Orthodontic dental casts: The case for routine articulator mounting

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To mount or not to mount: that is the question. The famous quotation from Hamlet, slightly transformed, continues: “Whether ’tis nobler in the mind to suffer the slings and arrows of outrageous fortune, or to take arms against a sea of troubles, and by opposing end them. To die, to sleep…”¹

Of course, the question of whether to mount dental casts is not worth “suffering slings and arrows,” nor is it worth getting depressed, and certainly we should not commit suicide over it! After all, it’s only an articulator; yes, there are many reasons why we should mount models on an articulator, but let’s think about its clinical importance, use some logical thinking, and take away the passion.

To better understand this Point/Counterpoint discussion, we should avoid relating the use of an articulator to a group, a philosophy, or a guru. It is simply what is best for the patient.

Researchers have reported that the use of an articulator is not evidenced-based, as stated by Rinchuse and Kandasamy² in their article, “Articulators in orthodontics: an evidence-based perspective.” Evidence-based research needs to be put in the proper clinical context. The most relevant question is whether research is always good for clinical practice. This implies that the clinical reality to which it is applied should not be misrepresented to satisfy the demands of the research. Use of the term “evidenced-based” in position-statement papers only confuses the situation. From a clinical perspective, several points should be considered.

The articulator is only a clinical tool that we can use to obtain a more complete diagnosis. The more information we have about the patient, the better our diagnosis and eventual treatment. Therefore, concerning its use, it is not a matter of yes or no but, rather, why not? An orthodontist can do good orthodontics without using an articulator, but an articulator can help him or her provide better treatment in many clinical situations.

The articulator provides an added dimension that helps in gathering more information by visualization of the pretreatment occlusion in static occlusion, and permits the visualization of various functional movements. In prosthodontics, once the musculoskeletal stable position has been obtained and the patient’s dental casts are mounted on the articulator, posterior teeth can be removed. It is then possible to determine whether the origin of the malocclusion is horizontal, vertical, or transverse. Knowing this in many Angle Class II cases will prevent the clinician from trying to do the impossible in correcting the malocclusion. By doing this easy step in diagnosis, we know the limitations even before placing the first bracket. This information is impossible to obtain with hand-held dental casts, and most orthodontic failures are due to an incomplete diagnosis and not determining the origin of the malocclusion before treatment. Mounted dental casts are an aid to a more complete diagnosis.

The following is a list of many important reasons for mounting dental casts on an articulator.

1. It helps in measuring the centric relation-centric occlusion discrepancy in 3 planes of space. This is important information when the goal is to treat to a musculoskeletal stable position.
2. It helps in determining the first contact point (fulcrum point) in centric relation. This is particularly important in patients with a reduced posterior vertical dimension and a vertical or clockwise pattern of growth. This gives a realistic picture of the vertical control mechanics that must be used to correct the malocclusion.
3. It helps in studying the attrition patterns and the proclination of the maxillary incisors in periodontal patients.
4. It helps in determining the need for “trial” treatments. A diagnostic setup on mounted dental casts is often necessary in patients with tooth-size discrepancies. We can determine the needed changes before our actual treatment.

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5. It helps during treatment to identify a lack of arch coordination and prematurities due to improper bracket placement, so that we can be more precise and efficient in our finishing procedures.

6. It helps in performing proper mock surgery in orthognathic patients.

7. It helps in constructing precise splints.

8. It helps to better coordinate our work with the prosthodontist in complex multidisciplinary cases.

As orthodontists, we need to relate the occlusion to a specific joint position or to a limited range of acceptable positions. The alternative is to disregard joint position, assuming that it does not matter how the joints and the occlusion are related. If we disregard joint position, orthodontics can be considered a discipline whose sole goal is to align the teeth.

Orthopedic stability or a position should be the goal of all orthodontists. Clinicians should strive to place the teeth in positions that achieve harmony between the teeth and the joints. Hand-held dental casts do not help in achieving orthopedic stability. They can mislead the practitioner, since they do not relate to the temporomandibular joint position.

Okeson, in his recent lecture entitled “Selecting the best joint position: why all the controversy?” said, “The criteria for optimal orthopedic stability in the masticatory system would be to have even and simultaneous contacts of all possible teeth when the condyles are in their most superoanterior position, resting against the posterior slopes of the articular eminences, with the disks properly interposed.” This joint position should be the goal for all orthodontic treatment.

What is orthopedic stability? Once again, Okeson stated that “Orthopedic stability in the masticatory structures exists when the stable intercuspal position of the teeth is in harmony with the musculoskeletal stable position of the condyles in the fossa.” In comprehensive orthodontic treatment, whenever possible, we are committed to provide our patients with orthopedic stability or a musculoskeletal stable position. Hand-held dental casts in maximum intercuspation display only the interarch relationship without considering joint positions. In certain patients, this can significantly mislead our treatment.

Can an experienced orthodontist manipulate the patient and diagnose dual bites? Certainly, but it is not always so easy, whereas mounted dental casts are a much more practical clinical method of evaluating the harmony between the teeth and the joints. What happens when we do not achieve orthopedic stability but, rather, orthopedic instability?

Okeson answered this question. “When there is a lack of harmony between the musculoskeletal stable position of the condyles and the intercuspal position of the teeth, the condition is known as orthopedic instability.” When this condition exists, there are opportunities for overloading and injury. When orthopedic instability is present and the teeth are not in occlusion, the condyles are maintained in their musculoskeletal stable positions by the elevator muscles. However, when the teeth are brought into occlusion, maximum intercuspation cannot be achieved if the condyles are maintained in their stable position. This results in an unstable occlusal position, even though each condyle remains in a stable joint position.

The orthodontist now has a choice: to either maintain the stable joint position and have the patient occlude on a few teeth, or bring the teeth into a more stable occlusal position that will compromise joint stability. This is a major reason for our commitment. With mounted dental casts, we can record and quantify whether the patient occludes in 1 position in harmony with the joints or has a dual bite. For the same reason, mounted models are no substitute for other important temporomandibular joint diagnostic records, whenever required.

Can we achieve the correct position with hand-held dental casts? Almost never! Maybe by luck, but your patient deserves to be treated with knowledge, not luck. Having used articulators for more than 25 years and after having treated thousands of patients, we believe that, to be able to diagnose and most importantly to treat to this position, the use of articulated dental casts is a necessity. Not just at pretreatment, which is important, but also during treatment to continually evaluate condylar position and to see whether we have obtained orthopedic stability.

This is methodologically impossible with hand-held dental casts. The reason is that most of these patients have vertical problems and vertical discrepancies cannot be diagnosed with hand-held dental casts. The patient will always avoid this first premature contact;
is displacement. Isberg stated that disc displacement is and opens the functional spaces; this can lead to disc displace- 4 ments (fulcrum), which pulls the condyle out of the fossa 6-7 8-9 position, so maybe it should be condyle position, occlusion, and temporomandibular disorders. Therefore, what you see on the hand-held casts made in centric occlusion is not always what the patient truly exhibits. Thus, one could misdiagnosis the patient. Most orthodontic failures, retreatments, and temporomandibular joint problems occur in patients with vertical problems.

As Palla from the University of Zurich stated, “The occlusion determines the fossa-condyle relationship and at the same time regulates the muscular activity through the periodontal receptors.” Let’s go a little further into the question because the temporomandibular joint is also involved in this relationship. We can now begin to clearly understand how and why occlusion might be a factor in the cause of signs and symptoms of temporomandibular disorders.

Orthopedic stability implies that the condyles also are in a stable relationship in the fossae; therefore, loading occurs with no adverse effects on the joint structures. If loading occurs when a joint is not in a stable relationship with the disc and fossa, unusual movement can occur in an attempt to gain stability. This movement, although small, often is a transitory shift between disc and condyle.

Movements such as this can lead to strain in the discal ligaments and eventually to elongation of the discal ligaments and thinning of the disc. These changes can lead to temporomandibular disorders. The cause of this shift between the condyle and the disc is an interference (fulcrum), which pulls the condyle out of the fossa and opens the functional spaces; this can lead to disc displacement. Isberg stated that disc displacement is an acquired position. There are many predisposing factors such as trauma, but do not forget occlusion. A large centric occlusion-centric relation discrepancy can lead to disc displacement and be the first cause of a temporomandibular disorder. So, considering this, we must now take a new perspective at the relationship between occlusion and temporomandibular disorders.

Instead of talking about occlusion and temporomandibular disorders, we should focus on the condyle position and temporomandibular disorders. As Palla stated, the teeth are responsible for where the condyle is positioned, so maybe it should be condyle position, occlusion, and temporomandibular disorders. This is where the articulator once again becomes a decisive factor in preventing and treating patients with temporomandibular disorders.

We know the importance of orthopedic stability in the diagnosis and treatment of these patients; without this instrumentation, it is impossible to reach an accurate diagnosis. If you cannot diagnose orthopedic instability, it will be difficult to choose the correct treatment plan. Thanks to the mounting and the visualization of the malocclusion (which sometimes is responsible for the temporomandibular disorder symptoms), we can decide what needs to be accomplished to maintain orthopedic stability.

As Okeson and Palla have stated, we need to place the teeth in a position so as not to displace the joints. Fortunately, a mounting, which represents such a position, now places us in a unique position as diagnosticians. We will be able to decide before placing 1 bracket in the mouth whether we have an orthodontic case, a prosthodontic case, an orthodontic-prosthodontic case, a surgical case, and so on. The ability to do this reduces the mistakes and failures in our orthodontic practices enormously. Now, is this not important enough to have the articulator in our tool box? As we said before, it’s just another tool that helps us diagnose more thoroughly.

We know from the recent publications of Heasman and Millett, Harrel and Nunn, Nunn and Harrel, and Harrel et al that there seems to be strong evidence of an association between untreated occlusal discrepancies and the progression of periodontal disease. In addition, these studies show that occlusal treatment significantly reduces the progression of periodontal disease over time and can be an important adjunct therapy in the comprehensive treatment of periodontal disease and that orthopedic instability has periodontal implications.

One goal of orthodontic treatment is a healthy periodontium. Orthodontic treatment has a direct affect on the face, teeth, joints, muscles, and periodontium. Diagnosis is the key to achieving optimal results in all of these areas. Our patients deserve the best treatment possible. It is difficult to achieve optimal results in all of these areas by using traditional plaster hand-held dental casts. There is absolutely no relationship to the face, teeth, joints, muscles, and periodontium. Orthodontic treatment has a direct affect on these static casts sitting on the desk. The only way is to use the necessary instrumentation. The treatment goal, as stated earlier, is to achieve a musculoskeletal stable position. To do this, the orthodontist must know the exact relationship of the condyles at the start of treatment. Only then can the treatment be planned to achieve the goal of a stable condylar position. An articulator is a key to diagnosis and thus helps us to obtain all of the goals.

As Dr Frank Spear states, “a CR (centric relation) to ICP (intercuspal position) slide by itself, is not evidence of occlusal pathology. However if it becomes necessary to treat a patient’s occlusion, centric relation is the condylar position of choice.” To treat to centric
relation, the use of an articulator will make the journey much easier and more efficient.

As in any methodology, there is space for improvement. In the future, we can count on electronic recordings or digital imaging that might make these procedures easier and more accurate. But so far, articulators and mounted casts are reliable clinical tools, chosen by most of the best clinicians in any field of dentistry to obtain excellent dental care. Mounting dental casts and many other clinical procedures that we routinely use every day are empirically unconfirmed methods, but this does not make them empirically invalid.

We face the risk that research, rather than contributing to an understanding of clinical practice, helps sustain a constant divide between real therapies as they are applied in clinical practices every day, and theoretical and experimental models artificially created in a laboratory that do very little to bring researchers and clinicians closer together.

REFERENCES