A quadrant tray and bite registration as an alternative to dual-arch impressions for fixed prosthetics: A clinical and dental laboratory technique

Barry D. Hammond, DMD • Michael L. Myers, DMD • Van B. Haywood, DMD

To perform fixed prosthodontic procedures, dentists take a full-arch or quadrant impression and articulate the casts. The dual-arch impression technique is a popular quadrants technique for crown fabrication. The technique described in this article, which uses a quadrant impression and separate interocclusal record, offers several advantages over the traditional dual-arch method.

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The process of fabricating well-fitting, functional, indirect dental restorations begins with a thorough evaluation of the patient’s existing occlusal scheme. Based on the results of this evaluation, the clinician will make choices regarding the impression method and subsequent articulation of the casts. Various methods of capturing tooth preparations have been discussed in the dental literature. These methods include full-arch impressions using either stock or custom trays and sectional impressions using either quadrant or dual-arch trays. Articulation methods include the use of adjustable articulators or simple hinge articulators. For quadrant casts, the difficulty in articulation is due to the lack of cross-arch occlusal contacts needed for buccal-lingual stability while mounting. For opposing casts to be held together in a stable and reproducible manner, both a tripod of vertical support and satisfactory horizontal stability between the two casts are required.

The dual-arch impression was first reported in 1951 by Getz utilizing reversible hydrocolloid in a water-cooled tray. The dual-arch impression technique was described further by Wilson and Werrin in 1983. Reported advantages of this technique include minimizing mandibular deformation during opening, registration of teeth in maximum intercuspsation, decreased time and materials, increased patient comfort, and ease of use. In vitro studies have demonstrated that the dual-arch impression technique can result in articulated casts with occlusal accuracy superior to full-arch casts mounted by hand articulation.

However, critics of the dual-arch impression technique indicate that lack of tray rigidity could result in flexure of the tray-impression complex, which in turn can lead to inaccurate die dimensions and resultant ill-fitting restorations. It also has been shown that thicker mesh found in certain dual-arch trays (for increased rigidity) can hinder closure into maximum intercuspation, which could negatively affect the accuracy of articulation. Also, if the patient closes in an eccentric jaw position when the dual-arch impression is made, correct articulation of the casts is very difficult or impossible, a fact that often is not discovered until after the casts are mounted.

Another concern with the dual-arch technique is that laboratory procedures can be problematic. For maximum occlusal accuracy with this technique, the dowel pins should be pre-positioned. Next, both sides of the impression should be poured and the casts articulated prior to removal from the impression. By following this protocol, however, the laboratory technician is not able to detect the presence of any defects or voids until the casts are removed from the impression. To avoid these potential problems, many technicians pour the two sides independently, create the removable die(s), and reinsert the casts into the impression for articulation. This method of articulation can create a significant occlusal error.

To overcome the clinical and laboratory shortcomings of the dual-arch impression technique, a quadrant articulation technique was described by Koth and Haywood in 1980. In their technique, the prepared tooth was impressed using a quadrant stock tray. The opposing cast was subsequently generated and
articulated by use of a disposable plastic registration tray and ZOE bite registration paste.

Use of a sideless registration tray to make the intraoral registration (IOR) not only captures the impression of the opposing arch, it also provides the support and stability of the quadrant casts needed for accurate articulation. Modifications to the Koth and Haywood technique include the use of contemporary, more dimensionally stable impression and IOR materials. Vinylpolysiloxane (VPS) material used to record the IOR has been shown to produce accuracy during articulation without significant vertical displacement of the casts. Not only must the occlusal registration material be accurate initially, it also must demonstrate accuracy over time (dimensionally stable), because it might not be used immediately.

The current article provides a step-by-step protocol to familiarize practitioners with this relatively unknown quadrant articulation technique, which is not described in any current prosthodontics textbook. The technique modifications described in the current article offer several advantages over the original technique described by Koth and Haywood, including the ability to rapidly make (by nature of the fast setting time) a new IOR if there is any question about the jaw position or accuracy of the record and the ability to remount the casts if necessary due to the accuracy and stability of the VPS registration material. Previously used rigid materials (ZOE registration paste) must be broken away from the impression tray to remove the tray to inspect the casts and determine the accuracy of the articulation. Destroying the impression tray precludes its use in the event that the opposing cast needs to be repoured or remounted.

**Procedure**

Prepare the tooth (or teeth) and make a quadrant impression using a rigid disposable stock plastic tray (COE Spacer Trays, GC America, Inc.) and the impression material of choice (VPS or polyether) (Fig. 1). Disinfect prior to pouring or submitting to the dental laboratory.

Using a sideless dual-arch impression tray (Triple Fit, Premier Dental Products) of sufficient width and length so as not to impinge the teeth or other anatomical structures, impress the teeth of the opposing arch and the occlusal surfaces of the arch with the prepared tooth. Evaluate the fit of the tray intraorally prior to making the IOR to ensure proper seating and repeatable closure into maximum intercuspation. Observe the contralateral teeth with and without the tray inserted for comparison. The IOR should be made with passive closure (without clenching) to minimize any displacement of teeth under occlusal load (because the impression of the quadrant with the prepared tooth was made in that state). Use of a rapid-set, rigid VPS registration material, such as Regisil Rigid (Dentsply Caulk), is recommended (Fig. 2). Disinfect prior to trimming or submitting to the dental laboratory.

Pour the previously disinfected quadrant impression with ADA ISO Type IV dental stone (Prima-Rock, Whip Mix). After separating, trim the cast and let it dry. Pindex the cast (Renfert USA Inc.), add dowel pin(s) (Dual Pin & Sleeve, Select Dental Manufacturing), and pour the base.

Separate and remove the working die(s) for evaluation and trimming. Trim the previously disinfected IOR with a sharp Bard Parker blade.
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Fig. 3. The previously disinfected IOR is trimmed to allow for complete passive seating on working cast.

Fig. 4. Quadrant working cast centered and mounted on an articulator. The IOR has been luted to the working cast with sticky wax.

Fig. 5. Pouring of the opposing cast to add retentive features for the mounting stone to follow. Note the use of a wax dam to control the flow of stone.

Fig. 6. Addition of mounting stone to the opposing arch to complete the articulation process.

Fig. 7. Evaluation of mounted casts on the articulator.

(Miltex Stainless Steel Surgical Blade #25, Integra York PA, Inc.), on the crown-preparation side only, to remove all soft tissue contacts, sharp projections, and interproximal areas while maintaining the occlusal third of the teeth for passive seating onto the working cast (Fig. 3).

Mount the working cast on a quadrant articulator (Keystone Deluxe Articulator, Keystone Industries) with ADA ISO Type III dental stone (Mounting Stone, Whip Mix) so that the IOR and the cast are centered in the articulator (Fig. 4). Ensure that the articulator closes without any interference from the IOR.

Seat the IOR on the working cast and trim as needed to ensure complete seating. Once the IOR is seated, lute it to the cast using sticky wax (Kerr Corporation) or hot glue. Do not allow the wax or glue to contact the removable die (Fig. 4).

Evaluate the IOR for future containment of stone. If the IOR is open at the end, create a wax dam to prevent die stone from flowing onto the working cast. Pour the opposing, untrimmed side of the IOR with ADA ISO Type III dental stone (Microstone, Whip Mix). Place retentive features on this pour, allowing adequate space between this pour and the opposing member of the articulator for the subsequent layer of mounting stone (Fig. 5).

Attach the opposing cast to the articulator with Type III dental stone (Mounting Stone, Whip Mix) (Fig. 6).

Separate the mounted casts by removing the IOR from the opposing cast rather than from the working cast so as not to damage the die. Visually verify that the teeth contact in maximum intercuspsation, as noted from the intraoral occlusal evaluation (Fig. 7).

Fabricate crown(s) as prescribed.
Discussion
Casts fabricated from full arch, dual-arch, or quadrant impressions and articulated either directly or by means of an IOR are the methods most commonly used by dentists and laboratory technicians. Although both the dual-arch and quadrant with IOR methods can yield predictable results under the appropriate clinical situation, the technique described in the present article offers numerous advantages for cases involving one or two teeth.

With this method, in contrast to the traditional dual-arch technique, the impression of the prepared tooth (teeth) is accomplished independently from the IOR. The advantage in separating these steps is that attention can be focused on the crown impression without being concerned with capturing the opposing arch and accurately recording the patient’s maximum intercuspation position at the same time. Once the impression of the working arch is deemed acceptable, attention can then be focused on accurately recording the maxillomandibular relationship and the opposing arch.

In this quadrant technique, the impression is made with a rigid stock tray; therefore, less chance exists for bending or deformation of the impression-tray complex (compared to a more flexible dual-arch tray), which could result in a distorted impression and a subsequent ill-fitting crown or inaccurate articulation. In the dual-arch technique, trays with walls (which are often recommended for support of the impression material), in combination with a high-viscosity impression material, can result in an eccentric closure by the patient. In contrast, fabricating the IOR in this quadrant technique involves the use of a sideless tray with a low-viscosity registration material and is less likely to interfere with the patient’s accurate closure into maximum intercuspation.

The described technique minimizes the inherent difficulty in the laboratory steps. Using this technique, the working cast can be made with standard dowel pinning methods (for example, Pindex). The IOR is made from a VPS material and can be easily trimmed to be seated on the working cast. The dental stone is poured into the IOR and the entire assembly is articulated without separation of the opposing cast from the IOR, to reduce the likelihood of occlusal errors. It also allows the technician to view the working die(s) for acceptability prior to pouring and mounting both arches, as is typically done with dual-arch impressions.

One final clinical advantage of this technique is the ability to adjust the opposing tooth to correct the occlusal plane or provide for additional occlusal clearance, if necessary, during provisional fabrication. If there is insufficient occlusal clearance when the provisional is fabricated following the impression of the prepared tooth, the opposing tooth can be adjusted (if necessary). This modification to the opposing tooth would be accurately replicated in the IOR. The advantage lies in the ability to capture this change in the IOR without having to make a new final impression, as would be the case with the traditional dual-arch technique.

Summary
The technique described in this article is a relatively simple method that can be used with ease to produce accurately mounted casts. The advantages of this technique are reduced risk for distortion of the impression material/tray complex, the separation of the impression and the IOR steps, the ability to inspect the die prior to articulation, and a reduction in other laboratory complications associated with the traditional dual-arch method. The technique has all of the advantages of the dual-arch technique while eliminating most of the disadvantages. When this protocol is utilized properly, definitive restorations should need only minimal occlusal refinement in maximum intercuspation, resulting in reduced chair time and a cost savings to the practice and the patient.

Author Information
Dr. Hammond is an associate professor, Department of General Dentistry, College of Dental Medicine, Georgia Health Sciences University, Augusta, where Dr. Myers is a professor and chair, Department of Oral Rehabilitation, and Dr. Haywood is a professor.

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GC America Inc., Alsip, IL
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