

Polyvinyl Impression Taking for the Dental Assistant - Success Lies in the Details

DR. LEENDERT (LEN) BOKSMAN D.D.S., B.SC., F.A.D.I., F.I.C.D.

DR. ROBERT R COWIE D.D.S., F.A.G.D.

INTRODUCTION

Introduced in the 1970's, polyvinyl siloxane impression materials (PVS) are addition reaction silicone elastomers which have gained a large share of the impression material market and have become the most widely used impression material in restorative dentistry¹. Over 95 percent of the impressions sent to commercial dental laboratories are polyvinyl siloxanes, and over 80 percent of prosthetic cases submitted to the laboratories are single units². PVS materials set quickly and have minimal intra-oral set times. They have flexible working times depending on the number of units that need to be impressed. Inherently PVS materials have no taste or odour and therefore they do not create excess salivation during the impression procedure. They reproduce exact detail with excellent stability over time. Polyvinyl siloxanes have a high elastic recovery to prevent distortion and offer enough flexibility to allow easy removal of the impression from the mouth. Most are available in auto mix cartridges making them easy to use, have adequate shelf life, are cost effective and can readily be disinfected without affecting their dimensional accuracy^{3,4}. However, as with all products and techniques used in dentistry, clinical success lies in the details.

TRAY SELECTION

Elastomeric impression materials contract slightly due to their chemical reaction of cross-linking during polymerization. Polyvinyl siloxanes have the smallest

dimensional change with a contraction from 0.1-0.05 percent^{5,6}. Even with this minor amount of contraction, it is imperative that the impression tray fits accurately to the arch, with an even spacing of the impression material around the preparation site. Therefore impressions made from custom trays are more accurate and consistent in reproduction than stock impression trays⁷. However, custom trays made from an acrylic/liquid mix should never be used immediately after fabrication. There is an inherent distortion of the tray over time, and these trays should be fabricated at least two to three days prior to use. It is critical to use a PVS dedicated adhesive on the tray⁸, even if the tray is perforated. When a heavy body PVS is used, it will not engage the perforations sufficiently to retain the PVS against the tray (Figure 1,2). If an adhesive is used, the polymerization contraction is pulled towards the tray rather than to the centre of the mass, creating a more accurate impression⁹. The adhesive will of course also ensure that the PVS material does not pull away from the inside of the tray, which would result in an inaccurate cast. It is important to note that polyvinyl siloxane putties are reported to show no chemical adhesion to their adhesive and so the use of putties requires mandatory mechanical retention in the impression tray¹⁰. As well, adhesive strength to acrylic resin (custom trays) is significantly lower than polystyrene or metal stock trays for the polyvinyl siloxanes¹¹ and therefore when using these types of trays auxiliary

retention holes as well as adhesive should be placed.

A dual-arch impression, which impresses the preparation site, opposing arch and registers the bite registration all at once, is often used for one or two adjacent preparations. The more rigid the tray and the more rigid the impression material, the more accurate is the final replicated stone die¹². Crowns fabricated from the double-arch impressions are equivalent in marginal accuracy and superior occlusally to crowns fabricated from complete-arch impressions¹³. The dual-arch impression also allows for more accurate maximal intercuspal relationships than mounted casts from full-arch impressions¹⁴.



Figure 1 separation of heavy body when adhesive is not used

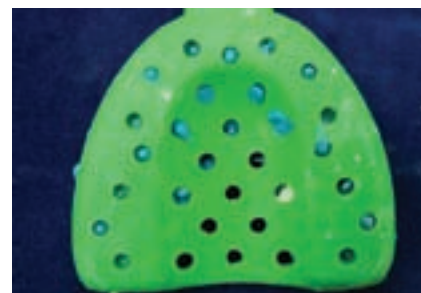


Figure 2 palatal view of tray with heavy body not engaging perforations

Accuracy however is reduced when these trays flex during closure of the arches¹⁵. Impressions taken with flexible plastic trays produce consistent discrepancy of 180 to 210 microns¹⁶. Therefore, plastic dual-arch impression trays should never be used, since plastic is elastic and changes dimensionally. In addition, many of these plastic trays have side walls that are too high, creating tissue impingement on closure which distorts the tray (Figure 3,4). Therefore it is critical to use a metal tray without side-walls (Quad-Tray Xtreme, Clinical Research Dental) and a PVS material that is specifically designed for this technique (Inflex, Clinical Research Dental). It is also critical when dispensing the heavy body, to coat the lateral walls of the dual-arch tray, so that the upper and lower impression is joined together (Figure 5,6). This “unitized” impression will facilitate multiple pours in the laboratory, ensuring that the upper and lower portions do not separate.



Figure 3 plastic impression tray showing tissue contact creating flex

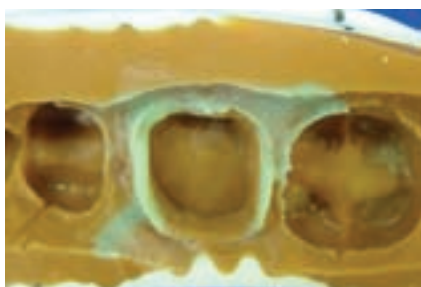


Figure 4 tissue contact due to high lateral walls of plastic impression tray

RETRACTION CORD

To facilitate precise viewing of, and access to the crown margin during preparation, retraction cord is placed, unless the margin is entirely supragingival¹⁷. If a two cord technique is used, the first cord must end



Figure 5 lack of material joining upper and lower impression. This results in separation at pouring in the lab preventing second pour.



Figure 6 impression material joining the upper and lower together creating a unitized impression facilitating laboratory procedures.

up butt-end to butt-end. Retardation or inhibition of set of polyvinyl siloxanes can occur clinically. A sulfur compound, zinc diethyl dithiocarbamate, which is present in latex gloves, can totally inhibit polymerization of polyvinyl siloxanes in concentrations as low as 0.005 per cent¹⁸. This inhibition occurs even if gloves are washed prior to contact of the PVS or tooth structure, and even if the surface is washed after contact with the gloves¹⁹. Therefore the use of latex gloves during crown and bridge procedures is contra-indicated. As well, particulate sulfur and sulfur-chloride compounds result in polymerization inhibition of PVS materials²⁰. These compounds are often present in products used to control bleeding. These haemostatic agents are usually used in combination with cord for sulcular control. It is extremely difficult to remove these materials from the preparation site. Since the impression material is at its thinnest and weakest at the gingival margin of the preparation, inhibition of set can have disastrous consequences²¹. Therefore, prior to impressing, a surface cleansing agent, such as Detail (Clinical Research Dental), an EDTA solution, should be used for 7-10 seconds to decontaminate

the surface. A side benefit of using EDTA is that it reduces the surface tension of the preparation making it easier for the PVS material to intimately contact the preparation. Alternatively, the prepared surface can be cleansed with an anti-bacterial slurry such as Consepsis Scrub (UltraDent). Residues from acrylics, methacrylates, and petroleum jelly lubricants may also interfere with the setting reaction of PVS materials and their ability to pick up fine detail.

MATERIAL MANIPULATION

Always check the expiration dates of dental materials, and make sure you are not using expired products. All products will denature over time and therefore the fresher the material, the more likely that it will work properly. From date of manufacture, to shipping from the manufacturer, to arrival at the distributor and shipping to the dental office can take as long as 18 months. It may be wiser then, if possible to get shipment directly from the manufacturer.

Every PVS material has a distinct working time and setting time. Syringing the light body material around the preparation site and the syringing of the heavy body into the tray, must occur before the end of the working time. Careful planning and co-ordination between the assistant and doctor are critical²². If the working time is exceeded, impression defects will be created. Figure 7 shows a complete lack of union between the heavy body and the light body due to exceeding the working



Figure 7 lack of material joining upper and lower impression. This results in separation at pouring in the lab preventing second pour.

time. If the working time of the heavy body and light body are the same, it is best to start to load the tray material before the dentist begins the injection of the light body around the tooth preparation. Because filling the tray, whether full or quadrant, takes longer than syringing one or more teeth intra-orally, this will ensure delivery of the tray with the heavy body, the second the intra-oral placement of the light body is complete. Also since the tray material is loaded at room temperature, it will have more working time than materials which are used in the mouth at a higher temperature. Refrigeration of PVS materials to increase working time has been recommended in the past, since for every 10 degrees lower in material temperature, the working time is doubled. However, the materials may not extrude evenly from the cartridge, creating a disproportionate mix, and polymerization may still be occurring when the impression is removed from the mouth creating distortion. Therefore refrigeration of PVS materials to gain working time is contra-indicated. With the introduction of longer working time PVS materials (MultiPrep Clinical Research Dental) this is not necessary.

IMPRESSIONING

The impression tray should be seated slowly, with time taken to properly align the tray. The slower placement and insertion of the tray will prevent drags, pulls and distortions of the PVS material due to tray realignment after seating²³. The tray should be held passively so that no pressure is placed on the material while it is setting. This pressure results in elastic recoil in the material creating inaccuracy. Do not move or "hand-off" trays during the critical intra-oral setting phase²¹.

The PVS impression material must be fully set when removed, or distortion or tearing at the margins of the preparation can occur. There is an easy trick to evaluate whether the impression material is set intra-orally and is ready to be removed. After syringing the heavy body material

into the tray, place a tiny amount on a working surface behind the patient. Since this material sets slower (it is at a lower temperature than in the mouth), when it is set, the material intra-orally will always be polymerized and ready for removal.

CONCLUSION

As can be seen from the above, there are many areas where knowledge of the manipulation variables in the use of polyvinyl siloxane materials can avert clinical misadventures. The dental assistant plays an invaluable role in helping to create consistency of performance and clinical predictability of the materials used in the dental operatory. The polyvinyl siloxanes are only one of a myriad of materials used clinically today. Thorough knowledge of the properties and handling of all materials used clinically is of paramount importance, not only to the dentist, but the patient as well.

Dr. Boksman is a 1972 graduate of the Faculty of Dentistry at the University of Western Ontario. He is a fellow of the Academy Dentistry International and the International College of Dentists. He has received the Award of Merit from the Ontario Dental Association and awarded the Alumni of Distinction from his alma mater. He has memberships in the Canadian Academies of Cosmetic as well as Esthetic Dentistry and the American Academy of Cosmetic Dentistry. Dr. Boksman has authored over 80 articles and chapters in dental texts. He is Adjunct Clinical Professor at the Schulich School of Medicine and Dentistry and as a consultant serves as Director of Clinical Affairs for Clinical Research Dental. He can be reached at lboksman@clinicalresearchdental.com.

Dr. Cowie is a 1976 graduate of Northwestern University Dental School and practices in Jacksonville, Florida. He has completed close to 2200 hours of continuing education, including the continuums at the Dawson Center for Advanced Dental Studies, the Society of Occlusal Studies and the L. D. Pankey Institute. Dr. Cowie has presented over

150 lectures nationally and internationally. He has published articles on impressioning in *Dentistry Today* and *Oral Health*. He can be reached at robertrcowie@netscape.net.

BIBLIOGRAPHY:

- 1) Donovan TE, Chee WW. A review of contemporary impression materials and techniques. *Dent Clin North Am* 2004 Apr;48(2):vi-vii, 445-70.
- 2) Boksman L. Eliminating Variables in Impression taking. *Ont. Dent.* 2005 Dec;22-25.
- 3) Wadhvani CP, Johnson GH, Lepe X, Raigrodski AJ. Accuracy of newly formulated fast-setting elastomeric impression materials. *J Prosthet Dent.* 2005 June;93(6):530-9.
- 4) Jagger DC, Al Jabra O, Harrison A, Vowles RW, McNally L. The effect of a range of disinfectants on the dimensional accuracy of some impression materials. *Eur J Prosthodont Restor Dent* 2004 Dec;12(4):154-60.
- 5) Craig RG. *Restorative dental materials*. 9th Edn. St. Louis: Mosby 1993.
- 6) Craig RG, O'Brien WJ, Powers JM. *Dental materials. Properties and manipulation*. 6th Edn. St. Louis: Mosby 1996.
- 7) Millstein P, Maya A, Segura C. Determining the accuracy of stock and custom tray impression/casts. *J Oral Rehabil* 1998 Aug;25(8):645-8.
- 8) Giordano R. Issues in handling impression materials. *Gen Dent* 2000 Nov-Dec; 48(6):648-8.
- 9) Adams D. Impression tips to reduce stress and increase profits. *Dentistry Today* 2006 October:104-6.
- 10) Mandikos MN. Polyvinyl siloxane impression materials: An update on clinical use. *Aust Dent J* 1998;43(6):428-34.
- 11) Chai JY, Jameson LM, Moser JB, Hesby RA. Adhesive properties of several impression material systems: Part 1. *J Prothet Dent* 1991;66:201-9.
- 12) Cox JR, Brandt RL, Hughes HJ. A clinical pilot study of the dimensional accuracy of double-arch and complete-arch impressions. *J Prosthet Dent* 2002 May;87(5):510-5.
- 13) Cox JR. A clinical study comparing marginal and occlusal accuracy of crowns fabricated from double-arch and complete-arch impressions. *Dent J* 2005 June;50(2):90-4.