

Construction Bite-The Crux of Functional Appliance Therapy

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Abstract: Introduction: A proper bite registration is one of the most important prerequisites for the successful construction of any functional appliance. Construction bite is an intermaxillary wax record used to relate mandible to maxilla in the three dimensions of space indispensable for correction of functional malocclusions like functional retrusion and functional protrusion. Aim: This article aims to sum up the basic requirements and various dimensions of construction bite used for the functional appliance fabrication. The purpose of the construction bite is to fabricate an appliance that induces the following effects: (1) to bring the lower jaw into a tolerable forward position with every occluding action of the mandible and (2) to "block the bite," depressing the lower anterior teeth and stopping their eruption, while attempting to stimulate eruption of the posterior segments. Conclusion: The construction bite when registered correctly determines the degree of activation built into the appliance, helps to reposition the mandible to improve the jaw relationship and stretch the muscles of mastication to provide a positive proprioceptive response within the physiological range of activity of the muscles of mastication and the ligamentous attachments of the TMJ, thus playing a pivotal role in construction of a functional appliance.

Keywords: Construction bite, myofunctional appliance, functional malocclusion

Introduction

The motive of dentofacial orthopedics is to alter the pattern of facial growth and the underlying bone structure of the face and to encourage harmonious facial growth by altering the functional muscle environment around the developing dentition. The concept of functional therapy is to reposition a backwardly placed mandible into a forward position by making an appliance which displaces the mandibular condyles forward and downward in the glenoid fossa. This causes an upward and backward pull in the muscles that support the mandible, the mechanics used are reversed to correct a retruded maxilla, but the basic principle remains the same.¹

A proper bite registration is one of the most important prerequisites for the successful construction of any functional appliance. The construction bite is registered differently for different malocclusions in the sagittal and vertical planes. The opening of the bite varies with the severity of the malocclusion, the amount of anterior displacement, the growth amounts

and direction projections, and the type of appliance used. The amount of repositioning required in the appliance that will reposition the mandible to correct the intermaxillary jaw relationship, while being sufficiently enough to stretch the muscles of mastication to create a positive proprioceptive response within the physiological range of the muscles as well as the ligaments of TMJ is also dependant on the registration of a proper construction bite.

There are some definitive principles that should be clearly understood and if followed describe the positioning of the mandible in preparation for construction of the functional appliance in three planes of space-vertical, horizontal, and transverse.²

POSITIONING OF MANDIBLE IN THREE PLANES OF SPACE

Vertical opening of the mandible²

The amount of opening of the mandible in the vertical plane depends on three variables:

A) The dysgnathic or dysplastic problem present in the sagittal or vertical plane or the growth pattern,

B) The age, sex, developmental stage of the patient and

C) The sort of appliance to be used.

It may be small, medium, or large depending on the treatment considerations. The bite opening should always be made concerning vertical distance between the lateral segments of the dental arches and is primarily determined by the distance between the upper and lower first molars.²

The greater the anterior mandibular displacement for the construction bite; the less the vertical opening should be. For example, in extreme sagittal protrusion (7-8mm) the vertical opening should just clear the cusps, or 2-3mm at the most.

When there is a probability of a more vertical growth direction for the mandible, the vertical opening can be made more considerable extending beyond the postural rest position which elicits both stretch reflex and viscoelastic response from the mandibular elevator muscles and soft tissues. However, a very large vertical opening makes patient acceptance more difficult and so in most cases the mandible should not be opened more than 4.0mm beyond the postural rest position.

Opening of the construction bite approximately 2 mm more than an individual's resting position is optimal, given a basic rule that antagonistic contact of teeth is avoided with appliance in the mouth is followed. In most individuals freeway space is approximately 2 - 3 mm in molar area, and 4 - 5 mm in incisor area so a bite opening of 4- 5 mm in molar area and 6-7 mm in incisor area is frequently desired.

In permanent dentition cases specifically in Class II Div 2, Class 1 with div 2 features, anterior cross bite, Class III, Class I with **Class III** signs, it is optimal to open the bite for the construction registration a distance of 1.5-3 mm vertically beyond the incisal edges.²

However, in severe **Class II Div 2** malocclusion, the bite may have to be opened up to 9 mm in the molar area particularly because of presence of deep bite, excessive curve of spee and the palatal plane tipped down and anteriorly in these cases. A large bite opening can improve the maxillary incisor inclination because the anterior end of the palatal plane is withheld or tipped up, which also reduces the deep overbite because the lower incisors are under intrusive action as the maxillary base rotates upward and forward. In mixed dentition, the bite opening in these types of cases may be increased to 4-7 mm.²

In **Class II Div 1** malocclusion cases with proclined upper incisors and a deep overbite, the bite opening is dependent on how much anterior posturing is necessary to establish a normal sagittal relationship. If small or no anterior mandibular positioning is required, the vertical opening should be raised more but in cases where the sagittal malrelationship is the width of a whole premolar with deep curve of spee, over erupted, retruded lower incisors and horizontal growth direction the bite opening should not be higher than a vertical end to end incisal relationship. However, a lesser vertical opening is advisable (3-4 mm) in cases with retarded development or in which treatment begins early. In cases with a moderate curve of spee, an increased vertical distance in the incisal area; 4 mm between incisal edges is desirable. In case of a vertical direction of growth and a deep bite, a larger bite opening is indicated. Thus, it can be concluded that the original overbite is a determining factor.²

A bite registration with mandibular protrusion approximately 3 mm distal to most protrusive position and bite opening within the limits of freeway space increases the frequency of reflex contractions in the muscles of mastication. This is reflex and Volitional control of masticator nucleus. A conditioned reflex to hold the appliance while sleeping is soon developed. The elevator muscles get activated and deliver force to the teeth. Thus, Myotatic reflex is activated when the mandible is opened approximately 4 mm beyond the rest position of the mandible even when the

musculature is more relaxed while sleeping. The contractions are isometric.

When the mandible is opened 8 - 10 mm beyond the freeway space, the viscoelastic properties of stretched muscles, tendon, skin and musculature play a role along with the forces generated by swallowing, biting, activation of myotatic reflex in the stretched muscles of mastication. This is clasp knife reflex.²

Horizontal posturing of the mandible

The optimal forward movement of the mandible for the construction bite is usually half the individual's maximum range and as a general rule, it should always be 3mm or more from the most protrusive mandibular position possible. This was also supported by Rocabado who advocated that horizontal positioning of the mandible must be 70% of total joint displacement or normal physiological TMJ movement. Also, it was observed that one of the best positions for obtaining the desired histological transformations of the TMJ from **Class II** malocclusion to a Class I occlusion is approximately half the distance that the condyle can move forward along the anterior wall of the fossa to the articular tubercle. In severe cases however, a stepwise horizontal advancement is recommended.⁵

In case of patients with 1.0 to 1.5 mm posterior condylar displacement and mandibular overclosure, an advancement of 4 to 6 mm and vertical opening is within interocclusal space limits to establish the supportive, proprioceptively desirable, end-to-end incisal relationship is standard operating procedure and is likely to produce the desired result, with proper patient compliance. However, Functional appliances are not the best choice in cases of **Class II** malocclusion where path of closure is upward and excessively forward. In pathological bite (malposition of single tooth or group of teeth) the bite is shifted as far as the occlusion allows without the creation of a cross bite condition.

Posturing the mandible forward from habitual occlusion causes a downward and forward condylar

translation on the articular eminence while opening the bite leads to rotary action in the lower TMJ. Thus, stimulation of mandibular horizontal growth component at the condyle as well as dental compensations by mesiovertical eruption of the posterior teeth including labial tipping of the lower anterior teeth and lingual tipping of the maxillary teeth is achieved with functional jaw orthopedics.

In **Class III** malocclusion (mesiocclusion) cases, the mandible is postured backward as much as possible in the fossa, opening the bite for end-to-end incisal relationship or a special functional appliance with a sagittal screw is used to reposition the mandible into a Class I relationship. In missing teeth or in extraction cases, sometimes mandible has to be brought into a class II or Class III relationship of the first molars.

Transverse posturing of the mandible

True midlines of upper/ lower jaws are determined in the original, diagnostic study and coincident midlines should line up in the forward posturing in the same relationship as in habitual occlusion, this is a general rule for most construction bites. Midline coincidence should be carefully checked, cutting away the wax in the midline to make sure that the positioning forward has not allowed the mandible to deviate to one side or the other.²

If the upper and lower midlines do not coincide, a determination must be made as to the fault-maxillary or mandibular. Usually the deviated midline results from the premature loss of a deciduous canine, often a lower deciduous canine. The patient is observed in postural rest to check the midlines and is then asked to slowly close the mouth into full habitual occlusion. If there is any shift from one side to the other, occlusal interferences should be checked. Generally speaking, construction bites should follow the resting position midline relationship.²

Jaw midlines are used to determine the construction bite relationship, opening the vertical dimension beyond the tooth interference zone if teeth in each jaw line up with the respective basal midline but are not

coincident in habitual occlusion with the midline of the other jaw.

When there is a lack of coincidence of the incisors and the true jaw midline the true midline of the jaws is marked carefully and must coincide when the construction bite is taken. Also, the original diagnosis should take note of the tooth size and position problems before the construction bite is taken.²

CONSTRUCTION BITE TECHNIQUE

Steps To Register the Construction Bite²

1. The first step in taking the construction bite is the preparation of the plaster casts with care being taken to extend the impression as deep as possible in the posterior lingual regions of the mandible for proper anchorage for the appliance, following which the bite is registered.
2. The patient is seated in a relaxed and upright posture and is instructed to move the mandible into the correct position with the help of a mirror or the operator can guide the mandible forward with the patient's chin being manipulated between the thumb and the forefinger into the desired sagittal relationship with the assistance of the patient.
3. The patient is shown on the casts and in the mirror in which direction the mandible should be moved and is advised to move the jaw slowly according to the verbal instructions and to stop movement immediately when asked to do so. After the patient has demonstrated that he can open and close to the desired position without guidance from the dentist, the bite is registered using a thick roll of softened baseplate wax approximately as thick as the little finger (approximately 1cm in diameter).
4. The roll is formed into a horseshoe shape and slightly impressed on the lower cast with the edges of the incisors not covered by wax. The anterior section is positioned lingual to the lower incisors, hence the angular shape. The lower midline is marked with a groove in the wax. The ends are shortened so that the retromolar tissue and the distal halves of the last molars are not covered by wax.

5. Before putting the softened wax roll in the mouth of the patient, it should be preadapted on the models. The bite roll can be prepared for either the upper or lower arches depending on; if the rim is first placed on the lower arch, the mandible can be guided into the anterior position required for the treatment of Class II malocclusions and if placed on the upper arch, the mandible can be moved easily into a more retruded position that is required for the construction of a Class III functional appliance.
6. The wax is partially softened in warm water and the patient is asked to close his jaws as previously instructed or the mandible is gently guided forward into the desired sagittal and vertical position by the operator with the fingers lightly touching the wax bite and the thumbs on the mandibular symphysis.
7. Any protruding wax on the anterior segment is displaced, so that it does not cover the lower incisors and obstruct the view of the incisor position. During the closing movement the edge-to-edge incisal relationship and the midline registration is controlled by the operator. The buccal excess is trimmed on the side, so that the distance and relationship between the molars can be seen.
8. The maximum forward movement of the mandible and the correct occlusal clearance of postural rest i.e. the amount of mesial and vertical mandibular displacement necessary for the construction bite is correctly reproduced. The amount of mesial shift is marked with a pencil on the buccal surfaces of the first molars and any functional lateral shift is observed by registering the true mandibular midline and incisor midlines with a pencil on the labial surfaces of the upper and lower incisors on the casts and in the patient's mouth. When the midlines do not match, they may be matched in the bite registration if (1) the deviation is due to a lateral functional displacement of the mandible, with the maxillary midline matching the mid-sagittal plane of the head when the mandible is at rest or (2) the discrepancy is not more than 2mm in

midline deviations that are not characterized by functional mandibular displacements.

9. After having achieved the desired relationship between the upper and lower dental arches, the wax bite is taken out from the patient's mouth with the assistance of the patient tongue and very carefully chilled immediately without distortion in cold water. This is best done by placing the wax bite between the dental arches of the plaster casts.

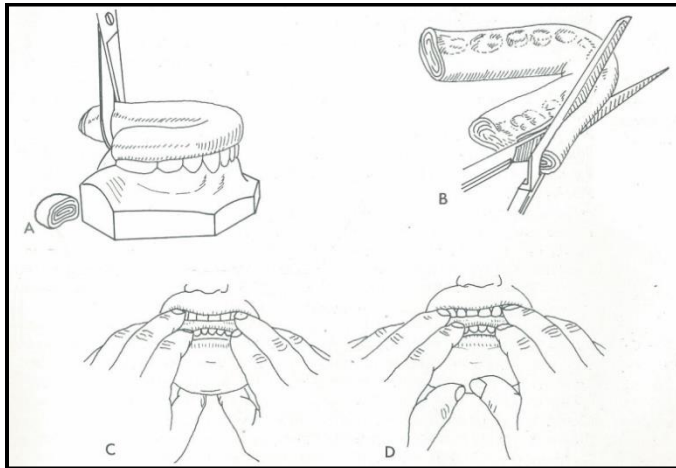


Fig 1 Steps For Taking A Construction Bite

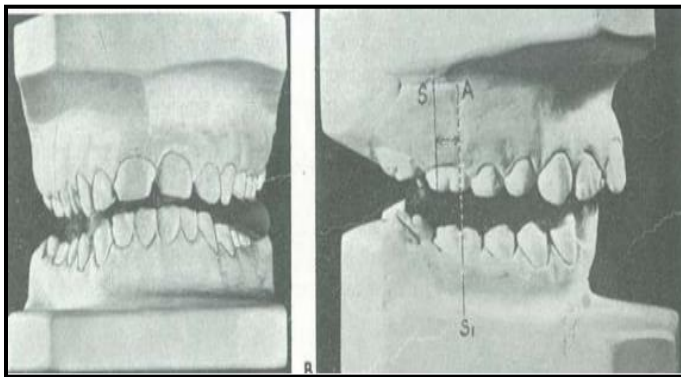


Fig 2 Measuring the amount of sagittal displacement

CONSTRUCTION BITE FOR ACTIVATOR

The horizontal "H" activator or horizontal-type functional appliance is a functional appliance that is constructed with a low vertical opening and a marked forward positioning of the mandible. This type of appliance is most effective when an anterior sagittal relationship of the mandible is a primary treatment objective and is indicated in Class II, Division 1 malocclusions with sufficient overjet caused by

mandibular overclosure that results in a functional retrusion of the mandible in which it acts in the sense of "jumping the bite". It is also suited in patients with a posteriorly positioned mandible as a result of a growth deficiency but with the likelihood of a future horizontal growth pattern. With this type of activator, it is possible to posture the mandible forward, even without tipping the lower incisors labially. The maxillary incisors can be uprighted, and the anterior growth vector of the maxilla will be slightly inhibited. However, there is no effect on the inclination of the maxillary base.²

The appliance indicated in cases with vertical growth patterns with high construction bite registration and slight anterior mandibular positioning can be designated as the vertical "V" activator or vertical type functional appliance. Here, the mandible is positioned less anteriorly, only 3 mm to 5 mm ahead of the habitual occlusion and depending on the magnitude of the interocclusal space, the vertical dimension is opened 4 mm to 6 mm, a maximum of 4 mm beyond the postural resting vertical dimension registration. The goal of treatment with the activator here is not just a minimal forward positioning of the mandible because of the vertical growth pattern, but an adaptation of the maxilla to the lower dental arch which can only be achieved by retroinclination of the maxillary base which must be supported by dentoalveolar compensation, that includes differential guidance of the eruption of the lower buccal segments, withholding of the maxillary buccal segment eruption as described by Harvold, lingual tipping of the maxillary incisors, and labial tipping of the mandibular incisors.²

CONSTRUCTION BITE FOR BIONATOR²

Balters strongly suggested that the construction bite be taken in the edge-to-edge position of the incisors, which determines automatically the patient's interocclusal clearance in the buccal segments. This will provide the maximum functional space for the tongue. In patients with markedly proclined maxillary incisors, attainment of an edge-to-edge relation of

incisors is unrealistic, and the mandible is postured forward only until neutroclusion of the canines is reached, but not further.

In all patients who show a marked and aesthetically unfavorable increase in lower face height when the incisors are brought into an edge-to-edge position, a lesser bite opening is needed, and the mandibular incisors should remain in contact with the lingual surfaces of the maxillary incisors, closing down the lower face height about 2 mm.

In Class III malocclusions, the mandible is retruded as much as possible with the least possible interocclusal clearance, just enough to correct the cross bite of the maxillary and mandibular incisors.



Fig 4: Bionator by Balters

CONSTRUCTION BITE FOR FRANKEL APPLIANCE²

In cases of minor sagittal problems (2 to 4 mm) the construction bite in an end-to-end incisal relationship is taken with the balance between protractor and retractor muscles maintained. In the Frankel technique the construction bite is not opened any more than needed to allow the crossover wires to pass through the interdental space. This measure is necessary for effective lip seal exercises. The amount of forward positioning is usually about 3 mm, or half the width of a cusp. In mild Class II malocclusions this can correct the sagittal discrepancy in one step. Frankel uses an adapted baseplate to which wax is added and softened for the construction bite. By leaving the anterior region open, the midlines are visualized for proper registration in all three dimensions.

If an end-to-end relationship no more than 6 mm forward posturing, is used with a clearance of at least 2.5 to 3.5 mm in the buccal segments to allow the crossover wires to pass through in the Frankel appliance, so the incisal vertical relationship results in discluding these teeth.

If 6 mm of sagittal movement is needed to correct the anteroposterior relationship: A construction bite of 3 mm forward posturing permits easy adaptation by the patient and reduces the likelihood of dislodgment during both day and night, muscle strain or fatigue, and unwanted proclination of lower incisors.

In case of Class III the construction bite for the FR III is taken in the most retruded mandibular position, opening the vertical dimension only as much as is needed to establish an end-to-end bite in the incisors.

CONSTRUCTION BITE FOR TWIN BLOCK APPLIANCE

The correct bite registration in deep bite cases is typically edge-to-edge with a 2 mm interincisal space. This is equivalent to an inter-premolar space of 5 to 6 mm. The resulting blocks are 5 to 6 mm thick in the first premolar region and 1 to 2 mm thick in the molar region. The important factor is to open the bite beyond the freeway space, so that the patient cannot retrude the mandible when in rest position, but to avoid making the blocks too thick so that the patient can eat and speak comfortably with the appliances in the mouth.⁴

In Class II, division 1 malocclusion a protrusive bite is registered to reduce the overjet and distal occlusion by 5 to 10 mm on initial activation of twin blocks depending on the freedom of movement in protrusive function. This degree of activation allows an overjet as large as 10 mm to be corrected without further activation of the twin blocks.⁵

In growing children with overjet as large as 10 mm, the bite may be activated edge to edge on the incisors with a 2mm interincisal clearance if the patient can

posture forward comfortably to maintain full occlusion on the appliances.⁵

In mild Class II division 1 cases where the overjet is small, or with Class II division 2 cases the protrusive activation may be beyond an edge-to-edge incisor position to achieve sufficient muscle activity to correct the Class II buccal segment relationship.¹

The George bite gauge is a convenient instrument used to register a protrusive bite because it has a sliding jig attached to a millimeter scale; it is designed to measure the protrusive path of the mandible and can be subsequently adjusted to record a protrusive bite of no more than of the total protrusive path.⁵

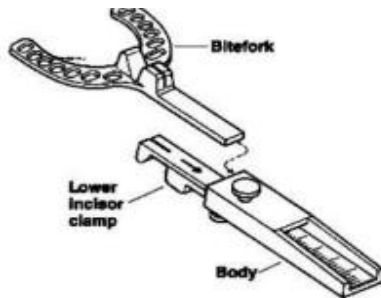


Fig 5: George Bite Gauge

The amount of vertical activation is crucial to the success of Twin Block treatment. The most common fault in Twin Block construction is to make the blocks too thin, so that the patient can posture out of the appliance, reducing the effectiveness of the treatment.¹

The ideal wax bite should be at least 7–8 mm thick in the premolar region. The reason why the patient is asked to close slowly is so that they can be asked to stop, when this 8 mm position has been reached. It is very important to open the bite slightly beyond the clearance of the freeway space to encourage the patient to close into the appliance rather than allow the mandible to drop out of contact into rest position. On average the blocks are not less than 5 mm thick in the first premolar or first deciduous molar region. This thickness is normally achieved in Class II division 1 deep bite cases by registering a 2 mm vertical interincisal clearance.³

The >7–8 mm rule is ideal for average or low angled cases. It should be born in mind, however, that in very high angled patients it may not be possible to achieve the 7–8 mm vertical opening because this will result in an excessive opening at the front of the mouth, which may not be comfortable for the patient. In these cases the height of wax bite can be reduced slightly to the maximum amount the patient can tolerate comfortably.³

The intergingival height measured from the gingival margin of the upper incisor to the gingival margin of the lower incisor when the teeth are in occlusion is an important guideline to establish the vertical dimension in a restorative approach to rebuild the occlusion in treatment of patients with TMJ dysfunction. In Twin Block treatment the correct intergingival height is achieved with great consistency. Overcorrection of deep overbite is advisable as a precaution against any tendency to relapse.¹

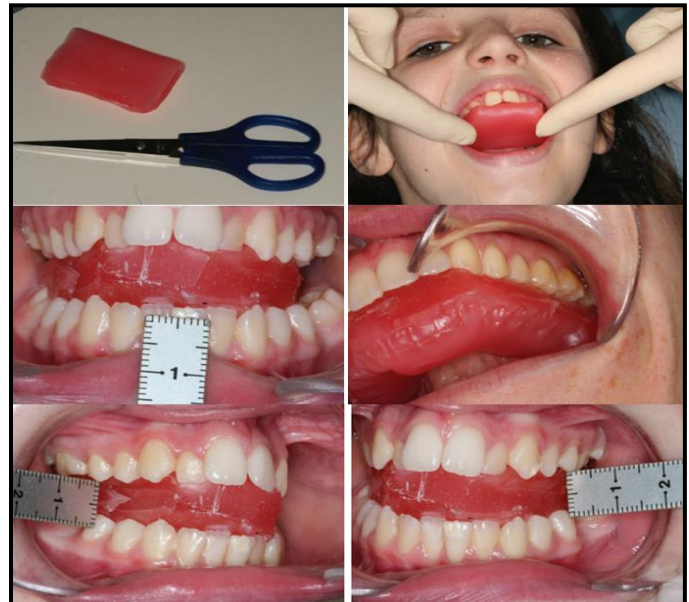


Fig 6: Bite registration for Twin Block appliance

CONCLUSION

Construction bite is crucial for the successful construction of any functional appliance and if certain principles as mentioned in this article are followed it is possible to describe the positioning of the mandible in fabrication of the functional appliance in three planes of space-vertical, horizontal and transverse.

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