Definitive Casts & Dies

- The definitive cast (or master or working cast) is the replica of the prepared teeth, ridge areas, and other parts of the dental arch.

- A die is a positive replica of the individual pre pared tooth on which the margins of the wax patterns are finished.

- These are individual tooth replicas prepared for easier handling during wax pattern fabrication and finishing of inaccessible areas of the cast.

A

B

C

Fig. 17-1
Removable die system. **A,** Definitive cast. **B,** The individual dies. **C, Epoxy die.** *(C, Courtesy of Dr. J. H. Bailey.)*

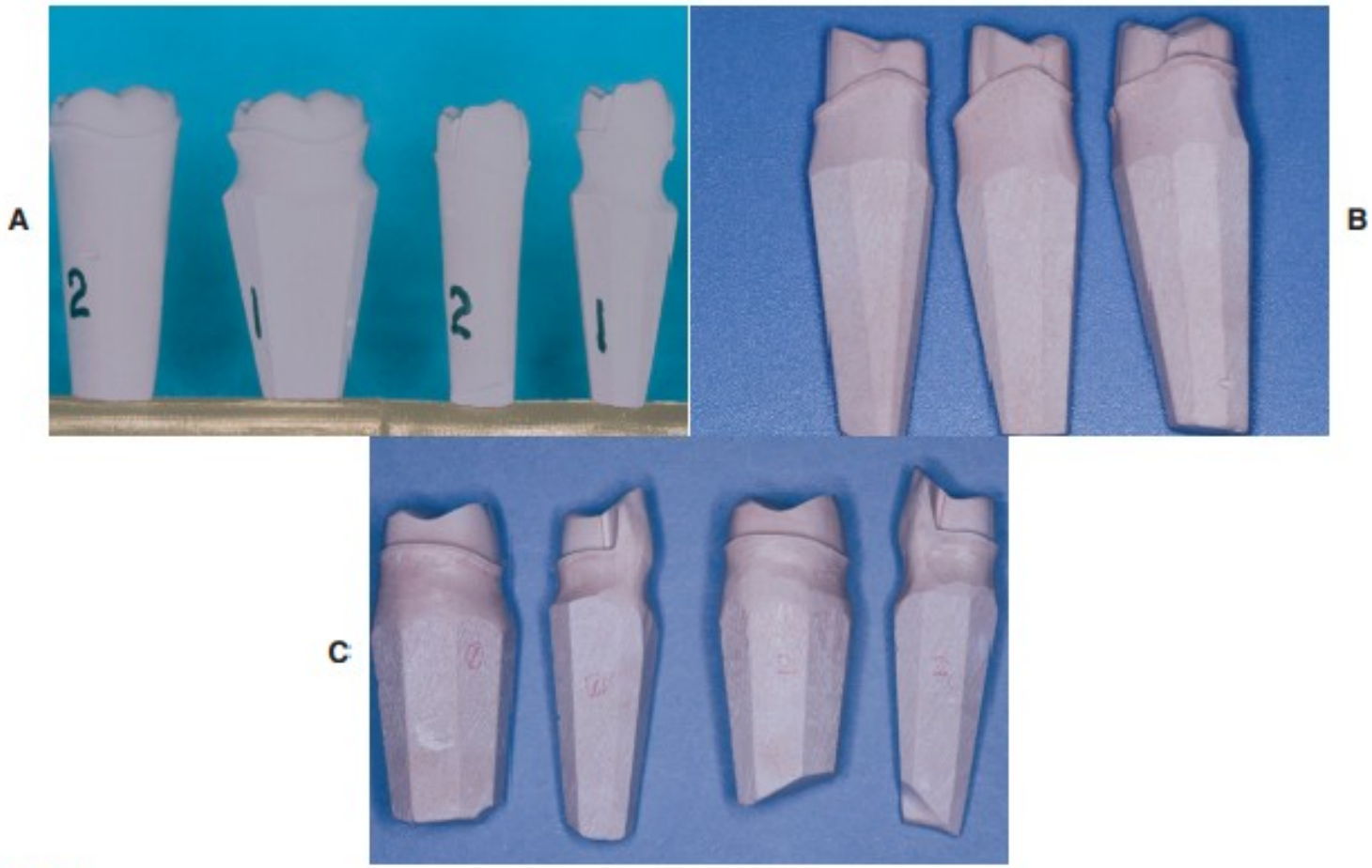


Fig. 17-2
A to C, Examples of individual dies.

Ideal Requirements of a definitive cast

- Reproduce both prepared and unprepared tooth surfaces
- Unprepared teeth immediately adjacent to the preparation must be free of voids
- All surfaces of any teeth involved in anterior guidance and the occlusal surfaces of all unprepared teeth must allow for precise articulation of the opposing casts
- All relevant soft tissues should be reproduced in the definitive cast, including all edentulous spaces and residual ridge contours that will be involved in the fixed prosthesis

Ideal Requirements of a Die System

- Must reproduce the prepared tooth exactly

- All surfaces must be accurately duplicated, and no bubbles or voids can be accepted

- Remaining unprepared tooth structure immediately cervical to finish line should be easily discernible on die, ideally with 0.5 to 1 mm visible

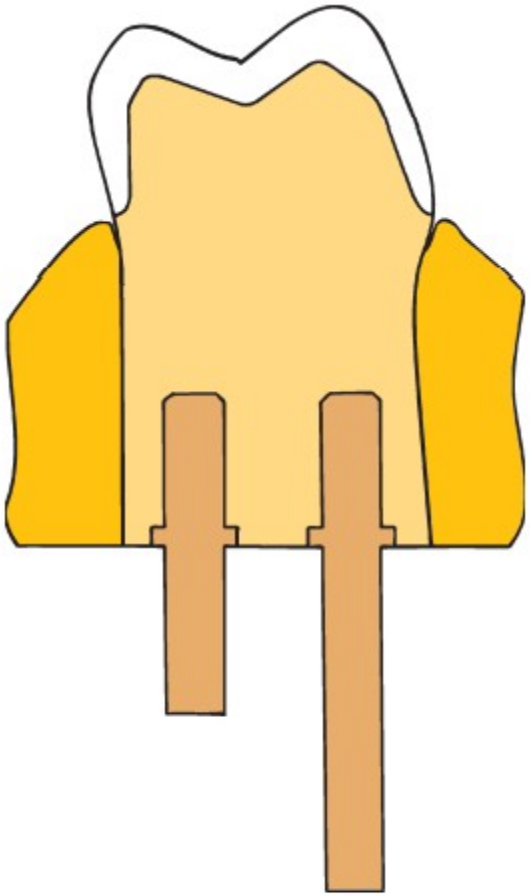


Fig. 17-4

To facilitate trimming, the impression should extend beyond the preparation margin. A properly trimmed die must have the same cervical contour as the tooth. (The gold areas indicate the parts of the die to be removed during trimming.)

- Adequate access to the margin is imperative. The die should be easy to remove and replaced in its original position.
- The die must be stable when placed in the cast. It should be easy to mount in the articulator.

CLASSIFICATION OF DIE MATERIALS :

1. Inorganic materials

a. Die stone, based on calcium sulfate hemihydrate Eg. Velmix

b. Dental cement – zinc silicophosphate

c. Ceramic materials, fired at 600^{0}C

2. Metallic materials

a. Dental amalgam

b. Metal sprayed dies (Bismuth-tin alloy)

c. Electroplated dies

   i. Copper plated

   ii. Silver plated

- **3. Polymeric materials**
  a. Auto-polymerizing acrylic
  b. Other resins which polymerize at room temperature.
- Eg. Epoxy resins
- **4. Composite materials**
  a. Polymer / metal composites with polyester polymer
  b. Polymer / ceramic composites based on epimine polymer
- **5. Flexible Die materials**
- similar to heavy-bodied silicone or polyether impression materials
- used to make interim restorations or indirect composite resin inlays or onlays chairside

SELECTION CRITERIA

1.The material must allow a dimensionally accurate cast and should be strong and resistant to abrasion.

2.It should be easy to section and easy to trim with the routinely available equipment.

3.It should be compatible with the separating agent that will be used so that the wax pattern does not stick.

4.It should reproduce surface detail accurately.

5. It should be available in a color that contrasts with the wax used so that the preparation margin can be seen.

6. It should be easily wettable by the wax. In addition, it must be compatible with the impression material.

7. The type of restoration needs to be considered, because certain procedures (e.g., some all ceramic crowns) require the strength of metal or epoxy resin and cannot be fabricated as readily on a weaker stone die.

Table **17-1 DIE MATERIALS**

	Advantages	Disadvantages	Recommended use	Precautions
ADA type IV stone	Dimensional accuracy Straightforward technique Low cost Straightforward in-office procedure	Will be damaged if not handled carefully	Most situations	Accurate proportioning essential Vacuum mix recommended
ADA type V stone	Straightforward technique Low cost Straightforward in-office procedure Harder than type IV	Increased expansion	Most situations	Accurate proportioning essential Vacuum mix recommended
Epoxy resin	High strength Good abrasion resistance	Polymerization shrinkage Time-consuming, complex procedure	Complete ceramic crowns	Not compatible with polysulfide or hydrocolloid
Electroplating	High strength Good abrasion resistance	Time-consuming Special equipment needed	Complete ceramic crowns	Silver entails use of cyanide, which is toxic Incompatible with many impression materials

ADA, American Dental Association.

Types of Dies

Based on the design, die systems can be classified into:

1. Working cast with separate die system
2. Working cast with removable die system

There are three commonly used removable die systems, they are:

- Dowel pin system
  - * Straight
  - * Curved
- Di-Lok tray system
- Pindex system
- DVA Model System

- Accutrac system

Working Cast and Separate Die System

- Two casts are poured from a single impression
- First pour - Impression is poured in type IV or V stone in the area of the preparation or preparations only. When set, it is separated.
- A second pour is then made of the entire arch.
- The wax pattern is prepared on the die (first pour) and later transferred to the working cast (second pour).

Advantage

- Simplest and easiest method
- Slightly more accurate

Disadvantage

- The wax pattern may get distorted while transferring it from the die to the cast
- Seating the pattern on the definitive cast may be problematic because the second pour of many impression materials is slightly larger than the first; therefore, it may be necessary to relieve the stone slightly to seat the pattern before occlusal evaluation.
- The technique can be used only with elastomeric impression materials

Working Cast with a Removable Die System

Special type of working cast is prepared and the dies are carefully sectioned so that the individual dies can be removed and replaced in their original position in the cast.

1. Dowel pin systems,
2. Di-Lok tray systems
3. Pindex systems
4. DVA Model System

Dowel Pin Systems

Dowel pins may be straight or curved

Straight dowel pin systems

They are prepared using two techniques,

- Pre-pour
- Post-pour

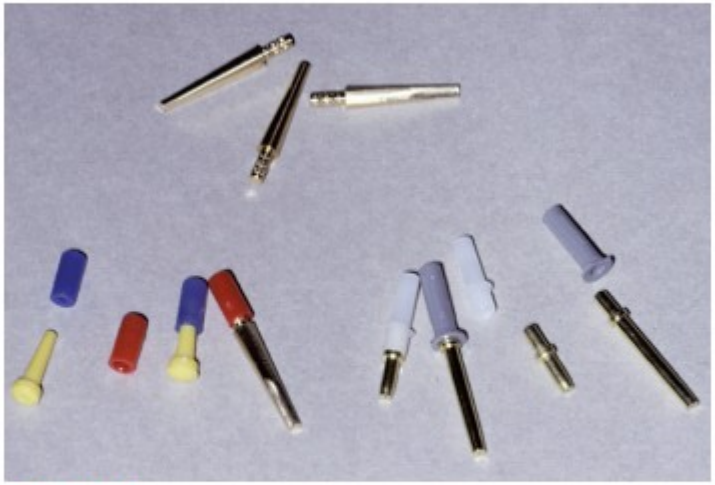


Fig. 17-5
Dowel pins.

Pre-pour technique

Here the die pins are positioned in their appropriate places within the impression using bobby pins and sticky wax

After positioning the pins, the impression is poured up to the level of the alveolar process of the remaining teeth

- Separating medium is applied over the first pour and die pin and the remaining portion of the cast is poured
- After the cast is set, the dies are sectioned by placing vertical sections on the interproximal regions of the cast using a die sectioner or a manual saw.
- Vertical sections at the interproximal regions should be made without damaging the contour of the adjacent teeth

- Since the separating medium was applied before pouring the second half of the cast, the dies can be easily separated with vertical sections alone.
- The die is carefully separated from the cast without chipping.
- After removing the die, a small hole will be visible in the cast. This indexing hole will guide the pin into position while replacing the die.

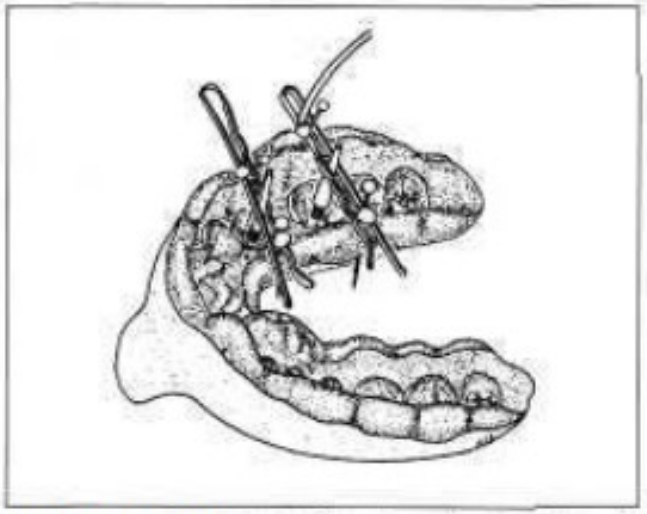


Fig 18-18 Dowel pins are positioned over the impression with bobby pins.

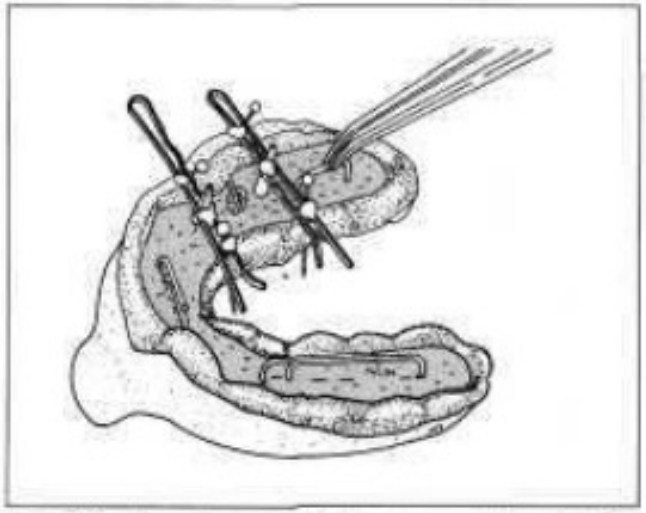


Fig 18-19 Paper clips are added to nonremovable parts of the unset first pour to provide retention for the second pour of stone.

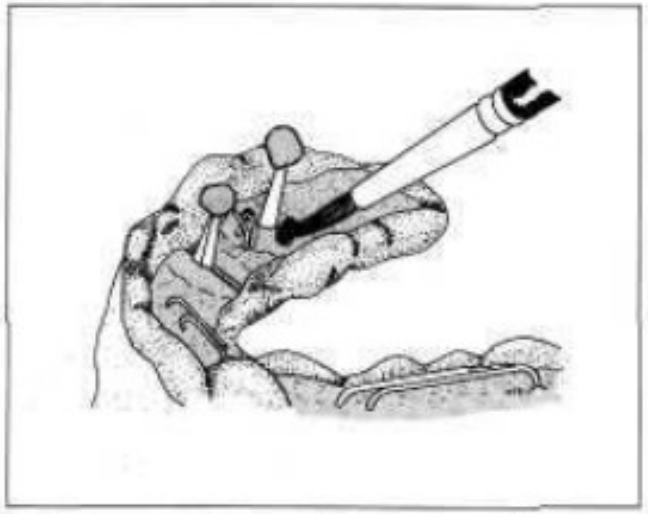


Fig 18-20 The stone around the dowel pins is lubricated.

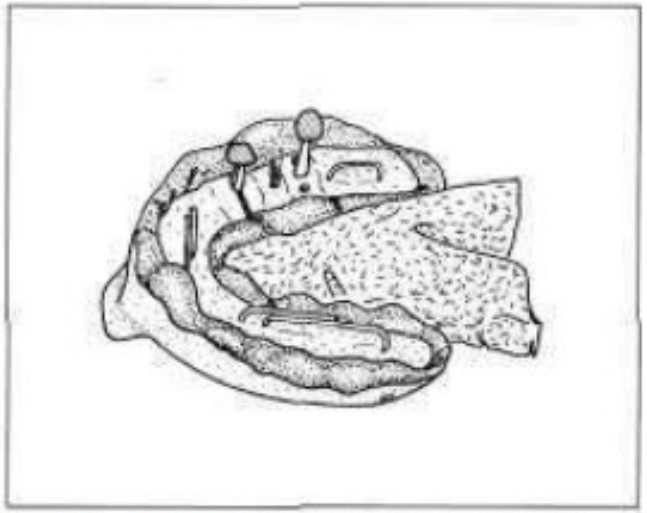


Fig 18-21 A wet paper towel can be used to fill in the open, center portion of the impression.

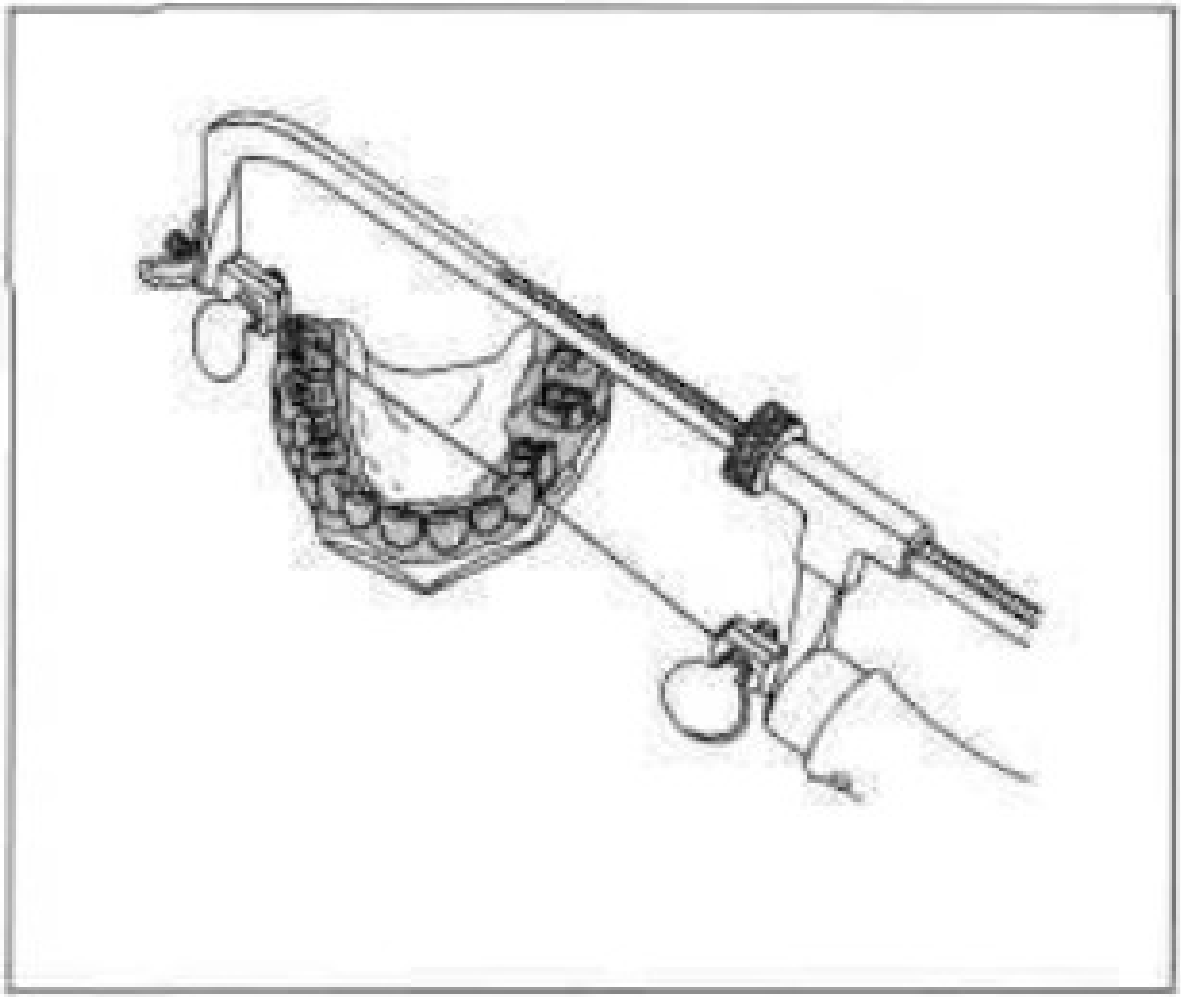


Fig 18-23 Dies are separated from the rest of the cast with a fine saw.

Post-pour Technique (cemented pin technique)

- Cast is poured up to the level of the crowns of the teeth in the impression.

- Subsequently, small holes are drilled within the first pour in the required places and the dowel pins are cemented into the holes.

- The remaining part of the cast is poured and the dies are sectioned as described in the pre-pour technique.

Advantages

. Easy to prepare

. No special equipment is necessary

Disadvantages

. The pins may get displaced while pouring the cast.

Curved Dowel Pin System

This is similar to straight dowel pin technique except that curved pins are used.

The curved pins will project from the sides of the base of the cast.

When the projecting pins are pressed, the die unit attached to the respective pin will pop out from its place

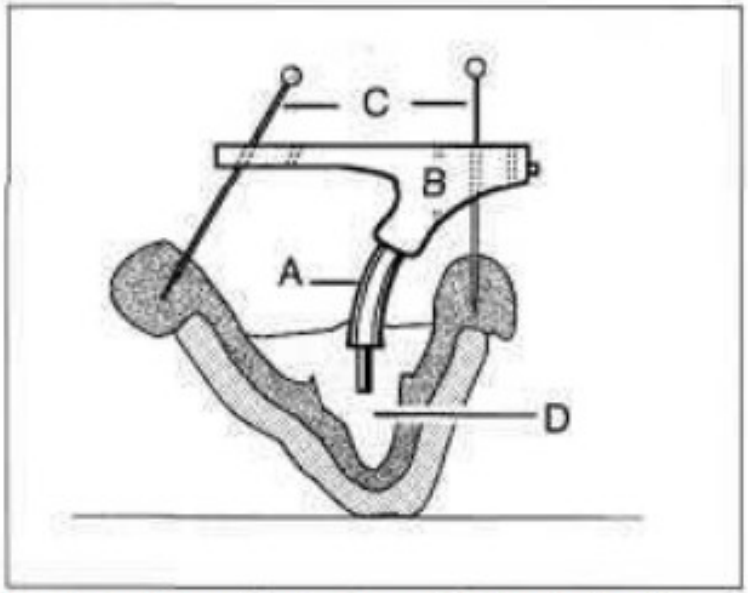


Fig 18-28 Croi-. section ..t an impression showing the relation of a curved dowel (A), positioning bar (Bt, straight pins (t), and first pour of die stone (Di to the impression.

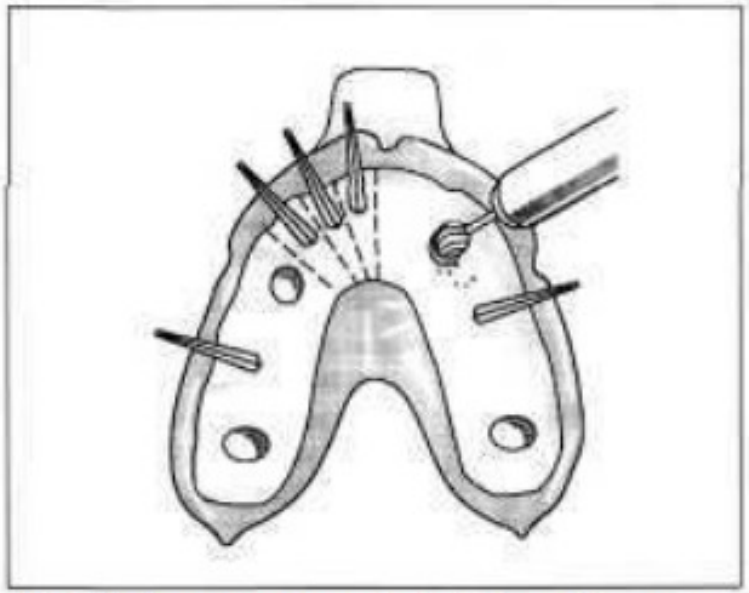


Fig 18-29 Depressions are made about 2.0 mm deep on either side of the dowels in the two large segments of the cast that will carry the unprepared teeth. The broken lines indicate where the cast will be sectioned later.

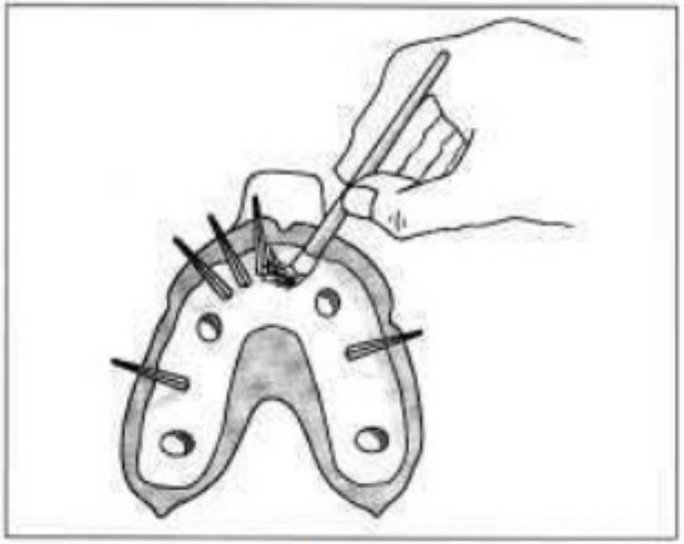


Fig 18-30 Thin mat of petrolatum is applied to the stone and dowels.

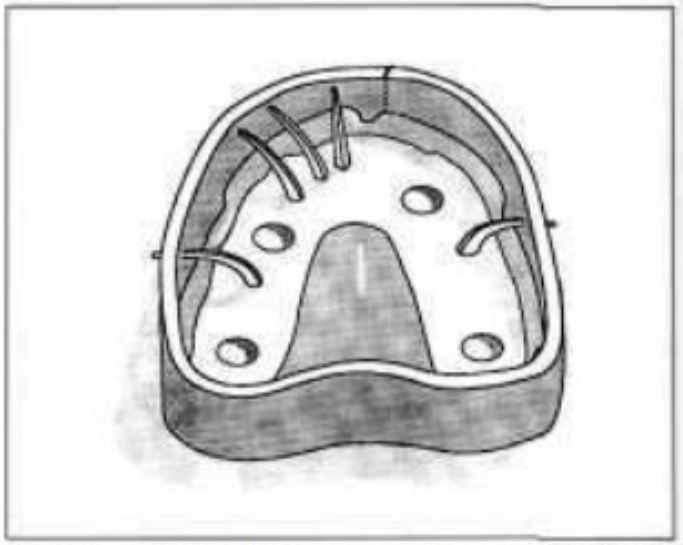


Fig 18-31 Boxing wax is placed around the impression, with the tips of the dowels sticking through.

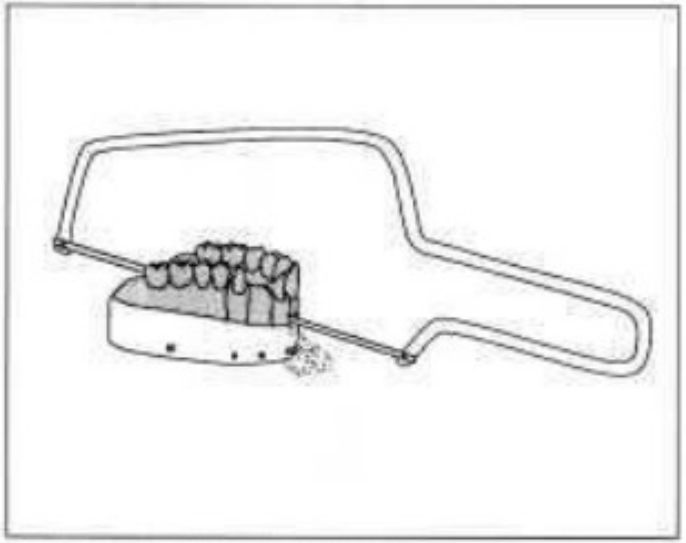


Fig 18-32 The completed cast is sawed.

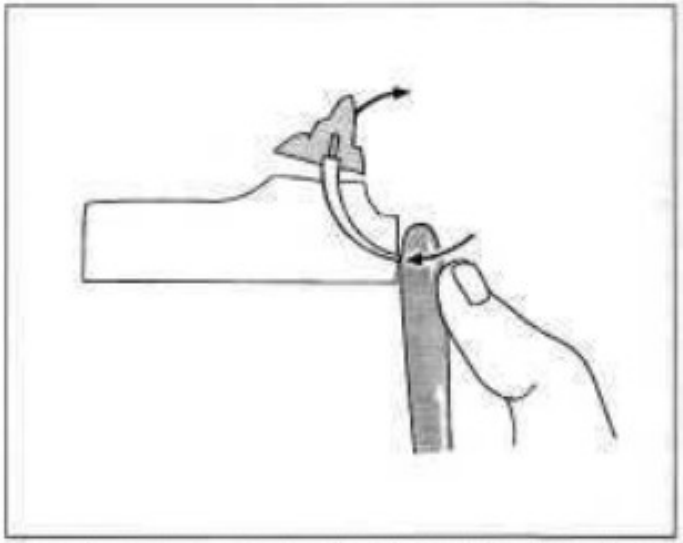


Fig 18-33 A segment is removed by pressing on the exposed tip of its curved dowel.

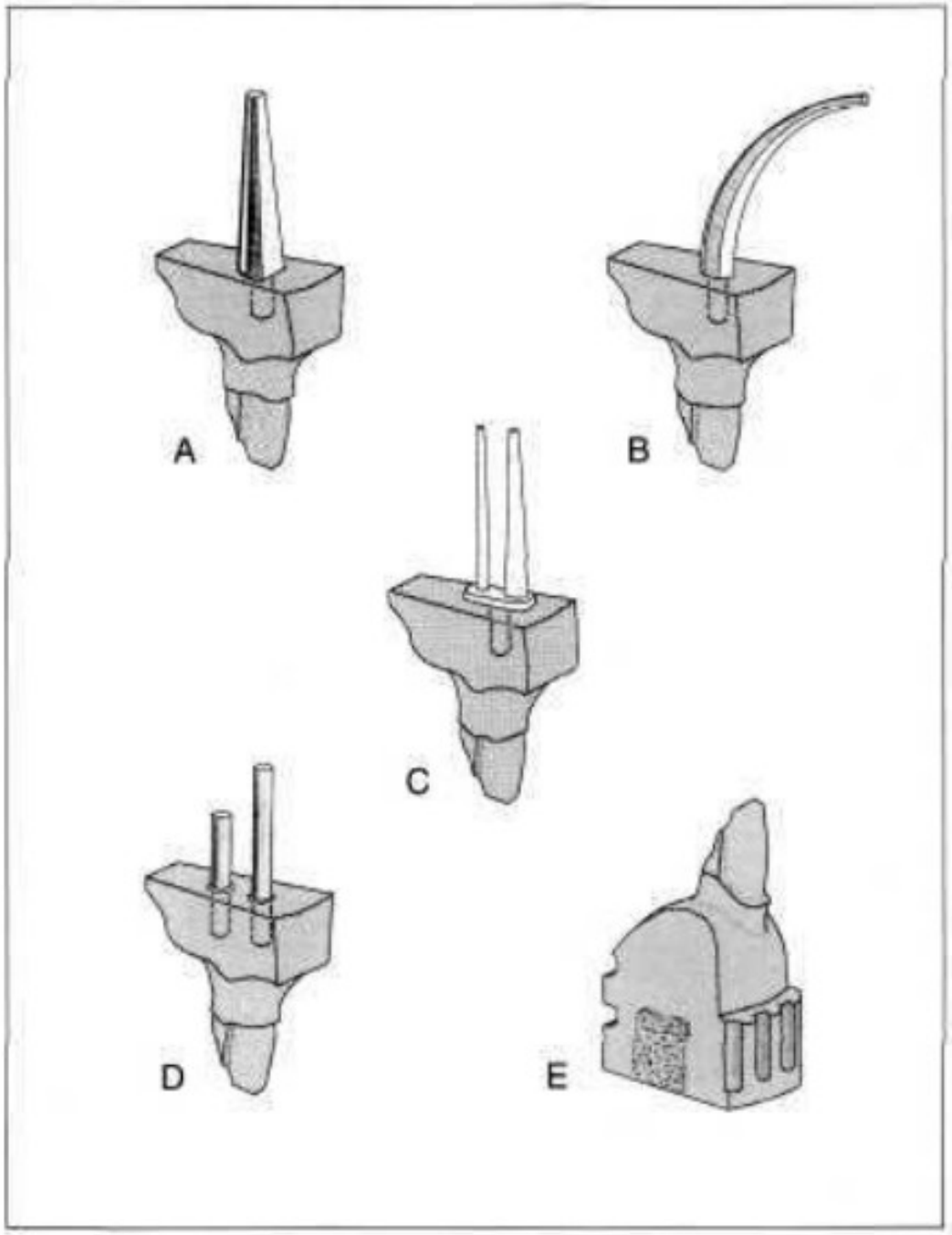


Fig 18-17 Types of antirotational devices used for removable dies: A, flat-sided single dowel; B, single curved dowel; C, double straight dowels with a common head; D_H two separate parallel dowels; E, keyed plastic outer tray.

Di-Lok Tray System

The Di-Lok technique involves the use of a specially articulated tray for precise reassembly of a sectioned definitive cast.

The impression is poured, and the cast is trimmed into a horseshoe configuration that fits in the special tray.

The tray is filled with a second mix, and the cast is seated.

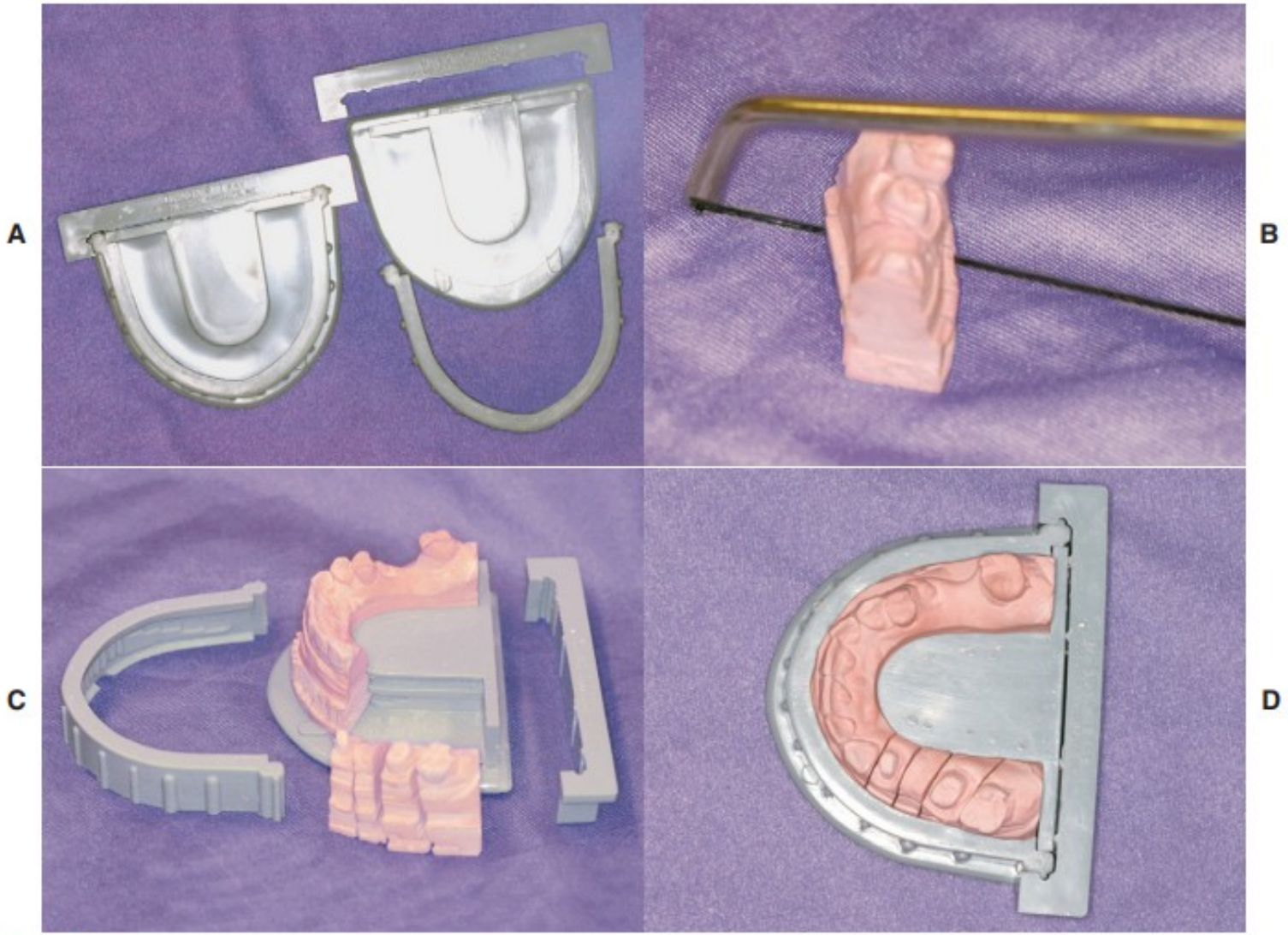


Fig. 17-9

The Di-Lok system. **A,** The system involves the use of specially segmented trays. With a single-pour technique, the impression is formed in the usual way, and the Di-Lok tray is filled. Then the tray is inserted into the impression while the stone is still wet. After the die stone has fully set, the locking and curved arms of the tray are removed. The cast can then be removed by tapping the anterior pad of the tray base. **B,** The dies are sectioned by sawing three-fourths through the stone and are separated by breaking the remaining stone base. **C,** Trimmed dies. **D,** Assembled cast ready for articulating. *(Courtesy of DentiFax/Di-Equi, Buffalo, New York.)*

Di-Lok Tray System

When the stone has set, the tray is disassembled, saw cuts are made on each side of the preparation, and the resulting die is trimmed.

The cast and die can be reassembled in the tray, which is then mounted on an articulator.

Advantages

Simple and easy to prepare

The cast can be mounted in an articulator

Disadvantages

Requires special equipments

Overall size of the tray can make articulation and manipulation awkward and difficult

Pindex System

Similar to the post-pour dowel pin technique.

Special drill press equipment is used to do die sectioning.

The drill press has a platform with a slot like opening through which the drill pin will project during the procedure.

Pindex System

The entire platform is spring mounted and when pressed down automatically starts the drill, which will project through the slot.

The unit has a red pilot light lamp on top, which will shoot a point exactly on the drill.

This red pilot pointer will act as a guide while drilling.

Die sectioning procedure is simple wherein the cast of 15 mm base is placed on the drill press and drill holes are prepared in the under surface of the base of the cast using the pilot light as a guide.

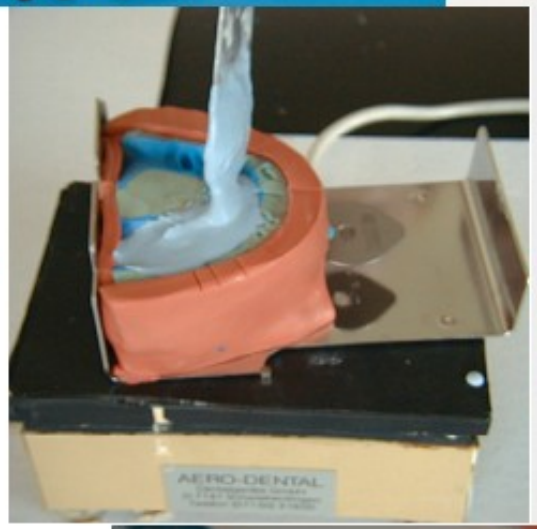
After making the drill holes to the required depth, sleeved die pins are placed and cemented using cyanoacrylate adhesive.

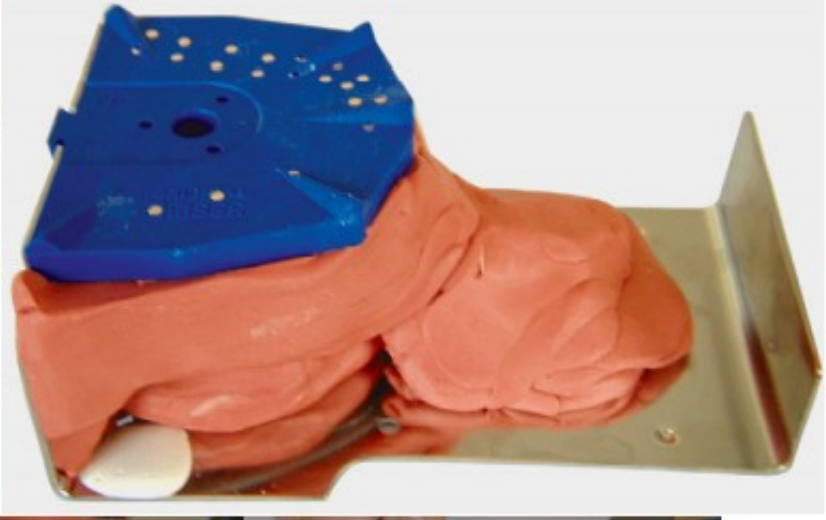
After cementing the pins, a base is poured over the base of drilled cast.

A,B

C,D

E





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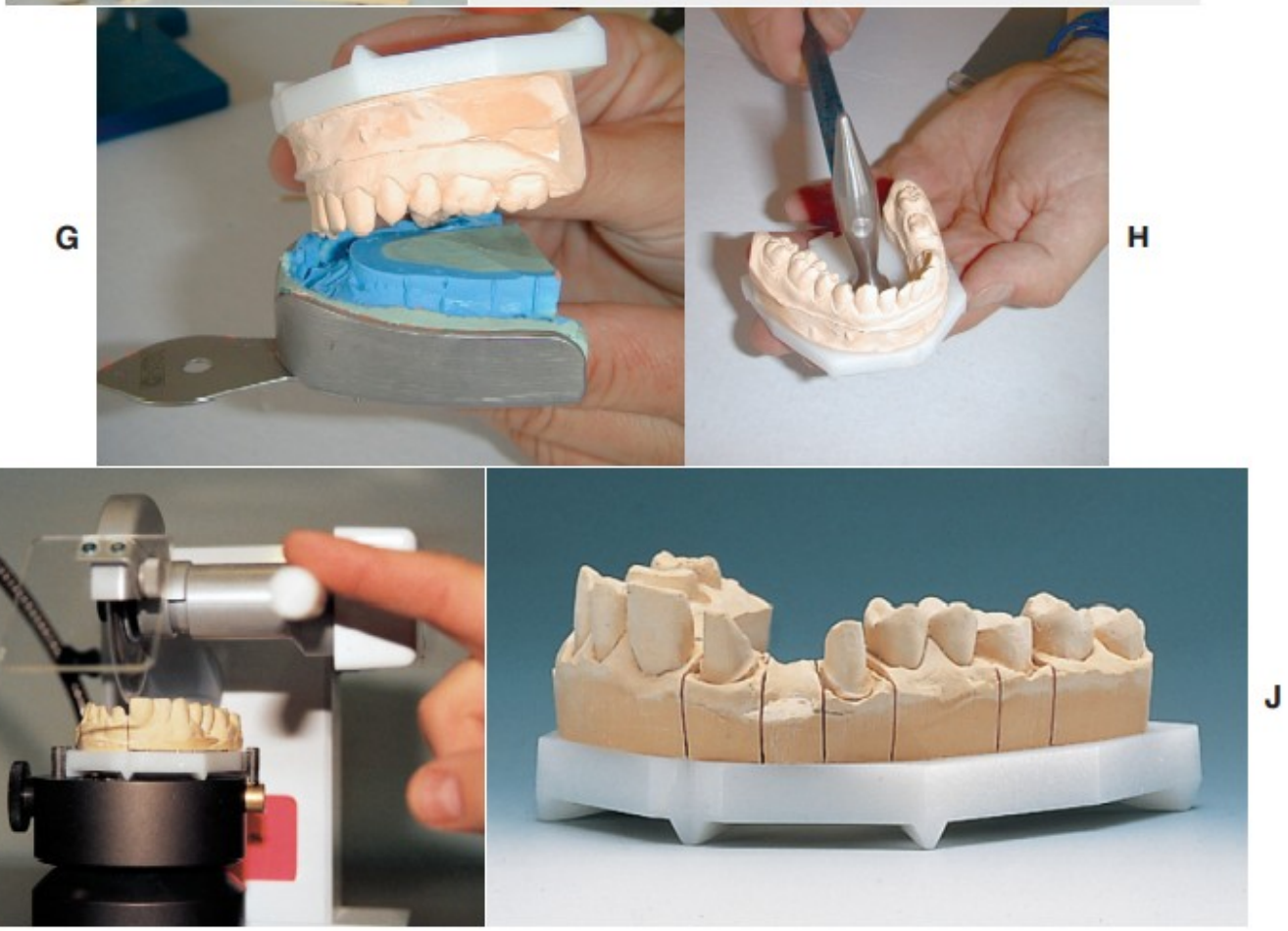


Fig. 17-11

A, Zeiser model system. **B**, The impression is leveled, blocked out with silcone putty, and positioned over the baseplate. **C**, The pin locations are determined and the pinholes drilled in the base. **D**, Pins are inserted into the base. The impression is poured (**E**) and the base inverted into the stone (**F**). **G** and **H**, The cast is separated from the impression when set and then separated from the base. **I**, A precision saw aids sectioning. **J**, The sectioned cast. *(Courtesy of Amann Girrbach GmbH, Koblach, Austria.)*

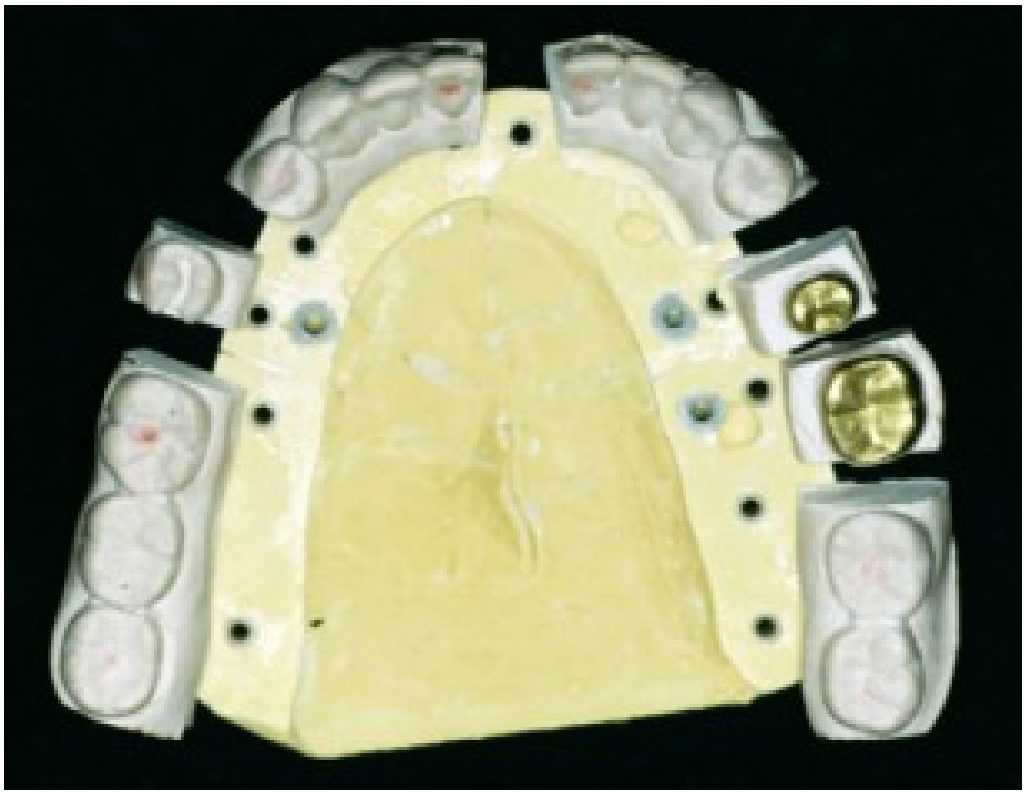


Fig. 17-6

Removable dies made with the Pindex (Whaledent) dowel system (see Fig. 17-21). *(Courtesy of Coltène/Whaledent AG, Altstatten, Switzerland.)*

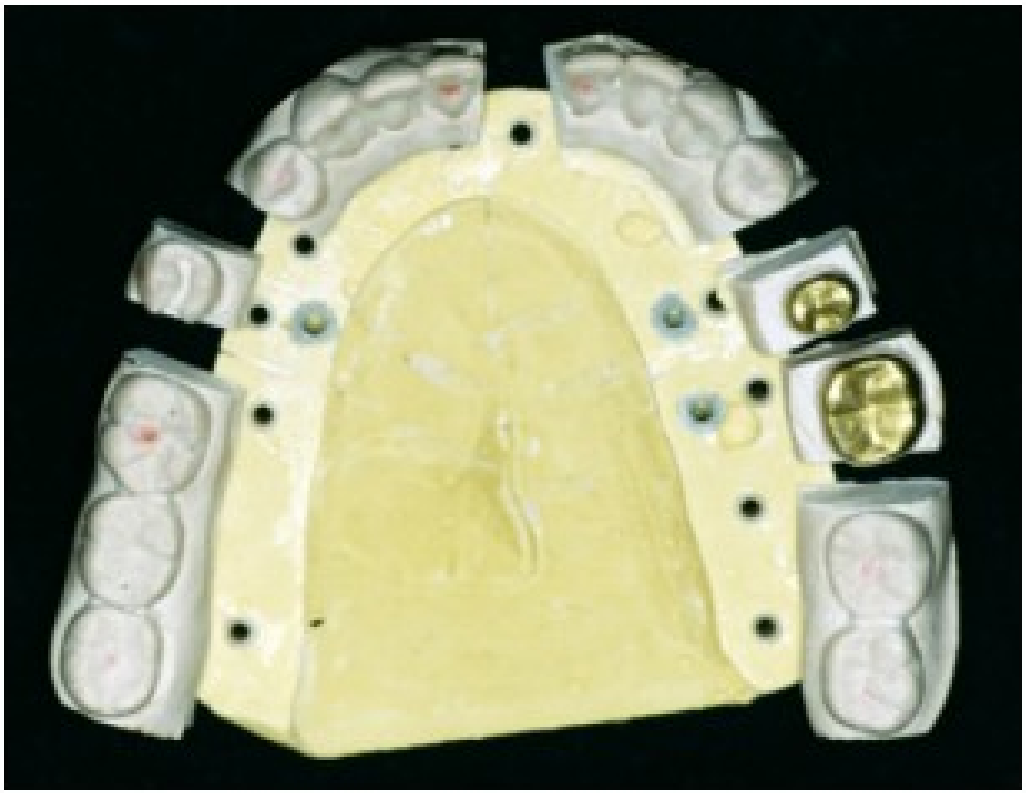


Fig. 17-6

Removable dies made with the Pindex (Whaledent) dowel system (see Fig. 17-21). *(Courtesy of Coltène/Whaledent AG, Altstatten, Switzerland.)*

Advantages

Allows accurate placement of the die pins

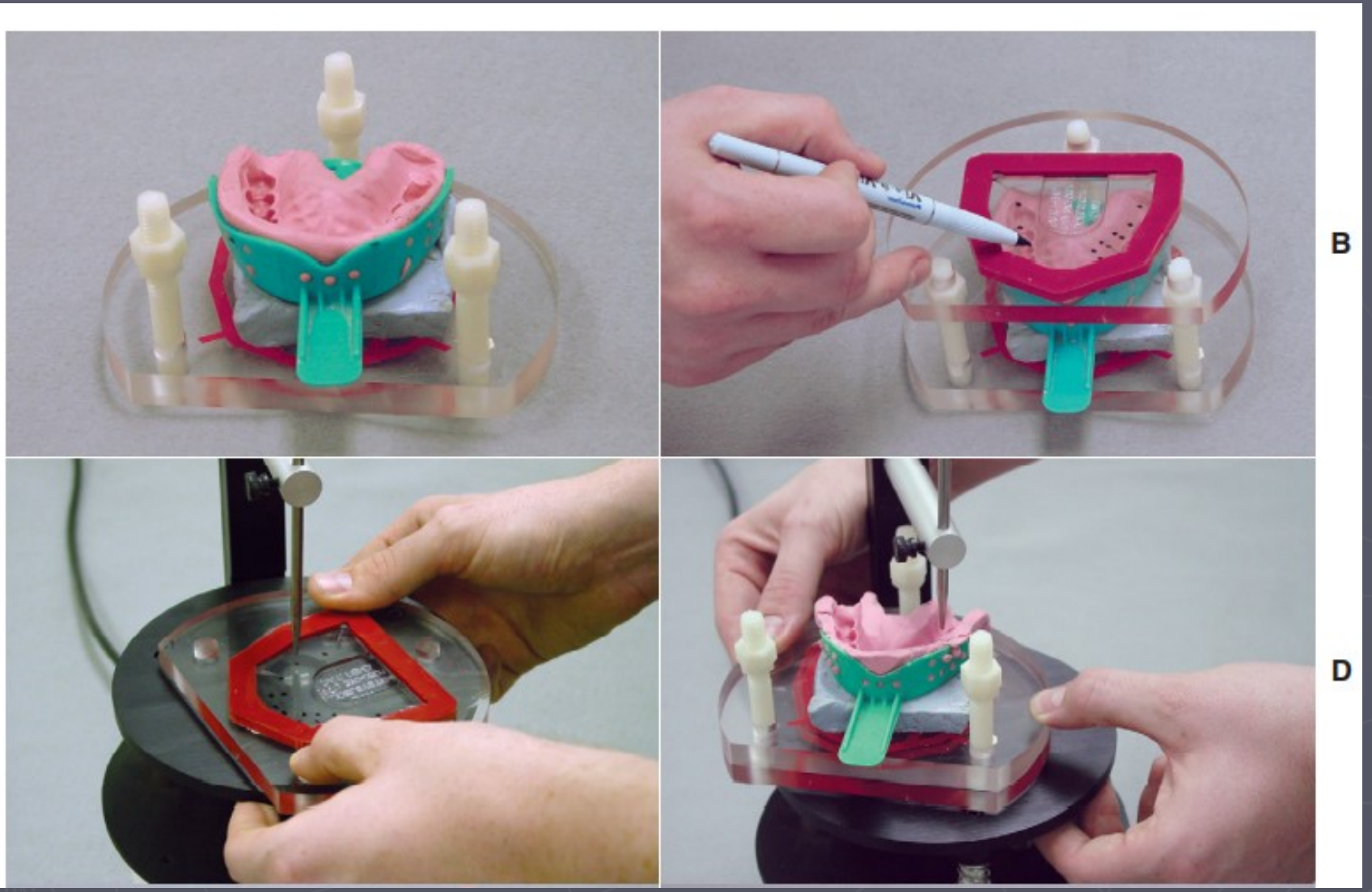
Disadvantages

Special equipment is required

The DVA Model System

The DVA Model System and the Zeiser model system use a precision drill and special baseplates that are aligned and drilled to provide die removal.

These systems offer the advantage of allowing for the expansion of stone, which is relieved by the saw cuts.


A
B
C
D

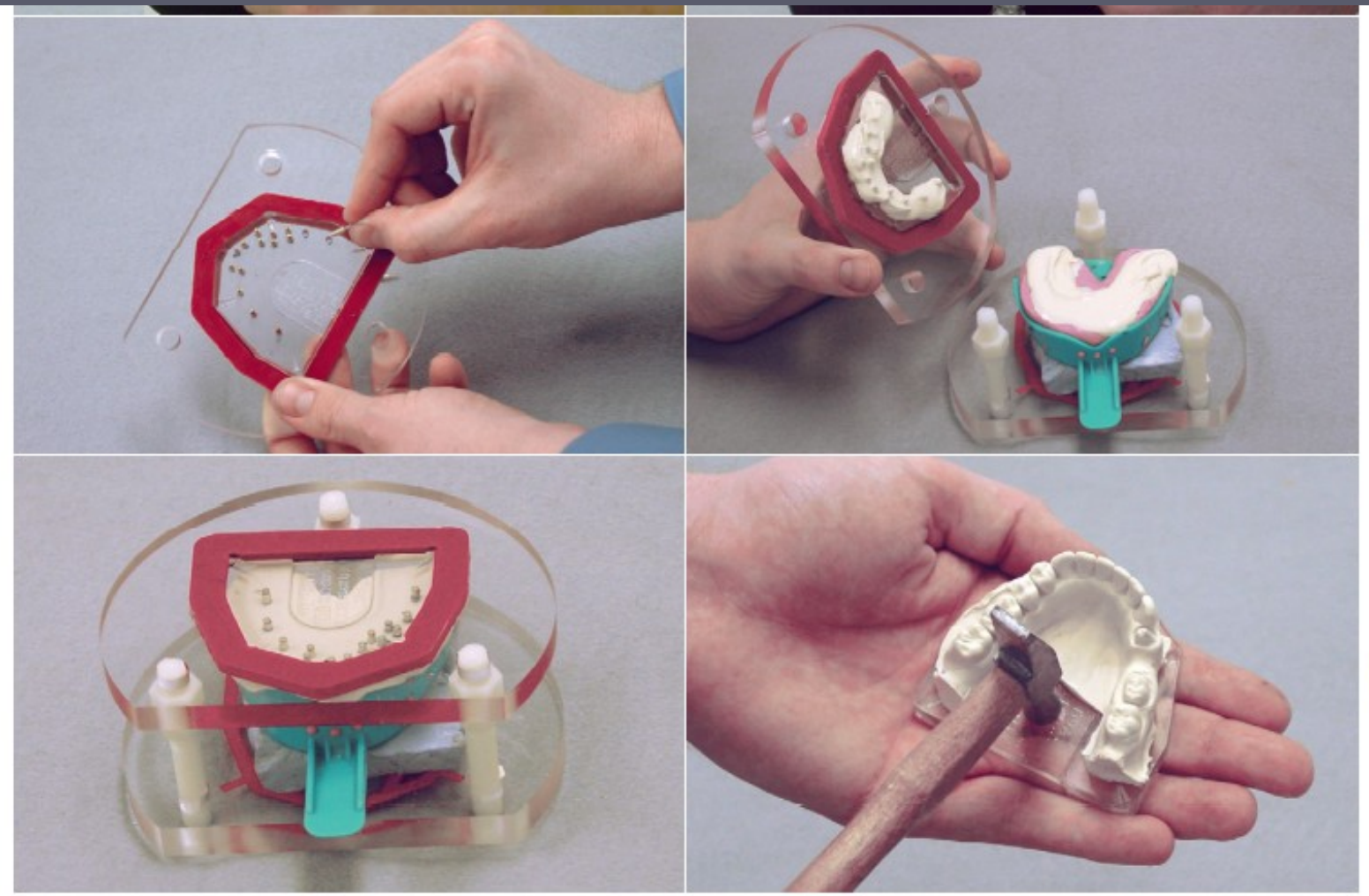


Fig. 17-10

DVA Model System. **A,** Trimmed impression on alignment fixture. **B,** Marking dowel pin locations on clear plate. **C,** Drilling holes for dowel pins as marked. **D,** Alternatively, the holes can be drilled with the top/base plate positioned on the underside of the fixture base. The pointer identifies the pin location. **E,** Inserting dowels in the baseplate. An adhesive is not required. **F,** The impression is

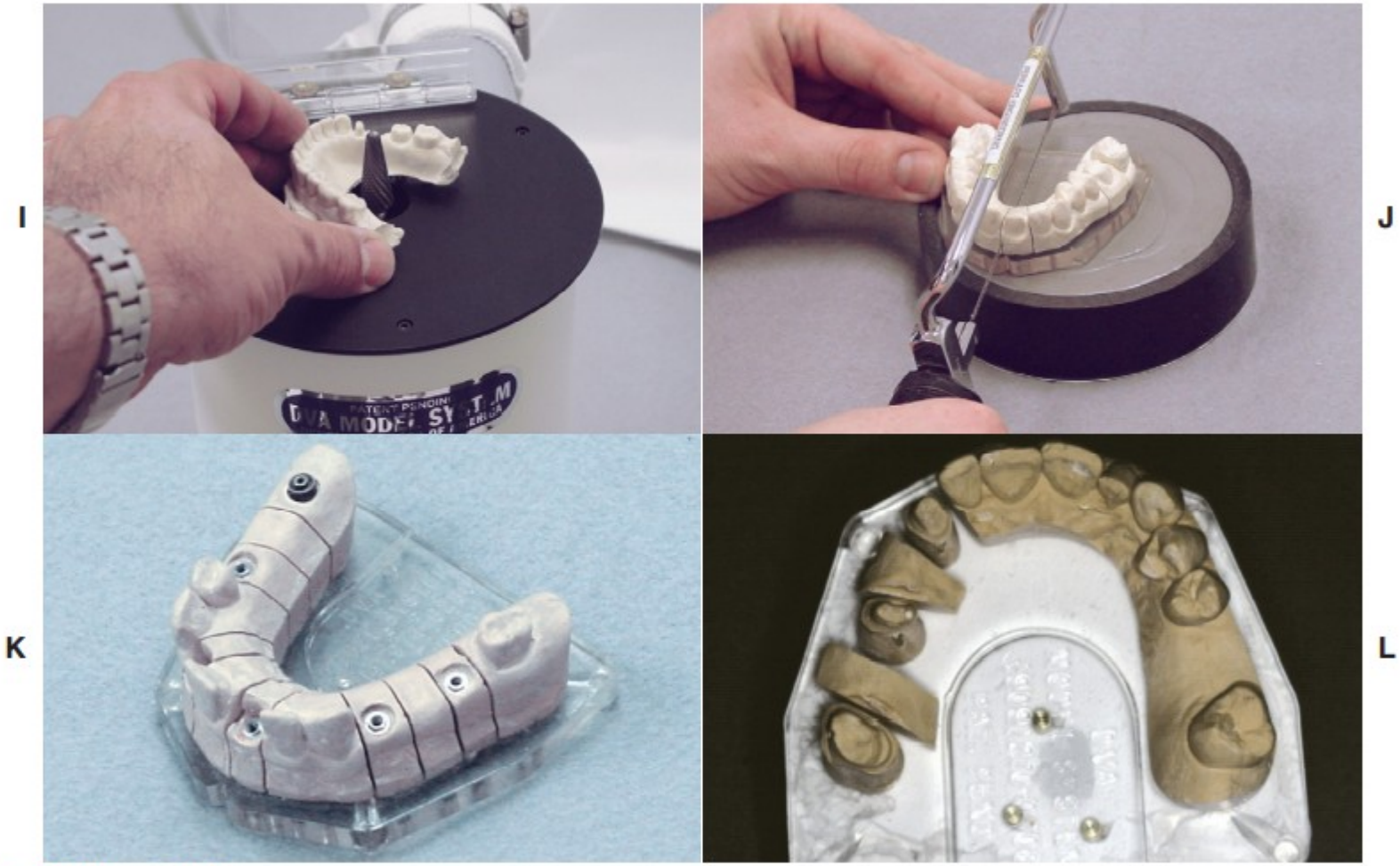


Fig. 17-10, cont'd

I, The cast is trimmed. **J,** Cast is sectioned. **K** and **L,** Definitive casts trimmed with the DVA Model System. *(**A** to **K,** Courtesy of Dental Ventures of America, Inc., Corona, California; **L,** courtesy of Dr. A. G. Wee.)*

The Accutrac System

These dies are exclusively used in the fabrication of laminate veneers.

Basically this system involves the fabrication of two casts as described in the working cast with separate die system. One cast (master cast) is sectioned into dies and used to prepare the coping. After preparing the wax pattern, the sectioned dies are reassembled in the master cast.

The master cast is blocked out with wax (filled with wax to seal the crevices).

The second cast (refractory cast) is duplicated from the blocked out, sectioned, die master cast using addition silicone. The second cast is poured using specially formulated stone, whose expansion will compensate for the shrinkage of porcelain when fired in the furnace.