Rapid Fabrication of Plastic Retainers*

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This report is intended to call attention to the advantages of polystyrene as a material of choice in the making of retainers and similar devices and to describe a technic for its use. Its chief advantage lies in the fact that it eliminates the two greatest time-consuming steps in retention; viz, the coating of the cast and the investment and processing of the material.

Polystyrene is the polymerized form of styrene, which is one of the three denture base materials used in modern dentistry. Those materials are acrylics, vinyls, and styrenes. Polystyrene was first produced in 1839 about the same time that Goodyear discovered the vulcanization of rubber. Manufacturing difficulties prevented its use for the following century, but during that time much was learned concerning its properties. Polystyrene is a synthetic resin obtained from ethylene and benzine, and is closely related to methacrylates in chemical formula.

$CH2 = CH.C6H5$	Styrene
$CH2 = C.CH3 . COOH3$	Methacrylate (Methyl)

Polymerization takes place readily under the influence of catalysts such as light, heat and a variety of foreign substances. It is the difficulty of controlling this ready polymerization that has made the styrene monomer (liquid) objectionable when employed in dental resins. Although control is obtainable through the use of plasticizers (agents which slow down the rate of polymerization or maintain plasticity), the addition of any agent changes or even destroys certain desirable physical properties. Plasticizers are therefore not acceptable.

At present styrenes are used in the monomeric form in conjunction with methacrylate crystals. The latest products utilizing this combination are AcRil, a new denture base material, and Enameltone used in crown and bridge prosthesis.

Polystyrene is crystal clear, possesses unusual dimensional stability, has a low water absorption (0 to 0.5%), unlimited color possibilities, perfect tissue tolerance and is extremely easy to handle.

EQUIPMENT

Only a few inexpensive items of equipment are needed for this technic. (1) A pressing block. This can be a round glass slab or any other object that presents a flat surface of about 3½ inches in diameter and is thick enough to grasp easily and securely with the hand. (2) A sponge rubber kneeling pad such as is sold by household goods stores and is approximately ½ inch thick. A piece about three inches square is all that is needed. This pad is used as the pressing agent for the close adaptation of the material to the fine details of the model. (3) A bunsen burner such as is commonly used in the laboratory. This is an excellent source of heat, but I prefer the heat of the Lenke alcohol blowpipe. This gives a hot, broad, well formed flame cone which can be directed at any specific point. (4) A good vulcanite bur for trimming and polishing.

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Materials

The materials are few. (1) A piece of impression compound from which a form is molded which will press the rubber pad into the vault of the model. (2) A length of brass ligature wire to secure the wire work of the Hawley retainer to the model while processing. (3) A sheet of cellophane to be used as the separating medium between the polystyrene and the rubber pad. (4) A three inch square of polystyrene 3/32 of an inch in thickness.

The Hawley Retainer

Before proceeding with the technic a point should be stressed in connection with the wire work of the case. Regardless of the type, that is, whether labial wire, clasps, or separation maintainers, the anchor ends of the wire must remain free of the palatal surface of the model by about 1/16 of an inch throughout their length. To insure their staying free of the model, the tips of the ends must be bent abruptly toward the cast to form rests which will hold the wire up and free permitting the polystyrene to flow under it. (Fig. 3)

Securing the Wire Work (Figs. 1 and 2)

Since the labial wire is to be secured on the model by a metal ligature it is necessary to make certain that the ligature will not slip. To insure against this the model is notched at each of its posterior corners. After the

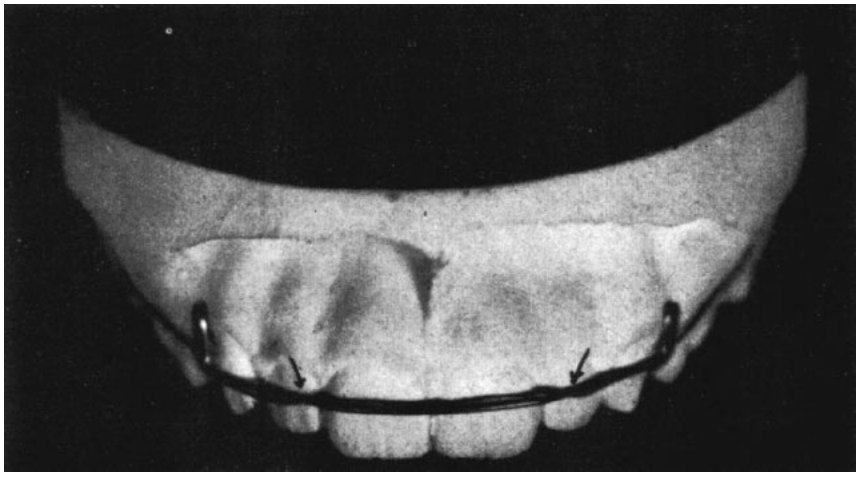

Fig. 1. Securing the wire work. Labial view with arrows indicating bearing points.

labial wire has been fitted into its correct position a piece of brass ligature wire (.020 or .015) is laid parallel and incisally to it and held with the tip of the index finger. The ends of the wire are carried around the model engaging the notches after the ligature has been crossed to the gingival side of the labial wire at each cuspid point. The ligature ends are then twisted tight. The crossing of the labial wire by the ligature at each cuspid area provides double bearing points and holds the fixture firmly in position.

Cuspid loops which are frequently incorporated in the retainer should not be used for securing the labial wire.

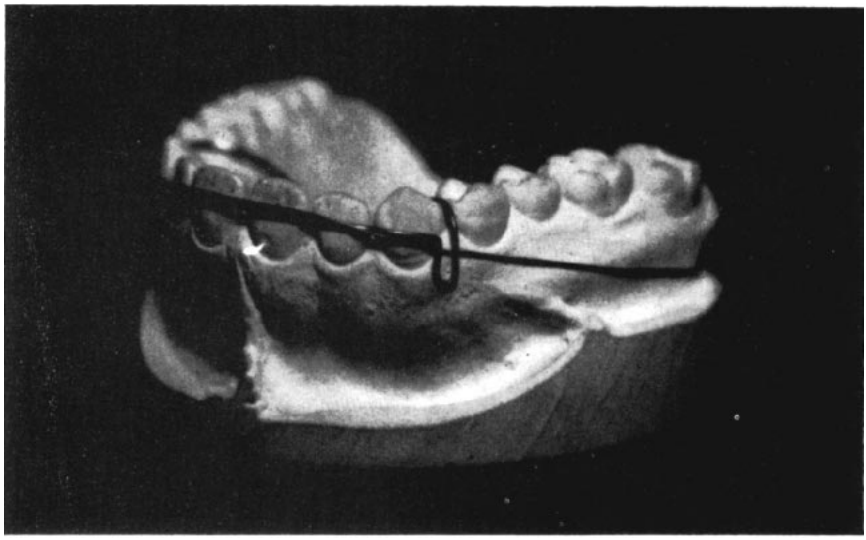

FIG. 2. Securing the wire work. Labial, and buccal view showing crossing of labial retainer wire by the brass securing wire.

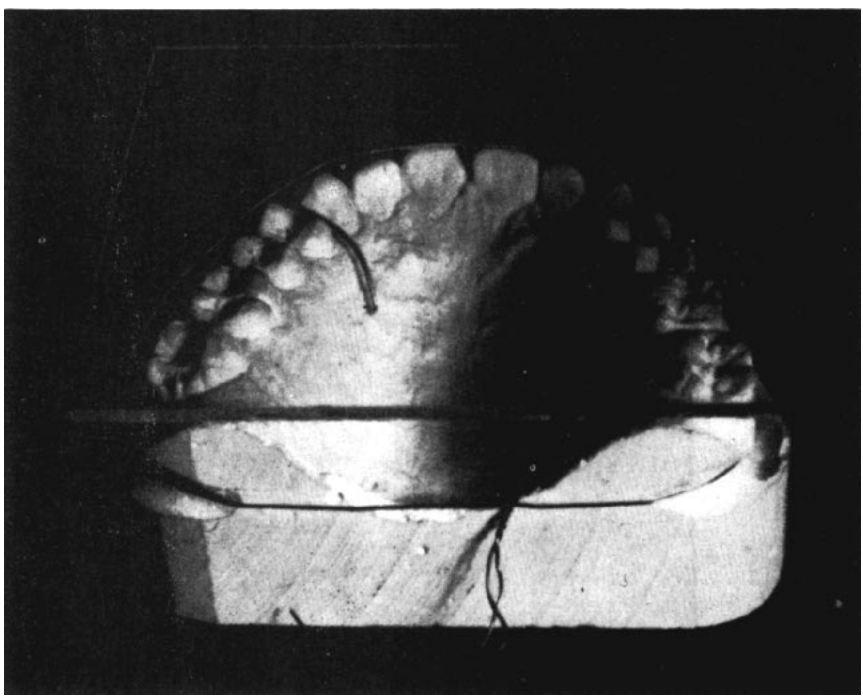

FIG. 3. Relationship of anchor wires to cast and scratchmarked polystyrene prior to trimming.

Trimming the Polystyrene (Figs. 3 and 4)

It is necessary to trim the square of polystyrene to the arch form of the model so that the excess material will not bend labially and buccally, thus preventing the material from sagging freely into the vault while heating. Uninhibited sagging insures uniform thickness in the highest part of the vault and at the edges of the retainer.

The three inch square of polystyrene 3/32's of an inch in thickness is placed on the occlusal of the model allowing an edge to extend about ½

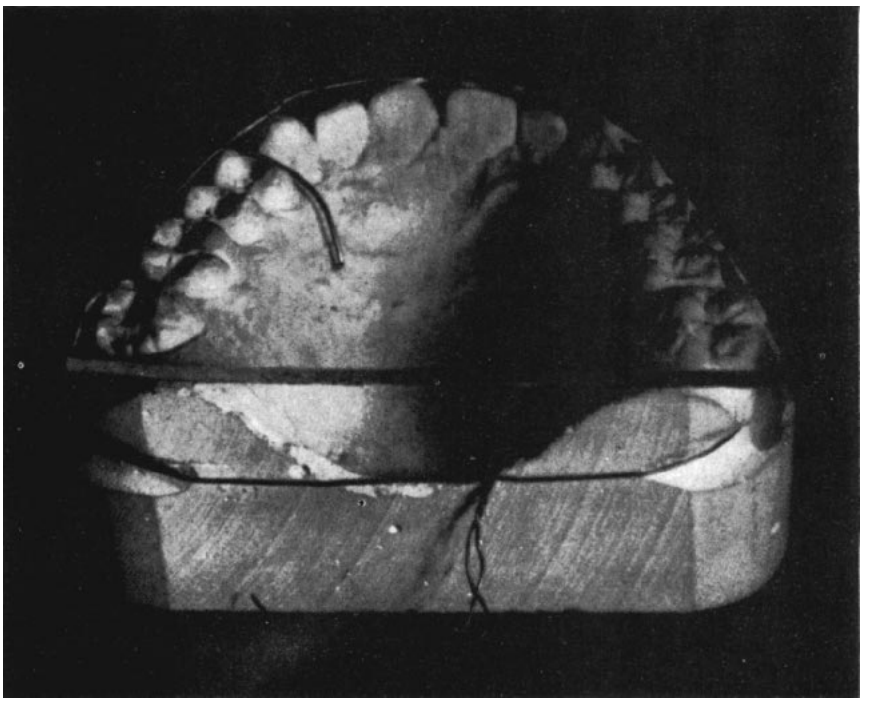

Fig. 4. Trimmed polystyrene in place ready for heating.

inch posterior to the last teeth to be included in the retainer. A line that follows the arch form of the case as determined by the labial and buccal surfaces of the teeth is scratched on the polystyrene. The square is then held over the flame and, when soft, trimmed to this line with shears.

The Palate Form (Figs. 5 and 6)

To insure the molding of the polystyrene into the details of the vault, a form is made which will press the rubber pad into the vault during the pressing operation. To produce this form a piece of compound is molded into a shape similar to the hull of a boat. The top of the form is flat and

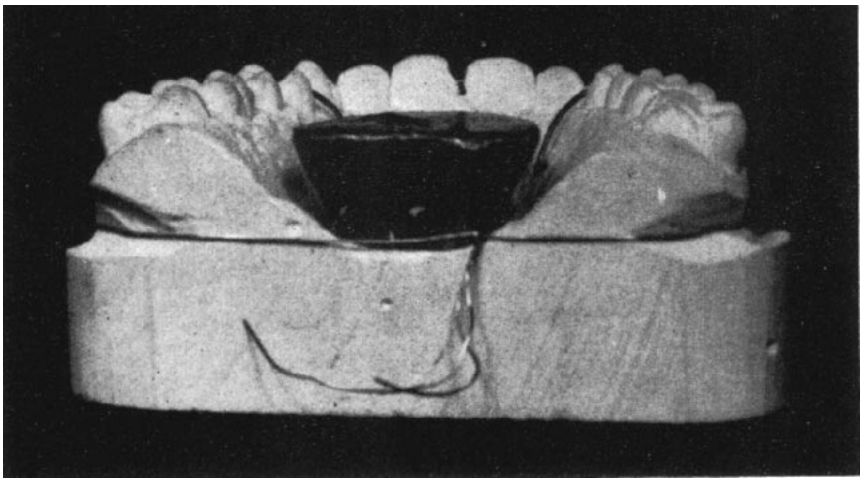

FIG. 5. Posterior view of "boat" showing relation to model.

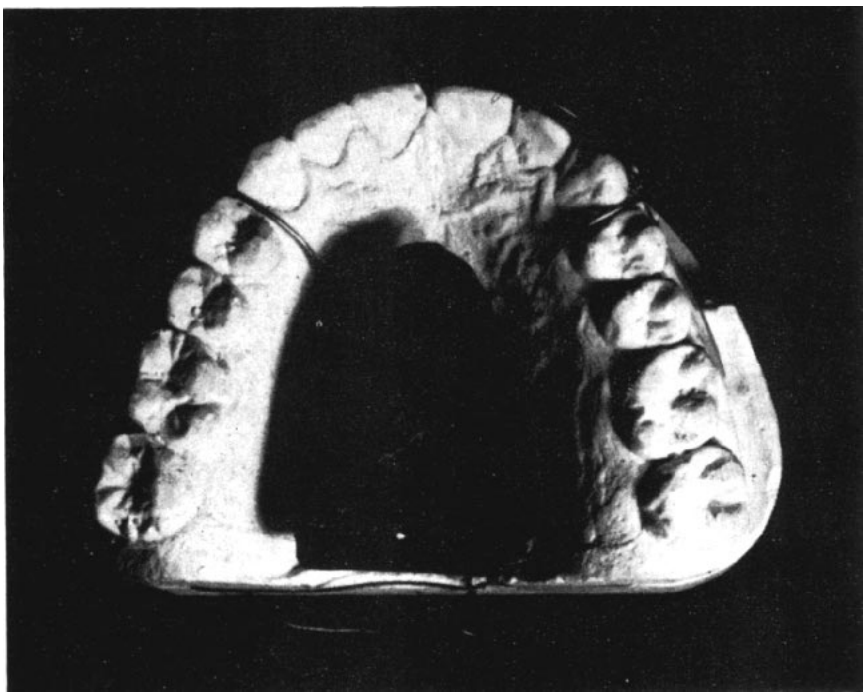

FIG. 6. Occlusal view of "boat" showing relation to model.

on a level with the gingival margins of the teeth. The sides of the form taper toward and touch the mid-line of the palate from the deepest part of the vault to the posterior border of the cast. Its anterior and lateral

borders are free from the model by approximately ½ inch. The clearances established allow for the thickness of the polystyrene and the rubber pad.

The Process

1. The model is dampened. The correct degree of dampness is comparable with that of a freshly poured and separated model. The importance of this dampness cannot be overestimated since it is the separating medium between the plaster and polystyrene.

2. The sheet of cellophane is dampened, perforated in its center a few times and placed loosely over the rubber pad. The perforations allow the escape of air and steam through the cellophane from the vault portion where they would otherwise be trapped and cause the formation of a sharp ridge. Placing the cellophane loosely over the rubber pad provides the excess necessary to prevent the cellophane from splitting when pushed into the palate.

3. The trimmed polystyrene is placed in position on the model and the flame gently applied, starting with the underside which is reached through the opening at the posterior of the vault and transferring the heat to the upper surface when the hot polystyrene sags into the vault and obliterates the opening. While heating the upper surface, the flame is passed frequently around the periphery, allowing the flame to heat the anchor wires in passing. Warming the wires insures the flow of hot polystyrene around them. (Fig. 4)

The pressing time is indicated by surface flashes. When these flashes occur readily at any point the flame is put aside.

4. The rubber pad and cellophane are placed cellophane downward on the polystyrene; (Fig. 7) the palate form is put in its approximate position, and the pressing block placed over all and pressed firmly and evenly

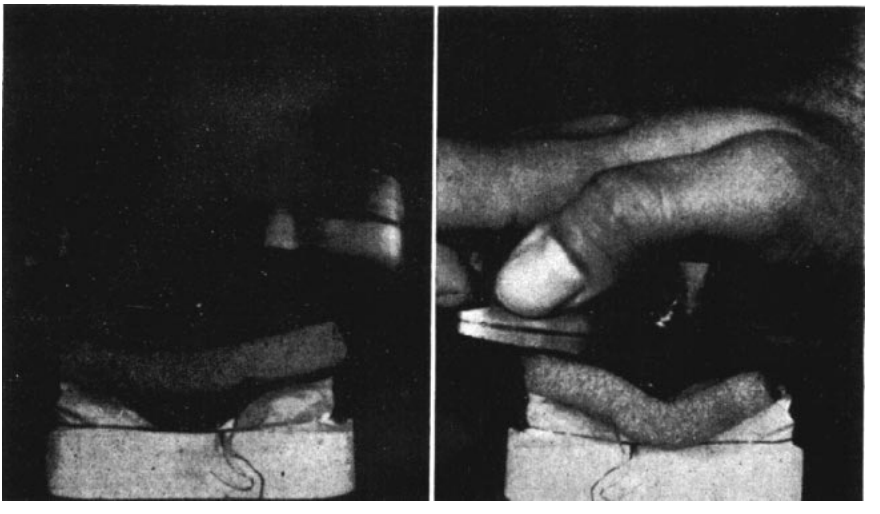

Fig. 7. Assembled press. From top to bottom, glass slab, "boat," sponge-rubber pad, cellophane, polystyrene, and model.

Fig. 8. Pressing.

on the incisal and occlusal surfaces of all of the teeth. The pressure need not be excessive but it must be sufficient to compress the rubber pad well down over the teeth. (Fig. 8)

The pressure is maintained for at least 1½ minutes.

5. The pressing block, palate form, and rubber pad are removed. The cellophane is peeled from the retainer. The brass securing wire is cut, and the retainer teased carefully from the model. The retainer should be clear and smooth showing the minute details of tissue and sharp gingival adaptation heretofore unobtainable by other methods. The greater excesses of material are removed with a Joe-Dandy disk, and the remainder trimmed with a vulcanite bur.

The Bite Plane

To incorporate a bite plane during the process a ¼ inch excess is allowed in the incisal area when trimming the polystyrene. While heating during the process this excess is folded over to the lingual of the incisal teeth. During the pressing operation the pressure is relaxed somewhat over the incisal area. Sufficient bulk is obtained in this manner lingual to the incisor teeth to carve a bite plane with the vulcanite bur.

Annealing

Polystyrene is classified as a hard rigid plastic and as such it cannot stand too much flexing. The sheet form in which it is received has been annealed by the manufacturer after molding, and consequently is no longer brittle. Compression molding such as the procedure indicated causes lines of stress and strain in any plastic and although they are invisible their presence may cause breakage. In order to remove the lines of stress and strain and give the retainer or other object made in this manner strength, it should be annealed before placement.

The retainer is annealed by placing it in a dry heat oven at 160 degrees Fahrenheit for a minimum of fifteen minutes. It should cool slowly. The temperature indicated will not cause distortion, thus the retainer may be annealed without the model.

Conclusion

Polystyrene is adaptable to other phases of dentistry. Having mastered the technic referred to in this article and having understood its principles the operator may produce many other devices with only slight changes in technics. Bite blocks, mouth screens, temporary adult partial dentures, children's dentures with replacement of anterior teeth, and bite rims or denture base plates are only a few of the possible uses for polystyrene and each of them can be made with equal rapidity.

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