



Denture lining materials

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DOI: 10.5281/zenodo.10519813

Submission Date: 20 Nov. 2023 | Published Date: 16 Jan. 2024

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Abstract

To improve denture fit, relining surfaces the tissue side with new foundation material. Several lining materials improve denture fit. Before taking an impression for a new denture, it may be required to apply a very soft material on the fitting surface of a denture to comfort traumatized soft tissues. Ridge loss and gap size determine the outcome. A new denture should be made if space and occlusal vertical dimension rise significantly. If space is restricted, a thin layer of fresh plastic might fill the denture foundation. This subsequent procedure is commonly referred to as a "reline".

Keywords: Denture; lining; dental materials; soft-liners; tissue conditioners.

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1. INTRODUCTION

After tooth extraction, the remaining bone resorbs, creating a gap between the denture's tissue-bearing surface and the residual ridge. Space compromises denture support, retention, and stability. The occurrence of heightened displacement of the denture base in relation to the underlying mucosa, commonly referred to as loose fitting dentures, results in a localized force distribution on the residual ridge rather than a uniform distribution. The patient experiences localized areas of irritation, known as "sore spots," due to the high stresses and lateral movements exerted on the delicate oral mucosa. These sore spots can lead to significant discomfort. In order to address this incongruous state, the clinician is presented with two options: fabricating a completely new denture or incorporating a minimal quantity of new polymer material to fill the voids, this action effectively restores the intimate contact and stability of the denture base over a significant area of the underlying mucosa (Rahamet *et al.*, 2009).

2. Materials and methods

The denture-lining materials fall essentially into three groups, namely:

- 1) Permanent hard reline materials
- 2) Semipermanent soft liners
- 3) Temporary soft liners / Tissue conditioners

3. Results

3.1. Permanent hard reline materials

Relining can be done at the dental clinic with a cold-cure acrylic resin or in a dental lab with a heat-cured acrylic. Chair-side relining lacks precise control over denture material removal and reline thickness. Chair-side relining can also cause exothermic reactions, bad taste, and poor colour stability.

3.2. Semipermanent soft liners

On certain occasions, patients may express dissatisfaction with enduring pain and discomfort resulting from a denture, despite the denture's apparent overall adequacy. This issue is frequently observed in the mandible, particularly due to its relatively limited surface area for load distribution. Additionally, patients may present with a sharp, thin, or extensively resorbed alveolar ridge in this region. In instances of this nature, patients experience challenges in accommodating a rigid denture. If the pain persists when all possible measures have been taken to minimize the occlusal load and redistribute the load over as large an area as is possible, the denture may be made more comfortable by the use of a soft liner. Consider and plan for the resilient lining. By placing an absorbent substance between the denture and the mucosa, this absorbs some of the mastication energy. Silicone polymers have a naturally low glass transition temperature, and plasticizers can lower the glass transition temperature (T_g) of polymethylmethacrylate (PMMA). The plasticizer lubricates the polymer chains, making them simpler to slide past one another and lowering the material's elastic modulus. Soft liners commonly use one of these two materials (Van Noort and Barbour, 2013). It can't fix denture design mistakes (Yankova *et al.*, 2021). Predictable results in removable denture prosthetics require understanding of elastic relining materials' varieties, procedures, processing, and basic properties.

3.2.1. Plastized acrylics

Heat-activated plasticized acrylic liners can be obtained in preformed sheets or in a formulation consisting of powder and liquid components. The powder consists of a methacrylate polymer called polyethyl methacrylate (PEMA) and benzoyl peroxide, which functions as an initiator. The liquid consists of a methacrylate monomer of elevated molecular weight, such as ethyl, n-butyl, or 2-ethoxyethyl methacrylate, along with a plasticizer, commonly a phthalate ester. The incorporation of a plasticizer into the resin results in a decrease in the (T_g) and serves as a lubricant, promoting enhanced flexibility and deformability of the polymer chains. The liner undergoes laboratory processing as part of the denture fabrication process. Soft liners made from chemically activated acrylic resins are also commercially accessible. The chemical composition of these substances bears resemblance to heat-activated resins, yet their polymerization process is facilitated by a peroxide-tertiary amine system. The aforementioned materials are commonly utilized for chair side relines, with the process of polymerization typically requiring a few minutes. However, similar to other mouth-cured liners, the utilization of these liners is limited to a temporary basis due to their propensity to become contaminated and detached from the denture within a few weeks. This significant drawback restricts their practical implementation in clinical settings. The existence of unbound monomer also leads to substandard mechanical characteristics and diminished biocompatibility (Zarbet *et al.*, 2004).

3.2.2. Silicone rubber

Silicone rubber is a poly dimethyl siloxane polymer with filler. Since the substance is a polymer, cross-linking solidifies it. Tetraethyl silicate or benzoyl peroxide can cross-link at room temperature or heat. An adhesive is needed since silicone rubber does not bond to denture acrylic resin. An alkyl-silane coupling agent or solvent-dissolved silicone polymer can accomplish this adherence. Both bonds are weak and break quickly. This substance also promotes Candida

albicans (*C. albicans*), which causes denture stomatitis (Van Noort and Barbour,2013). Despite an extensive range of instruments from various manufacturers, the challenge of optimal and high-quality mechanical treatment of polymerized resilient material remains unsolved (Yankova *et al.*,2019)

3.3. Temporary soft liners/Tissue conditioners

A tissue conditioner refers to a soft substance that is temporarily applied to the fitting surface of a denture with the aim of facilitating a more uniform distribution of stress. This facilitates the restoration of the mucosal tissue to its original form and the resolution of any inflammation present in the tissues that support the denture. After the subsidence of inflammation and the restoration of tissue, a dental impression can be obtained in order to fabricate another denture (Van Noort and Barbour,2013).

3.3.1. Composition of Tissue Conditioning Liners

- Acrylic gel sheets and powder/liquid systems are offered. The powder comprises (PEMA) or its copolymers.
- The liquid's solvent, ethyl alcohol, and plasticizer, dibutyl phthalate, decrease the polymer's (Tg) and make it a soft gel.

Tissue conditioner gelation is a physical process without chemical reactions or monomeric compounds that could cause tissue irritation. Alcohol and plasticizer leak out and are largely replenished by water, making tissue conditioner transitory. Thus, within a few days to a week or two, the substance hardens and loses its cushioning function. For optimal cushioning, tissue conditioner should be changed every 2–3 days. This treatment continues until tissue healing is complete (Zarbet *et al.*,2013)

3.3.2. Uses of tissue conditioners

A- Tissue treatment: Tissue conditioners usually keep the remaining ridge. They also treat hyperemic tissues before denture making.

B- Temporary obturator: Tissue conditioners can act as temporary obturators over dentures. This might be done directly in the mouth or indirectly following an impression of the surgical area.

C- Baseplate stabilization: An acrylic temporary denture base may lock into an edentulous cast's undercut and break it during removal. Stiff tissue conditioners can stabilize record bases and avoid cast fracture in such situations.

D- To evaluate resilient liners: Well-made dentures might cause prolonged soreness and discomfort. Tissue conditioners can evaluate if resilient liner can fix this problem (Veeraiyan,2003)

Table 1: Comparison between soft liners and tissue conditioners (O'Brien, 2002).

Material	Advantages	Disadvantages
Plastized acrylic	High peel strength to acrylic denture base	Poor resilience
Silicon rubber	Resilience	Low bond strength to dentures
Tissue conditioners	Rheological and viscoelastic	Alcohol can sting inflamed mucosa

3.4. Methods of application

3.4.1. Chair side Reline Materials

During the reline procedure, the denture base's tissue-bearing side is intentionally roughened to create a renewed and clean surface for the application of the new material. Subsequently, the various components of the product are mixed and evenly distributed across this prepared surface. During polymerization, the denture is placed in the patient's mouth. The oral mucosa might be scalded and burned by the heat emitted during the polymerization reaction. Thus, during intraoral polymerization, the denture may be removed and replaced multiple times. During the polymerization process, the excess material that emerges from the denture is eliminated, and the interface between the existing and new dentures is subjected to a polishing procedure. Despite the similarities in the fundamental components and chemistry between the lining agents and the processed denture base, the polymerization of the reline is comparatively less extensive. Thus, reline materials are weaker, absorb fluids more easily, and discolour with time. A new delivery system extrudes, mixes, and applies reline materials directly to the previous denture base chairside. This system uses a delivery cannon to dispense components from a single cartridge. When the trigger is pressed, a plunger releases both ingredients, which are driven into a nozzle with an auguring device to mix them before extrusion from the tip end. The denture base is introduced into the mouth and the mixed material is placed directly on it. This delivery device may supply soft and hard reline materials.

3.4.2. Laboratory Reline Materials

Denture reline materials prepared in the lab polymerize more than those used chairside. The old denture surface is roughened, an impression substance is put directly to the denture base, and the denture is reinserting into the patient's mouth for lab-processed relines. As an impression tray, the original base is used. After sending the denture/impression to

the lab, technicians stone the old denture. The new denture base material is polymerized directly against the old base under heat and pressure. This laboratory process creates a polymer that is stronger, more bonded, and more resistant to fluid absorption and colour change than chair-side materials. A soft, silicone-based "permanent" reline material is made in the lab. This process involves placing a flexible liner directly against the master cast's tissue-bearing side, painting it with adhesive, and treating it like a heat- or auto-polymerized flasked denture. Compared to liners produced entirely of modified methacrylate-based polymer, the resultant liner stays flexible longer. To limit the risk of bacterial and fungal growth, silicone surfaces must be treated (Rahanet *al.*,2009)

3.5. Care and maintenance of denture lining materials

Long-term and short-term soft liners are known to promote *C. albicans* and other microorganisms on and inside the liners. Silicones are porous, which aids water absorption and nutrient diffusion. Proper oral and denture care, combined with antimicrobial treatments, reduces fungal and microbial colonization on denture liners. Soft liners are cleaned with a delicate brush and a light detergent or nonabrasive dentifrice. The exterior surface of the denture can be cleaned using the above procedure, while the liner can be gently wiped with cold water-soaked cotton (Zarbet *al.*,2013)

3.6. Modifications in soft denture liners

3.6.1. Bond strength of liners

The denture base and liner stick better with organic solvents. To improve adhesiveness between repair material and polymethyl methacrylate denture base, chemical etchants such monomethyl methacrylate, acetone, or methylene chloride have been used (Hashem, 2015)

3.6.2. Color stability of liners

After long-term usage, stain, water absorption, component breakdown, and intrinsic pigment degradation discolour denture base materials. Thus, avoiding such beverages and tobacco, especially when soft liner is used, may help denture wearers maintain colour stability (Imirzaliogluet *al.*,2010)

3.6.3. Incorporation of antifungal agents

Medication

1. Add antifungal medications to commercial tissue conditioners to treat denture-induced stomatitis (Iqbalet *al.*,2015)
2. Disinfect denture liners and tissue conditioners with 0.5% sodium hypochlorite. Nystatin in those materials treats or prevents oral candidiasis (Skupienet *al.*,2013)
3. Nystatin (500,000 units) with tissue conditioner can treat non-compliant denture induced stomatitispatients (Iqbalet *al.*,2016)
4. Miconazole gel applied to tissue conditioner inhibited *C. albicans* development in vitro (Radnalet *al.*,2010)
5. The addition of the nystatin, chlorhexidine, and ketoconazole at modified by minimum inhibitory concentration for *C. albicans* biofilm resulted in no harmful effects on the tensile strength and elongation percentage of the temporary soft denture liner materials up to 14 days (Neppelenbroeket *al.*,2018)

Inorganic anti-fungal agent

Medicine uses silver's antimicrobial properties. Since their small size allows outstanding antibacterial effect at low filler level, silver nanoparticles have been synthesized and incorporated into numerous biomaterials. These nanoparticles reduce biofilm formation on dental materials (Corrêaet *al.*,2015)

Natural and herbal antimicrobial agent

Resilient soft liners containing tea tree oil have showed invitro antifungal activity for 60 days, suggesting that this essential oil may be therapeutic for denture stomatitis and other oral infections (Pachavaet *al.*,2015)

4. Summary and conclusions

1. Soft liners improve masticatory efficiency and oral comfort for patients with a thinner oral mucoperiosteum.
2. Direct relining of dentures created with hard chair-side reline resin is faster than laboratory-processed relining, and the patient does not need to be without the prosthesis during the laboratory procedure. However, auto polymerizing acrylic reline resins and denture base materials form a weak link.
3. Denture /liner interface should include sufficient physical, chemical and mechanical strength to resist the intraoral -deboning force.
4. There is a chemical -bond between (PEMA) resilient liner and (PMMA) denture base through application of monomer before the application of soft liners
5. Silicone lining material has no chemical bond, the silicone/PMMA bond relies on adhesive.

Abbreviations

C.albicans	Candida albicans
Tg	glass transition temperature
PEMA	polyethyl methacrylate
PMMA	polymethylmethacrylate

Acknowledgement

We gratefully acknowledge the support provided by. Lecturer **Dr. Hasanain Kahtan Abdulkhalik Alalwan**. College of Dentistry- University of Baghdad

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CITATION

Taqwa Majid AH, S. A. Jaleel Shiyaa, Waffaa I. M, Ban A.M., & H. N. Jihad. (2024). Denture lining materials. In *Global Journal of Research in Dental Sciences* (Vol. 4, Number 1, pp. 17–21).
<https://doi.org/10.5281/zenodo.10519813>