Mandibular centricity: Centric relation

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Centric relation can be a confusing term because it continues to evolve in meaning. This article presents a discussion of the historical aspects of centric relation. Guidelines to decide when to use centric relation in clinical dentistry are included. (J Prosthet Dent 2000;83:158-60.)

Nearly all concepts of dental occlusion have embraced the practice of mandibular centricity, with the exception of cranial orthopedics1-3 (also called oral orthopedics). Early writers loosely referred to mandibular centricity as centric relation (CR), but they rarely defined this jaw position adequately. In 1929, Hanau4 defined centric relation as the position of the mandible in which the “condylar heads are resting upon the menisci in the sockets of the glenoid fossae, regardless of the opening of the jaws.” He also stated that this relation is “either strained or unstrained.” Hanau4 preferred the unstrained centric relation associated with an acceptable opening for a reference “jaw relation.”4 In 1934, Niswonger5 described CR as a position where the patient can “clench the back teeth.” Schuyler6 defined the “centromaxillomandibular” position or centric position as “upper lingual cusps are resting in the central fossae of the opposing lower bicuspids and molars.”

In 1946, Thompson7 acknowledged the lack of knowledge that was the basis of clinical procedures and declared that “some believe that, in centric relation, the condyles are in the most retruded position in the fossae, while others maintain they are not.” The pioneers in prosthodontics rarely advocated manual manipulation of the mandible to achieve centric jaw registration. In 1923 Needles,8 used an intraoral arrow point tracing in which “the patient retruded the mandible to its fullest extent.” Schuyler9 advised the use of wax interocclusal records and “the patient may be requested to place the tip of the tongue far back on the palate to hold it there while closing. It is quite impossible for one to protrude the mandible when this position of the tongue is retained.” Meyer,10 who used the functional-sure on the chin.” Mandibular manipulation increased in popularity with more interest in gnathologic philosophy. Mandibular manipulation gained in acceptance and authors began to warn of strain to condyles. In 1951 Robinson11 stated that the mandible “can be retruded beyond what we should consider centric into a strained retruded position.”

The debate to accurately define the “centric jaw relation” escalated, and new terms began to appear in the literature. Terms such as posterior border closure, relaxed closure, bracing position, hinge position, ligamentous position, retruded contact position, and terminal hinge position merely added confusion. The various disciplines within dentistry could not agree on a definition of centric relation. The periodontal textbook by Goldman and Cohen12 defined centric relation as the most posterior relation of the mandible to the maxilla from which “lateral movements can be made.” Glickman13 stated that centric relation was “the most retruded position to which the mandible can be carried by the patient’s musculature.”

Graber14 thought that centric relation was an “unstrained, neutral position of the mandible” and “is deviating neither to the right nor to the left and is neither protruded nor retruded.” Boucher15 stated “centric relation is the most posterior relation of the mandible to the maxillae at the established vertical relation.” Schluger et al16 declared that centric relation was “the position assumed by the mandible relative to the maxilla when the condyles are in their most rearmost and midmost position in the glenoid fossae.” This definition is extremely close to the gnathologic RUM definition purposed by McCollum and Stuart,17 in which the condyles are in a “Rearmost, Uppermost, Midmost” position to the glenoid fossae.
"regrettable" and argued that centric relation is a bone-to-bone (mandible-to-maxilla) relation, whereas centric occlusion (MIP) is a tooth-to-tooth (mandibular teeth to maxillary teeth) relation. Schweitzer19 lamented, "with almost 40 definitions of centric, it would be presumptuous on my part to offer another."

Schluger et al19 admitted that the word centric may be the most "controversial term in dentistry," not only from a semantic point of view but also from a conceptual point of view. They admitted that these serious disparities in concept "may never be resolved."16 The most recent edition of The Glossary of Prosthodontic Terms (7th ed, 1999) defined centric relation as "the maxillomandibular relationship in which the condyles articulate with the thinnest avascular portion of their respective disks with the complex in the anterior-superoing position against the shapes of the articular eminences."20 The authors of the seventh edition also listed 7 other acceptable definitions of centric relation and quoted several personal communications from respected members of the dental profession including Drs Ramsfjord, Ash, Lang, and Kelsey. The authors of the 5th edition (1987) of The Glossary of Prosthodontic Terms stated, "This term (CR) is in transition to obsolescence."21 Most agreed that the more attempts to define this critical concept of clinical dentistry, the more confusing it became.

The current definition of CR is considerably different from definitions used by Hanau, Niswonger, Schuyler, and others. These clinical dentists recorded centric relation quite differently than today, but the concept of mandibular centricity remained constant, even though the definition and techniques have evolved and will probably be continuously modified. Furthermore, Schweitzer19 observed that most experienced dentists have been able to locate centric relation for the average patient they treat. Experienced dentists may not be able to give a precise definition of this controversial position, but they are able to record it.19

**CLINICAL IMPORTANCE OF CENTRIC RELATION**

Only a sparse number of patients function naturally in centric relation occlusion; but centric relation is an invaluable position in restorative dentistry. The question for a dentist is when is the occlusal scheme restored in CR and when in the habitual maximal intercuspal position (MIP) of the patient? The answer is not absolute because each patient possesses a different set of clinical circumstances that influence this decision.

Some guidelines for this clinical decision are as follows:

1. Use MIP for an individual crown.
2. Use MIP when there are 3 to 4 units of posterior fixed partial dentures (FPDs) or removable partial dentures (RPDs).
3. Use MIP when there are 3 to 6 units of anterior FPDs or RPDs.
4. Adjust the occlusion of the remaining posterior teeth to CR and build occlusion to CR if only 2 to 3 posterior teeth remain in contact after preparation of the abutments.
5. Use CR when there are no posterior occlusal contacts remaining at the desired vertical dimension of occlusion.

If a clinical decision is made to place the patient in an occlusal scheme based on centric relation for options 1 to 3, then occlusal adjustment, based on principles on biologic occlusion,22 should be accomplished before fabricating a prosthesis.

The principles of biologic occlusion (and occlusal adjustment) are as follows:

- 1. No interference between CR and MIP.
- 2. No balancing contacts in eccentric jaw movements.
- 4. A minimum of one contact per tooth, but multiple contacts per tooth are desirable.
- 5. Canine rise or group function in lateral mandibular movement.
- 6. No posterior contacts with protrusive jaw movements.
- 7. No cross-tooth balancing contacts.
- 8. Eliminate all frenitis, if possible.

It is unreasonable to demand that the condyles remain in their hinge position for long periods when teeth are in a maxillary intercuspal position. It is not unreasonable to ensure that there are no cuspal interferences between CR position and the MIP and that nonworking contacts are eliminated.

**SUMMARY**

This article presents a brief discussion of the evolution of dentistry to define the term centric relation. Guidelines to determine when to use centric relation in clinical restorative dentistry were also presented.

**REFERENCES**

Shear stresses in the adhesive layer under porcelain veneers: A finite element method study

**Purpose.** The cement interface is the weakest link in the bonding of porcelain veneers to natural teeth and that failure is due to shear stress. The purpose of this article was to calculate the shear stress in the composite cement and the enamel bond with a porcelain facing loaded in the incisal area under different angles and adhesive conditions using a finite element study.

**Material and methods.** A 2-dimensional finite element model of porcelain veneers with an intermediate layer of composite resin were designed for an average maxillary central incisor. The remaining enamel layer under the buccal surface of the veneer and the pulp were treated as dentin with regard to their mechanical properties. Three models were created with differing cervical designs: (1) featheredge preparation; (2) chamfer preparation; and (3) shoulder preparation. All preparations covered the incisal edge. The facings were 0.5 mm thick; composite cement layer, 25 mm; and enamel bond layer 1 mm. Three different adhesive conditions were tested: (1) lack of polymerization in the periphery; (2) lack of polymerization in the middle; and (3) total bonding of the veneer. All models were loaded at 0 degrees, 30 degrees, and 60 degrees to the long axis of the tooth. A total of 27 different examinations were made with a Hewlett-Packard computer(9000/720) and the ABAQUS FEM program.

**Results.** The maximum shear stresses did not exceed the stress level for debonding, but significant differences in the maximum shear stress appeared with varying loss of bond and different loading angles. The completely laminated facing showed stress levels in the composite cement only ¼ of those in the facing with a lack of adhesion in the periphery, and ¼ in the enamel bond. The maximum stresses increased about 4 times when the load angle was 30 degrees as compared with 0 degrees, and increased about 1.5 times from 30 degrees to 60 degrees.

**Conclusion.** A porcelain veneer that is kept within the enamel, with full lamination, shows low shear stresses in the enamel bond and composite cement and should exhibit a good long-term prognosis assuming that the incisal edge is not loaded in an unfavorable direction during function. 13 References. —RP Renner