

REVIEW ARTICLE

Conceptions and Misconceptions about Centric Relation: A Review of Literature

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ABSTRACT

Many prosthodontists feel that recording centric relation is the most challenging clinical step in treating edentulous patients. However the literature on centric relation in complete denture prosthodontics is voluminous and well documented. Majority of the dentists claim that a correct centric relation is the most important single step made in the fabrication of complete dentures, however, no single technique, philosophy is universally accepted. Over the period of time various theories and terminologies have been proposed, some are accepted and some are modified.

Keywords: Centric relation, Bite, Tracers, Interocclusal records, Maxillae, Mandible.

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INTRODUCTION

The principles of good occlusion apply to the dentulous as well as the edentulous patients. However, different requirements are necessary for the occlusion for complete denture prosthesis because artificial teeth are not attached to the bone in the same manner as natural teeth. Thus, an occlusion that is physiologically acceptable or desirable may not be applicable for complete denture prosthesis. Stability of the complete denture prosthesis can be maintained if the opposing teeth meet evenly on both sides of the arch when the teeth contact anywhere within the normal functional range of mandibular movement. An occlusion that provides these even contacts can only be developed in harmony with the centric relation.^[1]

Centric relation is the beginning of occlusion, and all treatment modalities are based on it. There is no doubt

that centric relation is a joint position and, therefore, requires knowledge and involvement of the temporomandibular joint (TMJ).

Definition

Centric relation is defined as a maxillomandibular relationship in which the condyles articulate with the thinnest avascular portion of their respective disks with the complex in the anterior superior position against the shapes of articular eminences. This position is independent of tooth contact. This position is discernible when mandible is directed superiorly and anteriorly and restricted to a purely rotary movement about a transverse horizontal axis GPT.^[2]

Significance of Centric Relation

The correct registration of CR is essential in the construction of complete dentures. Many dentures fail because occlusion is not planned or developed in harmony with this position. The difference between dentulous state and edentulous state is that in case of dentulous case, if the centric occlusion does not coincide with centric relation there will be deflective occlusal contact and the structure surrounding and supporting the teeth will be in danger.^[3]

This protective phenomenon prevents the mandible to deflect from its CR position. However, at the same time, if the CR and centric occlusion of the edentulous patient does not coincide, there is no proprioception or protective phenomenon as a result of which the stability of the dentures is in jeopardy, causing pain, and discomfort. This shows that any deflective contact other than CR closure will cause instability of the dentures. Therefore, the recording of proper CR is a must in case of any complete denture patients.

1. CR is a reference point in recording maxillomandibular relations.
2. It can be verified and repeated.
3. It serves as a definite reference point during the time frame of denture construction.
4. It is a starting point for developing occlusion.
5. It is a functional position although fleeting in nature.^[4]

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Necessity for CR

Many patients that are edentulous for a long time have the tendency to protrude the mandible when asked to close the jaws. Failure to restore the missing posterior teeth for a long duration of time.^[4]

Anatomic Considerations in CR

Centric relation refers to both the position and condition of the condyle-disk assemblies. The condyles can freely rotate on a fixed axis in CR up to about 20 mm of jaw opening without moving out of the fully seated position in their respective fossa. A properly aligned condyle-disk assembly in CR can resist max loading by the elevator muscles with no sign of discomfort. Centric relation is not about the teeth; it is the position of the condyles. If the disk is not properly aligned, the condyle is not in centric relation. When the condyle and disk are properly aligned, all loading forces are directed through avascular, non-innervated structures that were designed to accept loading.

Important Features of CR

- It is a bone relationship and hence the optimum position of jaws for the health, comfort, and function of TMJ.
- It is retruded position of mandible where the condyles are situated in a rearmost position in glenoid fossae as far as the ligaments of the TMJ and musculature would permit.
- In CR the condyles exhibit pure rotation without any translation. The mandible moves in a hinge motion to a distance of 15–25 mm at the incisal in the sagittal plane.
- It is a reproducible position which can be repeatedly arrived and thus serves as a guide to develop centric occlusion in artificial dentures.
- It is a starting point for the arrangement of artificial teeth to develop maximum intercuspatation in complete dentures.
- It is the starting point from which eccentric records can be made.
- It serves as a reference point for the institution of occlusal rehabilitation in dentulous conditions.
- It serves as a reference point to relate and nomenclature several occlusal positions of upper and lower teeth.
- The terminal position of masticatory stroke ends in centric relation. It is also a position where upper and lower teeth are braced against each other during deglutition.
- It is a relationship of the mandible to maxilla when both the condyles are in terminal hinge location. Centric relation is a precise point where pure condylar rotation takes place. In other words, it is a position of terminal hinge closure.

- It is a retrusive border position of mandible where the condyles are in up most, rearmost position in the glenoid fossa.
- It is the posterior border position and the posterior limit of the envelope of motion.
- It is the repeatable, recordable, and physiologically acceptable position for mastication and deglutition.

Methods of Recording CR

There are two concepts in making CR records.

Concept 1

The record must be made with minimal pressure, to prevent displacement of supporting tissues. The main objective of this concept is that the opposing teeth touch uniformly and simultaneously at their first contact. This uniform contact will not stimulate the patient to clench and relax the muscles during periods between mastication. If this concept is followed then occlusion should be checked at the first contact of teeth.

Concept 2

The second concept records CR under heavy pressure to displace the supporting tissues. The objectives are to produce the same displacement of soft tissues as would exist when heavy closing pressure is applied to the dentures. Thus, there will be even distribution of forces all over the supporting tissues. If the distribution of soft tissue is uneven that there will be uneven contact between the teeth when they first contact. If this concept is selected, then the occlusion will be checked under heavy occlusal forces. To obtain an accurate CR record, the patient should be trained to retrude the mandible to CR.

Different Methods to Retrude the Mandible to CR are as Follows

1. Instructions to the patient
2. Tongue retrusion
3. Control of mandible
4. Relaxation
5. Swallowing
6. Fatigue
7. Head position
8. Temporalis muscle check.

Difficulties in Recording CR

These can be classified as:

1. Biologic
2. Psychologic
3. Mechanical.

Methods of Recording CR

The three primary requirements for making a centric relation record are.

1. To record the correct horizontal relation of the mandible to the maxillae.
2. To exert equalized vertical pressure.
3. To retain the record in an undistorted form until the casts have been accurately mounted on the articulator.

Functional Methods

1. Needles-house method
2. Patterson's method
3. Meyer's method.

Graphic Methods

1. Intraoral methods
2. Extraoral methods
3. Digital tracing
 - Tactile/interocclusal check record
 - Terminal hinge axis method.

Review of Literature

Functional or "Chew in" records were another method described to record C.R. These were first discussed in the dental literature around 1910. All functional methods of recording C.R. require a stable record base; if this record base is dislodged the record will be inaccurate. Patient must have good neuromuscular coordination to participate in such a recording procedure. Needles mounted studs on maxillary occlusion rims, and these studs engraved arrow tracings into compound rims on the mandibular arch. After the rims were removed from the oral cavity, they were reassembled with the functional grooves in place.^[5]

Patterson was also known for promoting the use of functional records Patterson prepared a trough in the maxillary and mandibular occlusion rims and these troughs were filled with a plaster and carborundum mixture again, the patient was asked to move his mandible and continue the motion until appropriate curvature has been formed on the rims. This was said to equalize pressure and provides uniform contact in all excursive movements.^[2] Meyer also developed a functional technique in which soft wax occlusion rims were used, and wax paths were formed in these rims during functional movements. Then a plaster index was made of this wax pattern, and teeth were set opposing this generated plaster index.

One of the most famous promoters of functional records was Boos He developed the Gnathodynamometer.

Using this instrument, he determined the vertical and horizontal position where maximum biting force could be generated. This instrument was mounted on the mandibular occlusion rim, and it had a central bearing point that occluded a plate on the maxillary rim, plaster registrations were also used intraorally with the gnathodynamometer in place and with the patient exerting biting pressure.^[6]

Boos claimed that optimum occlusal position and the position of maximum biting force are coincident. He believed that all registrations be made under this biting force with a displacement of the soft tissue. He thought that this displacement would also occur in function.^[7]

Excursive Methods/graphic Recording (Review of Literature)

The earliest graphic recordings were based on studies of mandibular movements by Balkwill in 1866. The intersection of the arcs produced by the right and left condyles formed the apex of what is known as the Gothic arch tracing. The first known "needle point tracing" was given by Hesse in 1897 and the technique was improved and popularized by Gysi around (1910). GYSI'S tracer was an intraoral incisal tracer in which the plate was attached to the mandibular rim, and a spring-loaded pin was mounted on the maxillary rim. The rims were made of modeling compound to maintain the vertical dimension of occlusion. When a good tracing was recorded, the patient held the rims on the open of the tracing while notches were scored in the rims for orientation. Clapp described the use of a Gysi tracer which was attached directly to the impression trays. Sears used lubricated rims for easier movement. He placed the needle point tracer on the mandibular rim and the plate on the maxillary rim. He believed this made the angle of the tracing more acute and more easily discernable. They would then cement the rim together for removal. Phillips (1927) recognized that any lateral movement of the jaw would cause interference of the rims resulting in a distorted record. He developed a plate for the upper rim and a tripod ball bearing mounted on a jack screw for the lower rim. This innovation was named the "central bearing point" which was supposed to produce equalization of pressure on the edentulous ridges.

Stansbery (1929) introduced a technique which incorporated a curved plate corresponding to Monson's curve mounted on the upper rim, and a Central Bearing Screw was attached to the lower plate corresponding to the reverse Monson's curve. After the tracing was made, a biconcave centric registration was obtained using plaster. Silverman^[8] later developed graphic recording methods using the central bearing point to produce gothic arch tracing. Various tracing devices

were designed by Flight, Phillips, Terrell, Sears, House, Messermann, and others.

The graphic recording and check bite records received much praise and Criticism. Critics of gothic arch tracing stated that equalization of pressure did not occur in prognathic and retrognathic patients, and flabby tissues and large tongue could cause shifting of the bases and finally too much of patient cooperation was needed.

Intra oral Tracers: (Coble, Ballard, and Messermann)

The intraoral arrow point tracer combines a central bearing and tracing device. It has pointed screw in bearing and a tracing device mounted on the maxillary rim, and a plate mounted on the mandibular rim. The plate is covered with a marking substance. The central bearing pin (Hardy and Pleasure) is connected to the proper vertical relation, and when the rims are in place, the patient is instructed to perform lateral and protrusive movements. As these movements are performed, the Gothic arch form is traced on the plate.

Advantages

The advantage of intraoral tracers is that the bearing-tracing device is strong enough to resist biting pressures and can be held in position by means of a locking disk.

Disadvantages

1. Relative difficulty in visualizing the tracing
2. Since the intraoral tracings are small, it will be difficult to find the true apex.
3. The tracer must be seated in a hole at the point of the apex to assure accuracy when injecting plaster between the occlusion rims. If the patient moves the rims before they are secured, the records shift on their basal seat which destroys the accuracy.

Extra oral tracing: (Sears-64 and Gysi-63)

The extraoral tracer is always combined with an intraoral bearing device to ensure equalization of pressure on the bases. A needlepoint tracing made on a tracing table coated with carbon or wax is used to indicate the relative position of the upper and lower jaws in the horizontal plane. These tracings are shaped like a Gothic arch and so are sometimes referred to as Gothic arch tracings. They are also known as arrow point tracing.

Advantages of Extra Oral Tracers

1. The tracing point is usually much larger than its intraoral counterpart because they are made further from the centers of rotation, and the apex is more discernible.

2. The extraoral tracings are visible while the tracings are being made. Therefore, the patient can be guided and directed more intelligently during the mandibular movements.
3. The stylus can be observed in the apex of the tracing during the process of injecting plaster between the occlusion rims, and no hole is required.

Graphic methods are the most accurate visual means of making a centric relation record with mechanical instruments, but all graphic tracings are not necessarily accurate.

Direct Check Bite Recording

Review of literature

It is one of the oldest types of Centric record. In 1796, Phillip Pfaff, the dentist of Fredrick, Germany was the first to describe this technique of 'taking a Bite.' Until end of 19th century, it was the most commonly used method. The direct interocclusal record during that period, was a non-precision joint record obtained by placing a thermoplastic material, usually wax or a compound between the edentulous ridges and having the patient close into the material. This was known as the "mush," "biscuit," or "squash" bite.

In 1905 Christensen was one of early authors to use impression wax for bite records. Late in 1910, Greene described a mush bite made from modeling compound in which he used a plaster wash to achieve a more accurate record. Occlusion rims were later added to the technique to provide a more stable base. Gradually, these procedures evolved into interocclusal records as they are usually done today. Small amount of wax, compound, plaster, and zinc oxide eugenol paste were used as the materials for the registration of the records.^[9]

Hanau (1929) was one of the first individuals to be concerned about equalization of pressure when recording the bite. He coined the word "Realeff" which is formed by the beginning letters of the words "resiliency and like effect" this became a major factor in check bite techniques. Schuyler (1932) observed that if the recording medium was not of uniform density and viscosity, uneven pressures would be transmitted to the record bases which would cause disharmony of occlusion. He said that modeling compound was preferable to the wax for occlusal records because it can be softened more evenly cools slower and does not distort as much as wax.^[10,11]

Wright (1939) described the four factors he believed affected the accuracy of records as resiliency of tissues, saliva film, fit of the bases and pressure applied and concluded that the best technique was to record the occlusal record at zero pressure.

Trapozzano (1955) stated that wax check bite method was the technique of preference. Payne (1955)

and Hickey (1964) stated a preference for plaster.^[12,13] Payne (1959) Wrote it was important to avoid torsion when recording centric relation and felt that plaster or zinc oxide eugenol paste was more accurate. Hanau, Block, and others agreed the zero pressure philosophy. Schuyler, Payne, and Trapozzano among others advocated the use of light pressure.

The problem of pressure in any record was recognized by Boucher (1960). Who wrote, in additions to technical errors are the errors which occur as a result of failure to control jaw activities and pressure at the time of registration.

The importance of verifying the interocclusal records has been stressed by Greene (1910), Schuyler (1932), Trapozzano (1955), and Beck (1960).

Interocclusal Check Records: (Phillip Pfaff 1796)

It is particularly indicated in situation of:

1. Abnormally related jaws
2. Supporting tissues that are excessively displaced
3. Large awkward tongues
4. Uncontrollable or abnormal mandibular movements
5. To check the occlusion of teeth in trial dentures.

The record is made by placing a nick and notch on the maxillary rim and a trough on the mandibular rim in the region of the posterior teeth. The patient is made to retrude the mandible by applying any one of the methods mentioned earlier and recording materials used are waxes, impression compound, dental plaster, and zinc oxide eugenol paste or vinyl polysiloxane record mat.^[14]

Terminal Hinge Axis (McCollum –28, Stuart 1921)^[15]

Terminal hinge axis is an imaginary line between the temporomandibular joint, around which the mandible may rotate without translatory movements. Mandible is in the most retruded unstrained position to the maxilla both for locating transverse hinge axis and for recording centric relation.

CONCLUSION

The biologic considerations that have been enumerated should be essentially considered by the prosthodontist during Jaw relation procedures to relate its useful clinical application in the healthy service of the edentulous

patients. A blind orientation of the maxillary cast on an articulator may result in an error so slight that a face bow transfer appears to be unnecessary. However, since the procedure is not complicated nor time-consuming the chances of incorporating an error should not be taken.

It is obvious that the skill of the prosthodontist and the cooperation of the patient are probably the most important factors in securing an accurate centric relation records. The use of various methods enables the prosthodontist to make just preliminary and tentative determinations of the various jaw relation records. The final determination cannot be made by any method until the teeth are set in position in the wax trial dentures and verified in the mouth.

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