Study of Clinical Science and Engineering
Silicone Denture Reline Material Mucopren® soft

Introduction

Soft denture reline materials can be used for patients who have a high ridge resorption, thin mucosa coating and are likely have pain while chewing. The materials are mostly made from acrylic, silicone and polyolefin. Silicone reline materials are classified into autopolymer and heat-curing types. The autopolymer type has been widely used in clinical cases because it can be used both for direct and indirect methods. Since soft reline materials relatively degrade faster than hard reline materials, and it is hard to see the durable period, regular maintenance after treatment will be required.

Kettenbach, based in Germany, was the first manufacturer in the world to introduce silicone impression material, Lastic®, in the clinical scene in 1955. Also, the surgical micro sponge Sugí® (superabsorbency sponge based on cotton and cellulose), developed by Kettenbach, is the most recognized material in the global medical
MUCOPREN® SOFT

Table 1  Properties required for denture reline materials

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<tr>
<td>1. Shall meet the necessary property of denture base materials.</td>
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<td>2. Shall achieve solid bonding to base materials and not rub off in after extended wear.</td>
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<td>3. Not cause adverse effects (such as deformation or degradation) on the property of the materials.</td>
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<td>4. Shall gain proper curing speed and enough time for operation.</td>
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<td>5. Shall inhibit bacterial growth.</td>
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<td>6. Cutting and polishing shall be easily accomplished, and the surface shall be finished smooth and glazed.</td>
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<td>7. Shall be provided with appropriate viscoelasticity (applicable to soft reline materials only).</td>
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<td>8. Viscoelasticity shall be maintained in the long term (applicable to soft reline materials only).</td>
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Table 2  Properties and composition of Mucopren® soft components

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<tr>
<th>Components</th>
<th>Property</th>
<th>Composition</th>
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<tr>
<td>Mucopren® soft</td>
<td>Two component paste</td>
<td>Vinyl Polysiloxane, platinum catalyst, and others</td>
</tr>
<tr>
<td>Mucopren® silicone sealant</td>
<td>Two component paste</td>
<td>Vinyl Polysiloxane, platinum catalyst, and others</td>
</tr>
<tr>
<td>Mucopren® Adhesive</td>
<td>Liquid</td>
<td>Methacrylate, Ethylacetate, and others</td>
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Properties required in soft denture reline materials

Table 1 shows properties required in denture reline materials. The properties necessary for denture reline materials are rather challenges to be overcome when compared to hard reline materials. This means no product to date has resolved all problems, such as “Bond strength to base materials”, “Presence of bacteria and residue of food”, “Cutting and polishing”, “Appropriate viscoelasticity”, and “Long-term retainment of the viscoelasticity”. The following explains how Mucopren® soft can provide solutions to these problems due to the product’s characteristics and mechanical properties.

Characteristics of Mucopren® soft and its mechanical properties

Table 2 shows properties and composition of components of Mucopren® soft. Silicone has siloxane linkage –Si(CH₃)₂–O–Si(CH₃)₂—in its molecular frame, and silicone with a small amount of functional vinyl groups is called vinyl polysiloxane. Reline materials and silicone sealant are based on this vinyl polysiloxane. Since silicone sealant is based on the same composition as reline materials, a smooth and glazed surface where the base materials can be achieved after modification of periphery. Also, since the silicone sealant is

world. Kettenbach has just recently introduced a silicone denture reline material, Mucopren® soft, which was developed through the technology application of silicone impression material, to Japanese dentistry on June 2, 2008 (Figure 1). Reports indicate that this product has shown excellent adhesiveness to base materials compared to other silicone reline materials¹. Japanese clinical trials have seen more cases of soft reline material application to patients compared to Western medical cases. With this background information, the company is investigating the market potential of Mucopren® soft. In this report, the benefits and characteristics of this product are introduced and analyzed.
only manufactured by Kettenbach, the product has great potential for overcoming the challenges of modification and polishing of reline materials, such as “cutting and polishing.”

Figure 2 also shows molecular structure of Mucopren® Adhesive (US patent No. US 6,566,479B1, patented on 20 May, 2003). It is understood that the molecular makeup of adhesive makes the bonding between base materials and silicone materials stronger through spreading cross-linked structure and chemically bonding to base materials (PMMA resin) and silicone materials. Borchers shows that 1.77MPa of bond strength of Mucopren® soft to base materials is as twice strong as 0.78MPa of TOKUYAMA Soft relining (now replaced by Sofreliner medium soft developed by Tokuyama Dental Corp. with improvement in polishing and adhesiveness). This fact indicates that Mucopren® soft demonstrates the excellent characteristic in terms of “Bonding strength to base materials”.

Japanese manufacturers of silicone denture reline materials such as GC and Tokuyama Dental provide three different types of products in terms of viscoelasticity (hardness and resistance to flow) considering the market demand in Japan. Mucopren® soft, however, is able to cater to every type of case with one viscoelasticity, as shown in the characteristics of the products developed by Western manufacturers. The reasons for this include the following concerns: 1) The clinical guidance to differentiate the types (such as thickness of patients’ mucosa coating and viscoelasticity) has not been clearly determined; 2) The softer the materials are, the faster the material degradation occurs, which encourages the growth of bacteria and residue of rotting food; 3) The softer materials are, the thicker the materials should be, but even if the materials are thick enough, it encourages the instability of the denture and causes pain resulting from the wrong occlusion.

Under a situation where it is hard to select materials properly in terms of viscoelasticity by taking each patients’ mucosa condition into consideration, manufacturers would have no choice but to develop products which can be used for a long time with as less degradation as possible while mainly putting the elasticity property first.

Figure 3 shows a comparison of dynamic viscoelasticity (37 °C, 1Hz) among Mucopren® soft and the products developed by the two manufacturers above. The hardness of Mucopren® soft is in between GC reline soft and extra soft, and the flowability is almost similar to that of GC reline soft. This proves that Mucopren® soft provides better performance in terms of elasticity.

**Guideline of clinical application of Mucopren® soft**

The indirect method provides better performance in controlling thickness and shape since it is difficult to gain an appropriate thickness when applying soft reline materials with the
Figure 4
a: A resin stopper was added on both anterior and molar teeth in order to gain thickness of reline materials.
b: Transition part to the denture material was trimmed when limiting the application of reline materials to the base mucosal surface only.
c: Transition part to the denture material was trimmed when relining the reline materials including the periphery.

Figure 5
a: Apply adhesive and wait 30 seconds. Apply adhesive again and dry 90 seconds.
b: Mount reline materials uniformly.
c: Check occlusal relationship in the patient’s mouth, and wait the completion of polymerization of reline materials for 3 minutes and 15 seconds.
d: Immerse in hot water of 50 °C for 15 minutes to finish the polymerization and to improve the bonding strength.

Figure 6
a: Modify the shape by a special steel bur.
b: Polish with a special polishing disc.

Figure 7
a: Prepare a small amount of silicone sealant in a disposable dish.
b: Apply the silicone sealant to glaze the surface of Mucopren reline material after polishing.
c: Wait 5 minutes, until the polymerization is complete.
Further remove the layers other than the resin stopper, clean it with water, dry thoroughly, and apply adhesive. After 30 seconds, apply the adhesive again and dry for 90 seconds. (Figure 5a).

Mount relining materials on the mucosal surface of the denture base uniformly (Figure 5b), insert it in the patient’s mouth, press it to the lower mucosa of the base with finger pressure to achieve bonding, and slowly bring the teeth into occlusion at the location of intercuspation. Examine the occlusal relationship. (Figure 5c).

Wait for the pressure to form and complete polymerization of the relining material (3 minutes, 15 seconds). Then remove it from the mouth.

Remove the resin stopper, apply the relining materials, and repeat polymerization process again in the mouth.

Immerse it in the hot water of approx. 50 °C for 15 minutes to improve the polymerization of relining materials and bonding strength to the base materials (Figure 5d). Do not skip this step or rub-off of relining materials can be seen during the following steps.

Remove redundant reline materials with a pair of scissors or scalpel, modify the shape with a special steel bur (Figure 6a), and polish by a polishing disc (Figure 6b).

Prepare a small amount of silicone sealant in a disposable dish (Figure 7a). Apply a thin layer of Mucopren silicone sealant to glaze the surface of Mucopren relining material after polishing in order to eliminate the relining materials, and repeat polymerization process again in the mouth.

Immerse it in the hot water of approx. 50 °C for 15 minutes to improve the polymerization of relining materials and bonding strength to the base materials (Figure 5d). Do not skip this step or rub-off of relining materials can be seen during the following steps.

Remove redundant reline materials with a pair of scissors or scalpel, modify the shape with a special steel bur (Figure 6a), and polish by a polishing disc (Figure 6b).
porosity (Figure 7b). Wait for more than 5 minutes for completion of polymerization (Figure 7c), and mount it in the mouth. Figure 8 shows the completion of relining of Mucopren® soft.

Although the above steps require more than 30 minutes of patient chair time, the time is necessary to apply soft reline materials with meticulous caution, otherwise post-op control of the material can be difficult.

During post-op of applying soft reline materials, it has been widely known that the using denture cleaners for dentures causes deterioration of the materials. For your reference, therefore, Figure 9 shows the test results for comparison among Mucopren® soft, GC reline soft and Sofreliner Tough® after being immersed 24 hours in denture cleansers, "PIKA" (Blue: Enzyme-based, Red: Hypochlorous acid-based; SHOFU INC.) and "Polident® with Enzyme" (Neutral peroxide + enzyme-based; GlaxoSmithKline K.K). When these denture cleaners are applied, no reline materials presented blisters or any changes on the surface. Deterioration of reline materials resulting from long-term use of denture cleaners, however, still has to be cautiously kept in mind.

Lastly, the following details shows the actual trial by the author for using silicone sealant as the coating material for tissue conditioner. The production of KUREGUARD® (Kureha Corp.), which used to produce high clinical results as the coating materials for tissue conditioner, was discontinued, and no appropriate replacement materials has been developed since then. However, when Mucopren® adhesive was applied as the tissue conditioner with a silicone sealant layer over it, a smooth and glazed surface was achieved (Figure 10). Although the use of the product is in this manner different from its original purpose, using Mucopren® Adhesive this way should not cause any problems.

**Conclusion**

The product viability of Mucopren® soft is not fully understood in clinical cases in Japan, and the viscoelasticity of Mucopren® soft, silicone denture reline materials will affect the patients’ prognosis for long-term use. However, the results shown for “Bond strength to denture materials” and “Silicone sealant” of this product are more than attractive compared to other soft reline materials. Future evaluation of this product among readers would be promising.

In conclusion, remember it is important to appropriately consider each patient’s case when using soft reline materials, and regularly monitor patients’ prognosis.

**References**


2) Yasumasa Agakawa: Chapter 4 Maintenance after denture treatment, Prosthetic treatment for edentulous patients (Edited by Norio Hosoi, Toshihiro Hirai), Published by Ishiyaku Publishers, Inc., Tokyo, 236-246, 2004.

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