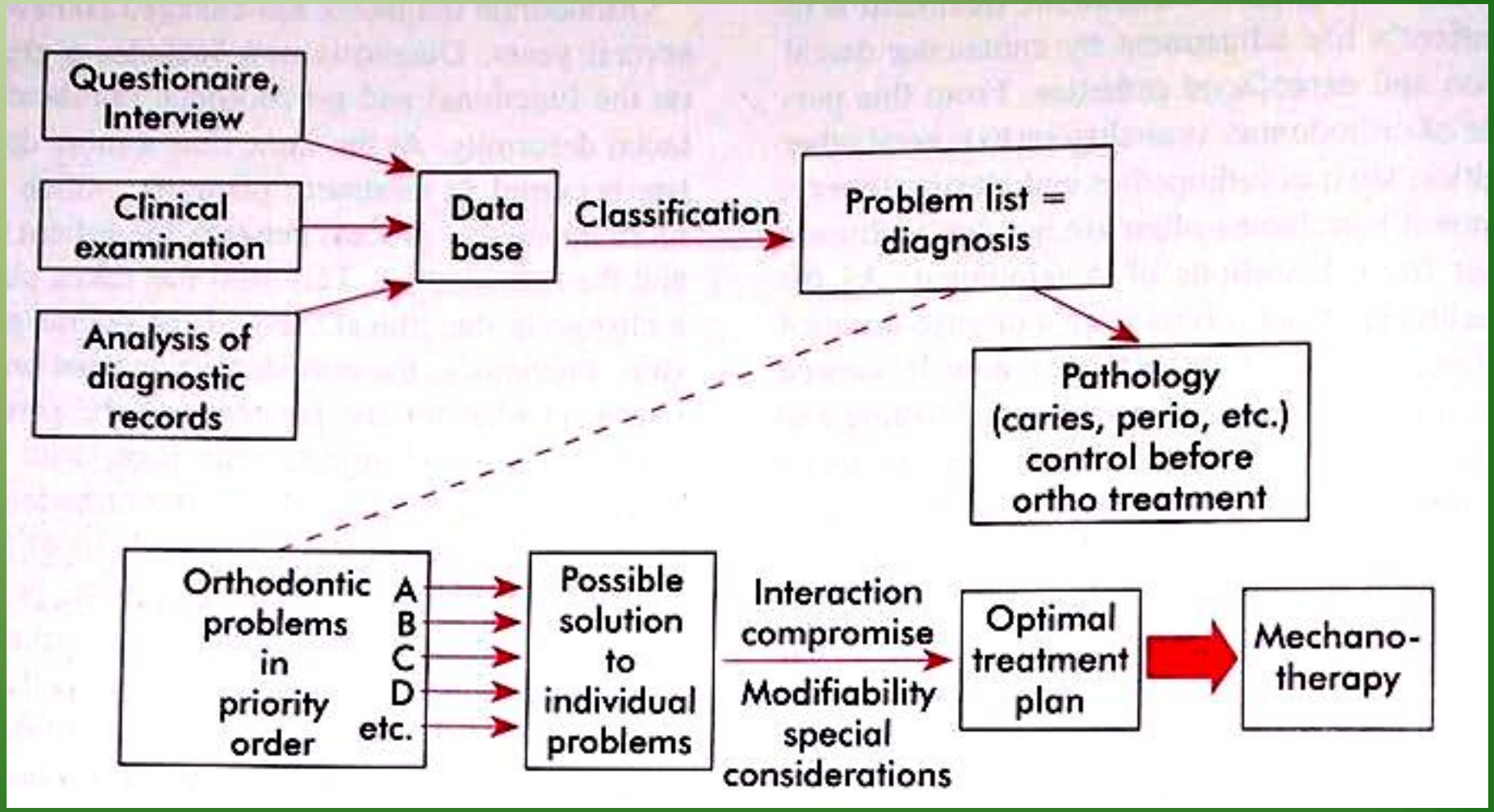
CASE HISTORY SUMMARY

DIAGNOSIS AND TREATMENT PLANNING

Malocclusion is not a disease but a disability with potential impact on the physical and mental health of an individual. An appropriate diagnosis and treatment plan is important for the patient's well being.

The goal of an orthodontist is to obtain an optimal occlusion with in a framework of compatible skeletal bases, the nerves and muscles surrounding them in perfect harmony. Physiological adaptation with normal function and stability is also important, without which an ideal stomatognathic system would be hard to imagine.

Flow chart


Questionaire, Interview
Clinical examination
Analysis of diagnostic records
Data base
Classification
Problem list = diagnosis
Pathology (caries, perio, etc.) control before ortho treatment
Orthodontic problems in priority order
A
B
C
D
etc.
Possible solution to individual problems
Interaction compromise
Modifiability special considerations
Optimal treatment plan
Mechano-therapy

The specific type of treatment should not be considered until complete diagnostic information has been evaluated, it is helpful in the beginning to consider how orthodontic treatment can be accomplished. The four basic treatment modalities that the orthodontist can use [either separately or in combination] are:

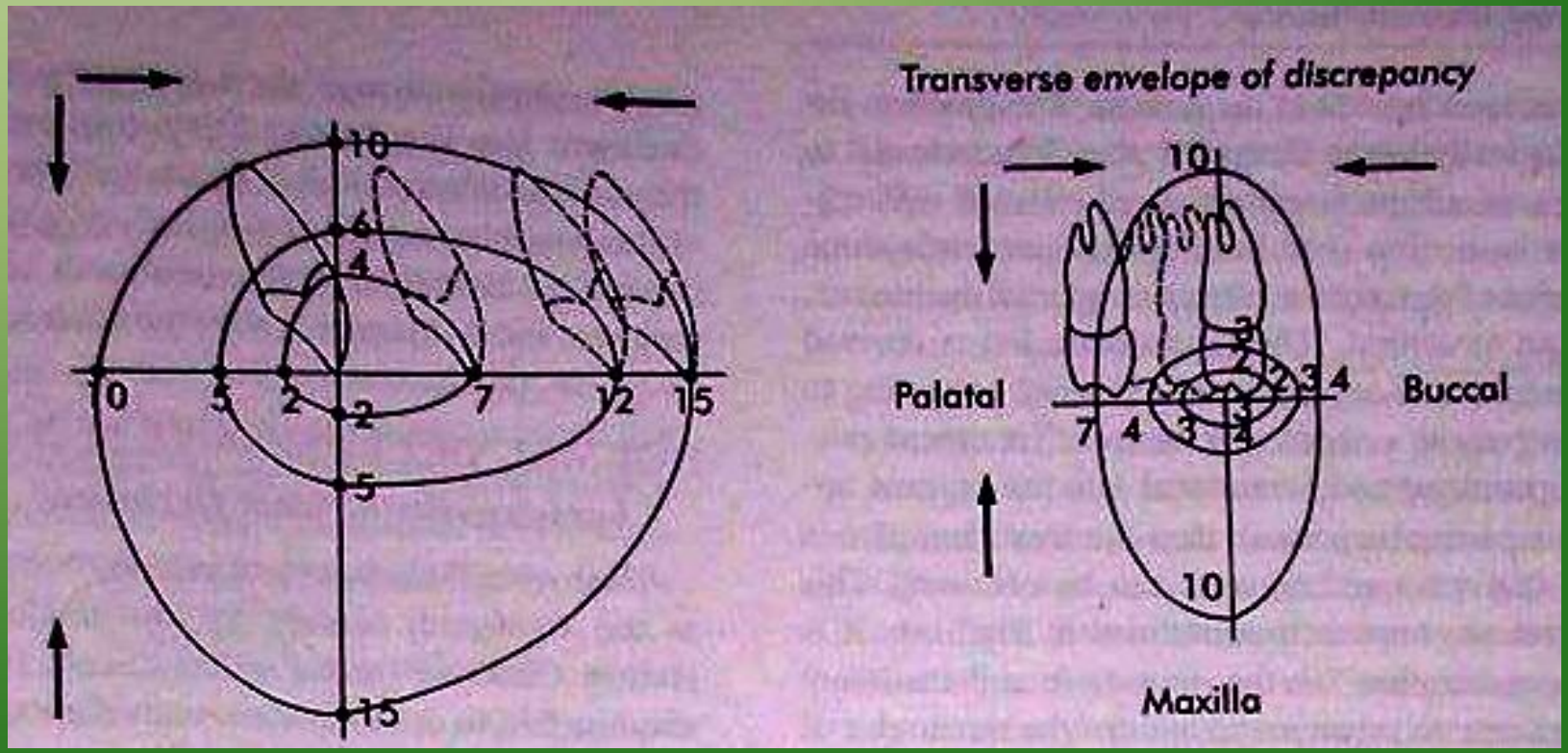
1. Repositioning the teeth through orthodontic tooth movement.

2. Redirection of facial growth through functional alterations or the use of strong modifying forces.

3. Dentofacial orthopedics in which dentofacial growth is altered through the use of strong modifying forces.

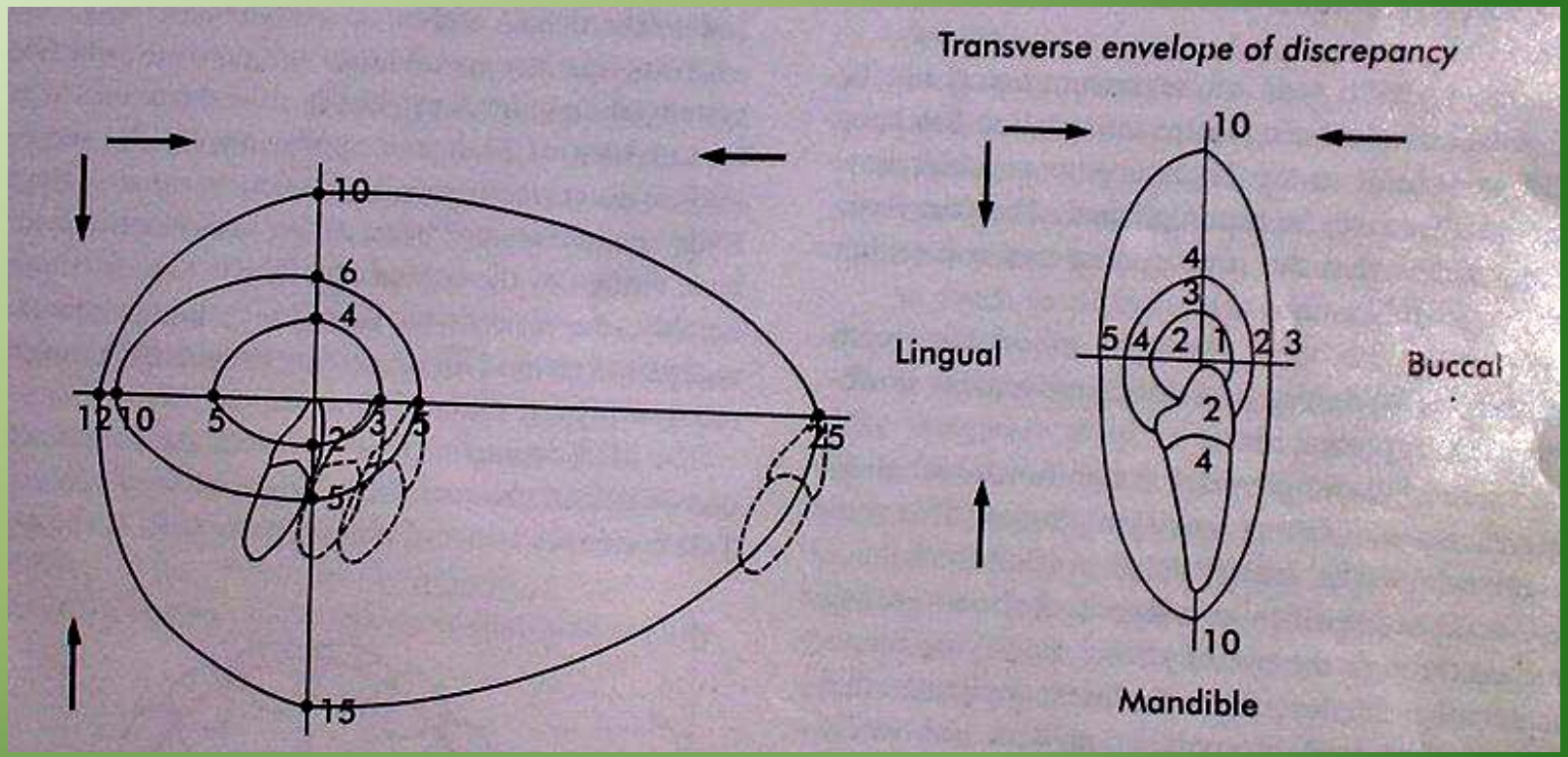
4. Surgical -orthodontic treatment

The treatment modality [or combination of modalities] that is best for an individual is determined by the nature and severity of the orthodontic problem. This can be best visualized by considering an ***envelope of discrepancy*** for the maxilla and mandible based on the degree of disparity in occlusal relationships.



Maxilla

Mandible



The orthodontic and surgical envelopes can be viewed separately for the upper and lower arches, but the growth modification envelope is the same for both.

These numbers, of course, are the guidelines and may underestimate or overestimate the possibilities for any given patient; however, they serve to place the potential of the 3 major treatment modalities in perspective.

Case history

The purpose of this examination is to understand the malocclusion so that by early elimination of the causative factors, correct therapy can be undertaken.

The clinical history enables the patient to communicate symptoms, feelings, and fears, and the sequence of events leading to the problem for which the patient seeks professional assistance. At the same time it allows assessment of the patient's mental and behavioral status. In general, an expression of interest, warmth, and compassion by the clinician encourages patients to communicate their concerns.

So as a rule case history is usually assessed with the help of a special questionnaire.

NAME: Helps in Identification and also helps in maintaining the records.

ADDRESS: This is routine demographic and referral information, which helps in identifying the location or place of the patient and also for communication. Even in some cases it gives clue about some diseases that are area related {e.g. Flourosis}

DATE: Helps to know the duration of the treatment time.

O.P.D. No: Helps to maintain the records of the patient.

COMPLETED AGE: This gives an insight of the patient's age at the time of treatment. In growing individuals this is a key factor in deciding the treatment modalities.

OCCUPATION AND INCOME: This describes the economy of the patient. Usually it is believed that higher-class groups have more awareness of the ortho treatment and esthetically oriented.

CHIEF COMPLAINT:

Always chief complaint should be recorded in patient's version.
There are 2 logical reasons for the patients concern about the alignment and occlusion of the teeth.

1. Impaired dentofacial esthetics- can lead to psychological problems.
2. Impaired function.

Here it is important to establish the relative importance of the patient by a series of leading questions.

FAMILY HISTORY:

It is widely acknowledged that most malocclusions have a genetic component; however it is extremely difficult to quantify how much a given problem is genetic and how much is due to prenatal or post natal factors.

A relative large number of dysgnathies are inherited and transmitted through a dominant gene, where as in cases of cleft lip and palate, it is usually through a recessive gene.

So family history to some extent reveal the genetic component of most malocclusions.

PRENATAL HISTORY:

Dentofacial problems related to either birth trauma or the intrauterine environment [i.e. intrauterine molding], in which the pressure during fetal growth distorts the developing face. The most frequently problem of this type is Pierre Robin Syndrome.

POSTNATAL HISTORY:

The role of the postnatal environment in the etiology of Malocclusion continues to be vigorously debated. The environment in this sense refers to all the nongenetic influences that may be brought to bear on the developing individual and refers particularly to the effects of muscle function and neuromuscular adaptation.

If both heredity and environment are involved, it may be difficult to decide which part of the problem is genetic and which is environmental. Nevertheless, the distinction is important because the orthodontist's concept of the relative importance of environment versus heredity can directly influence the approach to orthodontic treatment.

The orthodontist who believes that growth problems leading to skeletal malocclusion are largely if not entirely genetic has little hope of altering the growth patterns and tends to focus treatment on adapting the dentition to a skeletal pattern that cannot be controlled.

- Enlarged adenoids and tonsils usually experience problems with breathing and tongue posture. Factors those are associated with vertical problems such as open bite.

-Epileptic patients who take anticonvulsant drugs influence orthodontic tooth movement if gingival hyperplasia occurs.

HABITS:

Behavior that was appropriate at an earlier age now represents some developmental immaturity. Habits like thumb sucking and tongue thrusting can cause both protrusion of the maxillary incisor teeth and anterior open bite. If habits are present again it depends on duration, frequency and intensity.

TRAUMA:

Trauma to the teeth can lead to ankylosis and subsequent failure of eruption. Trauma to the mandible may result in the fracture at the neck of the condyle and this may pose problem with the possibility that a unilateral growth disturbance leading to asymmetry or mandibular deficiency.

DENTAL HISTORY:

Dental health status of the patient indicates oral health awareness and the potential susceptibility to periodontal disease particularly regarding loss of teeth.

If the patient ever had a traumatic accident involving the teeth, ortho treatment can exacebrate periapical symptoms in teeth. So necessary steps should be undertaken.

Likewise, clear details of any previous towards complications of dental treatment must be recorded or obtained subsequently if not immediately available from the patient.

GENERAL EXAMINATION:

It is important to judge general physical development in relation to the amount of growth that has occurred and the potential for future growth remains.

Orthodontist knows that best results are achieved in good growers [amount rate and direction of growth]. The acceleration of facial growth at puberty is mild compared to extremities of the body, but this is the most favorable time to attack ortho problems with skeletal manifestations.

One method of evaluating the growth status of a child is to plot the child's height and weight on standard growth charts. This is particular valuable in longitudinal studies because it indicates the channel of growth in which a particular child is likely to remain.

Another physical characteristic is the general body type.

Ectomorphic: Tall and thin.

Mesomorhic: Average

Endomorphic: Short and fat.

Ectomorphic children tend to grow more slowly and to reach the pubertal growth spurt later than do mesomorphic or endomorphic children.

AGE:

Chronological age is often not sufficient for assessing the development age and somatic maturity of the patient.

The biologic age is determined from skeletal, dental, chronological age, and onset of puberty.

Skeletal age correlates reasonably well with the physical growth status and has been used in orthodontic diagnosis for this purpose.

The basis for skeletal age assessment by radiographs is that different ossification centers appear and mature at different time The order, rate, time of appearance and progress of ossification in the various ossification centers occur in a predictable sequence.

Different methods to assess skeletal maturity

Hand wrist radiographs

Cervical vertebrae

Tooth development

Hand wrist radiograph

Different methods to assess skeletal maturity using hand wrist Radiographs:

- Bjork Grave and Brown (1972 and 1976)
- Atlas method by Greulich and Pyle (1959)
- Fishman's skeletal maturity indicators (1982)
- Hagg and Taranger (1982)
- Singer method of assessment (1980)

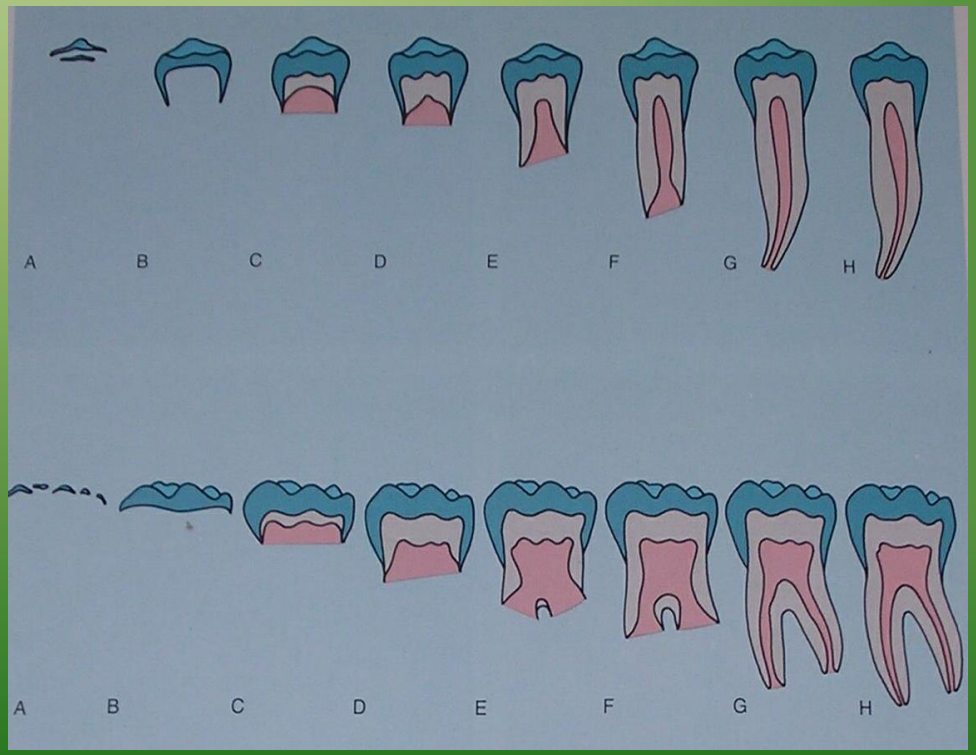
Indications of hand wrist radiographs;

- Predict pubertal growth spurt
- Treatment of skeletal malocclusions during growth period
- Borderline cases (16-20 years)
- Research work

Tooth development as skeletal maturity indicator:

When determining dental age radiographically according to the stages of germination, the degree of development of individual teeth is compared to a fixed scale.

For age determination one does not rely on the last stage of tooth formation but on the entire process of dental materialization, this renders the estimation of age more accurate



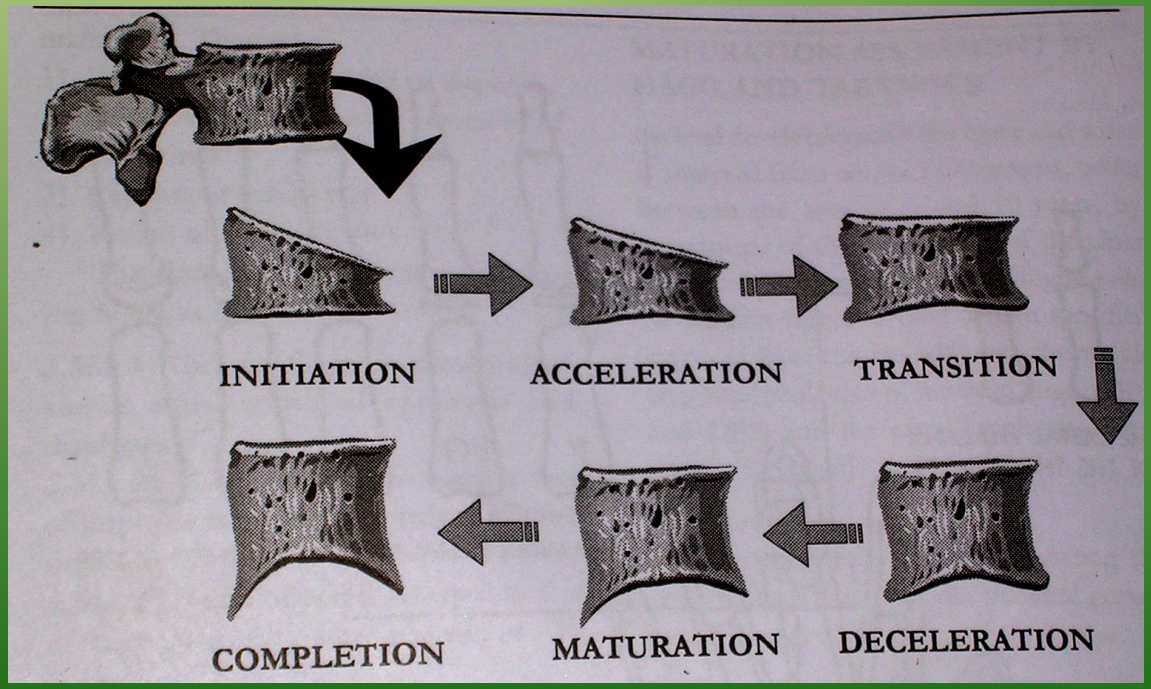
According to Demirjian et al (1973)

Cervical vertebrae as skeletal maturity indicator:

In 1972, Lamparski concluded that the cervical vertebrae were as statically and clinically reliable in assessing the skeletal age as hand wrist technique.

Advantages:

1. Determining skeletal age
2. Prevents additional radiation exposure to the patient.
3. Detecting pathological conditions.



Hassel and Farman;

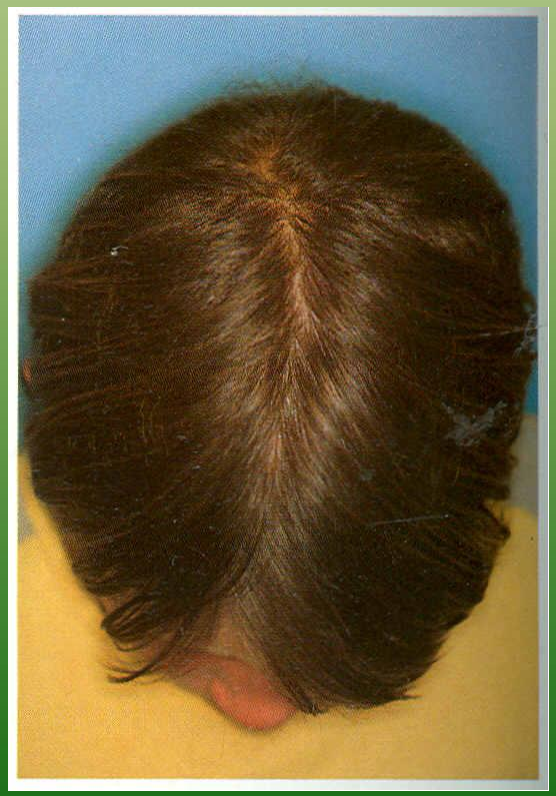
Profile and full-face analysis [EXTRA ORAL EXAMINATIONS]

Cephalic and Facial Examination

Cephalic Index:

The index is based of the anthropometric determination of the maximum width of the head and the maximum length.

(Classification and index values according to Martin and Saller [1957]



Cephalic Index

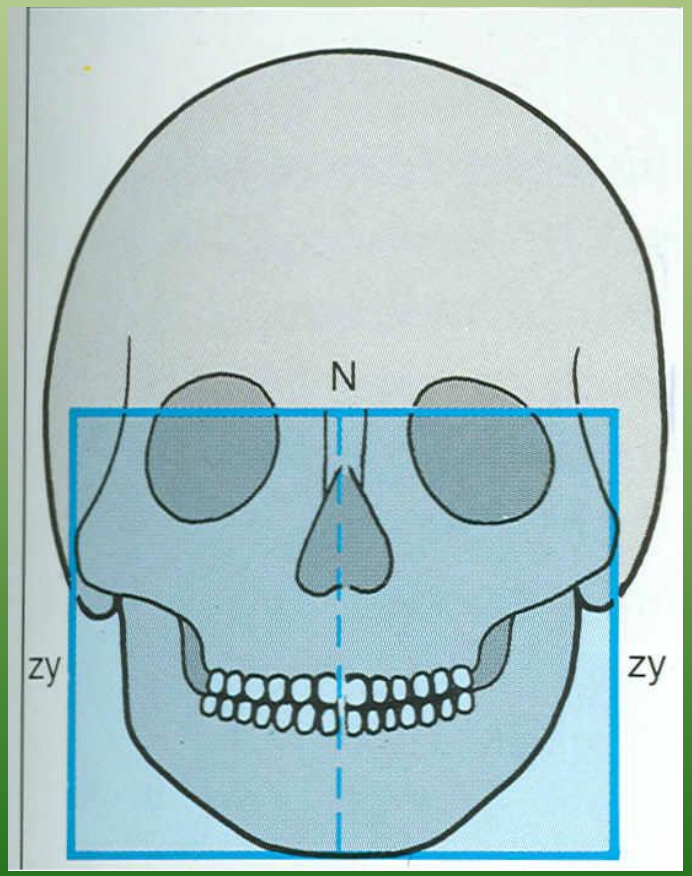
$$I = \frac{\text{Maximum skull width}}{\text{Minimum skull length}}$$

Classification:

Dolichocephalic (long skull)	x - 75.9
Mesocephalic	76.0 - 80.9
Brachycephalic (short skull)	81.0 - 85.4
Hyperbrachycephalic	85.5 - x

Morphologic Facial index:

The morphologic facial height is defined as the distance between nasion and gnathion, the bizygomatic width as the distance between the zygoma points. (Classification and index values according to Martin and Saller [1957]



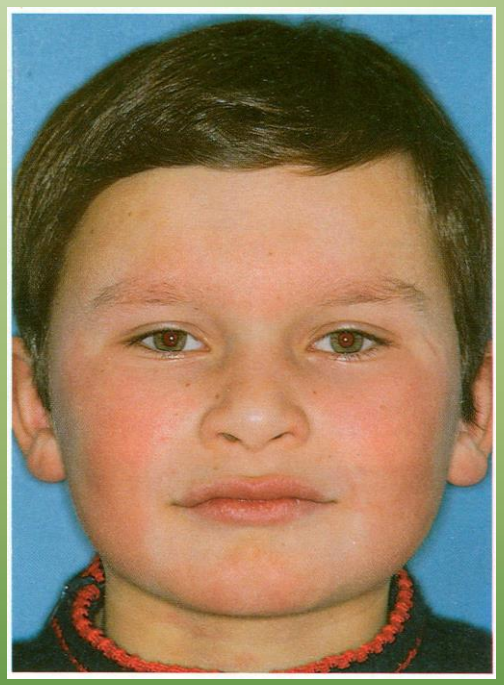
$$I = \frac{\text{morphologic facial height}}{\text{Bizygomatic width}}$$

Classification:

Hypereuryprosp	x - 78.9
Euryprosop	79 - 83.9
Mesoprosop	84 - 87.9
Leptopsosop	88 - 92.9
Hyperleptoprosop	93 - x

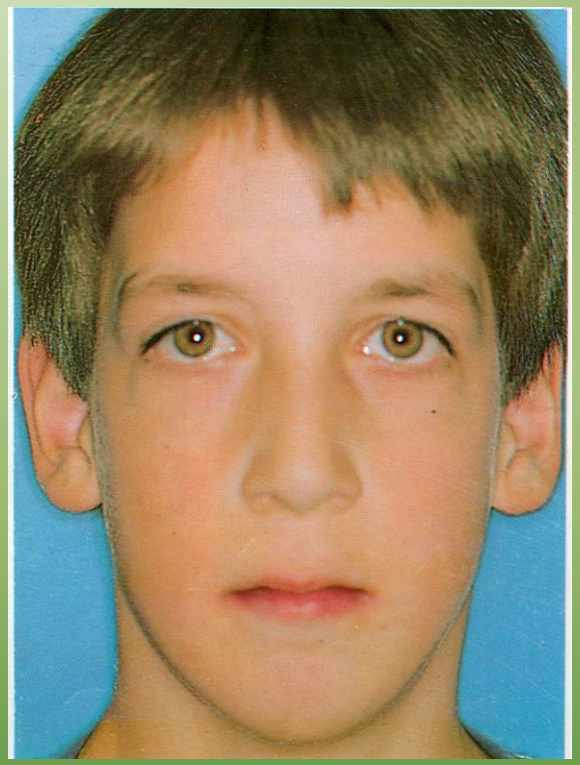
Broad face:

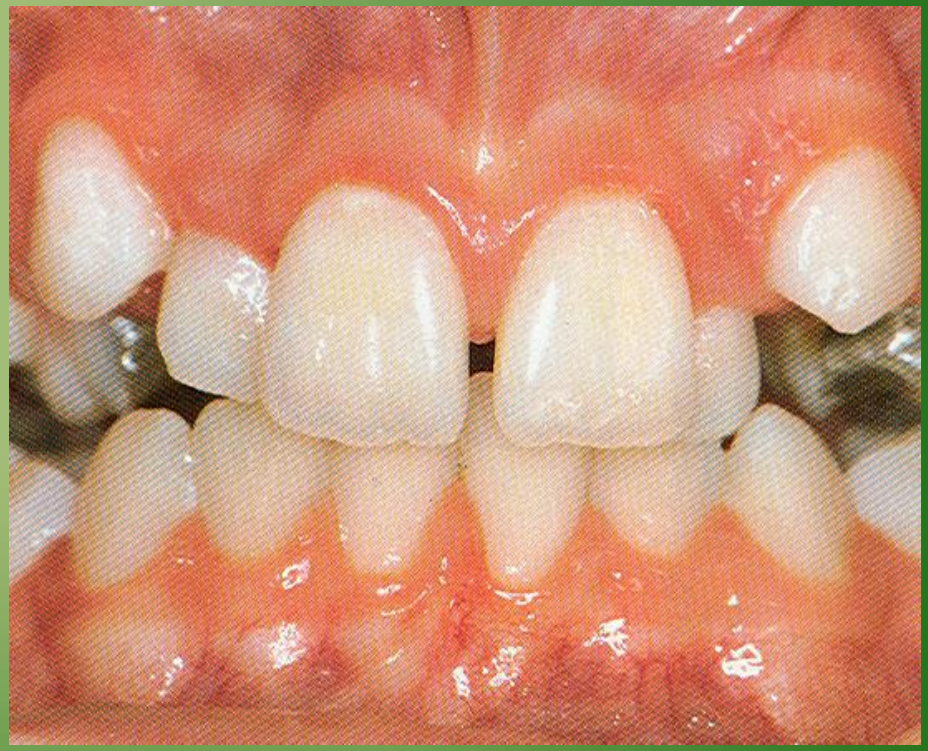
Intra and extra oral findings in a hypereuryprosopic facial type.



In these patients the apical base of the jaw is wide in the transverse direction
If there is dental crowding in such a case the inclination of the teeth is confined to the coronal part of the dental arch and is described as coronal crowding.
In broad facial types transverse expansion is indicated.

Narrow Face: Intra and extra oral findings in a leptoprosopic facial type.



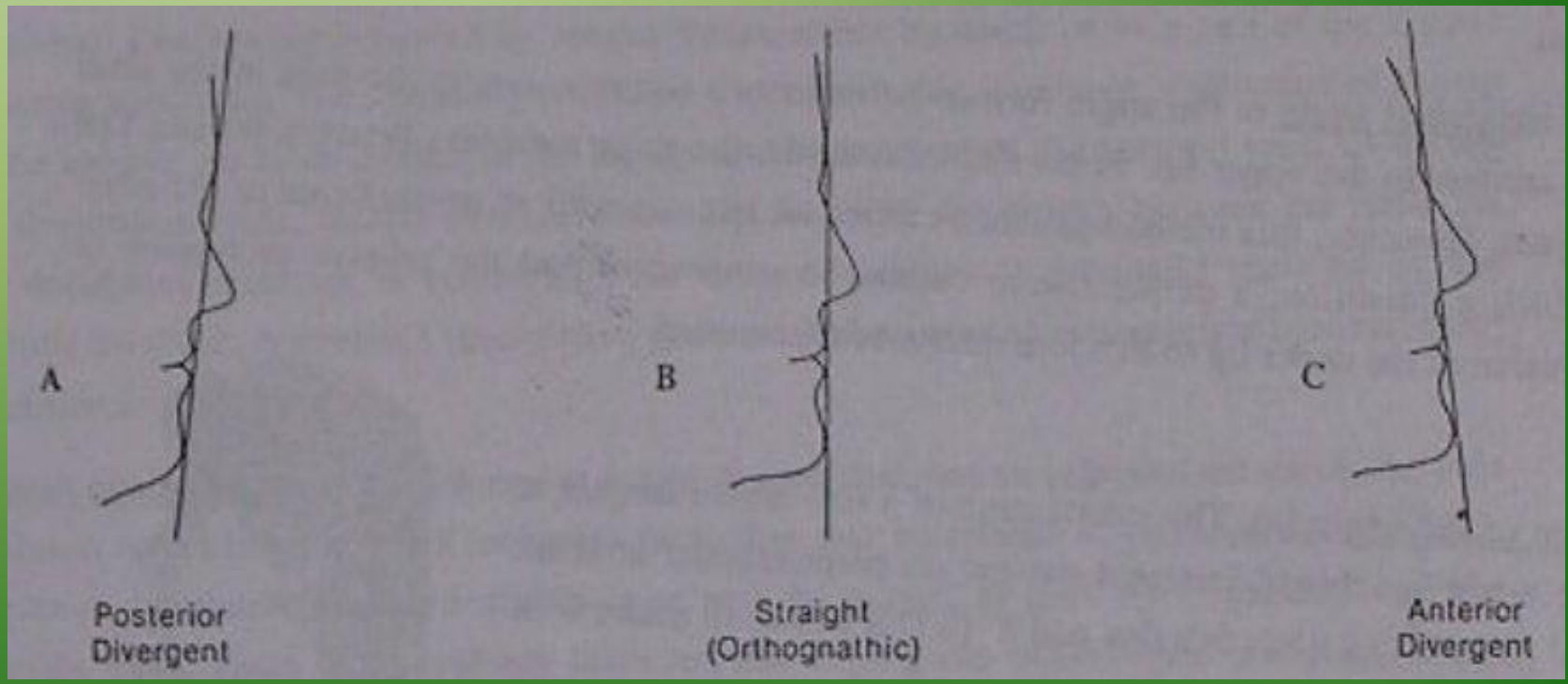


Parallel with the reduced development of the bizygomatic width, the apical base is often narrow in transverse direction.

Therefore, in cases of maxillary crowding not only is the narrowing of the coronal arch but also in the apical regions.

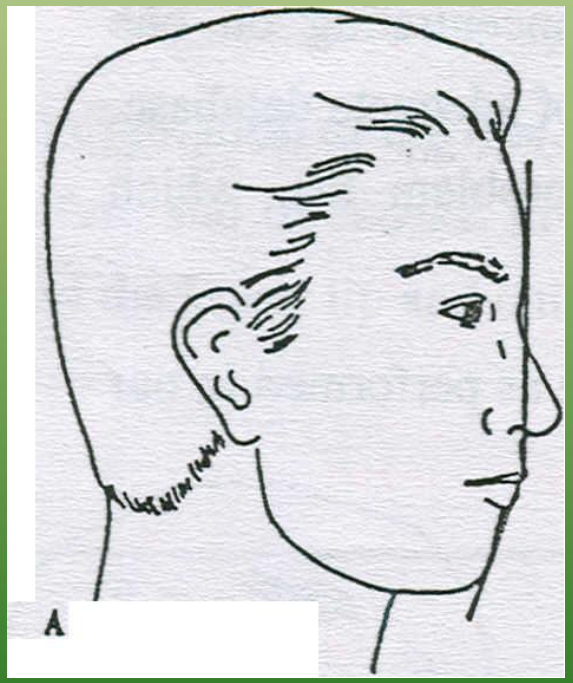
FACIAL DIVERGENCE

Divergence of the face is defined as an anterior or posterior inclination of the lower face in relation to the forehead. Divergence is purely influenced by the ethnic or racial background. This should be clearly distinguished from the profile. If the profile is straight it doesn't matter if the divergence slopes anteriorly or posteriorly.

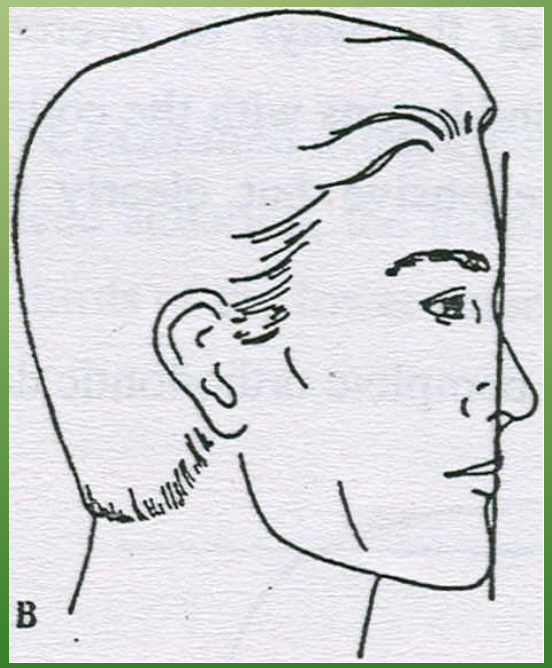


FACIAL PROFILE:

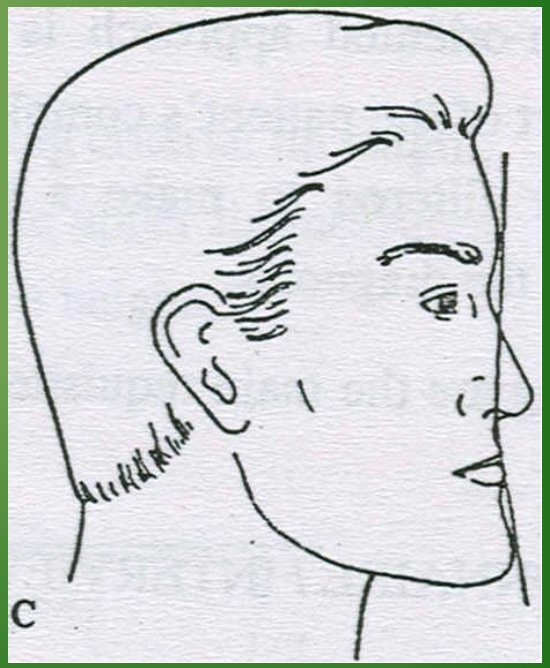
To establish this, the patient has to be placed in natural head position, either sitting or standing, but not reclining in the dental chair. Note the relationship between two lines, one dropped from the bridge of the nose to the base of the upper lip and the second one extending from that point down to the chin. These two line segments should form as straight a line as possible.



convex profile [Skeletal Class II]



Straight



Concave [Skeletal Class III]

Examination of the soft tissues.

Extra oral: Forehead, Nose, Lips and Chin

Intraoral: Lip and cheek frenal attachments, Gingiva, Palatal and oral mucosa

Forehead:

The height of the forehead is measured from the hairline to the glabella
Normally measures one third of the total facial height
The configuration of the forehead is genetically and ethnically determined and varies according to the age and gender.
The esthetic appearance of the nasal profile is influenced by the curvature of the forehead. In cases of a steep forehead the dental bases are more prognathic than in cases with flat forehead.

Forehead:

Flat Protruding Steep

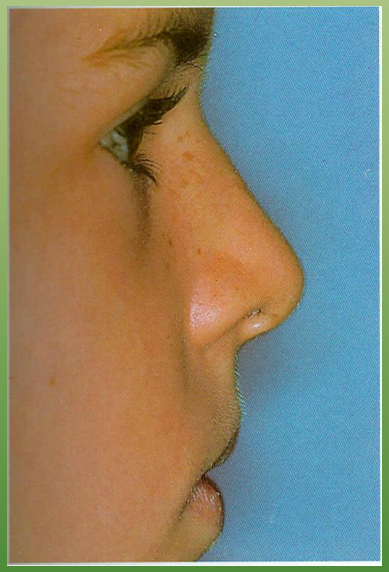
- The configuration of the forehead is genetically and ethnically determined and varies according to the age and gender.
- The esthetic appearance of the nasal profile is influenced by the curvature of the forehead. In cases of a steep forehead the dental bases are more prognathic than in cases with flat forehead.

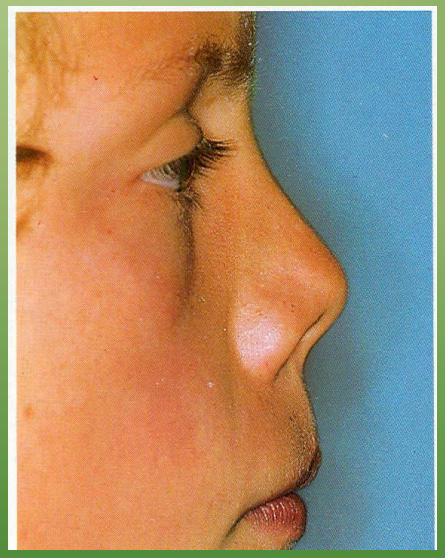
NOSE:

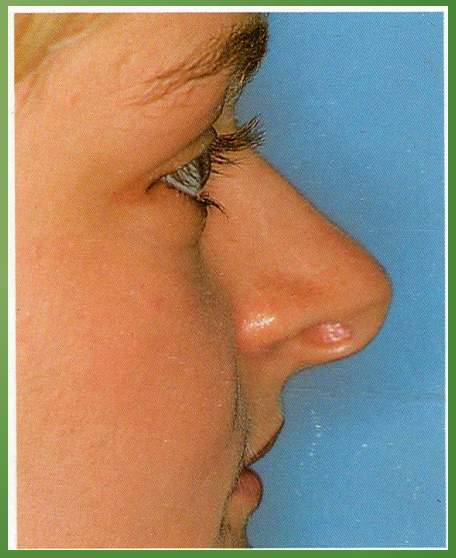
Size, shape, and position of the nose determine the esthetic appearance of the face. Before treatment it should be stressed that the nasal profile is not improved by orthodontic procedures and that a rhinoplasty may be necessary later.

Size of the nose:

Vertical nasal length measures one-third of total face height (distance hairline to gnathion).







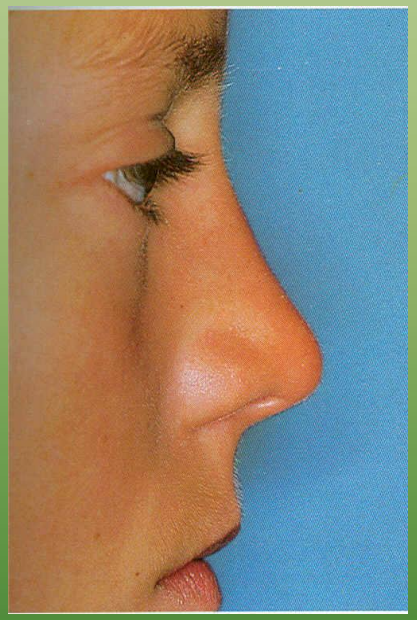
Left: In the normal case, the relationship between vertical and horizontal length of the nose is 2:1 as viewed from the side.

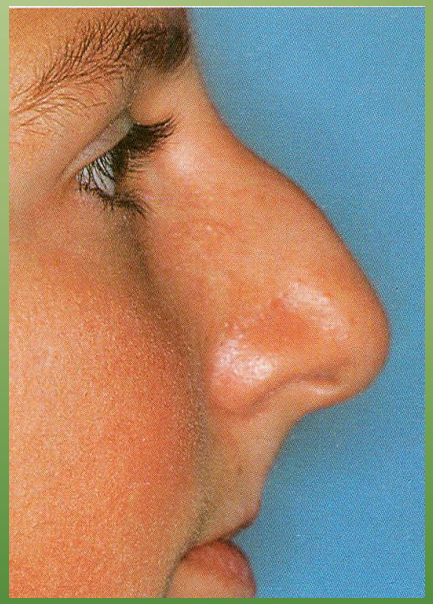
Middle: Microrhinic type with a high root of the nose, short nasal bridge, and an elevated tip.

Right: Patient with a large nasal profile: deep root of the nose, long nasal bridge, and a protruding tip.

The *shape of the nose* is not only determined by hereditary or ethnic factors but may be the result of trauma in childhood. Besides the contour of the bridge and the tip of the nose the size and the shape and width of the nostrils as well as the position of the nasal septum should be assessed. These findings can indicate impairment of nasal breathing.

Nasal contour:

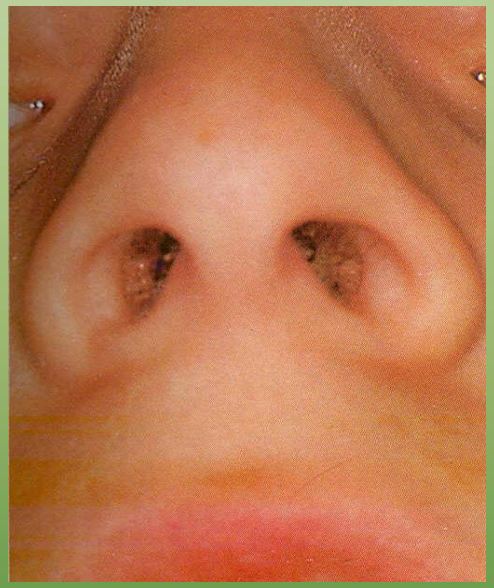


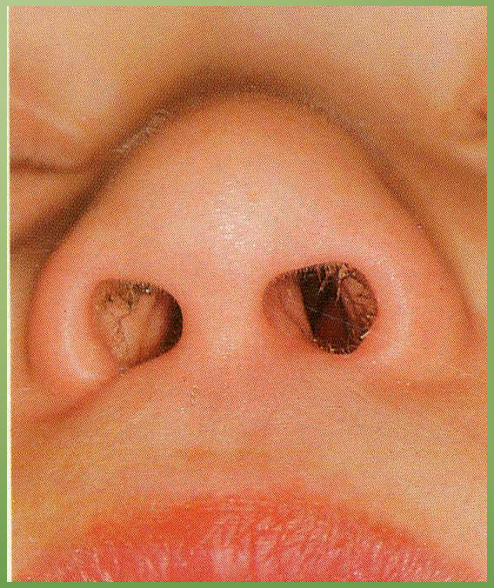


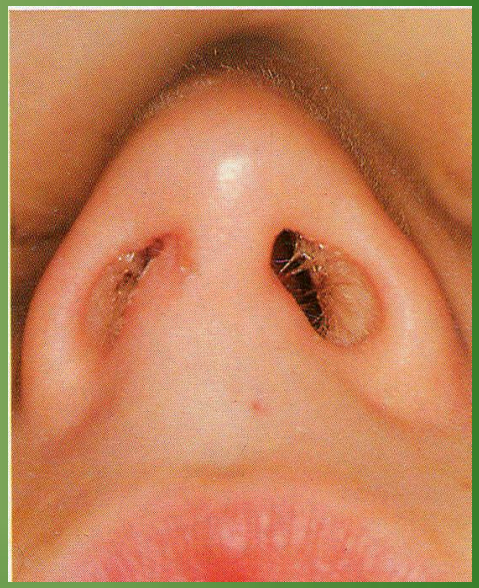
Left: Straight nose.
Middle: Convex nasal bridge
Right: Crooked nose, from previous trauma.

Nostrils

The width of the nostrils (alar base) is approximately 70% of the length of the nose (distance nasion to tip of nose).







Left: The nostrils are usually oval and bilaterally symmetrical

Middle: Nasal breathing is seldom impaired by a slight nasal anomaly with wide nostrils

Right: Disturbed nasal breathing due to stenosis of the right nostril, combined with a cartilaginous septal deviation.

Lips:

Configuration of the lips can be assessed by the following criteria :

Lip length, width, and curvature.

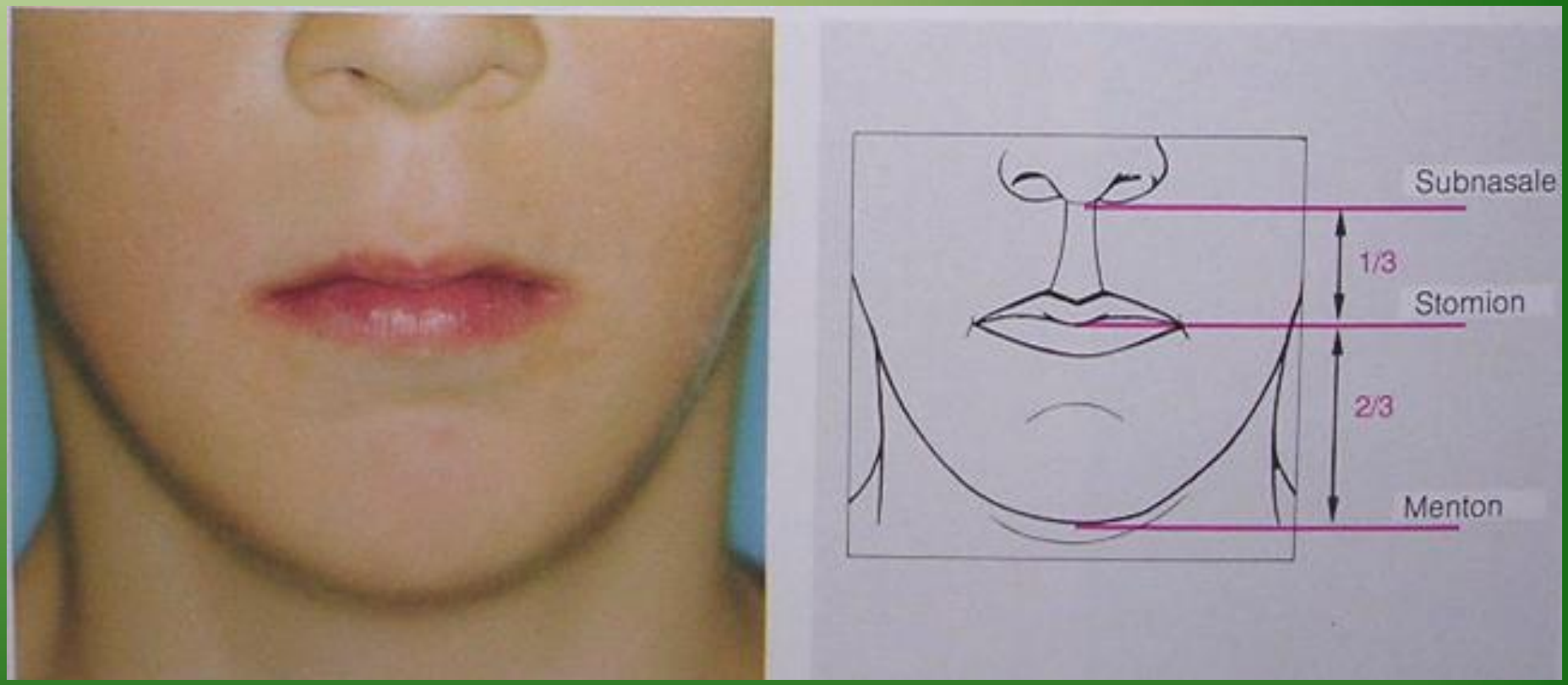
In a balanced situation, the length of the upper lip measures one-third, the lower lip and the chin two thirds of the lower face height. In addition, the length of the upper lip should be assessed in relation to the position of the upper incisal edges). The observation of the nasolabial angle and in particular the mentolabial fold is indicative of the degree of lip tension.

Apart from ethnic characteristics, lip protrusion is influenced by the thickness of the soft tissues, the tone of the orbicularis oris muscle, position of the anterior teeth, and the configuration of underlying bony structures.

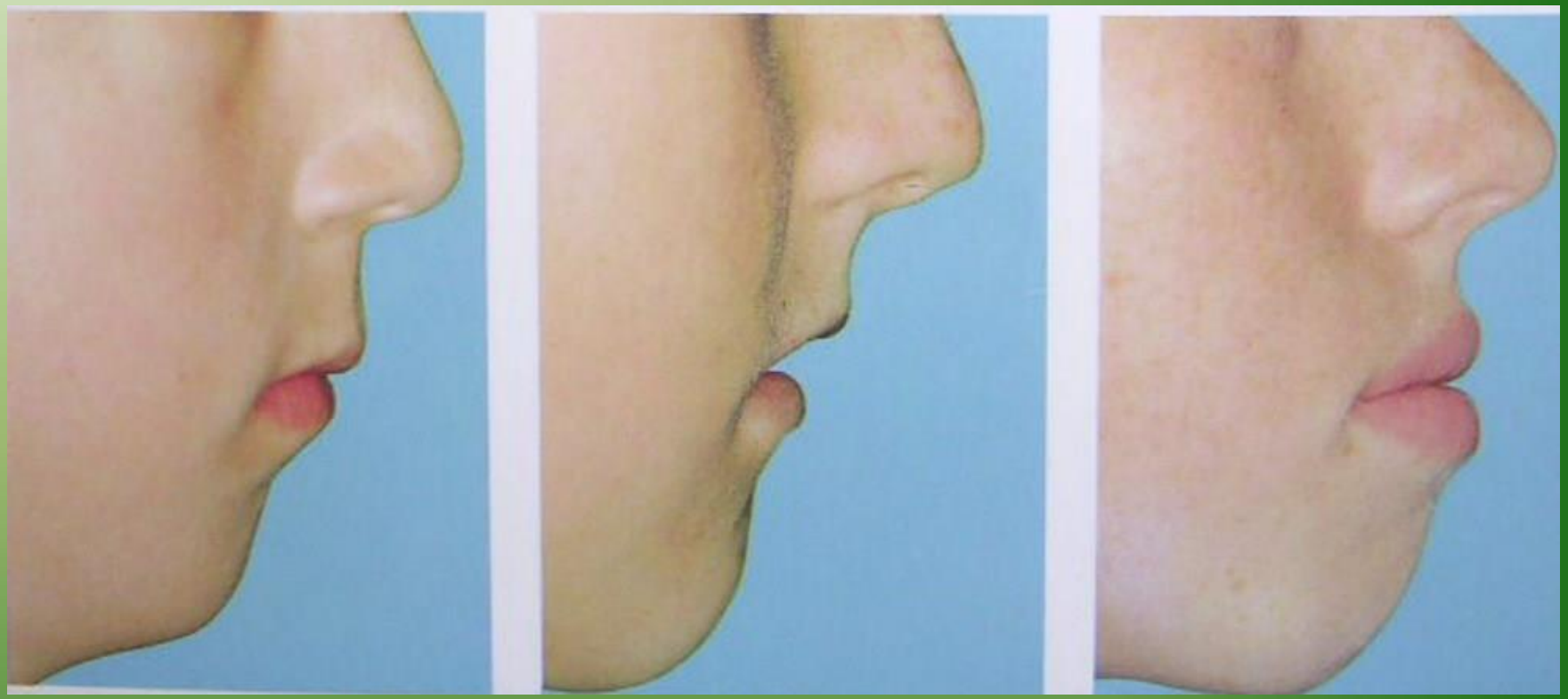
In patients with lower lip dysfunction, the upper lip is often everted, paler and dry ; the lower lip, however, has a better blood circulation and is moist. In some cases, indentations of upper incisal edges are present.

Vertical lip relationship

In a balanced situation, the upper lip length (distance of subnasale to stomion) is one- third and the length of the lower lip and of the chin (distance stomion to menton) is two thirds of the lower face height.



Lip morphology:



Left: Harmonious lip profile with a narrow mucosal element

Middle: Short upper lip with narrow mucosal element and disturbed lip seal.

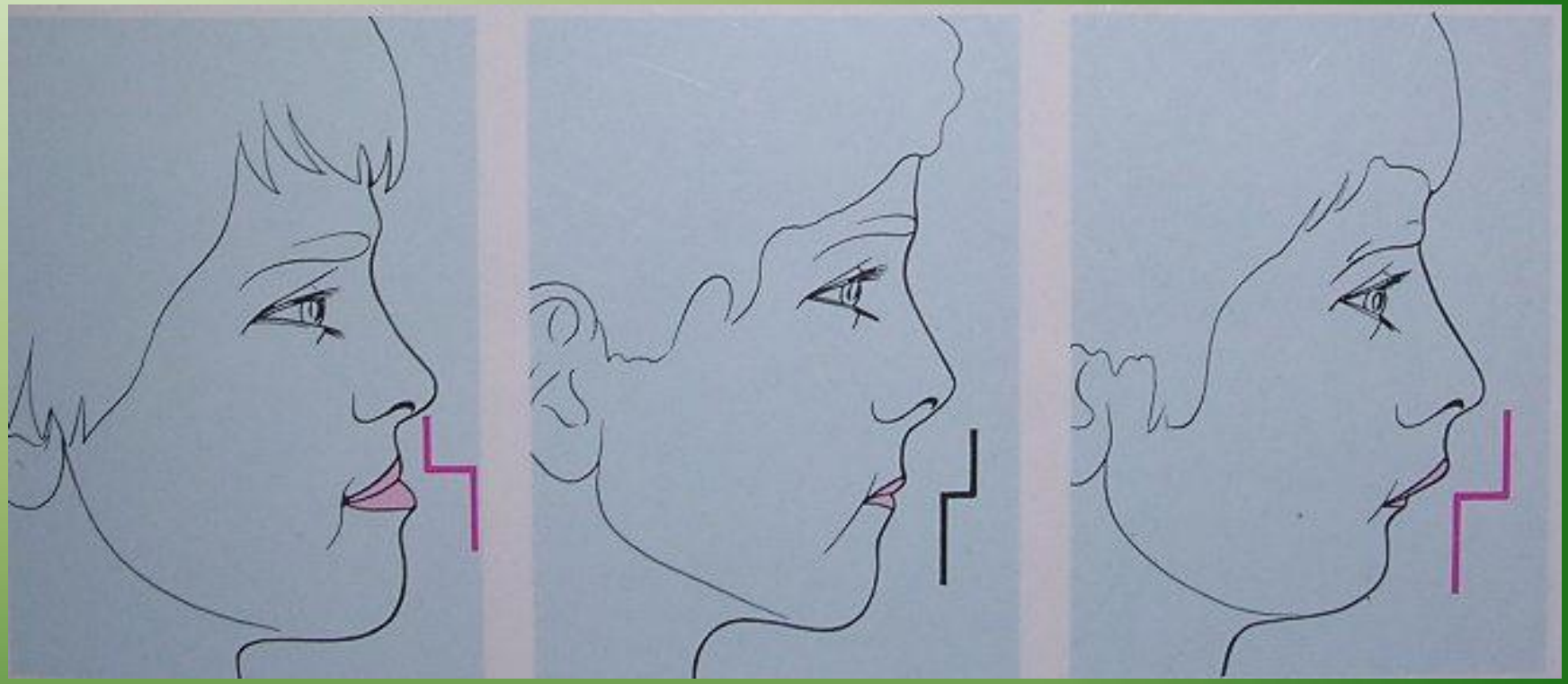
Right: Short cutaneous upper and lower lip with undisturbed lip closure. The lip insufficiency is compensated by eversion of the mucosal part.

Relation of upper lip length to front teeth:

Left: The upper incisal edges in the rest position and when smiling should show 2 mm in normal case.

Right: Disharmonious relationship between length of upper lip and incisal edges of upper incisors. The gingiva and the alveolar mucosa are visible in cases of a short upper lip, in conjunction with vertical over development of the. Alveolar process (**gummy smile**).

Horizontal lip profile:



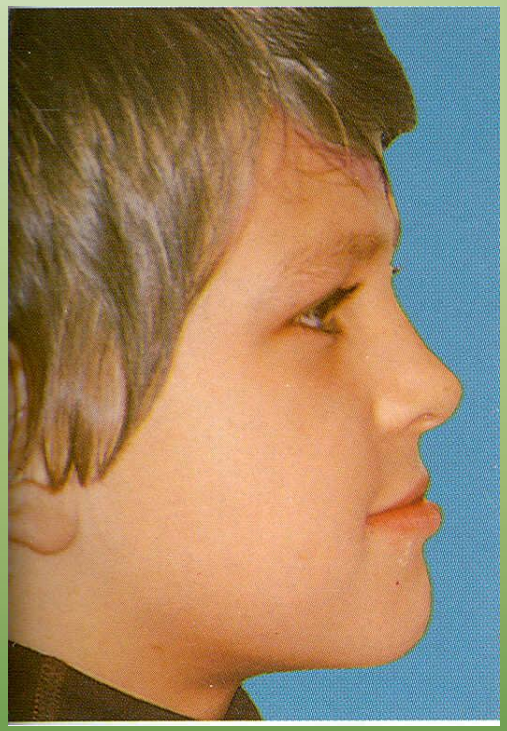
Lip step according to Korkhaus:

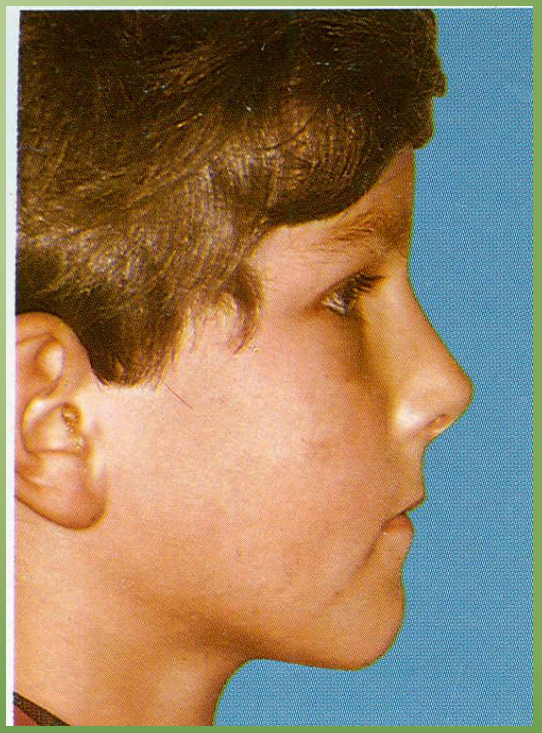
Left: positive lip step.

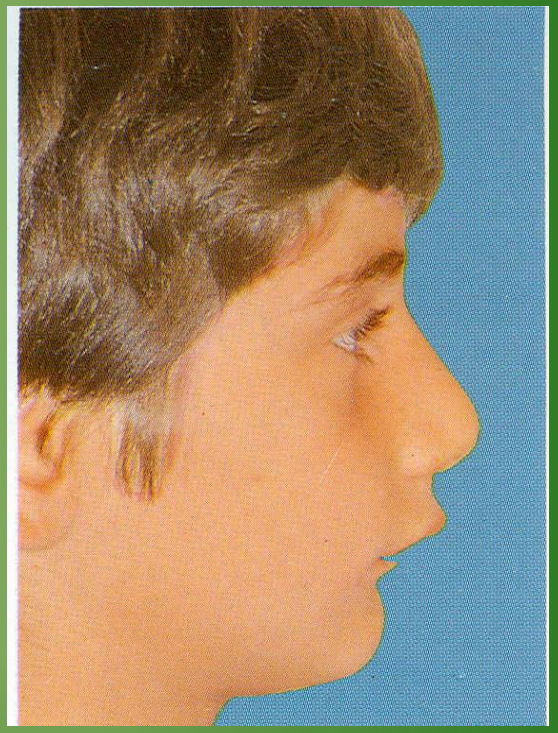
Middle: slightly negative lip step (normal case).

Right: marked negative lip step.

Clinical profile:





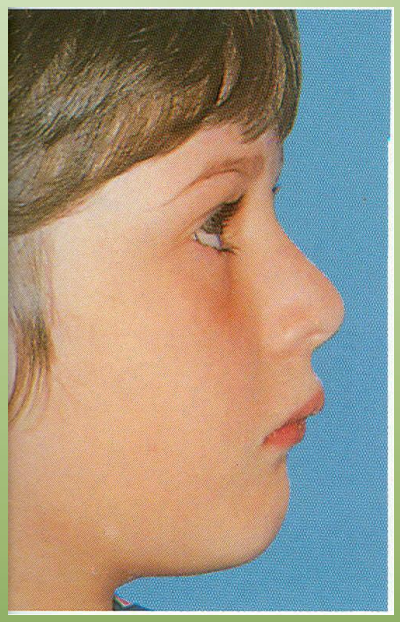


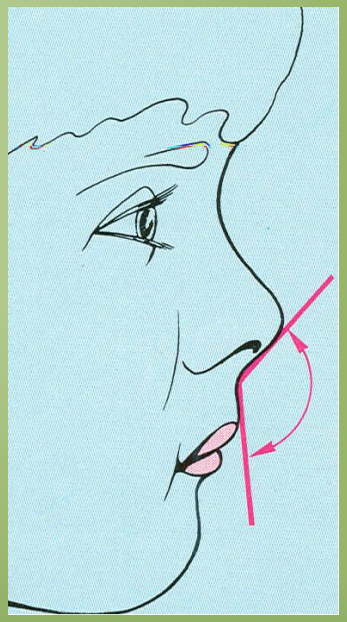
Left: Protrusion of lower lip in relation to upper lip - a symptom of the Class III malocclusion (positive lip step according to *Korkhaus)*

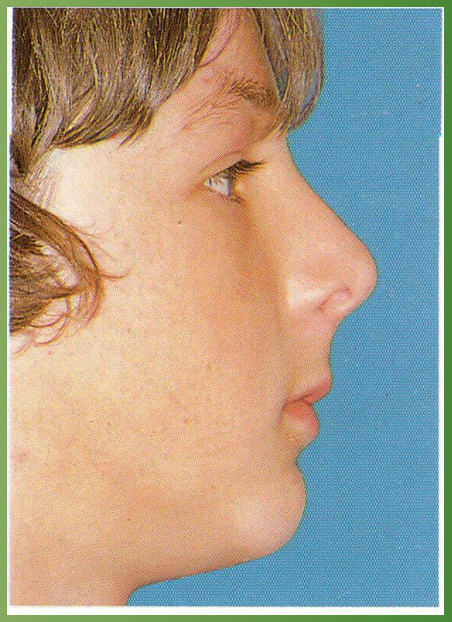
Middle: Normal lip profile. The upper lip protrudes slightly in relation to the lower lip.

Right: Marked retrusion of the lower lip as a symptom of a Class II malocclusion (Negative lip step according to *Korkhaus).*

Nasolabial angle:







Left: Tense upper lip in maxillary prognathism with anterior proclination of the front teeth

Middle: These patients usually show characteristic changes in the soft-tissue profile, with reduction of the nasolabial angle (angle between the tangents subnasale anterior most point of the columella and subnasale -Labrale superius).

Right: Enlarged nasolabial angle as a sign of the retrusive position of the upper lip to the nose.

Tense lower lip:

Right: Clinical appearance

Left: Profile radiograph of a tense lower lip
The marked labial position of the upper anterior teeth in conjunction with the resulting lower lip dysfunction (lower sucking) is the cause of this functional disturbance.

Chin:

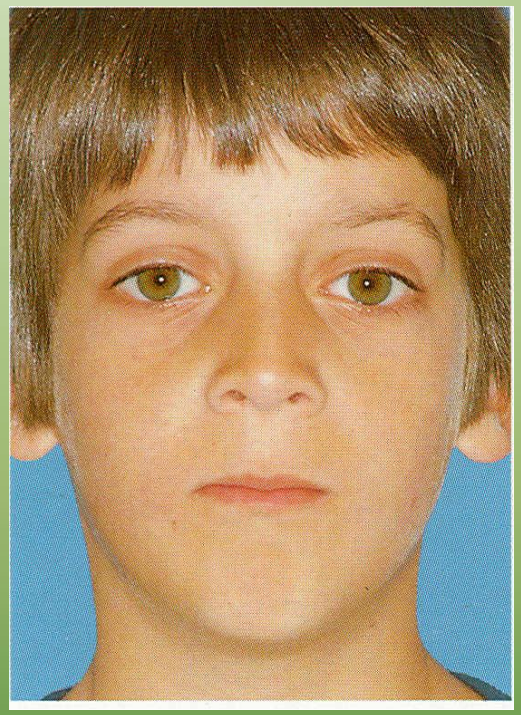
The *configuration of the soft-tissue chin* is not only determined by the bone structure, but also by the thickness and the tone of the mentalis muscle). Further factors include the morphology and the craniofacial relationship of the mandible.

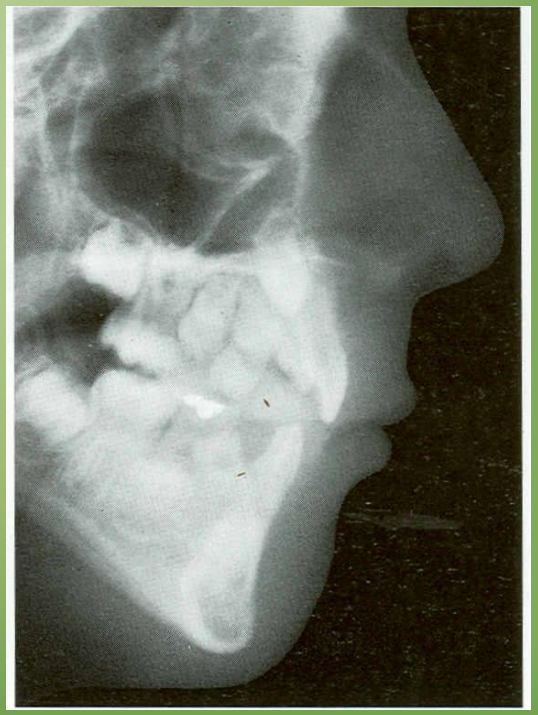
As well as *chin width*, the development of *chin height* is important from the orthodontic point of view (distance from mentolabial sulcus to menton). Over development of the chin height alters the position of the lower lip and interferes with lip closure

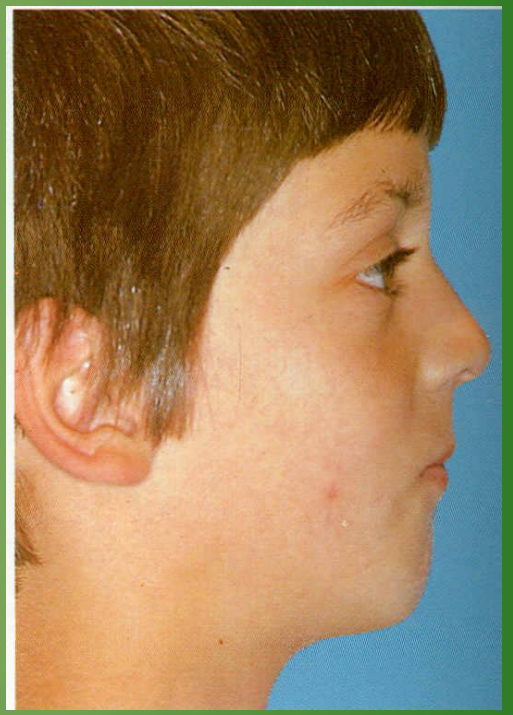
As a rule, the chin contour is assessed in connection with the lower lip position and the configuration of the mentolabial fold, as the profile of these two structures is dependent on the position of the soft-tissue chin.

The midline of the mandible must be examined in the clinical case of an *asymmetry of the chin.*

Relation of the soft-tissue chin to the bony chin:



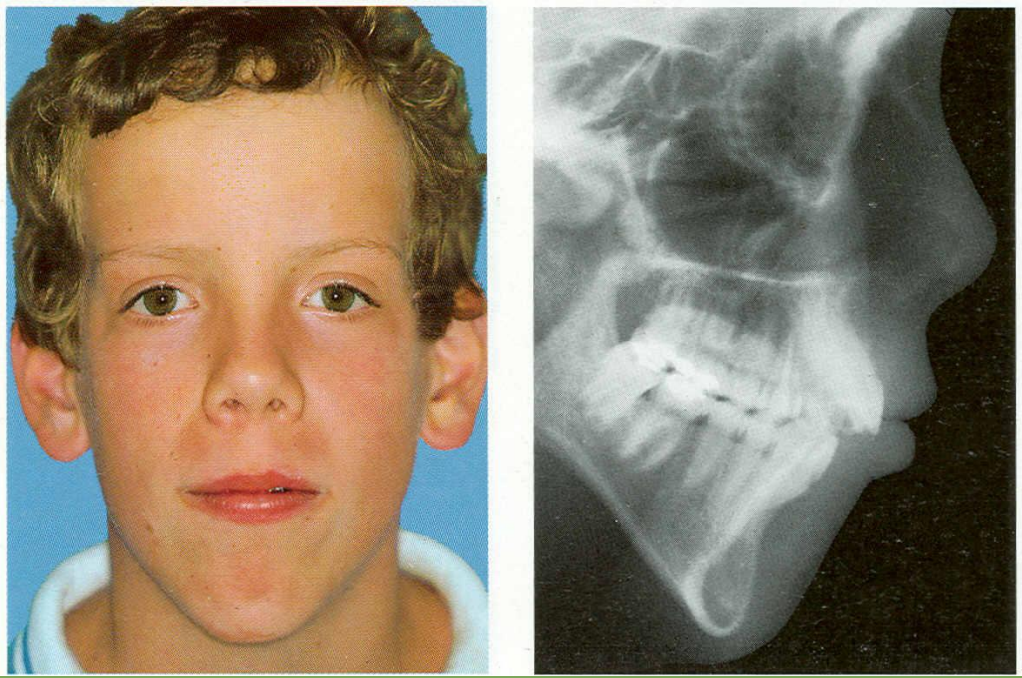


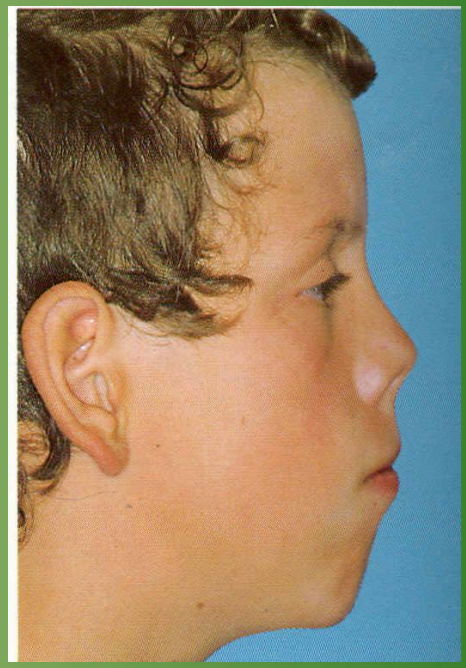


Frontal and profile picture of a 10-year-old patient with a flat soft tissue chin

Middle: The lateral cephalogram shows a distinct positive bony chin contour, compared With the soft tissue profile. In this case, the skeletal contour is compensated by the thin overlying soft tissue.

Over development of the chin height:.



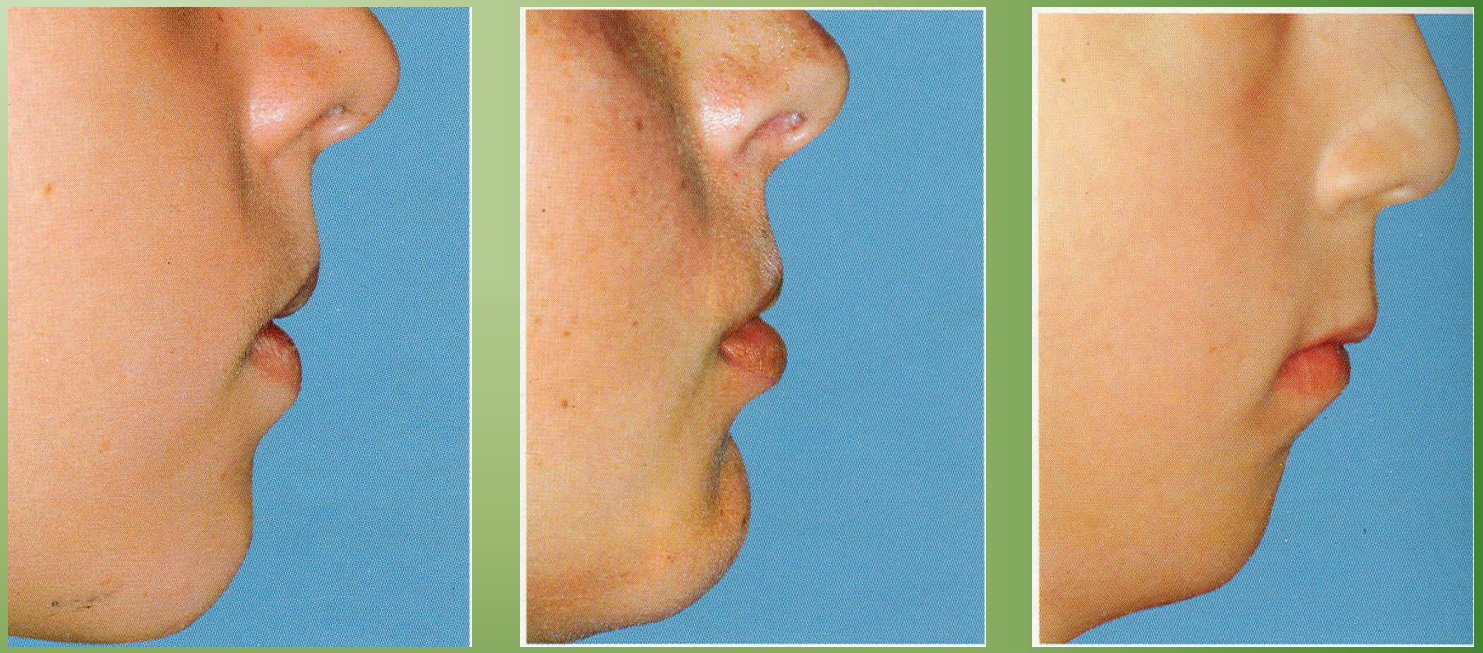


Frontal and profile view of a 12year-old patient with a long lower face and overdeveloped chin height, (distance from mentolabial sulcus menton) causing hyperactivity of the mentalis muscle.

Lip closure is difficult in this type of facial morphology.

In order to improve muscular imbalance, a genioplasty is required or a surgical change of the insertion of the mentalis muscle should be considered.

Chin formation and profile contour:



The degree of chin formation has a marked influence on the entire profile.

Middle: Protruding chin with a marked mentolabial sulcus, causing a retruded lip profile

Right: Negative chin formation with absence of the mentolabial sulcus, causing a protruded lip profile.

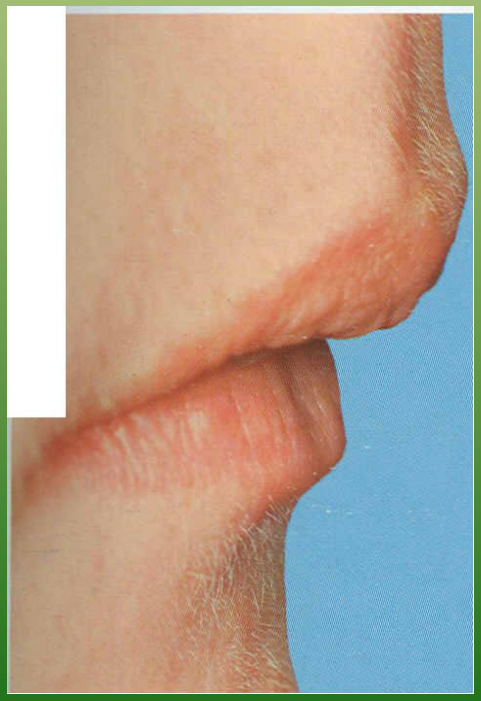
Lip Dysfunctions:

The etiology of lip dysfunctions is similar to that of tongue habits and is assessed in relation to the configuration and functioning of the lips.

Configuration of the Lips:

The configuration of the lips differs a great deal. Of the many classifications, the following is the simplest and most suited grouping for daily practice:

Competent lips. Lips which are in slight contact when the musculature is relaxed.

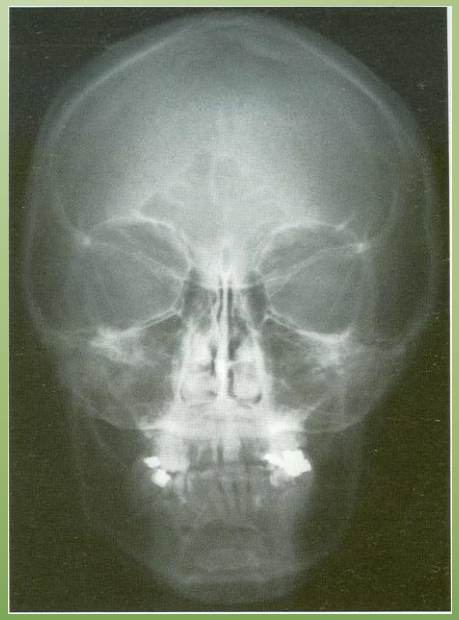


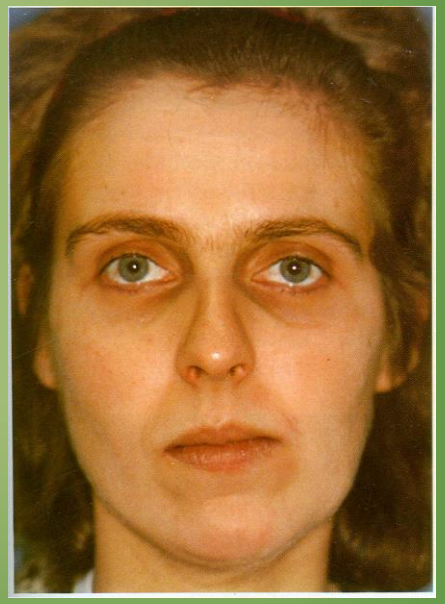
Incompetent lips. Anatomically short lips that do not touch when the musculature is relaxed. Lip seal is only achieved by active contraction of the orbicularis oris and the mentalis muscles.

Potentially competent lips. The protruding upper incisors prevent the lip closure. Otherwise, the lips are developed normally.

Asymmetric chin position:

Frontal view of soft-tissue and skeletal facial configuration

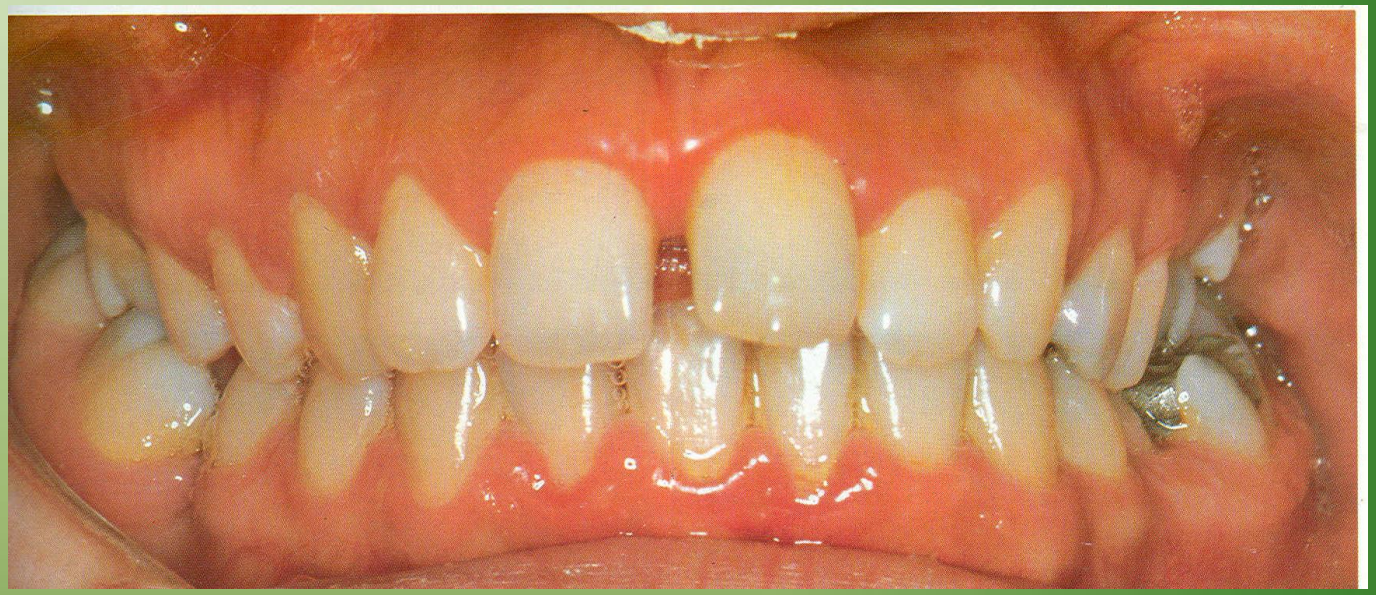




Frontal view of a 26-year-old female patient who shows a displacement of the chin to the left side on clinical examination.

Right: The posteroanterior cephalogram shows that the asymmetry seen on clinical examination is caused by a rotation of the entire mandible to the left - a mandibular laterognathy. (The frontal cephalogram is reversed, so that the asymmetry is in the same direction on both, the facial photograph and the radiograph).

Intraoral findings of the above patient:



In occlusion, the midline of the lower dental arch is displaced to the left by the lateral deviation of the mandible.

The molars are in cross-bite on this side.

Tomograms of the temperomandibular joints:

In conjunction with the mandibular deviation, a marked symmetry of form and position of the joints is shown.

The right condyle (left) is clearly larger than the left (right).

Also the width of the joint space differs between the right and left.

Tongue:

Shape, color, and configuration are assessed at the first clinical examination. The tongue can be small, long, or broad. These findings do not allow conclusions to be drawn about the relative tongue size.

A long, broad tongue does not mean that this is a case of "macroglossia." Changes in the tongue position and mobility are often associated with an abnormal lingual frenum. Studying a lateral cephalometric radiograph can make a rough assessment of tongue size in relation to the size of the oral cavity.

The diagnosis of a macroglossia requires in each case a more detailed diagnostic investigation (for instance cineradiography), and can only be made after exact analysis of tongue position and mobility, and studying physiological functions (for instance, speaking, swallowing).

Functional investigation is the most essential aspect of the clinical examination.

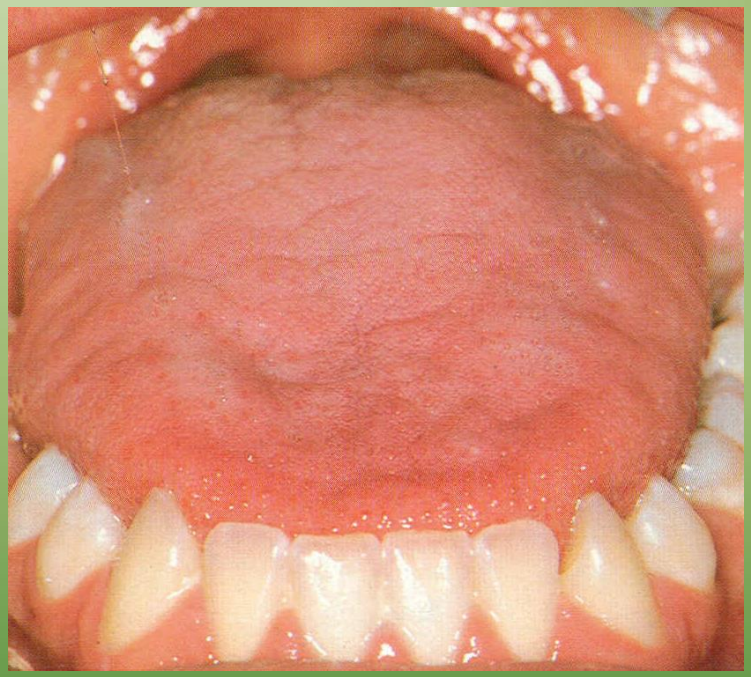
Tongue length:

The clinical picture of a long tongue, which can reach the tip of the nose. This single finding does not permit the diagnosis of "macroglossia".

Right: Position of tongue in the lateral cephalogram. The tongue is long but its volume is not too large in relation to the oral cavity.

Tongue width:

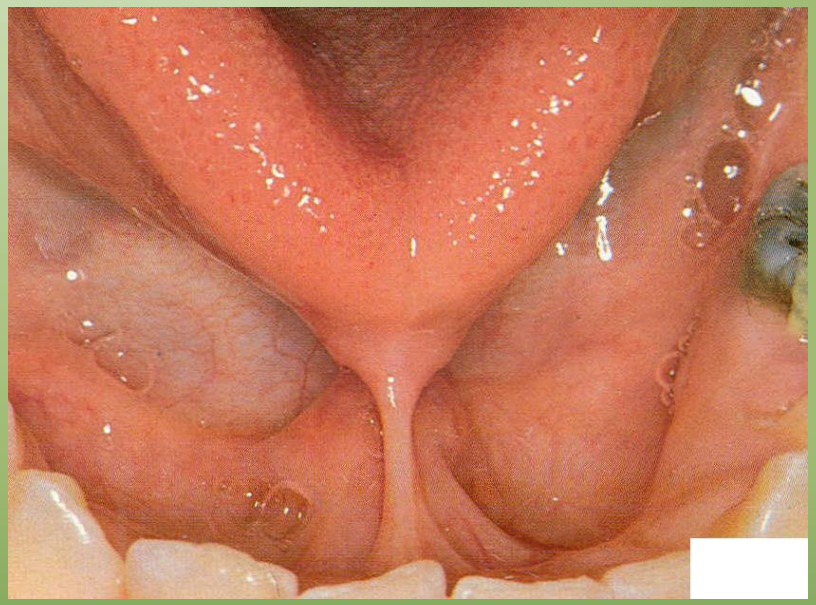
Class III case with a broad and low lying tongue, which extends over the dental arches



Right: Imprints of -the teeth on the lateral margins of the tongue indicate a discrepancy between the width of the dental arch and width of the tongue.

In these cases, the size of the oral cavity should not be decreased further by orthodontic therapeutic procedures (for instance, tooth extractions).

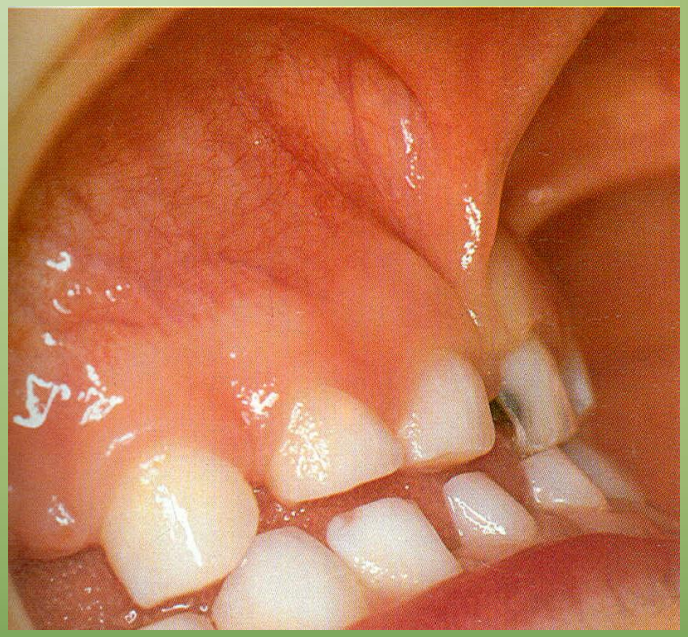
Lingual frenum:

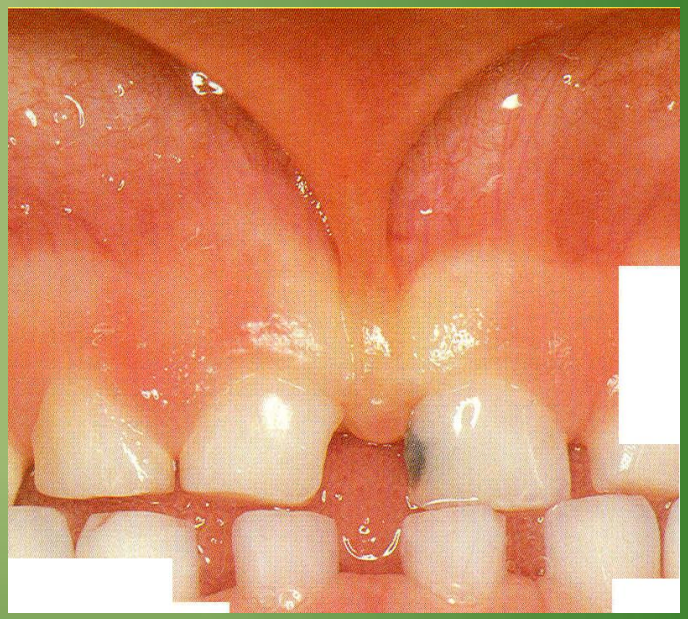


Left: Intraoral photograph of an attached lingual frenum.

Right: In these cases, the tongue lies low so that impairment of function predisposes to tongue thrusting.

Deeply inserted labial frenum in the deciduous dentition.

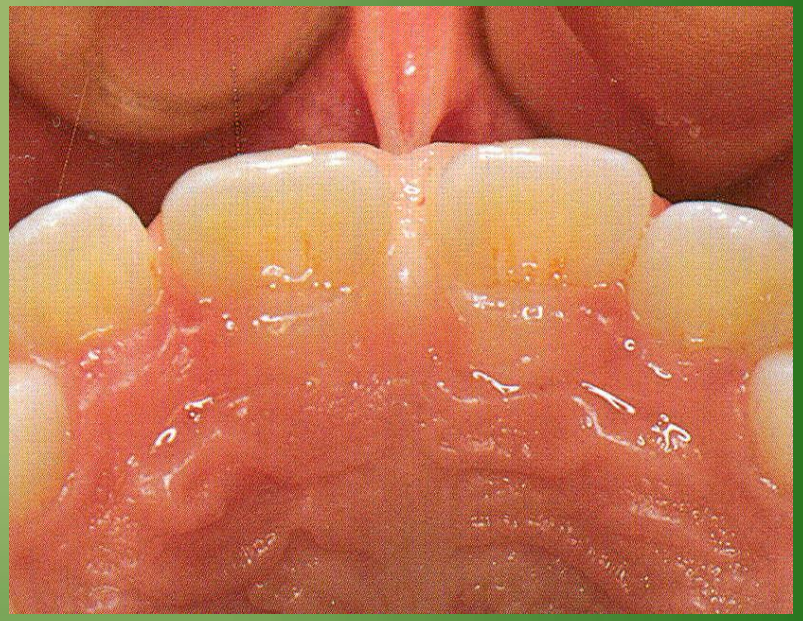




In this 5-year-old female patient, a physiological variant of the maxillary labial frenum attachment exists.

At this stage, there is no indication for frenectomy, since in the course of permanent incisor eruption, a spontaneous correction of the diastema can be expected.

Deeply inserted labial frenum in the maxilla:



Soft tissue morphology in an 8year-old patient in whom frenectomy is indicated.

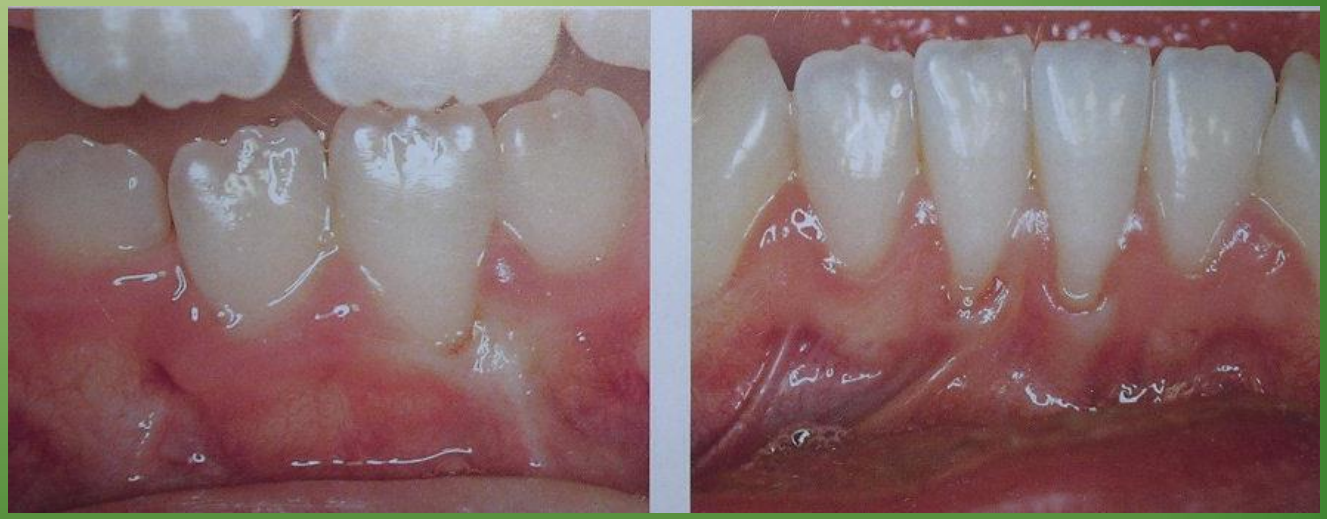
Right: If the upper lip is held away and a pull is exerted on the frenum the interdental tissue and the area around the incisive papilla becomes blanched or anemic; the condition of a true diastema exists, caused by interdentally running fibers.

The excision has to dissect out not only the soft tissues but also the interosseous fibers.

Mandibular labial frenum:

The *mandibular labial frenum* is less often associated with a median diastema. However, it frequently has a broad insertion, which exerts a strong pull on the free and attached gingiva; this can lead to gingival recessions in the lower anterior region already in the mixed dentition stage.

The presence of buccal attachments must be examined carefully, especially in adolescence and in adults.



The high insertion of the frenum exerts a strong pull on the attached mucosa of lower anterior teeth and leads to mucogingival lesions. In this morphologic condition, prophylactic, i. e. early periodontal surgery should be carried out.

Gingiva:

Examination of the gingiva should include the following criteria:

- Mucogingival lesions.
- Gingival type (thick-fibrous, thin-fragile).
- Gingival inflammation.

In children the most common form of gingivitis is caused by *plaque accumulation*, and can only be resolved by improving oral hygiene.

In adult patients, *periodontal treatment* must be carried out (scaling, curettage, mucogingival surgery) prior to orthodontic treatment.

Local gingival lesions may be a symptom of mouth breathing, abnormal occlusal, and functional loadings or of medication (for instance, epilepsy).

Gingivitis and poor oral hygiene are contraindications for orthodontic treatment. Therapy should only be commenced following improved dental and gingival care.

Thin-fragile gingival type:

*Left:*The alveolar process is narrow; the roots can be palpated through the mucosa. Gingival recessions develop around the lower central incisors.
Right: The clearly visible vascular pattern of the mucous membrane is characteristic for the thin fragile gingival type.

A marked tendency exists in this tissue type for producing periodontal damage by labiolingual orthodontic tooth movements.

Idiopathic gingival hyperplasia:{ heredity}

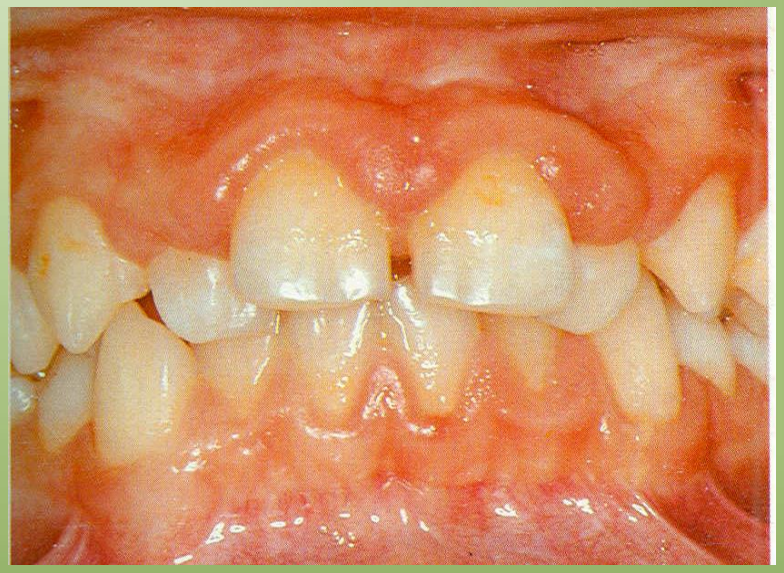
The abnormal tissue structure hinders dental eruption.

Oral hygiene - Gingivitis:

In young patients, lack of oral hygiene is the most common cause of this condition.

Oral hygiene can be assessed and explained to the patient by illustrating the plaque using disclosing agents.

Hyperplastic gingiva:



Left: Severe gingivitis in a chronic mouth breather.
Besides poor oral hygiene, the condition is worsened by the dryness of the mouth, caused by the open-lip posture.

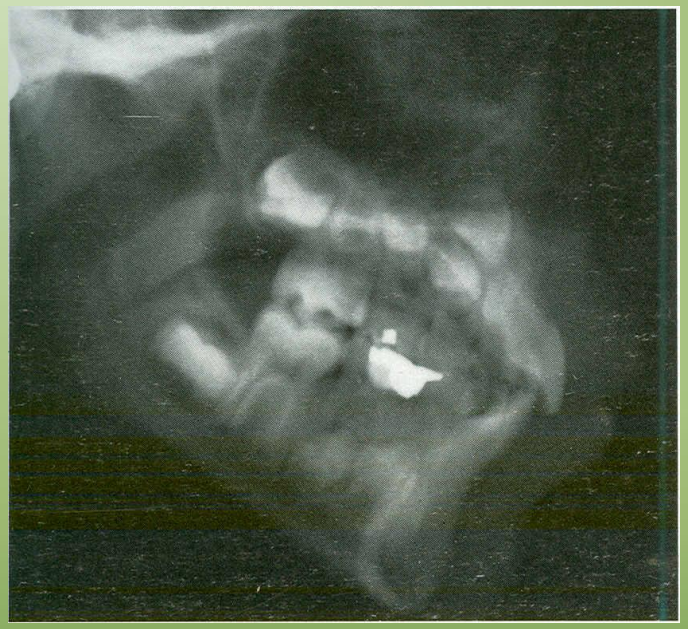
Right: Mild fibrous hydantoin hyperplasia in a 12-year-old epileptic girl.

Mucogingival lesions: [Occlusal trauma]

Left: Gingival condition in a 7 -year old girl during the eruption stage of anterior teeth. The upper right central incisor erupts in cross-bite so that the mandibular antagonist is subjected to nonphysiologic occlusal forces.

Right: 1 year later; the lower incisor shows increased mobility and a mucogingival lesion.

Lingual recessions:



Right: gingival recessions on the lingual surfaces of the lower anterior teeth in a young patient with tongue dyskinesia
The early damage results from the nonphysiologic tissue loading as a consequence of the dysfunction

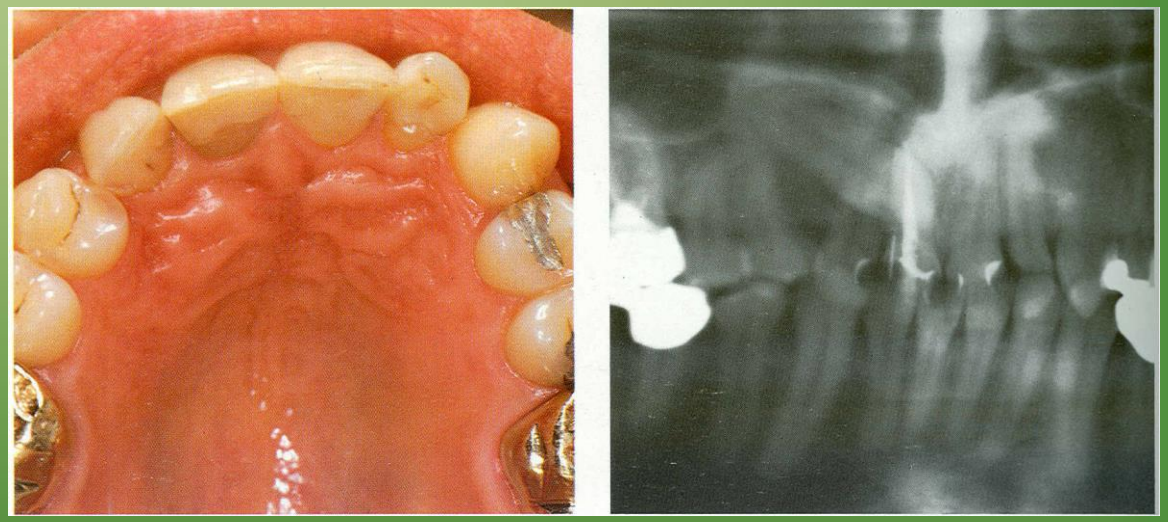
Left: Lateral cephalogram shows clearly the anomalous relation between the tip of the tongue and lower incisors.

Palatal Mucosa and Palatal Vault:

The *palatal mucosa* is examined as follows: pathologic swelling, ulceration, scar tissue formation.

Pathologic swellings are indicative of displaced tooth germs and cysts.

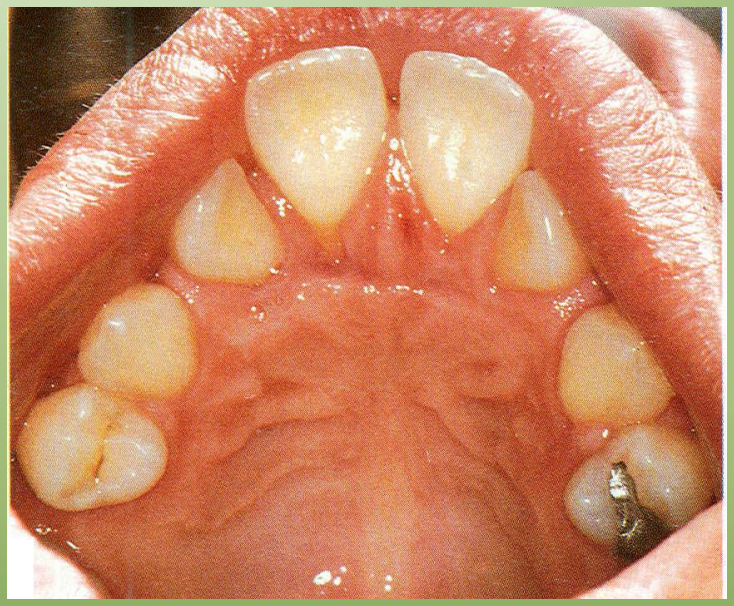
Mucosal swelling:



Abnormal swelling on the palatal aspect of the right anterior maxilla; continuous upper dental arch, with a missing canine.

Right: The X-ray film shows a displaced and impacted canine, as the cause of the swelling.

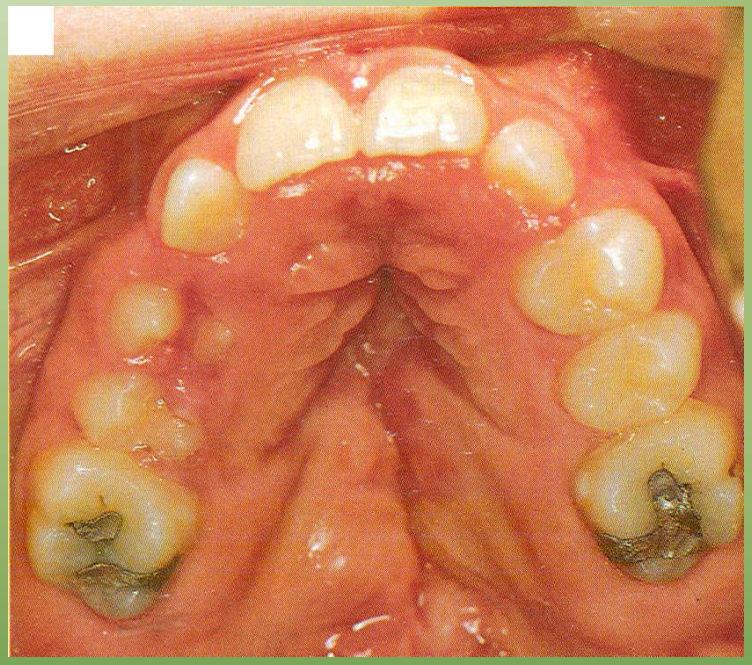
Mucosal indentations:

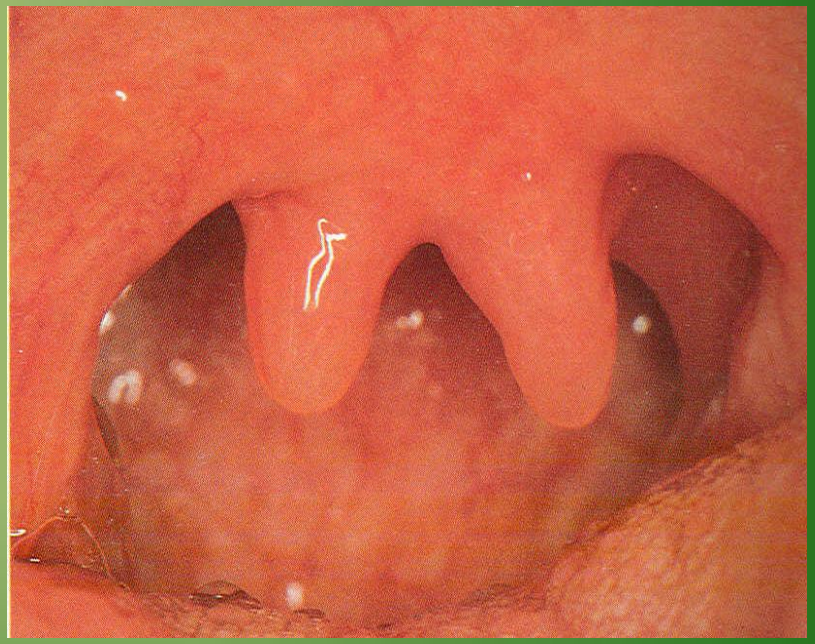


Right: Traumatic deep bite in a Class II, Division 1 case.

Left: A clearly visible groove in the palatal mucosa caused by the lower anterior teeth as the result of the long-standing vertical malocclusion.
Besides this finding, there is also gingival dehiscence on the lingual aspect of the central incisors.

Palatal mucosa:





Left: Scarred palate after surgical closure of an isolated palatal cleft.

Right: Bifid uvula in a 10-year-old girl; mild indication of a familial disposition to cleft lip and palate formation.

Clinical Examination of the Dentition:

Clinical examination of the dentition is made in the following sequence

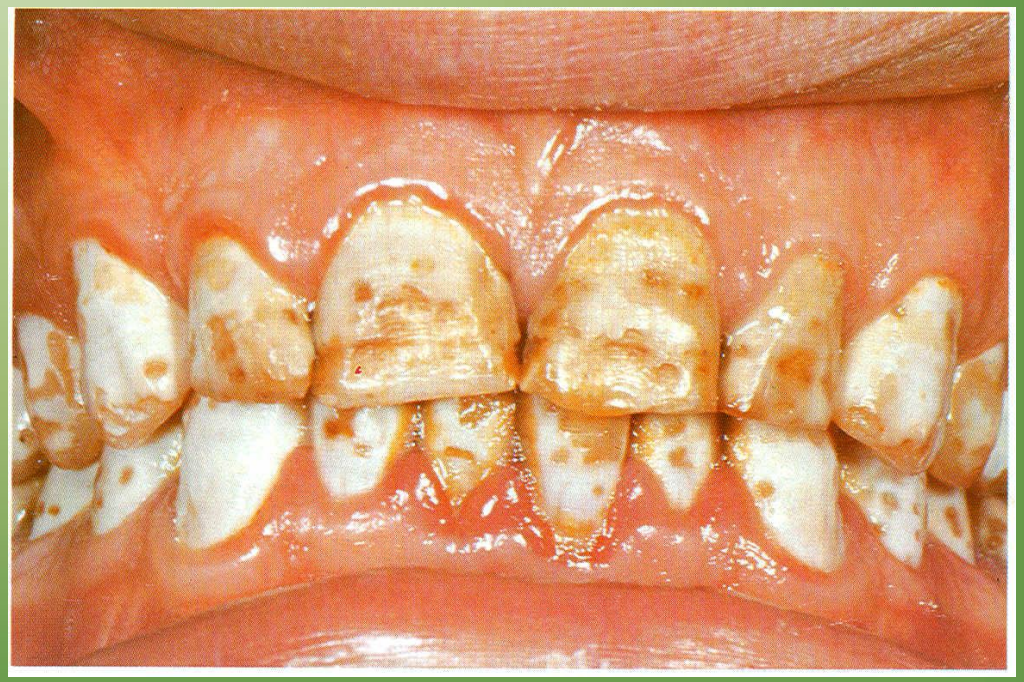
1) Assessment of the dental status
2) Detailed recording of dental and occlusal anomalies
3) Assessment of the apical bases
4) Determination of the midline of the face and coincidence with dental structures.

Orthodontic treatment is contraindicated when *carious teeth* are present. Therapeutic possibilities are limited if severely carious teeth as well as dental structural anomalies are present on account of the reduced enamel resistance (contraindication for fixed appliance treatment).

It is also important to determine the *number of teeth.* In a superficial examination, one often overlooks absent or supernumerary teeth, which are only found later during the course of treatment.

The clinical and radiographic examination should reveal all findings that are not clearly diagnosed on plaster models

Structure of tooth surface:



Enamel hypoplasia in a case of severe fluorosis.

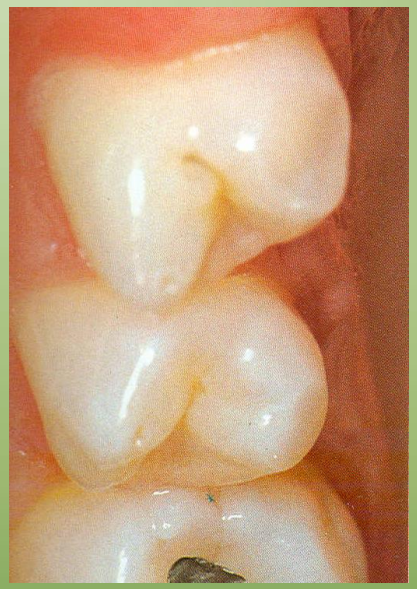
The pitted and flat-shaped brownish discolorations in the chalky hypo mineralized enamel are characteristic of fluoride induced changes.

Dental deposits:

Mixed dentition with hard black deposits which encircle and lie parallel to the neck of the teeth, particularly on deciduous teeth.

The black-brown deposits are caused by *Bacteroides melaninogenicus.* Dentitions with such recurrent accumulations show great resistance to caries. There is a physiologic recession of these changes in puberty.

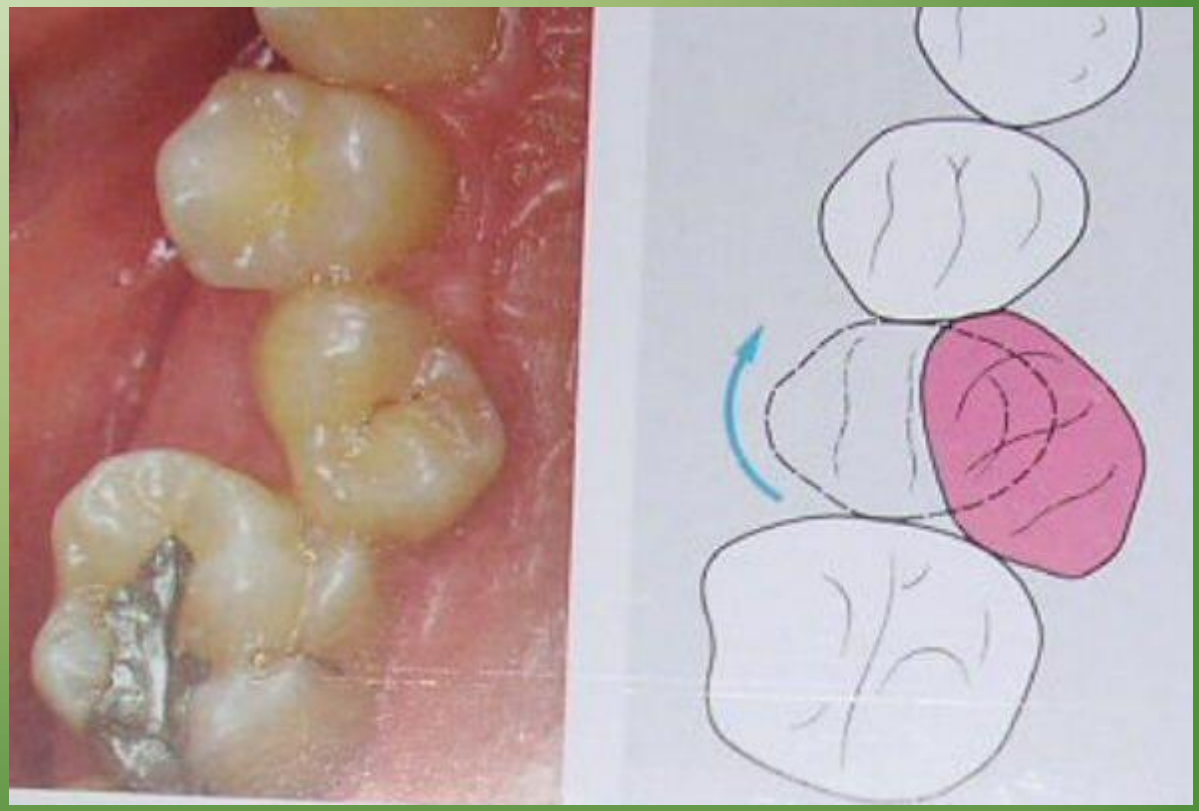
Wear facets:



Bilateral buccal nonocclusion with marked wear facets on the lingual cusps of upper premolars.

In our patients, occlusal abrasions are often the result of attrition and indicative of parafunctional mandibular movements.

Rotations:



In order to achieve correct occlusion, none of the teeth should be rotated. Rotated molars and premolars occupy more space in the dental arch than normal. Rotated incisors may occupy less space than those correctly aligned. Rotated canines adversely affect esthetics and may lead to occlusal interferences.

Size of the teeth:

From orthodontic point of view, it is usually not the actual size of the teeth that is relevant, but rather the size of the teeth in relation to that of their bony bases.

Microdontia:

Of all the types of teeth, the upper lateral incisors vary most in shape.
Anomalies in tooth size can be restricted to individual teeth or may occur generally.

Macrodontia:

Mesiodens:

This type of abnormality is often inherited and is the most common type of hyperdontia. It can severely impede the eruption of the anterior teeth.
Commonly seen with cleft lip and palate around the cleft area (lat incisors) and in cases of cledocranial dysostosis.

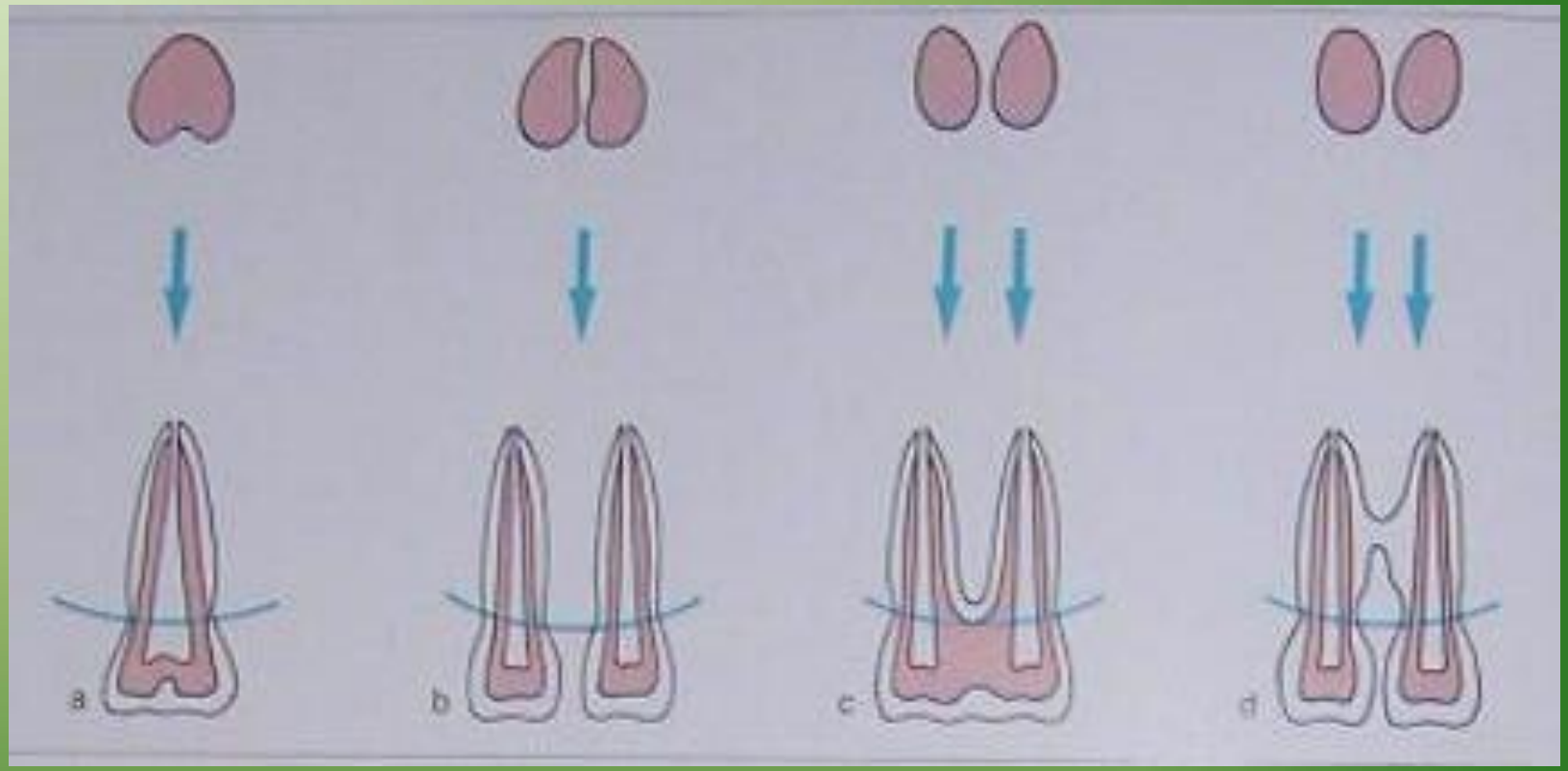
Hypodontia and occlusal relations:

The anterior arch has been flattened noticeably due to congenitally missing upper lateral incisors.

The third molars are the most often missing tooth, followed in descending order by the lower second premolars, the upper lateral incisors, the upper second premolars, the lower central incisors, and the lower first premolars.

Hypodontia often occurs in combination with syndromes (e.g. ectodermal dysplasia, cleft of lip, jaw and palate, down's syndrome).

Diagrammatic view of abnormalities of tooth morphology:



a) **Gemination:** incomplete division of one single tooth bud.
b) **Twinning:** complete division of one tooth bud to create 2 teeth.
c) **Fusion:** union of the dentin of two teeth, from tooth buds.
Concrescence: union of the cellular cementum of two teeth, from two tooth buds.

Transposition of teeth:

Unilateral transposition of the left upper canine and the upper first premolar with congenial absence of the upper lateral incisors.

Transposition of the upper canine and the premolars is the most common type observed.

Functional Analysis:

Modern orthodontics is not only restricted to static evaluation of the teeth and their supporting structures, but also includes all functional units of the masticatory system [i. e.the stomatognathic system]. Therefore, nowadays, functional analysis constitutes a considerable part of the clinical examination. It is not only significant for the etiologic evaluation of the malocclusion but also for determining the type of orthodontic treatment indicated.

The three most important aspects of orthodontic functional analysis are:

- **Examination of the postural rest position and maximum intercuspation.**
- **Examination of the temporomandibular joint.**
- **Examination of orofacial dysfunctions.**

Examination of the Relationship:
Postural Rest Position - Habitual Occlusion

1. Determination of the postural rest position.
2. Registration of the postural rest position
3. Evaluation of the relationship: postural rest position - habitual occlusion, in three planes of space.

When the mandible is in its rest position, the synergists and antagonists of the orofacial system are in their basic tonus and are balanced dynamically. This position of the mandible results from the reaction to the force of gravity. It can also be affected, in the short-term and long term other influences.

Components affecting the rest position:

Short-term influences:

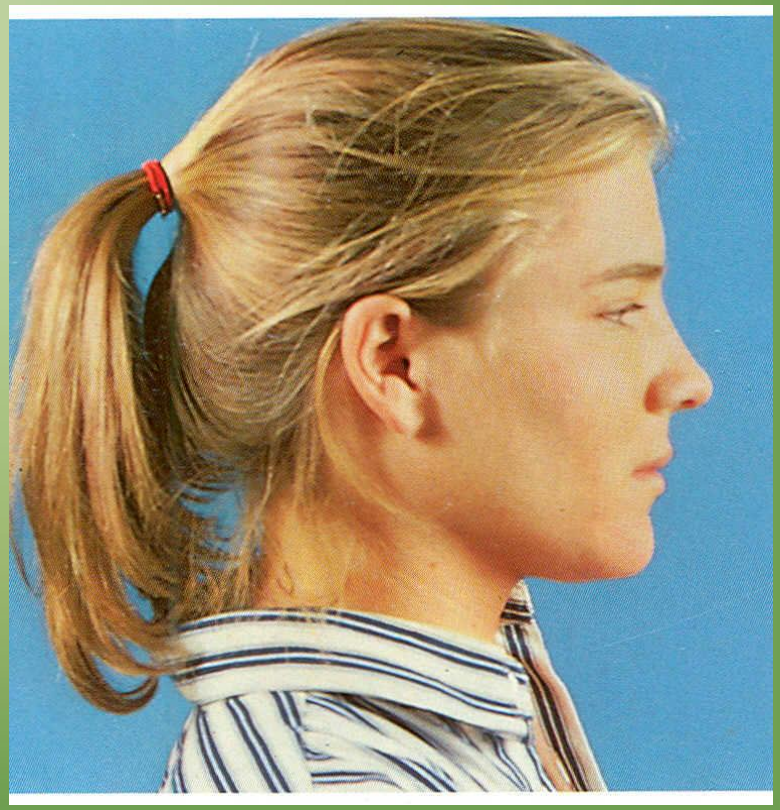
- Inconsistency in muscle tonicity
- Respiration
- Body posture
- Stress situations
- Dysfunction of the temporomandibular joint.

Long-term influences:

- Attrition of the dentition.
- Premature loss of teeth

Diseases of the neuromuscular system.

Head posture for determining the rest position:



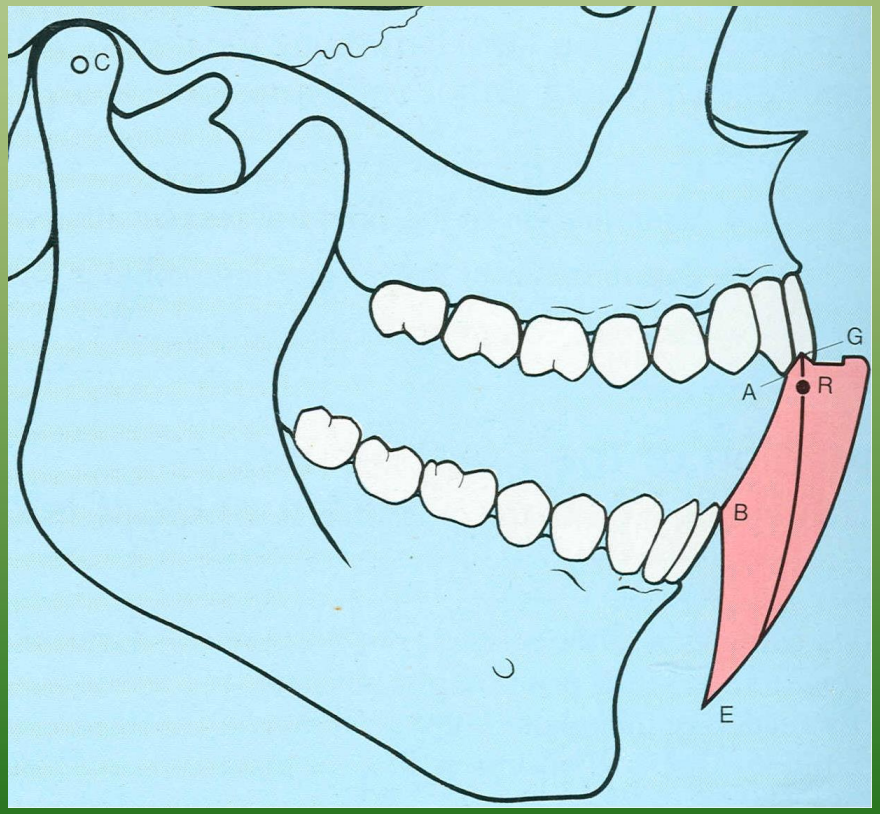
The physiologic rest position of the mandible is dependent on the head posture. Therefore, clinical registration must be carried out under standardized conditions.

The rest position should be determined with the patient completely relaxed, sitting upright and looking straight ahead.

Border movements of the mandible - sagittal plane

Projecting the movements of the mandible through the facial midline, along the vertical and sagittal planes, results in a characteristic pattern.

The location of the rest position in this schematic illustration of border envelope of mandibular motion is variable. Usually, the postural rest position of the mandible is 2-3 mm posteroinferiorly to centric occlusion (according to *Ramfjord* and *Ash*, 1968).



Posselt diagram

A = Retruded contact position
A-B = Hinge axis movement
B = Transition from hinge axis movement to posterior opening movement
C =Axis of rotation of the condyle when opening the mandible from the rest position
E = Maximum jaw opening
F = Protruded contact position
G = Habitual intercuspation
R = Mandibular rest position

1. Determination of the postural rest position:

In order to determine the postural rest, the patient's orofacial musculature must be relaxed. Muscle exercises (e.g. "tapping test") can be used to help relax the musculature prior to carrying out the actual examination. When using the "tapping test" the patient is told to relax and the clinician opens and closes the mandible passively and with constantly increasing frequency. Should the patient be very tense, the musculature can be relaxed with mild electric impulses (e.g. Myomonitor).

When the mandible is in the postural resting position, it is usually 2-3 mm below and behind the centric occlusion (recorded in the canine area).

The space between the teeth, when the mandible is at rest, is referred to as the freeway space or interocclusal clearance.

Several methods can be used to determine the rest position during the clinical examination.

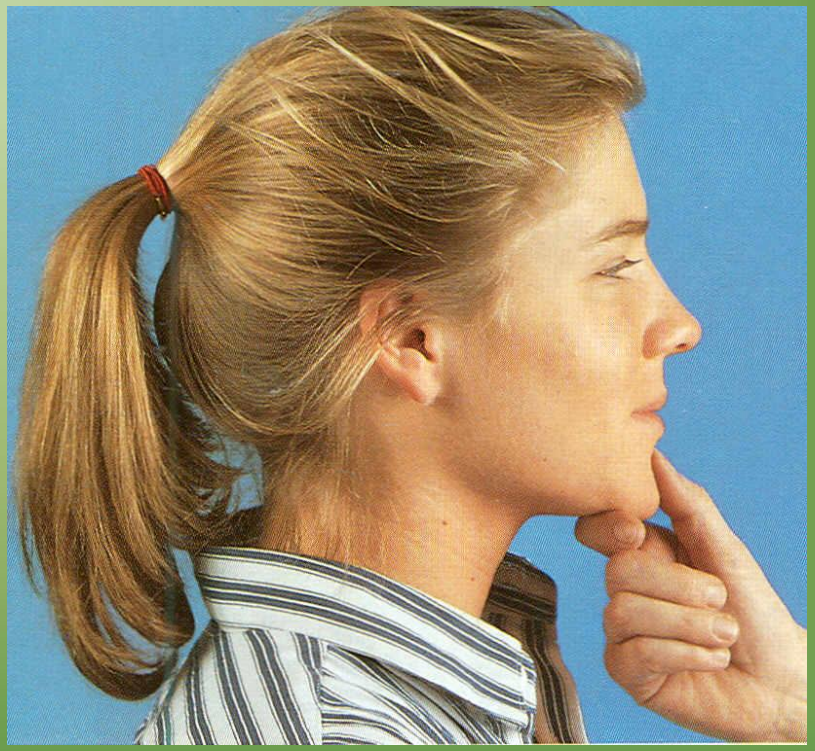
Phonetic method. The patient is told to pronounce certain consonants or words repetitively (e. g. "M", "Mississippi"). The mandible returns to the postural resting position 1-2 seconds after the exercise.

Command method: The patient is "commanded" to perform selected functions (e.g. swallowing), after which the mandible spontaneously returns to the rest position. In the strictest sense, the phonetic exercise can also be considered one of the command methods.

Non-command method: The patient is distracted (e.g. the clinician talks to the patient) so as not to perceive which type of examination is being carried out. While being distracted, the patient relaxes, causing the musculature to relax as well, and the mandible reverts to the postural rest position.

Combined methods: These methods of determining the rest position are the most suitable for functional analysis in children. The patient is first observed during swallowing and speaking. In the case of older children, the "tapping test" is carried out in order to relax the musculature. The patient is then distracted, similarly to when using the non-command method.

Manual guidance of the mandible while carrying out the "tapping test"



The chin is placed between the thumb and the forefinger. The clinician uses this grip to carry out passive opening and closing movements of the mandible in rapid succession in order to relax the masticatory muscles prior to determining the rest position. Verify whether the musculature has been relaxed by palpating the submental muscles.

Rest position speculum

Determination of the mandibular rest position using the rest position speculum, according to A. M. *Schwarz.* The instrument is placed laterally between the lips in order to observe the functional jaw relationship.

Clinical experience has shown the determination of the physiologic rest position to be difficult using the speculum, as this instrument interferes with the lip seal and the entire reflex mechanism of the resting tonus.

Registration of the Rest Position:

Registration of the mandibular rest position is important in those orthodontic cases where the functional analysis is significant for treatment planning. There are various techniques of registration. The two most commonly used methods originate from the field of prosthodontics and include the intraoral indirect method (registration with impression material) and the extraoral direct method (registration by means of skin reference points).

The *extraoral indirect methods* are the most reliable:

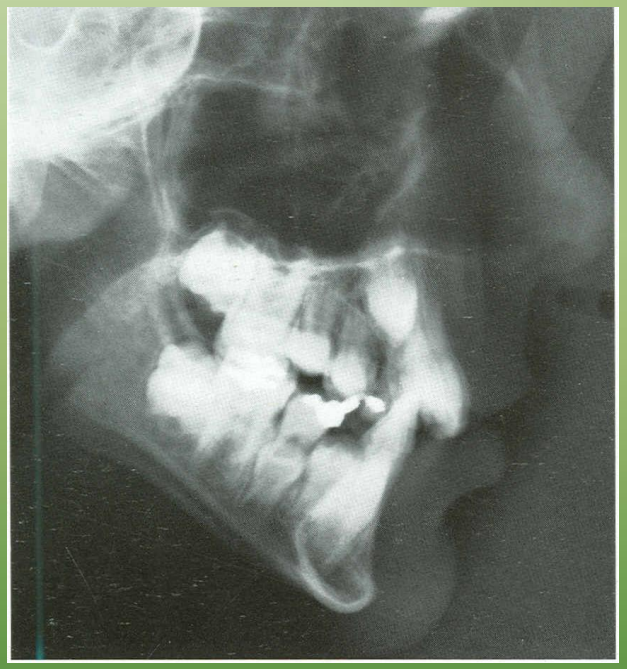
- Roentgenocephalometric registration
- Kinesiographic registration

Roentgenocephalometric registration of rest position:

Two cephalograms are required.

One radiograph in centric (habitual) occlusion

- And one with the mandible in its rest position



The rest position is 3 mm below and posterior to the centric occlusion, i.e. the mandible is moved from the rest position to centric occlusion by a rotational action only.

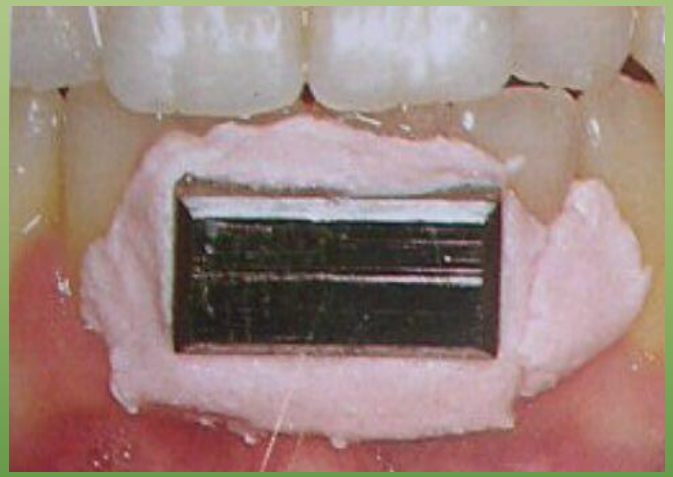
The advantage of this type of roentgenographic technique is that, unlike other methods, the physiologic reflex mechanism and the line of contact of the lips are not disturbed while taking the registration.

The rest position and freeway space can be determined by comparing the radiographs.

Kinesiographic registration:

The mandibular kinesiograph, according to *Jankelson* (1984), allows the mandibular rest position to be registered three-dimensionally. The position of the mandible is recorded electronically by:

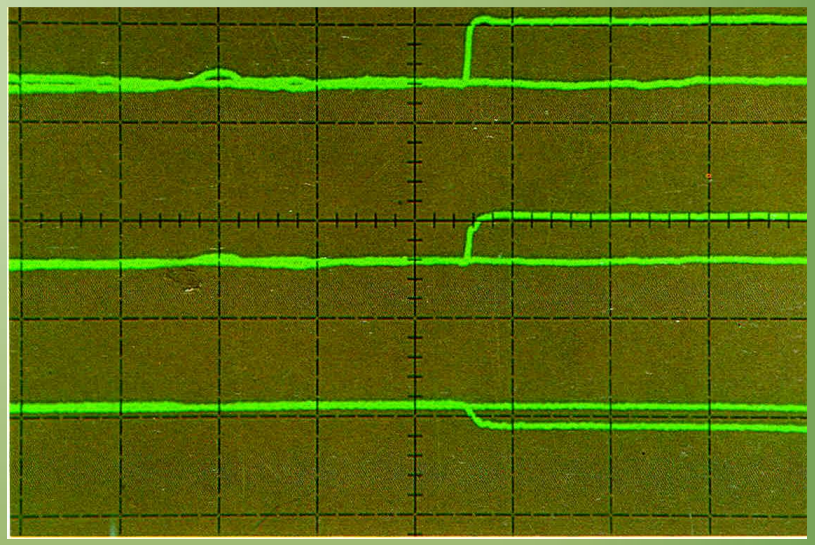
- A permanent magnet, which is fixed with rapid-setting acrylic to the lower anterior teeth,
- A sensor system of six magnetometers mounted on spectacle frames.



Every movement of the mandible and the attached magnet out of centric occlusion alters the strength of the magnetic field. These changes are recorded by the sensors, processed in the kinesiograph and displayed on a storage oscilloscope.

The mandibular movements and rest position are recorded two-dimensionally on two preselectable levels. The electronic circuitry also allows the rest position to be recorded as three-dimensional coordinates.

Stable rest position:

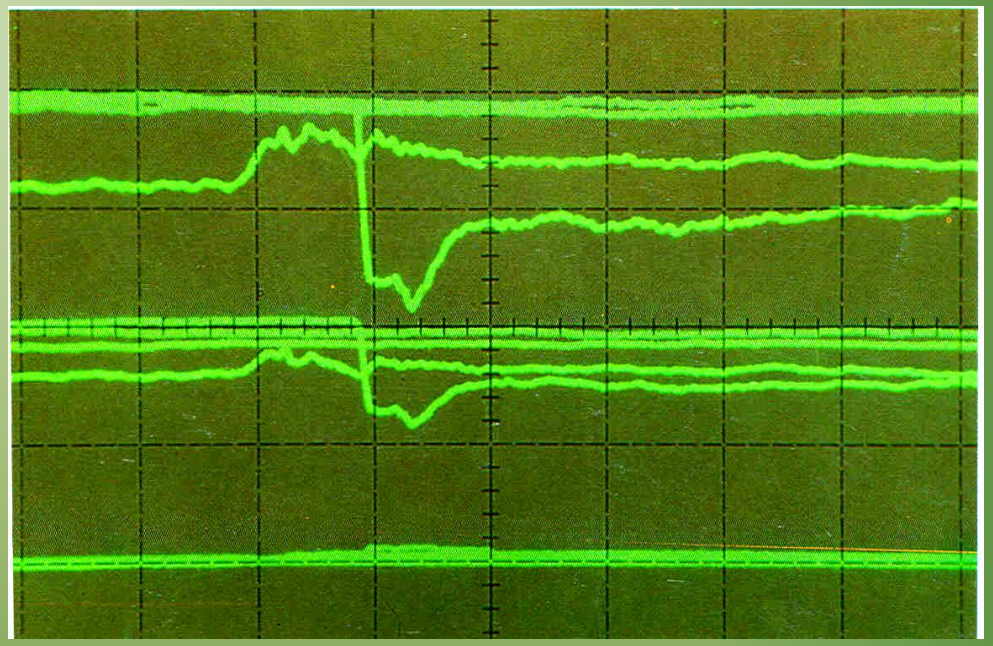


Top line: Vertical plane.
Center line: Sagittal plane.
Bottom line: Horizontal plane

Downward deviations of the line indicate inferior, posterior and left lateral movements of the mandible, depending on the dimension.

Stable mandibular rest position. When moving from the rest position to the occlusal position, the mandible moves upward and forward and deviates toward the left. The freeway space is small (1 graduation on the scale = 2 mm).

Unstable rest position:



When compared to above Fig, the lines fluctuate considerably over several recordings (same patient as in above Fig).

This is an example of incorrect registration of the rest position. In this case, the rest position of the mandible was determined, based on the centric occlusion. The rest position cannot be determined correctly using this technique. The relationship between postural rest and centric (habitual) occlusion must always be registered starting from the rest position of the mandible.

Evaluation of the Relationship between Rest Position and Habitual Occlusion:

The movement of the mandible from the rest position to full articulation is analyzed three-dimensionally: In the sagittal, vertical, and frontal planes.
The closing movement of the mandible can be divided into two phases:

Free phase: Mandibular path from the postural rest to the initial or premature contact position.

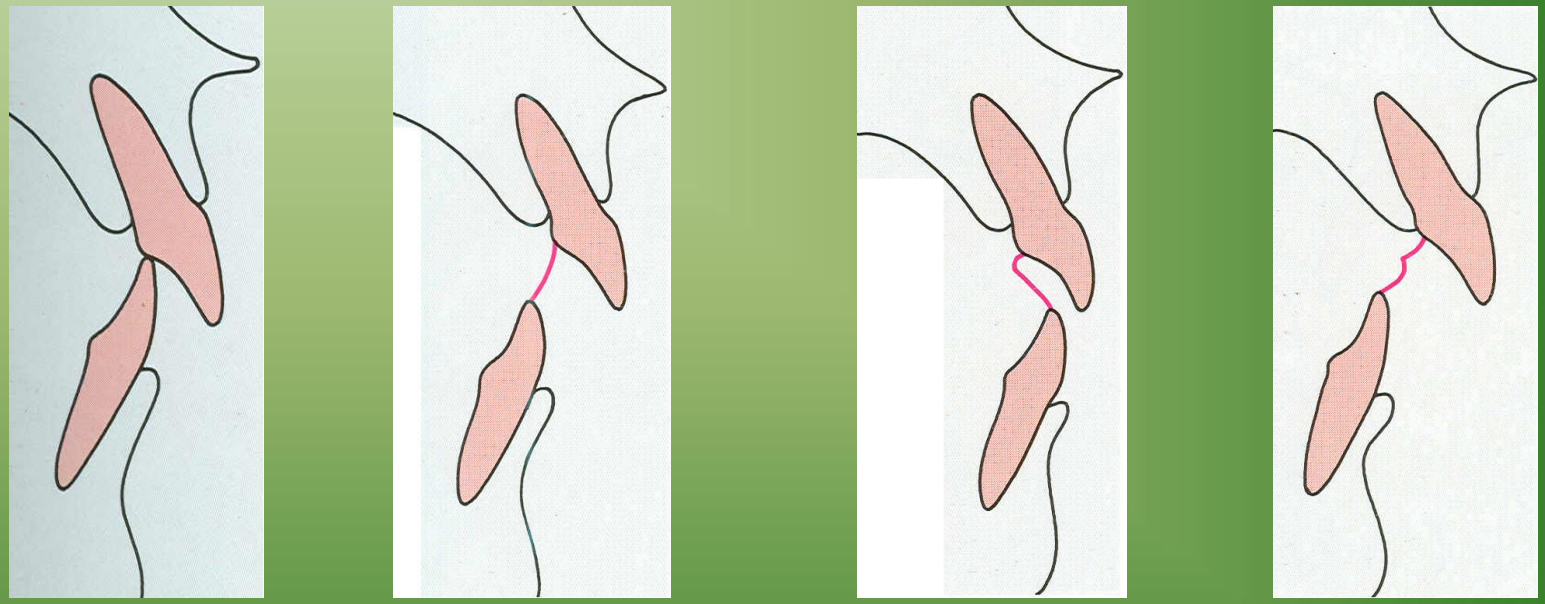
Articular phase: Mandibular path from the initial contact position to centric or habitual occlusion. In case of functional equilibrium, the articular phase does not occur (movement without tooth contact).

When closing from the rest position, the mandible may undergo both rotational and sliding movement. The objective of this analysis is to determine the amount and direction of movement as well as the proportions of the rotational and sliding components. The following movements of the mandible from the rest position to habitual occlusion must be differentiated for orthodontic diagnosis:

Pure rotational movement (hinge movement)
Rotational movement with an anterior sliding component
Rotational movement with a posterior sliding component.

Evaluation in the Sagittal Plane:

Functional classification of Class II malocclusions according to the relationship between rest position and habitual occlusion in the sagittal plane:

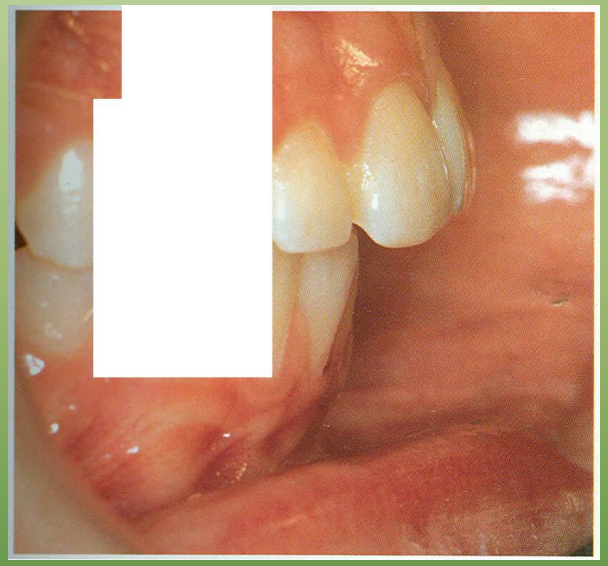


Red = Mandibular path from the rest position to full occlusion

a) Maximum articulation
b) Pure rotational movement of the mandible from postural rest to habitual occlusion.
c) Closing movement of the mandible, with posterior sliding action
d) Closing movement of the mandible, with anterior sliding action.

Rotational movement *without a sliding component*

The neuromuscular and morphologic relationships correspond to each other. There is no functional disturbance (functional true Class II malocclusion).



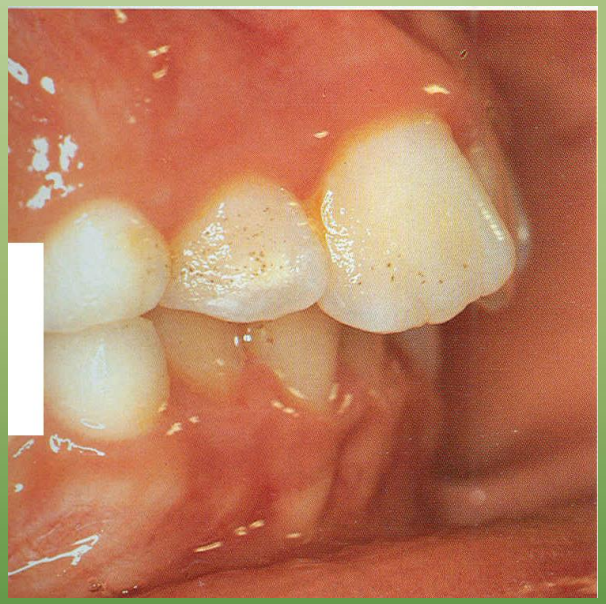
Left: Habitual centric position.

Right: Rest position of the mandible.

Functional true Class II malocclusion whereby the mandible moves from the rest position to habitual occlusion by means of rotational movement without severe sliding action.

- **Rotational movement *with posterior sliding movement.***

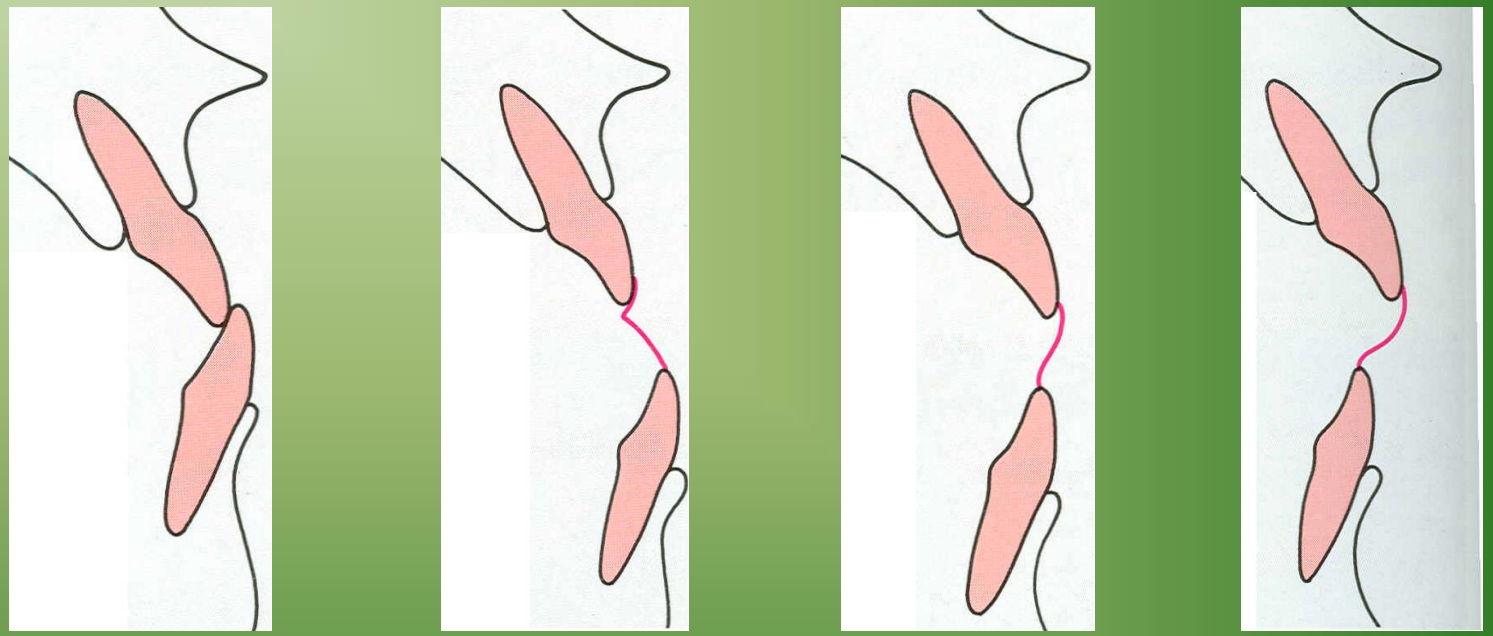
The mandible slides backwards and is guided into a posterior occlusal position. This finding reveals a functional Class II malocclusion and not a true Class II malrelationship.



When moving from the rest position (right) to habitual occlusion, the mandible performs a rotational movement as well as a posterior sliding action.

The functional relationships correspond to those of a Class I relationship. When in habitual occlusion, the mandible is forced posteriorly. The prognosis for correction of the mandibular displacement is very favorable in such cases.11

Functional classification of Class III malocclusions according to the relationship between rest position and full occlusion in the sagittal plane:



[Red = Mandibular path from the rest position to full occlusion]

A. Maximum articulation.
B. Closing movement of the mandible, with posterior sliding action.
C. Pure rotational movement of the mandible from postural rest to occlusal position.
D. Closing movement of the mandible, with anterior sliding action.

Rotational movement without sliding action:

The anatomic/morphologic relationships correspond to the functional relationships (non-functional, true Class III malocclusion - unfavorable prognosis).

- Rotational movement with anterior sliding action:

During the articular phase, the mandible shifts forwards and into a prognathic, forced bite (functional non-skeletal malocclusion, so-called pseudo-Class III- favorable prognosis).

Rotational movement with posterior sliding action:

In cases with pronounced mandibular prognathism, the mandible may slide posteriorly into the position 0f maximum intercuspation. This masks the true sagittal dysplasia.

Relationship between postural rest and habitual occlusion

Left: Rest position.
Center: Initial tooth contact.
Right: Habitual occlusion

Moving from the rest position the mandible slides forwards in the articular closing phase due to premature contact of the deciduous canines. Although the prognosis for the treatment of functional Class III malocclusions is favorable, the combination with an open bite, as in this case, is unfavorable.

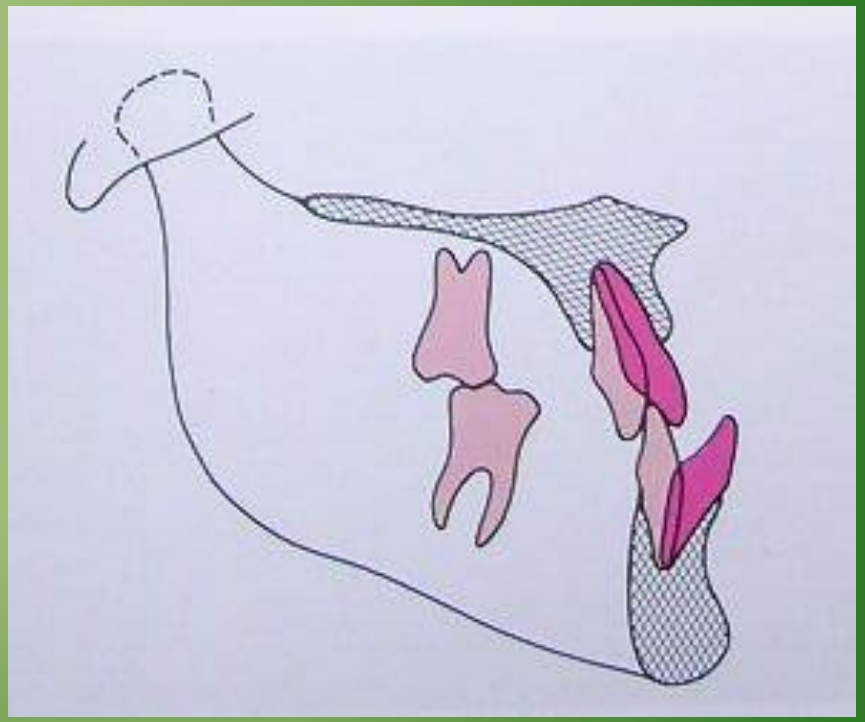
Mandibular Prognathism:

True Forced Bite - Pseudo-Forced Bite

In cases of mesioclusion, an anterior sliding action is not always a symptom of a functional Class III malocclusion. With this functional diagnosis, the "true forced bite", with its favorable prognosis, and the "pseudoforced bite", with its unfavorable prognosis, must be differentiated as far as cephalometries is concerned.

The term *"pseudo-forced bite"* includes those true skeletal Class III malocclusions where, due to partial dentoalveolar compensation of the skeletal dysplasia in the anterior region (labial tipping of the upper and lingual tipping of the lower incisors), the mandible occludes at the end of the closing path by means of an anterior sliding action. If one reconstructs the tipping of the anterior teeth in a pseudo-forced bite, these cases have a pronounced negative overjet. The dentoalveolar compensation of the skeletal dysplasia, which already exists when treatment is started, greatly restricts the range of orthodontic treatment possibilities and unlike a true forced bite, is indicative of a very unfavorable prognosis.

Dentoaveolar compensated Class III



In cases with partially dentoalveolar compensated skeletal Class III relationship, where the upper incisors are tipped labially and the lower incisors tipped lingually, the mandible may be guided toward the anterior while closing. However, placing the incisors in the correct axial position reveals a pronounced negative overjet, which eliminates the anterior sliding component

Left: Cephalogram of a patient with partially dentoalveolar-compensated mandibular, prognathism.

Pseudo-forced bite : Occlusion

Habitual occlusal position of a Class III dysplasia with linguoversion of the lower incisors and labioversion of the upper incisors as well as a pseudo-forced bite.

Left: Graphic registration of the sagittal closing movement in this female patient. The mandible slides toward the anterior during the articular phase.

Relationship between postural rest and habitual occlusion:

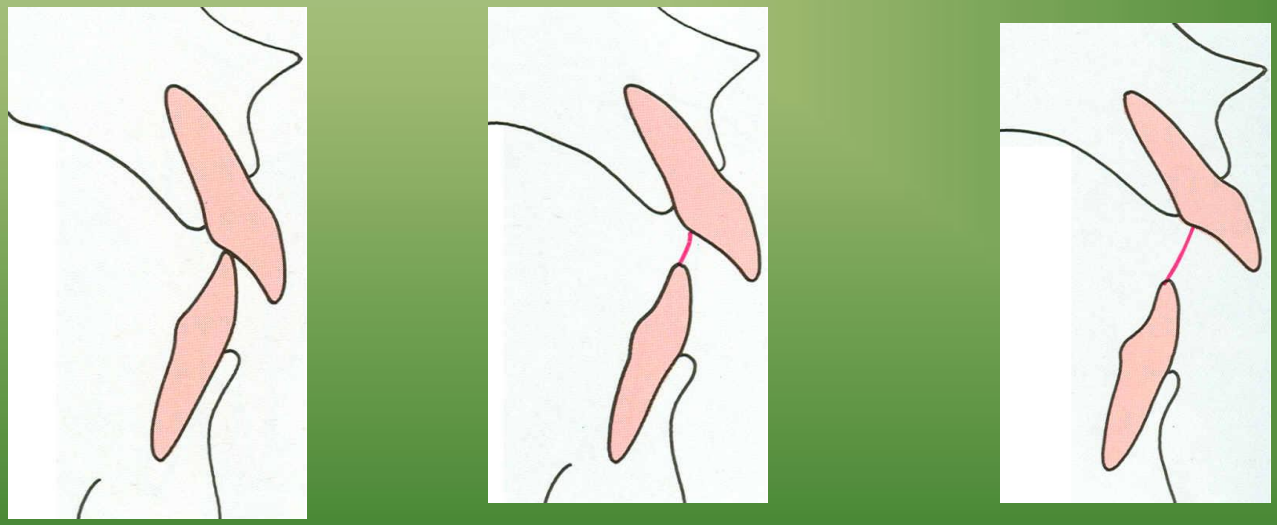
Left: Rest position.
Center: Initial tooth contact
Right: Habitual occlusion.

After the mandible has left its rest position, the incisal guidance of the upper labially and lower lingually inclined incisors forces it to slide towards the anterior during the final stages of the closing action.
The joint analysis of the incisor positioning and the functional deviation leads to the diagnosis of a pseudo-forced bite

Evaluation of the Relationship between Rest Position and Habitual Occlusion in the Vertical Plane:

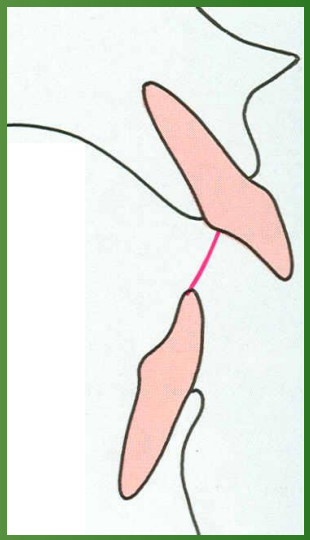
The vertical dimension of the freeway space is assessed
This analysis is of particular importance to cases with a deep overbite. According to Hotz and Miihlemann (1952) one should differentiate between two types: true deep overbites and pseudo-deep overbites.

Functional classification of deep overbite



A Occlusal position
B Pseudo-deep overbite with small freeway space.
C True deep overbite with large freeway space.

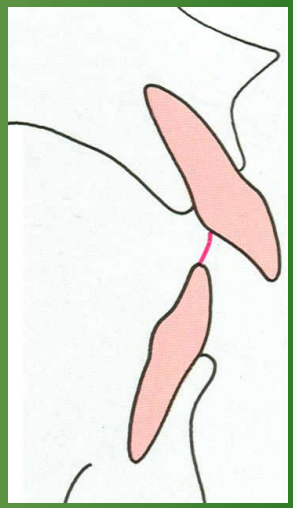
The ***true deep overbite*** with a large freeway space is caused by infraclusion of the molars. The prognosis for successful therapy with functional methods is favorable. As the interocclusal clearance is large, sufficient freeway space will remain after extrusion of the molars.



Left: Habitual occlusion.
Right: Rest position of the mandible

Class II, Division 2 malocclusion with a large freeway space in the postural resting position of the mandible. The prognosis for successful correction of the deep overbite is good, as this type of vertical maldevelopment can be treated with functional appliances and by extrusion of the molars. Lateral tongue-thrust and tongue posture is often associated with true deep overbite cases.

The ***pseudo-deep overbite*** has a small freeway space. The molars have erupted fully. The deep overbite is caused by overeruption of the incisors. The prognosis for elevating the bite using functional appliances is unfavorable. If the freeway space is small, extrusion of the molars adversely affects the rest position and may create TMJ problems or cause a relapse of the deep overbite.



Left: Habitual occlusion.
Right: Rest position of the mandible.

Class II malocclusion with small freeway space in the postural position.
The deep overbite is combined with overeruption of the lower incisors.
Pseudo-deep overbite cases are difficult to treat as this type of malocclusion cannot be corrected by extrusion of the molars.