

An insight into gothic arch tracing

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Human mandible can be related to maxilla at several positions in the horizontal plane. Among these, centric relation is a significant position because of its usefulness in clinical prosthodontics. Registration of centric relation is usually done by check bite record. This will hold the maxillary and mandibular casts and the relationship can be transferred to the articulator – the jaw simulating device. Mandible makes three dimensional movements in the space and static records are made at select positions. A shortcoming of the interocclusal records is that they provide accurate relations between the casts only at the jaw positions where they are made. The articulator must interpolate the movements between the recorded points.⁴ The border movements of the jaw are typically curved and an articulator programmed with only interocclusal records is likely to experience limitations.¹ Graphic records capture these curved limits, and an articulator capable of curved movements can be programmed to accept these records, thus yielding a more accurate reproduction of the jaw movements.⁷

Historical background:

The earliest graphic recordings were based on studies of mandibular movements by Balkwill in 1866.³ 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 gothic is taken from architecture which characterized by pointed and curved arches. (fig1) The first known “needle point tracing” was given by Hesse in 1897 and the technique was improved and popularized by Gysi. The apex of the gothic arch tracing indicates centric relation - most retruded relation of the mandible to the maxillae from which eccentric translatory movements can take place. It is also known as ligamentous position or the posterior border position. The classic characteristic of this position is its repeatability.

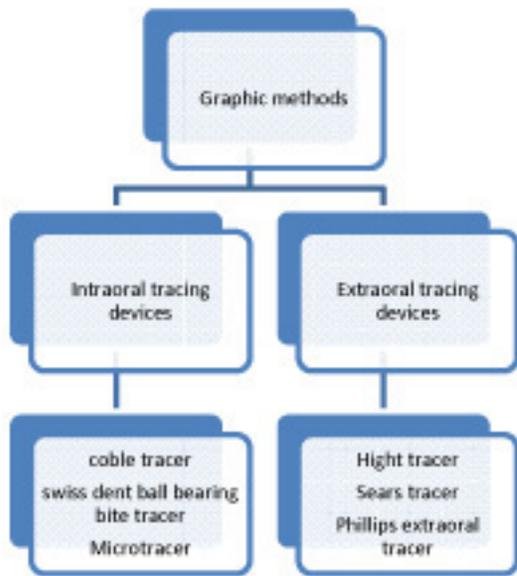
To make gothic arch tracing specially designed instruments are required. Occlusion rims made on stable bases are the primary requisites.⁸ If the occlusion rims make contact, excursive movements of the mandible may be interfered. Hence mandibular occlusion rim is reduced in height but the height will be maintained with metallic



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plates having central bearing points. In intra oral devices this will serve as stylus and tracing table. In extra oral tracing devices additional stylus and tracing table have to be attached. This procedure is known as gothic arch tracing and the synonyms are Stylus tracing, Centric bearing tracing, Arrow point tracing, and Needle point tracing.



Graphic methods are either intraoral or extraoral, depending upon the placement of the recording device:

Intraoral tracing:

In the intraoral method stylus is fixed to mandibular arch and tracing platform is attached to maxillary arch.⁵ The tracing platform is usually coated with coloured contrasting media and the vertical height is maintained by the stylus and a gap of 3mm is maintained between the occlusal rims which is usually created by reducing the lower occlusal rim.

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 of intraoral tracing

- The intraoral tracings cannot be observed during the tracing
- The intraoral tracings are small and it is difficult to locate the true apex.
- The tracer must maintain its position at the apex to assure accuracy while injecting plaster between the occlusion rims. If the patient moves the rims before they are secured, the records shift on their basal seat and the accuracy may become questionable.

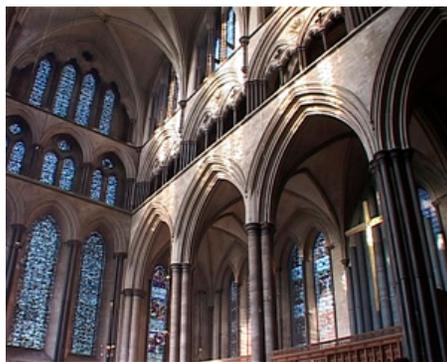
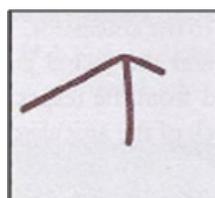


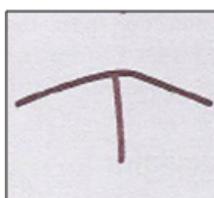
Fig 1: Gothic architecture in Ancient times



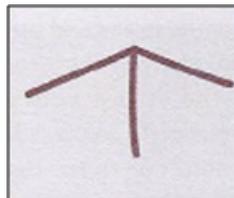
Fig 2: Hight tracers



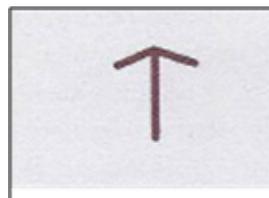
Asymmetrical form



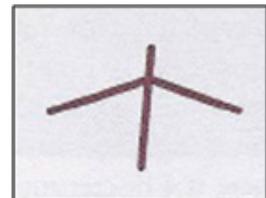
Classic flat form



Classic pointed form



Miniature gothic arch tracing



Vertical line protruding beyond arrow point

Extraoral tracing

The following is a description of Hightextraoral tracer (Hanau Engineering Co, Buffalo, New York, 1940-60) as found in the product instruction manual.

The determination of the correct centric relation of the mandible-or as often termed 'the correct bite' is essential regardless of the technique or the articulator used. The most reliable method for determining the correctness of this record is the arrow point tracing. The tracing may be used for verification after the casts have been mounted in the articulator or as an aid in establishing centric relation.

The 'Hight Tracer' fig 2 designed for this particular registration, eliminates the inconveniences and uncertainties so often experienced in obtaining this record. The tracings made outside the mouth on a tracing platform extended 3" forward are enlarged and clearly visible, permitting ready observation and control.

Correct centric relation of the mandible to the maxilla establishes both condyle heads in a retruded rest position in their sockets while the mandible is at the accepted degree of opening; from such position unstrained lateral excursions must still be possible.⁹ Therefore the vertical relation – the degree of opening – is first determined and definitely established by the height of the occlusal rims: an arrow tracing can then be considered a reliable check of the horizontal relation – to indicate whether the condyle heads are in their retruded rest position.⁶ After the tracing is obtained, an intra oral wax record registers the rims in their vertical relation. It must be kept in mind that tracings made at various degrees of opening are not identical.

A strictly protrusive movement records its excursion on the platform by an antero-posterior tracing not necessarily a straight line; a true left lateral movement: a tracing from the most anterior point towards the right; a true right lateral movement: a tracing extending to the left. An arrow tracing to be of use should show a distinct apex, indicating that the condyle heads returned to their retruded rest position after lateral excursions. When the condyle heads do not return to their retruded rest positions after each excursion, tracings without distinct apex are produced. Such tracings are useless for the purpose

and show that the patient is performing protruded-lateral instead of true lateral movements.

The correct centric relation of the mandible to the maxillae for a previously accepted degree of opening is obtained when the scriber point rests at the exact apex of the arrow tracing.¹⁰ The mandibular cast therefore is attached to the articulator while the instrument is in centric relation and the scriber point registers at the apex of the tracing (See Fig 1). If after mounting in the articulator or upon checking centric relation, the scriber is found resting within the tracing and not at the apex it would be evident that the lower cast has been incorrectly attached to the instrument.

In the extraoral tracing device both the tracing platform and stylus are placed extraorally. The vertical height is maintained by the central bearing plates. The mandibular occlusal rim bears spherical central bearing point and maxillary rim contains highly polished metallic surface. The gap has to be maintained between the plates as well as occlusal rims. Both the plates are fixed mutually parallel. The extraoral tracing stylus consists of a spring attachment which will allow the stylus to go up when the mandible is protruded and the gap between the occlusal rims gets diminished.¹² The occlusal rims and the attached tracing assembly are kept in the mouth and the patient is asked to make eccentric movements namely protrusive, right lateral and left lateral. After performing the movements the patient is asked to bring the mandible to centric position. The stylus will make a tracing which looks like an arrow (gothic arch). The arrow point designates the centric relation. The protrusive tracing is not always seen as a straight line where as lateral tracings are seen as straight lines. These lines represent the border positions of mandible.

Advantages of Extra Oral Tracers:

1. The tracing point is usually much larger than its intraoral counterpart because they are positioned farther from the centers of rotation, and the apex is more discernible.
2. The extraoral tracings are visible while the tracings are made. Therefore, the patient can be guided and directed 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.

Both in intraoral and extraoral tracing the arrow point can be obtained but the only difference will be the direction of arrow point. Arrow point will be directed towards the patient in intraoral tracing where as in extraoral tracing it will be directed away from the patient. The tracings are used to make interocclusal records both at centric and eccentric positions.² The eccentric records are not made at extreme positions and are made 6mm away from centric (arrow point) because of the following reasons:

- The normal functions are performed within 6mm
- Articulator will be optimally sensitive to be programmed for a horizontal angle and Bennett angle only at 6mm distance or above
- Beyond 6mm condyles will be positioned too anteriorly resulting in reduction of horizontal angle while programming the articulator

Factors to be taken care of during the graphic tracing

(1) If the central bearing point is placed off center, when the mandible moves into eccentric relations record bases may get displaced due to pressure variation

(2) If a central bearing device is not used, the occlusion rims offer more resistance to horizontal movements.

(3) It is difficult to locate the center of the true arches to centralize the forces with a central bearing device when the jaws are in favorable relation and far more difficult if the jaws are in excessive protrusive or retrusive relation.

(4) It is difficult to stabilize a record base against horizontal forces on tissues that are pendulous or otherwise easily displaceable.

(5) It is difficult to stabilize a record base against horizontal forces on residual ridges that have no vertical height.

(6) It is difficult to stabilize a record base or bearing device with patients who have large awkward tongues.

(7) The tracing is not acceptable unless a pointed apex is developed. A blunted apex usually indicates an acquired functional relationship, and a sharp apex usually indicates the position of centric relation.

(9) Double tracings usually indicate lack of coordinated movements or recordings at a different vertical dimension of jaw separation. In either event, additional tracings are necessary.

(10) A graphic tracing to determine centric relation is made at the predetermined vertical dimension of occlusion.⁴ This harmonizes centric relation with centric occlusion and the anteroposterior bone-to-bone relation with the tooth-to-tooth contact.

(11) Graphic methods can record eccentric relations of the mandible to the maxillae.

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

Gerbers classification of arrow point tracing:¹

- **Typical:** seen as well defined apex with a symmetrical left and right lateral component. The mean gothic arch angle is about 120 degrees. It reflects a healthy TMJ without interferences in condylar path and balanced muscle guidance.
- **Flat form:** It is similar to typical arrow point tracing except that it has more obtuse left and right lateral tracings. The gothic arch angle is more than 120 degrees. This form signifies marked lateral movement of condyle in the fossa
- **Apex absent /Round form:** Instead of a sharp arrow point the tracing should be repeated till a definite arrow point is obtained. Patient training is necessary.
- **Miniature arrow point:** Similar to typical arrow point, however the extension of tracing is very limited. This can be due to restricted Mandibular movements, improper seating of denture bases and painfully fitting denture bases. It is also an indication of long period of edentulousness with an inhibition in condylar movements.
- **Double arrow point:** It is a record of habitual and retruded centric relation. It is also

seen when vertical dimension is altered during registration.

- **Dorsally extended arrow point:** The protrusive path extends **beyond** the apex of gothic arch. This signifies a forced strained retrusive movement of lower jaw either by patient or operator. It is also seen when the patient head is tilted too far posteriorly.
- **Interrupted arrow point:** It is the break or loss of continuity of lateral incisal path of gothic arch. This happens due to posterior interference at the heels of the denture bases.
- **Atypical form:** Protrusive component does not meet at apex but on one lateral path. It is seen in old denture patients who are using complete denture with incorrect centric relation.

Technique for extraoral arrow point tracing:

1. Fixing the central bearing plates:

- Reduce the mandibular occlusion rim height by 4mm and make sure to have parallel walled space between the occlusion rims
- Fix the central bearing point by counter sinking and the surface of rim and the plate should be same
- Fix the maxillary central bearing plate by countersinking
- The central bearing plate – resin base junction should be reinforced with sticky wax to prevent sinking of the central bearing plates during tracing
- Adjustable central bearing point in the lower base is raised to contact the maxillary central bearing plate when the articulator is closed
- Incisal guide pin of the articulator is verified for its correct positioning
- Place an articulating paper(blue) over the central bearing point
- Tap the upper member over it to make a mark on the upper plate
- Place both the bases in the mouth and place an articulating paper(red) over the central bearing

point and ask the patient to close the mouth firmly to make a mark on the upper plate

- The blue mark and the red mark, if coincides indicate correctness of centric relation recorded otherwise re-do centric relation registration
- Block the gaps between the metal plates and occlusion rim with wax
- Incorporate triangular location notches on the wax rim (minimum two in each occlusion rim)

2. Fixing the extra oral tracer

- Lower member of the **Hight** tracer is fixed to the mandibular occlusion rim 3mm below the modified occlusal plane and maintain parallelism
- The tracing table should not touch any part of the articulator
- The upper member of the tracer is fixed to maxillary occlusion rim 3mm above the occlusion plane parallel to lower member of tracing unit with sticky wax
- The stylus should just touch the tracing table and find out whether the stylus can move vertically under the spring load
- No heavy pressure exerted by the stylus

3. Tracing

- Place both the bases in the mouth and smear the surface of the maxillary plate with petroleum jelly
- Coat the tracing table with a mix of zinc oxide and spirit with a flat brush no.5
- Apply with single strokes and allow it to dry and ask the patient to close the mouth in centric
- Repeat three times-ask the patient to protrude and go back without any restriction.
- Do not insist on straight lines because slowly the patient will learn. Repeat minimum ten times.
- Tap on the right shoulder of the patient and ask him to move the jaw to the right and comeback. Repeat ten times and similarly do it on the left side

- Give training till you get an arrow point tracing where three lines meeting at a point and the point designates centric relation
- The lines represent mandibular border movements
- Mark a point 6mm away from the centric on the protrusive line using a small divider with metal points
- zinc oxide coating should be thin but with contrast and never apply on previous coating

References:

1. Babithayeshwante, nikita kale. nazishbiag, nikitaparasrampur, A Pathwat to centric –Gothic Arch. Int J of Allied Med Sci and Clin Res 2015; 3(3):308-312
2. Nair KC, A primer on complete denture fabrication, 1 st edition, 2013, Ahuja publications, India. pp:108-114
3. Myers ML. Centric relation record – historical review. J Prosthet Dent 1982;47:141-5.
4. Rahn AO, Heartwell CM Jr. Textbook of complete dentures. 5th ed. New Delhi: B.C. Decker- Harcourt; 2002. p. 290-3
5. Trapozzano VR. An analysis of current concepts of occlusion. J Prosthet Dent 1955;5:764.
6. Solomon EG. Significance of centric jaw relation and centric occlusion. J Indian Dent Assoc 1973;45:255-8.
7. Kapur KK, Yurkstas AA. An evaluation of centric relation records obtained by various techniques. J Prosthet Dent 1957;4:770-85.
8. Silverman MM. Centric occlusion and jaw relations and fallacies of current concepts. J Prosthet Dent 1957;7:750.
9. Rubel B, Hill EE. Intraoral gothic arch tracing. New York State Dental Journal. 2011 Aug 1;77(5):40.
10. Keshvad A, Winstanley RB. An appraisal of the literature on centric relation. Part III. Journal of oral rehabilitation. 2001 Jan;28(1):55-63.
11. Berman MH. Accurate interocclusal records. J Prosthet Dent 1960;10:620.
12. Solomon EG. Significance of centric jaw relation and centric occlusion. J Indian Dent Assoc 1973;45:255-8.