

# Recent developments in the soft denture liners

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## ABSTRACT

Tissue conditioners (TCs) are short term soft liners, formed in situ from the mixture of a polymer powder and a liquid plasticizer. The article reviews recent advances in composition, functions, clinical use, gelation process, and physical properties of TCs and their effects on denture bases and oral mucosa. TCs are used to improve the fit and function of an ill-fitting denture. They can also be used to treat abused mucosal tissues underlying ill-fitting acrylic dentures as temporary expedients. TCs are recommended as provisional liners to maintain the fit of removable dentures and to prevent mechanical irritation from the denture.

**Key words:** tissue conditioners, gelation, leaching out.

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## INTRODUCTION

Removable dentures were and are the inseparable part of prosthodontics. Though fabrication of dentures done very precisely inadvertent errors and changing substructure such as remodeling of bone and mucosa can't be predicted. To overcome such challenges. Lytle, who pioneered in tissue conditioners differentiated between physiologic and the pathologic changes associated with the residual alveolar bone and overlying mucosa. In cases with the severely abused oral tissue, the displacement of soft tissue was found to be 0.050 to 0.030 inch<sup>2</sup>. Denture liners were introduced in the year 1945<sup>1,2</sup>.

Liners have been greatly utilized in the removable dentistry. They are primarily used to modify the intaglio surface of denture. Conditions such as prosthesis fracture, remodeling of bone, and maxillofacial defects. It can be of two types - one fabricated in lab using heat polymerization and the other one being self-polymerized, generally used for chair side relining. Soft liners are resilient materials which relined the denture base. Resilient liners are elastic, absorb energy and act as cushion like effect. Soft liners also called as tissue conditioners can be of two types. Short term and long-term resilient liners. Short term stays resilient for less than 30 days whereas long term can maintain somewhere between 1 month to 1 year. Tissue conditioners are the liners used for a brief period only.

Tissue conditioners are used to improve the fit and function of an ill-fitting denture. Liners can also be used for providing conditioning to the abused oral tissues. Sometimes they can also be utilized for making functional impressions. Tissue conditioners are an aid for abused tissues, improves the fit and retain interim maxillofacial obturator. Other modalities like base plate stabilization for surgical splints, in trial denture bases, functional impression material which can be relied upon use of tissue conditioners. The major disadvantages associated with them is gradual loss of resiliency, changes in color, adhesion loss. Other prominent issues that arise are water loss, bacterial and fungal growth.

This article reviews the recent development in tissue conditioners. In this article, the properties and composition is reviewed along with the recent advances which are occurring in this field.

## COMPOSITION OF TISSUE CONDITIONERS

Tissue conditioners generally compose of polymer, monomer and a liquid plasticizer. Plasticizer is used for controlling the flow of the mix. The constituents of polymer are generally polyethyl-methacrylate, polymethyl methacrylate, silicone rubber, poly "n" propylmethacrylate, poly "n" butyl methacrylate. a mixture of aromatic ester and ethyl alcohol forms the liquid of monomer. The plasticizers are low molecular weight aromatic esters, such as dibutyl phthalate, butyl phthalyl butyl glycolate, butyl benzyl phthalate, and benzyl benzoate. Mixing of polymer and monomer results in the formation of a coherent gel which is having viscoelastic properties just desired for clinical use. The PEMA particles are slowly penetrated by the large molecules of the ester-based plasticizer, while the alcohol swells the polymer and hence accelerates plasticizer penetration to produce a clinically acceptable gelation time. The gelation of PEMA is controlled by varying polymer molecular weight and ethanol content.

Benzoyl peroxide is the initiator in heat cured liquid. polyvinyl acetate, ethyl alcohol, calcium carbonate, polypropylene glycol, white bees wax and alkyl methacrylate copolymers are the constituent of home liners. When tissue conditioners are in continuous contact with liquids such as oral fluids, the plasticizer and alcohol contents leach out and hence lose its resiliency. Whereas silicone materials remain resilient for a longer time because they are devoid of plasticizers. In addition, they have greater cross linking and higher bonding capacity to the fillers. Increase of temperature reduces the gelation time. Higher the degree of polymer comminution, more rapid the gelation. In the oral cavity the frequent rinsing and fluid intake the ethanol responsible for gelation is evaporated and washed off leading to hardening of tissue conditioner, due to which it can not be used for a very long time period. The maximum loss of ethanol occurs within first 12 hours after the placement of prosthesis in mouth. Leaching of alcohol leads to loss of resilience. The silicone based materials are used for a longer period as they remain resilient comparatively for a longer period cause they do not rely on plasticizers. Moreover, they have higher cross linking and better bonding capacity to the filler particles<sup>3-5</sup>.

### Properties of tissue conditioners:

The ethanol and plasticizers leach into the saliva, which is then absorbed by the polymeric phase of the gel.<sup>13-15</sup> It has been shown that over a period of 1 week, water sorption increased from 0.2 to 5.6 mg/cm, and solubility ranged from 0.03 to 0.40 mg/cm for various commercial products. Though the silicone based conditioners do not leach ethanol, but they have poor bond strength. Bonding is better with PEMA. Detachment of tissue conditioner from denture would be a failure. The sites of detachment will act as areas for plaque deposition and calculus formation. Bonding can be enhanced by using rough surface rather than smooth surface.

Denture liner should be of adequate thickness to provide strength. A minimum of 2mm is required to provide adequate bulk. As the thickness of liner is increased it is more associated with deflection of tissue conditioner layer. As time passes, there is leaching of ethanol which may lead to dimensional instability and weight changes. The lowest shrinkage (1.16–1.61%) occurred in the first 24 h after preparation. It is suggested that the time of forming the functional impression in oral cavity should not exceed 24 hours. While forming the functional impression it was evaluated the effect of tissue conditioner affect plaster surface, but the results were comparable to silicone based impression materials.

Since the effect of ethanol leaching and water sorption are quite prominent in affecting properties and usability of tissue conditioners, they can be surface coated to slightly increase the resiliency in mouth and can be used for a little longer clinical conditions. Surface coating prevents leaching and water sorption in oral conditions. Also surface coating can prevent absorption of salts from oral cavity which can lead to hardening of tissue conditioner. Moreover, they also present with reduction in bacterial and fungal growth on tissue conditioner. Apart from this the loss of plasticiser can affect the properties and life of acrylic based denture base as it can diffuse into denture. It can lead to deformation or fracture of denture base after prolonged use.

Tissue conditioners are an effective way of combatting denture induced stomatitis as they redistribute the masticatory forces over a larger area. Therapeutic incorporation of antifungals and anti-microbial can also reduce the chances of fungal and bacteria induced stomatitis. The use of crystalline aluminium silicate with silver ions acts as antiseptic. Although the release of silver ions leads to a cytotoxic effect, but because it has a short term effect, the health risk seems to be insignificant<sup>6-8</sup>. Fungal growth on TC surfaces can cause irritation of the oral mucosa. Adhesion of *Candida albicans* to the surface of TCs is a result of cell proliferation and matrix production.

#### Required properties of tissue conditioners:

- Viscoelasticity
- Slow fluid absorption
- Color stability
- Tear resistance
- Good adhesion to denture base
- Dimensional stability
- Inertness to fungal and bacterial growth
- Ease of processing and repair
- Long shelf life
- Biocompatibility
- Good resiliency
- Low glass transition temperature
- Adequate wettability
- Absence of odor, taste, irritability and toxicity
- Economical
- Compatible with gypsum plaster
- Dimensionally stable to not to change occlusal relations.

### Clinical application of tissue conditioners:

The soft resilient nature of TCs on the acrylic denture surface facilitates a whole range of diagnostic and treatment modalities. Various clinical applications are:

- Conditioning of inflamed denture bearing mucosa
- Making functional impressions
- Provisional relining material for ill fitting dentures
- Preventing mechanical irritation from denture base
- Trial of denture base extensions
- Denture modification post surgery-implant or other surgeries
- Relining of maxillofacial obturators

### Types of tissue conditioners:

Based on curing	<ul style="list-style-type: none"> <li>• Self-cured</li> <li>• Heat cured</li> <li>• Light cured</li> </ul>
Based on composition	<ul style="list-style-type: none"> <li>• Silicone elastomers</li> <li>• Soft acrylic compounds</li> <li>• Phthalate ester compounds</li> <li>• Polyolefin liners</li> <li>• Fluid containing liners</li> </ul>
Based on durability	<ul style="list-style-type: none"> <li>• Temporary/ short term liners</li> <li>• Definitive/ long term liners</li> </ul>
Based on consistency	<ul style="list-style-type: none"> <li>• Hard denture liners</li> <li>• Soft denture liners</li> </ul>
Based on availability	<ul style="list-style-type: none"> <li>• Home reliners</li> <li>• Tissue conditioners</li> </ul>
Based on water sorption	<ul style="list-style-type: none"> <li>• Hydrophilic</li> <li>• hydrophobic</li> </ul>

## DISCUSSION

Tissue conditioners have seen great revolution in its composition over the years. There is advancement from hard acrylic liners to the newer silicone based liners. Materials like anti-fungal agents were incorporated into the liners for prevention of fungal growth in the moist oral cavity. Incorporation of harmless herbal extracts into the liners to prevent the side effects and also to overcome development of resistance to the commercially available antifungal agents by the candidal species<sup>8,9,10</sup>. Schneid demonstrated that a sustained release delivery system that incorporated 4 antifungal agents (chlorhexidine, clotrimazole, fluconazole, and nystatin) into a tissue conditioner significantly inhibited *Candida albicans*, although its hardness increased. Biofilm development was overcome by applying a sealer onto the surface of the tissue conditioner.

Bonding of the conditioning materials to denture base material is seen as a major problem in addition to staining and biofilm development. According to Wright, most common reason for failure of a soft-lined denture was the failure of adhesion between the liner and denture base. Bonding to the denture base surface is a significant problem especially for silicone-based products. Bonding between the denture base resin and silicone-based lining material rely completely on the adhesive. Bond failure between the liner and denture creates a potential interface for micro leakage, plaque and calculus<sup>11</sup>. Therefore, effective bonding is important for the longevity of tissue conditioners.

Limitations of tissue conditioners result from the effects of the oral environment on their properties which necessitate frequent replacement of the conditioning material<sup>12</sup>. The oral environment allows the plasticizers to be leached out into saliva, and water is then absorbed by the polymeric phase of the gel<sup>13-16</sup>. However, Graham et al. 30 showed that the percentage of plasticizer loss from a tissue conditioner at the end of 14 days of usage was  $31.1 \pm 12.4\%$ <sup>16</sup>.

## CONCLUSION

The greatest virtue of tissue conditioners lies in their versatility and ease of use. Their biggest flaw is that they are so easily misused. Because the conditioner-lined dentures provide immediate relief and comfort, there is a danger that the patient will wear them too long and so cause trauma to the supporting tissue – thereby producing the very same situation that their use is intended to prevent or correct. Their longevity in wear is very limited. They harden and roughen within

four to eight weeks because of loss of the plasticizer. This requires close observation of the patient by the dentist. Whatever may be the limitations of tissue conditioners, there is no doubt that it is a healing magician to the abused tissues under the hard denture bases.

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