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SOFT LINERS IN DENTISTRY-A REVIEW OF THE LITERATURE ON ITS PROPERTIES AND CURRENT CONCEPT.

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ABSTRACT Soft denture liners performs an important role in modern removable Prosthodontics. It has been used in the oral rehabilitation for centuries ,still the resilient soft liners has not met its clinical requirements. It may be because of its high cost and only short term use. The structure of the soft liner encourages the colonization of the bacterial growth. These article is to provide good knowledge on the duration of the selected modern soft lining materials based on its physical and chemico-mechanical properties, its adhesion mechanism, effect of bacterial colonisation, sorption and solubility,effect of its surface roughness.

KEYWORDS : soft liners, sorption, solubility, nanoparticles.

INTRODUCTION

Soft liners provide a cushioning affect for denture bearing area through absorption and redistribution of forces transmitted to the stress-bearing area.¹

They works excellently on affected person who have lesions on the mucosal floor, areas with severe undercuts, congential or obtained defects of the palate. Thus the result is that wearing the prosthesis becomes more comfortable for the patient. However with many advantageous also, still the soft liners uses dentistry is very limited as it exhibits multiple clinical failures characterised by adhesion loss with denture base, surface and bulk deteriotion, debries cumulation ,loss of resilience and accumulation of fungal or microbial agents.

During use soft liners are constantly immersed in saliva and When not in use the denture is kept in water here is where most of the problem is encountered – water sorbtion and solubility. Swelling leads to distortion of the soft liners, supports the growth of candida albicans, and increases stress at the denture-liner interface which reduces its shear bonding, all these results in the change in structure and properties of the materials.

Soft liners is divided into two types-acrylic and silicone based both groups are either autopolymerised or heat cured. According to duration it is of long term and short term soft liners.Soft liners(short term) is normally used for 1month which is also know as tissue conditioner, elasticity which last for 1 to 6 months is intermediate liners, soft liners lasting for more than 1 year is long-term permanent liners.An ideal soft denture liner is expected to have the following properties; superordinary physical and chemical performances, such as good resilience, viscoelasticity and abradability, bonding strength, no laceration to the mucosa, less sorption and solubility, ease of cleaning, having no harm on the denture and doesn't fit for microbe's survival.²

Physical And Chemico-mechanical Properties Of Soft Liner-Soft liners bond to the denture-

Soft Liners and poly(methylmethacrylate) PMMA bond strength has been studied by Peel, shear and tensile test. The geometry of the bond surface, whether it has been clinically roughened or etched, the bonding chemicals employed, the inherent bond strength, the tear strength, and the thickness of the lining materials are the factors that affect the bond strength.⁵ Literature has proven that none of the resilient soft liners has been found to absolutely satisfy. Most of the failures are commonly associated with poor physical and mechanical properties like poor adhesion of the liners to the dentures which subsequently results to the adhesion of certain microbe (fungal and bacterial).⁴

Without an adhesive, one of silicone's most prevalent drawbacks is its inability to adhere to the heat polymerised denture base. Even though if it manages to bind, the bonding is weak and its duration is compromised. However, acrylic products have a better bonding ability to denture bases.⁵

Mechanism of Denture Liner Adhesion-

Adhesive properties of the acrylic denture base polymer is altered with aging which leads to flaws on the interface between the polymer and liners.⁶⁷.

Bonding between the soft liner and prosthesis starts with resin dissolution, Surface layer swelling, and solvent evaporation. There is penetration of the monomers in the pores of the resin which , and forms a network called as interpenetrating polymeric network[®]. A deep porous layer causes the surface to swell more and improves the bond between the resilient soft liners and denture base.

Soft liner and denture bonding was evaluated $^{\rm 9.10.11.16}$ by application of primer, layer of primer (GC) applied on the polyamide surfaces $^{\rm 12}$, with the bonding agent $^{\rm 9}$, after

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sandblasting the acrylic base resin surfaces with 50 m Al2O3 particles¹³ with application of acetone and ethylacetate solution. Through application of impregnanted with unidirectional glass fiber¹⁴, with mixture of solution of methy formate & methyl acetate or changing the material in the prosthesis like PMMA⁹.

Ohkubo et alin his study concluded that more old the denture, less it is likely to reline because microbial colonization produces methyl mercaptan,which leads to detachment of the liner despite of dissolution of primer. Bacterial penetrate upto 3mm approximately, more adequacy is achieved by reducing the thickness of the denture base or by application of primer with high penetration ability such as dichloromethane based¹⁵

Silicone-based soft Liners-

Silicone-based soft liners are superior mechanically and also much durable as compared to acrylic based liners¹⁴. Neverthless Silicone soft liner lacks chemical adhesion with the denture baes it may be related to the bonding agent which is used^{9,11}

Increase of 13.8% to 60% adhesion failure rate between the silicone-based soft liner and prosthesis after storage in water for about 30days. This suggest that bonding progressively weakens with time.

Methylmethacrylate and ethyl acetate solvents enhances the adhesive properties of silicone soft liners to PMMA because they cause softening and porous formation which improves the adhesive peroperties¹⁴. Since applying a primers resulted in fewer bubbles formation during denture relining, Kim et al¹⁷ observed that silicone soft liners adhered to PMMA surfaces with superior results. Using a bonding agent like ethyl acetate resulted in enhanced adhesion, according to Lassila et al.

Liners adhesion to Different Prostheses-

4-META/MMA-TBB (4-methacryloxyethyl trimellitate anhydride . Due to their high degree of crystallinity, polyamides are materials that resist chemical deterioration.¹⁴. Akin et al.¹⁸ proved that hard liners and thermoplastized acrylic resin was almost identical to conventionally thermoplastized acrylic resin, but was different for the polyamide , because the polymers present are are chemically resistant. Ahmad et al found similar adhesion to UDMA which were most likely due to high reticular nature of the polymers which must have hindered the penetration of the monomer. ¹⁴ Non-reticulated amorphous polymers with absence of monomers results in the week adhesion of the resilient liners and denture bases. Non-reticulated amorphous polymers in micrometric scale in PMMA reinforce with glass fiber showed to increase adhesion with liner⁹.

Sorption and solubility-

Two processes takes place when the soft liners is kept immersed in water. Leaching of Plasticizers, while the water is being absorbed by the polymer. The dimension of the materials is highly affected by these two processes¹⁹. Factors that affects the rates of sorption and solubility is highly dependent on the material contents and solution to which the material is immersed.

Molloplast -B, a heat cured (HTV), silicone soft lining material, showed higher solubility and sorption in distilled water, and lowest in denture cleanser after 1, 4 and 16 weeks. According to a study conducted by Yanikoglu and Duymus in 2004 it was concluded that, Mollosil and Molloplast-B showed the lowest water sorption values, which was in agreement with the study conducted by Braden and Wright,¹⁹ but the current study shows that highest water sorption of Molloplast -B in distilled water was not in agreement with the previous studies. It could be due to the Chemical reaction taking place in polyphosphazene fluoroelastomer to increase the mass. Low water sorption and solubility in silicone is due to the cross linking of the heat. $^{\rm 1}$

Antimicrobial Agents in soft liners-

The simultaneous treatment of wounded peri-prosthetic tissues and fungal infection is one of the key benefits of including antimicrobial agents in robust soft liners for drug administration in the oral cavity. Both in-vivo and in-vitro studies have been shown to show effective results in the incorperation of antimicrobial agents in the soft liners.

Pisani et al²¹ demonstrated no changes in the resin liner's bonding, immersion time, or use of sodium perborate, and they came to the conclusion that these factors have no impact on the materials' dissolving. The insertion of antifungal substances such nystatin, miconazole, ketoconazole, or chlorhexidine diacetate in various dosages had no influence on the liner's adhesion to the prosthesis, as demonstrated by Alcântara et al. S. Kreve, C. Vidal et al in their studies showed that material with antimicrobial potential elevates the efficacy against , P. Aeruginosa, E. Faecalis and Candida albicans, keeping the roughness property unchanged, did not show any changes in the adhesion of the material to polymethyl methacrylate, and hardness values compatible with resilient denture liners is also maintained²⁰

Surface Roughness-

Williams and Lewis²⁵ stated that surface roughnes of the denture base indirectly cause injury to the tissue surface. Meaning, more the surface roughness, more the surface irregularities, staining, calculus deposits, bacterial adhesion and colonisation, which directly or indirectly, may effect oral tissues health decreasing the longevity of resilient reliners.

Many differents ways of removing the contaminants from the soft liners are available, however the morphology of the liner surface is important to assess given that the solution used for cleaning may penetrate the resin structure and alters its morphology. Polymer is altered greatly by time of immersion and the concentration.

After exposure to microwave radiation and sodium perborate immersion. Self-polymerizable hard liners roughness was increased due to the change in temperature and release of oxygen by sodium perborate. Bubbling seen in this process is a mechanical cleansing mechanism²² Izumida et al showed a reduce roughness in association with brushing and disinfection with chlorhexidine gluconate and was connected to cross-linking agents which reduces the acrylic resin solubility in organic solvents.. Since sodium carbonate, an abrasive ingredient, is a component of toothpaste. Using Brush with toothpaste and water has showed greater surface roughness of silicone soft liner.

No surface roughness changes were seen in heat-activated (Lucitone) acrylic resin and the other auto-polymerized resin reliner (Tokuyama Fast II) with different cleaning agents, it was due to the short immersion time. Machado et al²⁰ showed increase in surface roughness of the hard liner due to porosities which was from the release of residues of the monomers and plasticizers and also from disinfection with microwave which leads to increase in temperature. When MMA were applied on PMMA to improve adhesion with the silicone-based soft liners increase in the surface roughness was noticed¹⁴, these may be because surface drgradation cause by the solvent and morphology is altered.

Surface roughness values of the resin-based and siliconebased soft liners crossed the ideal parameter (0.2 m). Higher values were also obtained by many authors²² Goll et al study's found that sodium hypochlorite denture cleaners significantly worsened the surface qualities of soft liners than sodium perborate denture cleaners did.

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Methacrylate based resilient soft liners are more rough as compared to silicone liners because of the chemical structure, monomer content, method of polymerization, mixing time and technique.

The increase in acrylic roughness could be caused by the potential loss of soluble components like plasticizers, leaving empty spaces. The roughness and size expansion that eventually results in craters is probably caused by these empty gaps. The porosity of the liner may also be related to surface disturbances. Air is trapped while mixing, and it appears that some of the cleansers make the bubbles grow bigger before some of them eventually rise to the top. It is likely that microbial colonisation will be facilitated by the surface's extreme roughness.

Incorportion of nano particles-

S.Habibzadeh, A.Omidvaran et al²⁴ in their studies concluded that addition of Silver Nano Particles to silicone-based liner (Mucopren) lowers the tensile strength of the acrylic resins. SNPs addition to soft silicone (Mucopren) liner improves the anti-fungal properties which may unfavourably affect the acrylic denture base resin's tensile strength.

Inclusion of nano particles also decreases the water sorption properties and had no impact on the soft liner material's shear bond strength., yet it resulted change of color in material by increasing its opacity.

CONCLUSION-

Many studies concluded that autopolymerized silicone lining materials, are the most frequently used liners because of their mechanical properties and easy usage. It is important to note that there is still no perfect soft lining material that meets all the key requirements. Good knowledge of the resilient lining materials and lining techniques, as well as their characteristics is a prerequisite for the predictable final outcome of this type of prosthetic treatment. To improve the materials physical and chemical properties more studies should be conducted which will result more fit for human's physiological needs. More physical and meachanical properties will results in good functioning of the soft liner which will leads to more usage of it in the field of dentistry.

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