Liquid-supported denture: A gentle option

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The ideal properties of a complete denture are adequate rigidity on the polished surface to bear masticatory forces and at the same time, flexibility and softness on the tissue surface for proper and even distribution of the masticatory forces. The problem with a conventional denture is that on its tissue surface, the denture is rigid leading to uneven distribution of load. This drawback even worsens in the case of flabby, atrophic and unemployed ridges with excessive bone resorption. Various methods and materials have been used to give a cushioning effect to the tissues when dentures are actually in use including liquid-supported dentures.

The complete denture is designed so that the base is covered with a preshaped, closed fitting, flexible, foil. This technique allows continued adaptation of the denture to the mucosa in the resting and functional states. A complete denture will not have a good prognosis if it violates the foundation on which it rests. Liquid-supported dentures eliminate the main disadvantages encountered due to rigid denture base materials thereby providing proper retention, stability, support and comfort to the patient.

Key words: Fluid-retained denture, water-filled dentures

The dimensions of resident alveolar ridge are not stable due to bone resorption, mucosal changes and tissue irritation. An ideal denture should be flexible and continuously adapt itself to the mucosa. However, it also has to be rigid to support the teeth during actual use. These properties are difficult to combined in one material, but can be done by using a combination of materials and techniques. In 1961, Chase[1] reported the application of an elastic impression material on the mucosal side of the rigid base to relieve the traumatized soft tissue. Since then, a variety of tissue-conditioning materials have been used and introduced. Another group of materials called soft liners has been used to relieve denture-sore mouths. They differ from tissue conditioners because they are plastic and flow continuously under masticatory pressures. This case report / article describes the fabrication of a complete denture with design characteristics of plastic and elastic recovery.

CASE REPORT

A 70 year-old male patient was referred to the Department of Prosthodontics, D. Y. Patil Dental College for prosthetic rehabilitation of the maxillary and mandibular ridges. The patient had been wearing dentures since the past 12 years even at night. The overlying mucosa was flabby in the anterior region and highly compressible in the hard palate area. The mandibular ridge was atrophic and flabby. An orthopantograph showed no bony support in the maxillary arch. The superficial mental nerve and inferior alveolar canal in the mandibular arch were easily seen due to resorption [Figures 1-3]. The resorption had progressed to such an extent that the patient had a dull aching pain on palpation in these regions. The general condition of the patient was debilitated and frail hence, a liquid-supported denture was planned for this particular patient.[2,3]

Procedure

For the sake of convenience, let us divide the procedure into two stages!

Stage I

At the time of packing, a 1 mm thick, soft, flexible polyethylene sheet was incorporated in the denture which was 2 mm short of the borders [Figure 4]. This sheet was adapted over the master cast with the help of a vacuum heat-pressed machine (Drufolen). Now the foil was heat-cured with a heat-cure, denture-base resin to facilitate sealing. The denture with this 1 mm thick temporary foil was then finished, polished and inserted into the patient's mouth to check for retention, stability, support and border extension. The patient was asked to use the denture for two weeks till he

got adjusted to the new dentures [Figure 5].

Stage II

The denture was now ready to be converted into a liquid-supported denture. A putty impression of the tissue surface of the denture was obtained to get the junction of the temporary sheet and the denture base resin. The cast was poured into a dental stone and the positive replica of the denture was obtained with the junction marked over it [Figures 6, 7].

A new polyethylene sheet of 0.5 mm thickness was adapted on this stone replica, again heat-pressed at 6 atmospheres (atm, pressure) and cut into the desired shape as on the stone replica to form the ultimate denture base. (This sheet was a permanent one of 0.5 mm thickness as compared to the temporary one which was of 1 mm thickness. This difference in space was occupied by liquid in the final prosthesis) [Figure 8].

The temporary 1 mm thick sheet / spacer embedded in the denture was replaced [Figure 9] with the new 0.55 mm thick permanent sheet in the final denture. Two inlets [Figure 10] were made in the denture bucally in the molar region. The permanent polyethylene sheet was then incorporated in the denture base with the aid of a cyanoacrylate adhesive and sealed with light-cured dental varnish.[4] The seal was checked properly by blowing air around it. In areas of leakage, it was resealed till a perfect seal was obtained at the junction [Figure 11].

A viscous liquid, i.e., glycerin was filled through the inlets [Figure 12] and one inlet was sealed with cold-cured acrylic resin. The occlusal vertical dimension was adjusted by fitting the denture in the patient's mouth and the other inlet was closed with resin. Metal screws can also be used to seal the inlet but they should be of good quality and should not lacerate or impinge on the mucosa. The denture was now ready to be used by the patient [Figures 13-15]. In this particular patient, it was technically challenging to convert the mandibular denture into a liquid-supported one due to the fact that very little residual ridge was actually left. So the existing mandibular denture was relined with a permanent soft liner.

DISCUSSION

The principle of this design was that a liquid-supported denture is flexible and continuously adapts itself to the mucosa. However, it is also rigid enough to support the teeth during actual use. Thus, the denture base is covered with a preshaped; close-fitting, flexible foil to keep a thin film of liquid in its place. This design will act as a continuous reliner for the denture and thus has an advantage over the existing denture designs. An important requirement for retention is the close adaptation of the denture base to soft tissues. A fluid-supported, preshaped foil will fulfill this requirement.

When no forces are applied, the foil remains in the resting position, which acts as a soft liner and when the dentures are in use, vertically directed loads are distributed in all directions by the liquid resulting in optimal stress distribution [Figure 16]. This helps in the long-term preservation of bone and soft tissues.. Apart from the combined benefits of tissue conditioners and soft liners, liquid-supported dentures will have optimal stress distribution during masticatory function. Load from biting forces and even bruxism, will be distributed over a larger surface. Thus, pressure spots and overloading of supporting tissues may be reduced.

For this case, polyethylene foil (Drufolen) was used due to its compatibility and excellent physical and mechanical properties. It is soft, flexible and dense and protects the mucosa from bacterial and biomechanical irritation. The adhesive used is n-butyl-2 cyanoacrylate which is used in surgery as an alternative to suturing and as a protective covering over ulcers etc. For a liquid cushion, glycerin was used which is clear, colorless, odorless with a good pharmaceutical placation. It has good thermal stability, water repellency, low surface tension and low vapor pressure. Furthermore, it acts as a vehicle and solvent, a sweetening agent, a preservative in some liquid medications so it is has proven *in vivo* safety.

Precautions

1. Thickness of the denture base should be at least 3 mm.
2. Seal should be perfect and should be checked for microleakage.
3. Denture care instructions should be given to the patients.
4. In case the liquid leaks out, the patient should inform the dentist and the denture should be refilled.
5. Repair is possible if the sheet gets ruptured and can be replaced over the preserved stone replica.

A liquid-supported denture can add a series of attributes to the conventional acrylic resin denture:

1. Preservation of residual ridge by optimal distribution of masticatory forces.
2. Better retention, stability, support, and comfort due to close adaptation.
3. Optimized atmospheric pressure, adhesion, cohesion and mechanical interlocking in undercuts.
4. Improved patient tolerance because of great comfort due to smooth flexible surfaces!

Figure 1: Severely resorbed maxillary ridge with overlying flabby tissues

Figure 2: Severely resorbed mandibular ridge with overlying flabby tissues

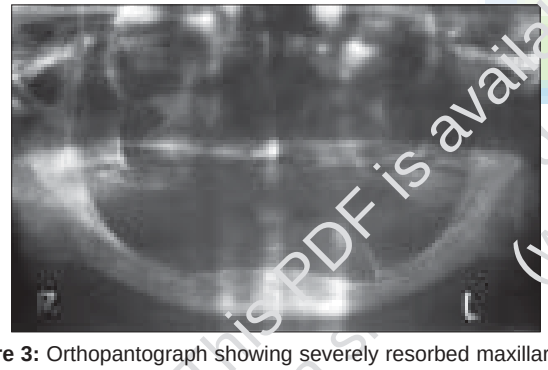

Figure 3: Orthopantograph showing severely resorbed maxillary and mandibular alveolar bone

Figure 4: Vacuum heat-pressed polyethylene sheet (1 mm thick) incorporated at the time of packing

Figure 5: Processed maxillary denture with temporary sheet (1 mm thick) which is 2 mm short of the borders

Figure 6: Putty index of tissue surface of denture

Figure 7: Obtained cast

Figure 8: Vacuum heat-pressed polyethylene sheet (0.5 mm thick)

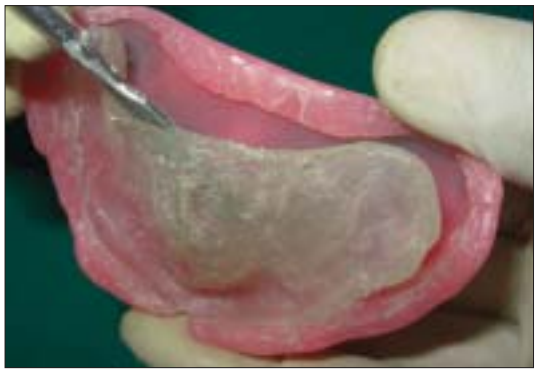

Figure 9: Temporary sheet (1 mm thick) removed from the denture

Figure 10: Holes made in denture for injecting liquid

Figure 11: New sheet (0.5 mm thick) incorporated in denture with adhesive and sealed with light-cured dental varnish

Figure 12: Incorporation of glycerin as a liquid medium

Figure 13: Liquid-supported denture with shock-absorbing effect

Figure 14: Preoperative view

Figure 15: Postoperative view

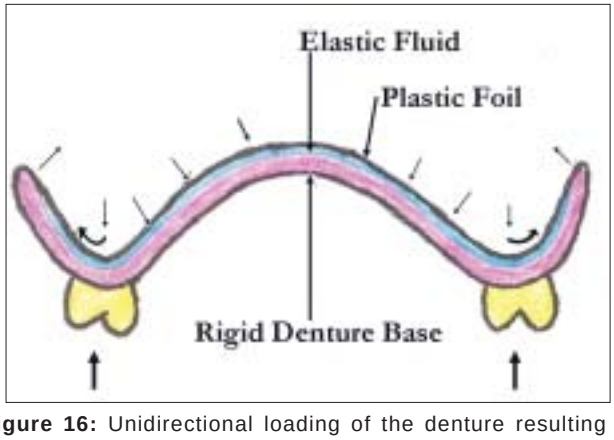

Figure 16: Unidirectional loading of the denture resulting in multidirectional distribution of hydrodynamic pressure throughout fluid and clasping pressure at its borders (cross section)

5. !Prevention of chronic soreness from rigid denture ! surface.

Days and nights change, so do men, so do tissues, so ! do our treatments. Ultimately, Devan's dictum holds ! true!"Our objective should be perpetual preservation ! of what remains, rather than meticulous reconstruction ! of what is lost."!

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