

A Philosophical Approach to Selecting an Impression Technique

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There has been an emphasis over the last decade in dentistry to make evidence-based treatment decisions, that is to use documented research rather than anecdotal evidence that a particular treatment is advantageous to a patient and that treatment is then customized to a patient's particular needs and the conditions that they present. This philosophy seems to be logically advantageous to both the patient and the practitioner.

In the same context it would seem logical that dentists would choose a crown and bridge impression technique that has evidence-based success, that is, a technique that seems compatible with documented university-based research and presented in peer-reviewed literature. By applying knowledge from basic scientific research and then understanding what we are trying to accomplish with the crown and bridge impression, certain techniques can be discounted as being more likely to cause problems than others. This philosophy of choosing an impression technique also seems to be logically advantageous to both the patient and the practitioner.

THE TWO-STEP IMPRESSION TECHNIQUE

The two-step impression technique can be generally defined as a technique that can utilize a variety of materials to take two impressions — the first being a medium body, heavy body or putty impression that is allowed to set and removed from the mouth. That impression is then relined

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with a light body material and the impression is resealed in the mouth, constituting the second step of the impression. Some techniques advocate taking the first impression before tooth preparation, some after. Some techniques advocate reseating the first impression as it was taken without alteration, some by removal of the

heavy body material around where the tooth preparation is located and then washing the preparation area (Figs. 1 & 2). Others advocate utilizing efferent and afferent vent holes around the prepared tooth so that light body material can be injected directed into the heavy body impression after it is resealed around the prepared tooth. There are also variations as to whether the light body wash is placed only around the prepared tooth or throughout the entire arch. The concept that reportedly makes these techniques advantageous is that the light body wash material is forced into the sulcus utilizing hydrostatic pressure, thereby getting a better impression of the tooth margins.

There are three errors of fact and philosophy that make all of the above variations in two-step impression techniques a poor choice of technique for the dentist and likely to result in a less precise result for the patient.

RESEATING AN IMPRESSION

Reseating an impression in the mouth after it has set is not as easy as it may sound. An incorrect



FIGURE 1—Initial putty impression prepared for the reline wash by removal of 2mm of material adjacent to the prepared tooth.



FIGURE 2—Light-bodied wash impression material placed into the initial putty impression just prior to reseating in the mouth.



FIGURE 3—Two-step impression showing incomplete reseating and a “step” between the initial putty impression and the subsequent wash impression.

placement or incomplete placement of the initial impression results in a “step” in the impression that obviously creates inaccuracies in occlusion and contact areas. If the first set impression is just microns off from being replaced in the exact same place, a step in the occlusal plane occurs and the occlusion can be considerably altered. Set putty and tray materials that are later lined with a wash material and reseated create an increased risk of error.¹ The minute error in reseating can occur on the working side of the impression or on the non-working side of a full arch impression with equally devastating results (Figs. 3 & 4).

In addition to the difficulty of reseating the impression, there is an increased risk of failure of the wash to adequately bond to the set putty material due to saliva contamination (Fig. 5).² Bond strength between the wash and putty materials is decreased by about one-third when the surface was contaminated with saliva.³ Enough contamination of the surface can lead to total delamination of the two impression materials (Fig. 6).

UNDERSTANDING THE EFFECT OF HYDROSTATIC PRESSURE

The degree of preparation taper plays an integral role in the amount of hydrostatic pressure that occurs at the margin of the

preparation during this impression technique. The greater the taper of the preparation the greater the dimensional accuracy.⁴ Too much hydrostatic pressure at the margin causes a “pull back” or rebound effect when the impression is removed from the mouth after setting. This is why all full arch impressions should be held passively while setting.

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Any active force while the impression is setting causes an increase in elastic recoil when the impression is removed from the mouth and creates a reduction in the size of the casting.⁵ The greater the preparation taper, the less the hydrostatic pressure at the margin, creating in theory enough hydrostatic pressure to displace fluids and tissue, but not enough to create three-dimensional distortion. Unfortunately, an increase in the degree of preparation taper to fulfill the requirements to make this technique work adds to the clinician’s problems by ulti-

mately increasing retention difficulties because of excessive taper.

THE LABORATORY’S EXPERIENCE

There is little doubt in the minds of owners and managers of commercial laboratories as the increased frequency of problems that they see arise from these two-step impression techniques.

To make the castings fit dies from impressions taken this way, the technician must place an increased number of coats of die spacer onto the working dies to produce a casting that will seat on the tooth. Labs report having to place upwards of ten coats of die spacer on two-step impression cases.

This, of course, creates additional problems for the dentist whose goal is create as precise of fit as possible while maintaining long-term retention without debonding and dislodgement of the unit. The thickness of die spacer can vary considerably, from 8-40 microns. Anyone who has worked with die spacer knows that the consistency of die spacer is inconsistent depending on the age of the material. Vaporization of the solvent occurs with time, and the consistency can be made more fluid by the addition of more solvent to thin the solution. Of course, this is a very imprecise process with no control that could be measured at the level of 8-40 microns.

Additionally, it has been shown that the optimal thickness of the luting media is less than 25 microns.⁶ Manufacturers of cements test and provide data to compare strengths at or very close to the ideal film thickness of 20-40 microns. Excessive coats of die spacer and the unpredictable nature of die spacer lead to a loss of control over both the fit of the casting as well as the thickness of the luting material required for retention.

TO USE OR NOT TO USE RETRACTION CORD: THAT IS THE QUESTION

Finally, there is an inherent philosophical flaw in selecting an impression technique on the basis that there will not be a need to place retraction cord thereby making the procedure faster and easier to accomplish.

The reason for using retraction cords, laser, or electrosurgical techniques is not limited to taking the impression. Equally important is for the precise viewing of the margin of the preparation, imperative for final preparation of the margin, unless the entire margin is being placed completely supragingival. Without complete access to the margin of the preparation, final margination of the preparation is at best done blindly. Philosophically, then, any technique that proposes elimination of the use of retraction cords leaves the clinician unable to visualize and finalize margin preparation, unless the clinician is using laser or electrosurgery on every single patient.

Most clinicians advocate the use of a dual-cord impression technique, where the first cord is placed to fill about one-half of the sulcus as soon as the contact is broken. This process expands the sulcus to allow for better visualization of the preparation margins for final preparation, as well as



FIGURE 4—View of model from the impression viewed in Figure 4 graphically depicting the resulting occlusal and contact problems that will result from the step in the impression.

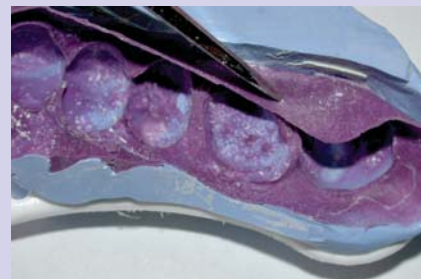


FIGURE 5—Contamination between the wash and initial putty impression shows partial delamination at the periphery. Note the telltale bubbles on the occlusal surface of the first molar indicating surface contamination.

greatly benefits the procedure because the first cord is placed prior to any gingival bleeding. It is much easier to do this and prevent gingival hemorrhage than it is to arrest hemorrhage after it begins. A correctly chosen diameter of cord can be placed quickly and atraumatically. After the preparation is completed, the second cord is placed to further expand the sulcus so that the margin is visible for impression taking. The second cord is left in position for 3-5 minutes and removed for the impression, while the first cord is left in place to insure hemostasis until completion of the impression when it is removed.

If the gingival sulcus is very shallow (1-2mm), particularly on anterior teeth, veneer preparations, and when the gingival margin is being placed just at or just below the height of the sulcus, it is frequently better to use only one cord. In these situations the preparation is completed supragingival, and then the retraction cord is placed, again filling about one-half the depth of the sulcus. The preparation can then be refined to the height of the sulcus or slightly below without trauma to the gingival tissues. The impression can be taken after careful removal of the retraction cord, or it can be left in place as there should be adequate access to the supragingival margin to take the impression. If the

impression cord is picked up in the impression the dentist should carefully remove the cord from the impression before the impression is poured because the cord can wick water from the die stone creating a porous chalky surface or margin in the die.

In addition to being able to visualize and finalize the margin preparation, lateral displacement of the tissue to widen the sulcus allows for a greater bulk of the wash impression material to capture the margin. There is good evidence that the greater the bulk of material at the margin the less the tendency for the material to tear and distort. Between 70% and 100% of the impressions taken with the sulcular width of 0.05mm exhibited distortion, with the critical minimal width being 0.2mm to minimize distortion and maximize accuracy.⁷

It is appropriate for the profession to change terminology from “gingival retraction” to the more correct “sulcular expansion.” Gingival retraction, which may have been a more viable term in years past when a patient’s tissue health may have been less than ideal, is no longer descriptive of the procedure that is actually performed. When a patient has good gingival health — and there should be no reason to begin an indirect restoration until that has



FIGURE 6—Complete separation between wash and putty impressions probably attributed to surface contamination of saliva on the initial putty impression.



FIGURE 7—Well executed dual-arch quadrant impression taken with an inflexible metal tray and materials whose viscosities are designed for the technique employed (Quad Tray Xtreme and Inflex heavy body impression material, Clinical Research Dental).

been achieved — the procedure that is accomplished is a temporary expansion of the sulcus to permit access for final preparation of the margin and then taking the impression. Removal of the cords following the completion of the impression then permits the tissue to return to its normal biological position without a change in the occlusal-apical height of the tissue. Changing the terminology helps the dentist, chairside assistant and patient more accurately visualize and then achieve the ideal result.

RESEARCH-BASED TECHNIQUES

It would be prudent for the astute clinician to rely on the results of published literature when choosing an impression technique and material. There is ample research to support the use of the most rigid dual-arch quadrant tray, and yet there are many dentists who continue to use flexible plastic trays, presumably because they are less costly. Metal trays have been shown to be more accurate in dual-arch quadrant impressions than plastic trays,⁸ especially when they are combined with the use of a more viscous tray material (Fig. 7).⁹ It has also been shown that dual arch impressions taken with an inflexible quadrant metal tray are as accurate as full arch impressions taken with custom trays.^{10,11}

CONCLUSIONS

The astute clinician will refer to evidence based on sound scientific study when selecting an impression taking technique. The literature indicates that there is a greater tendency for error with a two-step impression than a one-step impression.^{12,13} Caution should be exercised when listening to or reading the personal anecdotes of clinicians who recommend a technique that has little scientific documentation. Finally, techniques should be philosophically evaluated to make sure there is congruency between what you are trying to accomplish and the technique you are employing to achieve your results. **OH**

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REFERENCES

- Christensen, G. What Category of Impression material is best for your practice. *JADA*. 1997; 128: 1026-1028.
- B Millar. How to make a good impression. *British Dental Journal*. 2001; 191(7): 402-405.
- Pfeiffer P, Sommer MP, Schwickerath H. Bond between wash elastomers and putty silicones. *Dtsch Zahnärztl Z*. 1991; 46(7): 464-7.
- Fenske C. The Influence of Five Impression Techniques on the Dimensional Accuracy of Master Models. *Brazilian Dental Journal*. 2000; 11(1): 19-27.
- Sadat-Khonsari MR, Fenske C, Maus S, Jde HD, Gttschow F. Untersuchung zur Korrekturabformung. *ZWR*. 1999;108: 288-291.
- Rosenstiel SF, Land MF, Crispin BJ. Dental luting agents: A review of the current literature. *Journal of Prosthetic Dentistry*. 1998; 80(3): 280-301.
- Laufer BZ, Baharav H, Ganor Y, Cardash HS. Journal of Prosthetic Dentistry. 1996; 76(5): 466-471.
- Ceyhan JA, Johnson GH, Lepe X, Phillips KM. A clinical study comparing the three-dimensional accuracy of a working die generated from two dual-arch trays and a complete-arch custom tray. *Journal of Prosthetic Dentistry*. 2003; 90(3): 228-234.
- Ceyhan JA, Johnson GH, Lepe X. The effect of tray selection, viscosity of impression material, and sequence of pour on the accuracy of dies made from dual-arch impressions. *Journal of Prosthetic Dentistry*. 2003; 90(2): 143-149.
- Cox JR, Brandt RL, Hughes HJ. A clinical pilot study of the dimensional accuracy of double-arch and complete-arch impressions. *Journal of Prosthetic Dentistry*. 2002; 87(5) 510-515.
- Larson TD, Nielsen MA, Brackett WW. The accuracy of dual-arch impressions: A pilot study. *Journal of Prosthetic Dentistry*. 2002; 87(6): 625-627.
- Siemer A, Balkenhol M, Trost M, Ferger P, Woestmann B. Accuracy of one-step vs. two-step putty-wash impressions. *ADR/AADR/CADR 82nd General Session*. March 10-13, 2004.
- Mandikos, M. Polyvinyl siloxane impression materials: An update on clinical use. *Australian Dental Journal*. 1998; 43(6): 428-34.

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