

# Anchorage in Orthodontics

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## Overview

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- Introduction
- Definition
- Classification of anchorage
- Methods of reinforcing anchorage
- Factors affecting anchorage
- Planning Anchorage
- Summary-Methods of Reinforcing Anchorage

# Introduction

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## Introduction

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- Anchorage in orthodontics is a **critical issue** independent of the technique or philosophy followed by a clinician.
- Inadequate anchorage can be **the most limiting factor** of the therapy and unwanted side effects are frequently seen due to insufficient anchorage.
- In relation to the treatment of **adult patients**, many of the traditional means of obtaining anchorage are only of limited use.
- **In young and growing individuals**, tooth movement depends on the interaction between ongoing growth and changes produced by the orthodontic appliance.

## Introduction

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- In the case of the **adult patient**, there is no growth to interfere with the effect of the forces generated by the orthodontic appliance and **the tooth movement reflects the applied force system more closely**.
- However, the **soft tissue balance and muscle function** still modify the effect of orthodontic treatment that aims to change the arch form or the facial height

## Definition

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- Anchorage is defined as **resistance to unwanted tooth movements of the reactive unit**.
- The anchorage unit can move, however its role is to provide resistance.
- **Proffit** offered a more detailed definition when he described anchorage as the resistance to reaction forces usually provided by other teeth or sometimes by the palate, head and neck, or implants in bone (Proffit and Fields 2000).

## Classification of anchorage

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## Classification of anchorage according to Site of anchorage

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- **Intraoral**
  - Utilizing the teeth, mucosa and other oral structures
- **Extraoral**
  - Anchorage established outside of the oral cavity
    - Cervical
    - Occipital
    - Cranial
    - Facial

## Classification of anchorage according to the jaws involved

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

## Classification of anchorage according to Burstone (Burstone 1982)

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In the work-up of the treatment goal it should be determined which teeth will be moved, i.e. belong to the active unit, and which will be considered anchorage i.e. belong to the reactive unit

In relation to space closure, anchorage has been defined as

- **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 closure is primarily by protraction of **posterior units**.

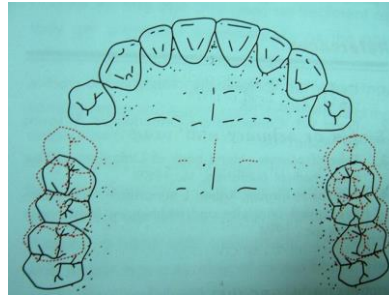
## Classification of anchorage according to space availability

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- Minimum Anchorage
- Moderate Anchorage
- Maximum Anchorage
- Absolute Anchorage

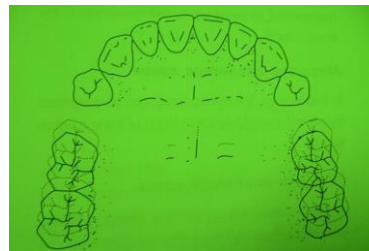
## Minimum Anchorage

- 2/3rd of space utilized by the movement of the anchor unit



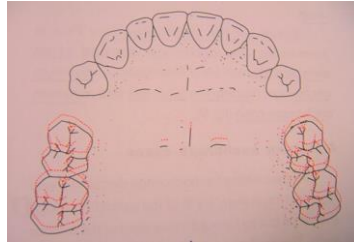
## Moderate Anchorage

- 1/2 space utilized by the movement of anchor unit & remaining 1/2 by the movement of active unit



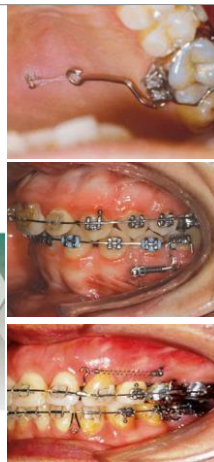
## Maximum Anchorage

- Anchorage demand is very high
- Not more than  $\frac{1}{4}$  of the extraction space should be lost by forward movement of the anchor teeth



## Absolute Anchorage

- No movement at all of anchor unit is allowed e.g. Implants



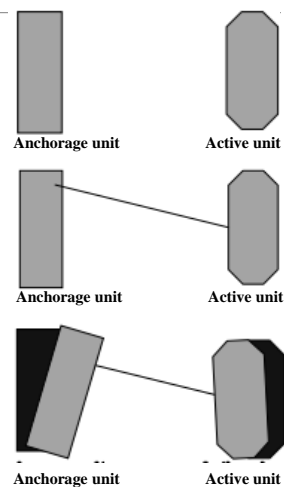


## Classification of anchorage according to manner of force application

- Simple anchorage
- Stationary anchorage
- Reciprocal anchorage

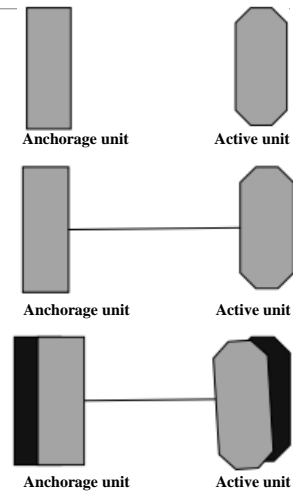
## Simple Anchorage

- **Tipping of the anchorage unit:** The anchorage tooth is 'free' to tip during movement



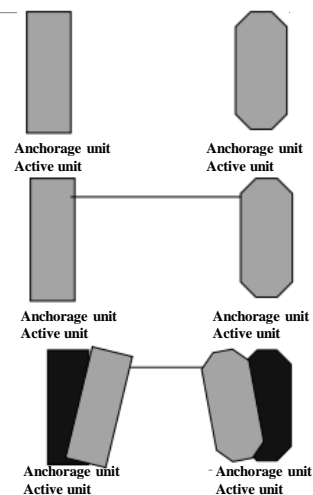
## Stationary Anchorage

- **Bodily movement of the 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 the anchorage unit is equal to that of the teeth to be moved
- Both bodies which are mal-positioned act as a resistance and active elements



# Methods of reinforcing anchorage

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## Use of many teeth against fewer teeth

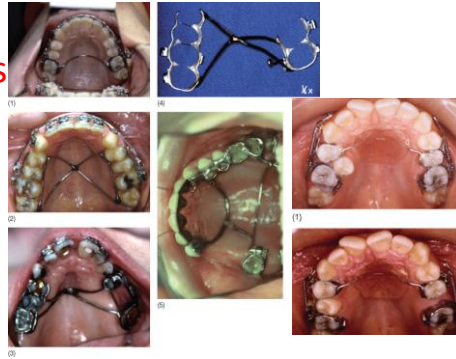
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Distalization of canines against six posterior teeth. In spite of the larger number of teeth in the anchorage unit, this set-up frequently leads to anchorage loss



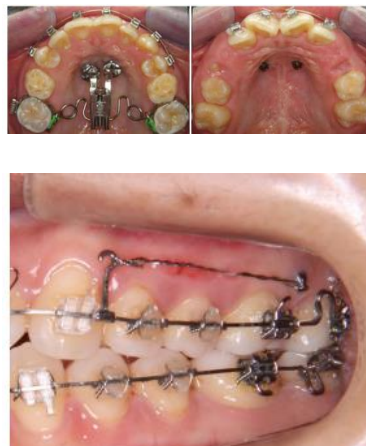
## Use of rigid wires

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



## Use of metallic implants

- Palatal implants
- Temporary anchorage devices (TADs)/  
Mini screws



## Anchorage preparation

Anchorage preparation by **distal tipping of the molars** so that the force will be more perpendicular to the roots when Class II traction is used.

The force systems generated during anchorage preparation.



Tooth movement resulting from the anchorage preparation.

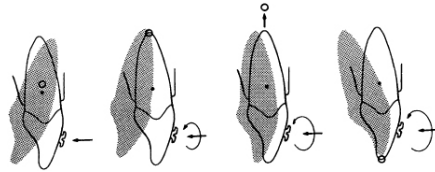


## Cortical anchorage (Ricketts, 1976)

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

## Differential anchorage Burstone (1982) and Melsen et al. (1990)

- Is 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 determines the type of tooth movement

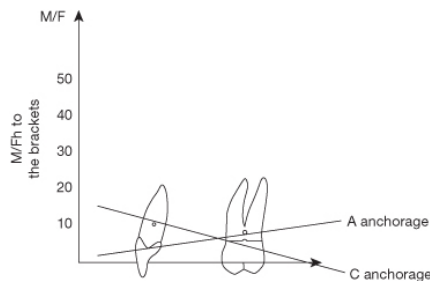


Different types of tooth movement depending on the moment- to- force ratio delivered to the bracket.

## Differential anchorage

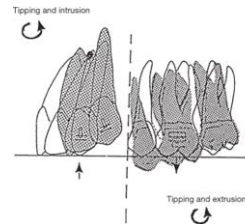
### Type A and C anchorage

- In the case of **type A anchorage**, space closure will start with controlled tipping, intrusion of the anterior unit and translation and extrusion of the posterior anchorage unit.
- In the case of **type C anchorage**, the line of action of the force will generate translation, extrusion of the anterior unit and tipping and intrusion of the 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 the anchorage unit below the level where posterior tipping moments are generated.



**Clinical example** of a posterior unit that has tipped distally as a result of a too-large moment delivered from the T-loop.



## Free Anchorage

- Free anchorage indicates that **no 'price' has to be paid** in terms of undesirable force on teeth belonging to the anchorage unit.
- The principle is that **reactive forces are transferred to teeth which are to be extracted** according to the treatment plan, and so there are no adverse effects on the teeth that will remain in the arches following treatment.
- **Ankylosed teeth and 3<sup>rd</sup> molars** can also be used to provide free anchorage

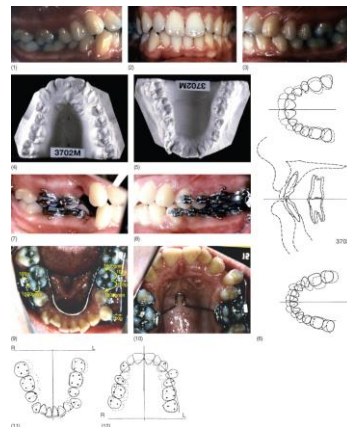
## Free Anchorage

14 which is  
**planned for  
 extraction** was  
 used in this case as  
 an anchorage



## Free Anchorage

24 which is  
**planned for  
 extraction** was  
 used in this case as  
 an anchorage





## Free Anchorage

24 which is  
planned for  
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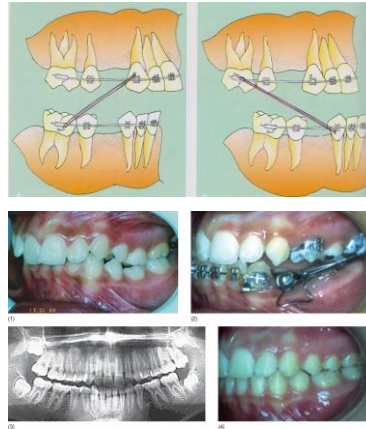
## Free Anchorage

- Another use of 'free anchorage' is via the use of **ankylosed teeth**
- The ankylosed 21 was used as anchorage during the correction of the distal relationship in both posterior segments.
- Following the correction of the sagittal problem, the ankylosed tooth and the adjacent bone were extruded by distraction osteotomy.



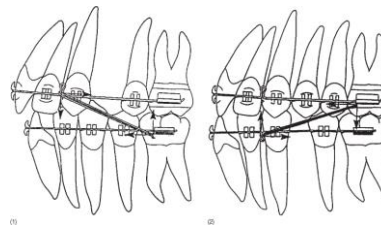
## Methods of intermaxillary anchorage

- Class II elastics
- Class III elastics
- Different types of bite-jumping appliances such as
  - Herbst appliance
  - Bite correctors and the various types of appliance transferring forces from one arch to the other.
- Occlusion itself is also a type of intermaxillary anchorage



## Side effects of intermaxillary traction

- Extrusion and changes to the **inclination of the occlusal plane**
- The **intermittent nature** of the forces
- The dependence on the **patient's compliance** and the unavoidable changes in the **inclination of the incisors**.



## Methods of extraoral anchorage

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



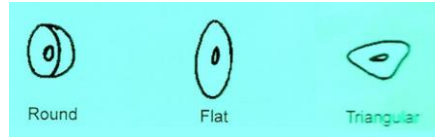
## Factors affecting anchorage

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## Factors affecting anchorage

- **Teeth**

- Root form
- Root size
- No. of roots
- Root length
- Root inclination



## Factors affecting anchorage

- **Alveolar bone**

- Alveolar bone resist tooth movement up to its limit, beyond that it allows tooth movement by remodeling.
- Healthy alveolar bone-more anchorage

## Factors affecting anchorage

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- Basal bone
  - Certain areas act as resistance areas and provide good anchorage like hard palate, lingual surface of mandible

## Planning Anchorage

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## Planning Anchorage

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- 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 Reinforcing Anchorage

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- Incorporate as many teeth as possible in the anchor unit
- Reduce number of teeth in the moving unit
- Use of anchorage bends in the archwire
- Use an optimal force producing the required tooth movement
- Reinforce intra-oral anchorage with extra-oral anchorage
- 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