Constructing a casting that seats well and is retentive and comfortable to the patient taxes even the most conscientious dentist. The final seating is dependent upon so many sequential elements that any single procedure may prove to be an unacceptable link, resulting in failure.

We must face the fact that under average conditions, when the casting, whether extracoronal or intracoronal, comes from the laboratory, it will be elevated approximately 200 µ on the prepared tooth. Occlusal adjusting is almost routine. Occlusal margins are not in apposition with the cavosurface angle. These problems and the attendant frustrations will be considered in their logical order: impressions, die materials, die-spacing or casting relief, choice of cements and liners, and the mixing of cements.

IMPRESSIONS

The two most commonly used impression materials are polysulfides and silicones, each having different allowable shrinkage standards after 24 hours as determined by American Dental Association (ADA) specifications. Although acceptance standards do accommodate the materials, the dentist finds little solace in their certification when attempting to seat castings made on varying degrees of undersized dies.

The range of shrinkage of polysulfides generally averages less than with silicone materials. This was not always found to be true. These two types of impression materials must be poured immediately to assure reasonable accuracy. Even after setting for only 30 minutes, enough change occurs to result in a slightly undersized die.

Although polyethers were found to be much more stable over long periods of time, they lacked resilience.

The polysiloxanes are categorically the most advanced elastomeric product available. They are virtually tasteless, less likely to run, more resilient, and remain stable for long periods of time. The double-mix types allow for more ease in handling than the single-mix type, which is stiff and difficult to use with a syringe.

Hydrocolloids have recently become more popular because of economics. The success or failure of hydrocolloids is often due to their degree of compatibility with the stone dies that are chosen. Detail reproduction varies widely. As a generalization, most hydrocolloids are appreciably improved by soaking impressions in 2% or 3% potassium sulfate for 15 minutes prior to pouring the die.

An alginate derivative has recently been introduced in paste form with a companion syringe system. This may prove to be a viable all-purpose impression material at considerably less cost. While further clinical testing is needed to verify the materials capabilities, the concept is, at the least, revolutionary.

STONE DIES

Stone dies (gypsum) are most commonly used for laboratory models. Their tendency to expand slightly is almost negated by the extrusion of the die during setting. Shrinking die materials are not inhibited by the containment of the impression. Some epoxy materials shrink grossly, while some that are centrifuged, appear to have offset this problem.

There are large differences in the scrape resistance of gypsums. Some of the most widely used stone die materials are the poorest in this respect. Several brands of die stones are improved by substituting die
hardeners instead of water, and one,* with the addition of a hardener,† approaches the resistance of silver plating. However, at least two stone die materials‡ which are more scrape resistant are available. These materials contain die hardeners and need only water for mixing.

**IMPROVED CASTING METHODS**

*Etching or die spacing*

In studies at Emory University, it was found that in complete crown casting using both 10 degrees and 20 degrees convergence, acid-etching, electro-milling, or die-spacing was more effective than venting. Zinc phosphate and polycarboxylate cements seated equally well, regardless of whether the crown was etched with aqua regia or unrelieved. Silicophosphate cement§ would not allow satisfactory seating even when relieved, and the filled resin cement¶ was unsuitable under any of the conditions.

Because of casting discrepancies, crowns which will not seat with finger pressure before cementation by as much as 250 μ may be seated under occlusal pressure by as much as 200 μ. When under force on the tooth, even though they are not completely seated, these crowns tend to spring back to their original elevated position as occlusal pressure is released. It has been demonstrated that this force concentrates on a few small areas within the casting, producing deformation of the dentin and of the casting.

Relieving the casting by etching with aqua regia, electro-milling, or painting multiple coats of “spacers,” allows seating without heavy occlusal force, thus assuring more accurately adapted margins upon cementation. Our current studies have shown that the use of die spacing is safer and more convenient than either etching with aqua regia or electro-milling. The effect of relieving the crown does more than make room for cement. This procedure permits complete seating prior to cementation.

**Retention**

During the try-in, it will appear that the casting is not “snug,” as we have been taught it should be for retention. The more complete seating, however, will assure better retention. Contrary to the assumption that a tight fit assures good retention, it was found that 40 castings made on dies that were and were not die-spaced, gave 25% increased retention when one of the fast drying die-spacers* was used. This can be logically explained because the internal high spots that need adjusting tend to force the castings off the tooth and do not leave any space for the cementing agent.

The taper of the prepared tooth still remains an important factor in retention. The cement simply fills the space between the casting and the tooth. Die-spacing allows more complete seating and results in better margins.

**CHOICE OF CEMENTS**

In comparing the several types of presently available cements, zinc phosphate cement remains strongest under compressive forces and has the longest record of clinical success. However, the polycarboxylate cements exhibit higher tensile strengths and chelation (bonding) to enamel and are as compatible with the pulp as zinc-oxide and eugenol cements. They can also be used as an effective basing material. Zinc-oxide/eugenol cements are also compatible with the pulp but have lower tensile strength. The eugenol slowly leaches out. Zinc-oxide/eugenol cements cannot be considered permanent luting agents.

The phosphoric acid of zinc phosphate cement is driven into the tubules during in vitro tests, but the cement can be safely used when the tubules are sealed with a liner containing calcium hydroxide.† Copal varnish is not effective as a barrier to phosphoric acid.‡ Recent studies with rhesus monkeys have shown that the calcium hydroxide liner is an effective barrier to the hydraulic force of zinc phosphate cement during cementation of castings, producing only a mild pulpal response. A polycarboxylate cement produced only a mild pulpal response as did its liquid component, polyacrylic acid, when used alone. This was in sharp contrast to the severe pulpal reaction resulting from 50% phosphoric acid, sometimes used as an etchant.

No liner should be used before placement of polycarboxylate cements since this would not allow for the advantages of chelation. Polycarboxylate cements

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*Indie-Die-Stone, Lactona Corp., Morris Plains, NJ
†Stalite, Buffalo Dental Mfg. Co., Brooklyn, NY.
‡Die-Keen and Die-Stone, Modern Materials, St. Louis, MO.
¶CBA 9080, Lee Pharmaceuticals, South El Monte, CA.

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*Tru-Fit, George Taub Products & Fusion Co. Inc., Jersey City, NJ.
†Hydroxyline, George Taub Products & Fusion Co. Inc., Jersey City, NJ.
cements and zinc-oxide/eugenol cements are less water soluble in the first 10 minutes after seating the casting. This may be an advantage if gingival seepage occurs. Reports on glass ionomer cements are promising, but there is little clinical evidence to predict long-term success as luting media.

**Mixing cements**

When a dentist becomes accustomed to zinc phosphate cement, it may be mixed empirically and satisfactorily without measuring the proportions. However, polycarboxylate cements must be carefully proportioned because the viscosity of the liquid makes it difficult to dispense. A newly marketed calibrated dispenser provides improved accuracy. Both zinc phosphate and polycarboxylate cements have the same working time, and will provide 4 minutes to mix and seat a casting when correctly proportioned. Mixing times for zinc phosphate cement longer than 1½ minutes do not give a longer working time but yield a weaker, more soluble cement.

**Film thickness**

Some of the cements used today will not meet ADA Specification No. 8 which allows a maximum thickness of 25 μ after 3 minutes from the end of the mixing procedure. Most dentists do not require 3 minutes for the cementing procedure. Some cements are too thick to use even after 2 minutes.

To allow adequate seating, a manufacturer’s instructions for polycarboxylate cements should call for approximately a 1:1 powder/liquid ratio. A silicophosphate cement* will not meet film thickness specifications and cannot be used for precision castings. The film thickness of bis-GMA filled resin,* sold as a “crown and bridge adhesive” measures an unacceptable 190 μ. This product is not adhesive and elevates castings more than 0.5 mm.

**SUMMARY**

Although some of the techniques described may appear to be time consuming, busy and meticulous dentists will find that they will perform far more efficiently by carefully selecting materials and perfecting restorative techniques for seating castings in a minimum of chair time.

*CBA 9080, Lee Pharmaceuticals, South El Monte, CA.

**REFERENCES**