cushioning effect on the resorbed ridges and facilitate broad stress distribution.^{1,4} During patient's use, the soft denture lining materials are immersed in saliva when the patient is wearing the denture or may be immersed in cleansing agents or water at night. Such immersion causes absorption of water by the polymer and leaching of plasticizers and other soluble materials. No plasticizer is present in silicone-based liners, an adhesive is used to bond it to the denture base.^{5,8} This study was undertaken to compare the water sorption and solubility of silicone and acrylic liner after 3 months of storage in distilled water at 37 degrees centigrade.

2. Materials and Methods

For testing water sorption and solubility specimens of dimension 45mm x 1mm were prepared for each group. Stainless steel flask for fabrication of liner specimens were prepared having three parts (Upper, Middle and Lower part). Each part was of 150mm x 100 mm dimensions. The middle part had two identical slots of

45mm diameter and 1mm thickness. 30 specimens were taken and divided into two groups of 15 specimens each. One group contained acrylic liner while the other group contained silicone liner.

The specimens were initially weighed to an accuracy of 0.0001 gm with an analytical balance (Satorius CP 224 s) until a constant weight was achieved. This value was considered to be the initial weight of the specimen (W1). The specimens for both acrylic and silicone liner was immersed in distilled water at 37 degrees centigrade for a period of 3 months. After 3 months the specimens were removed and excess water was removed by blotting with a filter paper and the specimens were weighed. This was the weight of the specimen after absorption or desorption of distilled water (W2). Solubility was evaluated by placing the specimens in a desiccator and then weighed until a constant weight was obtained (W3)

Percent sorption and solubility was determined by Kazanji and Watkinson formulae:

$$\text{Percent Sorption} = \frac{W2-W3}{W1} * 100$$



$$\text{Percent solubility} = \frac{W1-W3}{W1} * 100$$

The values were recorded in grams. The findings were compared analysed and subjected to statistical analysis.

3. Results

Table 1 shows the average values of percent sorption and percent solubility of silicone and acrylic liners. X is significantly higher than X¹ and also Y is greater than Y¹ both for percent sorption and solubility as shown by high ‘t’ values (p<0.001).

To facilitate statistical test (student ‘t’ test), logarithmic transformation of data (which are in percentage) were first made. [log X = A, log X¹ = A¹, log Y = B and log Y¹ = B¹]. Then the new data set were subjected to statistical test and the results being tabulated in Table 2 and 3. A graphical comparison of percent sorption and percent solubility of silicone and acrylic liners is shown in Figure 1.

Table 1 – Average values of percent sorption and percent solubility of silicone and acrylic liners.

	Percent sorption		Percent solubility	
	(X)	(X ¹)	(Y)	(Y ¹)
Average (%)	2.662	0.796	0.816	0.091
C.D.	0.278	0.266	0.142	0.027
Significance	t = 18.80, p< 0.001		t=19.44, p<0.001	

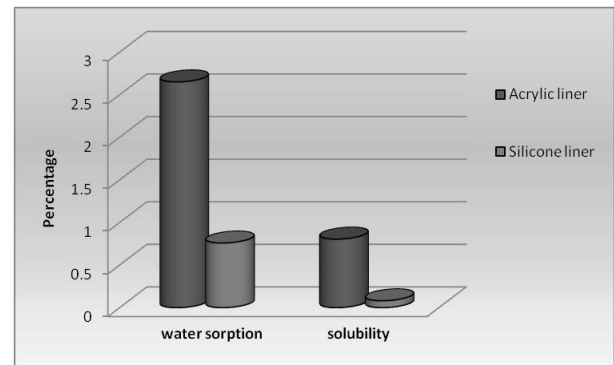
Table 2 – Average values of percent sorption and solubility after logarithmic transformation.

	A	A ¹	B	B ¹
Average	0.423	-0.1206	-0.095	-1.098
S.D.	0.0428	0.1439	0.0794	0.3186
	t = 14.02, p<0.0001		t = 11.83, p<0.001	

Table 3 – Average values of percent sorption and solubility in original scale.

	X	X ¹	Y	Y ¹
Average	2.65	0.758	0.804	0.080

Figure -1 -Comparison of percent sorption and percent solubility of silicone and acrylic liners.



4. Discussion

El-Hadary A et al. reported a lower water sorption and solubility and higher tensile bond strength of silicone based soft liner (Luci-sof). The water sorption of silicone liner (Ufi Gel) in our study is about 0.80 % after 3 months is close to the 6 weeks of water sorption of Luci-sof (0.41%), while solubility of Ufi gel was about 0.08% after 3 months is also close to the solubility of the Luci-sof (0.17%).⁹ The present study is also in agreement with Kazanji MN et al. who reported at 1 months, an absorption value of 0.46 % and a solubility value of 0.06 % for silicone-based liner (Molloplast B) and 1 week absorption value of 1.87 % and a solubility value of 0.78% for acrylic based liner (Softic 49).¹⁰

Das et al concluded that silicone based liner, Molloplast B may provide better clinical success based on its lower solubility and water sorption.¹¹ Acrylic resin-based resilient liner showed the lowest solubility values in another study and materials polymerized by microwave energy and visible light showed predominantly adhesive/cohesive failures.¹² Other studies showed that the acrylic resin soft lining materials had higher solubility (3.432% Visco-gel in artificial saliva) and absorption (3.349% Visco-gel in distilled water) than Molloplast-B after 16 weeks of aging. The greatest hardness and color change were shown in the acrylic



soft lining materials.¹³ The laboratory-processed silicone based liner was harder than the autopolymerized product and demonstrated greater resin solubility over time.¹⁴ Yilmaz H et al stated that disinfectants significantly affected the physical properties of water sorption, water solubility, and hardness of the soft-liner materials.¹⁵ Thus it is clear from the above studies that composition of the material affects the physical properties of the material.

5. Conclusion

Within the limitation of the present study and on the basis of results obtained, it can be concluded that silicone-based liner showed lower water sorption and solubility than acrylic based liners.

The authors report no conflicts of interest.

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