Orthodontics

Lec 1 **Fifth Stage** **د بان غانم اغا**

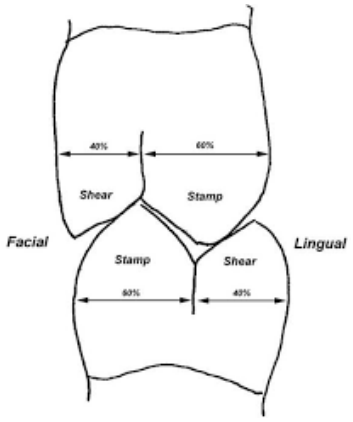
OCCLUSION

Ideal occlusion: Is the harmonious static and dynamic relationship of teeth and jaws that dentists would like to reproduce when restoring a patient's entire mouth to good form and function.

Normal occlusion: Is an absence of large or many facets, bone loss, closed vertical dimension, bruxing habit, freedom from joint pain, and crooked and loose teeth.

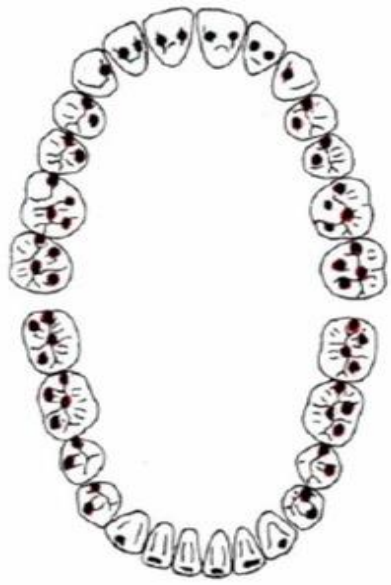
Centric Occlusion: It is the maximum intercuspation or contact attained between maxillary and mandibular posterior teeth.

Centric Relation: Centric relation is the most posterior position of the mandible relative to the maxilla at a given vertical dimension.



Centric Holding Cusp/Stamp Cusp/Supporting Cusp

Guiding Cusp/Shear Cusp/Non-supporting Cusp



CENTRIC OCCLUSAL CONTACTS

One scheme of occlusal contacts, presented by Hellman included 138 points of possible occlusal contacts for 32 teeth. Concepts of ideal occlusion are used primarily in orthodontics and even in restorative dentistry. Centric occlusal contacts are classified into anterior centric occlusal contacts and posterior centric occlusal contacts points.

Anterior Centric Occlusal Contacts

Palatal surfaces of maxillary incisors and canines—6

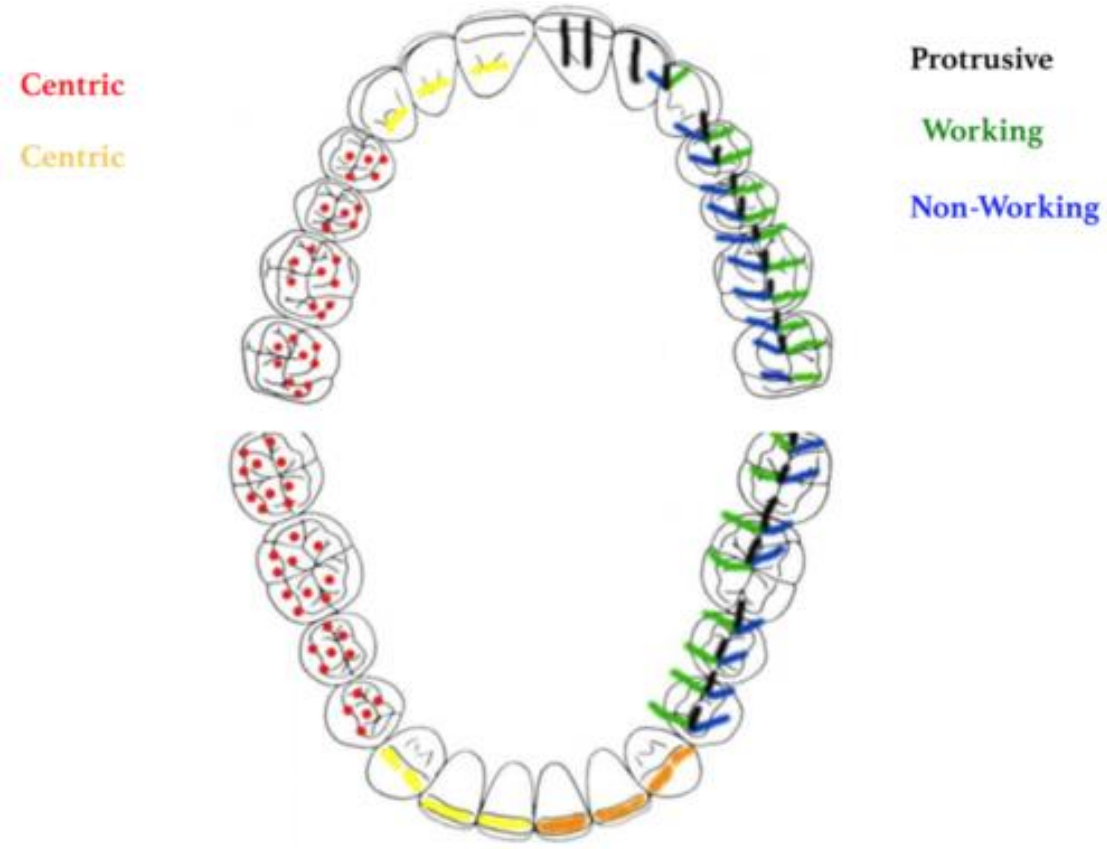
Labial surfaces of mandibular incisors and canines—6

Posterior Centric Occlusal Contacts

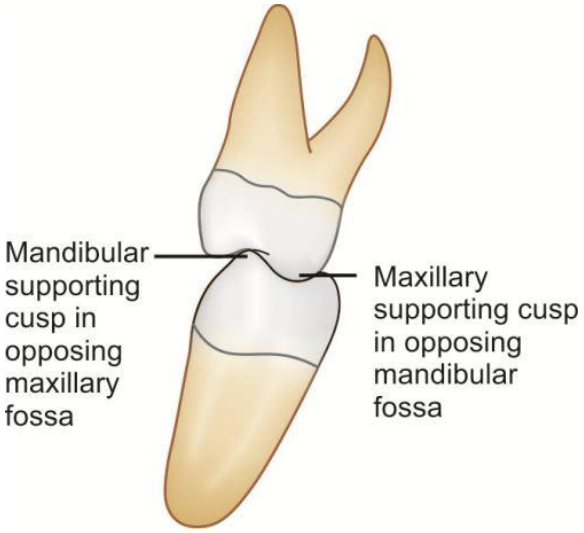
Posterior centric occlusal contacts consist of the buccal range of contacts and the lingual range of contacts of maxillary and mandibular p osteriors.



Cusp-Fossa Occlusion: The supporting cusp of one tooth occludes in a single fossa of a single opposing tooth are referred to as cusp-fossa occlusion or tooth-to-tooth arrangement.



Cusp-Embrasure Occlusion: When a tooth occludes with two opposing teeth, it is called cusp-embrasure occlusion or tooth to two teeth occlusion



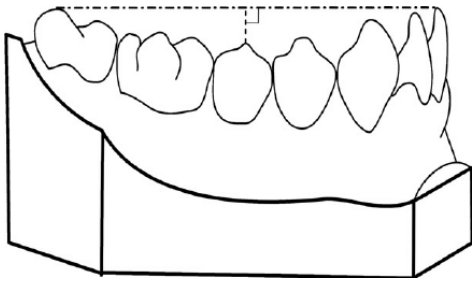


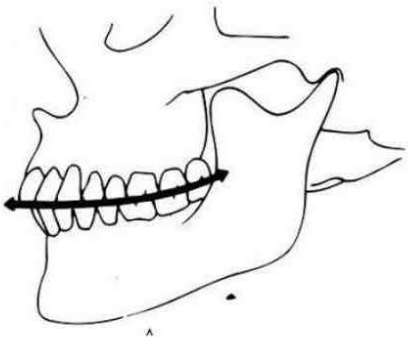
Cusp-Embrasure Occlusion

Imaginary Occlusal Planes and Curves

1. Curve of Spee (Anteroposterior Curve/the Curve of Occlusal Plane)

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. If the curve were extended, it would form a circle of about 4 inches diameter. The curve of the maxillary arch is convex and that of the mandibular arch is concave.

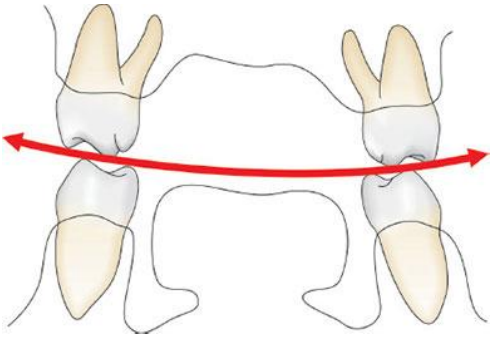




Curve Of Spee

2. Curve of Wilson (Side-to-Side Curve)

When viewed from anterior aspect with the mouth slightly open, the cusp tips of the posterior teeth follow a gradual curve from the left side to the right side. The curve of the maxillary arch is convex that of the mandibular arch is concave. Thus, the lingual cusps of the posterior teeth are aligned at a lower level than the buccal cusps on both sides and in both arches.



Curve of Wilson

Canine-guided occlusion

It is a mutually protected occlusion where the vertical and horizontal overlap of the canine teeth causes disengagement of the posterior teeth in the lateral movement of the mandible.



Group function occlusion

The occlusion is considered group function occlusion if more than two teeth in one arch were contacting laterally.

Group function

Anterior Guidance

According to Dawson, anterior guidance is the dynamic relationship of the lower anterior teeth against the upper anterior teeth through all the ranges of function. It plays a very important role in protecting the posterior teeth from protrusive and lateral stresses by disocluding effect.



Occlusion in orthodontics

The concept and philosophy of "normal" occlusion in orthodontics developed in relation to the teeth having a "specific arrangement" in the dental arches (intra-arch) and in relation to opposing arches (inter-arch). The well-aligned dental arches that have "normal" labial and buccal overjet, some overbite, and a "normal" anteroposterior relationship between maxillary and mandibular arches constitute normal occlusion. Historically, cusp-to-fossa relationships of upper and lower teeth were regarded as being of special significance. In the late nineteenth and early twentieth centuries, Angle (1899) emphasized the relationship of the mesiobuccal cusp of the maxillary first molar to the buccal groove of the mandibular first molar as the "key factor" in the establishment of a class I molar "normal" relationship. He considered the maxillary first molar to be a stable tooth, which occupied a distinct relationship in the maxillary bone. The position of each dental unit in the arch was also described in terms of its unique "axial inclination".

Clinical observations on occlusion were considered both within an arch and in relation to the opposing arches. Within the arch the following were considered: tight proximal contacts, labiolingual and buccolingual placement, rotation, and labiolingual and mesiodistal inclination. Angle also believed that a full complement of teeth was essential for teeth to be in balance with facial harmony.

Following Angle, clinical research evidence was considered. Studies from the University of Illinois reported that the maxillary first molar did not always have a distinct relationship with the key ridge in the maxilla. The research by Begg (1954) on the occlusion of Australian Aborigines suggested that reduction in tooth substance by proximal and occlusal wear was physiological. Tweed (1954) considered the face and the occlusion from the perspective of axial inclination of the lower incisors and their relationship with the mandibular plane as a guide for determining normal or abnormal relationships of other dental units to their basal bones.

Classification of Malocclusion

Occlusion: when the teeth in the mandibular arch come into contact with those in the maxillary arch in any functional relation.

Malocclusion: a condition in which there is a deflection from the normal relation of teeth.





Classification of Malocclusion

1. Quantitative method: **a) PAR index (Treatment Outcome)** **b) IOTN index (Treatment Need)**	**2. Qualitative Methods:** **a) Angle classification** **b) Andrew's Classification** **c) Incisor relationship** **d) Canine relationship**

Peer Assessment Rating (PAR) index

The Peer Assessment Rating (PAR) index is a valid and reliable measure of orthodontic treatment outcome and is the most widely accepted such index. Assessing outcomes with the

PAR index requires the examination of pre-treatment and post-treatment orthodontic study models.





Index of Orthodontic Treatment Need (IOTN)

It is a scale designed to measure the orthodontic need of a patient. It has two components: The Dental Health Component (DHC) The Aesthetic Component (AC). When assessed on the IOTN scale, a patient is first graded as 1, 2, 3, 4 or 5 on the Dental Health Component. Grade 1 does not need treatment, whereas grade 5 is in great need of treatment. If assessed as grade 3, the patient is further allocated to a grade somewhere between 3.1 and 3.10 by application of the Aesthetic Component. To be eligible for free NHS treatment, the overall score must be 3.6 or higher.

1) Intra arch Malocclusion

A tooth can be abnormally related to its neighbouring teeth, such abnormal variations are called individual tooth malpositions or intra arch malpositions.

a) **Inclination:** Lingual inclination, Buccal inclination
b) **Angulation:** Distal angulation, Mesial angulation
c) **Displacement**: Lingual displacement, Buccal displacement
d) Supraocclusion or infraocclusion
e) **Rotation:** Mesio buccal rotation or disto buccal rotation
f) Transposition

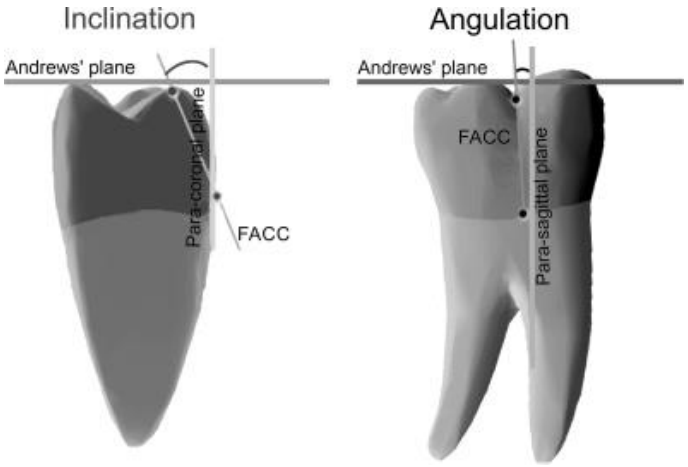
CROWN INCLINATION

Labiolingual or Buccolingual inclination. Crown inclination is determined from the mesial or distal perspective. Angle formed by a line 90 degree to occlusal plane & a line tangent to

bracket site. “Positive” when gingival portion of tangent line is lingual. “Negative” when gingival portion of tangent line is labial or buccal.

CROWN ANGULATION

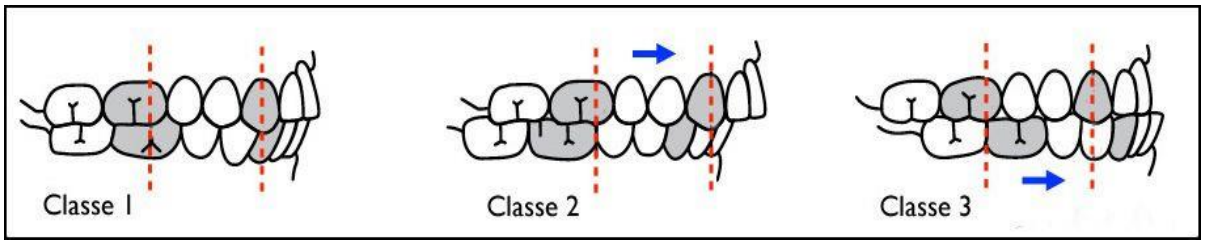
The Mesiodistal tip of the crown. The degree of crown tip is the angle between the long axis of the crown & a line drawn 90 degrees from occlusal plane. “Positive” when gingival portion is distal to incisal portion. “Negative” when gingival portion is mesial to incisal portion.

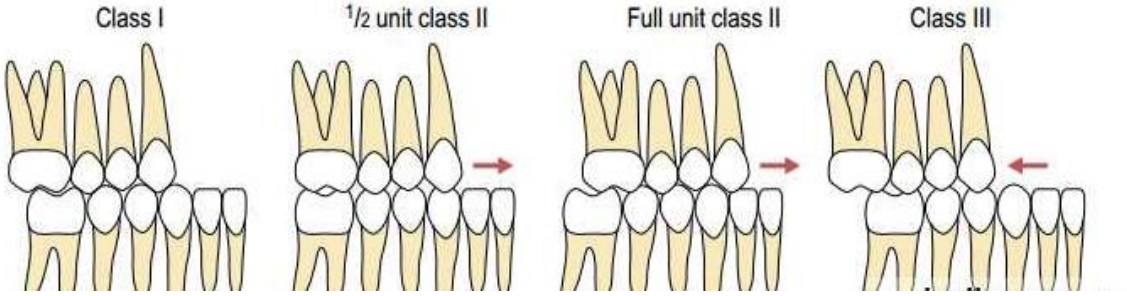


2) Inter-arch Malocclusion

These malocclusions are characterised by abnormal relationships between two teeth or groups of teeth of one arch to the other arch. These inter arch malocclusion can occur in sagittal plane, vertical plane and transverse plane.

A. Sagittal inter-arch discrepancies





B. Transvers interarch discrepancy (Cross bite)



C. Vertical discrepancies (Openbite and deepbite)



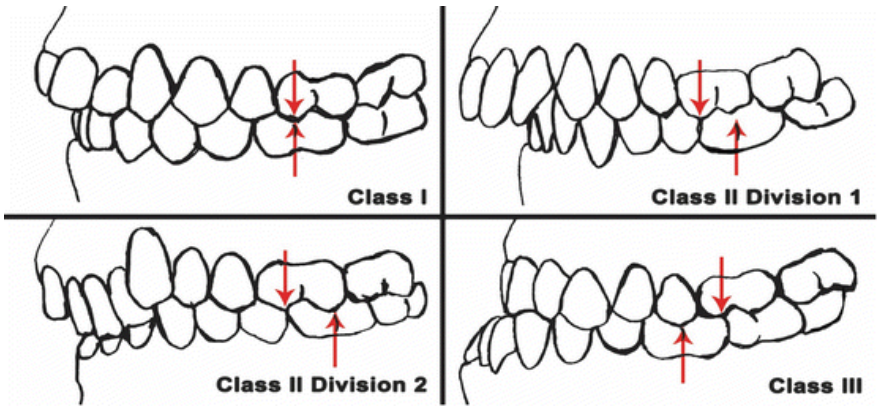
Openbite



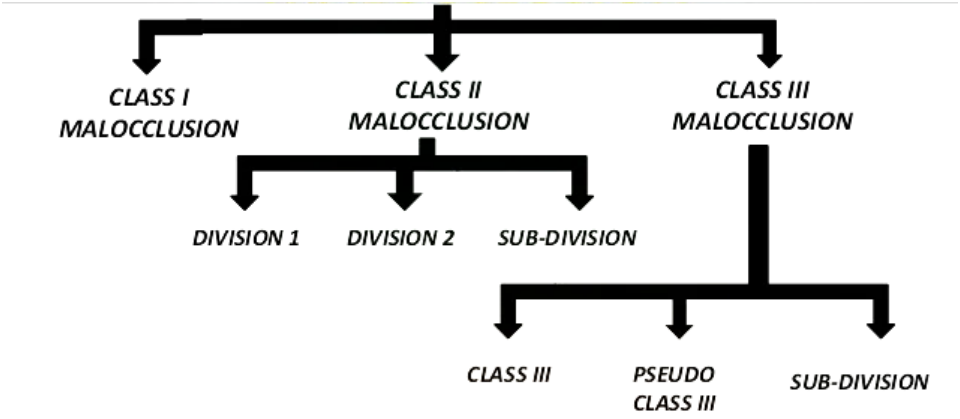
Deepbite

Angle Classification

Based on the relation of the buccal groove of the mandibular first molar and the mesiobuccal cusp of maxillary first molar.



Angle Classification of occlusion



Angle Class I Malocclusion

Characterized by normal anteroposterior molar relationship, which may be associated with transverse and/or vertical mal-relationships. The mesiobuccal cusp of the upper first molar occludes with the mesiobuccal groove of the lower first molar.



Angle's Class II Malocclusion

The mesiobuccal cusp of the maxillary first molar occludes anterior to the buccal groove of the mandibular first molar.

1. **Angle's Class II division 1 Malocclusion:** The anterior maxillary teeth are tilted forward or proclined, presenting a large overjet.



2. **Angle's Class II division 2 Malocclusion:** It has a pronounced horizontal growth pattern with decreased lower anterior facial height, retroclined upper anteriors, and significantly increased maxillary arch width parameters.



Angle's Class III Malocclusion

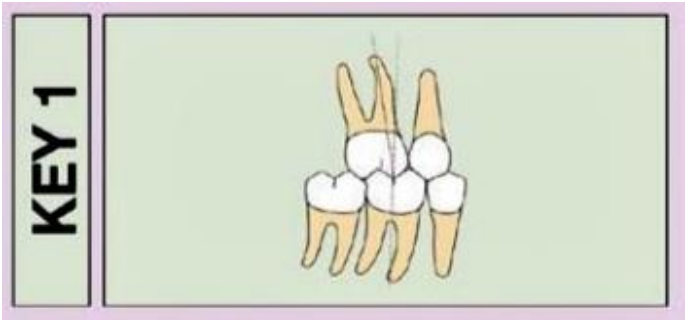
The mesiobuccal cusp of the maxillary first molar occluding posterior to the buccal groove of the mandibular first molar.



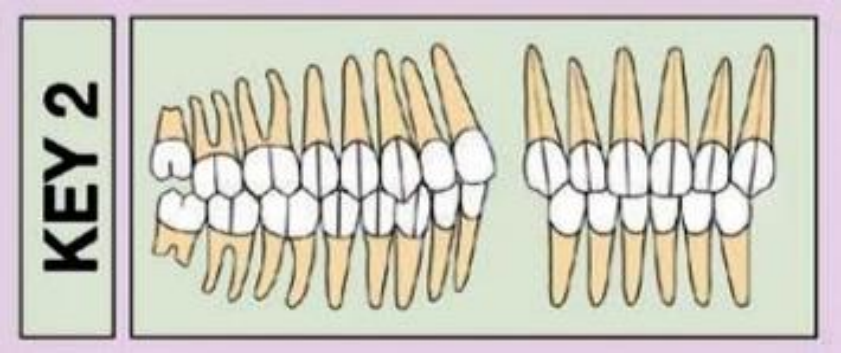
ANDREW'S SIX KEYS OF OCCLUSION

In 1972 Andrew's Six Keys of Occlusion to Normal occlusion can be best defined as the contact of the upper and lower teeth in the centric relationship. But the concept of "normal occlusion" is still not clear. Different authors defined normal occlusion but no single definition could be found as yet. The concepts, which are described here, are based on Lawrence Andrew's works on 120 nonorthodontic models based upon which he gave six keys to normal occlusion and developed the "straight wire appliance." These are:

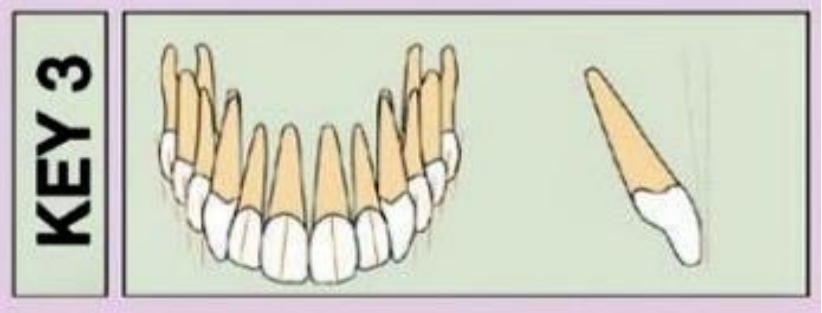
1. **KEY I Correct molar relationship.** The molar relationship should be such that the distal surface of the distal marginal ridge of the upper first permanent molar contacts and occludes with the mesial surface of the mesial marginal ridge of the lower second molar. Secondly, the mesiobuccal cusp of 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.



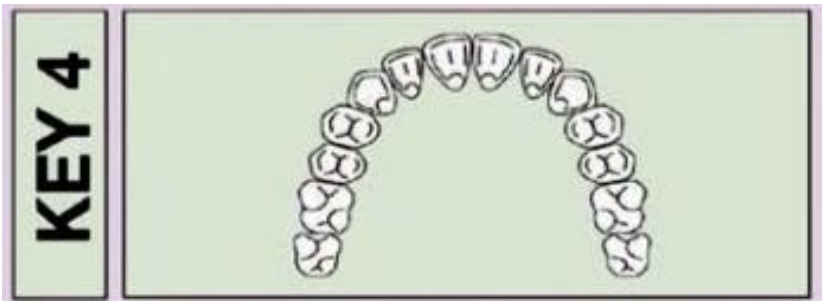
2. **KEY II Correct crown angulations:** The mesiodistal "tip". In normally occluded teeth, the gingival portion of the long axis (the line bisecting the clinical crown mesiodistally or the line passing through the most prominent part of the labial or buccaI surface of a tooth) of each crown is distal to the occlusal portion of that axis. The degree of tip varies with each tooth type.



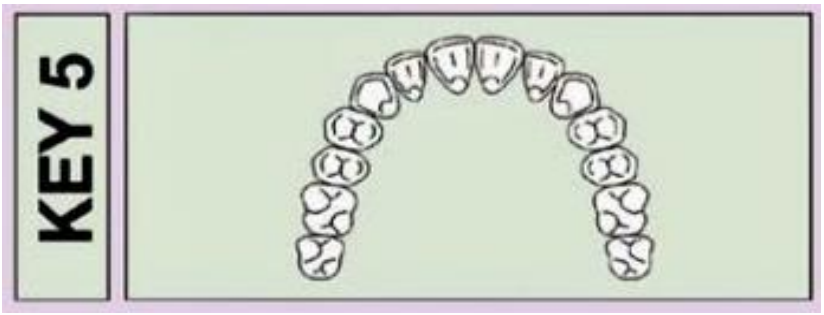
3. **Key III Correct crown inclination** i.e. Class I incisor relationship. The labiolingual or buccolingual, "torque". Crown inclination is the angle between a line 90 degrees to the occlusal plane, and a line tangent to the middle of the labial or buccal surface of the clinical crown. The crowns of 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 bicuspids. In the mandibular posterior teeth the lingual inclination progressively increases.



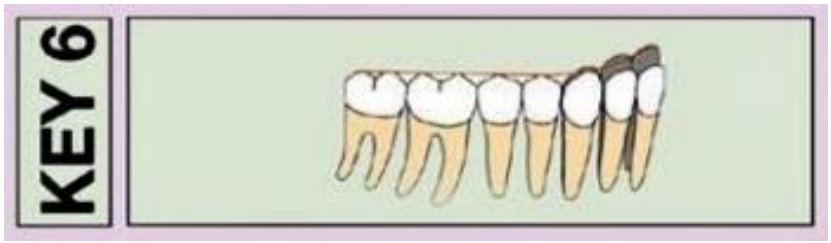
4. **KEY IV No rotation present.** Teeth should be free of undesirable rotations. If rotated, a molar or bicuspid occupies more space than it would normally. A rotated incisor can occupy less space than normal.



5. **KEY V Teeth in tight contact with no spacing**. In the absence of such abnormalities as genuine tooth-size discrepancies, contact points should be tight.



6. **KEY VI Occlusal plane or curve of Spee should be flat**. A flat occlusal plane is a must for stability of occlusion, no curve deeper than 1.5 mm is acceptable from a stand point of stability. A deep curve of Spee results in a more contained area for the Upper teeth, making normal occlusion impossible.



7. Bannet & McLanghlan's add **KEY VII No tooth size discrepancies**.

Advantages of Angle classification

1. Easy
2. No instrument is needed
3. Useful for teaching and research

Limitation of Angle classification

1. Sagittal dimension only
2. Not applicable with missing 1st molar
3. Not applicable in deciduous dentition
4. Skeletal problems are not considered

British Classification of Incisor relationship

1. CLASS I INCISOR RELATIONSHIP

The lower incisor edges occlude with or lie immediately below the cingulum plateau of upper central incisors.

2. CLASS II INCISOR RELATIONSHIP

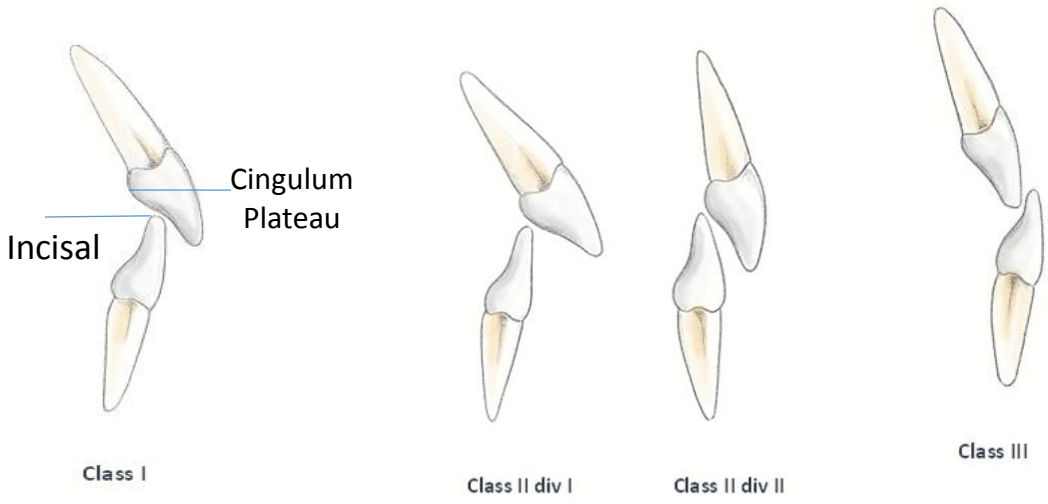
The lower incisor edges lie posterior to the cingulum plateau of the upper incisors. There are two sub-divisions:

DIVISION 1: The upper central incisors are proclined or of average inclination & there is an increase in overjet.

DIVISION 2: The upper central incisors are retroclined. The overjet is usually decreased.

CLASS III INCISOR RELATIONSHIP

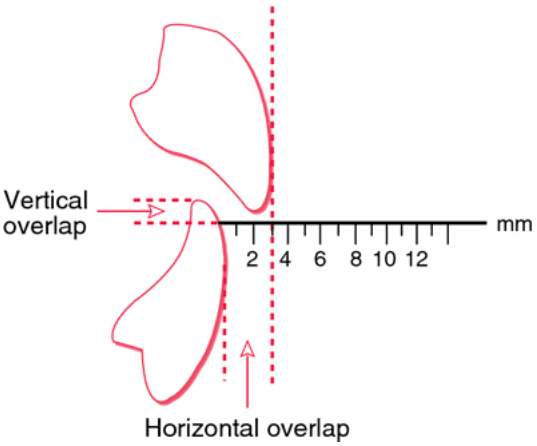
The lower incisor edges lies anterior to the cingulum plateau of the upper incisors. The overjet is reduced or reversed.



How to measure Overjet and overbite?

Overjet: The distance from the most prominent point on the incisal edge of the upper central incisors to the labial surface of the lower central incisors, measured parallel to the upper occlusal surface. The normal range of overjet is considered as 2-4 mm.

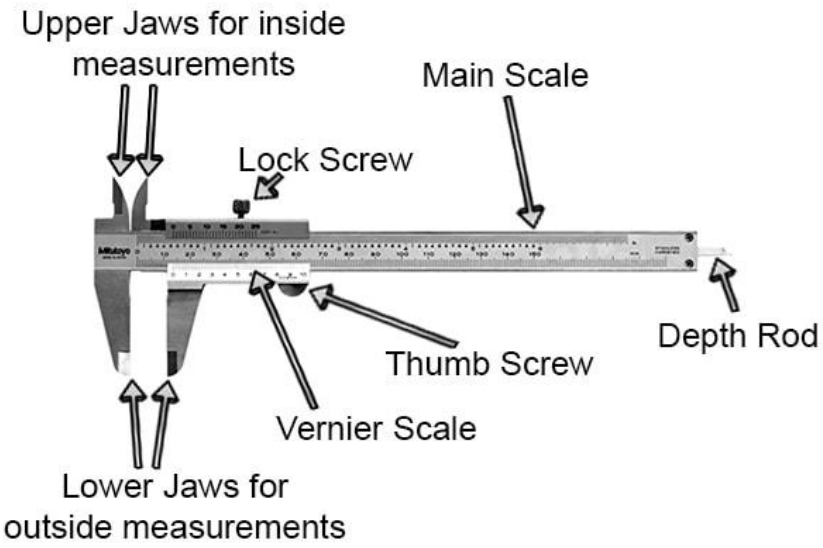
Overbite: Vertical overlap of the central incisors. The incisal edge of the maxillary central incisor with the greatest degree of overlap was projected onto the labial surface of the mandibular central incisor parallel to the upper occlusal surface and marked with a sharp pencil and the distance was measured. The normal range is approximately 1–3 mm overbite. Due to differences in the crown lengths of the incisors, normal overbite is about 30% or one third of the clinical crown height of the mandibular incisors.



Vernier calipers

It was first designed by a French mathematician, Pierre Vernier. Its idea was first conceived at Vernier in southern Germany. It is a measuring apparatus that consists of a fixed jaw primary scale and a sliding jaw with a Vernier connected. Vernier calipers are used to measure the distance between two parts of an object. It can measure the internal and external dimensions and even the height of an object with accuracy. It can measure up to one-hundredth of a millimeter. Main scale - can read up till 1mm. Vernier scale - length of 10 divisions is equal to length of 9 divisions on the main scale.

Least count = 1mm/10 = 0.1 mm = 0.01 cm.



Canine Relationship

Class I Canine Relationship

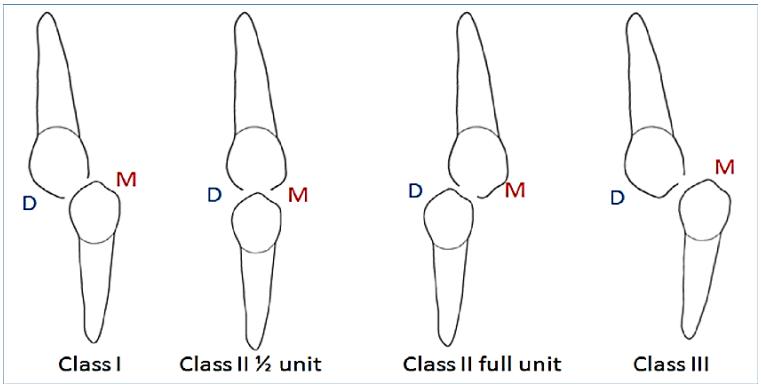
When the mesial slope of upper canine coincides with the distal slope of lower canine.

Class II Canine Relationship

When the mesial slope of upper canine is ahead of the distal slope of lower canine.

Class III Canine Relationship

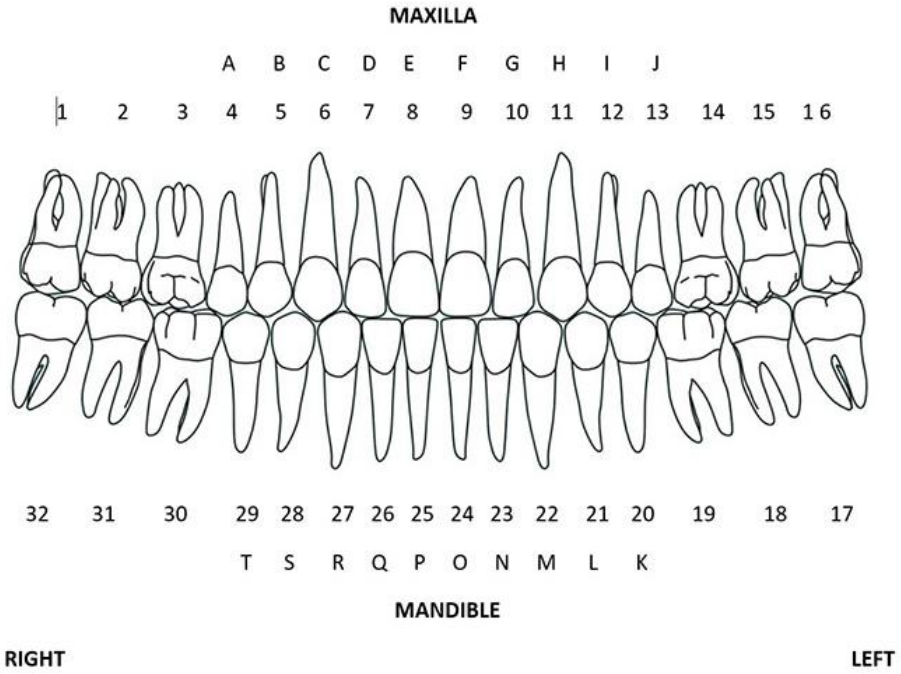
When the mesial slope of the upper canine lies behind the distal slope of the lower canine.



Numbering System

1. **Universal numbering system table "American system"**

The numbers 1 - 32 are used for permanent teeth and the uppercase letters A through T are used for primary teeth.



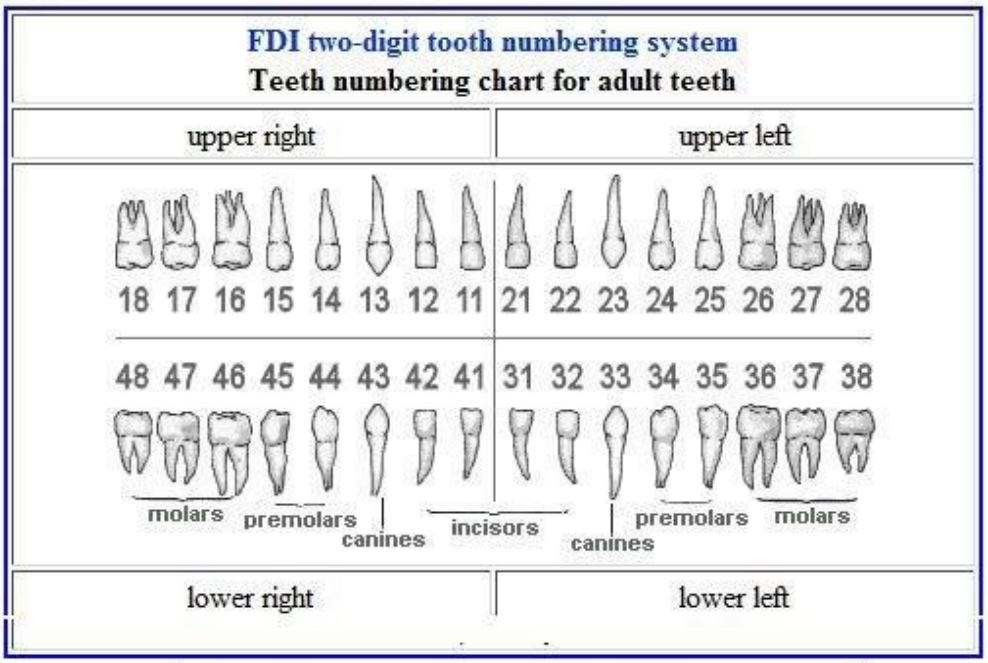
2. International or FDI Dental Numbering system

The FDI two-digit system helps to prevent errors when differentiating between right and left sides of the mouth or between upper and lower dental arches. It also has advantages when typing and is capable of being incorporated in computer languages. The first number identifies the quadrant

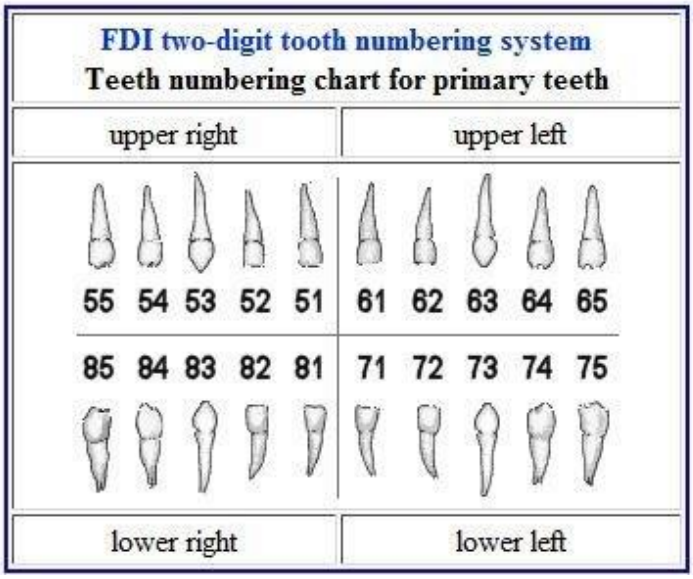
The upper right is Quadrant #1, the upper left is Quadrant #2, the lower left is Quadrant #3, the lower right is Quadrant #4

Deciduous teeth (primary teeth) follow the same system: Quadrants #5, #6, #7, #8. The second number identifies the tooth

Adults

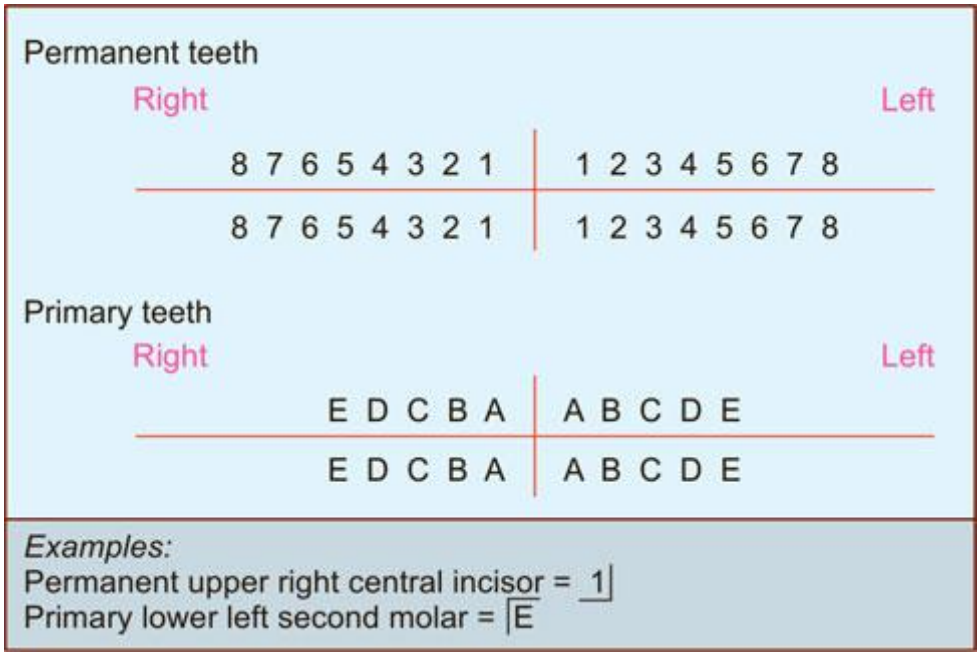


Children



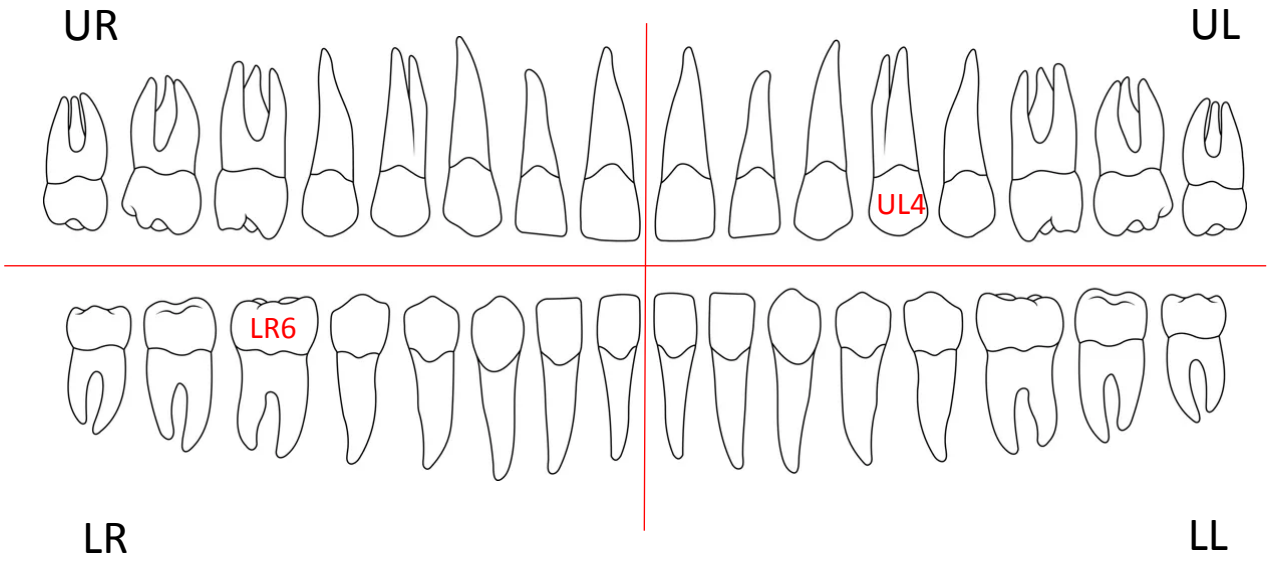
3. Palmer notation method

Consists of a symbol (┘ └ ┐ ┌) which designates the quadrant of the tooth and a number which indicates the position from the midline. Adult teeth are numbered 1 to 8, with primary or baby teeth indicated by letters A through E.



4. Letters and numbers system

The teeth were numbered by quadrants, 1-8 for permanent and A-E for deciduous, both starting at the midline (upper right, upper left, lower right, lower left or UR, UL, LR, LL).



Clinical Examination of the Dentition

The dentition is examined for:

1. **The dental status**:

- **Number of teeth** present, un-erupted or missing or there is an extra teeth (supernumerary teeth).
- **Position of the teeth** (normal, Buccaly or lingualy positioned, rotated, transpositioned and proclined and retroclined).
- **Non carious lesions**, including **tooth wearing** which could result from erosion, attrition (bruxism) or abfrction. **Cracks** have been assist by using a mirror with reflecting light.
- **White spot lesions (WSLs)**: White lesions on the enamel are classified into
    a. ***Non Carious lesion*** which either *dental Fluorosis* (accumulation of fluoride during enamel development) or *opacities* (enamel hypomineralisation, injury or infection of primary teeth)
    b. ***Carious white spot Lesions*** (Milky opacity): Demineralisation or decalcification of the enamel surface adjacent to fixed orthodontic appliances or around cervical area. 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. Diagnosis of WSLs could be done by 1. Light refraction through enamel 2. Visually white opacities



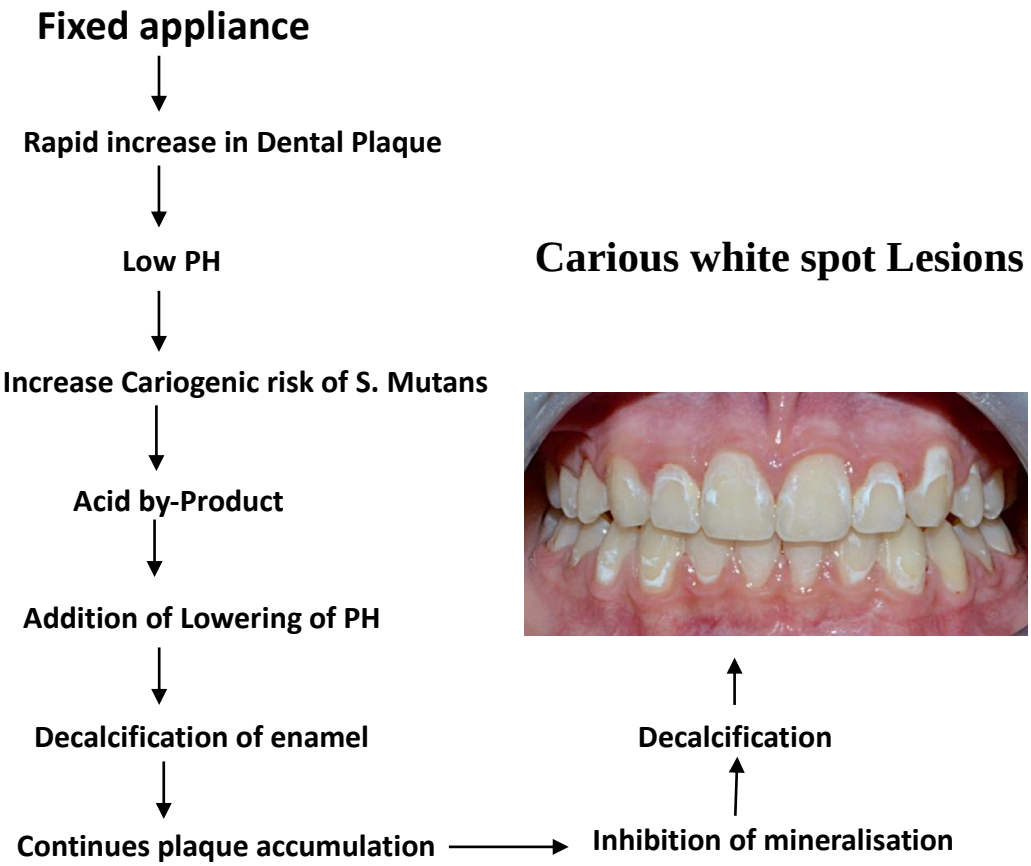
Dental Fluorosis



Enamel hypomineralisation



Carious white spot



Risk factors for WSLs:

1. Inadequate oral hygiene.
2. Inappropriate diet (refined sugar, frequent snacks).
3. History of recent caries lesions or high DMFS.
4. Lack of adjunctive preventive measures (fluoride or antibacterial exposure, xylitol, calcium – derived supplements).
5. Orthodontic treatment time (fixed appliances) > 36 months.

Diagnosis of WSLs:

1. The WSL'S chalky appearance is an optical phenomenon caused by mineral loss in the subsurface and the surface of the enamel.
2. Visual Enamel Opacity on Wet and dry surface- Porous enamel scatters more light than sound enamel.
3. Fluorescence methods – Infra-red Fluorescence.
4. DIAGNOdent – Laser.

Location

Cervical and middle third of the crowns

- 1st Molars, maxillary lateral incisors, mandibular incisors and canines.

- Mainly on the vestibular surfaces



Appearance: Differential Diagnosis of WSLs carious versus non carious Lesions

- Carious lesions: Rough, Opaque, and Porous appearance
- Non carious lesions: Smooth & Shiny appearance



Non carious lesions



Carious lesions

Treatment of WSLs

- About 75 % of the small lesions will regress during 6 months after debonding of the orthodontic appliance because of improved oral hygiene, the available minerals in saliva
- Daily Brushing with Fluoridated toothpaste (NaF over 1000 ppm), Duraphat 5000 ppm
- Fluoridated mouth rinses (NaF 0.05 or 0.2)
- Fluoride Varnishes (NaF 0.05 or 0.2), Enamel demineralisation decrease 44.3%, every 3 months then every 6 months

Action of Fluoride

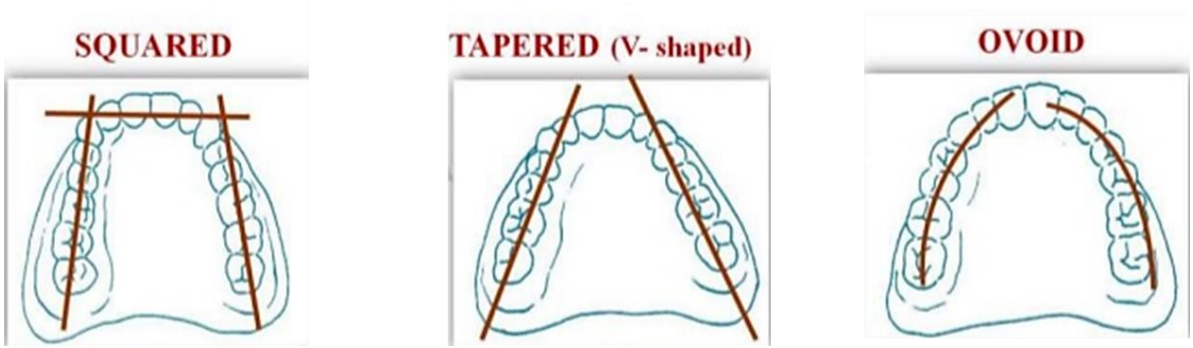
- Inhibits demineralization
- Enhances remineralization
- Inhibits plaque bacteria
- Prevention of WSLs

2. Dental & Occlusal Anomalies

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 dental malocclusion

- **Sagittal plane**: Check whether molar relation is Class I, II or III.
- **Vertical plane**: Overjet 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.
- **Midline** of the face and its coincidence with the dental midline should be examined. The facial midline is defined by the landmark such as nose, philtrum, and chin aligned in a straight line. It should be in the center of the face and should coincide with the dental midline. The dental midline is the mid-sagittal of maxillary and mandibular arches when teeth are in maximum intercuspation.
- **Individual tooth irregularities**, e.g. rotations, displacement fractured tooth.
- **Shape and symmetry** of upper and lower arches.



4. Assessment of Periodontal health

Basic Periodontal Examination (BPE): The BPE is a simple and rapid screening tool that is used to indicate the level of further examination needed and provide basic guidance on treatment needed. These BPE guidelines are not prescriptive but represent a minimum standard of care for initial periodontal assessment. BPE should be used for screening only and should not be used for diagnosis.

How to record the BPE

1. The dentition is divided into 6 sextants and the highest score for each sextant is recorded:

Upper right (4,5,6,7)

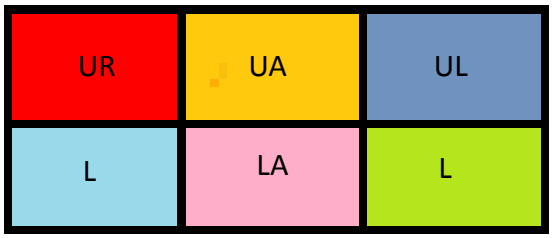
Lower right (4,5,6,7)

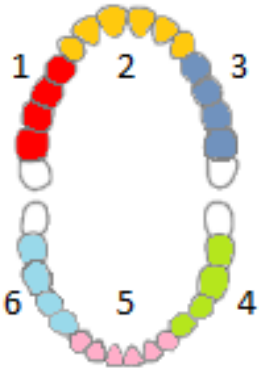
Upper anterior (3,2,1,1,2,3)

Lower anterior (3,2,1,1,2,3)

Upper left (4,5,6,7)

Lower left (4,5,6,7)





2. All teeth in each sextant are examined (with the exception of 3rd molars unless 1st and/or 2nd molars are missing).

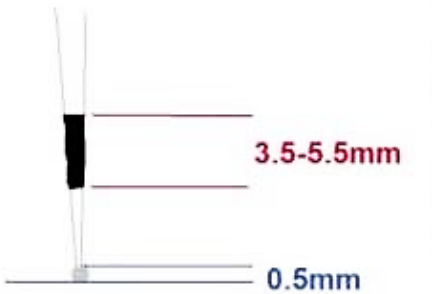
3. For a sextant to qualify for recording, it must contain at least 2 teeth.

4. A World Health Organisation (WHO) BPE probe is used. This has a 'ball end' 0.5 mm in diameter and a black band from 3.5mm to 5.5mm. Light probing force should be used (20-25 grams).

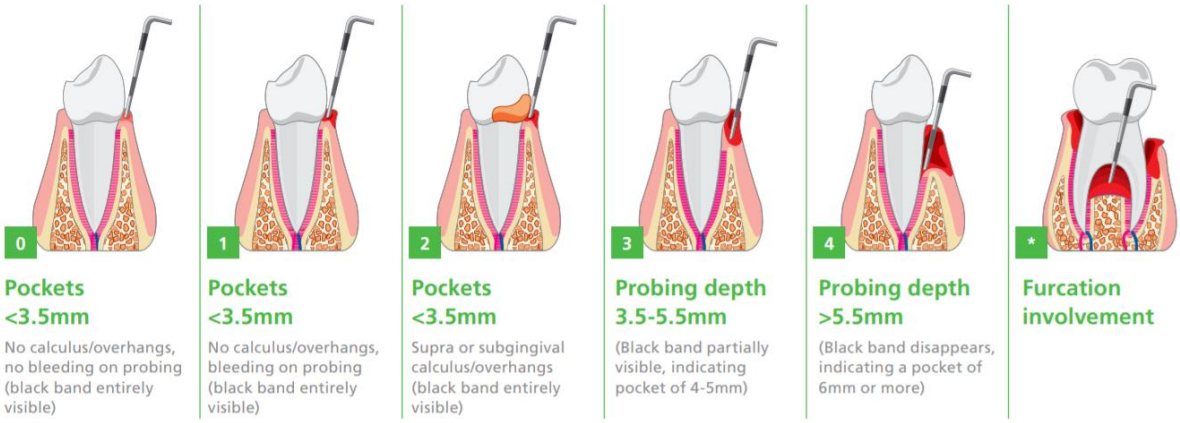
5. The probe should be 'walked around' the teeth in each sextant. All sites should be examined to ensure that the highest score in the sextant is recorded before moving on to the next sextant. If a code 4 is identified in a sextant, continue to examine all sites in the sextant. This will help to gain a fuller understanding of the periodontal condition and will make sure that furcation involvements are not missed.

WHO BPE Probe

- **Ball end = 0.5 mm**
- **Silver band = 0.5-3.5 mm**
- **1st black = 3.5-5.5 mm**
- **Pressure of 20-25 g**



BPE Score	Criteria
0	No bleeding on probing (BOP), no pocket depths greater than 3.5 mm, no calculus/overhangs
1	BOP, no pocket depths greater than 3.5 mm, no calculus/overhangs
2	Plaque retentive factors present, eg calculus or overhangs, no pocket depths greater than 3.5 mm
3	Pocket depths between 3.5 mm and 5.5 mm
4	Pocket depths greater than 5.5 mm
*	Furcation involvement



5. 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 aetiology 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: two cephalograms 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.

1. Laterognathy or true crossbite: the centre of the mandible and the facial midline do not coincide in rest and in occlusion.
2. 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.

6. 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 II div 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.

Temporo-mandibular joint dysfunction (TMD) and Orthodontics

The aetiology and management of TMD has caused considerable controversy in all branches of dentistry. TMD comprises a group of related disorders with multifactorial aetiology including psychological, hormonal, genetic, traumatic, and occlusal factors.

Studies suggests that depression, stress, and sleep disorders are major factors in the aetiology of TMD and that parafunctional activity, for example bruxism, can contribute to muscle pain and spasm. Some authors suggested that minor occlusal imperfections can lead to abnormal paths of closure and/or bruxism, which then result in the development of TMD; however if this were the case, a much higher prevalence of TMD would be expected to reflect the level of malocclusion in the population.

The role of orthodontics in TMD has been extensively debated, with some authors claiming that orthodontic treatment can cause TMD, while others advocate appliance therapy to manage TMD. After considerable discussion in the literature, the consensus view is that orthodontic treatment, either alone or in combination with extractions, cannot be reliably shown to either 'cause' or 'cure' TMD. The alleged success of a wide assortment of treatment modalities for TMD highlights both the multifactorial aetiology and the self-limiting nature of the condition. Given this, conservative and reversible approaches are advised to manage TMD in the first instance. It is advisable to carry out a TMD screen for all potential orthodontic patients, including questions about symptoms, examination of the temporo-mandibular joint and associated muscles, and a record of the range of opening and movement.

Therefore, if patients present with signs/symptoms of a TMD condition, clinicians will be faced with two choices. They can either manage the TMD problem for this patient prior to initiating prolongs interventions, or they may refer to a colleague with expertise in the field of TMD and orofacial pain. If the choice is made to manage this individual, then it should be done in accordance with currently accepted guidelines for TMD diagnosis and treatment.

The history portion of a TMD assessment should be similar to that conducted by all dental practitioners.

1) **Chief complaint**

The chief complaints as presented in the patient's own words. These complaints should be documented in the order of severity as expressed by the patient, and details of each complaint are elicited in a systematic manner. This is then followed by the history of the chief complaint which should include such information as the location of the pain(s), date of onset, event onset (spontaneous or stimulus induced), quality, frequency, duration, and intensity.

2) **A TMD Screen Examination**

The screening examination should include the palpation of facial muscle, and the TMJs as well as observations of jaw movement.

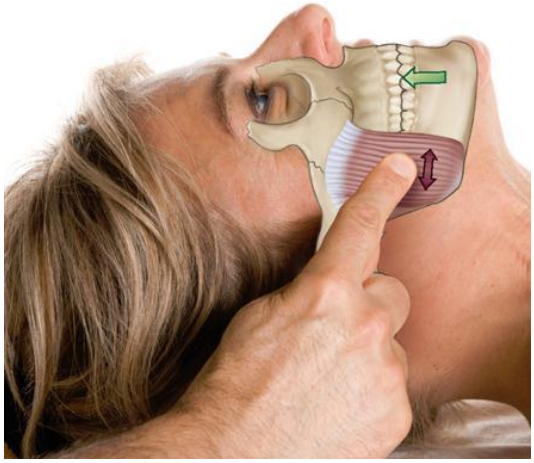
Muscle Palpation

Several important muscles of the masticatory system are palpated for pain or tenderness during the screening examination. The temporalis and masseter muscles are palpated bilaterally. Palpation of the muscle is accomplished mainly by the palmar surface of the middle finger, with the index finger and forefinger testing the adjacent areas. Soft but firm pressure is applied

to the designated muscles, the fingers compressing the adjacent tissues in a small circular motion. A single firm thrust of 1 or 2 seconds duration is usually better than several light thrusts. During palpation, the patient is asked whether it hurts or is just uncomfortable.



Palpation of the temporalis



Palpation of the masseter muscle

Temporomandibular Joint Palpation

The TMJs are examined for any signs or symptoms associated with pain and dysfunction. Pain or tenderness of the TMJs is determined by digital palpation of the joints when the mandible is both stationary and during dynamic movement, fingertips are placed over the lateral aspects of both joint areas simultaneously. The patient is asked to report any symptoms, once the symptoms are recorded in a static position, the patient opens and closes, and any symptoms associated with this movement are recorded. As the patient opens maximally, the fingers should be rotated slightly posteriorly to apply force to the posterior aspect of the condyle. Posterior capsulitis and retrodiscitis are clinically evaluated in this manner.

Joint sounds are recorded as either clicks or crepitation. A click is a single sound of short duration. If it is relatively loud, it is sometimes referred to as a pop. Crepitation is a multiple, gravel-like sound described as “grating” and “complicated.” A more careful examination can be performed by placing a stethoscope over the joint area. Not only should the character of any joint sounds be recorded (clicking or crepitation), but also the degree of mouth opening associated with the sound. Of equal importance is whether the sound occurs during opening or closing or can be heard during both these movements.



Palpation of TMJ in closed, opened and fully opened mouth position.

Range of Mandibular Movement

A screening examination should also include evaluation of the patient's range of mandibular movement. The normal range of mouth opening when interincisally measured is between 53 and 58mm. Even a 6-year-old child can normally open a maximum 40mm or more. The patient is asked to open slowly until pain is first felt . At that point, the distance between the incisal edges of the maxillary and mandibular anterior teeth is measured. This is the maximum comfortable opening. The patient is next asked to open the mouth maximally. This is recorded as the maximum opening. In the absence of pain, the maximum comfortable opening and maximum opening are the same. A restricted mouth-opening is considered to be any distance less than 40mm. Only 1.2% of young adults open less than 40mm. Less than 40mm of mouth opening, therefore, seems to represent a reasonable point to designate restriction; however, one should always consider the patient's age and body size. The patient is next instructed to move his mandible laterally. A lateral movement less than 8mm is recorded as a restricted movement. Protrusive movement is also evaluated in a similar manner.



Measuring the amount of mouth opening and lateral eccentric movement.