

GOOD AFTERNOON



ANCHORAGE

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INTRODUCTION

An important aspect of treatment is maximizing the tooth movement that is desired, while minimizing undesirable side effects

In planning orthodontic therapy, it is simply not possible to consider only the teeth whose movement is desired, reciprocal effects throughout the dental arches must be carefully analyzed, evaluated & controlled.

EVERY ACTION HAS EQUAL AND
OPPOSITE REACTION !!!.....



DEFINITIONS :

Moyers :

- ▶ “ Resistance to displacement.”
- ▶ Active elements and reactive elements.

T.M. Graber :

- ▶ “The nature and degree of resistance to displacement offered by an anatomic unit when used for the purpose of effecting tooth movement.”

DEFINITIONS :

Proffit :

- ▶ “Resistance to unwanted tooth movement.”
- ▶ “Resistance to reaction forces that is provided (usually) by other teeth, or (sometimes) by the palate, head or neck (via extraoral force), or implants in bone.”

DEFINITIONS :

Nanda :

- ▶ **“The amount of movement of posterior teeth (molars, premolars) to close the extraction space in order to achieve selected treatment goals.”**

CLASSIFICATIONS:

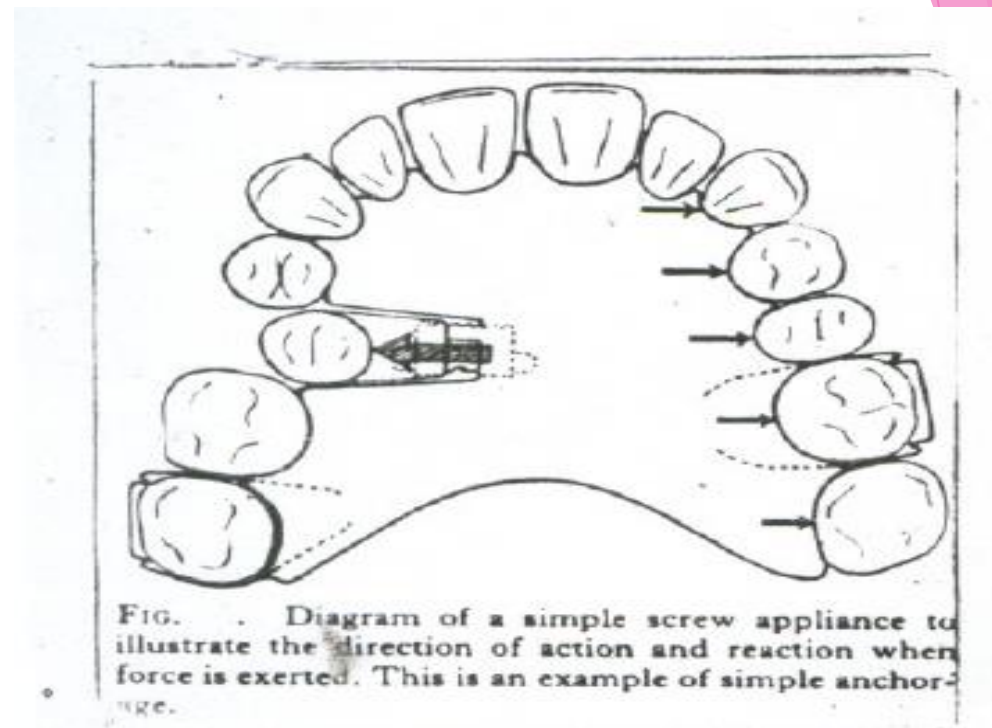
Moyers :

- ▶ According to the manner of force application:

1. Simple anchorage :

Resistance to tipping.

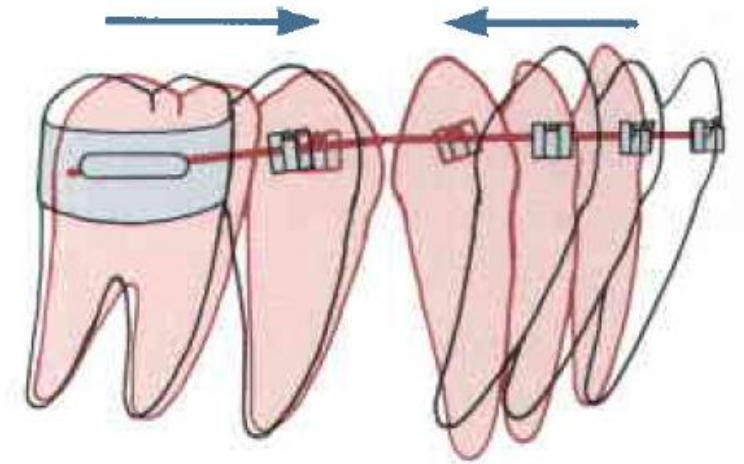
- ▶ Simple anchorage is the dental anchorage in which the manner and application of force tends to change the axial inclination of the tooth or teeth that form the anchorage unit



2. Stationary anchorage :

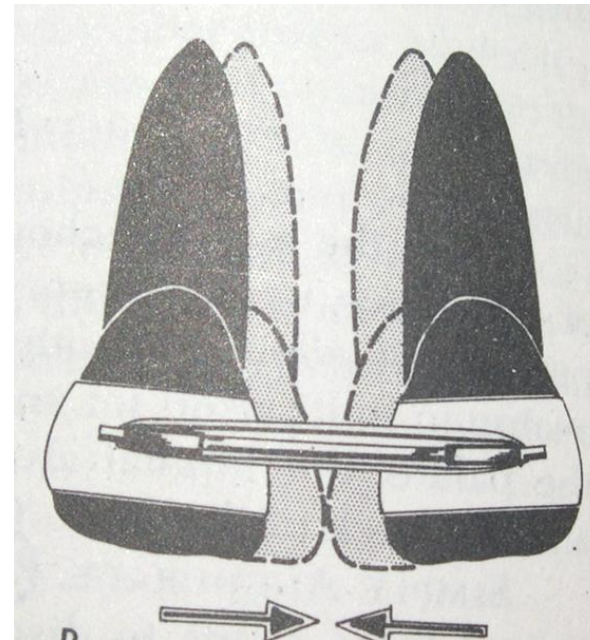
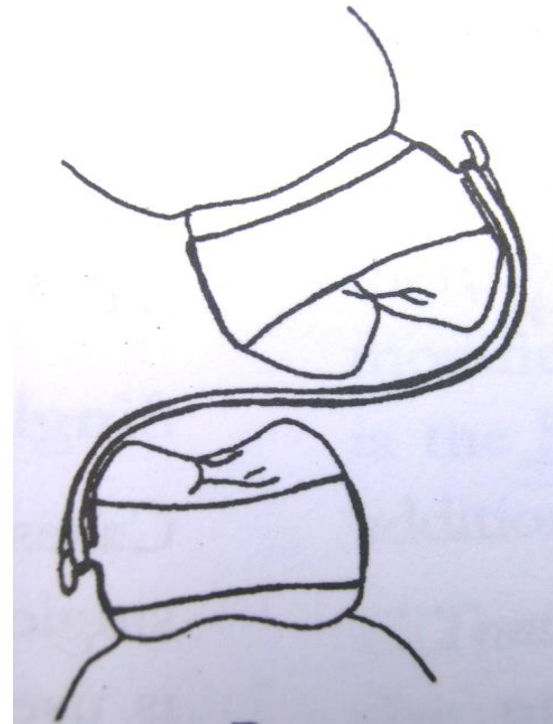
Resistance to bodily movement.

- ▶ Dental anchorage in which the manner and application of force tends to displace the anchorage unit bodily is called stationary anchorage.
- ▶ In simple words, resistance to bodily movement is called stationary anchorage.
- ▶ A classical example for stationary anchorage is the retraction of maxillary incisors using the molars as the anchor teeth.



CLASSIFICATIONS:

3. **Reciprocal anchorage :**
Two or more teeth moving in opposite directions and pitted against each other by the appliance.

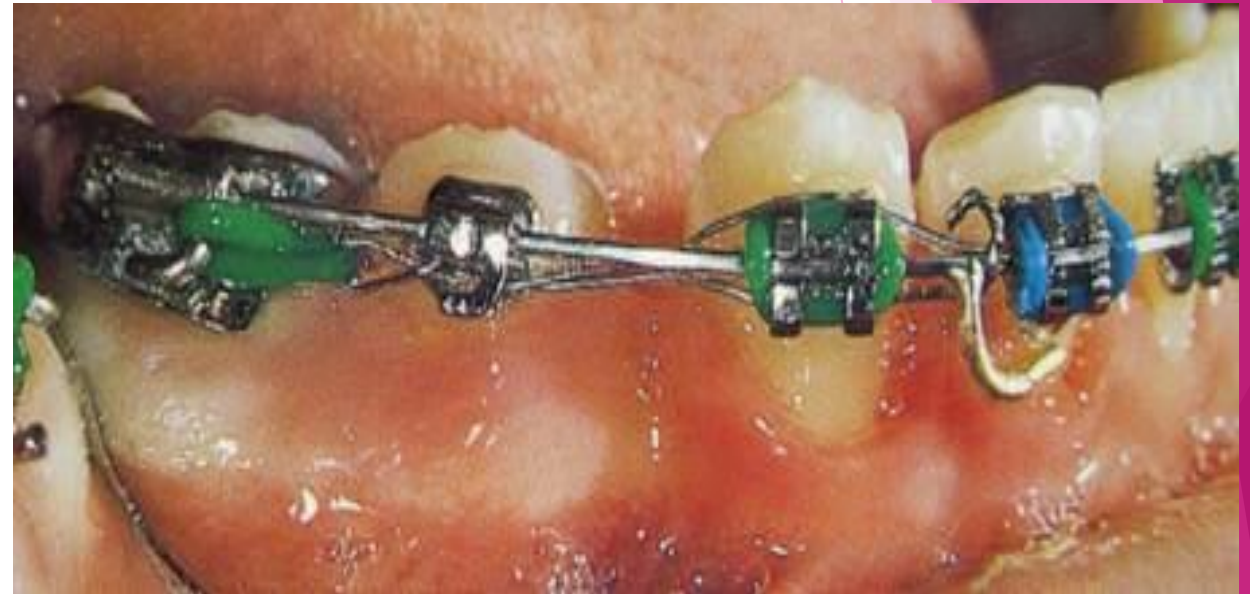


CLASSIFICATIONS:

Moyers :

- ▶ According to the jaws involved:

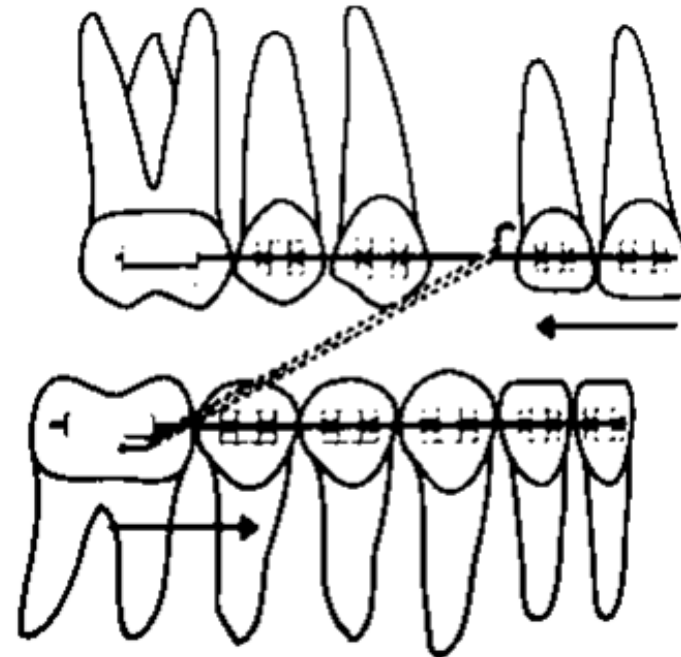
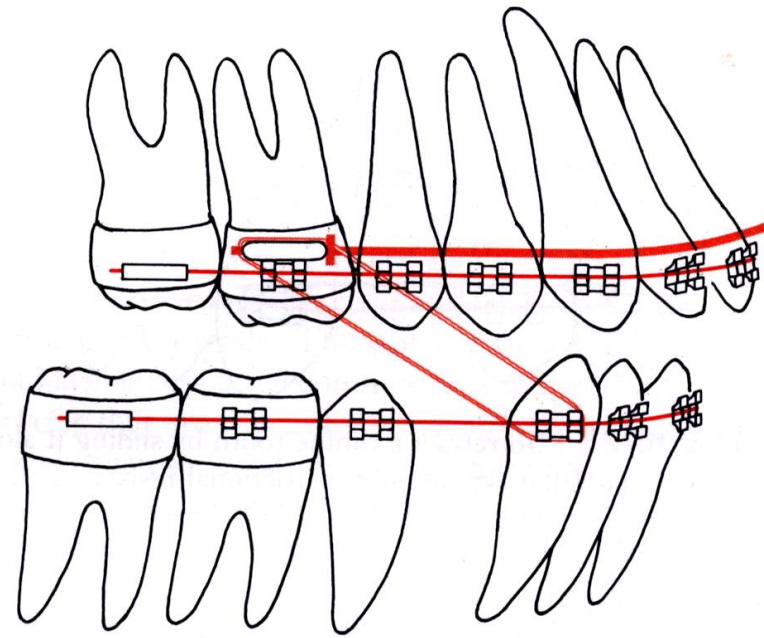
1. Intra maxillary :
Anchorage established in the same jaw.



CLASSIFICATIONS:

2. Inter maxillary :
Anchorage distributed
to both jaws.

Baker's anchorage (1904)



CLASSIFICATIONS:

Moyers :

▶ **According to the site of anchorage:**

1. Intra oral :

Anchorage established within the mouth.

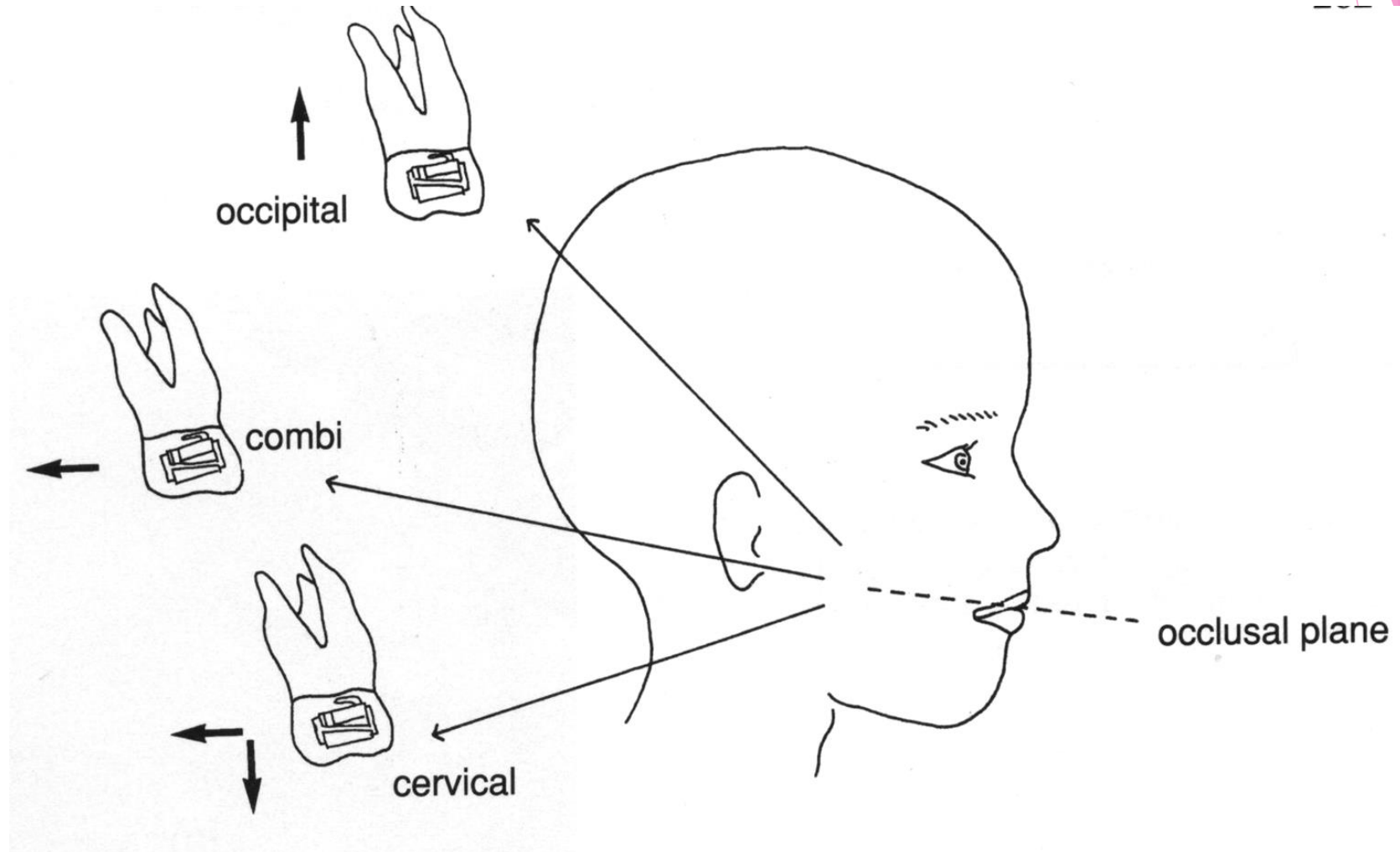
CLASSIFICATIONS:

2. Extra oral :

Anchorage obtained outside the oral cavity.

- a.) Cervical : eg. neck straps
- b.) Occipital : eg. Head gears
- c.) Cranial : eg. High pull headgears
- d.) Facial : eg. Face masks

CLASSIFICATIONS:



CLASSIFICATIONS:

3. Muscular :
- Anchorage derived from action of muscles.
- eg. Vestibular shields, lip bumper



CLASSIFICATIONS:

Moyers :

▶ According to the number of anchorage units :

1. Single or primary anchorage:

Anchorage involving only one tooth.

2. Compound anchorage:

Anchorage involving two or more teeth.

CLASSIFICATIONS:

- 3. Reinforced anchorage:**
Addition of non dental anchorage sites.
eg. Mucosa, muscle, head, etc.

CLASSIFICATIONS:

Nanda :

- ▶ **Type A anchorage : *critical / severe***
75 % or more of the extraction space is needed for anterior retraction.
- ▶ **Type B anchorage : *moderate***
Relatively symmetric space closure (50%)
- **Type C anchorage : *mild / non critical***
75% or more of space closure by mesial movement of posterior teeth

CLASSIFICATIONS:

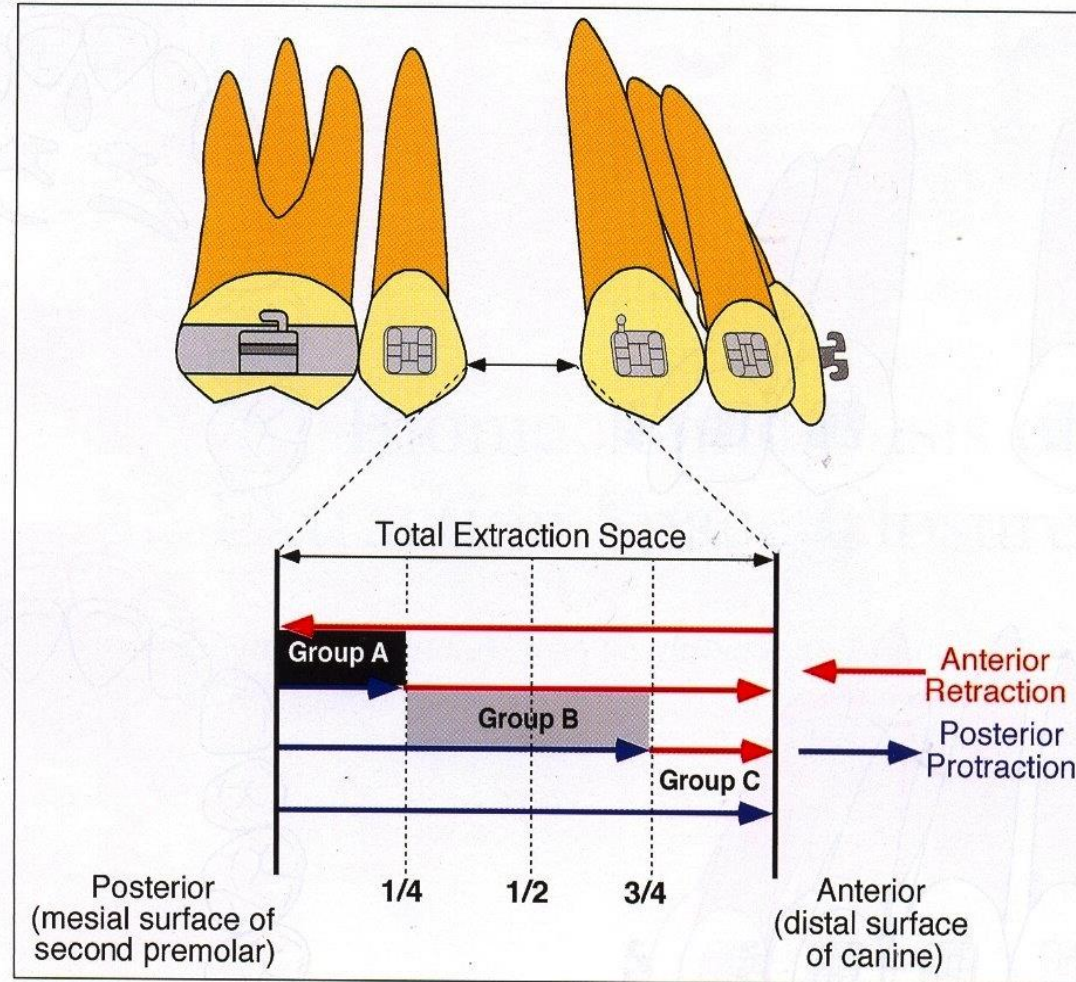
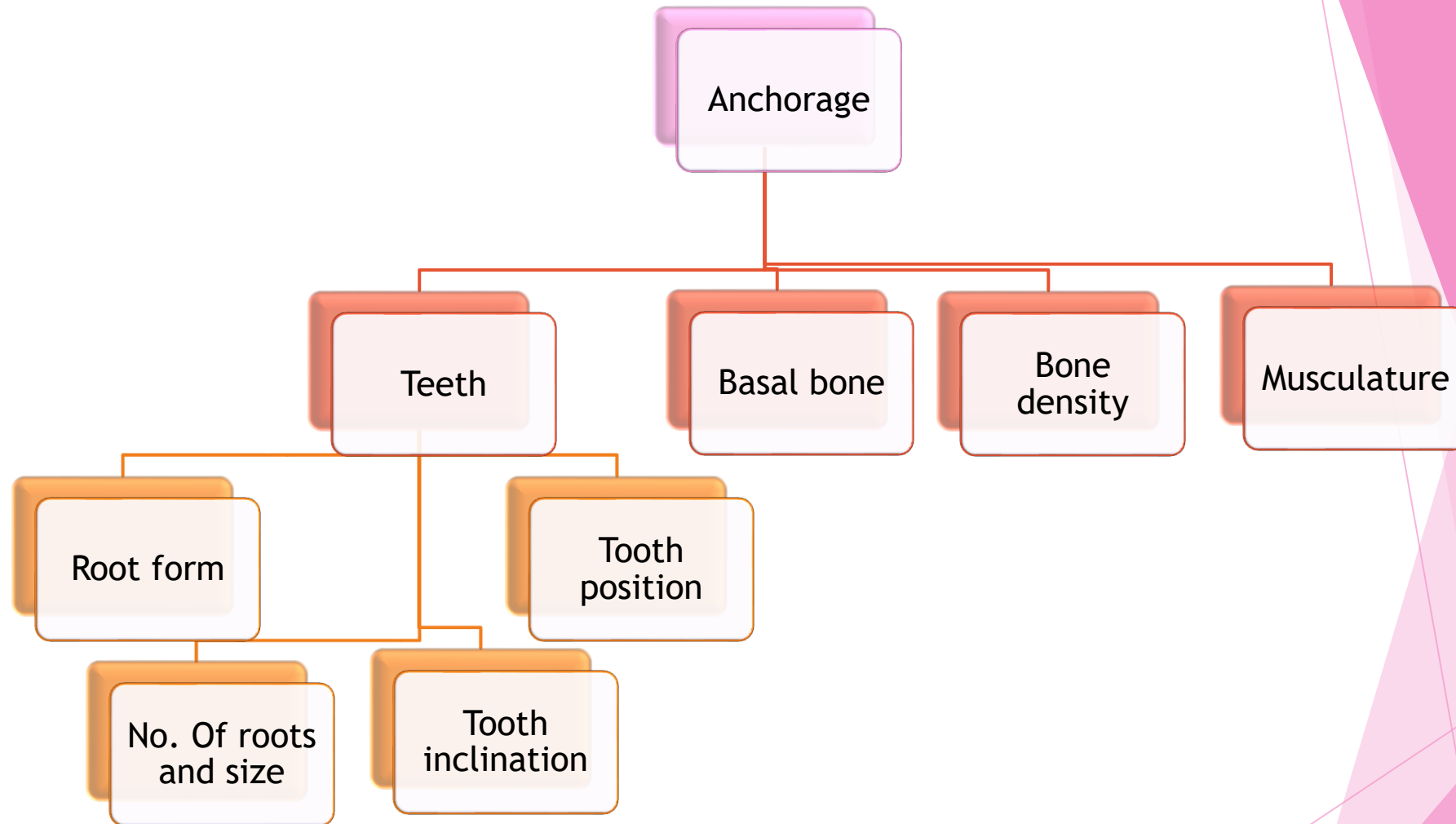


Fig. 10-2 Anchorage classification. Dividing the total extraction space into quarters aids in visualizing the anchorage classification. The shaded areas represent the final position of the interproximal contact between the canine and premolar. Group A space closure includes 100% (no posterior anchorage loss) to 75% anterior retraction (25% of space closure from posterior anchorage movement). Group B space closure includes more equal amounts of anterior and posterior tooth movement. Group C space closure includes 75–100% posterior protraction.

BIOLOGICAL ASPECTS OF ANCHORAGE :

Factors affecting anchorage:

- ▶ Number of roots
- ▶ Shape, size and length of each root
- ▶ multirooted > single rooted
 - longer rooted > shorter rooted
 - triangular shaped root > conical or ovoid root
 - larger surface area > smaller surface area



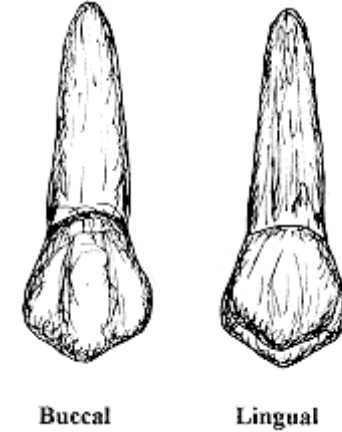
Teeth

Root

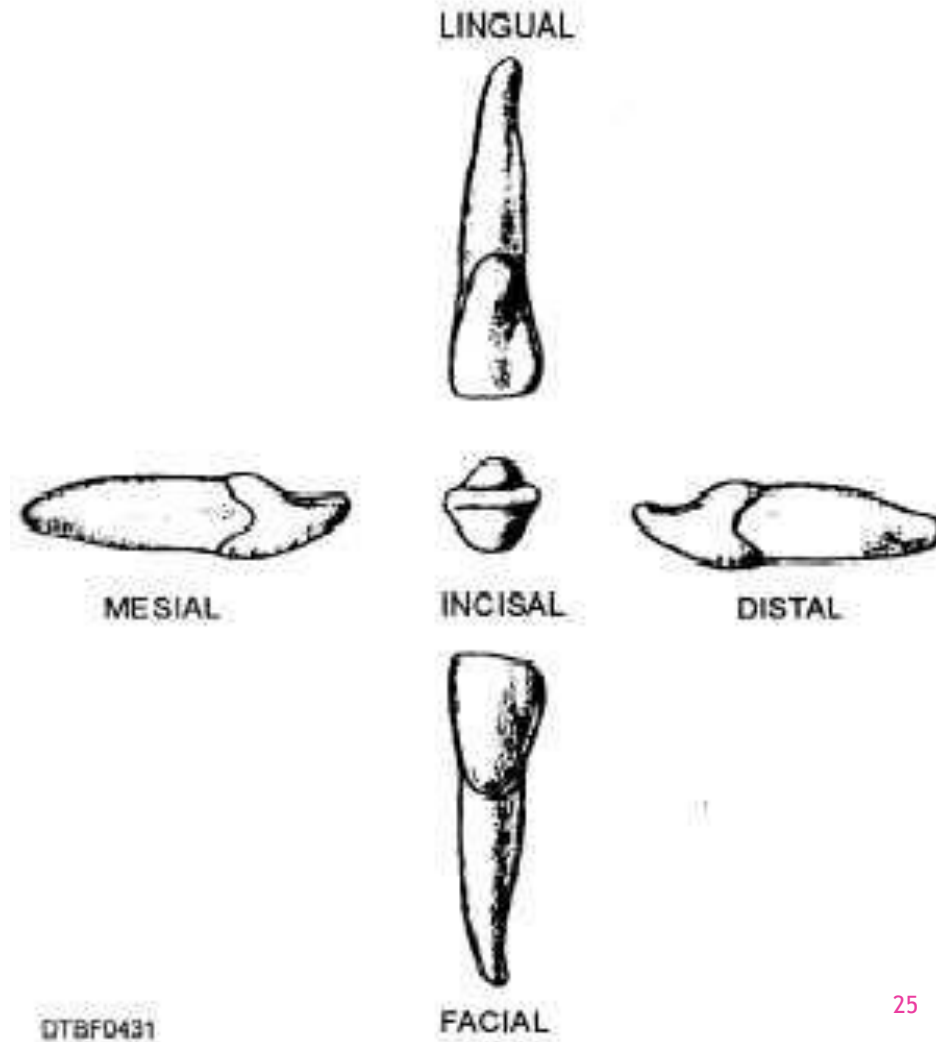
Root form:-

(a) Round

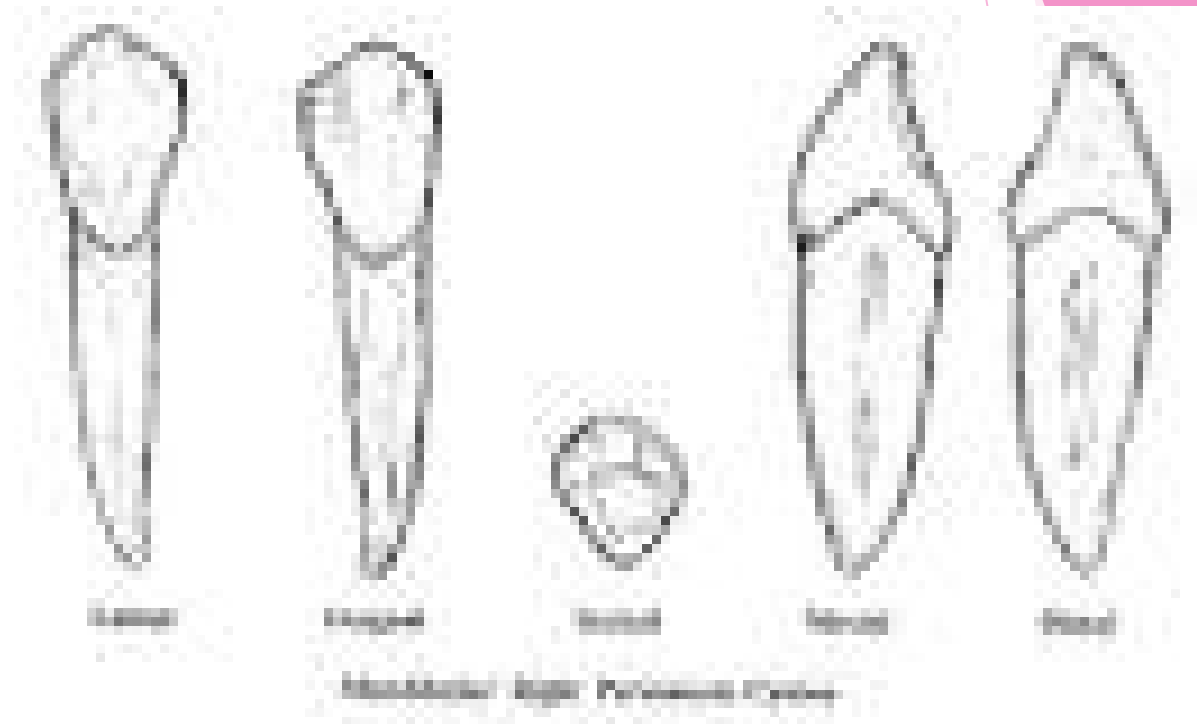
Eg : Roots of bicuspid, palatal roots of maxillary molars



(b) Flat: Mandibular incisors, Mandibular molars, buccal roots maxillary molars



**(c) Triangular roots: Eg :
Maxillary canines,
Maxillary central
incisors, and to a lesser
degree, maxillary
laterals**



Size And Number of Roots

“Anchorage value” of any tooth is roughly equivalent to its root surface area.

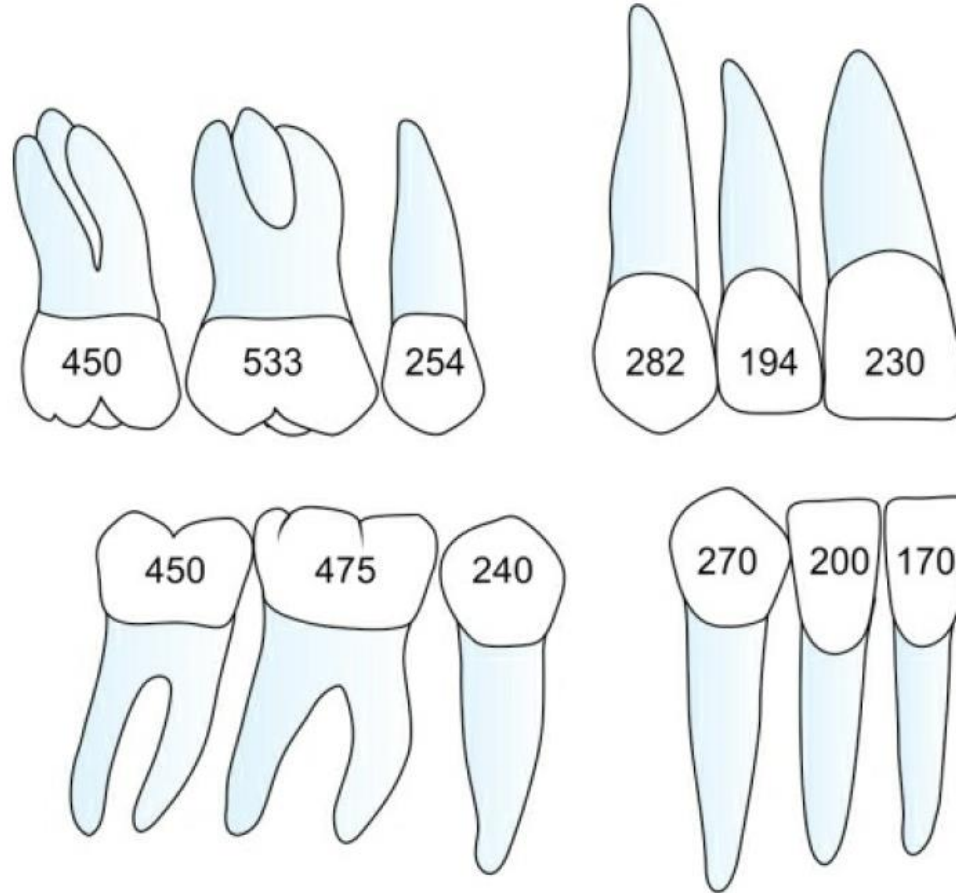
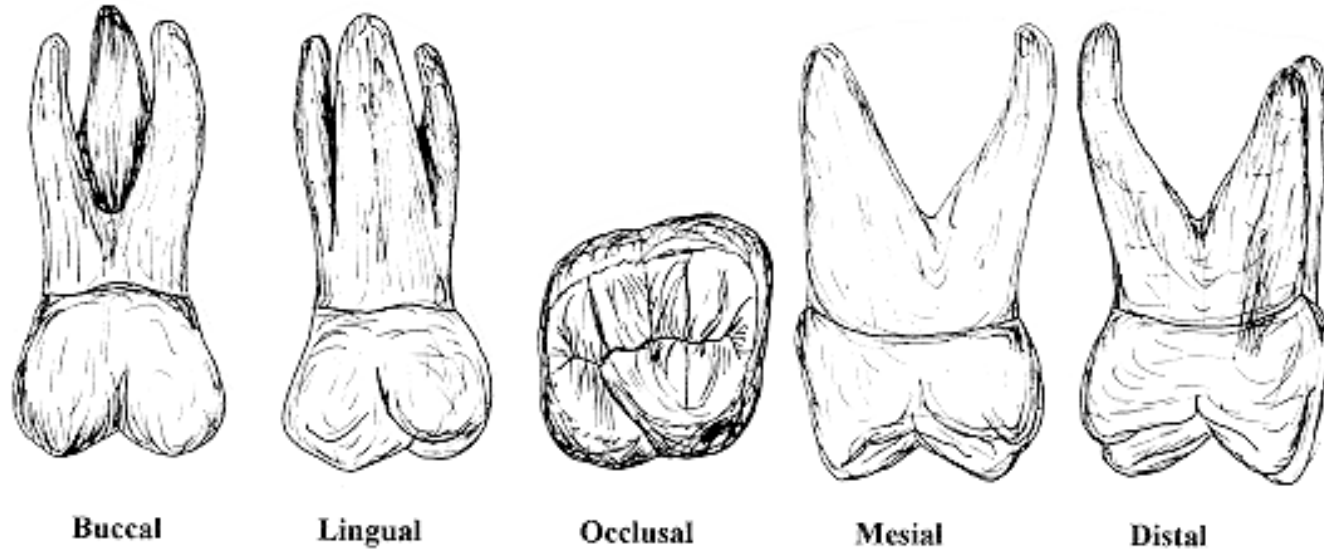


FIG. 16.13. Anchorage values.

Maxillary molar



Maxillary Right First Permanent Molar

4. Root Length

▶ ***Eg : Maxillary canines***

5. Position of tooth in the dental arch

- ▶ *Eg: Mandibular second premolar,*
- ▶ *b/w mylohyoid line and external oblique ridge*

6. Inclination of tooth

- ▶ Important in assessing its value as a source of anchorage.
- ▶ **When the axial inclination is in a direction opposite to the force acting upon it , it offers a great resistance to dislodgement**

► List of teeth in the order of diminishing resistance

- 1) *Mand. molars.*
- 2) *Max. cuspids.*
- 3) *Mand. cuspids.*
- 4) *Max. molars.*
- 5) *Max. centrals.*
- 6) *Mand. bicuspid.*
- 7) *Max. bicuspid.*
- 8) *Max. laterals.*
- 9) *Mand. centrals and laterals.*

7. *Mutual support*

- ▶ Interproximal contacts - adds to anchorage
- ▶ Also the mandibular arch is confined by the maxillary arch .

9. The musculature

- ▶ **Hypotonic musculature** - flaring and spacing of teeth.
- ▶ **Hypertonic musculature** - causes crusting of teeth lingually

BIOLOGICAL ASPECTS OF ANCHORAGE :

Factors affecting anchorage:

- ▶ Cortical anchorage:
Cortical bone vs. medullary bone
- ▶ Muscular forces:
Horizontal growers vs. vertical growers

BIOLOGICAL ASPECTS OF ANCHORAGE :

Factors affecting anchorage:

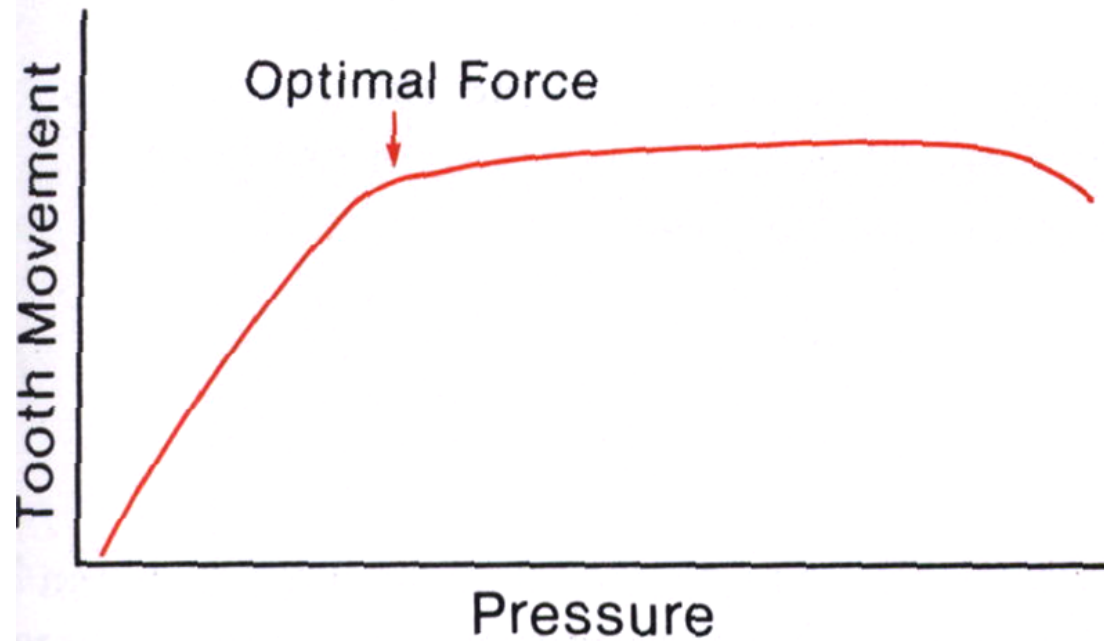
- ▶ Relation of contiguous teeth
- ▶ Forces of occlusion
- ▶ Age of the patient
- ▶ Individual tissue response

BIOLOGICAL ASPECTS OF ANCHORAGE :

- ▶ Pressure in the PDL= $\frac{\text{Force applied to a tooth}}{\text{Area of distribution in PDL}}$
- ▶ Tooth movement increases as pressure increases upto a point, remains at same level over a broad range and then may gradually decline with extremely heavy pressure.
- ▶ Anchorage control : Concentration of desired force and dissipation of reactionary force

BIOLOGICAL ASPECTS OF ANCHORAGE :

▶ PRESSURE RESPONSE CURVE :



BIOLOGICAL ASPECTS OF ANCHORAGE :

Anchorage situations :

▶ Reciprocal tooth movement :

Equal force distribution over the PDL

eg. Midline diastema,

First premolar extraction site

Anchorage value depends on the root surface area

BIOLOGICAL ASPECTS OF ANCHORAGE :

Anchorage situations :

- ▶ Reinforced anchorage:

Distribution of force over a larger surface area

Light forces vs. heavy forces

eg. Addition of extra teeth,

Extra oral anchorage

BIOLOGICAL ASPECTS OF ANCHORAGE :

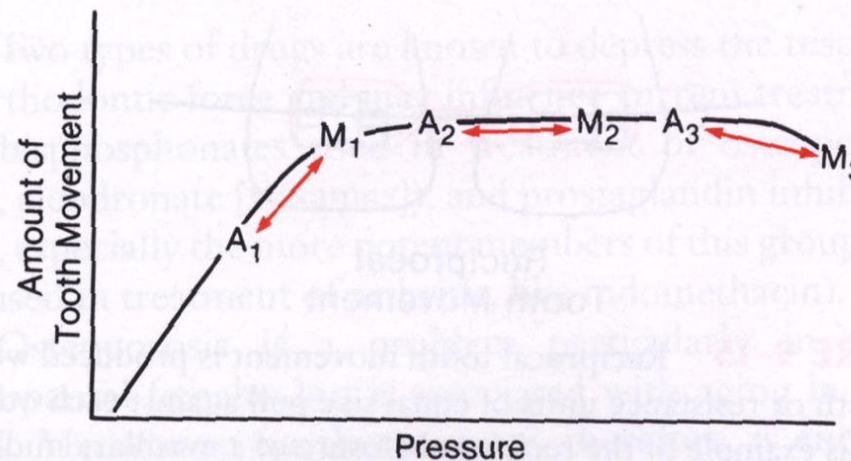
Anchorage situations :

- ▶ Stationary anchorage:

Bodily movement of anchor teeth vs. tipping of teeth to be moved

BIOLOGICAL ASPECTS OF ANCHORAGE :

- Anchorage situations :
- ▶ Differential effect of very large forces:
More movement of arch segment with the larger PDL area.
Questionable response.

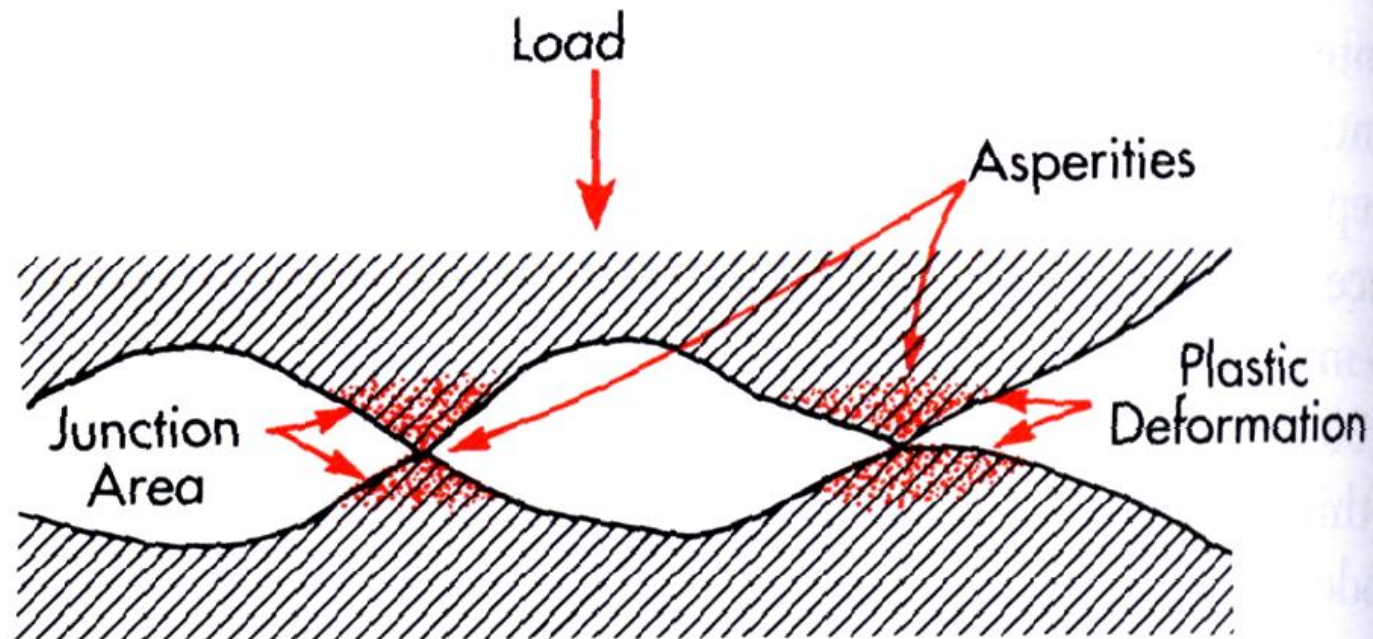


MECHANICAL ASPECTS OF ANCHORAGE :

- ▶ Tooth movement is brought about after overcoming the frictional resistance during sliding of wire in the bracket.
- ▶ Frictional force is proportional to the force with which the contacting surfaces are pressed together
- ▶ Affected by the nature of the surface
- ▶ Independent of the area of contact

MECHANICAL ASPECTS OF ANCHORAGE :

- ▶ Asperities :
Peaks of surface irregularities.



MECHANICAL ASPECTS OF ANCHORAGE :

- ▶ Local pressure at asperities causes plastic deformation
- ▶ At low sliding speeds, 'stick slip' phenomenon occurs
- ▶ Anchor teeth feel reaction to both friction and tooth moving forces

ANCHORAGE LOSS

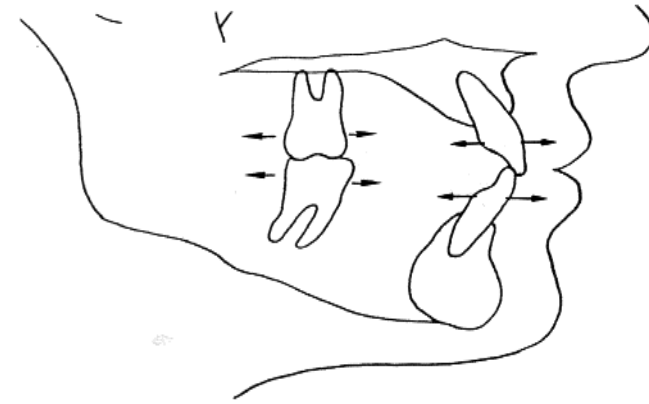
REASON FOR ANCHORAGE LOSS

- EXCESSIVE FORCE
- IMPINGEMENT TO LABIAL CORTICAL PLATE
- IMPROPER ANCHORAGE PREPARATION
- IMPROPER TREATMENT PLANNING
- RESISTANCE BETWEEN ARCHWIRE AND BRACKETS



▶ **Sagittal plane:**

- Mesial movement of molars,
- Proclination of anteriors



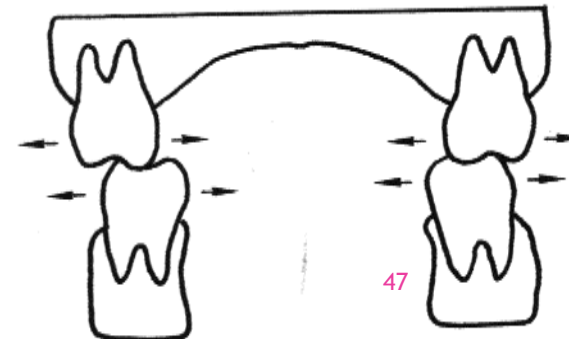
▶ **Vertical plane:**

- Extrusion of molars,
- Bite deepening due to anterior extrusion



▶ **Transverse plane:**

- Buccal flaring due to over expanded arch form



Differential anchorage

Anchorage potential -Influencing factors-

- ▶ *Density of alveolar bone*
- ▶ *Cross sectional area of the roots*
- ▶ *Anchorage value-resistance of bone to resorption*
- ▶ *Anchorage value for mandibular molar > max. molar*

- ▶ **Two physiologic factors lead to increased anchorage value of mandible-**
 - ▶ *The thin cortices & trabecular bone of the maxilla*
 - ▶ *thick cortices and more coarse trabeculae of the mandible*

Why mandibular bone is dense?

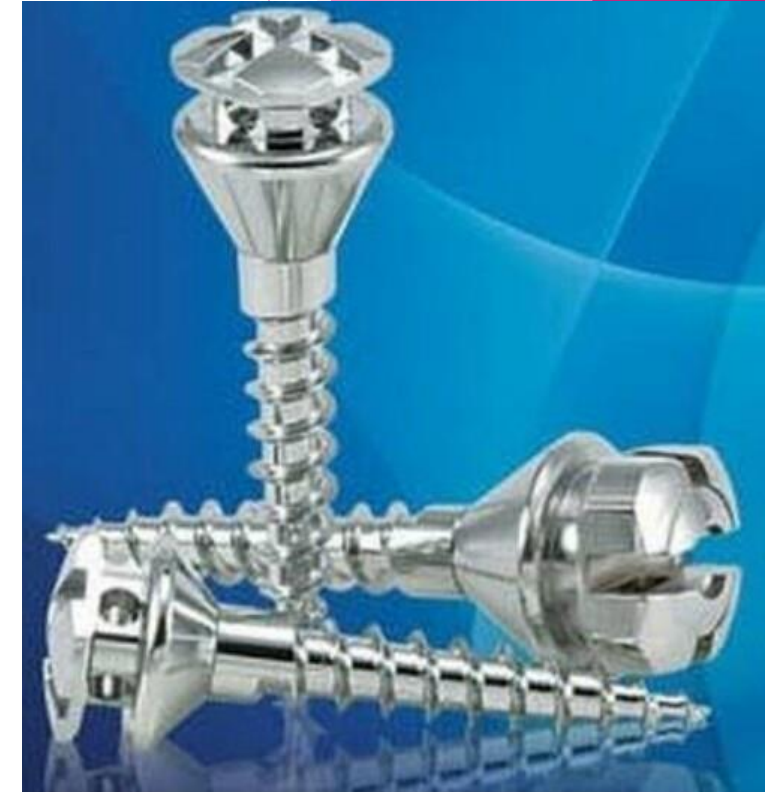
- ▶ *substantial torsion & flexure caused by muscle pull & forces of mastication*

Why maxilla has more porous bone?

- ▶ ***compression loading***

Implant as anchorage units/absolute anchorage/temporary anchorage devices

- ▶ Traditionally, orthodontists have used teeth, intraoral appliances and extraoral appliances to control anchorage; minimizing the movement of certain teeth, while completing the desired movement of other teeth.
- ▶ **Newton's third law**, i.e. for every action, there is an equal and opposite reaction, there are limitations in our ability to completely control all aspects of tooth movement.
- ▶ Conventional means to reinforce the anchorage have drawbacks, including heavy reliance on patient compliance (headgear, elastics) and cumbersome, uncomfortable or unhygienic attributes.



- ▶ A temporary anchorage device (*TAD*) is that which is temporarily fixed to bone for the purpose of enhancing orthodontic anchorage, either by supporting the teeth of the reactive unit or by obviating the need for the reactive unit altogether, and which is subsequently removed after use.
- ▶ They can be located transosteally, subperiosteally or endosteally; and they can be fixed to bone either mechanically (cortically stabilized) or biochemically (osseointegrated).
- ▶ At a minimum, when initially placed, TADs must have primary stability and be able to withstand orthodontic force levels. TADs are called *absolute anchorage* because the extracted or available space is fully utilized for orthodontic correction without space loss due to movement of anchor teeth.

CONCLUSION

- ❑ IN PLANNING ORTHODONTIC THERAPY IT IS SIMPLY NOT POSSIBLE TO CONSIDER ONLY THE TEETH WHOSE MOVEMENT IS DESIRED
- ❑ RECIPROCAL EFFECTS THROUGHOUT THE DENTAL ARCH MUST BE CAREFULLY ANALYZED EVALUATED AND CONTROLLED
- ❑ AN IMPORTANT ASPECT OF TREATMENT IS MAXIMIZING DESIRED TOOTH MOVEMENT AND MINIMIZING UNDESIRABLE TOOTH MOVEMENT

ACCESSORY POINTS

- ▶ The word anchorage was coined by *Alexis Schlange*.
- ▶ The anchorage value of a tooth depends more on *PDL surface area*.
- ▶ Root shapes which provide most resistance to tooth movement: *Triangular*.
- ▶ One ounce = **28.35 g**.
- ▶ One pound = **453.9 g**.
- ▶ Transpalatal arch is an example for *reinforced anchorage*.
- ▶ Baker's anchorage is an example for *intermaxillary anchorage*.
- ▶ When implants are used as source of anchorage, it is also called *skeletal anchorage or absolute anchorage*.
- ▶ Anchorage provided by periodontal ligament is called *Hammock anchorage*.
- ▶ Tooth with maximum anchorage value is *maxillary first permanent molar*.
- ▶ Tooth with minimum anchorage value is *mandibular central incisor*.

▶ Thank you