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Soft lining materials in denture relining: Biological, mechanical, and clinical perspectives

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Abstract

Introduction. Loose-fitting dentures are a common clinical problem that compromises patient comfort, function, and prosthesis stability, primarily due to residual ridge resorption, systemic conditions, and excessive occlusal loading. Residual ridge resorption is a chronic and progressive process that reduces the quantity and quality of supporting tissues, particularly affecting removable dentures. Relining and rebasing procedures are widely used to restore denture adaptation, retention, and stability without fabricating a new prosthesis. Application of soft lining materials has gained clinical importance, especially in elderly patients with thin, sensitive, or traumatized oral mucosa.

Material and method. Soft liners are classified into short-term materials, commonly referred to as tissue conditioners, and long-term soft liners. Tissue conditioners are viscoelastic materials used temporarily to promote mucosal healing, improve denture fit, and serve as functional impression materials. Long-term soft liners, including plasticized methacrylates and silicone-based materials, are indicated for patients with chronic mucosal discomfort, severe ridge resorption, or anatomical limitations.

Result and discussion. Silicone-based soft liners demonstrate superior long-term elasticity, dimensional stability, and biocompatibility compared with acrylic-based liners. Clinical outcomes of denture relining depend on appropriate material selection, handling protocols, and bonding quality between the liner and denture base. Silicone soft liners, particularly autopolymerizing types, are favoured due to their sustained resilience and minimal tissue irritation. Overall, soft liners play a significant role in reducing mucosal trauma, improving stress distribution, and enhancing denture retention. Proper clinical indication and material selection are essential to achieve optimal long-term therapeutic outcomes in removable prosthodontics.

Keywords: Denture; Relining; Soft Liner; Tissue Conditioner

1. Introduction

Dental prostheses may become loose over time, resulting in discomfort for the wearer. Several factors contribute ill-fitting of the prosthesis, including residual ridge resorption, systemic diseases, and excessive occlusal loading, all of which adversely affect prosthesis function, retention, and stability. Residual ridge resorption is a chronic, progressive, and cumulative process characterized by intermittent metabolic bone activity that leads to a gradual loss of bone mass. This condition reduces the availability of supporting tissues for dental prostheses, particularly removable dentures, thereby compromising their retention and stability [1]

To restore retention and stability in loose removable dentures, clinicians must be familiar with relining and rebasing procedures of the denture base. Relining refers to the process of adding new material to the tissue-facing surface of a

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removable denture in order to improve its adaptation and retention. In contrast, rebasing involves the complete replacement of the denture base with a new material while preserving the existing artificial teeth and maintaining their original position and occlusal relationships. Both relining and rebasing are intended to rehabilitate removable dentures so that they can function effectively without the need to fabricate a new prosthesis [1,11].

In elderly patients, alveolar bone may become painful and resorbed, while the oral mucosa becomes thinner, often rendering conventional acrylic dentures uncomfortable or unwearable. To address this condition, denture relining—particularly with soft lining materials—has been shown to be clinically beneficial [5,8]

Currently, dentists are presented with a wide variety of soft liner materials, each designed for different clinical applications. As the number of available products increases, clinicians must understand the differences among these materials in order to prescribe, select, and use the most appropriate option for each patient's clinical condition. Even when material selection is based on an accurate diagnosis, treatment prognosis must still be carefully evaluated. In some cases, it may be more appropriate to consider complete denture replacement rather than relining alone, as relining may provide only short-term benefits without ensuring long-term success [11]

Most soft lining materials currently available exhibit certain limitations, including inadequate colour stability, reduced long-term durability, low abrasion resistance, weak bond strength, and increased porosity. Various modifications have been proposed in recent years to overcome these shortcomings [7]. Prior to the application of soft lining materials, tissue conditioning is often performed to improve the health of the supporting soft tissues [14]. This paper discusses the use of soft liners for soft tissue rehabilitation.

2. Material and methods

Denture lining materials are used to refit the complete denture, improve the retentions of tissue and provide a time-dependent, simulated cushion-like effect. The earliest recorded resilient liners were made of natural rubber material, then in 1945 synthetic resin were developed and introduced as a liner material. the first silicone-based denture liners were introduced in 1958 [8].

Denture lining materials are generally classified into 2 type :

- Short term soft liners (tissue conditioner)
- Long term soft liners

2.1. Short Term Soft Liners (Tissue Conditioner)

Short-term soft liners are resilient, plasticized methacrylate-based resins that function as temporary lining materials. They are widely used in clinical dentistry for managing a variety of patient-related conditions and therapeutic applications. These materials are typically mixed chairside, applied to the tissue-contacting surface of the denture, and subsequently adapted intraorally [8,14].

Indication of soft term soft liners / tissue conditioner :

- To treat and condition irritated denture-supporting tissue
- Provisional adjunctive/diagnostic purposes of recovery of the vertical dimension occlusion and correction of the occlusion of an old denture
- As temporary relining material of immediate dentures/immediate surgical splints
- Relining the cleft palate speech aids
- Tissue conditioning material during implant healing period
- Impression material prior to indirect relining

The composition of tissue conditioning liner are provided in powder/liquid system, and preformed acrylic gel sheets are also available. The powder contains a polymer (usually PMMA) or copolymers. The liquid contains a mixture of ethyl alcohol (solvent) and an aromatic ester (dibutyl phthalate) as plasticizer that lowers the glass transition temperature of the polymer, rendering it a soft gel. Tissue conditioners gel through a physical process that doesn't involve any chemical reactions or monomeric materials that could irritate tissue. The alcohol/plasticizer mixture diffuses into the swellable methacrylate beads when the powder and liquid are combined. Gelation produces a tacky-set gel with strong cohesive qualities by entangling the exterior polymer chains of juxtaposed swelling beads. This improves its adherence to the denture's fitting surface. The set gel can function as a shock absorber due to its elastic and viscoelastic qualities [9,10]

The temporary nature of tissue conditioners is attributed to the leaching of plasticizer and alcohol, which are gradually replaced by water, resulting in increased hardness and loss of cushioning effect within a short period of clinical use. Prolonged use may lead to surface deterioration, microbial colonization, and contamination, potentially aggravating the underlying mucosal tissues. Therefore, tissue conditioners should be replaced at short intervals to maintain their therapeutic effectiveness [7,11].

2.2. Properties of Tissue Conditioner

The gelation behavior and viscoelastic properties of tissue conditioners differ according to variations in their composition and structural characteristics, including molecular weight, powder particle size, ethyl alcohol content, and the type of plasticizer employed. Certain formulations are designed to maintain softness and resilience over extended periods. Therefore, it is essential for clinicians to adhere strictly to the manufacturer's handling instructions when using tissue conditioners. Rheological investigations have demonstrated that different products require intraoral placement at specific times following mixing, as they exhibit variations in viscosity and gelation kinetics [9-11].

The clinical effectiveness of tissue conditioners is closely associated with their viscoelastic behavior, which reflects a combination of fluid-like viscosity and solid-like elasticity. The viscous properties of tissue conditioners enable close adaptation to inflamed or irritated mucosa, improving denture fit and influencing stress distribution according to load magnitude and duration. Simultaneously, their time-dependent elastic behavior under cyclic masticatory forces allows recovery from deformation, absorption of impact forces, and cushioning of underlying tissues, thereby promoting mucosal healing beneath ill-fitting dentures [4,7,9,11].

For effective tissue conditioning, materials must exhibit sufficient flow and elastic properties, with sustained viscoelastic behavior being critical to clinical success. In contrast, functional impression materials should demonstrate good flow with minimal elastic recovery, allowing continuous adaptation to soft tissues under functional loading. To ensure impression accuracy, such materials must exhibit limited elastic rebound, maintain compliance over extended periods, possess adequate dimensional stability—including minimal weight change, water sorption, and solubility—and demonstrate strong bonding to resin denture bases [3,14].

2.3. Long Term Soft Liners

Long-term soft liners mostly used as therapy for patients who cannot tolerate the stresses induced by the dentures. This material often used in the management of edentulous patients with chronic pain, soreness, or discomfort caused by prolonged contact between denture base and underlying tissue, and may develop in the following clinical conditions [4,8,11] :

- Patients with thin and sharp alveolar ridges
- Patients with severely resorbed ridges
- Patients with sensitivity due to inferior alveolar nerve sub mucosal exposure
- Patients with large bony undercuts
- Patients with defect of the palatal area

In these situations, soft liner with viscoelastic material would become useful to compensate the depleted mucoperiosteal support as well as increasing the retention of the denture. Long-term soft liners permit wider dispersion of the pressure and absorb impact forces that involved in functional and parafunctional movements, so the tissue would heal and the patient's comfort and tolerance to the prosthesis will increase [4,11].

The most common long-term soft liners are plasticized methacrylates and silicone rubbers. Those material can be activated through chemical or heat process. The requirements of ideal long-term soft liner are [7,9]:

- Biocompatible
- Low degradation
- Good dimensional stability
- Low saliva wettability
- Permanent softness/viscoelasticity
- Adequate resistance from tear and abrasion
- Good bond to denture base
- Easy to clean
- Simple to manipulate

- Color stable and good esthetic
- Inhibit colonization of fungi and other microorganism

Another material also available although not as widely used, include plasticized vinyl polymers and copolymers, hydrophilic polymers, polyphosphazene fluoropolymers, fluoroethylene, and polyvinyl siloxane addition silicones.

2.4. Methacrylate Resin and Heat-Activated Resilient Liners

The composition of heat-activated plasticized methacrylate soft liners [4,7,11]:

- The liners are available as preformed sheets or powder/liquid form. The powder consists of a polyethyl methacrylate and benzoyl peroxide as an initiator
- The liquid consists of methacrylate monomer, such as ethyl, n-butyl, or 2-ethoxyethyl methacrylate, together with plasticizer, commonly phthalates ester

Plasticizer lower the temperature of the glass transition of resin, acting as a lubricant between polymer chains, also allowing them to deform easily and thus imparting flexibility. During clinical use, resilient liners are continuously exposed to saliva and are commonly stored in water or cleansing solutions when not in use. Water absorption and leaching of plasticizers progressively reduce liner resiliency, increase hardness, and diminish its cushioning effect. The primary limitation of plasticized methacrylate liners is biodegradation in the oral environment, which results in surface hardening and roughness that promote microbial and debris accumulation. Despite these limitations, such materials exhibit strong bonding to methacrylate denture bases, high tear and abrasion resistance, and superior polishability compared with silicone liners. They are typically processed in the laboratory during denture fabrication [6,9].

2.5. Chemically Activated Methacrylate Resins

Chemically activated methacrylate resins are also used as soft lining materials and share a composition similar to heat-polymerized resins. Polymerization is initiated by a peroxide–tertiary amine system and is typically completed within minutes, allowing chairside application as temporary relines. However, like other intraorally polymerized liners, their clinical use is limited to short-term applications due to surface fouling and debonding from the denture base within a few weeks. Additionally, residual monomer content contributes to inferior mechanical properties and reduced biocompatibility, further restricting their clinical applicability [11,13]

2.6. Silicone-Based Soft Liners

Silicone-based soft liners material is available as heat-activated or room temperature vulcanized (RTV). The silicone material has considered success over methacrylate liner due to their superior resilience and ability to retain elasticity longer. The material does not depend on leachable plasticizer to maintain their resiliency as a result of the inherent chemical properties [4,6,7].

2.6.1. Heat-Activated Silicone Liners

The material supplied as single paste form consist of polydimethylsiloxane, a filler, and benzoyl peroxide as initiator. The liner material sets by a cross-linking reaction that is catalyze by heat and peroxide initiator. The liner is processed against methacrylate dough of the new denture and recommended over addition of the liner to a previously polymerized base, because it will have better bond with the denture base [4,9,11].

2.6.2. Chemically Activated Silicone Liners (Room Temperature [RTV] Silicones)

The chemically activated silicone liners or room temperature vulcanized silicones (RTV) use a condensation cross-linking process catalyzed by an organotin compound. The condensation reaction is similar to the same reaction of silicone impression material. The material are supplied in paste and liquid systems [4,7].

2.7. Laboratory Procedure

2.7.1. Tissue Conditioner

Short-term soft liners may also serve as functional impression materials during denture relining procedures, although the material requirements differ from those for tissue conditioning. Functional impression with tissue conditioner should be done in 5-7 days or shorter to obtain optimum results. The impression should be poured with dental stone immediately after removal from patient's mouth. Patients must be advised to take care of the temporarily relined denture, with hygiene routine of rinse the denture and clean with soft toothbrush [3,14].

2.7.2. Silicone Base Soft Liners

The laboratory procedures for both heat cured and RTV silicone liners are the same. The bases are invested in a flask and mold spaces are prepared. A relief inside the fitting surface of the denture is provided to achieve adequate thickness of the liner. Packing process, compression of the molding, and processing are carried out according manufacturer's instructions. Then, the dentures are deflasked, finished and polished [4,7,8,11].

3. Results and discussion

3.1. Causes of Denture Looseness and Clinical Management

Denture looseness is a frequent clinical problem primarily caused by residual ridge resorption, systemic diseases, and excessive occlusal loading, which collectively lead to compromised retention and stability of the prosthesis. These factors alter the adaptation of the denture base to the supporting tissues and reduce the effectiveness of load distribution during function [5,8]. Clinical management of loose dentures commonly involves relining procedures using either direct or indirect techniques, which may be performed intraorally or through laboratory processing. In cases where repeated relining does not restore adequate stability due to changes in the patient's vertical dimension, rebasing of the denture base is indicated as the appropriate treatment option, as previously reported [1,2,5,8]

The selection of a relining approach should consider patient-related factors, prosthesis condition, and expected clinical outcomes. Direct relining using self-curing acrylic resin offers procedural simplicity and reduced chairside time; however, this technique is associated with increased porosity and colour instability, which may negatively affect the durability and aesthetics of the prosthesis [1,2,11]. Conversely, indirect relining using heat-cured acrylic resin, performed under laboratory conditions, provides superior mechanical strength and reduced porosity. This technique is particularly advantageous for elderly patients and individuals with unstable mental conditions, as it produces a more durable and stable denture base [3,8].

3.2. Silicone-Based Soft Liners: Material Properties and Clinical Relevance

Silicone-based soft liners are widely used in denture relining due to their favourable physical and mechanical characteristics. These materials demonstrate adequate tear resistance, low absorption and solubility in saliva, good elasticity, and sufficient mechanical strength, while maintaining long-term softness. In contrast, acrylic-based soft liners tend to lose their resiliency over time as a result of plasticizer leaching, which reduces their cushioning effect and clinical longevity [4,8]

Silicone-based soft liners are composed of dimethyl siloxane polymers that can be polymerized through either thermal or chemical activation. Autopolymerizing silicone soft liners are more commonly used in clinical practice due to their practicality, allowing relining procedures to be performed directly without prolonged removal of the denture [5]. The clinical performance of relined dentures is strongly influenced by the quality of adhesion between the denture base material and the relining material. Additionally, the inherent mechanical properties of both the denture base polymer and the relining polymer contribute to the overall strength and durability of the prosthesis [8,10].

3.3. Biocompatibility and Tissue Response to Relining Materials

Several studies have reported allergic reactions associated with methacrylate monomers present in acrylic materials, which may be related to excess residual monomer content. Repeated contact between acrylic prosthetic materials and the oral mucosa during clinical use may lead to sensitization, while thermal and chemical effects generated during acrylic resin polymerization can contribute to traumatic stomatitis. In contrast, laboratory investigations evaluating the cytotoxicity of silicone soft liners have demonstrated that these materials are non-toxic, even following prolonged exposure, supporting their biocompatibility in clinical applications [12,13,14]

Silicone-based soft liners are particularly beneficial in patients presenting with thin atrophic mucosa, residual ridge resorption, deep anatomical undercuts, bruxism tendencies, or oral mucosa with limited tolerance to occlusal loading. Two types of soft lining materials are commonly available: soft acrylic compounds and silicone elastomers. Clinically, silicone elastomers are preferred due to their superior dimensional stability, whereas acrylic materials exhibit greater shrinkage and progressive loss of cushioning capacity over time. Silicone soft liners are available in both autopolymerizing and heat-cured forms, allowing flexibility in clinical application [4,6,11].

4. Conclusion

Soft liners applied to the anatomical surface of dentures play an important role in reducing mucosal trauma associated with conditions such as xerostomia, bruxism, and residual ridge atrophy, while also improving patient comfort and denture retention through more uniform stress distribution. The use of permanent silicone-based soft liners in new dentures or during relining procedures provides effective cushioning for thin and vulnerable mucosal tissues and enhances prosthesis retention by maintaining intimate tissue contact. Tissue conditioners remain valuable as temporary materials for conditioning traumatized tissues and supporting various clinical applications due to their viscoelastic properties.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

References

[1] Siahay AJ, Habar ID. Clinicians need a relining or rebasing procedure. Makassar Dent J. 2020;9(2):101–104.

[2] Duran I, Yilmaz B, Ural C. A technique for removing implant-retained denture: direct relining complication. Case Rep Dent. 2015;2015:1–3.

[3] Zaki MQ. Impression techniques in removable partial denture. J Curr Res. 2017;9(4):49514–49516.

[4] Grzegorz C, Jarosław Z, Jacek K. Long-term soft denture lining materials. Materials (Basel). 2014;7:5816–5842.

[5] Hsu YT. Consequences of relining on a maxillary complete denture: A clinical report. J Prosthet Dent. 2015;114(1):13–16.

[6] Ayse M, Guzel KG. Effect of storage duration on the hardness and tensile bond strength of silicone- and acrylic resin–based resilient denture liners to a processed denture base acrylic resin. J Prosthet Dent. 2008;99:153–159.

[7] Hashem MI. Advances in soft denture liners: An update. J Contemp Dent Pract. 2015;16(4):314–318.

[8] Zarb G, Hobkirk JA, Eckert SA, Jacob RF. Prosthodontic treatment for edentulous patients. 13th ed. St. Louis (MO): Elsevier; 2013.

[9] Yankova M, Yordanov B, Dimova-Gabrovska M, Apostolov N. Resilient lining materials for removable dentures: Types, composition and technology. J IMAB**.** 2019;25(3):2632–2639.

[10] Hashem MI. Advances in soft denture liners: An update. J Contemp Dent Pract. 2015;16(4):314–318.

[11] Garcia LT, Jones JD. Soft liners. Dent Clin North Am. 2004;48(3):709–720.

[12] Ghorab SA. Comparative study between two different types of soft liners used for patients with maxillary obturators. Egypt Dent J**.** 2018;64(2):1805–1812.

[13] Kucharczyk M, Słowik-Rylska M, Cyran-Stemplewska S, Gieroń M, Nowak-Starz G, Kręcisz B. Acrylates as a significant cause of allergic contact dermatitis: new sources of exposure. Postepy Dermatol Alergol. 2021;38(4):555–560.

[14] Baslas V, Singh SV, Aggarwal H, Kaur S, Singh K, Agarwal KK. A technique for using short-term soft liners as complete dentures final impression material. J Oral Biol Craniofac Res. 2014;4(3):204–207.