Anchorage

Inadequate anchorage change be most limiting factor and might cause unwanted side effects. In relation to treatment of adult patients. In young and growing individuals, tooth movement depends on interaction between ongoing growth and changes produced by the orthodontic appliance. In the case of adult patient, there is no growth to interfere with the effect of forces generated by the appliance and the tooth movement reflects the applied force system. However, soft tissue balance and muscle function still modify the effect of orthodontic treatment that aims to change arch form or facial height.

Anchorage: resistance to reaction forces usually provided by other teeth or sometimes by the palate, head and neck, or implants in bone. The anchorage unit can move; however, its role is to provide resistance.

Classification of Anchorage

A. According to Site

- **Intraoral**: utilizing teeth, mucosa, and other structures
- **Extraoral**: anchorage establish outside of the oral cavity (cervical, occipital, cranial, facial)

B. According to Jaws Involved

- **Intra-maxillary**: anchorage established in same jaw as active element.
- **Inter-maxillary**: anchorage establish in opposite jaw of the active element.

C. According to Burstone

It should be determined which teeth will be moved (belong to active unit) and which will be considered anchorage (belong to reactive unit)

- **Type A**: when space is closed primarily by retraction of anterior teeth.
- **Type B**: when there is equal contribution of the anterior and posterior units to closure of space.
- **Type C**: when space is closed primarily by protraction of posterior teeth.

D. According to Space Availability

- **Minimum Anchorage**: 2/3rd of space is utilized by the movement of the anchor unit
- **Moderate Anchorage**: 1/2 space utilized by movement of anchor unit & remaining 1/2 by movement of active unit
- **Maximum Anchorage**: Anchorage demand Is very high – not more than 1/4 of extraction space should be lost by forward movement of anchor teeth
- **Absolute Anchorage**: No movement at all of anchor unit is allowed (implants)

E. According to Manner of Force Application

- **Simple Anchorage**: Tipping of the anchorage unit – the anchorage tooth is "free" to tip during movement
- **Stationary Anchorage**: Bodily movement of anchorage unit – the anchorage tooth is permitted to translate only
- **Reciprocal Anchorage**: When two teeth or two sets of teeth move equally in an opposite direction. Root surface area of anchorage unit is equal to that of teeth to be moved. Both bodies which are mal-positioned act as a resistance and active elements.

Methods of Reinforcing Anchorage

A. Use of many teeth against fewer teeth

- Distalization of canines against six posterior teeth. Despite the larger number of teeth in the anchorage unit this set-up frequently leads to anchorage loss.

B. Use of Rigid Wires

- Transpalatal arches
- Lower lingual arches
- Cast structures
- Stiff stainless-steel wires – to keep the teeth of the anchorage unit together

C. Use of Metallic Implants


- Palatal Implants
- Temporary Anchorage Devices (TADs) / Mini-screws

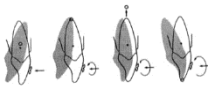
D. Anchorage Preparation


- Anchorage preparation by **distal tipping of molars** so the force will be more perpendicular to the roots when Class II traction is used. The force systems are generated during anchorage preparation which will result in tooth movement.

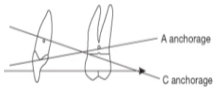
E. Cortical Anchorage (Ricketts)

- The difference in bone turnover between **cortical** and **trabecular bone**.
- The theory is based on the observation that when roots of molars are moved against or into buccal cortex before serving as anchorage, their anchorage potential increases due to the greater resistance of cortical bone.
- However, there is **no evidence that root cannot move through cortical bone** as alveolar bone dehiscence and fenestrations with root surface exposures have clearly demonstrates the opposite in an animal model.

F. Differential Anchorage (Burstone)



- Based on the fact that **tipping is an easier tooth movement to achieve than translation** (bodily movement) and that the **moment-to-force ratio** delivered to the bracket determined the type of tooth movement.
    - **Type A Anchorage**: space closure will start with controlled tipping, intrusion of anterior unit and translation and extrusion of posterior anchorage unit.
    - **Type C Anchorage**: line of action of force will generate translation, extrusion of the anterior until and tipping and intrusion of posterior unit.



- Side effect of differential anchorage: distal tipping of the posterior unit and thus **two occlusal planes** which can be avoided by keeping moment to anchorage unit below the level where posterior tipping moments are generated.

G. Free Anchorage

- Indicates that no "price" must be paid in terms of undesirable force on teeth belonging to anchorage unit. The principle is that **reactive forces are transferred to teeth which are <u>to be extracted</u>.**
- Ankylosed teeth and 3rd Molars can also be used to provide free anchorage

Methods of Anchorage

A. Intermaxillary Anchorage

- Class II elastics
- Class III elastics
- Different types of bite-jumping appliances (Herbst Appliance, Bite correctors – transfer forces from one arch to the other)
- Occlusion itself is also a type of intermaxillary anchorage
- <u>Side Effects</u>:
    - Extrusion and changes to the inclination of the occlusal plane
    - Intermittent nature of the forces
    - Dependence on patient's compliance
    - Unavoidable changes in the inclination of the incisors.

B. Extraoral Anchorage

- Reactive forces transferred to the head, neck or both at the same time or to the chin.

Factors Affecting Anchorage

- Teeth
    - Root form
    - Root size
    - Number of roots
    - Root length
    - Root inclination
- Alveolar Bone – Alveolar bone resist tooth movement up to its limit, beyond that it allows tooth movement by remodeling. Healthy alveolar bone = more anchorage.
- Basal Bone – Certain areas act as resistance areas and provide good anchorage like:
    - Hard palate
    - Lingual Surface of Mandible

Planning Anchorage

- Number of teeth to be moved
- Type of teeth to be moved
- Type of tooth movement required
- Periodontal condition
- Duration of tooth movement

Summary – Methods of Reinforce Anchorage

- Incorporate as many teeth as possible in the anchor unit
- Reduce number of teeth in moving unit
- Use of anchorage bends in the archwire
- Use an optimal force to produce the required tooth movement
- Use of palatal or lingual arch
- Use of intra/inter maxillary elastics
- Use of lip bumper – anchorage from musculature
- Use of cortical anchorage
- Use of mini-screw implants.