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COMPARISON OF CHANGE IN HARDNESS OF TWO SILICONE-BASED DENTURE RELINERS STORED IN ARTIFICIAL SALIVA - AN IN VITRO STUDY.

* Anjana S Raj, ** Rajesh C, ***Indu Raj

* PG Student, **Associate Professor, ***Professor and Head of the Department, Department of Prosthodontics, Govt. Dental College, Kottayam . Corresponding author: Dr Anjana S Raj. Email: dranjanasraj3@gmail.com

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Abstract

Introduction: Resilient lining materials are used on dental prostheses to aid in the distribution of functional loads to the denture bearing areas, to avoid localised stress concentrations, and to improve retention by engaging undercuts. The major requirements for long-term, resilient liners are permanent resiliency, high dimensional stability, good adhesion to the denture base, adequate tear resistance and compatibility with oral tissue. The material which increases in hardness during use, loses its therapeutic properties.

Aim: To compare the difference between the change in hardness in two silicone-based denture reliners after storing in artificial saliva in different time period.

Methodology: Two commercially available silicone-resilient denture reliners were tested in this comparative in vitro study: Elite soft Relining; Zhermack SpA, GC Reline Soft; GC Corp. Specimens were prepared using metal moulds and stored in artificial saliva and the measurement were taken with Shore A durometer in a period of 1month, 6months and 1 year and the mean was compared.

Conclusion: Elite relining material is proved to have greater hardness than Mollosil but both the materials have hardness within the limit of required hardness of long term soft denture liner (LTSDL). b. Elite and Mollosil did not increase their hardness when studied at different time period and this property of stability in hardness overtime is beneficiary for a LTSDL.

Keywords: Geriatric dentistry, Oral health, Denture reliners, long term lining, soft lining materials, silicon based lining, gerodontology

Introduction

Removable prosthodontics is concerned with replacing the teeth and soft tissues with a prosthesis that can be removed. These are often known as dentures, and can replace a full

arch of teeth (complete dentures), or a number of individual or grouped tooth spaces (partial dentures).[1] There is, inevitably, the potential for problems to arise subsequent to the insertion of complete dentures which may be transient and be essentially disregarded by the patient or they may be serious enough to result in the patient being unable to use the dentures.[2] The relining of complete dentures involves solving the problems encountered in the construction of new dentures, except positioning the individual teeth.[3] Denture relining is defined as procedure used to resurface the tissue side of denture.[4]

Resilient lining materials are used on dental prostheses to aid in the distribution of functional loads to the denture bearing areas, to avoid localized stress concentrations, and to improve retention by engaging undercuts.[5] They have the potential of improving comfort to denture patients with ridge atrophy, thin and non resilient mucosa, bony undercuts, in cases of irregular bone resorption, immediate prosthesis, healing after implant placement, and for patients with bruxism and xerostomia.[6] Based on their chemical structure, soft lining materials can be acrylic-based and silicone based liners. Although acrylic-based soft denture liners exhibit better viscoelastic properties, they have disadvantages such as unpleasant odor and taste, and irritation to the soft tissue inside the mouth. These drawbacks are caused by the monomer contained in acrylic-based soft denture liners. On the other hand, silicone-based denture liners have often been used on a longterm basis because they are more resilient and more resistant to aged deterioration than acrylicbased denture liners.[6]

The major requirements for long-term, resilient liners are permanent resiliency, high dimensional stability, good adhesion to the denture base, adequate tear resistance and compatibility with oral tissue.[7] The material, which increases in hardness during use, loses its therapeutic properties. The appropriate degree of hardness and its stability over time is significant clinical importance and determines the period in which relining performs its therapeutic role. In this in vitro study change in hardness of two different silicone based denture reliner stored in artificial saliva at different time intervals are compared.

Materials and Methods

Two commercially available silicone resilient denture reliners were tested in this comparative in vitro study: Elite soft Relining; Zhermack SpA, Mollosil soft relining material.[8]

SAMPLE SIZE: Sample size for this study is calculated from the formula using Nmaster

$$N = \frac{2 \times (Z\ \alpha + Z\ \beta)2 \times SD2}{d2}$$

S1= Standard deviation in the hardness of Elite at 1 month=2.5; S2=Standard deviation in the hardness of Mollosil at 1 month=2.9 (9)

(Alpha error (%) =5, Power (%) =80, SD=3.9, Mean Difference=3.2); Sample Size = 11 per arm The hardness of materials is determined by Shore method using an instrument called a durometer which measures the penetration depth in the material created by a given force on a standardized presser foot.[10] Pilot testing of specimens revealed that to obtain objective results using a Shore A durometer, the specimen thickness should be at least 6 mm and all measurements should be performed at least 12 mm from their edges. For Shore A hardness examination, disk-shaped specimens were prepared with a base diameter of 40 mm and a height of 8 mm using metal moulds and stored in artificial saliva and the measurements were taken in a period of 1 month, 3 months and 6months and then the mean were compared. (Fig 1 to 5)

Fig. 1: Elite

Fig. 2: Mollosil

Fig. 3: Artificial Saliva

Fig. 4: Shore a Durometer

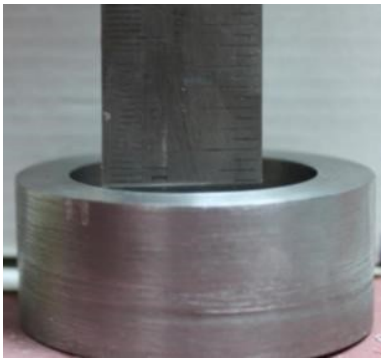
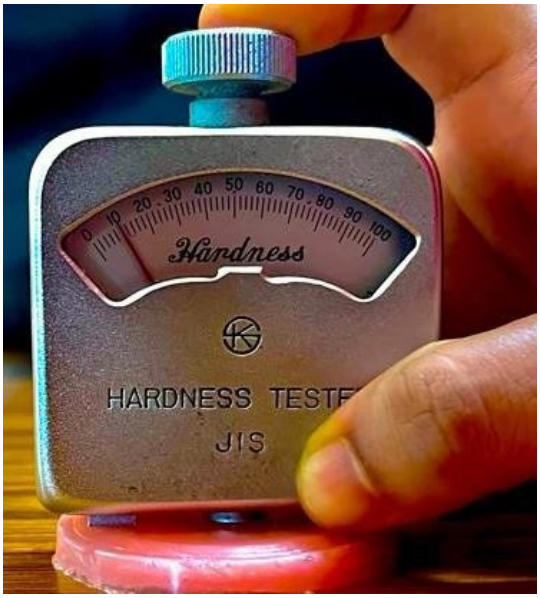


Fig. 5: Metal Mould with 40mm Diameter and 8mm depth which was used for making disk shaped specimens of Soft Reliners for Testing the Hardness.

Fig. 6: Relining Materials Stored in Artificial Saliva



Results

Two commercially available silicone resilient denture reliners (Elite soft Relining; Zhermack SpA, Mollosil soft relining material) were tested for hardness at different time periods in this comparative in vitro study. Mean and standard deviation among two silicone-based denture reliners after storage in artificial saliva are provided in Table 1. Elite relining material it prove to have greater hardness than mollosil at different time intervells of one month, 3 months and 6 months (table 2 and 3).

Table 1: Descriptive Statistics of hardness in the two silicone-based denture reliners

HARDNESS OF MATERIALS	N	MINIMUM	MAXIMUM	MEAN	STD. DEVIATION
1 MONTH	22	24.0	47.0	34.7	8.45
3 MONTH	22	23.0	46.0	35.1	8.66
6 MONTH	22	24.3	48.0	35.5	8.66

Table 2: Comparison of hardness at 1month, 3 months and 6 months in Elite soft relining material.

HARDNESS	Mean Rank	p Value
1 Month	1.82	0.663
3 Month	2.00	
6 Month	2.18	

Table 3: Comparison of hardness at 1 month, 3 month and 6 month in Mollosil relining material

HARDNESS	N	Mean Rank	p Value
1 Month	11	1.77	0.469
3 Month	11	1.95	
6 Month	11	2.27	

#Friedman test

Discussion

Resilient denture liner is an interim (ethyl methacrylate with phthalate plasticizers) or definitive (processed silicone) liner of the intaglio surface of a removable complete denture, removable partial denture, or intraoral maxillofacial prosthesis- GPT 9 [11] As long as material is soft and resilient it will have a rehabilitating effect of basal structures that has traumatized, irritated, deformed or abused. Some soft lining materials are not stable in aqueous conditions such as oral cavity. This is true for acrylic based soft lining materials containing plasticizer which will leach out and cause the lining to harden limiting its usefulness. Silicone rubber material are most often been reported to retain their hardness overtime for long. [12] Stability of hardness during use is a desirable feature of long term soft denture liner (LTSDL) materials because any increase in hardness can worsen the distribution of the masticatory load and lower the absorption of elastic energy, which is transmitted onto the mucosal membrane under dentures, thereby exacerbating the clinical problems experienced by patients.

In case of increase in hardness of resilient denture liners it may be a result of ongoing polymerization and an increasing number of cross-linking bonds between polymer chains. Their initial hardness ranges between 25 and 50 degrees Sh A, and should not exceed 55 degrees Sh A 28 days after the denture is relined. [9]

Here in this in vitro study we compared the change in hardness of two silicone based reliners at 1 month, 3 months and 6 months. Properties were evaluated at 1st, 3rd and 6th month to study the change in properties overtime. Artificial saliva was used to simulate the oral environment.

When the hardness of Elite soft relining material was compared with Mollosil after storage in artificial saliva at different time period; Elite shows more hardness than Mollosil but the hardness was within the required limits of LTSDL. The comparison of hardness at 1 month, 3 month and 6 month of both Elite and Mollosil shows that there is no overall statistically significant difference (p >0.005). This shows that there is no change in hardness or loss of softness in Elite

and Mollosil relining materials. This property of stability in hardness over time is s beneficiary property for a LTSDL for its use for a long time.

Future Perspective: An in vivo study on complete denture patients wearing dentures relined with different denture relining material would give a better result.

Conclusion

Within the limitations of this study; following conclusions were drawn:

1. Elite relining material is proved to have greater hardness than Mollosil but both the materials have hardness within the limit of required hardness of LTSDL.

2. Elite and Mollosil did not increase their hardness when studied at different time period and this property of stability in hardness overtime is beneficiary for a LTSDL. As long as material retains its initial hardness without increase in hardness overtime and is resilient it will have a rehabilitating effect on basal structures that has traumatized, irritated, deformed or abused.

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