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Diagnosis of deep bite

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Abstract
Deep bite is a malocclusion that occurs in the vertical plane of space. Some degree of vertical overlapping or overbite is a normal feature of human dentition. However, some patients present with excessive overbite termed as deep bite or deep overbite. The deep bite in the permanent dentition may be caused by inherent factors or factors acquired during the life of that dentition.
A successful treatment of deep bite requires a careful analysis of the factors contributing the problems. Detailed clinical examination of the dentition, occlusion, jaw movements and soft tissue pattern of the face is very important. Along with clinical examination, study models, cephalograms and photographs must be taken to study the skeletal, dental and soft tissue relationship and growth pattern and its status. During the treatment planning, considerations should be given to the soft tissue, skeletal pattern, stability, occlusal plane, interocclusal space, treatment time and age of the patient.

Keywords: Diagnosis, deep bite, vertical, malocclusion

Introduction
A condition where there is an excessive vertical overlapping of the mandibular anteriors by maxillary anteriors is termed as deep bite.
Deep bite is one of the most common malocclusion seen in children as well as adults that can occur along with other associated malocclusions. It is said to be one of the most deleterious Malocclusion when considered from the viewpoint of the future health of the masticatory apparatus and the dental units.

> "If we fould first know where we are and whither we are tending, we fould better judge what to do and how to do it."
> Abraham Lincoln

A deep bite anteriorly could be caused by supraeruption of upper and / or lower incisors or infraeruption of posterior teeth. To evaluate whether infraeruption or supraeruption is present, the orthodontist must use linear measurements from the base of the alveolar process. The amount of eruption anteriorly or posteriorly can be established by Cephalometric analysis. For example, Supraeruption of mandibular incisors often contributes to the anterior deep bite that accompanies most class II malocclusions. To evaluate whether this is the case one can measure the distance from the incisal edge vertically to the lower border of the mandible and compare this with the cephalometric standards for the patient's age and sex. If the distance is increased, supraeruption of the incisors has occurred.
If a deep bite exist but the lower incisors have not supraerupted, another cause for deep bite must be sought. Similar measurements can be made posteriorly, from the palatal plane to the cusp tip of the upper first molar and from the lower border of mandible to the cusp tip of the lower first molar.
It is quite conceivable that a patient could present with a class II deep bite dental relationship despite the presence of the skeletal open bite pattern. In this instance the cause of the class II relationship would be downward and backward rotation of the mandible while the deep bite was due to excessive eruption of incisors. Obviously the treatment for such a class II deep bite problem would differ from that for a class II deep bite relationship in an individual who had a skeletal deep bite problem.
A successful treatment of deep bite requires a careful analysis of the factors contributing to the problem.

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A detailed clinical examination of the dentition, occlusion, jaw movements and soft tissue pattern of face is very important. For an adolescent patient, a lateral cephalograms must be taken to study the skeletal, dental and soft tissue relationship and the growth pattern and its status [14].

The different diagnostic aids are
1. Clinical examination
2. Study models
3. Cephalograms
4. Photographs

Clinical examination.
a. Extraoral examination
b. Intraoral examination

a. Extraoral examination
The extra-oral examination shows following features in deep bite cases
1. Full face and profile evaluations are made with the head in the natural position.
2. By relating the parts of face to one another, the patient's principal esthetic problems are identified.
3. Full-face examination typically discloses that the patient has a short, square face and an edentulous appearance.
4. When the jaws are at rest, or when the patient is speaking or smiling, the maxillary incisors are hidden behind the upper lip.
5. The upper lip curves downward and the corners of mouth are below the occlusal line.
6. When the mandible is in centric occlusion, distinct skin folds are seen lateral to the oral commissure.
7. Clinical analysis shows that upper third of face is within normal limits.
8. A study of the middle third of the face shows broad nasal alar bases and large nostrils.
9. The posterior part of face appears wide because of prominent mandibular angles.
10. Large masseter muscles are attached to the laterally flared gonial processes.
11. Analysis of the lower third of face reveals that the naso-labial angle is essentially normal or obtuse.
12. With the mandible in a rest position and the upper lip relaxed, the incisal edges of the maxillary anterior teeth are positioned above the inferior margin of upper lip.
13. There is distinct chin button, which is made more apparent by a deep mentolabial fold.
14. Large anteriorly attached masseter muscles and small gonial angles add to square appearance of the patients face.
15. Studying the angle formed between lower border of mandible and Frankfort horizontal plane can assess deep bite relationship. Normally the two planes intersect at the occipital region. If the two planes meet beyond occipital region, it indicates a deep bite case.

b. Intraoral examination
In general intraoral examination of deep bite shows
1. Absolute transverse maxillary excess.
2. The maxillary arch is broad and the palatal vault is typically flat.
3. Maxillary buccal crossbites are commonly associated with interdental spacing.
4. Gingival recession with maxillary and / or mandibular incisors is seen.

Dentoalveolar deep bite shows following features
1. Majority of the problems in this category are created by premature loss of permanent teeth causing a lingual collapse of maxillary or mandibular anterior teeth.
2. Similarly loss and / or mesial tipping of the posterior teeth may also cause a deepening of the overbite, primarily due to a decrease in the vertical height of the face.
3. Occasionally a deep bite may be caused or accentuated by an aberration in the tooth morphology. This can be diagnosed by careful analysis of size and shape of teeth.

Dentoalveolar true deep bite (due to infraocclusion of molars) shows
1. Partially erupted molars.
2. Large interocclusal space
3. A lateral tongue thrust and lateral tongue posture present.

Dentoalveolar pseudo deep bite (due to over eruption of incisors) shows
1. The incisal margins of the incisors extended beyond the functional occlusal plane.
2. Excessive curve of spee.
3. Molars are fully erupted
4. Small inter occlusal space present.

Skeletal deep bite shows
1. It may be due to either malrelationships of alveolar bones and / or underlying mandibular or maxillary bones.
2. In the mandibular dentition it may manifest as a deep curve of spee or reverse curve of spee in the maxillary dentition.

Study models
1. Study models show excessive overbite.
2. Lower arch shows exaggerated curve of spee.
3. Typically, reverse curve or compensatory curve of maxillary occlusal plane in cases of class II division 2 malocclusion.
4. Palatal vault appears to be flat.
5. Molars are in infraocclusion in true deep bite cases.
6. Incisors are supraerupted in pseudo deep bite cases.
7. Maxillary arch is wider.
8. Sometimes teeth are in buccal cross bite.

Cephalograms
A roentgenographic technique for producing a lateral head film was introduced by Pacini16 in 1922. In 1931, Broadbent in USA and Hofrath in Germany simultaneously presented a standardized cephalometric technique.
A lateral cephalogram is one of the orthodontic records that provides information about the sagittal and vertical relationships of the craniofacial skeleton, the soft tissue profile, the dentition, the pharynx and the cervical vertebrae.
These structures and there relationships to each other are calculated by means of linear and angular measurements as well as by the ratios based on the various cephalometric landmarks.
A proper cephalometric analysis enables a classification of deep bite malocclusions. In the dentoalveolar deep bite the extent of the deep bite depends on the extent of eruption of the teeth. An infraocclusion of molars and or supraocclusion of incisors can be a primary etiologic factor.
So, cephalometrically skeletal deep bite and dentoalveolar deep bite can be differentiated from each other as the

dentoalveolar deep bite shows only changes in dentition and the maxillary and mandibular bases are normal.

Few parameters in the different cephalometric analysis emphasize and differentiate the vertical dysplasia.

They are

1. Downs 16 Analysis (1948)
1. Mandibular plane angle - $21.9^0 \pm 3.24^0$. (Go-Me to FH)
2. Y-axis - $59.4^0 \pm 3.82^0$. (S-Gn to FH)
3. Inter incisal angle - $35.4^0 \pm 5.76^0$

(Long axis of upper 1 to long axis of lower 1)
In skeletal deep bite cases, the mandibular plane angle and y-axis value decreases whereas Interincisal angle increases.

2. Steiner 16 Analysis (1953)
1. Mandibular Plane angle – 32^0 (Go Gn - SN)
2. Inter incisal angle - 131^0

(Long axis of upper 1 to long axis of lower 1)
In skeletal deep bite cases, mandibular plane angle decreases and interincisal angle increases.

3. Ricketts analysis (1957)
1. Facial axis - $90^0 \pm 3^0$ (Ptm Gn to Ba N)
2. Mandibular plane angle - $26^0 \pm 4^0$ (Go Me to FH plane)

In skeletal deep bite cases facial axis increases and mandibular plane angle decreases.

4. Schwartz analysis (1958)
1. Interincisal angle - $140^0 \pm 5^0$.
2. Base plane angle - $20^0 \pm 5^0$ PP - MP)
3. Height relations
a. Upper incisor: Lower incisor - 2: 3
   (Incisal edge of U/1to PP) (Incisal edge of L/1 to MP)
b. Upper molar: Lower molar - 2: 3
   (Cusp tip of U/6 to pp): (Cusp tip of L/6 to MP)

4. Gonial angle - 1330
   (Ar- Go to Go-M)

Base plane angle and gonial angle decreases in skeletal deep bite cases. Base plane angle decreases due to the anticlockwise rotation of mandible and or clockwise rotation of palatal plane anteriorly. In the skeletal deep bite it is 230 at 9yrs of age and 20.50 at 15 yrs of age.
Interincisal angle increases in deep bite cases.

5. Sassouni (1969)
The Sassouni analysis was the first cephalometric method to emphasize vertical as well as horizontal relationships and the interaction between vertical and horizontal proportions. Sassouni pointed out that the horizontal anatomic planes i.e. the inclination of the anterior cranial base, F-H plane, palatal plane, occlusal plane and mandibular plane in a well proportioned faces tend to converge towards a single point. The inclination of these planes to each other reflects the vertical proportionality of the face.
If the planes are nearly parallel, so that they converge far behind the face and divert only slowly as they pass anteriorly, there is a skeletal predisposition towards anterior deep bite and the condition is termed skeletal deep bite.

Sassouni developed an analysis for differentiating deep bite and / or open bite relationship. According to him, the constitution of each skeletal type may be due to a positional or dimensional imbalance.
When it is positional, the direction of the displacement is described as anterior or posterior, downward or forward, upward and lateral.

When it is dimensional, it is desfribed as large or small.

I. Positional Deviations
1. The four planes of the face (supraorbitale, palatal, occlusal and mandibular plane) are horizontal and nearly parallel to each other. According to the archial analysis, this carries the center (o) of convergence of four planes far away from the profile.
2. The anterior arc traced from center O and Nasion is nearly a straight line.
3. The midface is usually retrusive, creating a concave profile.
4. The posterior vertical chain of muscles (masseter, internal pterygoid, temporal) is attached anteriorly on the mandible and stretches in nearly straight line vertically.
5. The molars are directly under the impact of masticatory forces on the posterior vertical chain of muscles.

II. Dimensional deviations
1. The total posterior facial height (Sella to Gonion) is nearly equal to anterior facial height (Supra Orbitale to Menton).
2. The lower face height (ANS-Me) is equal or smaller than upper face height (SOr - ANS).
3. A lack of antegonial notch in the mandible leads to what is some-times called as a 'rocking lower border of the mandible.
4. The facial breadth tends to equal to total face height, giving a square face appearance in the frontal view.
5. The mandibular symphysis is short vertically and broad anteroposteriorly.
6. Often the distance between supramentale (point B) and pogonion is large, creating a 'chin button'.
7. At the cranial area the skull is usually round or brachycephalic.
8. Nasion is deep-seated posterior to both frontal and nasal bones.

Table 1: Burstone analysis (1979)

S. no		Males	Females
1	ANS – Gn (1HP)	68.6±3.8mm	61.3±3.3mm
2	MP -HP angle	230±5.90	24.20±50
3	Upper incisor -NF (U/1 NF)	30.5±2.1mm	27.5±1.7mm
4	Lower incisor –MP (L/1 MP)	45±2.1mm	40.8±1.8mm
5	Upper molar - NF (U/6 NF)	26.2±2mm	23±1.3mm
6	Lower molar - MP (L/6 MP)	35.8±2.6mm	32.1±1.9 mm

6. In the skeletal deep bite cases all the values decrease
In a dentoalveolar deep bite due to supraeruption of infisors the upper infisor to NF and lower infisor to MP measurements in frease. If a dentoalveolar deep bite is true i.e. due to infraofflusion of molars then upper molar to NF and lower molar to MP measurements defrease.

Table 2: Bell and profit analysis (1980)

Sr. No		Males	Average	Females
1	SN-PP		70±30	
2	SN-Functional - OP		140±4	
3	SN-GoGn		320±50	
4	FH-Functional OP		110±30	
5	PP-NA		880±40	
6	Ramal plane - MP		1230±50	
7	Me-ANS	80±6mm		70±5mm
8	Me-PP Perpendicular	76±6mm		67±4mm
9	Me-N	137±8mm		123±5mm
10	S-Gn	144±7mm		133±5mm
11	S-o	88±6mm		80±5mm

The values of all the parameters decrease in skeletal deep bite cases.

4. Photographs
The photographs should be taken with the head in the natural position.

Frontal view
In the deep bite patients following features are seen in frontal view.
1. In normal individual upper, middle and lower third of face are proportional to each other but in deep bite cases, the lower third of face height is decreased.
2. A study of the middle third of face shows broad nasal alar bases and large nostrils.
3. Full-face examination typically discloses that the patient has a short, square shaped face and an edentulous appearance.
4. The posterior part of face appears wide because of prominent mandibular angle.
5. The smile view shows maxillary incisors hidden behind the upper lip.
6. Frontal view shows curled or redundant lips.
7. The upper lip curves downward and the corners of mouth are below the occlusal line.
8. Upper tooth to upper lip relationship is a vertical measurement made in midline from the incisal edges of maxillary central incisor to the most inferior portion of the upper lip. Usually this distance is 2-5 mm. If the upper teeth are buried under the upper lip, it indicates skeletal deep bite.
9. Interlabial distance is the vertical distance between the most inferior portion of the upper and lower lip when the lips are relaxed and the teeth are in centric relation. In normal individual it is approximately 2mm. Decreased interlabial distance or redundancy of the lips indicates skeletal deep bite.

Profile view
1. The lower third of face height is decreased.
2. Analysis of lower third of face reveals that nasolabial angle is essentially normal or obtuse.
3. There is distinct chin button, which is made more apparent by a deep mentolabial fold.
4. L0069ps are curled or redundant.

References
1. Graber TM, Swain BE. Orthodontics: Current Principles and Techniques, St. Louis: Mosby Co, 1985.
2. Graber TM, Vanarsdall R. Orthodontics: Current Principles and Techniques 2nd Ed. St. Louis: Mosby yearbook, 1994.
3. Nanda R. Differential diagnosis and treatment of excessive overbite. DCNA. 1981; 25:61-83.
4. Bell WH, Proffitt WR, White RP. Surgical correction of dentofacial deformities. W.B. Saunders Co. Philadelphia, 1980.
5. Athanasiou AE. Orthodontic Cephalometry. Mosby – Wolfe.
6. Sassouni VA. Classification of skeletal facial types. Am. J Orthod. 1969; 55:109-123.
7. Sassouni V. Orthodontics in dental practice. The C.V. Msby Co, 1971.
8. Salzmann. JA. Practice of Orthodontics. J.B. Lippincott Co. Philadelphia, 1957.
9. Nanda R. Correction of deep overbite in adults. DCNA, 1997; 41:67-87. Intrusion of incisors in adult patients with marginal bone loss. Orthod Am J. 1989; 96:232-241.
10. Zachrisson BU. Important aspects of long-term stability. J Clin. Orthod 1997; 31:562-585.