DENTAL TECHNIQUE

A modified indirect method for fabricating silicone soft-lined complete dentures

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Patients with mandibular edentulism and highly resorbed sharp ridges with a thin mucosal membrane under the denture area frequently experience chronic pain or discomfort.1,2 The application of a soft lining material is beneficial because of the cushioning effects.1-5 Soft denture liners provide wearers with better masticatory function than conventional hard-based denture materials, and the use of long-term silicone liners significantly improves mastication parameters, including masticatory performance, chewing strokes, chewing time, and maximum occlusal force.3-5 Furthermore, the stress distribution with soft liners is lower and more homogeneous than that with hard resin dentures, particularly liners composed of silicone-based materials.6 However, eventually, the soft lining materials become harder, have greater resin solubility, and decreased stress relaxation.7 Their adhesive properties also decrease because of aging and cause adhesive failure at the interface between the denture base and the resilient soft lining material, frequently occurring at the exposed edge of the lining material.7-10

Soft denture lining materials may be applied using either direct or indirect techniques.1,2 With the direct method, the thickness and location of the denture base can be difficult to control, and the resulting material is often porous.1,2,10 Moreover, the lining material is easily debonded from the peripheral area of the denture in an apparent peeling process. Bond failure can lead to microorganism growth, particularly Candida growth, on a surface.9 Because silicone materials have lower bond strengths than acrylic resin soft liners, silicone soft liners should be directly processed with a polymerized acrylic resin base treated with a primer or monomer, or they should be indirectly processed with acrylic resin dough.11 Areas of hard bone prominence and sharp edges of the bone ridge under the denture base are indications for soft lining, whereas the peripheral area of the lingual border is not.1 Moreover, covering the peripheral area along the lingual or buccal denture margins with soft lining materials, particularly silicone-based denture materials, is not feasible because they are susceptible to debonding from the hard denture base.1,2,11

Dentures with soft liners that cover the attached mucosa but do not extend to the periphery of the denture have long-term shock-absorbing capacity similar to dentures covering both the mucosa and the periphery.12 Thus, with the indirect technique, the denture can be correctly positioned and adequate thickness of the soft lining material ensured, thereby covering the attached mucosa but not extending to the periphery of the denture.

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ABSTRACT

A method is described of polymerizing silicone soft lining materials with a hard acrylic resin base by using a photoactivated spacer. The use of a photoactivated spacer is convenient because of the ease in determining the correct location covering the attached mucosa but not extending to the border margins. By using this method, the optimum shape and thickness of the spacer can also be ensured. Thus, the long-term durability of soft lining dentures is achieved without invasion by microorganisms or peeling away from the denture margin. (J Prosthet Dent 2016;116:853-857)
A new indirect method for placing denture soft lining materials in which the thickness and location are controlled by using a photoactivated spacer is described. In this method, the silicone denture soft lining material is polymerized simultaneously with the heat-polymerized denture base materials, resulting in long-term durability.

**TECHNIQUE**

1. After the trial placement of the wax denture, complete the form of the polished surfaces of the waxed denture.
2. Select the location and thickness of the soft denture lining material and fabricate a spacer according to the design by using a photoactivated polymer base plate (Physio-spacer; Nissin) (Fig. 1). Ensure that the marginal borders of the denture are covered by heat-polymerized acrylic resin. Include the top of the alveolar crest to determine adequate thickness. Activate the spacer for 5 minutes by using the photoactivating machine (Pearlcure Light; Tokuyama) and trim it until optimum margins are achieved.
3. Prepare the gypsum (Advastone; GC Corp) mold for the heat-polymerized acrylic resin in the conventional manner. Remove the wax from the mold and add a coat of acrylic resin (Acro-Sep; GC Corp) as a separating medium on the mold surfaces (Fig. 2).
4. Attach the spacer to the lower half of the flask with cyanoacrylate adhesive (Aron Alpha; Toagosei). Mix and place the acrylic resin dough of the hard-base denture material (Acron; GC Corp) in the upper half of the flask (Fig. 3).
5. Insert a sheet of separating plastic film (Polyethylene film; GC Corp) between the halves of the flasks and close them by pressing the flasks (Fig. 4).
6. After pressing, open the flasks and trim the excess flash resin at the denture border until the mold is filled and no flash is formed (Fig. 5).
7. Remove the spacer and apply a coat of adhesive primer for the denture soft lining material (Sofreliner Tough Primer; Tokuyama) to the hard denture material surface. Then place the denture soft lining material (Sofreliner Tough Super-soft; Tokuyama) on top of the denture material (Fig. 6).

8. Press and clamp the halves of the flask after removing the separating sheet and process the denture base material and soft lining material simultaneously for 8 hours at 75°C following the conventional procedure (Fig. 7).

9. After cooling, open the flask, deflask the denture, and polish the surface of the denture following conventional procedures.

10. Deliver the soft relined denture (Fig. 8A).

**DISCUSSION**

Using the indirect method described here, the location and thickness of the denture soft lining material can be controlled, and covering the margin of the denture border area with the lining material can be avoided. Several lining designs have been previously described, including the soft liner covering the entire mucosa and a liner covering the attached mucosa but not extending to the border area of the denture.¹ ² ¹² Kawano et al¹² evaluated the influence of these lining designs on the cushioning effect and showed that a silicone denture liner that covers the entire mucosa was the most effective design. Soft lining materials should cover the entire supporting bone ridge. Compressive stress might occur at the border area during mastication, but the denture material even though hard acrylic resin at the lingual peripheral border may not cause pain because there is no supporting bone. Moreover, lining materials at the marginal areas may have weak adhesion and peel easily.⁷ However, separation can be prevented by confining the margin of the silicone soft lining material, which exhibits low bond strength, within the denture border.² Therefore, the margin of the denture border area should not be covered with the lining material.

Different methods have been described to allow the spacer material to withstand deformation during flask pressing, including the use of photoactivated denture base materials, baseplate wax, and thermoplastics.¹ ² Gupta et al¹³ used a 2-mm thick silicone putty as a spacer applied to a mandibular denture that was prepared with a glass slab. However, an accurate thickness was somewhat difficult to determine and maintain over the entire surface as well as to trim the spacer to the desired shape. Hayakawa² used a 1.4-mm paraffin wax sheet as a spacer, and the wax was added where sharp alveolar ridges were noted. In the method described here, a photoactivated denture base plate material was used as a spacer; this material involves the use of a 1-mm-thick sheet and requires a working time of 20 minutes. This method is convenient because the correct location can be easily determined, as can the optimum shape and thickness after photoactivation and sufficient working time. An excessively thick spacer may result in fracture...
of the denture, but one too thin will result in mucosal pain. This method provides an adequate distributional thickness of 1 to 2 mm to maintain the strength of the denture with a good cushioning effect and adequate adhesion.

This method can be used not only with silicone-based materials but also with methacrylate-based denture soft lining materials. Acrylic-based soft lining materials have stronger adhesive properties compared with hard resin-based materials, but as a result of aging, acrylic-based soft lining materials have higher hardness values, lower viscoelastic properties, and more color change compared with silicone-based resilient materials.7,9-12 The correct amount of space is difficult to estimate because acrylic resin-based soft materials are polymerized by mixing monomers and polymers. However, a gun-type of silicone-based denture soft lining material is a convenient replacement for the spacer material. The amount of denture soft lining material can be estimated based on the dimensions of the spacer. If the lining material is spread on areas that are not to be coated, it can be easily removed from the hard base of the denture. Moreover, as the cushioning effect of silicone-based soft materials is longer than that of acrylic-based materials,7,3-8,10 silicone-based resilient materials are more suitable for this method.
This method has been used for 5 patients with mandibular complete dentures who had experienced chronic pain with hard-based dentures. The masticatory function of these patients increased, and chronic pain was no longer reported. No obvious complications were associated with this method.

For example, after 1 year, the complete denture with a denture soft lining material applied by using this technique did not show any obvious damage at the margin of the denture soft lining material (Fig. 8B). A limitation of this technique is that it cannot be used for patients with a thin denture base because of the occurrence of fractures or for patients with an inadequate lingual flange because of the occurrence of chronic pain during mastication.

**SUMMARY**

Soft denture liners were used in patients with highly resorbed ridges and thin mucosa under denture bearing areas, thereby improving their masticatory function. This article describes an indirect method of applying denture soft lining material by using a photo-activated spacer. The spacer is prepared according to the thickness and location of the denture soft lining material. The spacer is then placed on the lower flask at the initial packing of the dough of the polymer base material. The denture base material and soft lining material are simultaneously polymerized. Using this technique, the thickness and location of the soft lining material are reliably controlled, and it is easy to make dentures with soft lining materials on the intaglio and hard-resin marginal base. No obvious complications were associated with this method, and masticatory function improved without any damage to the soft lining material.

**REFERENCES**


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