How to mount study casts on an articulator.

by Dr Mark Spencer

Introduction

A wealth of diagnostic information is available to the practitioner by accurately mounting study casts on an articulator. Regardless of whether the dentist decides to restore or treat any of the teeth to maximum intercuspation (MI - the existing habitual bite) or centric relation, it is essential that the casts be articulated to centric relation to record all the possible positions and movements of the jaw and the dynamic relationship of opposing teeth.

Benefits of articulating study casts:

1. Analysis of Existing Occlusion:
   - Evaluating individual tooth trauma.
   - Determining cause of opening contacts causing food impaction.
   - Diagnosing factors that might contribute to TMD.
   - Understanding the mechanics of wear patterns in the dentition.
   - Determining which of the posterior teeth deserve cusp protection with crowns or other cast restorations.
   - Assessing masticatory effectiveness.
2. Treatment Planning for:
   - Orthodontics and orthognathic surgery.
   - Occlusal equilibration.
   - Prosthetic reconstruction of existing teeth and/or edentulous spaces (including implants).
3. Patient Education and Visualisation of Proposed Treatment.
4. Laboratory Fabrication of Crowns and Bridgework (especially those involving three units or more).
5. Medico-Legal Record.

Choice of Articulator:

The author recommends a semi-adjustable arcon-type articulator. An arcon articulator permits the device's condyle to drop from the “fossa” and the condyle is not encased. The “semi-adjustable” description refers to the straight surface of the articular eminence as opposed to the anatomically reproduced surfaces of a fully adjustable instrument. The Denar or Whipmix models are good diagnostic semi-adjustable articulators.

Procedures:

1. Take four good alginate impressions:
   It is important that a pair of diagnostic casts should remain an accurate record of the patient’s current dental status and therefore not altered or damaged. If any adjustment is to be done to the models for treatment planning, then a second set of casts should be poured.
   Two upper and two lower alginate impressions are taken and poured with Type 4 diestone, (e.g. FujiRock). In some cases, it is permissible to pour two casts from the one impression, if the alginate is kept moist, but generally it is better to make a single impression for each cast.
   The alginate should ideally be mixed under vacuum to avoid air-bubbles which will produce positive stone nodules in the cast. It is also important to pour the alginate impressions within ten minutes to avoid any dimensional change which will occur if the alginate dries out (syneresis) or absorbs water in a wet or submerged environment (imbibition).
   Before inserting the alginate trays, smear a small amount of alginate on the tip of a finger into the fissures of the teeth to avoid bubbles. This is essential to provide accurate diagnostic casts. Removing bubbles afterwards may introduce artifacts and inaccuracies into the casts. It is also advisable to keep the jaw as closed as possible while taking the impression, without the patient’s opposing teeth contacting the tray. The contraction of the suprahyoid muscles upon wide opening causes the jaw to flex and can narrow the arch as much as 0.9 mm to 2 mm between the first molars.
2. Facebow Record:
   The purpose of the facebow record is to triangulate in space the upper arch to the opening and closing axis (hinge). A good centric relation record is taken with the teeth slightly apart, so that the wax wafers only exhibit cusp tip indexing (see next section).
   Because the teeth are apart, an accurate registration of the axis of rotation of the condyle is essential to be able to reproduce the correct closure path for the bite and determine the exact occlusal contacts on the
Mounting study casts. (cont)

exact occlusal contacts on the surfaces of the teeth when the casts are brought together.

A facebow record is also used:
- To allow a visualisation of the cant of the occlusion. From front-on, does it slope inferiorly to the right side or left? It also allows assessment and planning of treatment options if a more level occlusion is desired for aesthetic purposes.
- Any cant or tilt to the occlusal plane accurately reproduced on the articulator is important in accurately assessing the excursive movements of the teeth in relation to each other (see illustration below).

For this reason, it is important to reproduce any cant existing in the occlusal plane and not to orientate the upper occlusal plane parallel to the table-top as suggested by some schools of thought.

If your articulator has adjustable inter-condylar width settings, match the articulator condyle width adjustment to the facebow inter-condylar width markings. Normal dental plaster does not have the dimensional stability required for accurate mounting of casts, nor does it have the good handling properties desirable for this exercise. A proper mounting stone like Whipmix Mounting Stone sets quickly, does not slump and has excellent dimensional stability during setting.

The more anterior position of the maxilla to the hinge axis on the right results in a wider arch of closure which brings the distal cusp tip of the lower second molar into a more anterior contact on the upper second molar.

The Whipmix facebow in use to record the maxilla’s relationship to the opening and closing hinge axis.

Source: www.dentaloutlook.com.au
3. **Centric Relation Record**:

There have been a number of methods suggested for obtaining a centric relation record of a patient. The leaf-gauge method is the simplest and most reproducible method.

For our purposes, centric relation may simply be defined as that position of the mandibular condyle in relation to the glenoid fossa of the temporal bone and the interposing disc, without the dictating influence of the intercuspation of posterior teeth. More simply put, it’s where the condyle would go without the over-riding influence of the back teeth. Patients will attempt to find their centric relation position and work in that position so it should not be neglected if potentially damaging contacts and fulcrum points are to be avoided, especially during nocturnal bruxing.

A good and easy method for recording centric relation is to use a leaf gauge (Huffman Dental Products LLC; www.leafgauge.com). The leaf gauge (illustrated with photo) is similar to a “feeler gauge” except all leaves are of the same dimension and are plastic. Its use is essentially as an anterior deprogramming device.

The author typically starts with enough leaves between the upper and lower central incisors to separate the back teeth. This allows the muscles to seat the condyles which invariably will result in posterior tooth contact, at which time, more leaves are added.

The patient is asked to protrude the jaw just a little, so they understand the jaw going forward, then asked to retrace the jaw (the opposite direction they just went). This will assure the patient is not biting on the leaf gauge with any forward position of the jaw. The patient is then asked to let the dentist know when they feel any of the back teeth contact. As soon as they are aware of posterior tooth contact, more leaves (say three to five) are interposed between the anterior teeth. Again, when they are aware of posterior tooth contact, another three to five leaves can be interposed. This goes on until the patient is no longer aware of any posterior tooth contact for at least five minutes. At this time, the operator should check the clearance between the upper and lower teeth by inserting shim stock or articulating paper between the back teeth.

When there is no longer any posterior tooth contact, it is presumed that the condyle is seated against the eminence in the glenoid fossa according to muscle and ligament guidance only. Centric relation is established, given the state of health of the joints at that time.
The Huffman leaf gauge is inserted between the anterior teeth to de-program the muscle memory associated with the habit bite.

A hard inflexible wax such as Moyco Beauty Wax is recommended for the inter-occlusal record. It is recommended that two separate recording strips be used for each side rather than one piece of wax stretching across the palate. The latter technique can result in a distortion of the record by any bending of the single piece in the middle region. There is also a risk of wax extended over the palate depressing soft tissue (which is clearly not soft in the stone cast).

Wax strips can be prepared as suggested in the diagram below. A small strip of lead foil (from old xray packaging) is inserted into the fold of wax at one end to allow the wax to sink vertically into hot water (about 55 deg C) for even softening. Otherwise, air trapped between the fold can keep the wax floating on top of the water, possibly resulting in uneven softening. (If lead foil is not used ensure that the strips remain fully immersed). Both wax strips should go into the water bath and out of the bath at the same time.

Even though enough leaf-gauge strips have been inserted between the front teeth to avoid any posterior tooth contact, an additional ten leaves are interposed to achieve cusp tip indexing only. The most accurate part of the record are the elevations; the least accurate are the depressions, so we only wish to record the cusp tips but not so lightly that the casts are not securely held by the records. If the cusp tip indexing is too shallow, remove some leaves and repeat the procedure. If the indentations are too deep (so that the grooves and fissures are also included), add more leaves and repeat the procedure.

While the assistant holds the leaf gauge in position between the front teeth, the dentist removes the Moyco wax strips at the same time from the hot water bath (55 deg C) and lightly presses each strip onto the occlusal surfaces of the upper teeth between the mesial of the upper second molars and extending over the cuspids. It is important that the wax does not extend beyond the most distal tooth, as the soft retro-molar gingiva will compress in the mouth, but the stone gingiva on the cast will hold up the wax record. The assistant should retract the cheek so that the cheek does not dislodge the wax record. Room must be left for the width of the leaf gauge between the upper and lower incisors. The patient then closes back onto the leaf gauge, again makes a slight protrusive movement, then “back”, and then squeezes the teeth together. The dentist can leave the wax between the teeth to gradually harden.

When the wax has hardened, it will trigger a neural response from the periodontal ligaments of the posterior

The leaf gauge is left in place as the Moyco wax bite strip records centric relation.

A template can be made to most efficiently prepare bite recording wafers from a single sheet of Moyco wax (photo courtesy of Dr W. McHorris)
Mounting study casts. (cont)

Moyco wax is folded over a short strip of lead foil from xray film packets so that the wax sinks vertically in the warm water bath.

Coprwax is simple to use for lateral bite records, used to set the condylar inclines.

teeth, causing a contraction of the jaw closure muscles (masseter and medial pterygoid). This will further assure the condyle-disc assembly is securely positioned against the eminence of the articular fossa.

After approximately one minute, the wax strips can be removed and carefully set aside. Warn the patient that their “bite” might feel strange for a minute or so.

3. Lateral Excursion Records for Condylar Incline Settings:

Two horseshoe-shaped sheets of Coprwax are used to record the right lateral excursion and left lateral excursion. One sheet of this comparatively soft wax is inserted between the teeth and the patient asked to swing their jaw to one side, such that upper and lower canines are almost edge to edge. A separate sheet of coprwax is used to record the lateral excursion to the other side. This wax is not softened with a flame or hot water but used at room temperature.

Position the Coprwax such that only the palatal cusps of the upper teeth on the non-working side are covered. This will ensure that there is available wax for cusp tip indentation as the lower jaw moves medially. The operator will need to use open hand pressure at the angle of the mandible on the non-working side to seat the condyle against the eminence and create sufficient indentations into the Coprwax. The patient may assist this closure into the wax but at the same time, not moving back into centric and losing the translated condylar position.

On the articulator, the condylar angle settings are loosened, and the articular plate swivelled until it touches the articulator’s condyle. This is done on both sides with the Coprwax between the upper and lower casts.

The side-shift plates are also loosened and allowed to contact the translated condyle to record the degree of side-shift in condylar translation on the non-working side.

4. Checking Accuracy of Articulation:

Note the patient’s first point of contact in centric relation while the patient is in the chair. Once the patient reports that they can no longer feel any back teeth contacting after inserting a number of leaf gauge leaves, the first point of CR contact can be located by removing leaves one at a time until the patient is again aware of tooth contact. This point of contact is registered with articulating paper and noted in the records.

Once the casts have been articulated, the same first point of contact should also be present on the stone models, using articulating paper. Look carefully for wear facets on the stone casts and visualise the mechanics of that wear pattern by working the casts against each other on the articulator.

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Mounting study casts. (cont)

An upper 7 demonstrates a first CR contact on the distal aspect of a wear facet created by a CR-CO slide. Such an inclined working area can open contacts allowing food impaction, or cause a hyperaemic pulp or contribute to TMD.

A typical situation where an over-erupted upper third molar is the first contact in centric relation (arrowed).

about the author.....

Dr Mark Spencer is in private practice in Coffs Harbour, Australia.

He is a meticulous operator with an extensive knowledge of occlusion. He has been involved with undergraduate teaching at the University of Sydney.

Dr Spencer has been a long-time contributor to Dental Outlook and his articles are always extremely well received for their thoroughness and practicality.