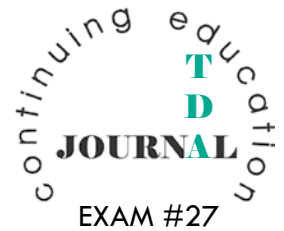


The Acrylic Resin Transfer Coping Technique for Making Accurate Interocclusal Records

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Basic Principles

Interocclusal records are the most important maxillomandibular records used to transfer interarch relationships from the mouth to an articulator.¹ Accurate interocclusal records minimize the need for intraoral adjustments during prosthesis delivery and are essential in providing high-quality fixed restorations and reducing overall treatment time and cost. A clinician's ability to relate and mount casts accurately will have a greater impact on the quality of a restoration than the programming of an adjustable articulator.²

If the patient has an adequate number of teeth and a stable intercuspal position, no signs and symptoms of trauma to the occlusion (e.g., the presence of wear facets, widened periodontal ligament spaces and muscle tenderness), and the goal of treatment is to maintain pretreatment intercuspatation and occlusal vertical dimension (OVD), then the most accurate method of articulation is to occlude opposing casts by hand, without intervening bite registration material.¹ Recording material placed between teeth in this case often prevents casts from fully intercuspatating, and an interocclusal record is registered at an increased OVD (**Figures 1 and 2**). Mounting casts in the maximum intercuspal position (MIP) facilitates treatment, and the majority of cases fall within the MIP category.

If the planned restorations involve terminal teeth in the arch, an interocclusal record is needed as there is insufficient horizontal stability of the casts for hand articulation and mounting. For opposing casts to occlude accurately, a tripod of vertical support and horizontal stability must exist between the casts. To ensure that there are sufficient numbers of occluding teeth to mount working and opposing casts in MIP, as well as horizontal stability, casts must reproduce the full dental arch. When terminal teeth are prepared for crowns or fixed partial dentures (FPDs) and the third leg of the

ABSTRACT

When the goal of restorative treatment is to maintain the patient's pre-existing intercuspatation and occlusal vertical dimension (OVD) following tooth preparation for crowns or fixed partial dentures (FPDs), casts must be mounted on an articulator in the same pretreatment tooth-to-tooth relationship. A simple technique is described that uses acrylic transfer copings over prepared teeth to record and preserve this relationship so that working and opposing casts can be mounted accurately. The technique may be used to recapture the lost third leg of the tripod after teeth have been prepared. To further reduce errors when mounting casts onto an articulator, a method is recommended that uses rigid connectors to join and stabilize casts in a manner that minimizes potential movement during placement and setting expansion of gypsum mounting materials.

tripod is lost, the dentist must fabricate an interocclusal record to recapture the lost leg and create a tripod of vertical support to mount casts accurately. The classic example of a "created tripod" interocclusal record is a fully-dentate patient for whom tooth No. 29 and terminal tooth No. 31 have been prepared for a three-unit FPD. A rigid interocclusal record that covers only the prepared teeth, with the remaining unprepared teeth in MIP, can be made to replace the lost leg. The ideal material for recording interarch relationships should: (1) initially be fluid and offer no resistance to mandibular closure during registration, (2) reproduce opposing surfaces accurately, (3) set to a rigid consistency and (4) be dimensionally stable on setting to provide a definite location/stop into which opposing casts may be accurately placed.

This report describes the situation where the dentist must create a tripod of vertical support where it does not exist to mount opposing casts. The technique is especially applicable for patients who present with widely-separated abutment teeth, and whose MIP and OVD will not change as a result of treatment (**Fig. 3**). Pattern Resin LS (GC America Inc., Alsip, IL), an auto-polymerizing

polymethyl methacrylate (PMMA) resin that meets all four prerequisites when manipulated in the prescribed manner, is used to fabricate intraoral acrylic transfer copings and register interocclusal records. Pattern Resin LS offers minimal resistance to closure; therefore, periodontal proprioception is not compromised and no deviation of mandibular closure into MIP occurs. As a direct technique, it can be used at the same appointment when final impressions are made; the need to schedule an extra visit to produce the record on a working cast is eliminated. Copings should not be fabricated on the working cast since the resin separating agent will prevent adhesion of the spacer.³ The following sequence is recommended:

Technique

Direct Coping Fabrication

Step 1. Isolate all prepared teeth with cotton rolls in the buccal and lingual sulci to keep the field dry.

Step 2. Lightly lubricate the prepared abutment teeth and the occlusal surfaces of opposing teeth. Surgilube (E. Fougera & Co., Melville, NY), a water-based lubricant, is recommended as it facilitates separation of the copings after resin polymerization is complete.



Figure 1 – When there is an existing tripod of widely spaced contacts with good intercuspation, an interocclusal bite registration is unnecessary.



Figure 2 – An elastomeric interocclusal record was made unnecessarily. Casts were not seated properly in the untrimmed record and subsequently not occluded accurately (arrow points to lack of contact between opposing molars) prior to mounting.



Figure 3 – Mandibular teeth have been prepared for a fixed partial denture (FPD). Opposing teeth are present at desired tripod stop locations, but occlusal contact is now lacking.

Surgilube contains the antimicrobial chlorhexidine gluconate and is non-irritating to mucous membranes.

Step 3. Place small volumes of Pattern Resin LS acrylic monomer and polymer in separate rubber cups provided by the manufacturer. Moisten the tip of a disposable brush with liquid monomer and then pick up a small amount of powder. Apply the wet bead of mixed acrylic to the tooth. Deposit a uniform thickness of resin—approximately 0.3 to 0.5 mm is ideal—to the occlusal, buccal, lingual and proximal surfaces of the prepared tooth to build a coping (**Figure 4**). At these thicknesses, copings are sufficiently strong to resist fracture. Change brushes frequently to ensure that only small volumes of mixed acrylic are applied during the incremental build-up of the coping. To ensure accuracy, allow the resin to polymerize completely (approximately three minutes at mouth temperature) on the abutment tooth before the coping is withdrawn.

Step 4. Use curved mosquito forceps to remove the coping from the prepared tooth. Mark the buccal surface with a permanent marker to aid in future orientation. Rotate the coping under a bright light; shadows on the intaglio surfaces are formed by folds or creases where acrylic failed to flow properly when applied, an indication that the coping is not well-adapted to the tooth and should be discarded. Use sharp scissors to remove flash. To ensure positive seating on the prepared tooth and working cast die, trim the coping to terminate no more than a millimeter occlusal/incisal from the finish line. Reseat the coping

on the abutment tooth and adjust the occlusal surface until it is at least 0.5 mm out of contact with the opposing tooth. Check the occlusal clearance with thin (19µm) articulating paper (Exacta-Film, Ardent International, Inc., Ossining, NY); eliminate any occlusal contacts by grinding with a diamond bur. Each coping should be fabricated separately and removed from the tooth before additional copings are made.

Step 5. Remove all copings and then cut a window (approximately 1.0 mm in diameter) into the mesio-buccal axial-occlusal line angles with a No. 330 carbide bur (**Figure 5**). When copings are placed on the prepared teeth, each window should provide visibility of the axial-occlusal line angle, which confirms completeness of seating on the teeth. Also, red Pattern Resin LS acrylic contrasts with the ivory color of teeth for easy evaluation of full seating and marginal accuracy of copings.

Step 6. Replace each coping on the abutment teeth and identify areas on the occlusal surfaces that will make contact with an opposing functional cusp or central fossa. Reapply lubricant to opposing teeth. Place a small drop of resin monomer-polymer mix on the occlusal surface of each coping, one at a time, to gradually build a resin cone that simulates a cusp; two resin cones may be added to molar copings. Allow the resin to polymerize completely before continuing with the build-up of a cone. When the glossy resin surface takes on a frosty appearance, ask the patient to close into MIP and maintain tooth-cone contact until resin polymerization is complete.

The cusp or central fossa of the opposing tooth will produce an indentation in the resin cone and provide an index that can be transferred back to the die and used to articulate a working cast accurately. Remove each coping and carefully grind away excess occlusal resin flash from each cone until the impression of only one opposing functional cusp or the central fossa is registered in MIP. Use 8µm shim stock (Almore International, Inc., Beaverton, OR) to adjust each cone separately until contacts with opposing unprepared teeth are light and simultaneous (**Figures 6 and 7**). Natural occlusal contacts should be checked before and after coping placement to ensure that no change has taken place. To minimize mandibular deviation during closure, the diameter of all contacts should be limited to 1 to 2 mm.

Step 7. To ensure stable occlusal stops, remove all occlusal blebs from opposing casts. If the working cast is not held immobile during mounting, any slight movement will translate into an occlusal discrepancy. Position the copings on their respective working cast dies. There should be absolute adaptation between resin copings and the opposing gypsum cast (**Figures 8 and 9**). Should it become necessary to further improve the stability of the working cast during mounting, adjacent copings may be joined together with acrylic resin while they are seated on the prepared teeth. An excellent method for rigidly stabilizing the mandibular to the maxillary cast during mounting on an articulator while avoiding any potential movement is by joining the casts with three CaStix (Articulation Innovations,



Figure 4 – Rigid resin copings are used as an alternative method of interarch registration.



Figure 5 – Absolute adaptation between resin copings and natural teeth is evident through verification windows. Note the build-up of occluding cones simulating cusp tips and the narrow, blue contact markings made by articulating ribbon.



Figure 6 – Bite registration accuracy is checked with foil shim stock.

LLC., Hedgesville, WV). CaStix is a rigid attachment device that connects the lateral borders of both cast bases to stabilize the mandibular cast in the record during the mounting procedure (**Figure 10**). CaStix may be affixed securely to casts with cyanoacrylate adhesive and adhesive accelerator. After pindexing, the dental technician can place the copings on the working cast dies and mount the cast with this method.

A semi-adjustable articulator is recommended when fabricating fixed prostheses as it reproduces mandibular border movements adequately and reduces the number of intraoral adjustments—the use of a simple hinge articulator should be avoided for prosthodontic procedures.⁴ For routine dental procedures, a facebow record—made with an arbitrary hinge axis facebow (e.g., Quickmount Magnetic System Face-bow, Whip Mix Corp., Louisville, KY)—is recommended to

orient the three-dimensional relationship of the maxillary cast to the transverse horizontal axis of the articulator; its use may decrease both intercusp and excursive errors (**Figure 11**).⁵ In this description, it will be assumed that the maxillary cast is mounted first and then the mandibular cast hand-articulated to the maxillary cast for mounting on a semiadjustable articulator.

Caveat: Ask the laboratory to produce a second solid cast from the original elastomeric final impression. Dies of working casts often exhibit some mobility because of pindexing, which precludes establishing perfect proximal and occlusal contacts. A solid cast can help the dental technician examine contacts produced on a working cast and improve the contacts when deficient prior to delivery of the definitive restoration to a patient.

Step 8. Use shim stock to verify all contacts when the definitive restoration is

placed prior to final cementation.

Discussion

Accurate articulation of full arch casts is achieved only when there is equilateral tripod stability. The firm and secure fit of functional cusps into opposing central fossae forms the basis for tripodization (**Figure 12**). It becomes increasingly difficult to articulate full arch casts accurately as fewer posterior teeth are available to provide the third leg of the tripod for mounting. In these situations, some dentists will resort to using thick elastomers to capture the missing leg and record interocclusal relationships; however, failure to remove areas of the record that contact soft tissues and the axial surfaces of teeth will prevent the dentist from visualizing areas where the casts and the record touch, ensuring that the record provides only horizontal support, with contacting teeth providing the vertical support.⁶ The likely result



Figure 7 – Natural contacts around the arch must be verified to ensure accuracy in mounting.



Figure 8 – To verify accuracy of the mounting, occlusal contacts between casts are compared with those observed intraorally using foil shim stock. Sufficient horizontal stability is obtained by contacts at other points in the arch; therefore, narrow cone contacts on any angle will provide addition support for mounting.



Figure 9 – An acrylic cone (lingual view) establishes light contact—approximately 1.5 mm in diameter—with the functional cusp of a mandibular molar and provides sufficient vertical stability to mount a working cast used to fabricate a maxillary three-unit FPD.



Figure 10 – CaStix may be used also to join damp casts prior to mounting on an articulator. A breakaway feature ensures neat separation from the casts; residual tabs that remain on the casts validate articulation procedures were accomplished.



Figure 11 – For indirect mounting of the maxillary cast, the Transfer Assembly of the Quickmount system may be removed from the facebow and positioned on the lower frame of the articulator for greater user access, ease and efficiency.



Figure 12 – Only one coping—on the distal abutment tooth—was needed to replace the lost tripod after a maxillary premolar and molar were prepared for a three-unit FPD

is an inaccurate mounting made at an increased OVD.⁷ It is difficult to objectively determine the amount of force needed to occlude casts when elastomeric materials are used to make interocclusal records. Excessive force will cause compression of the elastic record; some parts of the casts will be placed too close together and will likely lead to the fabrication of a restoration that lacks occlusion. Inadequate force will lead to inadequate seating of casts into the record, resulting in casts that are too far apart and a restoration that requires excessive adjustments. Each scenario will produce imprecise mountings, which will lead to lengthy adjustments or costly remakes of restorations.

The Pattern Resin LS transfer coping design is supported entirely by prepared tooth structure. Bite registration accuracy is ensured as the record avoids contact with soft tissues, which can cause displacement and inaccurate seating on prepared teeth. Inadvertent changes in the OVD are minimized as cone contacts with opposing teeth are adjusted until they are light, bilateral and simultaneous. Full arch or full sextant elastomeric or acrylic interocclusal records are more likely to produce increases in the OVD through improper handling of materials. The Pattern Resin LS transfer coping interocclusal record is accurate because it is both a segmental and a rigid record. In the example illustrated—where three teeth have been prepared—at least two widely-spaced tooth-to-tooth contacts (teeth No. 28 and 31) with opposing dentition are needed to ensure stability during mounting; however, an additional

coping (on tooth No. 29) has been used to improve the stability of the working cast and help verify accuracy of the MIP record. As the occlusal-cervical lengths of prepared teeth range from approximately 2-5 mm, records made with resin copings are usually short; however, Pattern Resin LS exhibits excellent flow characteristics, which ensures close adaptation to prepared teeth and stability in the record.

A potential error in mounting occurs when a mandibular cast becomes displaced as the technician or dentist attempts to stabilize it while adding a viscous gypsum mounting material to the cast base and mounting ring. Setting expansion of gypsum materials can produce additional errors in articulation as the mandibular cast moves either against the maxillary cast or within the interocclusal record. CaStix have been shown to significantly reduce vertical and horizontal displacement of the mandibular cast during setting expansion of mounting materials.⁸ Affixed casts are sufficiently secure to be sent to the dental laboratory as a unit prior to mounting.⁹

The transfer coping interocclusal bite registration technique may also be used to record the occlusion in sectional fashion when posterior teeth on both sides of an arch have been prepared for crowns or FPDs. Envision a case where three-unit FPD provisional restorations have been made for two posterior sections in an arch: teeth #s 18-20 and teeth #s 29-31 (with #s 18 and 31 serving as the terminal abutment teeth). A Pattern Resin LS transfer coping interocclusal bite registration may be used to capture

the occlusion on the right side of the arch while the left-sided provisional restoration holds a stable OVD. Once the right side is captured, the provisional restoration on the left side is removed and the restoration on the right side is reinserted. Additional acrylic resin copings are fabricated to capture the bite on the left side at the correct OVD.

Potential errors caused by polymerization shrinkage of resin during construction of copings and during the build-up of contacting cones can be kept to a minimum if small drops of resin are added via the brush-bead technique and the resin is allowed to set completely before additional resin is added.⁷ To maximize mounting accuracy, large contacts with opposing teeth must be avoided. It is recommended to limit occlusal contacts in resin cones to 1 to 2 mm in diameter at a few essential points. A record of opposing tooth contacts should be made during the first minute while the mixed acrylic resin is fluid and provides negligible resistance (approximately 0.5 to 0.6 N) to mandibular closure (**Figure 13**).¹⁰

Other materials for recording interarch relationships have included zinc oxide paste, impression plaster, baseplate wax, metallic wax (e.g., Aluwax™ [Aluwax Dental Products Company, Allendale, Mich.]) and impression (modeling) compound. Inaccuracy is inherent with the use of zinc oxide, which exhibits substantial polymerization shrinkage (1.0%) after 30 minutes.¹¹ Zinc oxide is somewhat difficult to use as it has a tendency to contract upon setting and adhere to teeth and fixed




Figure 13-Pattern Resin LS autopolymerizing acrylic resin is used to construct an interocclusal record. Stable contacts with occlusal surfaces of the opposing dentition provide the missing third leg of the tripod.

restorations. Impression plaster possesses characteristics that are excellent for making interocclusal records: it expands minimally upon setting (0.09%) and is soft at placement; however, mixing time is short (20-30 seconds) and plaster must be loaded onto a gauze tray prior to its introduction into the mouth. Baseplate wax is unreliable for making interocclusal registrations because it undergoes considerable thermal expansion (as much as 330 ppm/°C); is easily deformed under stress and with temperature change (a shortcoming that makes storage of all wax records difficult); and is less durable than resins.¹⁰ Modeling compound, which becomes rigid upon setting, has been used to fabricate segmental interocclusal records.^{11,12} Two potential errors associated with its use include: (1) flow of the material over axial surfaces of natural teeth and over soft tissues, which invites errors in repositioning working casts within the bite registration and (2) abrasion of working cast dies during mounting and subsequent removal of the record.

When carefully executed, the direct acrylic resin transfer coping technique avoids damage to working cast dies and minimizes errors in recording interarch relationships. The interocclusal registration technique outlined: (1) is simple to implement, (2) does not require that a coping be prepared in advance, (3) can be completed at the final impression appointment, (4) is easily verified and (5) reduces the number of clinical visits.

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Questions for Continuing Education Article - CE Exam #27

1. Accurate interocclusal records minimize:
 - a. The need for intraoral adjustments
 - b. Lab errors related to shade
 - c. Number of impressions required
 - d. All of the above
2. Mounting casts in the maximum intercuspal position does what?
 - a. Facilitates treatment
 - b. Reduces vertical dimension
 - c. Guarantees no TMJD
 - d. All of the above
3. When terminal teeth in an arch are prepared for crowns or FPD, the dentist must fabricate an interocclusal record to:
 - a. Recapture the lost leg
 - b. Increase the vertical dimension
 - c. Correct sleep apnea
4. When fabricating fixed prostheses it is recommended the dentist uses:
 - a. A simple hinge articulator
 - b. A semi-adjustable articulator
 - c. A facebow transfer and a simple hinge articulator
 - d. A Boley gauge to establish vertical dimension
5. Accurate articulation of full arch casts is achieved only when:
 - a. Pink base-plate wax is used to stabilize models
 - b. Blue Mousse is used to stabilize models
 - c. Equilateral tripodal stability is present
 - d. A facebow transfer is made to a Hanau articulator

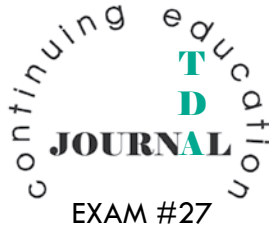
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