



Orthodontic

Lec:1

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Orthodontic Diagnostic Aids-Case History and Clinical Examination

The primary task for the clinician is to identify the problem and find its etiology. Once this is done, and only then can a treatment plan be formulated. Diagnosis involves the development of a comprehensive and concise database of patient information, sufficient to understand the patient's problem as well as answer questions arising in the treating clinician's mind. The data is derived from essential and nonessential diagnostic aids or supplemental diagnostic aids. **So the treatment is secondary**

ESSENTIAL DIAGNOSTIC AIDS

Essential diagnostic aids, as the name suggests are considered essential for the diagnosis of an orthodontic case. Ideally before starting a case, a treating clinician must possess these aids. These include the following.

1. Case history
2. Clinical examination
3. Study models
4. Certain radiographs
 - a. Periapical radiographs
 - b. Lateral radiographs
 - c. Orthopantomograms
 - d. Bite wing radiographs
5. Facial photographs

These diagnostic aids are simple and easy to obtain except for specialized radiographs like orthopantomograms and lateral cephalograms where a specialized radiographic setup might be required

NONESSENTIAL OR SUPPLEMENTAL DIAGNOSTIC AIDS

These diagnostic aids may be required only in certain cases and may require specialized equipment, which might not be available in every dental clinic. The supplemental diagnostic aids include

1. Specialized radiographs; like
 - a. Occlusal views of maxilla and/or mandible
 - b. Selected lateral jaw views, etc.



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2. Electromyographic examination of muscle activity
3. Hand-wrist radiographs
4. Computed axial tomography (CT scan)
5. Magnetic Resonance Imaging (MRI)
6. Endocrine tests and/or other blood tests
7. Estimation of the basal metabolic rate
8. Sensitivity (vitality) tests
9. Biopsy

CASE HISTORY

Case history is the information gathered from the patient and/or parent and/or guardian to aid in the overall diagnosis of the case. It includes certain personal details, the chief complaint, past and present history. The aim is to establish a rapport with the patient and to obtain an accurate account of the individual's complaints, which, following examination will enable, a diagnosis to be made.

***PERSONAL DETAILS**

These include very basic data, for communication and access. It includes:

Name

The patient's name should be recorded not only for the purpose of communication and identification but because it gives a personal touch to the following conversation. It makes the patient more comfortable when he is addressed by his first name and arouses a feeling of familiarity, which has a positive psychological effect on the patient.

Age and Date of Birth

The chronologic age of the patient helps in diagnosis treatment planning and growth prediction. Certain transient conditions, which might be perceived as malocclusion by the patient and parents, can be identified and the concerned are counseled accordingly. The age of the patient also dictates the use of certain treatment protocols—for example, surgical correction might be advocated following cessation of growth whereas the same malocclusion might be treated using functional appliances if the patient has a potential to grow.

Sex (gender)

Sex of the patient also helps in treatment planning. Girls mature earlier than boys, i.e. the timing of growth related events including growth spurts, eruption of teeth and onset of puberty are different in males and females. Psychologically also the reaction of males and females may be different to similar malocclusion. Females are generally more concerned about facial aesthetics.



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Address and Occupation

These are important for communication, assessing the socioeconomic status as well as for records. The socioeconomic status might dictate the kind of appliance required. Also, patients coming from far may require a different appliance therapy as they might not be able to visit the clinician more frequently.

***CHIEF COMPLAINT**

The patient's chief complaint should be recorded in his or her own words. It should mention the conditions the patient feels he / she is suffering from. This helps in identifying the priorities and desires of the patients. The parents' perception of the malocclusion should also be noted. This will help in setting the treatment objectives and satisfying the family in general.

***MEDICAL HISTORY**

Knowledge of a patient's general health is essential and should be obtained prior to examination. It is best obtained by a questionnaire. In most cases orthodontic treatment can be undertaken but precautions may be required prior to extractions. Antibiotic coverage may be required in patients with rheumatic fever or cardiac anomalies even for molar band placement/removal, if the adjacent gums are inflamed or bleeding is anticipated. Mentally or physically challenged patients may require special management.

***DENTAL HISTORY**

The patient's dental history should include information on the age of eruption and exfoliation of deciduous and permanent teeth. Reason for exfoliation will also hint at the oral hygiene maintenance capabilities of the patient. The past dental history will also help in assessing the patients and parents attitude towards dental health.

***PRENATAL HISTORY**

Prenatal history should concentrate on the condition of the mother during pregnancy and the type of delivery. Her nutritional state and any infections that she might have will affect the developing teeth of the child. The use of certain drugs or even excess use of certain vitamins can result in congenital deformities of the child. Forcep deliveries have been associated with injuries to the temporomandibular joint (TMJ). Excess forcep pressure in the TMJ region can cause ankylosis of the joint and associated mandibular growth retardation

***POSTNATAL HISTORY**

The postnatal history should concentrate on the type of feeding, presence of habits especially digit/thumb sucking and the milestones of normal development. Tongue thrust and digit sucking habits are associated with mal occlusions. These will be discussed later in detail.

***FAMILY HISTORY**

Skeletal malocclusions especially skeletal Class III malocclusions and congenital conditions such as cleft lip and palate are inherited. Detailed records of such malocclusions might aid in any future studies on the subject.



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CLINICAL EXAMINATION

GENERAL EXAMINATION

General examination should begin as soon as the patient first comes to the clinic. A general appraisal of the patient is done. The clinician should observe the gait, posture and physique of the patient. Height and weight are recorded to assess for the physical growth and development of the patient. Abnormal gait may be present due to an underlying neuromuscular disorder. Abnormal posture also may lead to malocclusions.

Body Build

Sheldon classified body build into:

- Ectomorphic: Tall and thin physique
- Mesomorphic: Average physique
- Endomorphic: Short and obese physique

Cephalic and Facial Examination

The shape of the head can be evaluated based on the cephalic index of the head which was formulated by Martin and Saller (1957) as:

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

Index values

- **Mesocephalic** (average) 76.0-80.9
- **Brachycephalic** (short, broad skull) 81.0 - 85.4
- **Dolicocephalic** (long face, narrow skull) <75.9
- **Hyperbrachycephalic** >-



A



B



C

Fig 1: Classification of head types: (A) Mesocephalic head, (B) Brachycephalic head, and (C) Dolicocephalic head



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

The shape of the **face** is assessed by the morphologic facial index which was given by Martin and Saller (1957) as:

Morphologic facial height (distance between nasion and gnathion)

I= _____

Bizygomatic width (distance between the zygoma points)

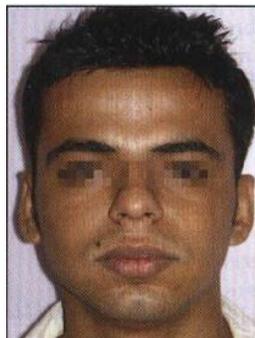
Index values

- **Hypereuryprosopic** low facial x - 78.9
- **Euryprosopic** skeleton 79.0 – 83
- **Mesoprosopic** average facial skeleton 84.0 – 87.9
- **Leptoprosopic** high facial 88.0 – 92.9
- **Hyperleptoprosopic** skeleton 93.0 - x

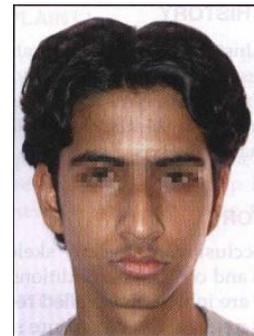
The type of facial morphology has a certain relationship to the shape of the dental arch, e.g. euryprosopic face types have broad, squar arches; border line crowding in such cases should be treated by expansion. On the other hand, leptoprosopic face types often have narrow apical base/arches. Therefore, extraction is preferred over expansion.



A



B



C

Fig. 2: Classification of head types: A (Euryprosopic face) B (Mesoprosopic face) c (Leptoprosopic face)

— A certain degree of asymmetry between the right and left sides of the face is seen in most individuals. The face should be examined in the transverse and vertical planes to determine a greater degree of asymmetry than is considered normal. Gross facial asymmetries may be seen in patients with:

- i. Hemifacial hypertrophy / atrophy
- ii. Congenital defects
- iii. Unilateral condylar hyperplasia
- iv. Unilateral Ankylosis, etc.

fig 3; Facial asymmetry





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Facial Profile

The profile is examined from the side by making the patient view at a distant object, with the FH plane parallel to the floor. Clinically or in extraoral photographs the profile can be obtained by joining two reference lines:

- Line joining forehead and soft tissue point A
- Line joining point A and soft tissue pogonion.

Three types of profiles are seen:

- Straight/orthognathic profile:** The two lines form an almost straight line.
- Convex profile:** The two lines form an acute angle with the concavity facing the tissues. This type of profile is seen in Class II div 1 patients due to either a protruded maxilla or a retruded mandible.
- Concave profile:** The two lines form an obtuse angle with the convexity facing the tissues. This type of profile is seen in Class III patients due to either a protruded mandible or a retruded maxilla.

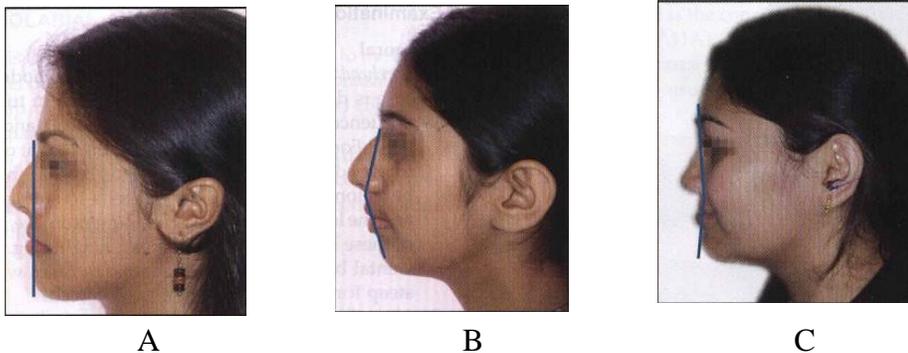


Fig. 4: facial profile assessment

A: Straight/orthognathic profil. B: Convex profile. C: Concave profil

Facial Divergence

The lower face may be straight or inclined anteriorly posteriorly relative to the forehead. This inclination is also termed as the facial divergence, which may be influenced by the patient's ethnic or racial background.

A line is drawn from the forehead to the chin to determine whether the face is:

- Anterior divergent , line inclined anteriorly.
- Posterior divergent , line inclined posteriorly.
- Straight/orthognathic , straight line, no slant seen



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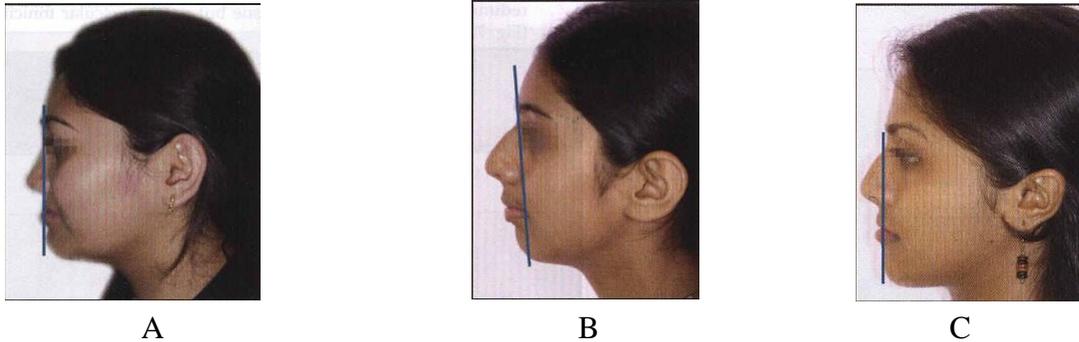


Fig. 5: Facial divergent classification A: Anterior divergent profile. B: Posteriorly divergent profile. C: Straight/orthognathic profile

ASSESSMENT OF ANTEROPOSTERIOR JAW RELATIONSHIP

A fair picture of the sagittal skeletal relationship can be obtained clinically by placing the index and middle fingers at the approximate A and B points after lip retraction (Fig. 6). Ideally, the maxilla is 2 to 3 mm anterior to the mandible in centric occlusion. In skeletal Class II cases, the index finger is much ahead of the middle finger whereas in Class III the middle finger is ahead of the index finger.

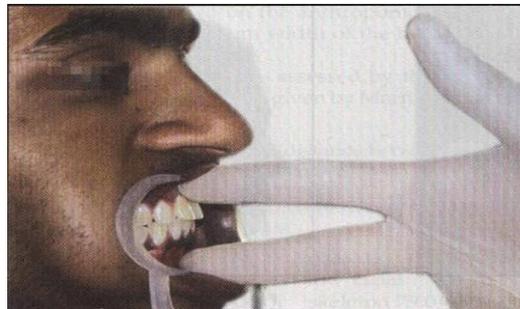


Fig. 6: Assessment of anteroposterior jaw relationship

ASSESSMENT OF VERTICAL SKELETAL RELATIONSHIP

A normal vertical relationship is one where the distance between the glabella and subnasale is equal to the distance from the subnasale to the underside of the chin (Fig. 7). Reduced lower facial height is associated with deep bites while increased lower facial height is seen in anterior open bites.

Fig. 7: Evaluation of facial proportion





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Examination of the Soft Tissues

Extraoral

1. **Forehead** The esthetic prognosis of an orthodontic case is determined by its profile, which in turn is influenced by the shape of the forehead and the nose. For a face to be harmonious, the height of the forehead (distance from hairline to glabella) should be as long as the mid-third (glabella-to-subnasale) and the lower third (subnasale-to-menton), i.e. each of these is one-third the total face height (Fig.1). Dental bases are more prognathic in cases with a steep forehead, than with a flat forehead.

Fig. 1: Evaluation of facial proportion



2.Nose

Size, shape and position of the nose determines the esthetic appearance of the face and is therefore important in the prognosis of a case.

3.Lips

Lip length, width and curvature should be assessed. In a balanced face, the length of the upper lip measures one-third, the lower lip and chin two thirds of the lower face height. The upper incisal edge exposure with the upper lip at rest should be normally 2 mm. Lips can be classified into:

- Competent lips: Slight contact of lips when musculature is relaxed (Fig. 2A)
- Potentially competent lips: Lip seal is prevented due to the protruding maxillary incisors despite normally developed lips (Fig. 2B).
- Incompetent lips: Anatomically short lips which do not contact when musculature is relaxed. Lip seal is achieved only by active contraction of the orbicularis oris and mentalis muscles (Fig. 2c).
- Everted lips: These are hypertrophied lips with redundant tissue but weak muscular tonicity (Fig. 2D).



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A

B

C

D

Fig. 2 classification of lips A: Competent lips. B: Potentially competent lip. C: Incompetent lips. D: Everted lip

NASOLABIAL ANGLE

This is the angle formed between a tangent to the lower border of the nose and a line joining the subnasale with the tip of the upper lip (labrale superius) (Fig. 3). Normal value is 110 degrees. proclined upper anteriors this angle reduces whereas it becomes more obtuse in cases with a retrognathic maxilla or retroclined maxillary anteriors

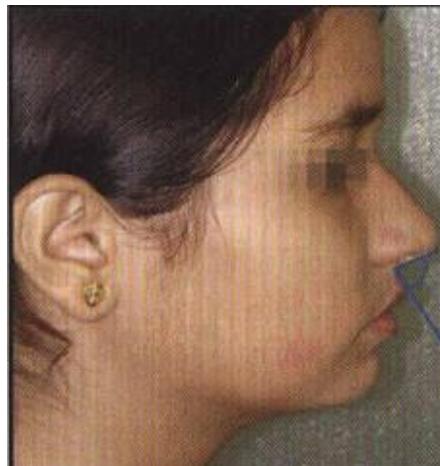


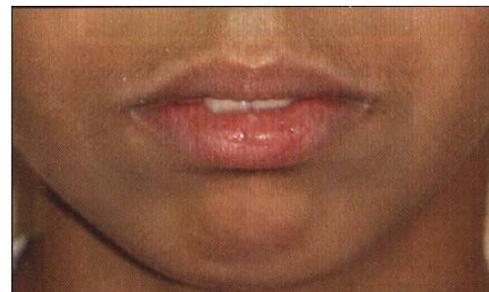
Fig 3: Nasolabial angle

4.Chin

The configuration of the chin is determined not only by the bone structure, but also by the thickness and tone of the mentalis muscle

- Mentalis activity A normal mentalis muscle becomes hyperactive (Fig. 4) in certain malocclusions like Class II di v 1 cases, where in puckering of the chin may be seen.

Fig. 4: Hyperactive mentalis





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- Mentolabial sulcus It is the concavity present below the lower lip (Fig. 5A). Deep sulcus (Fig. 5B) is seen in Class II cases whereas a shallow sulcus (Fig. 5C) is seen usually in bimaxillary protrusion cases. Along with the chin width, development of chin height is important. Chin height is the distance from the mentolabial sulcus to menton. -over development of chin height alters the lower lip position and interferes with lip closure.
- Chin position and prominence; prominent chin is usually associated with Class III malocclusions whereas recessive chin is seen in Class I malocclusion.

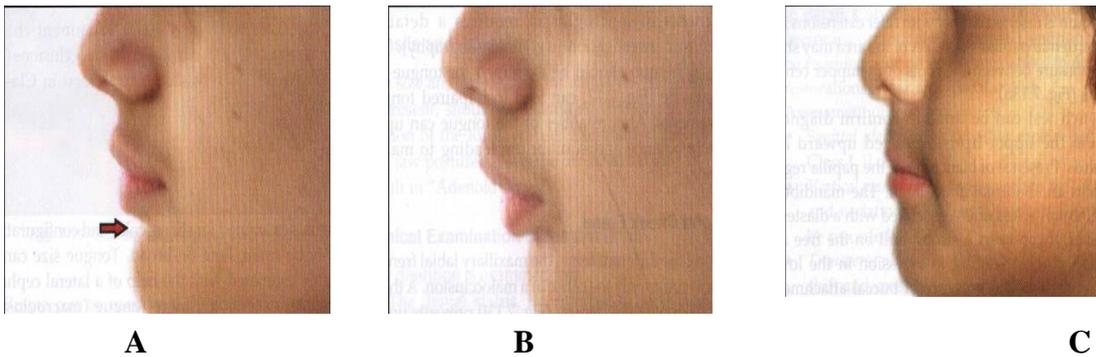


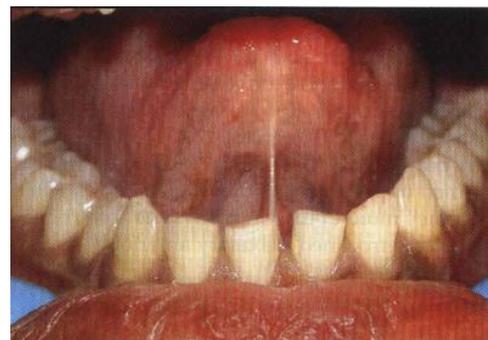
Fig 5 Mentolabial sulcus. A: normal Mentolabial sulcus. B: Deep mentolabial sulcus C: Shallow mentolabial sulcus

INTRAORAL EXAMINATION

- **Tongue**

Tongue is examined for shape, color and configuration it may be small, long or broad. Tongue size can be roughly estimated with the help of a lateral cephalogram an excessively large tongue (macroglossia) usually shows imprints on its lateral margins, which gives the tongue a scalloped appearance. However diagnosis of macroglossia requires a detailed diagnostic investigation (e.g. cineradiography). The lingual frenum should be examined for tongue tie. Tongue tie (Fig. 6) can lead to impaired tongue movements. Abnormalities of the tongue can upset muscle balance and equilibrium leading to malocclusion.

Fig 6: Tongue tie, restricted movement of the tongue

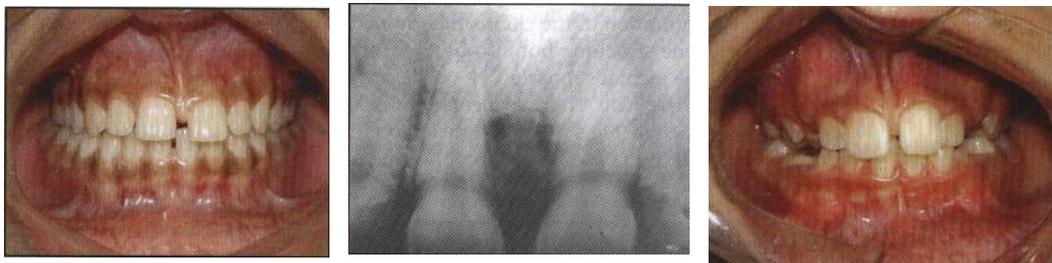




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Lip and Cheek Frenum

Among the different frena, the maxillary labial frenum is most commonly the cause of a malocclusion. A thick fibrous, low labial frenum (Fig. 7A) prevents upper central incisors from approximating each other leading to a midline diastema. A frenectomy is indicated when the frenum is inserted deeply with fiber extensions into the interdental papilla. An IOPA of the area may show a bony fissure between the roots of the upper central incisors (Fig. 7&B). Blanch test can be done to confirm diagnosis wherein the upper lip is stretched upward and outwards. Presence of blanching in the papilla region indicates an abnormal attachment. The mandibular labial frenum is less often associated with a diastema. However, it can exert a strong pull on the free and attached gingiva leading to recession in the lower anterior region. The presence of buccal attachments must also be examined carefully especially in adolescents and adults (Fig. 7C)



A

B

C

Fig 7: A: Fleshy labial frenum. B: 'V' shaped notching seen in the interdental region on an IOPA. C: Blanching seen in the inter-dental region

.Gingiva

The gingiva should be examined for the type (thick fibrous or thin fragile), inflammation and mucogingival lesions. In children, most commonly generalized marginal gingivitis occurs due to plaque accumulation and can be resolved by improving the oral hygiene. In adults, scaling followed by curettage and sometimes mucogingival surgery is usually required. Local gingival lesions may occur due to occlusal trauma (Fig. 8), abnormal functional loadings or medication (e.g. Dilantin). In mouth breathers, open lip posture causes dryness of the mouth leading to anterior marginal gingivitis. Gingivitis is a contraindication for orthodontic treatment. Treatment should be started only when the gingival condition improves.

Fig. 8: Trauma from occlusion causing gingival recession in relation to 41





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Palate

The palatal mucosa is examined for:

- a. Pathologic palatal swelling: Indicative of displaced impacted tooth germ, cysts, etc.
- b. A traumatic deep bite can lead to mucosal ulcerations and indentations.
- c. Palatal depth and shape varies in accordance with the facial form, e.g. Brachyfacial patients have broad and shallower palates as compared to dolicofacial patients.
- d. Presence of clefts of varying degree may be seen scar tissue following palatal surgery prevents normal development of the maxillary arch Fig.9.
- e. Rugae can be used as a diagnostic criterion for anterior proclination. Third rugae is normally in line with the canines.

● Tonsils and Adenoids

The size and presence of inflammation in the tonsils if present, should be examined. Prolonged inflammation of the tonsils causes alteration of the tongue and jaw posture, upsets the orofacial balance and can result in "Adenoid facies".

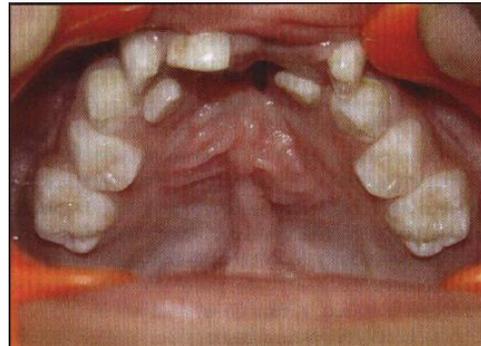


Fig. 9: Scarring following cleft palate repair



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Lec:3

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Occlusion in Orthodontics

DENTAL OCCLUSION

Dental occlusion defined , "as the static, closed contacting position of the upper teeth to lower teeth".

DISOCCLUSION OF TEETH

Disocclusion defined , "as a separation of the teeth from occlusion; the opposite of occlusion".

STAMP CUSPS

The cusps that stamp into a fossa of an opposing tooth are known as stamp cusps. The lingual cusps of the upper teeth and the buccal cusps of the lower teeth are the posterior stamp cusps.

NORMAL OCCLUSION

What is referred to as normal occlusion orthodontically, is an Angle's Class I occlusion. The key teeth for this classification are the permanent first molars. The mesiobuccal cusp of the maxillary first molar should occlude in mesiobuccal groove of the mandibular first permanent molar (Fig. 1). *However, even with this relationship, when the teeth are in full closure there may be a significant discrepancy between the relationships of mandibular or temporomandibular joints (TMJ) and the maxilla.* Normal occlusion usually involves occlusal contact and alignment of teeth, over jet, overbite, arrangement and relationship of teeth between the arches and relationship of teeth to osseous structures. "Normal" simply implies a situation commonly found in the absence of disease. It should include not only a range of anatomically acceptable values but also physiological adaptability.

(Fig. 1) normal occlusion



IDEAL OCCLUSION

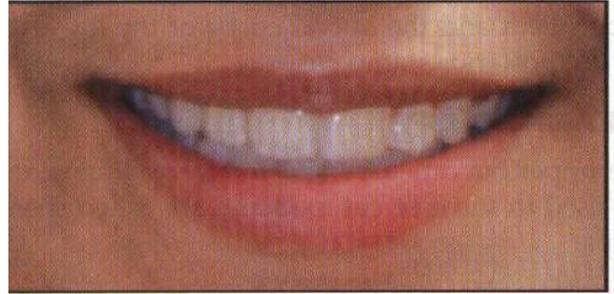
This concept refers both to an aesthetic and a physiologic ideal (Fig. 2). In recent times, emphasis has moved from aesthetic and anatomic standards to the current concern with function, health and comfort.

Hence now the important aspect of ideal occlusion includes functional harmony and stability of masticatory system and the neuromuscular harmony in the masticatory system.



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(Fig.2) ideal occlusion, aesthetic , and satisfying the idealized and functional characteristics



BALANCED OCCLUSION

Balanced occlusion is said to exist when there exist a simultaneous contact of maxillary and mandibular teeth, on the right and left, in the anterior and posterior occlusal areas when the jaws are either in centric or eccentric occlusion.

PHYSIOLOGIC OCCLUSION

The occlusion that exists in an individual, who has no signs of occlusion related pathosis, is a physiologic occlusion. Physiologic occlusion may not be an ideal occlusion but it is devoid of any pathological manifestation in the surrounding tissue due to these deviations from the ideal. Here there is a controlled adaptive response characterized by minimal muscle hyperactivity, and limited stress to the system.

TRAUMATIC OCCLUSION

It is an occlusion which is judged to be a causative factor in the formation of traumatic lesions or disturbances in the supporting structures of the teeth, muscles and TMJ (Fig. 3). Almost every dentition has supra contacts that have traumatic potential to alter the status of muscle tones and induce stress. However, the criterion which determines if an occlusion is traumatic or not is not how teeth occlude but whether it produces any injury.



(Fig.3) Examples of traumatic occlusion

THERAPEUTIC OCCLUSION

It is a treated occlusion employed to counteract structural interrelationship related to traumatic occlusion.

CONCEPTS OF OCCLUSION

Numerous concepts of occlusion have been suggested. Some of the important ones are listed below.

Occlusion in Orthodontics

- 1. Angle 1887**
- 2. Hellman 1921**
- 3. Lucia 1962**



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4. Stallard and Stuart 1963

5. Ramford and Ash 1983

These concepts stress to a varying degree, state and/ or functional characteristic of occlusion. None are completely applicable to natural dentition. Since a few concepts provide specific occlusal relations to joint positions, some provide ways in which muscles and the neuromusculature functions.

CLASSIFICATIONS OF OCCLUSION

Many different classifications have been suggested, but the important ones are:

1. Based on mandibular position.
2. Based on relationship of 1st permanent molar.
3. Based on organization of occlusion.
4. Based on pattern of occlusion.

BASED ON MANDIBULAR POSITION

- **Centric Occlusion**

It is the occlusion of the teeth when the mandible is in centric relation.

Centric relation has been defined as the maxillomandibular relationship in which condyles articulate with the thinnest avascular position of their respective discs with the complex in the anterosuperior position against the shape of the articular eminence. This position is independent of tooth contact and is clinically discernable when the mandible is directed anteriorly and superiorly. It is restricted to a purely rotary movement about the transverse horizontal axis.

- **Eccentric Occlusion**

It is defined as the occlusion, other than centric occlusion. It includes:

1. *Lateral occlusion* it can be right or left lateral occlusion. It is defined as the contact between opposing teeth when the mandible is moved either right or left of the midsagittal plane.
2. *Protruded occlusion* Defined as the occlusion of the teeth when the mandible is protruded, i.e. the position of mandible is anterior to centric relation.
3. *Retrusive occlusion* Occlusion of the teeth when the mandible is retruded, i.e. position of mandible is posterior to centric relation.



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BASED ON RELATIONSHIP OF 1ST PERMANENT MOLAR

Depending on the anteroposterior jaw relationship, Edward H Angle classified occlusion into 3 types.

a. Class I (also known as neutro-occlusion) (Fig. 4): Dental relationship in which there is normal antero posterior relationship, as indicated by the correct inter digitation of maxillary and mandibular molars (crowding rotation or other individual tooth mal relations may be present elsewhere in the arch).

b. Class II (also known as disto-occlusion) (Fig5): Dental relationship, in which the mandibular dental arch is posterior to the maxillary dental arch in one or both lateral segments as determined by the relationship of the permanent first molars. Mandibular 1st molar is distal to the maxillary 1st molar.

Further subdivided into 2 divisions:

Division 1 Bilateral distal retrusion with a narrow maxillary arch and protruding maxillary incisors, increased overjet.

Division 2 Bilateral distal retrusion with a normal or square-shaped maxillary arch, retruded maxillary central incisors, labially malposed maxillary lateral incisors, an excessive overbite (deepbite).

Subdivision Unilateral, right or left, distal retrusive position of the mandible



Fig.4 molar relation angel class I (Fig.5) angel class II

(Fig.6) angel classIII

c. Class III(or mesio-occlusion-Fig. 6.): Dental relationship, in which mandibular arch is anterior to maxillary arch in one or both the lateral segments. The mandibular first molar is mesial to the maxillary first molars and mandibular incisors are in anterior cross bite.

Subdivision Right or left, i.e the molar relation exists unilaterally, with other characters remaining same.

d. Class IV: Dental relationship in which occlusal relations of the dental arches present the peculiar condition of being in distal occlusion in one lateral half and in mesial occlusion in the other half. This term is obsolete now.

BASED ON THE ORGANIZATION OF OCCLUSION

a. Canine guided or protected occlusion During lateral movements, only working side canine comes into contact with the other. This results in disocclusion of all posterior teeth, i.e. on both the working and balancing side. This is because the mandible moves away from the centric occlusion. Here the tip or the buccal incline of the lower canine is seen to slide along with palatal surface of the upper canine.



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b. Mutually protected occlusion Occlusal scheme in which the posterior teeth prevent excessive contact of the anterior teeth in maximum intercuspation. Also, the anterior teeth disengage the posterior teeth in all mandibular excursive movements.

c. Croup function occlusion It is defined as the multiple contact relationship between the maxillary and mandibular teeth, in lateral movements of the working side; where by simultaneous contacts of several teeth is achieved and they act as a group to distribute occlusal forces.

BASED ON PATTERN OF OCCLUSION

There are two types:

a. Cusp to embrasure/marginal ridge occlusion development of occlusion can result in fitting of one stamp cusp into a fossa and the fitting of another cusp of the same tooth into the embrasure area of two opposing teeth. This is a tooth-to- two teeth relation occlusion.

b. Cusp to fossa occlusion development and growth of the masticatory apparatus results in most or all of the stamp cusps fitting into fossa. This cusp-fossa relationship normally produces an interdigitations of the cusps and fossa of one tooth with the fossa only on opposing tooth.

This is a tooth-to-one-tooth relation. The cusp-fossa, tooth-to-tooth arrangement has some distinct advantages over the cusp-embrasure arrangement.

Advantages of cusp-fossa arrangement over cusp-embrasure arrangement:

- i. Forces are directed more towards the long axis of the teeth
- ii. The arrangement leads to greater stability of the arch, decreasing the tendency towards tooth movement.
- iii. The chance of food impacting in the embrasures is less.

IMPORTANCE OF CENTRIC RELATION IN ORTHODONTICS

Diagnosis and treatment planning should be performed by an evaluation of the occlusion with mandible in centric relation, that is, the natural musculoskeletal position of the condyles in the fossa, in order to obtain the true maxillary-mandibular skeletal and dental relationship in the three plane of space. If this is overlooked, an incorrect diagnosis and treatment plan of the actual malocclusion, along with its unfavorable consequences may result.

Example: A case of false Class III, may incorrectly be considered a true Class III, with a consequently poorer prognosis, or the cusp crossbite, in centric relation. Therefore, bilateral manipulation of the mandible into centric relation is imperative at the first visit. Usually, the models are trimmed and the lateral cephalograms are obtained in centric occlusion because of the difficulties in taking them in centric relation. Hence, during treatment planning we have to consider any discrepancy presented. Moreover, during every appointment the patient has to be monitored in centric relation so that the mechano therapy is guided to accomplish the final ideal state of functional occlusion. If monitoring is not done in this manner the treatment may finish with the mandible in centric occlusion, with several prematurities. This may later cause trauma from occlusion and TMJ disorder.



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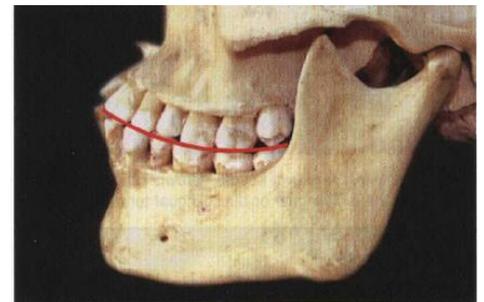
COMPENSATORY CURVATURES

The occlusal surfaces of dental arches do not generally conform to a flat plane.

- a. According to Wilson the mandibular arch appears concave and that of maxillary arch convex.
- b. According to Bonwill, the maxillary and mandibular arches adapt themselves in part to an equilateral triangle of similar sides.
- c. According to Von Spee, cusps and the incisal ridges of the teeth display a curved alignment when the arches are observed from a point opposite the 1st molar. The curve of Spee, as it is frequently called, is seen from the sagittal plane .
- d. Monson connected the curvature in the sagittal plane with compensatory curvatures in the vertical plane and suggested that the mandibular arch adapts itself to the curved segment of a sphere of similar radius. Here, the maxillary canine guides the mandible so that the posterior teeth come into occlusion with a minimum of horizontal forces.

CURVE OF SPEE

It refers to the anteroposterior curvature of the occlusal surfaces, beginning at the tip of the lower cuspid and following cusp tip of the bicuspid and molars continuing as an arc through to the condyle (Fig.7). If the curve were extended, it would form a circle of about 4 inches diameter.



(Fig.7)The curve of spee)

CURVE OF WILSON

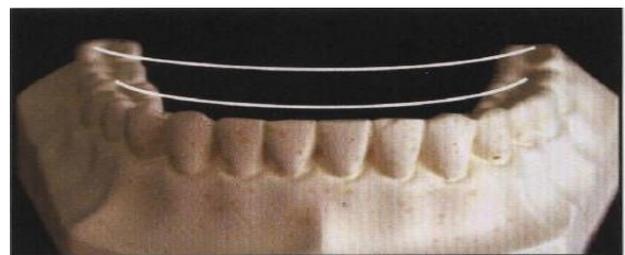
It is a curve that contacts the buccal and lingual cusp tips of the mandibular posterior teeth. The curve of Wilson is mediolateral on each side of arch. It results from the inward inclination of the lower posterior teeth (Figs 8and Fig.9).

The curve helps in two ways

1. Teeth aligned parallel to the direction of medial pterygoid for optimum resistance to masticatory forces.
2. The elevated buccal cusps prevent food from going 'past the occlusal table.



(Fig.8) curve drawn on the third molar(of a skull)



(Fig.9) an curves on the first and Second molars of the mandible



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CURVE OF MONSON

It is obtained by extension of the curve of Spee and curve of Wilson to all cusps and incisal edges.

ANDREWS SIX KEYS TO NORMAL OCCLUSION

The six keys were:

KEY I

Molar relationship (Fig.10) The molar relationship should be such that the distal surface of the distal marginal ridge of the upper first permanent molar contacts and occludes with the mesial surface of the mesial marginal ridge of the lower second molar. Secondly, the mesiobuccal cusp of the upper first permanent molar falls within the groove between the mesial and middle cusps of the lower first permanent molar. Also, the mesiolingual cusp of the upper first molar seats in the central fossa of the lower first molar.

KEY II

Crown angulation (Fig.11), the mesiodistal "tip". In normally occluded teeth, the gingival portion of the long axis (the line bisecting the clinical crown mesiodistally or the line passing through the most prominent part of the labial or buccal surface of a tooth) of each crown is distal to the occlusal portion of that axis. The degree of tip varies with each tooth type.

KEY III

Crown inclination (Fig. 12), the labiolingual or buccolingual, "torque". Crown inclination is the angle between a line 90 degrees to the occlusal plane, and a line tangent to the middle of the labial or buccal surface of the clinical crown.

The crowns of the maxillary incisors are so placed that the incisal portion of the labial surface is labial to the gingival portion of the clinical crown. In all other crowns, the occlusal portion of the labial or buccal surface is lingual to the gingival portion. In the maxillary molars the lingual crown inclination is slightly more pronounced as compared to the cuspids and bicuspid. In the mandibular posterior teeth the lingual inclination progressively increases.

KEY IV

Absence of Rotations (Fig. 13). Teeth should be free of undesirable rotations. If rotated, a molar or bicuspid occupies more space than it would normally. A rotated incisor can occupy less space than normal.

KEY V

Tight contacts (Fig. 14). In the absence of such abnormalities as genuine tooth-size discrepancies, contact points should be tight.

KEY VI

Flat curve of Spee (Fig. 15). A flat occlusal plane is a must for stability of occlusion. It is measured from the most prominent cusp of the lower second molar to the lower central incisor, no curve deeper than 1.5 mm is acceptable from a stand point of stability



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(Fig.10 key I)



Fig.11 Key II

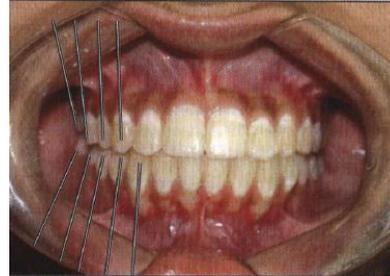
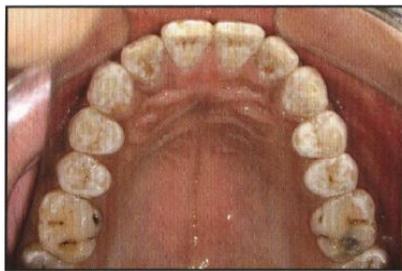


Fig.12 keyIII



(Fig.13 Key IV)



(Fig.14 Key V)



(Fig.15 Key VI)

Incisal over jet

The over jet is the horizontal distance between the upper and lower incisors in occlusion , measured at the tip of the upper incisor .It is dependent on the inclination of the incisor teeth and the antero -posterior relationship of the dental arches. In most people there is a positive over jet , i.e. the upper incisor is in front of the lower incisor in occlusion , but the over jet may be reversed ,or edge-to edge. The normal range (2 – 4 mm).

Incisal overbite

The overbite is the vertical distance between the tips of the upper and lower incisors in occlusion . It is governed by degree of vertical development of the anterior dento – alveolar segments. Ideally, the lower incisors contact the middle third of the palatal surface of the upper incisors in occlusion , but there may be excessive overbite , or there may be incisal contact ,in which case the overbite is described as incomplete when the lower incisors are above the level of the upper incisal edges , or anterior open bite ,when the lower incisors are below the level of the upper incisal edges in occlusion.

Midline

The midline of the teeth must be coming closest to the midline of the face(which mean ,the midline of the oral commissures, natural dental midline , tip of philtrum, nasion , and tip of the nose) if there is any abnormality in these point that is mean there is shifting in the dental midline. Three commonly used anatomic landmarks, nasion , tip of the nose and tip of the philtrum used to determine the facial midline. while the dental midline mean the line extended between the two central incisors.



Orthodontic

Lec:4

أ.د.إيمان الشبخلي

Clinical Examination of the Dentition

The dentition is examined for:

1. The dental status, i.e. number of teeth present un erupted or missing or there is an extra teeth (super neumerary teeth) and the position of the teeth wither (normal ,Buckley position or lingually or rotated) .in addition to that we have to assess wither there is wearing in the teeth(there is a layer removing from the tooth surface that is mean there is a bad habit like bruxism)also the present of the cracks have been assist by using a mirror with reflecting light. In addition to that we have to assist the presence of white spot lesion(subsurface enamel demineralization are known as white spot lesions, and they represent the early phase of caries formation. Demineralization may take place rapidly, as fast as within 4 weeks after placement of brackets and can stay present even years after treatment. The white spot lesion is considered to be precursor of frank enamel caries and in the orthodontic practice has been attributed to prolonged accumulation and retention of bacterial plaque on the enamel surface adjacent to the appliances. So the favored sites for such accumulation are around the cervical margins of the teeth. As light refraction through enamel is directly related to the level of mineralization, WSLs manifest themselves as white opacities visually.

2. Dental and occlusal anomalies should be recorded in detail. Carious teeth should be treated before beginning orthodontic treatment. Dentition should be examined for other malformation, hypoplasia, restorations, wear and discoloration.

3. Assessment of the apical bases:

- Sagittal plane Check whether molar relation is Class I,II or III.
- Vertical plane Over jet and overbite are recorded and variations like deep bite, open bite should be recorded.
- Transverse plane Should be examined for lateral shift and cross-bite.

4. Midline of the face and its coincidence with the dental midline should be examined.

5. Individual tooth irregularities, e.g. rotations, displacement fractured tooth.

6. Shape and symmetry of upper and lower arches.

DENTAL AGE

Dental age can be correlated to skeletal and chronological age but there is some controversy as eruption timetable can be altered due to general and local factors. Spier (1918) was the first to associate tooth eruption to growth stature.

Methods to Determine Dental Age

Eruption time table: Chronological age can be correlated to the eruption time table of primary and secondary teeth. Radiographic appearances of developing jaws and teeth are taken into account. Factors such as completion of crowns, cusps and roots are studied. Radiological development of root of lower canine is considered to be an accurate method to correlate dental age to skeletal age, e.g. second permanent molar, which erupts at age 12 years, was once considered the indication for British child to *allow* him to work in the factory under the terms of British factory Act and hence was known as the 'Factory tooth'



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FUNCTIONAL EXAMINATION

Orthodontic diagnosis should not be restricted to static evaluation of teeth and their supporting structures but should also include examination of the functional units of the stomatognathic system. A functional analysis is important not only to determine the etiology of the normal occlusion but also to plan the orthodontic treatment required. A functional analysis includes:

1. Assessment of postural rest position and maximum intercuspation.
2. Examination of the temporomandibular joint.
3. Examination of orofacial dysfunctions.

ASSESSMENT OF POSTURAL REST POSITION

Determination of postural rest position: The postural rest position is the position of the mandible at which the synergists and antagonists of the orofacial system are in their basic tonus and balanced dynamically. The space which exists between the upper and lower jaws at the postural rest position is the interocclusal clearance or freeway space which is normally 3 mm in the canine region. The rest position should be determined with the patient relaxed and seated upright with the back unsupported. The head is oriented by making the patient look straight ahead. The head can also be positioned with the Frankfurt horizontal parallel to the floor. Various methods to record the postural rest position:

- a. Phonetic method:** The patient is told to pronounce some consonants like "M" or words like "Mississippi" repeatedly. The mandible returns to the postural rest position 1-2 seconds after the exercise.
- b. Command method:** The patient is asked to perform selected functions like swallowing, at the end of which the mandible returns spontaneously to the rest position. Phonetic exercise is also a type of command method.
- c. Non command method:** The clinician talks to the patient on unrelated topics and observes the patient as he speaks and swallows while he remains distracted. Patient is not aware that any examination is being carried out. While talking, the patient's musculature is relaxed and the mandible reverts to the postural rest position.
- d. Combined methods:** A combination of the above methods is most suitable for functional analysis in children. The patient is observed during swallowing and speaking. The "Tapping test" can also be carried out to relax the musculature. Here, the clinician holds the chin with his index finger and thumb and then opens and closes the mandible passively with constantly increasing frequency until the musculature is relaxed. This can be confirmed by palpating the submental muscles. The rest position can then be determined. Regardless of the method, mandible position is checked extraorally and the patient is told not to change the jaw, lip or tongue position. The lips are then parted and the maxillomandibular relation as well as the freeway space is determined.

Registration of the Rest Position

1. Intraoral methods.

- a. Direct method Vernier calipers can be used directly to measure the interocclusal clearance in the canine region.
- b. Indirect method Impression material is used to register the freeway space.



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2.Extraoral methods

a. Direct method Reference points are made on the skin with plaster, one on the nose and the other on the chin in the midsagittal plane. at the rest position and centric occlusion. The distance between these two points is measured, difference between the two is the freeway space.

b. Indirect method Includes

- Cephalometric registration: 2 Cephalogram one at postural rest position and other in centric occlusion are taken to determine the freeway space.

-Kinesiographic registration: a magnet is fixed on the lower anterior teeth and the mandibular movements are recorded by sensors which is then processed in the Kinesiograph.

Evaluation of the Path of Closure

The path of closure is the movement of the mandible from rest position to full articulation which should be analyzed.

Sagittal Plane

In Class II malocclusions, 3 types of movements can be seen:

a. Pure rotational movement without a sliding in component-seen in functional true Class II malocclusion.

b. Forward path of closure-i.e. rotational movement with anterior sliding movement. The mandible slides into a more forward position, therefore, Class II malocclusion is more pronounced than can be seen in habitual occlusion.

c. Backward path of closure, i.e. rotational movement with posterior sliding movement. In Class II div 2 cases, the mandible slides backward into a posterior occlusal position because of premature contact with retroclined maxillary incisors.

Vertical Plane

It is important to differentiate between two types of overbites.

The true deep overbite is caused by infra occlusion of the molars and can be diagnosed by the presence of a large freeway space. The prognosis with functional therapy is favorable.

Pseudo-deep bite is caused due to over-eruption of the incisors and is characterized by a small freeway space. Prognosis with functional therapy is unfavorable.

Transverse Plane

During mandibular closure, the midline of the mandible is observed. In case of unilateral crossbite. this analysis is relevant to differentiate between laterognathy and laterocclusion.

Laterognathy or true crossbite-the centre of the mandible and the facial midline do not coincide in rest and in occlusion. Laterocclusion-the centre of the mandible and facial midline coincide in rest position but in occlusion the mandible deviates due to tooth interference leading to non-coinciding midlines.