Three-Way Trays: Easy to Use and Abuse

Igor J. Pesun, *DMD, MS, FACP;* ***Vanessa L. Swain,*** *DMD, MSD*

Contact Author

Dr. Pesun
Email: pesun@cc.umanitoba.ca

ABSTRACT

The 3-way tray technique is popular as it provides master and opposing arch impressions and an interocclusal record at the same time. Excellent clinical results can be achieved with appropriate case selection, use of rigid tray and impression materials, attention to tray positioning and other details throughout the process, and clear understanding of the limitations of the technique by the operator and dental technician.

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In fixed prosthodontics, the use of a single tray to make an impression is a popular technique. The procedure is alternatively called closed-mouth impression, dual-arch impression, triple-tray or double-arch impression, to name but a few. Dentists and patients appreciate the speed at which the information required to fabricate an indirect restoration can be obtained. When prepared properly, dual-arch impressions have been shown to be more accurate than or as accurate as complete-arch impressions.[1–3]

A major difficulty in making a dual-arch impression is ensuring that the patient closes properly into the maximum intercuspation position (MIP).[4,5] Determining whether MIP has been achieved can be a challenge, especially when the occlusion is not ideal. For example, if the patient has no posterior occlusion on the side opposite the impression, it may be extremely difficult for the operator to know when maximum intercuspation has occurred.[6]

The technique is not without its pitfalls and can be easily overused and abused.[7] A review of the literature provides guidelines for the use of 3-way trays including tray and material selection. We also describe the 3 most popular techniques.

Why Are 3-Way Trays so Popular?

In general dental practice, most restorations are single units, and most dentists use 3-way trays to fabricate these restorations.[8] Three-way trays have several advantages, a main one being the saving in time and money. The technique requires 50% less material than a complete-arch impression,[9] and, as only one impression is needed to collect all the information needed to fabricate a crown, it is also 60% faster than standard full-arch techniques.[9] The one impression yields a master cast, the opposing cast and an interocclusal record.

Patients may prefer this technique because impression material is in their mouth only once. Closed-mouth impressions are 80% more comfortable than open-mouth techniques.[10] This is especially important for patients who have gagging problems.[11]

Indications

Use of the 3-way tray impression technique should be limited to single units. Although it can be used for multiple units in select cases, the units must be adjacent or short-span fixed partial dentures.

An adequate number of teeth must be present in both arches to provide stability for the master casts, the ideal being teeth present

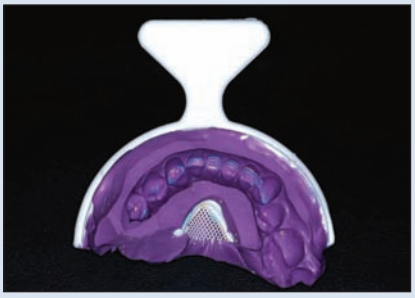

Figure 1: Anterior triple tray (DTW anterior impression tray, Patterson Dental Supply, St. Paul, Minn.). Note the lack of support of the impression material lingual to the anterior teeth.

Figure 2: Examples of posterior 3-way trays: left to right, plastic (Dentsply, Woodbridge, Ont.), metal (Tri-Bite Impression Tray, Milwaukee, Wis.) and plastic reinforced with metal trays (Discus Dental, Culver City, Calif.).

Figure 3: Tray contact with soft tissue through impression material results in distortion of the tray.

on either side of the tooth or teeth to be restored. These adjacent teeth should provide stable occlusal and proximal contacts.

A 3-way impression technique is indicated only when the desired final treatment position for the teeth is in MIP. Other positions, such as centric occlusion, cannot be recorded using a 3-way tray impression.

In excursive movements, the path that the opposing tooth makes on the tooth to be restored is based on the geometric relation of the cusp to the condyles. The relation to the condyles is not maintained when casts are mounted using 3-way trays, thus limiting the use of 3-way trays to those cases where the patient has canine disocclusion.

Contraindications

If one attempts to use a 3-way tray impression for a fixed partial denture of more than a short span or where there are no intact teeth on either side of the prepared tooth, the resultant casts will not be stable, and the occlusion of the final restoration will require extensive modification before it can be delivered to the patient.[4]

For successful removable partial denture treatment, some patients may require surveyed crowns. Fabrication of a surveyed crown requires the evaluation of the contour of teeth on the contralateral side of the arch. Quadrant 3-way trays are unable to capture the contour of teeth on the contralateral side of the arch needed by the laboratory to fabricate crowns specific to the denture's path of insertion. In addition, patients with free-end distal extension usually do not have an adequate number of functional contacts with the opposing arch to allow stable cast interdigitation for the fabrication of crowns using the 3-way impression technique.[4,12]

Restorations for patients with complex occlusal schemes, such as cross-arch balancing contacts and group function, will require a significant amount of adjustment if they are fabricated using 3-way trays. The contralateral side of the mouth can have a significant effect on the occlusion, especially when the restoration includes the terminal molar. Use of 3-way quadrant trays in these situations is not recommended as it will result in a restoration that requires significant modification before delivery.

Anterior 3-way trays create an interesting situation, as most anterior contacts between the incisors and canines are on an inclined plane and are not particularly stable. When there are fewer than 3 stable contacts, tripoding of the casts cannot be achieved and the opposing casts cannot be related to one another in a consistent manner. It can also be challenging for dental technicians to manage deep vertical overlaps.

There is also an issue related to the strength of the impression material and its ability to support the die stone when the casts are poured. Without the support of the tray extending behind the posterior-most teeth or across the arch, only the impression material that extends between the teeth is left to support the impression material on the lingual surface (**Fig. 1**). When the impression is poured, the weight of the die stone may distort the impression and result in an inaccurate die.

Tray Selection

Careful tray selection is required to ensure that an adequate amount of tissue is captured in the impression and that there is no distortion of the tray during the process. Trays are made of plastic, metal or metal-reinforced plastic (**Fig. 2**).

Metal or metal-reinforced trays are preferred, as plastic trays tend to be more flexible and more likely to deform during acquisition of the impression and pouring of the final impression. When a tray of heavy body

Box 1 Ideal properties of impression material

- Hydrophilic
- Long working time
- Short setting time
- Resistant to deformation
- Dimensional stability
- Detail reproduction
- Tasteless and odourless
- High tear strength
- Ease of use

impression material is seated and the patient occludes, the force of compaction can push the side walls of the tray laterally. The selection of a rigid tray reduces the risk of distortion.[13,14]

Before the impression is made, it is important to evaluate the length and width of the tray in the patient's mouth. The tray should not touch the buccal or lingual surfaces of the alveolar ridges (**Fig. 3**). If the tray contacts these tissues, its sides may be forced apart when the patient occludes. When the impression is removed from the patient's mouth, the rebound of the tray's side walls results in distortion of the impression.

The tray must extend far enough anteriorly to capture the canines, so that they can be used to help approximate the vertical component of lateral excursive movements.[6] Tori, bony exostoses and third molars may interfere with the seating of the tray and cause distortion of the impression upon removal. To ensure that the occlusal record is correctly captured in the impression, the patient must be able to fully close into MIP without interference. Elastomeric impression materials do not possess sufficient strength to overcome flexure error in the tray.[6,8,12,14–19]

Clinical Techniques

Several techniques have been described in the literature to ensure accurate 3-way impressioning. Irrespective of technique, a number of pretreatment steps are essential to ensure accuracy of the final impression.

Before administering anesthetic, determine the final position the patient will occlude into for the impression. Most often the patient will bite down firmly into MIP. To ensure that MIP is achieved when the impression material is in the patient's mouth, it helps to evaluate the occlusal contacts on the opposite side of the mouth using mylar ribbon. The canine area is generally the most visible and accessible for this purpose. The practitioner must note this position, as it is the only reference available once the impression material covers the preparation(s) and adjacent teeth. Other techniques, such as the use of acrylic resin guides, to confirm full occlusion of all the teeth in MIP have been described in the literature.[6]

Once occlusion has been evaluated without the tray in position, have the patient bite firmly in MIP with the tray in the mouth. Rehearsal of closure into MIP is recommended before making the actual impression. Centre the teeth in a buccal–lingual direction between the walls of the tray. Ensure that the bar connecting the buccal and lingual walls of the tray is distal to the most posterior tooth. This bar should also not impinge on the tuberosity or the retromolar pad. Verify the occlusal contacts on the opposite side of the patient's mouth using mylar ribbon. Confirm with the patient that there is no impingement of the tray on the patient's soft tissues.[6]

Selection of Impression Materials

The ideal properties of impression materials are listed in **Box 1**. For 3-way tray techniques, the impression material must be relatively rigid due to the minimal support of the tray.[20] Heavy-body polyether and vinyl-polysiloxane work well.

The introduction of machine or syringe mixed impression materials overcomes the technique's sensitivity to hand mixing. Machine or syringe mixing also decreases the risk of contamination and reduces ledges, drags and pulls. Quick and complete mixing results in a more uniform compound that produces better results.

Before using either machine or syringe mixed material, it is important to bleed the cartridges to ensure uniform flow of catalyst and base; otherwise, cross-contamination may occur with the removal and replacement of mixing tips and result in set material becoming stuck in the mixing tip and improper mixing of the impression material.[4,13,19]

Keys to an Accurate Impression

The tissue at the gingival margin must be displaced in 2 directions: vertically to expose the margin of the preparation and horizontally to provide space for a sufficient amount of impression material. As elastomeric materials are affected by excess moisture, the hard and soft tissue to be reproduced must be clean and dry with no hemorrhage. Standard tissue retraction techniques should be employed when using 3-way trays, as the seating pressure alone is not sufficient to provide adequate tissue retraction for margin exposure.

It is important to place the material immediately after mixing. Although injecting the material into a separate intraoral syringe, such as a COE syringe (GC America, Alsip, Ill.), delays injection, for operators with small

Figure 4: Syringes for injecting light-body impression material. Top to bottom: regular syringe with mixing tip (Dentsply), Digit Targeted Delivery system (Dentsply), COE syringe (GC America).

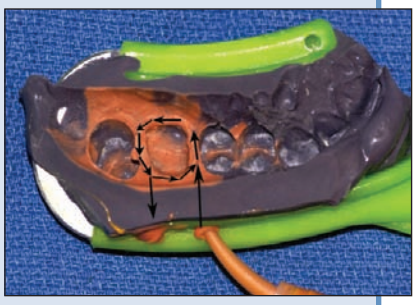

Figure 5: Injection of impression material using the laminar technique. Arrows show flow of light-body material around teeth and out vent hole.

hands, it may be easier and advantageous to manipulate a smaller syringe intraorally. Several companies, such as Dentsply, have produced small, unidose syringes that are easy to manipulate (**Fig. 4**). Using an injection tip fitted directly on the mixing syringe minimizes voids. The lowest viscosity of material should be used to allow for better flow, marginal accuracy of the impression and tissue coverage. As the impression material is placed into the retracted tissue sulcus, the syringe tip remains immersed in the material and a stirring motion is used to ensure adequate coverage of the tissue.[20]

The use of tray adhesives prevents separation of impression material from the tray, as mechanical retention alone is insufficient. The tray should be properly aligned and slowly seated intraorally, maintaining alignment as the patient closes into MIP. Once the tray is in the correct position, it is immobilized until the impression material is fully set, at which time it can be removed.[19]

Impression Techniques

Several techniques can be used to make a 3-way impression. They include a standard technique that is very similar to that used for full-arch impressions. Two additional techniques make use of a pre-impression before the tooth is prepared, followed by either a wash or a laminar flow technique that injects light-body material around the preparation(s). Each has advantages and disadvantages.

Standard Technique

While light-body wash material is being syringed onto the prepared tooth, the 3-way tray is filled with heavy-body impression material on both sides. Sufficient impression material is required to result in a 2–3 mm thick wall of impression material around the prepared tooth.

The tray is seated in the patient's mouth and the patient is instructed to close into MIP. An assistant places mylar ribbon between chosen teeth on the opposite side of the mouth to ensure that the patient has closed to the correct occlusal position.

Pre-impression Techniques

Pre-impression techniques involve a 2-step process. The first step is fabrication of a pretreatment matrix followed by either a wash with light-body material or the use of a laminar flow technique. The pretreatment matrix is made of putty or heavy-body impression material. The pretreatment matrix may also be used to fabricate provisional restorations, thus requiring the use of less material. Once the provisional restoration is fabricated, the pretreatment impression matrix must be properly cleaned before it is used for the final impression. Any residue of provisional materials will contaminate and prevent the wash impression material from setting.

In the wash impression technique, the operator should confirm that the matrix allows sufficient space for the wash material. Light-body impression material is placed around the tooth and the tray is reseated. Pressure is used to force impression material into the sulcus around the tooth. It is important not to overfill the area and to provide a vent for excess material. Excessive pressure results in distortion of the tray. When removed from the patient's mouth, the tray will flex back to its original shape causing the resultant die to be too small and the crown too tight.[3,9,13,21,22]

The laminar flow technique also uses a pre-impression matrix followed by injection of light-body impression material around the prepared site. Impression material is used to wash out the area around the prepared tooth. The pre-impression matrix is modified by drilling 2 access holes through the impression material on the buccal aspect of the prepared tooth or teeth. One access hole is made at the mesial line angle and the other at the distal line angle. The modified pre-impression matrix is reseated in the patient's mouth, with the teeth fully occluded into MIP. The tip of the syringe containing light-body impression material is inserted into the mesial hole and material is injected until clean material extrudes from the distal hole (**Fig. 5**).[23]

Conclusions

The main reason for the popularity of the 3-way tray technique is the ability to obtain a master impression, opposing-arch impression and an interocclusal record at the same time, saving time and expense. The technique

can provide excellent clinical results under the following conditions:

- appropriate case selection — 2 teeth or fewer to be restored, intact teeth on either side of the restoration area, stable occlusion, canine protected excursions with no cross-arch interferences
- use of rigid tray and impression materials
- no tray–tissue contact
- meticulous attention to detail throughout the process
- good understanding and management of the limitations of the technique by the operator and dental technician.

As with most techniques, success is primarily determined by the ability and diligence of the operator, not by the technique itself.

THE AUTHORS

Dr. Pesun *is an associate professor and head of the department of restorative dentistry, University of Manitoba, Winnipeg, Manitoba.*

Dr. Swain *is an assistant professor and head of the division of fixed prosthodontics, University of Manitoba, Winnipeg, Manitoba.*

Correspondence to: *Dr. Igor J. Pesun, Department of restorative dentistry, University of Manitoba, D227B–780 Bannatyne Ave., Winnipeg MB R3E 0W2.*

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