

DENTAL OCCLUSION

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

DISOCCLUSION OF TEETH

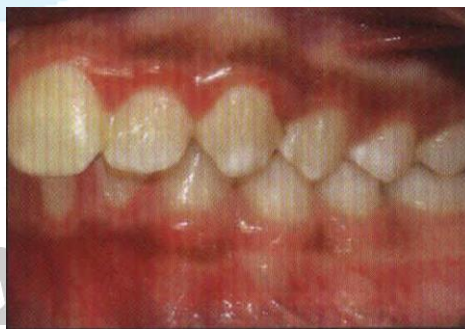
Disocclusion defined , "as a separation of the teeth from occlusion; the opposite of occlusion".

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

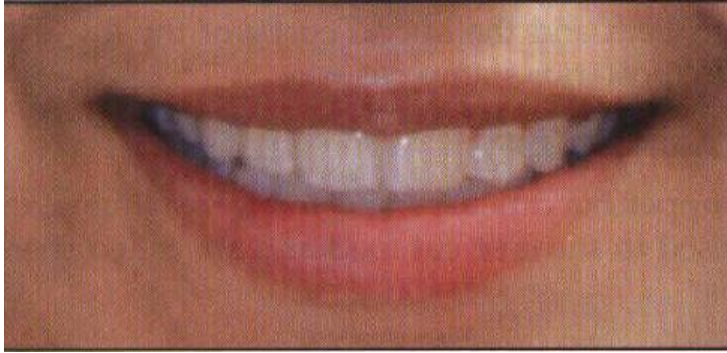
What is referred to as normal occlusion orthodontically, is an Angle's Class I occlusion. The key teeth for this classification are the permanent first molars. The mesiobuccal cusp of the maxillary first molar should occlude in mesiobuccal groove of the mandibular first permanent molar (Fig. 1). *However, 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 .



(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
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.

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

Division II 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 1 (Fig.5) angel class II (Fig.6) angel class III

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.

b. Mutually protected occlusion Occlusal scheme in which the posterior teeth prevent excessive contact 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 mechanotherapy 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.

COMPENSATORY CURVATURES

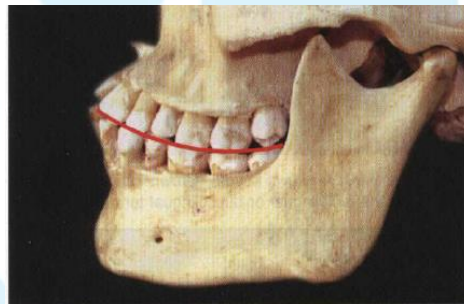
The occlusal surfaces of dental arches do not generally conform to a flat plane.

- 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 bicuspids 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.



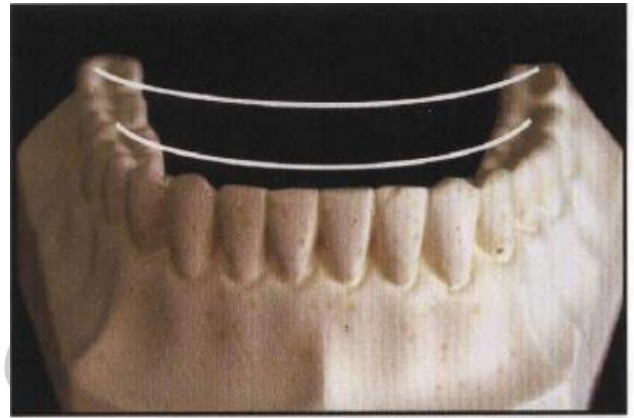
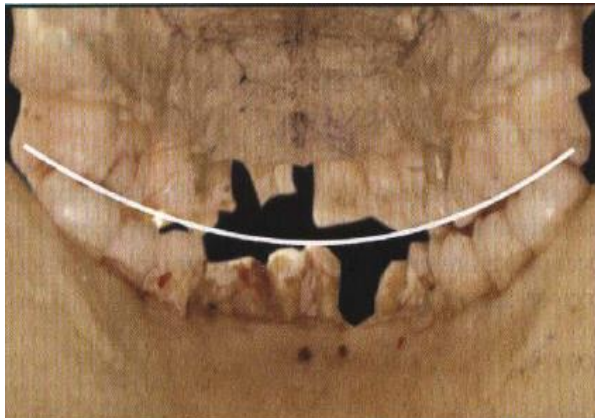
(Fig.7)The curve of spee)

CURVE OF WILSON

It is a curve that contacts the buccal and lingual cusp tips of the mandibular posterior teeth. The curve of 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) curves on the first and second molars of the mandible.

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 11

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 bucca I 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.

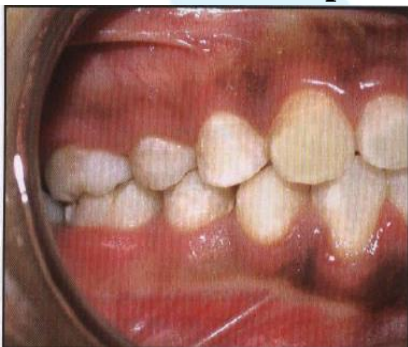
KEY IV

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.

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.



(Fig.10 key I)



Fig.11 Key II

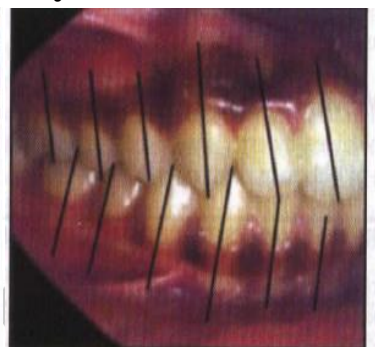
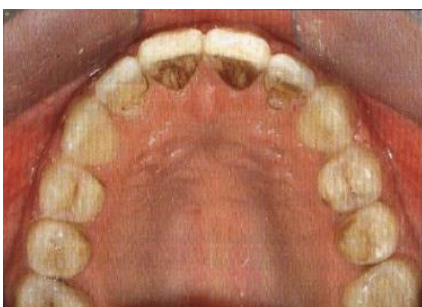
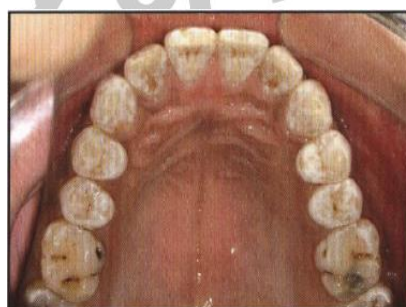


Fig.12 keyIII



(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.

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 un extra teeth (super neumerary teeth) and the position of the teeth wither (normal ,Buckley position or lingualy 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. Radio logical 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'.

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.

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 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.

EXAMINATION OF THE TEMPOROMANDIBULAR JOINT (TMJ)

The clinical examination of the TMJ should include auscultation and palpation of the temporomandibular joint and the musculature associated with mandibular movements as well as the functional analysis of the mandibular movements. The main objective of this examination is to look for symptoms of TMJ dysfunction such as crepitus, clicking, pain, hypermobility, deviation, dislocation, limitation of jaw movements and other morphological abnormalities. Specific TMJ radiographs may be indicated as part of orthodontic diagnosis in exceptional cases, Tomograms of the TMJ in habitual

occlusion and maximum mouth opening may be analyzed from condyle position in relation to the fossa, width of the joint space, etc. Adolescents with Class ITdiv 1 malocclusions and lip 'dysfunction are most frequently affected by TMJ disorders. Therefore, orofacial dysfunctions must also be assessed as they may lead to unbalanced joint loading which can then trigger off TMJ disturbances.

