Principles of Orthodontics II

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University of Louisville School of Dentistry
Spring 2015

- Introduction
- Diagnose and Treatment Planning
- Biology and Biomechanics
- Adjunctive Orthodontics
- Problems in the Mixed Dentition
- Extraction Orthodontics
- Surgical Orthodontics

Principles of Orthodontics II

- OPGD 0649-805-06
- Sunita S. Chandiramani DMD, MS
- Director, Orthodontic Residency Program
- 852-4173/2829

Principles of Orthodontics II

- Room 125
- Mondays
  1:00-2:00 p.m.
- ULSD Juniors

The class of

2016

Course Information

- **Format**
- **Course participants**
- **Schedule**
- **Grades**
- **Office hours**

Graduate Orthodontics

- 13 residents
- 24 months
- Competitive
- MS option

Michael Becht Orthodontics - Meet Dr. Becht - Windows Internet Explorer provided by Yahoo!

http://www.bechtortho.com/michaelbecht/

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Michael Becht Orthodontics - Meet Dr. Becht

mb Michael Becht Orthodontics

Home | About Orthodontics | Meet Dr. Becht | Treatment | Patient Information | Location | Contact

Meet Dr. Becht

Dr Becht is a native of Louisville, Ky. He is a graduate of Saint Xavier High School where he ran cross country and track and was president of the student council. He obtained a degree in Biology with honors from the University of Dayton where he also ran cross country. He then returned home and graduated with honors from University of Louisville School of Dentistry in 2006. He is very happy to be back in Louisville after his three year residency at West Virginia University in Morgantown, WV, where he earned a masters of science in Orthodontics.

Dr. Becht is an active member of the American Dental Association and the American Association of Orthodontists. Dr Becht is also an active member of the Louisville Dental Society and the Kentucky Dental Association. Dr. Becht's personal interests include running golf, hunting, and college sports (especially the University of Louisville). He also enjoys learning how to cook.

"My goal is to create beautiful smiles that my patients can enjoy for a lifetime. I look forward to the opportunity to provide quality orthodontic care to the citizens of Louisville, KY and the surrounding areas."

invisalign ADA

Education Background

- University of Dayton, 2001
- B.S. in Biology

- University of Louisville, 2006
- D.M.D.

- West Virginia University, 2009
- M.S. in Orthodontics

Michael Becht Orthodontics

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STOP
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Terrell Meats
ANDERSON WOODWORK


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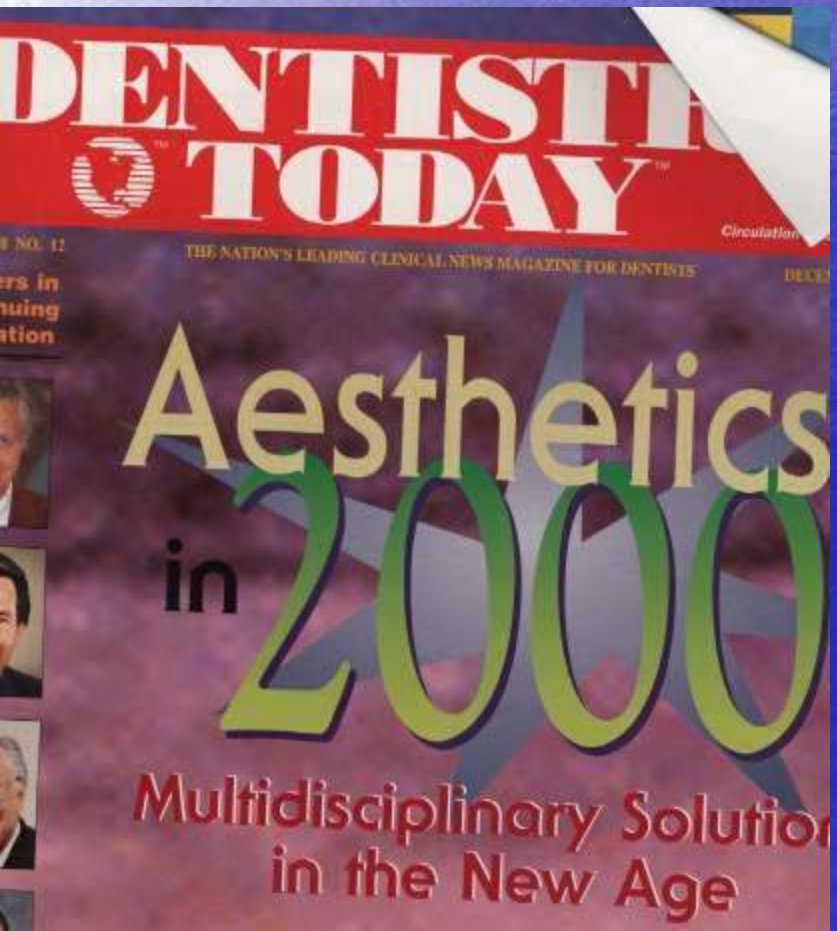
Meats
40

Practical Orthodontics for the General Practitioner



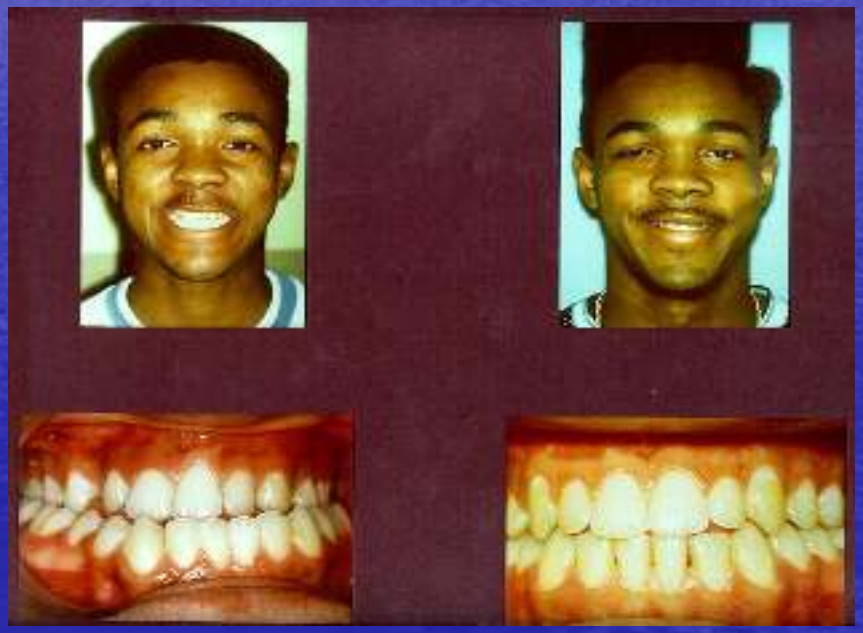
Practical Orthodontics for the General Practitioner

- What you need to know
- What you should know

Patients Who Won't Benefit From Orthodontics

When is an Occlusion Malocclusion?

- Prevalence
- Tangible benefits
  - longevity of the dentition
  - general health considerations
  - quality of life



Molar Relationship

When is an Occlusion Malocclusion?

- Many faces of malocclusion

History of Orthodontics

- Oldest dental specialty
- Kingsley – 1850
  tooth regulation
- E. H. Angle - 1890
  "Father of Modern Orthodontics"

History of Orthodontics

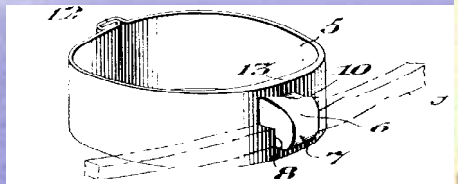
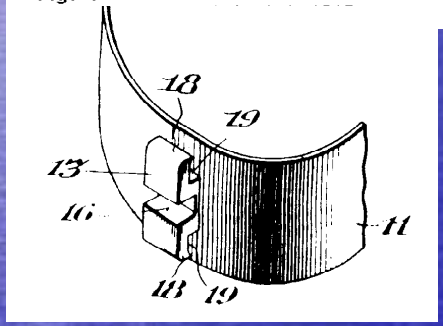
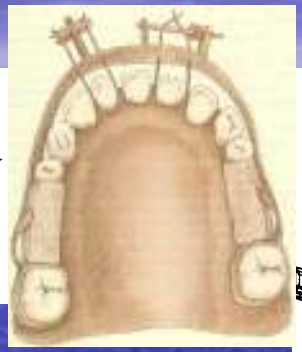
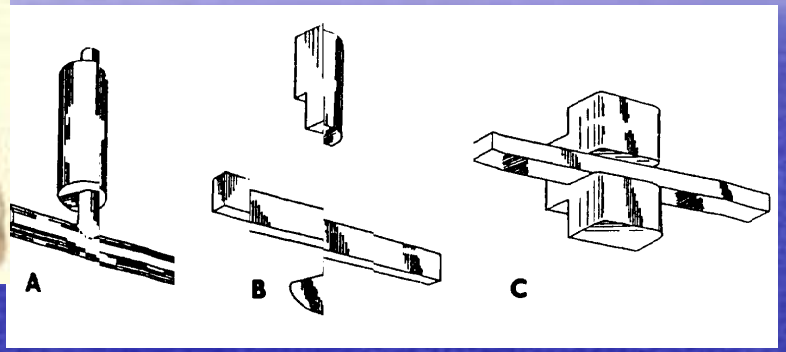


Figure 1. Ribbon arch bracket and wire

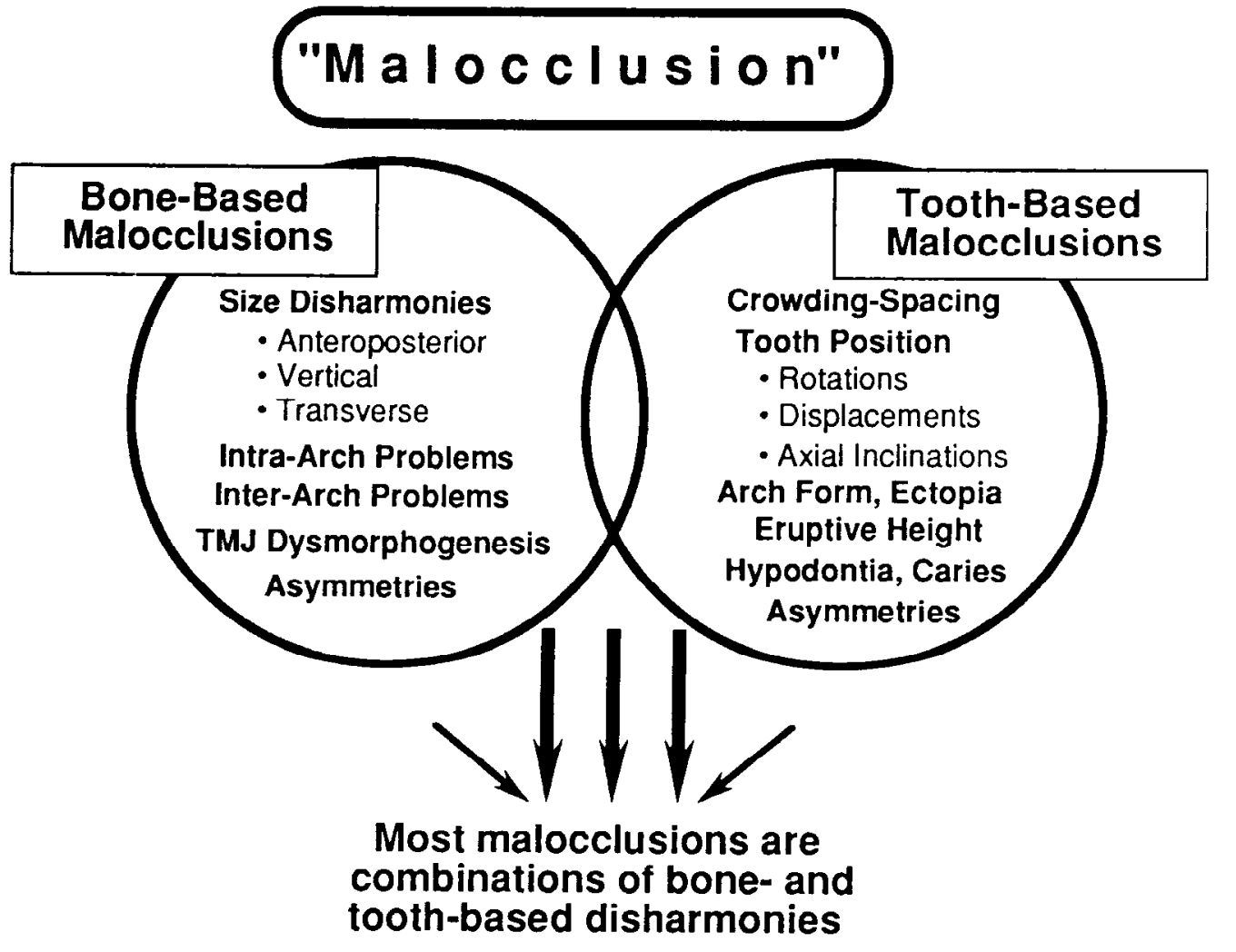






Angle's latest and best but not last!

Etiology of Malocclusion



Successful Orthodontics

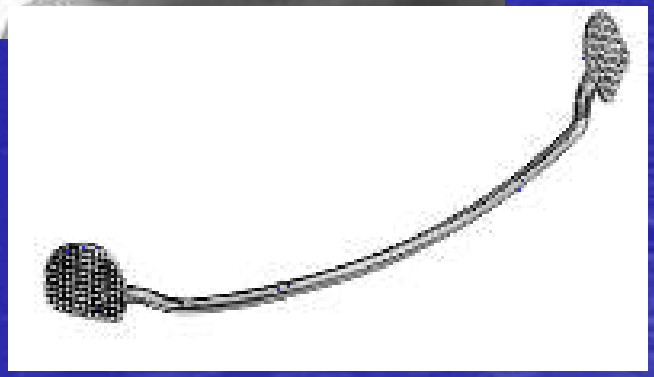
- Accurate diagnosis
- Identification of problems
- Developing treatment goals and treatment strategy
- Thoughtful treatment plan
- Good mechanics

Treatment Objectives

- Best in Esthetics
- Best in Function
- Best in Stability
- Avoid Iatrogenia
- Efficiency in Effort
- Economy in Effort

Retention


AOA COLORS
TRADITIONAL
SPECIAL STRIPES*
HEAVY METAL
ELECTRIC COLORS
NEW WAVE



Treatment Risks

- Decalcification
- Caries
- Root resorption

Components of Orthodontic Diagnosis and Treatment

- Facial Analysis
- Dental Analysis
  - crowding, OB, OJ, ALD
  - function
  - radiographic
- Cephalometric Analysis
  - diagnosis
  - tx planning
  - assessment of results
- Growth analysis
  - direction, potential and timing of growth spurt

Profile and Dental Analysis

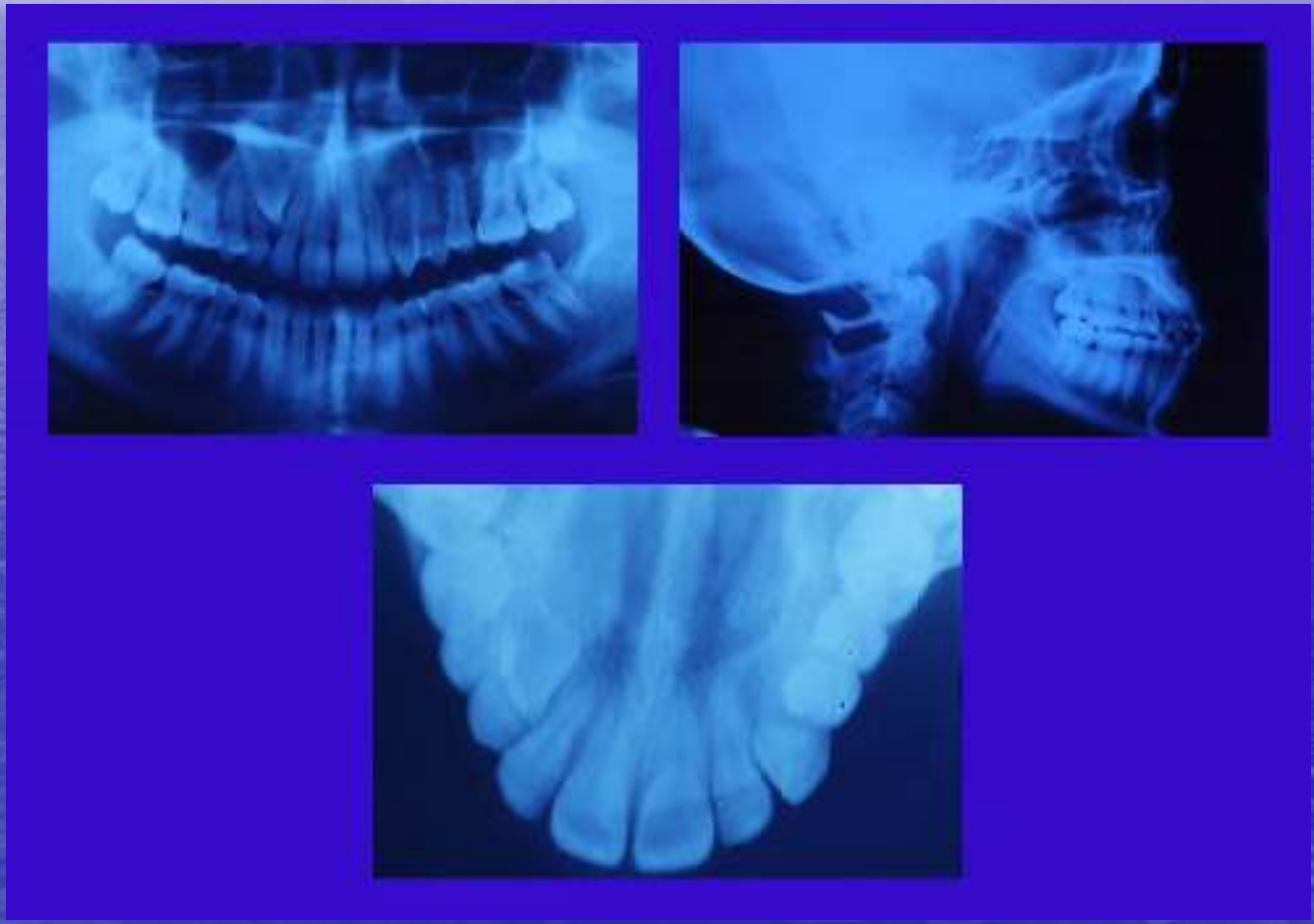
Normal Occlusion

Angle Class I

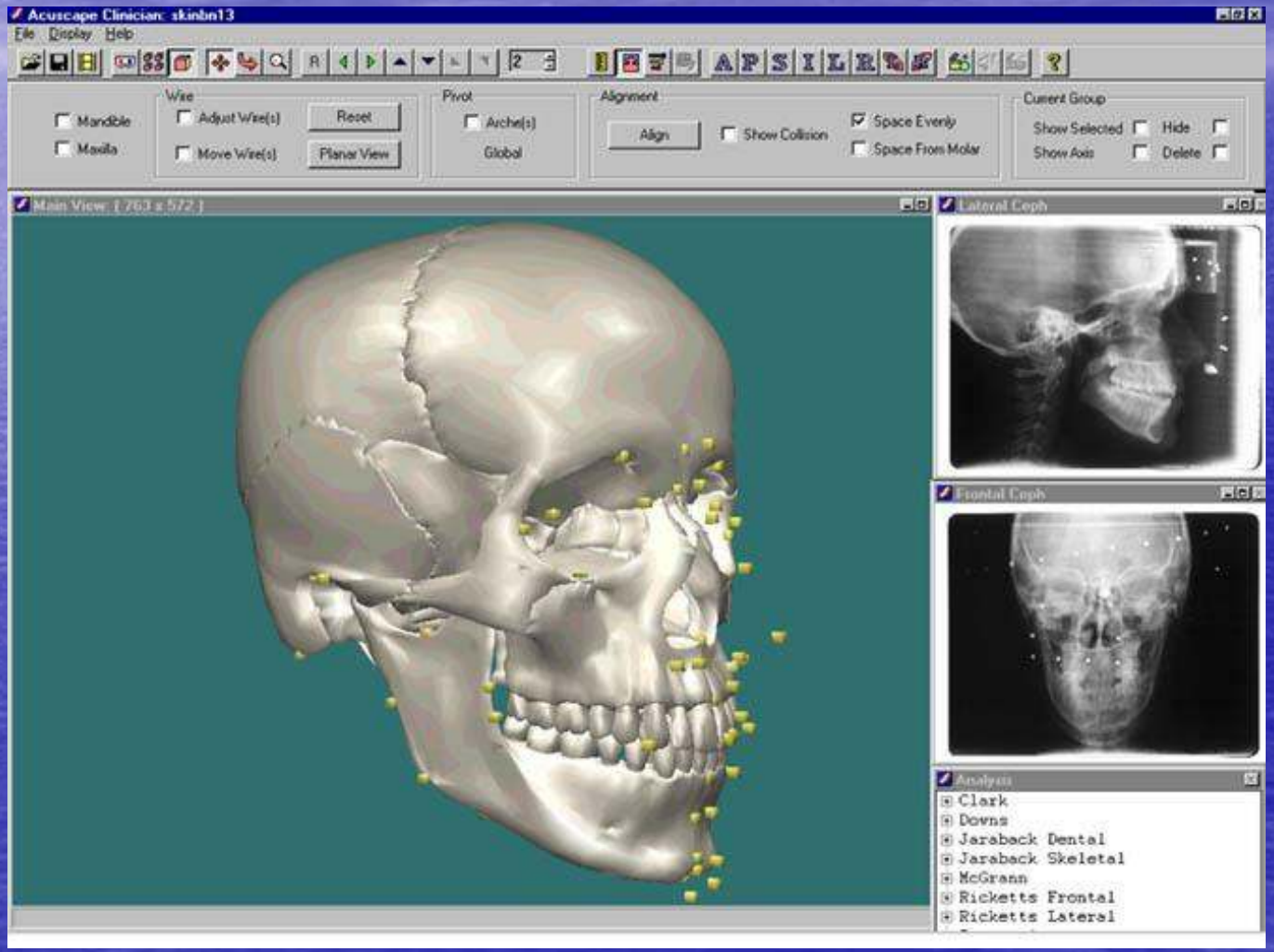
Angle Class II Division 1 and Division 2

Angle Class III

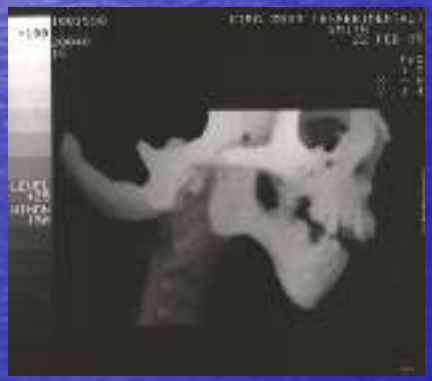
Radiographic Analysis



Radiographic Analysis



Cephalometric analysis

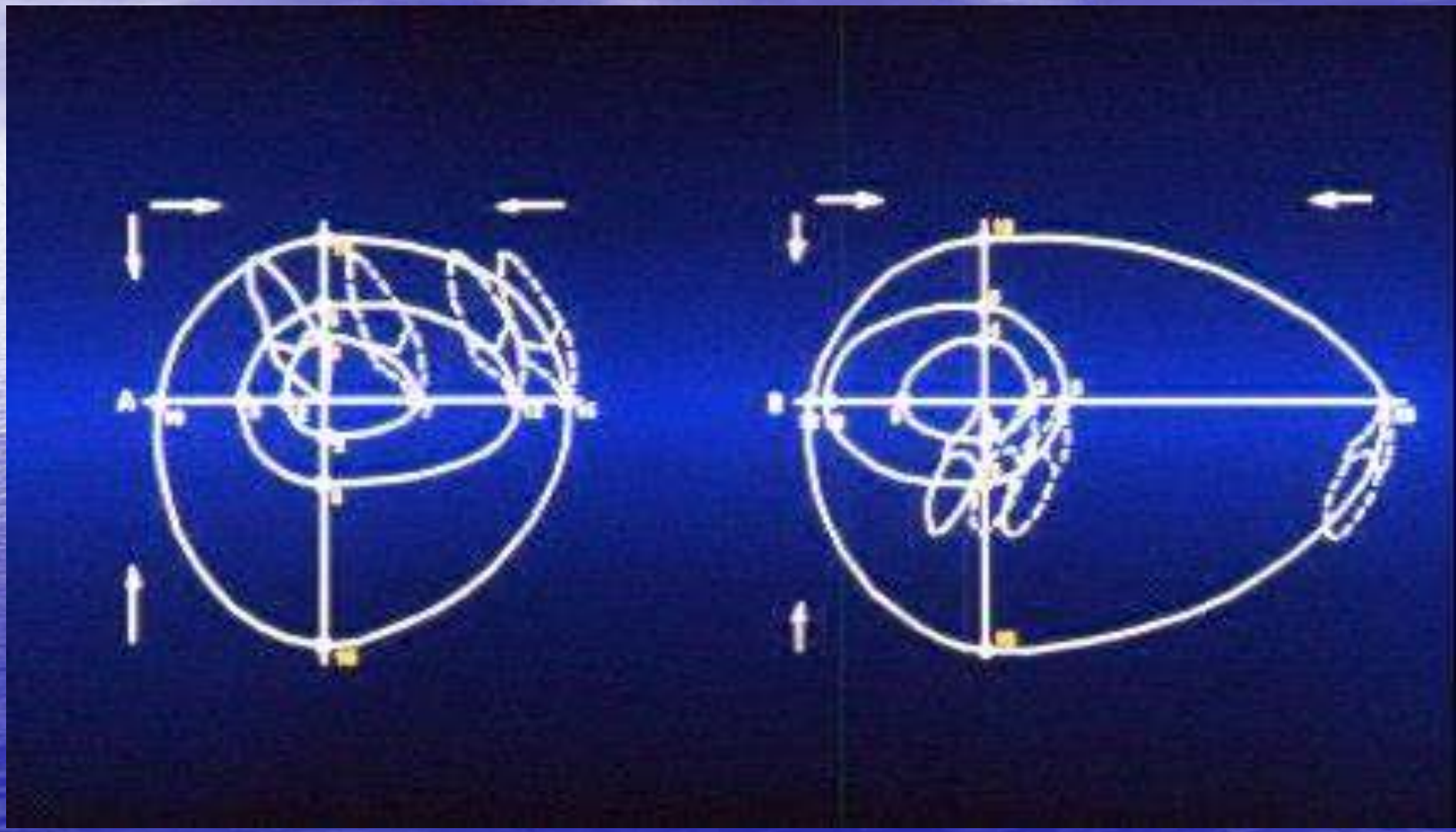


- Maxilla
- Mandible
- Maxilla to mandible
- Dentition to maxilla
- Dentition to mandible
- Dentition to dentition
- Three planes of space

A collection of numbers to compress as much information about the size, shape and relationship of the craniofacial components and their relative positions

Integration

Malocclusions in Three Dimensions

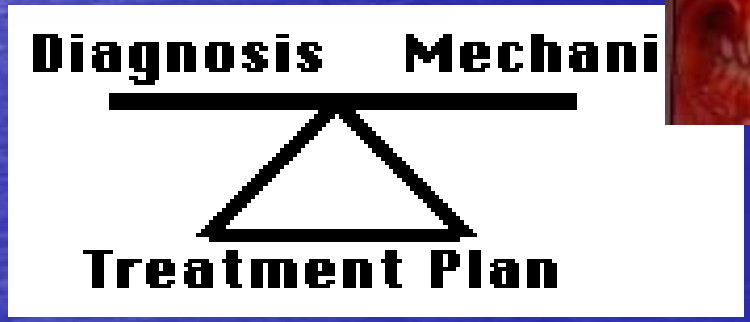


Timing of Treatment

- Preventive
  - Prevention of irreversible soft tissue or bony changes.
- Interceptive
  - Improvement of skeletal malrelationships by influencing the increment and direction of facial growth with orthopedic appliances ie headgear or face masks.
- Comprehensive
- Reconstructive

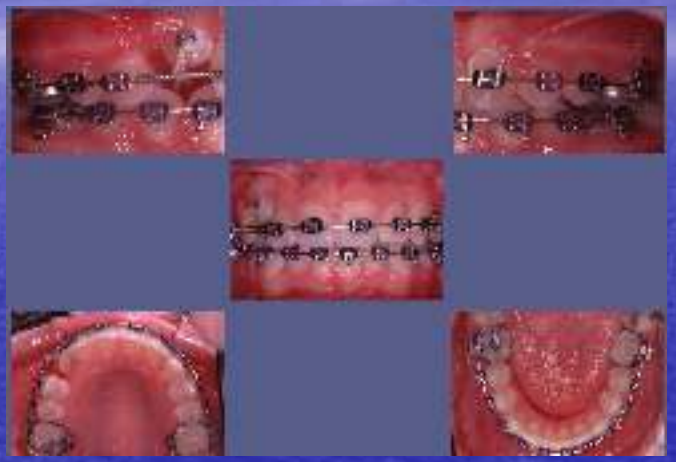
The Medicine of Orthodontics

- Force
  - Dental 8-10oz
  - Growth inhibiting 12-16oz
  - Orthopedic 24-48 oz
- Treatment timing

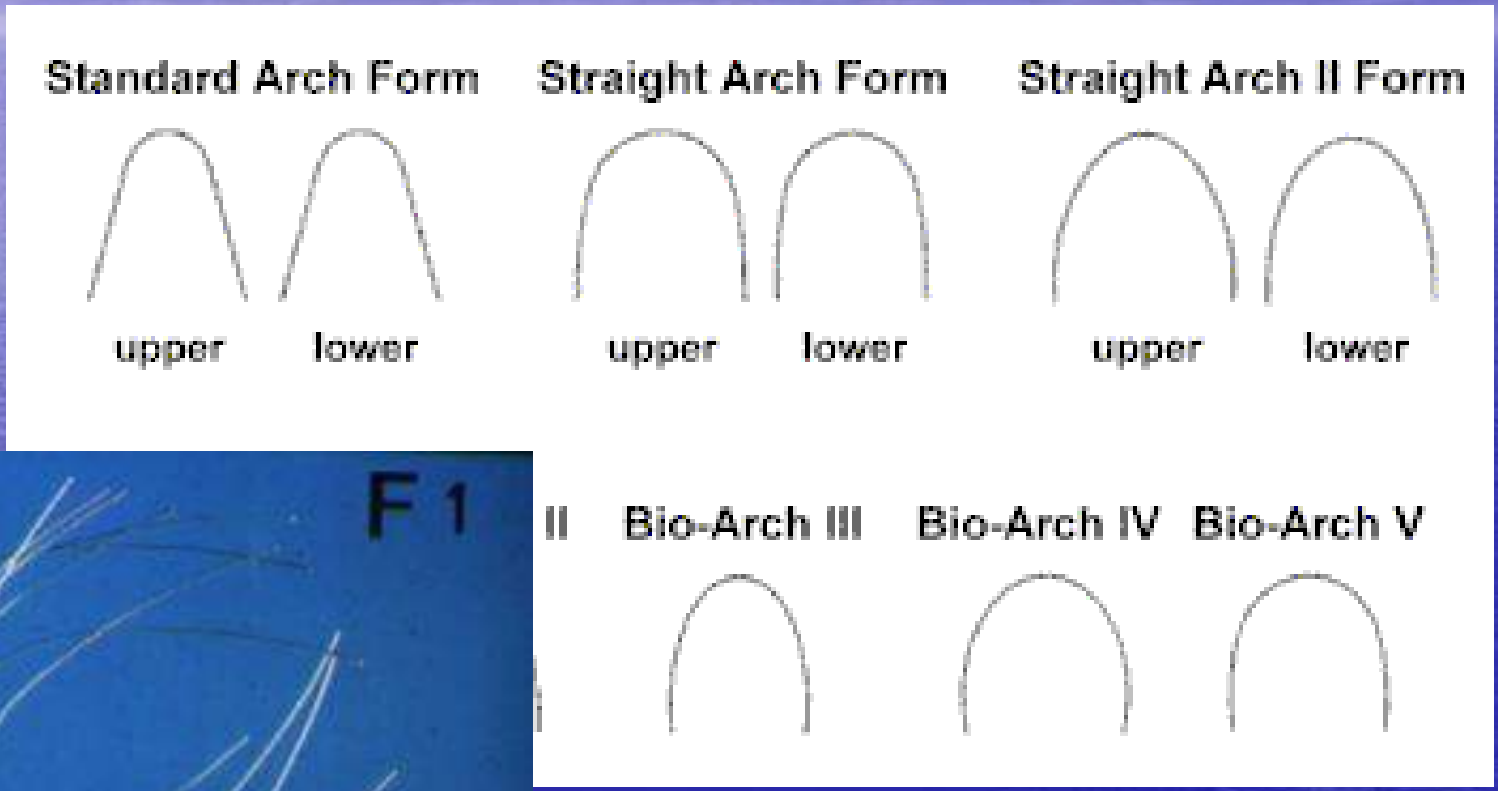


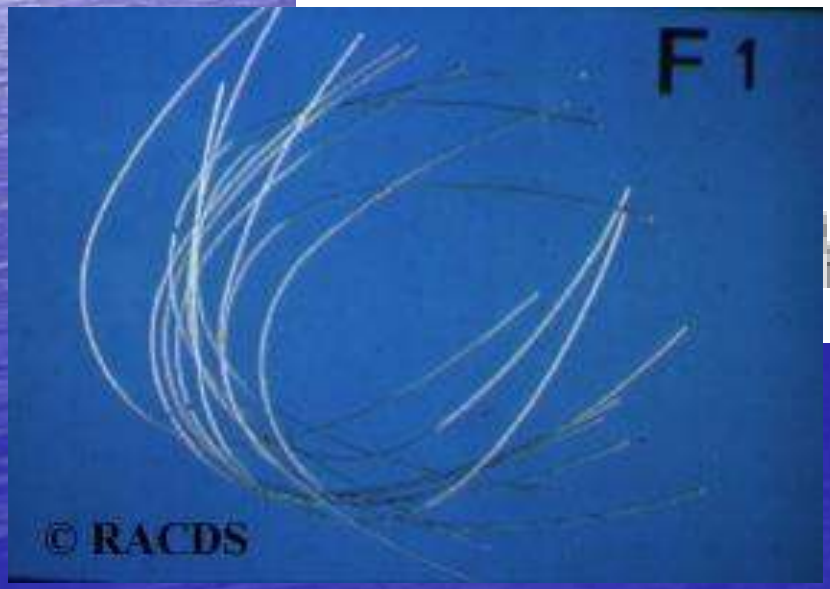
Orthodontic Hardware

- Bands/bonds
- Archwires
- Auxillaries

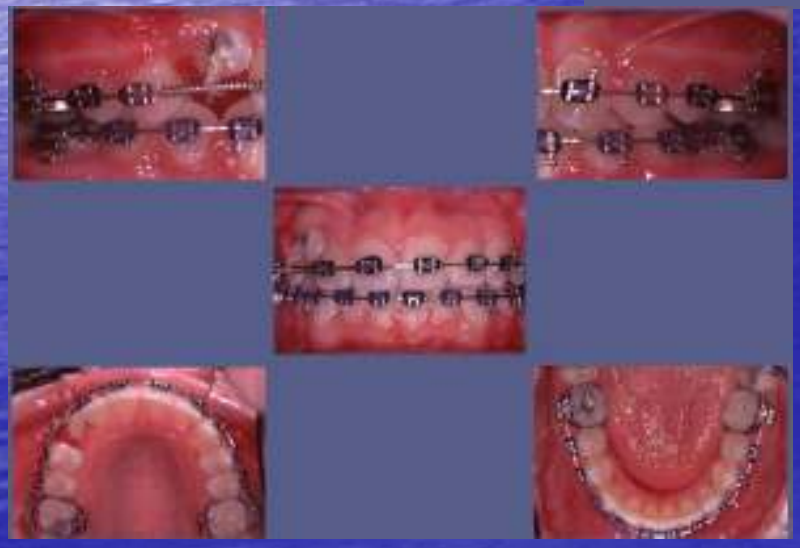


Orthodontic Wires

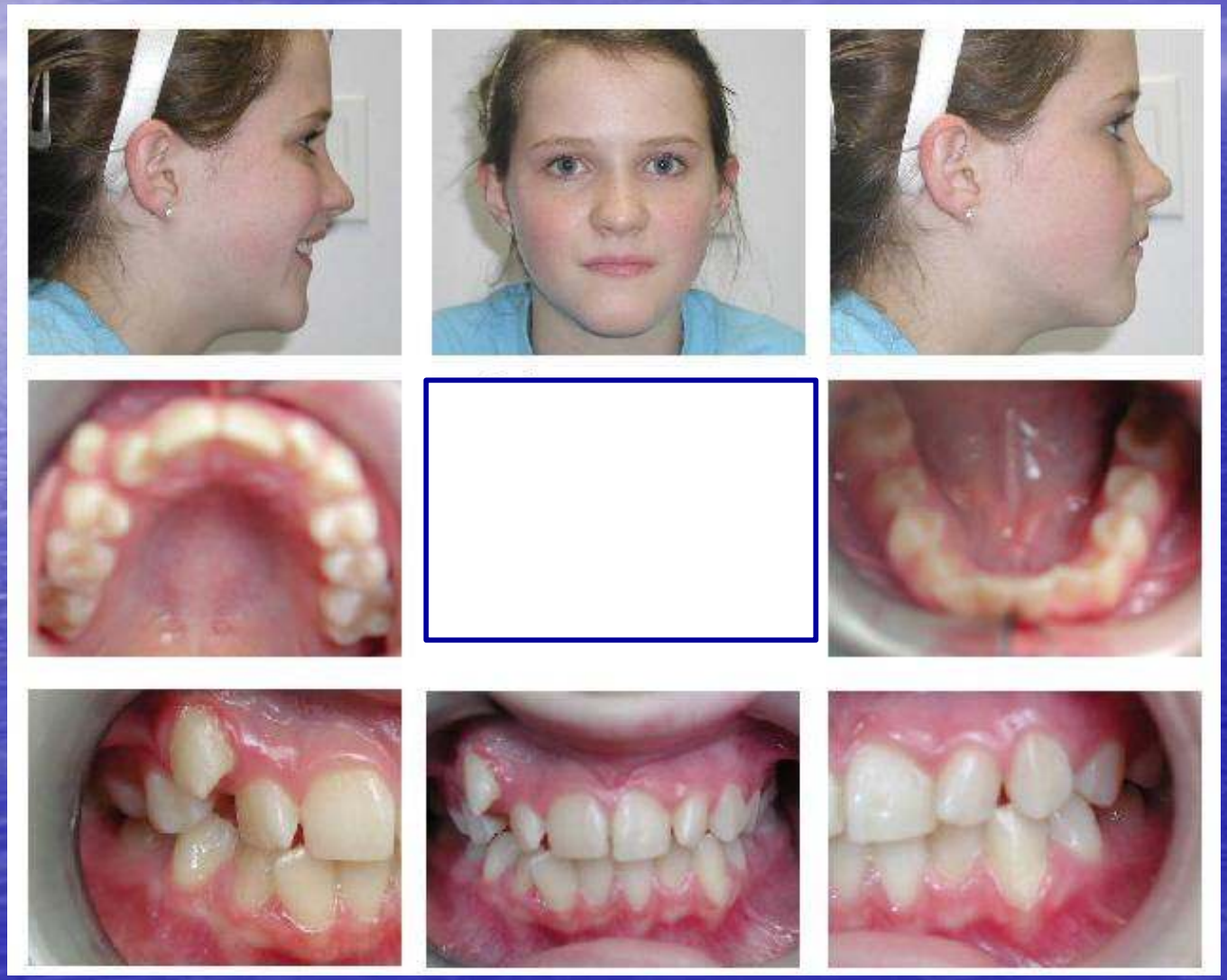




Orthodontic Treatment



Case Example



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Michael Becht Orthodontics





Any Questions?

Principles of Orthodontics I

OPGD – 0615-801-04

Lecture II
Orthodontic Classification

Spring 2015

Classification of Malocclusion

- Introduction
- Historical Perspective
- Angle's Classification
- Criticism of Angle
- Example cases
- Treated Case

Norman W. Kingsley,(1829-1913)

- Considered the **Father of *Orthodontics***
- Published: “Treatise on Oral Deformities as a branch of Mechanical Surgery”
- Contributed many practical procedures for mechano-thrapy, including Occipital anchorage.
- First to attempt to systemize occlusal abnormalities.

Edward H. Angle, (1855-1930)

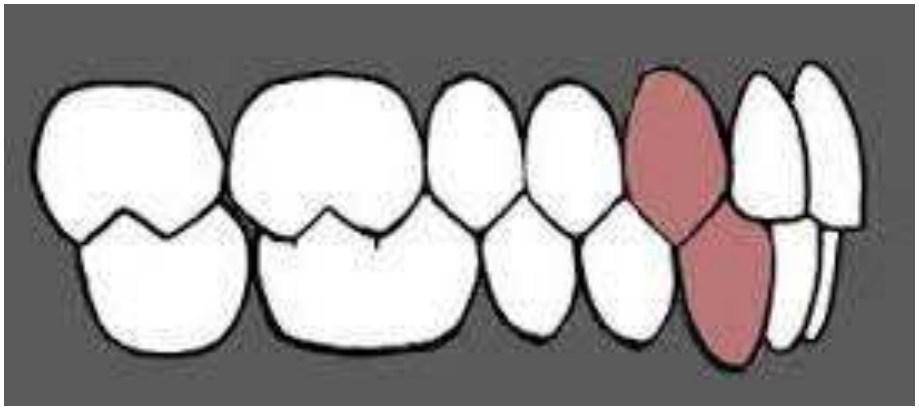
- Considered **Father of *Modern Orthodontics***
- First orthodontics school in 1900
- Orthodontics in 1901 became the first recognized specialty in dentistry
- Invented many appliances to help correct malocclusions.
- His final appliance was the Edgewise system which most modern systems are derived from.
- Believe if you placed the teeth in alignment the jaws will follow. (The extraction of teeth was taboo)

Angle's Classification

- Angle's postulate was that the **upper first molars** were the key to occlusion
- ***Mesiobuccal cusp of the upper first molar occludes in the buccal groove of the lower first molar***

Angle's Classification

- The mesial incline of the upper canine should occlude with the distal incline of the lower canine
- MUDL Rule



Angle's Classification

- Additionally, Angle described arch form based on the Line of Occlusion

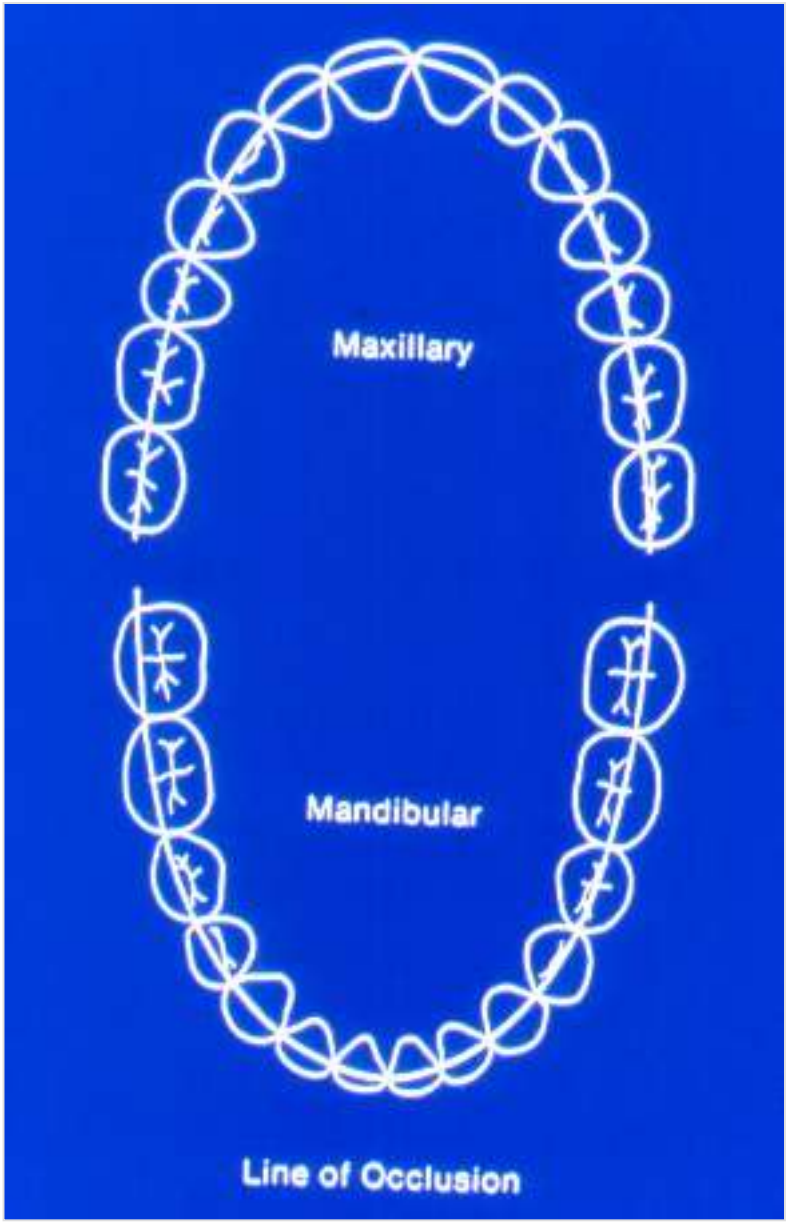
“Line of Occlusion”

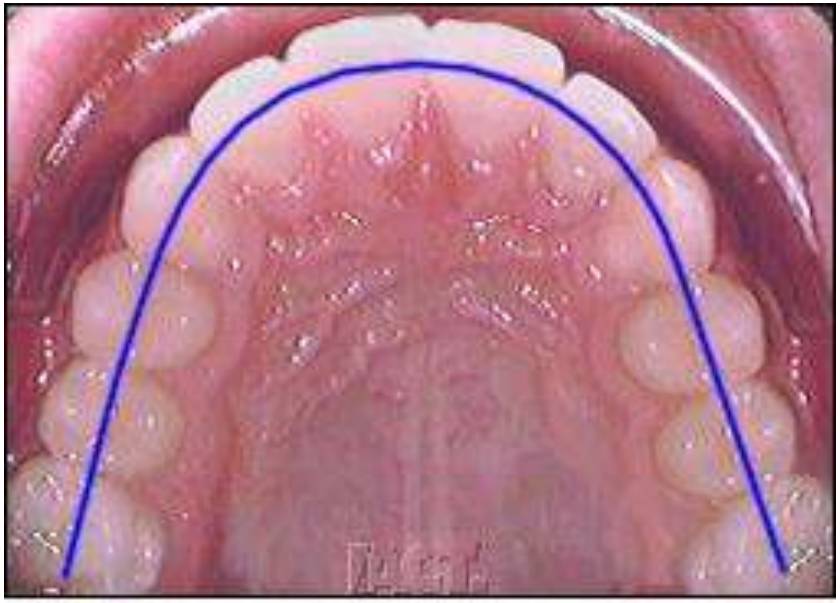
- The line of occlusion should follow a catenary curve
- Imagine a chain hanging from two hooks. This form a catenary curve

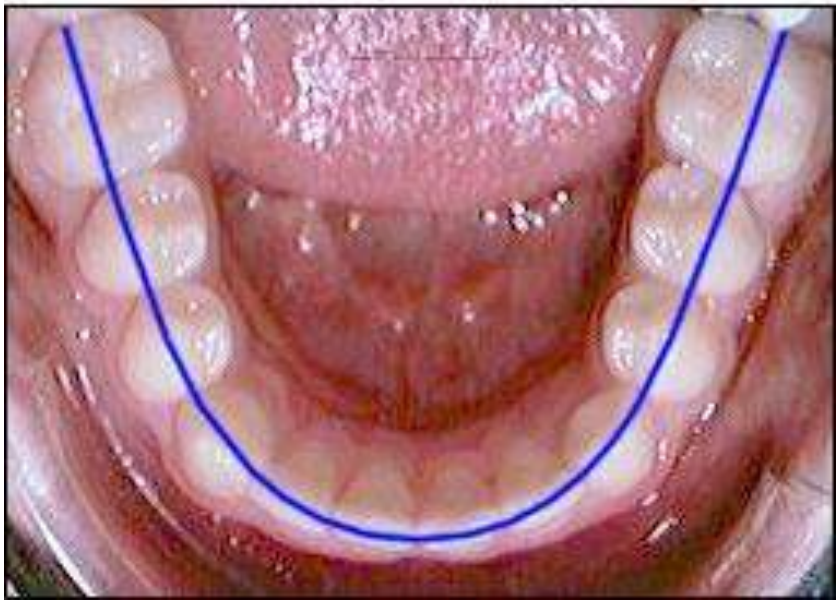
“Line of Occlusion”

- Maxilla: The curve should pass through the central fossa of the posterior teeth and lie along the cingulum of the anterior teeth

- Mandible: The same line runs along the buccal cusps and incisal edges of the lower anterior teeth

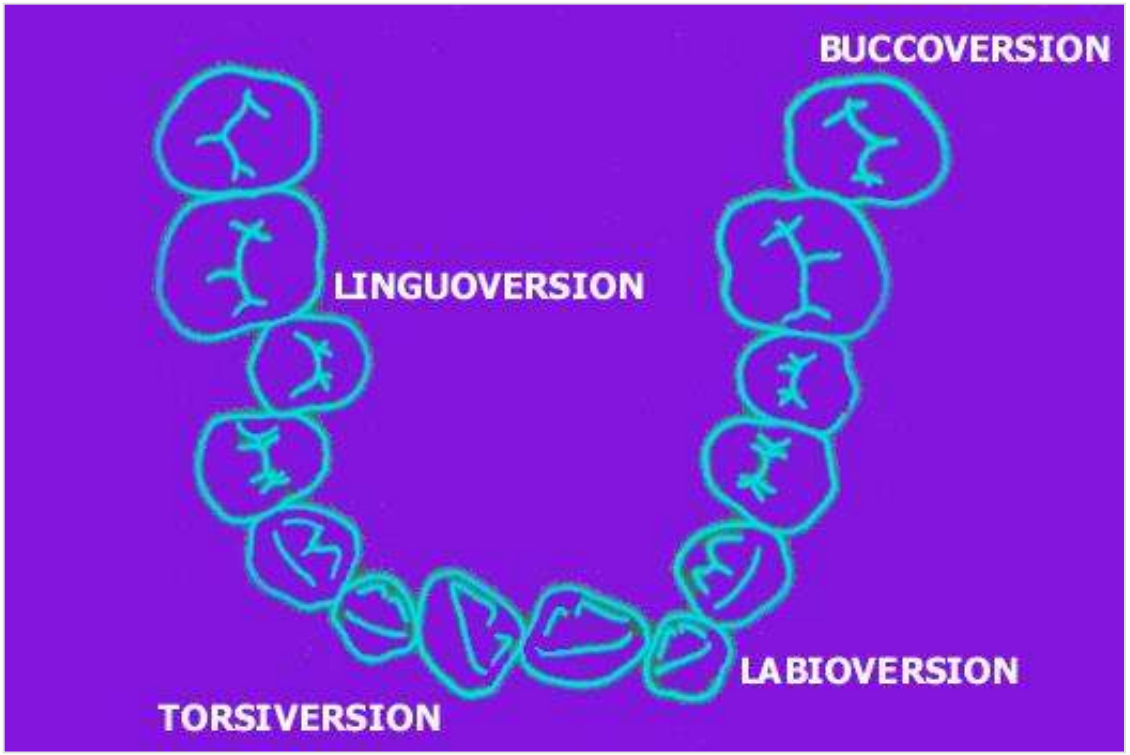

Maxillary
Mandibular
Line of Occlusion





“Line of Occlusion”

- Displacements from the line of occlusion form various “versions”



Normal Occlusion

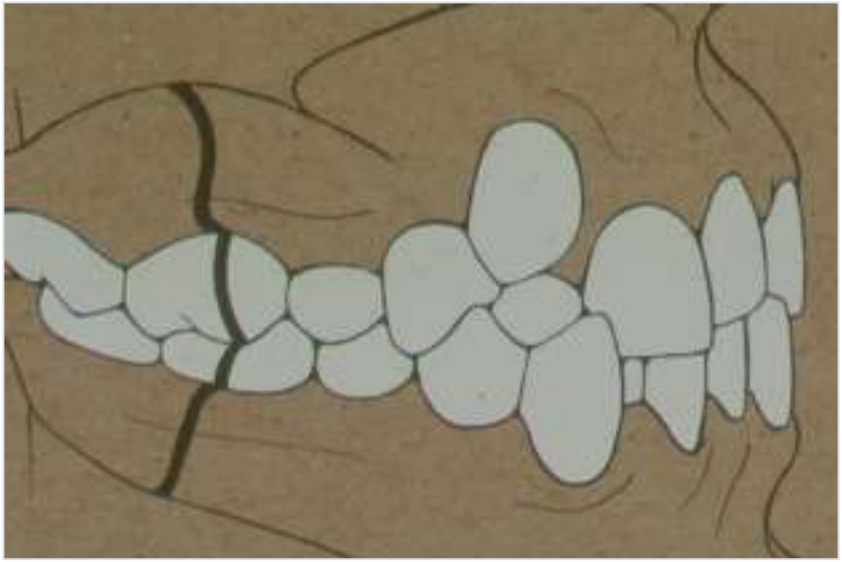
- Angle's first postulate plus a proper Line of Occlusion equals *normal occlusion*

Angle Class I malocclusion

- Normal relationship of the first molars
- The *Line of Occlusion* is incorrect because of malposed teeth, rotations, or other causes.

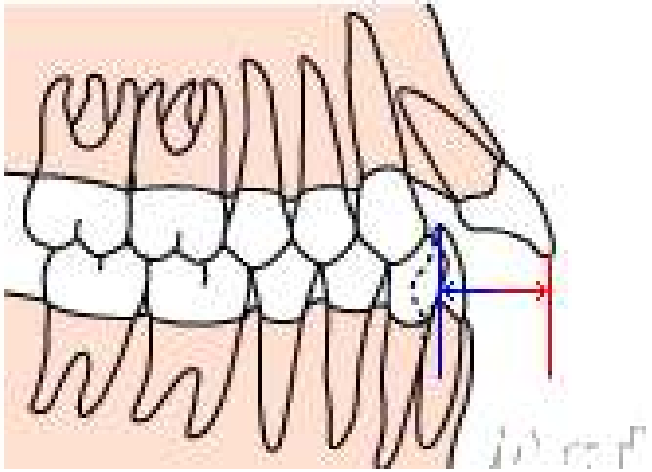
Angle Class I malocclusion

- Type I
  - Bunched or crowded Incisors
  - The canines are frequently labial



Angle Class I malocclusion

- Type II
  - Protrusion or labioversion of the maxillary incisors
  - This is sometimes referred to as “Incisor crowding expressed as protrusion”



Angle Class I malocclusion

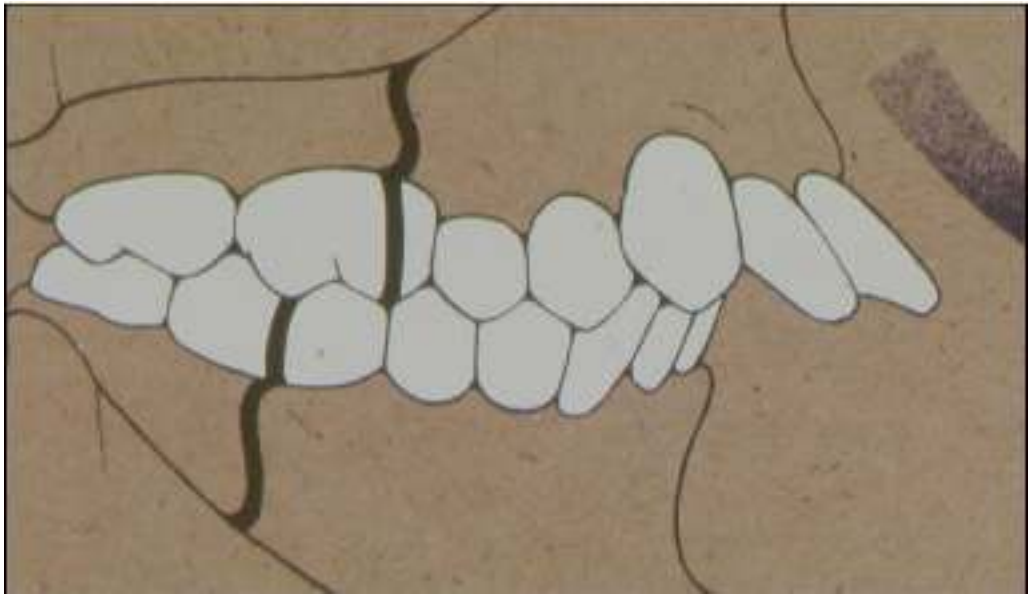
- Type III
  - One or more of the maxillary incisors in linguoversion to mandibular incisors
  - *Anterior crossbite*
- Type IV
  - Molars alone or molars and premolars in buccal or linguoversion
  - *Posterior crossbite*
- Type V
  - Mesial drifting of molars resulting from premature loss of teeth

Angle Class II malocclusion

- Lower molar distally positioned relative to upper molar
- The upper canines are mesial to the lower canines
- Line of occlusion not specified

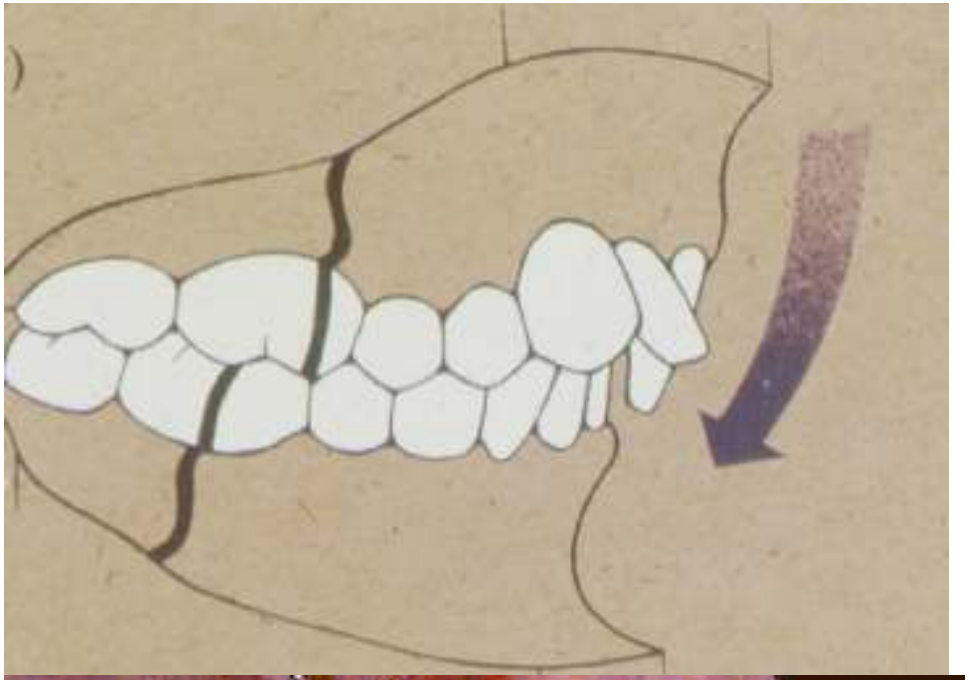
Angle Class II malocclusion

- Division 1:
  - ***Protruding*** maxillary incisors.
  - Maybe associated with the following:
    - Underdeveloped lower jaw
    - Protrusive upper jaw
    - Narrow arch form
    - Abnormal muscular pressure



Angle Class II malocclusion

- Division 2:
  - ***Retruding or bunched*** maxillary incisors
  - Maybe associated with the following:
    - Underdeveloped lower jaw
    - Deep bite
    - Laterals or canines tend to be in labioversion while the centrals are upright with minimal overjet

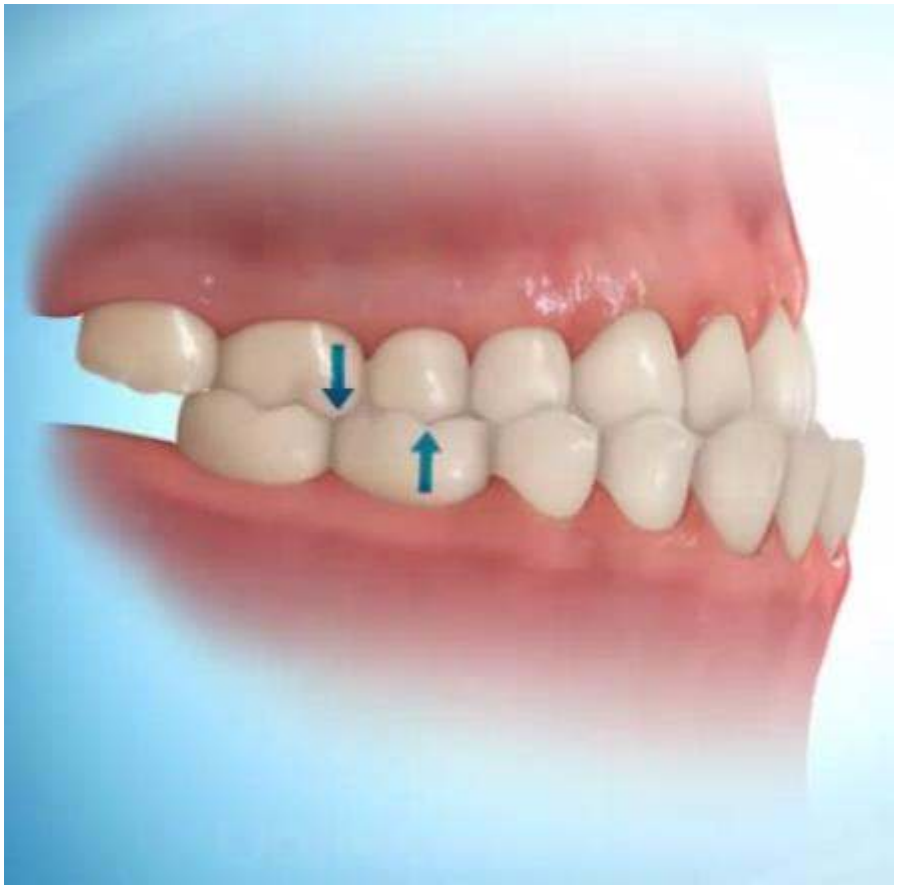


Angle Class II malocclusion

- ***Sunday Bite***
  - An individual postures the lower jaw forward to gain improved facial esthetics
  - If not identified an underlying Class II malocclusion may go undiagnosed

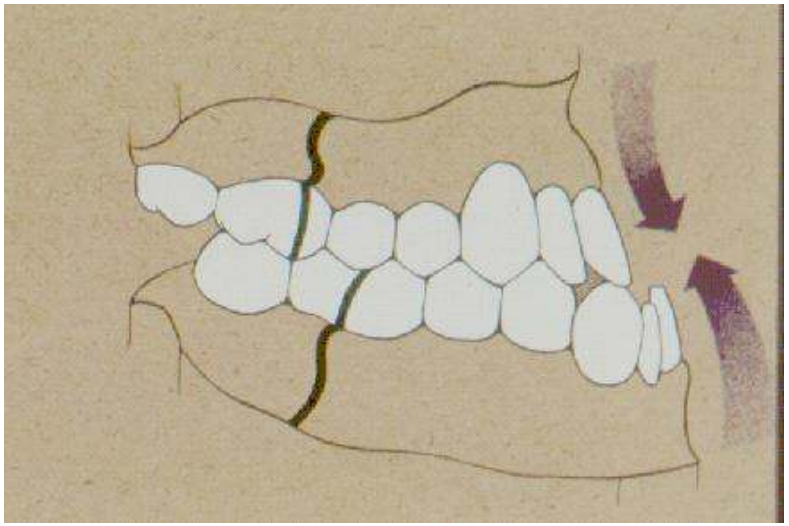
Angle Class III Malocclusion

- The mesialized relationship of the lower first molar to the upper by one-half cusp width or more
- The upper canines are distal to the lower canines
- Line of Occlusion not specified



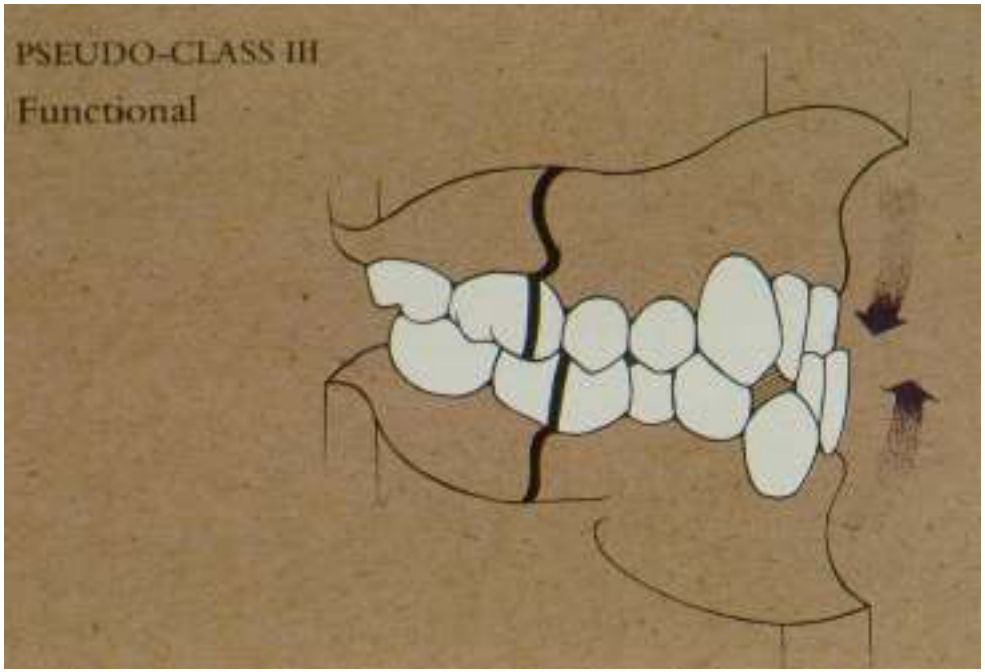
Angle Class III Malocclusion

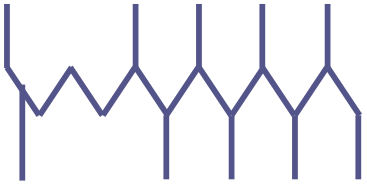
- Tends to be associated with on or more of the following
  - Overdeveloped lower jaw
  - Underdeveloped and constricted upper jaw
  - Dental compensations include:
    - Upright lower incisors
    - Flared upper incisors

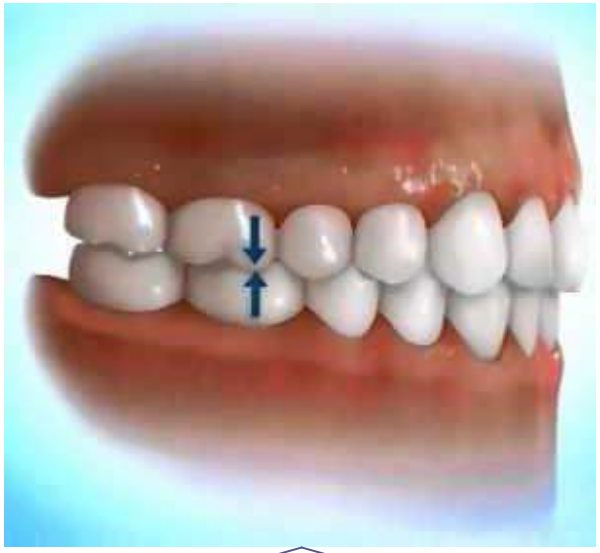


Angle Class III Malocclusion

- ***Pseudo – Class III***
  - An anterior interference causes the lower jaw to shift forward when closing.
  - This is ***not a true class III pattern***







Criticism of Angle

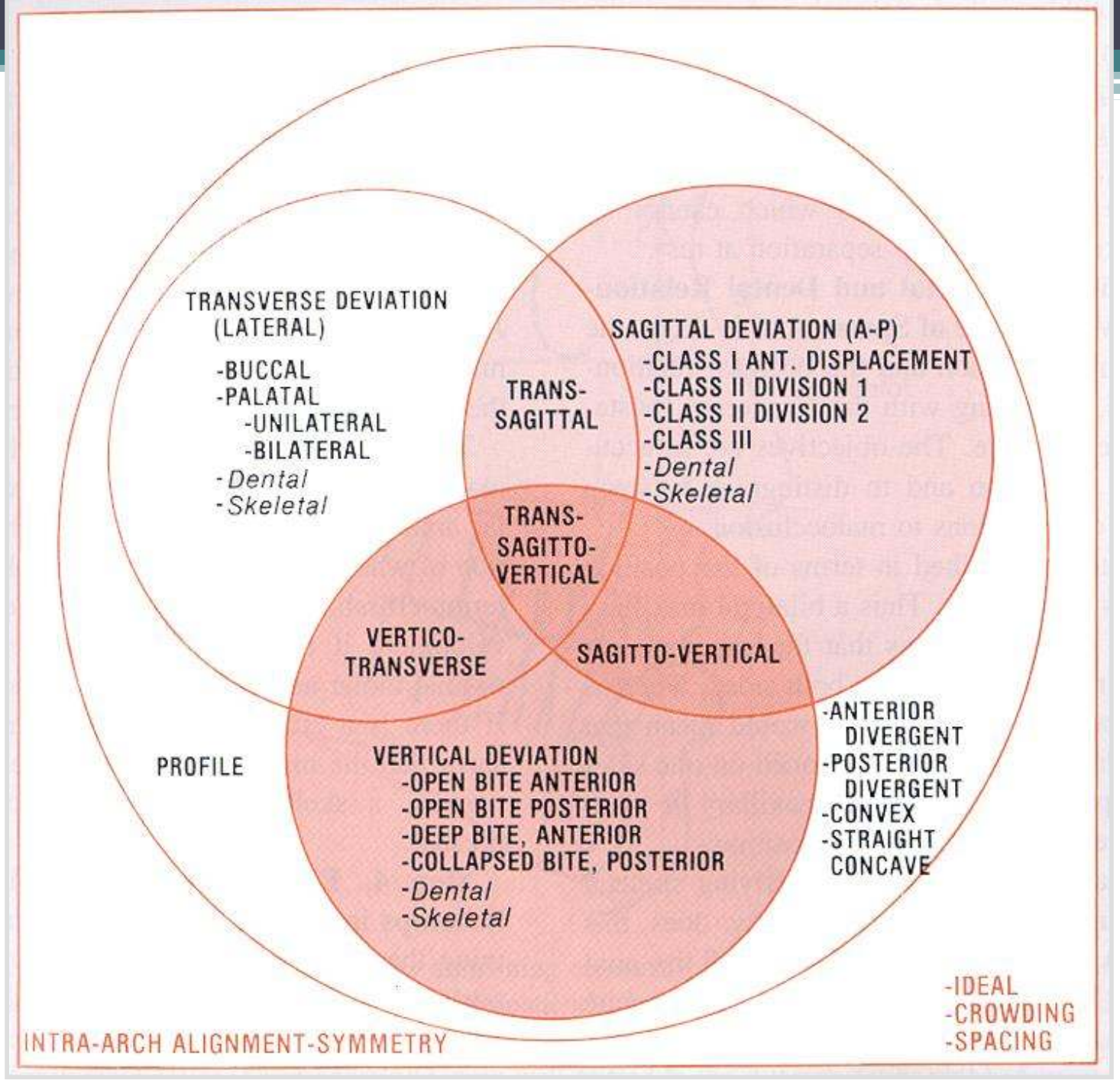
- The Pro's
  - Simple
  - Widely accepted
  - Has stood the test of time
- The Con's
  - Focuses only on the dentoalveolar relationships
  - Fails to recognize skeletal differences
  - Ignores Facial esthetics
  - Does not include the vertical and transverse dimensions
  - Does not recognize tooth size differences

Criticism of Angle

- Due to the limitations of Angle's classification other systems have been developed, but the spirit of Angle's classification still remains
- Angle's classification has been extended to include skeletal patterns:
  - Orthognathic or Class I skeletal…
  - Retrognathic or Class II skeletal…
  - Prognathic or Class III Skeletal…

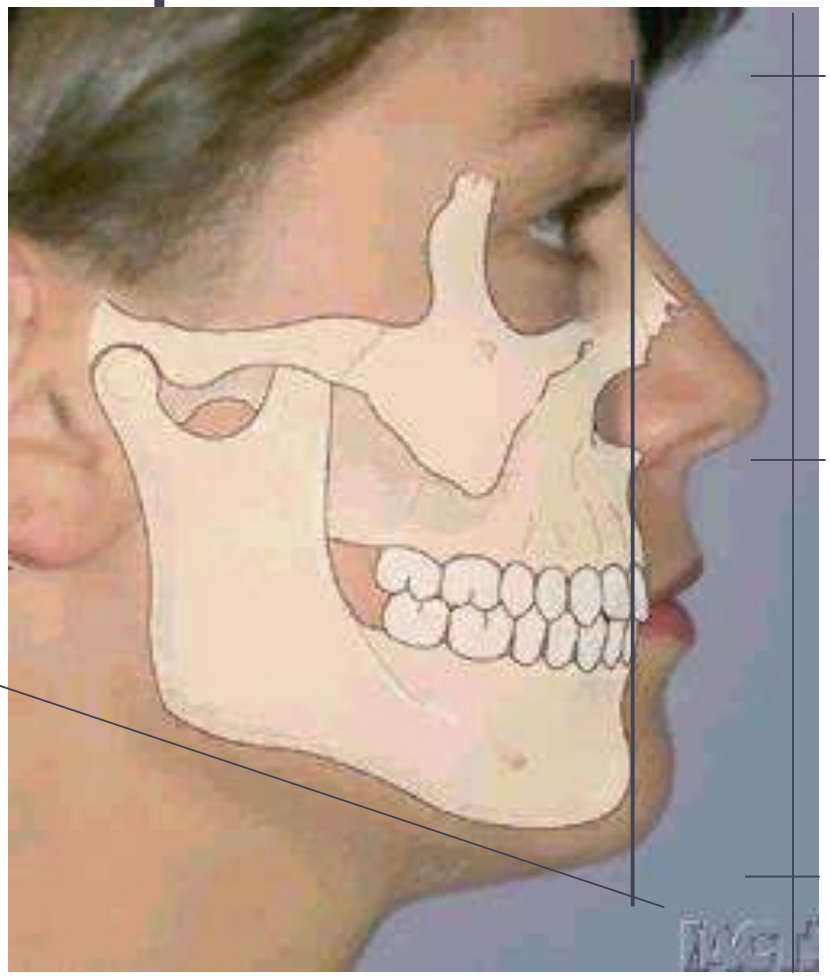
Ackermann and Proffit

- Modern orthodontic classification is comprised of five main characteristics which leads to the development of a diagnosis.
  - Intra-arch alignment
  - Soft tissue profile
  - Transverse plane of space
  - Saggital or A-P plane of space
  - Vertical plane of space
- Additionally, each characteristic may overlap one another. This is best seen in a Venn diagram

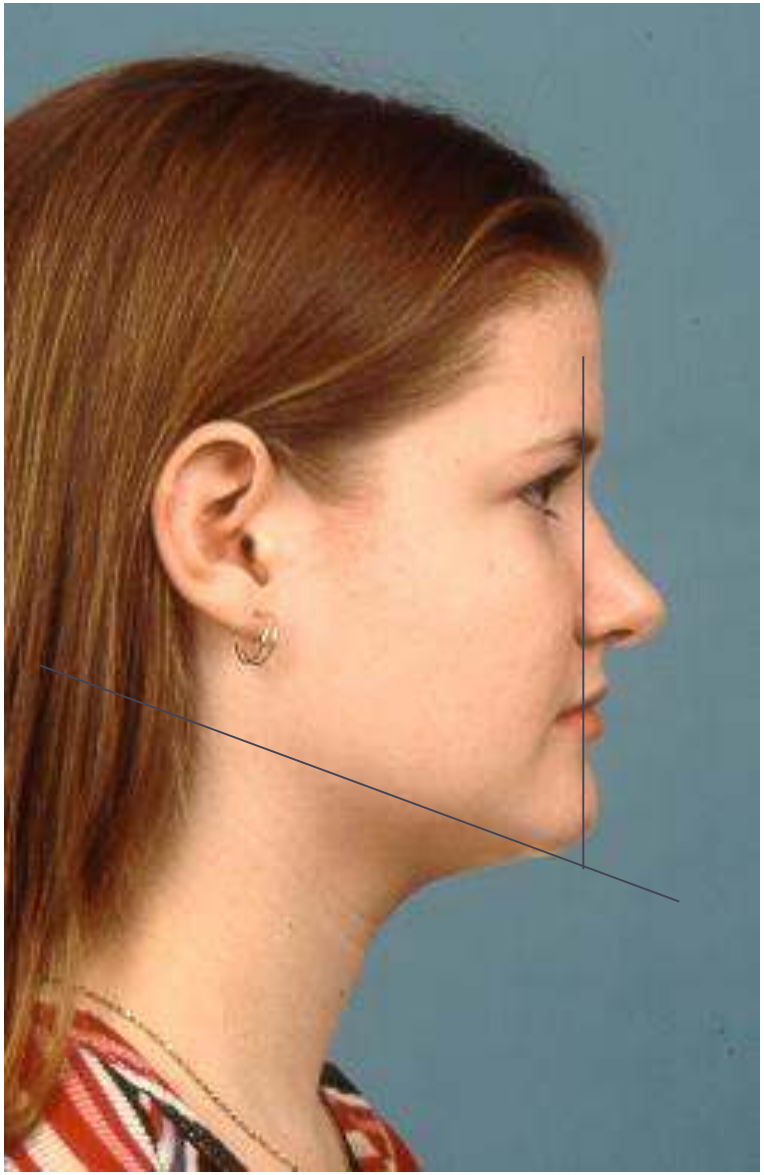

TRANSVERSE DEVIATION
(LATERAL)
-BUCCAL
-PALATAL
-UNILATERAL
-BILATERAL
-Dental
-Skeletal
TRANS-
SAGITTAL
SAGITTAL DEVIATION (A-P)
-CLASS I ANT. DISPLACEMENT
-CLASS II DIVISION 1
-CLASS II DIVISION 2
-CLASS III
-Dental
-Skeletal
TRANS-
SAGITTO-
VERTICAL
VERTICO-
TRANSVERSE
SAGITTO-VERTICAL
PROFILE
VERTICAL DEVIATION
-OPEN BITE ANTERIOR
-OPEN BITE POSTERIOR
-DEEP BITE, ANTERIOR
-COLLAPSED BITE, POSTERIOR
-Dental
-Skeletal
-ANTERIOR
DIVERGENT
-POSTERIOR
DIVERGENT
-CONVEX
-STRAIGHT
CONCAVE
-IDEAL
-CROWDING
-SPACING
INTRA-ARCH ALIGNMENT-SYMMETRY

Evaluating the facial profile

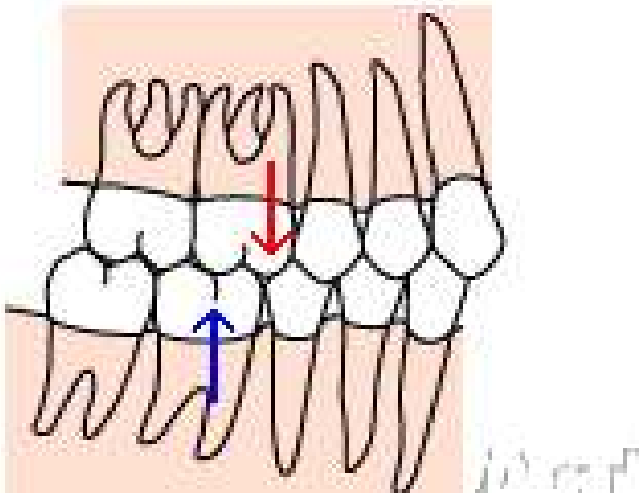
- Evaluation of the profile will help anticipate the skeletal and occlusal relations.

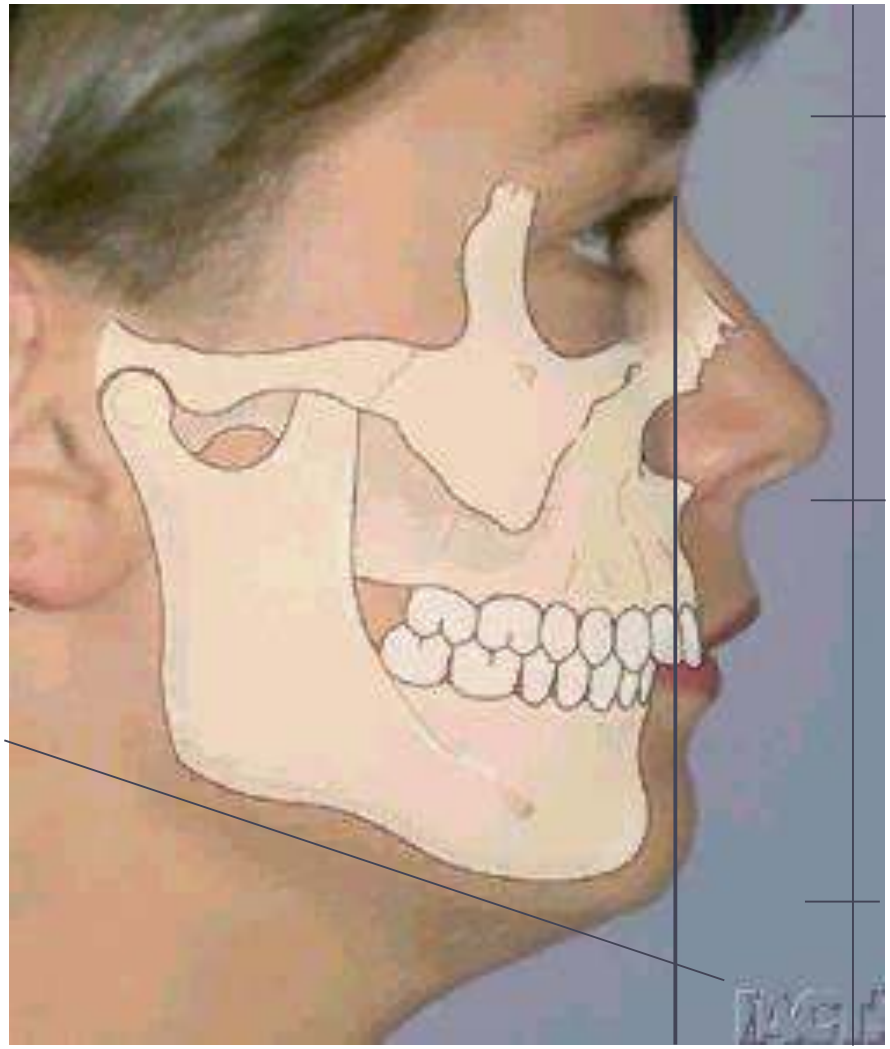


Class I Malocclusion

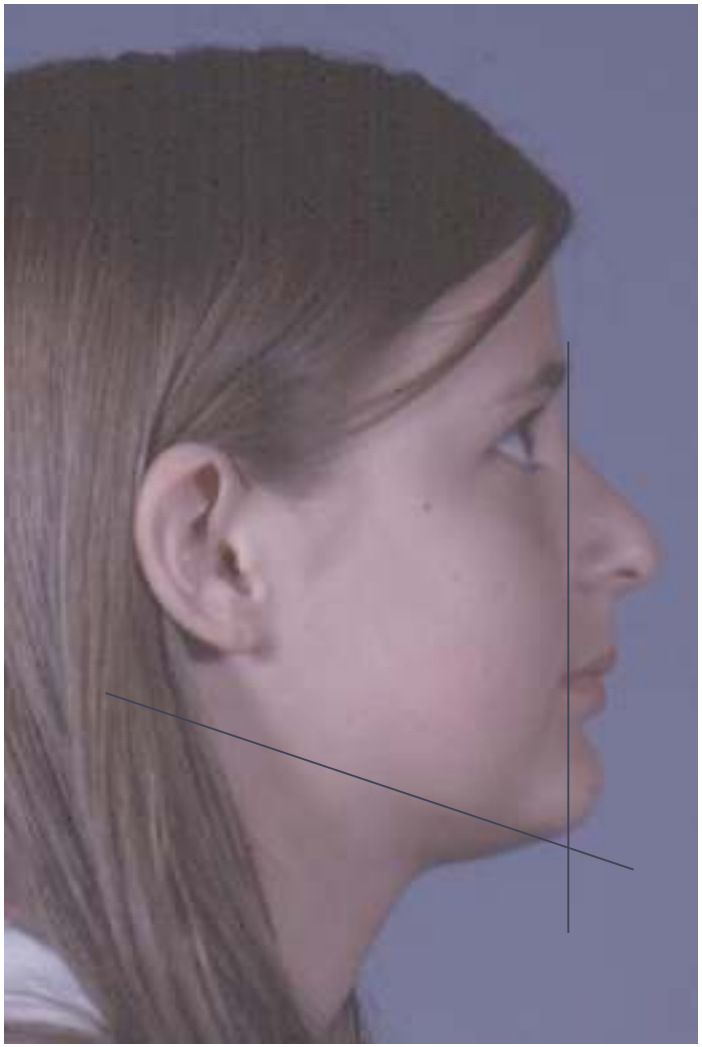


Class II Subdivision 1



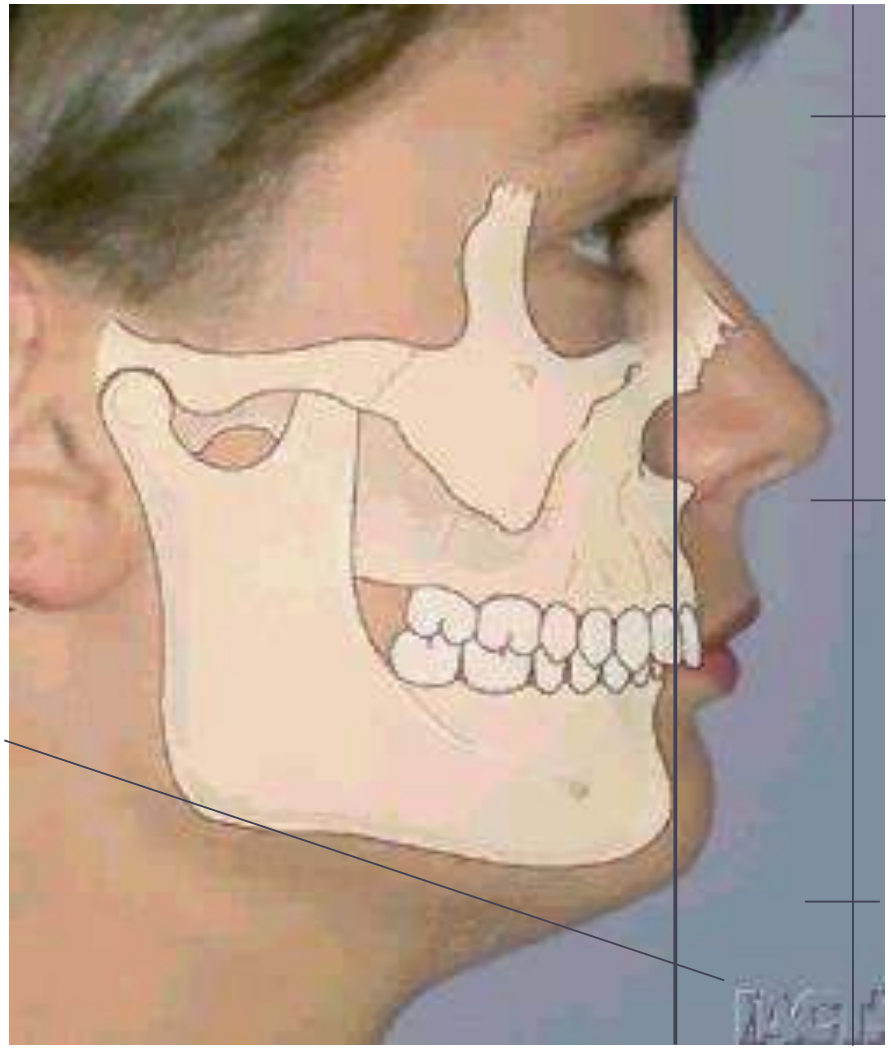


Class II Subdivision 1



Class II Subdivision 1

Class II Subdivision 2



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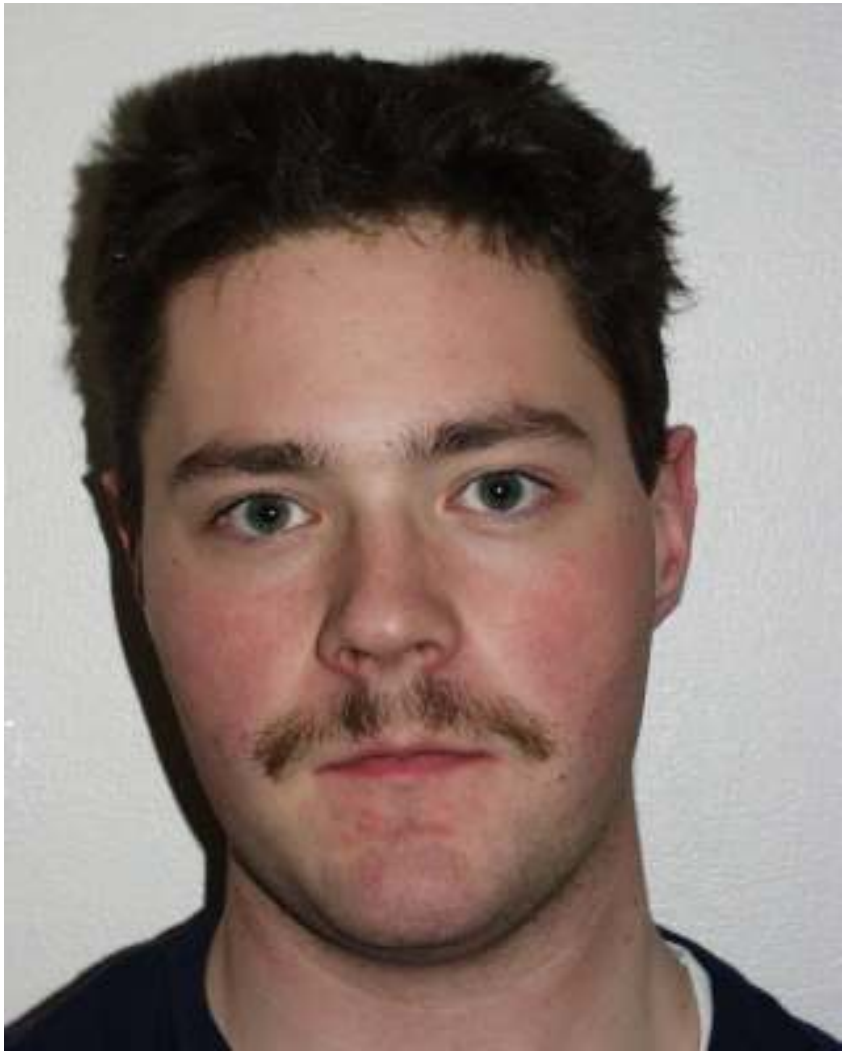
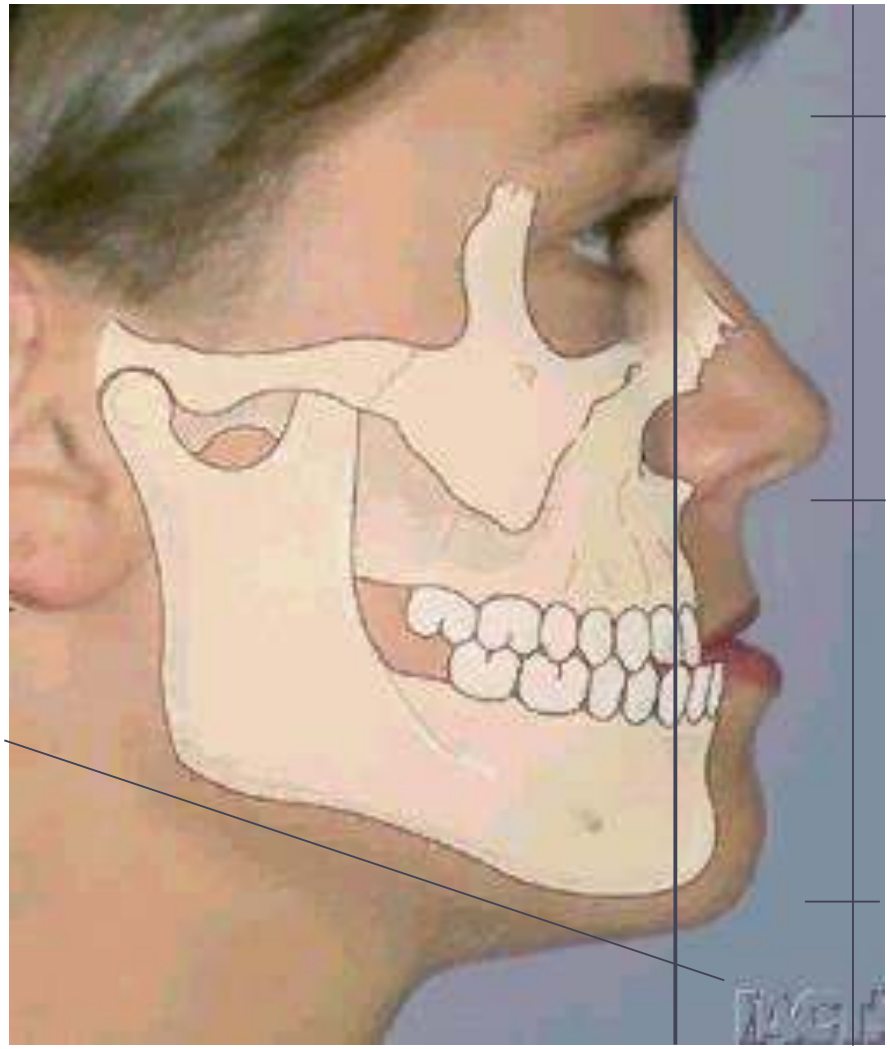


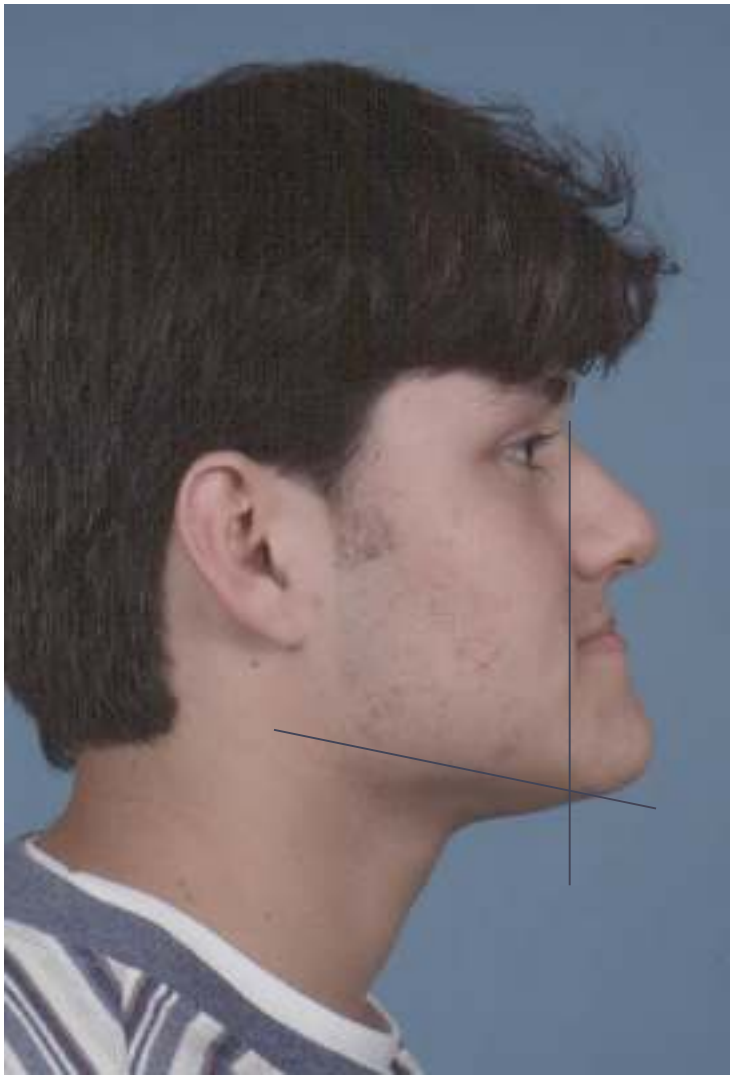
Class II Subdivision 2

Class II Subdivision 2

Class III



Class III



Class III

Treated Class II Subdivision 2

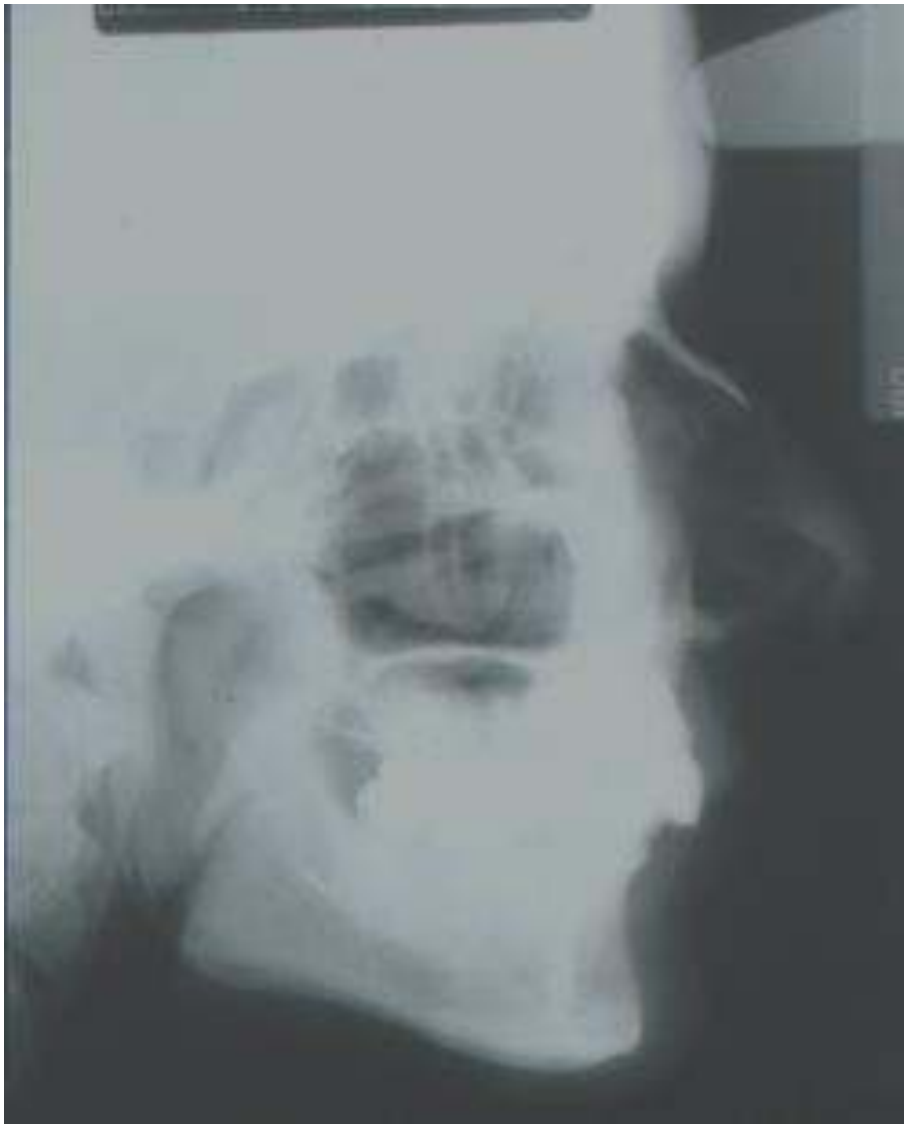
Treated by
Dr. William R. Proffit

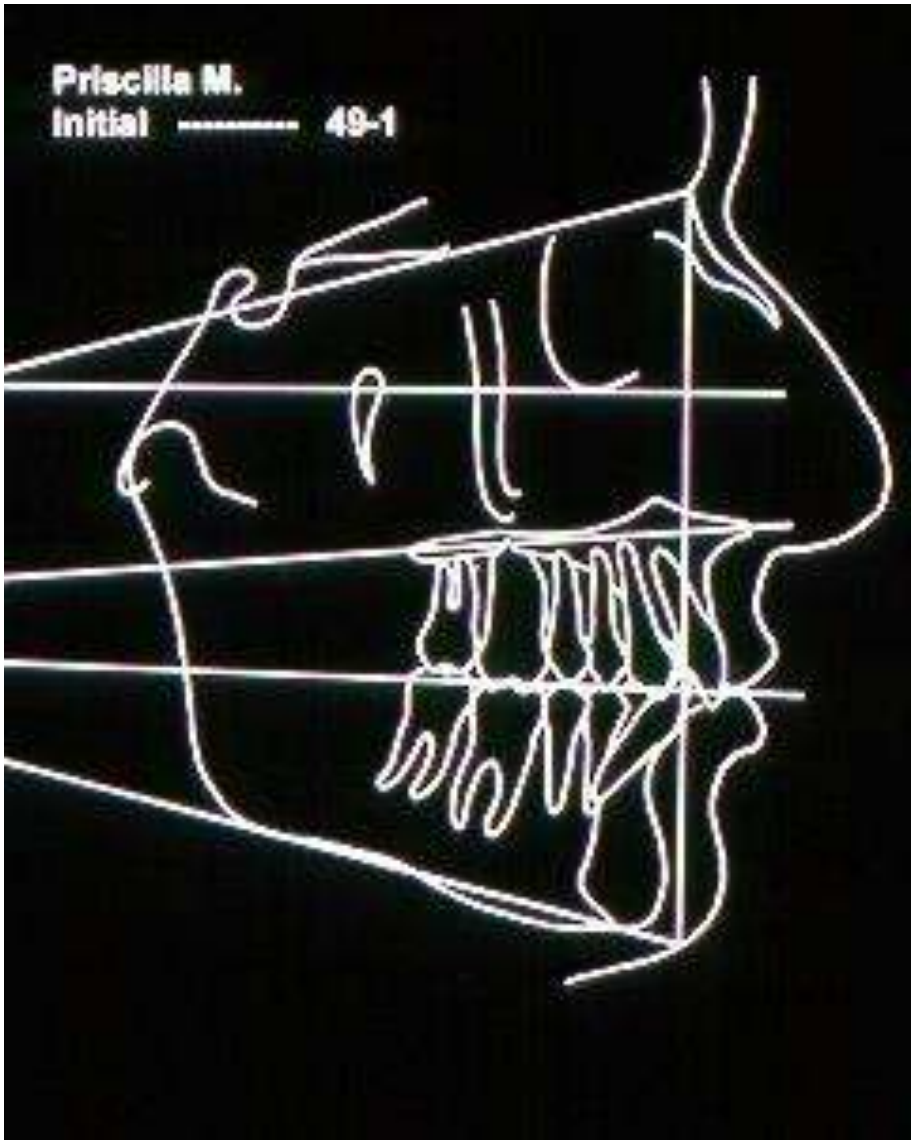
Priscilla M.

Age:49-1

Priscilla M. Age:49-1

Priscilla M. Age:49-1




Priscilla M.
Initial ---------- 49-1

Priscilla M. -- Age:49-1

Problems:

- Skeletal II/2, deep bite
- Missing max L 1st molar, bridge replacing it, crowns lower molars
- Localized mild periodontitis, especially mand premolar area

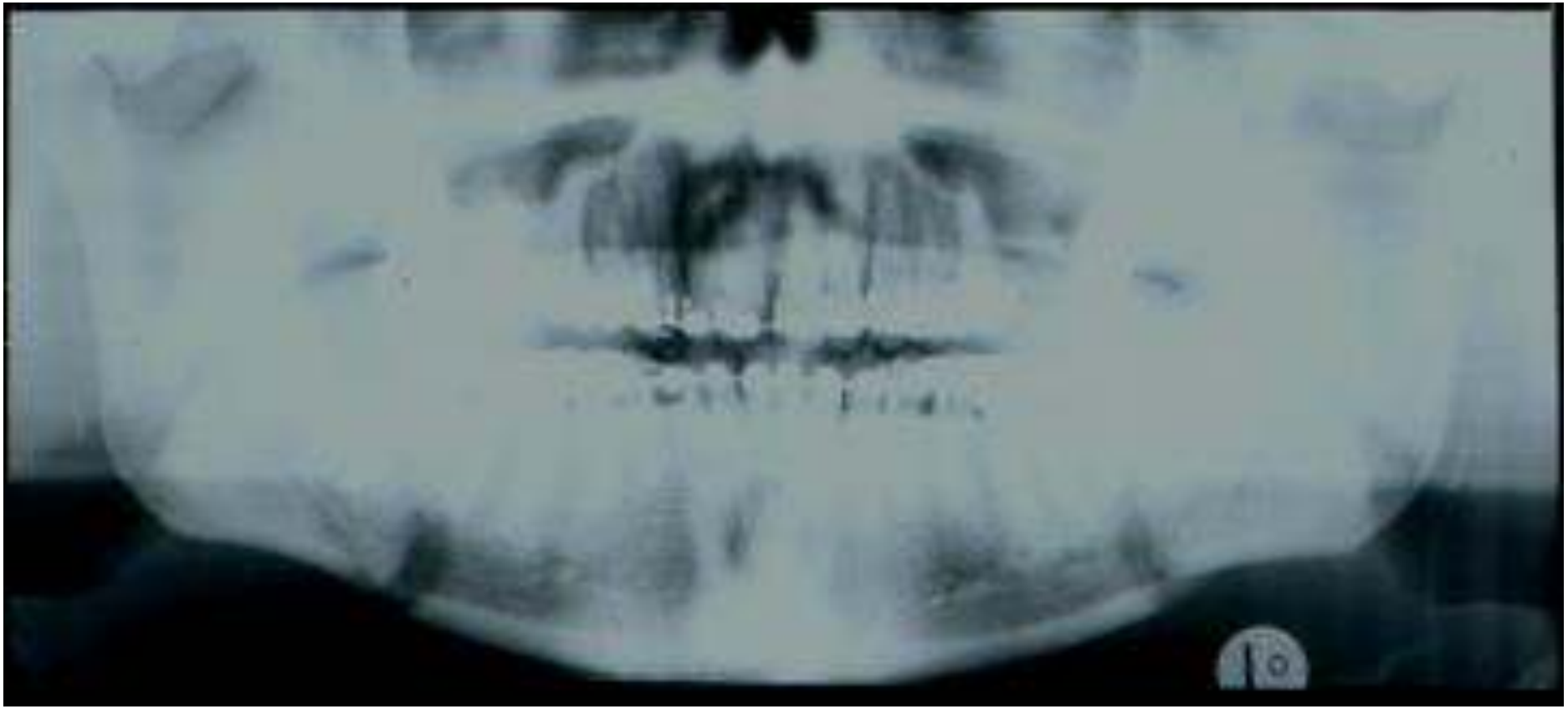
Priscilla M. -- Age:49-1

Plan:

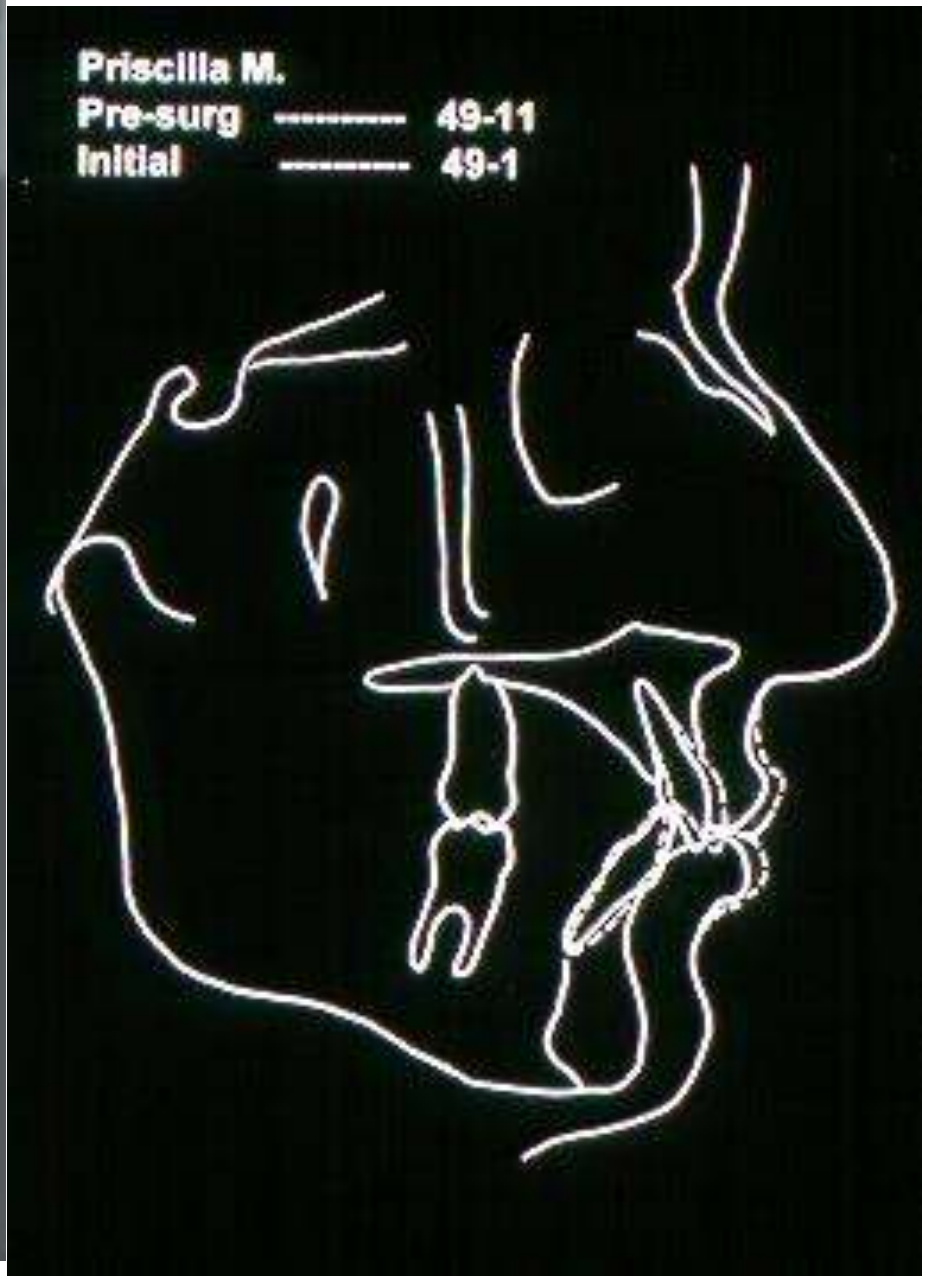
- Refer to periodontist for eval, general dentist to remove pontic
- Align with transverse maxillary dental expansion at premolars
- BSSO advancement
- Post-surgical leveling

Priscilla M. Age:49-11 Pre-Surg.

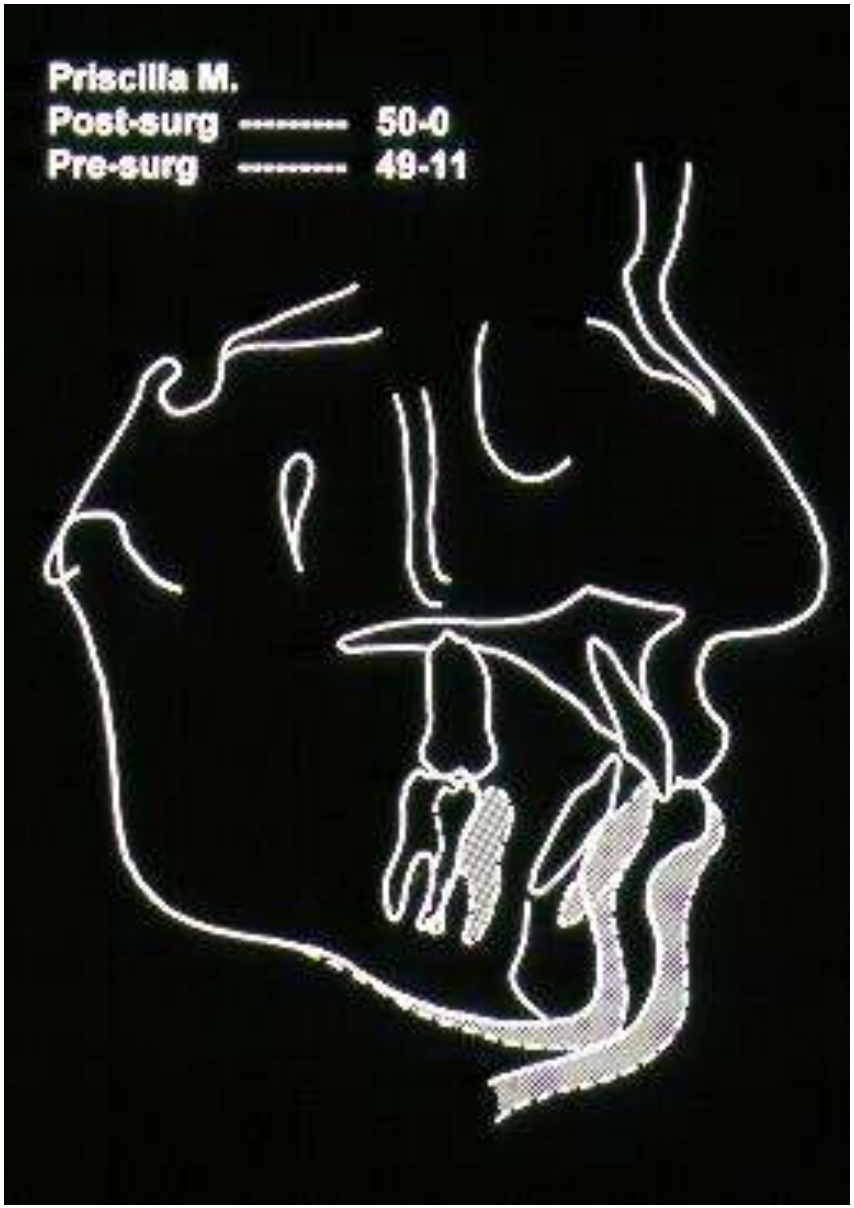
Priscilla M. Age:49-11 Pre-Surg.



Priscilla M. Age:49-11 Pre-Surg.

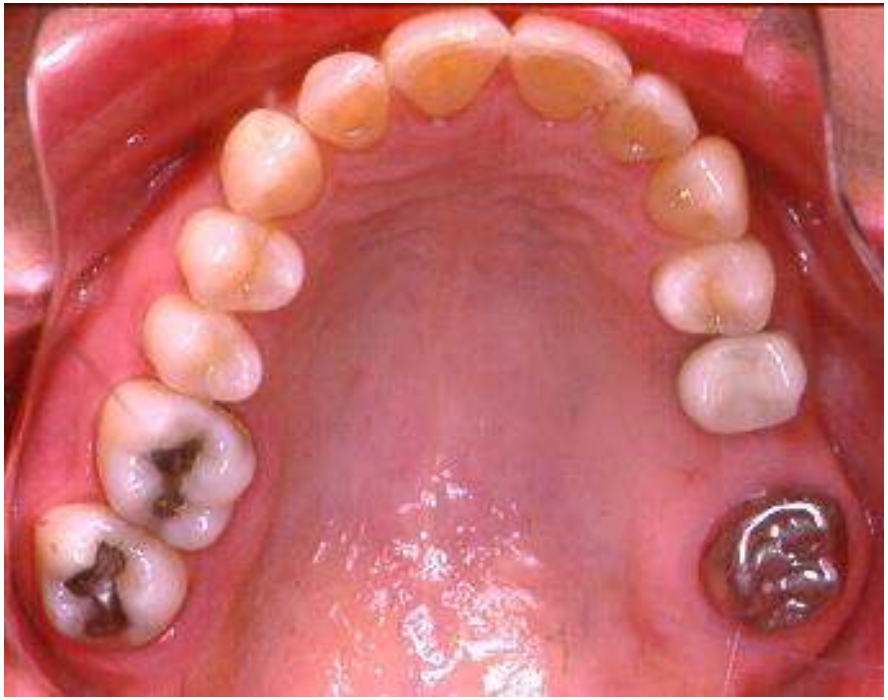

Priscilla M.
Pre-surg ---------- 49-11
Initial ---------- 49-1

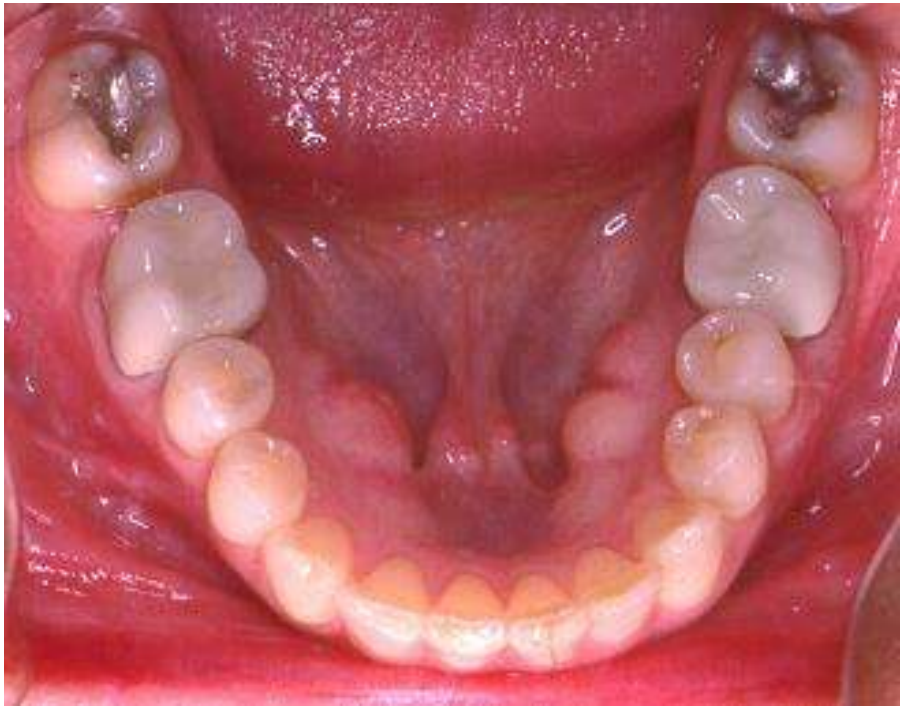
Priscilla M. Age:50-0 Post-Surg.


Priscilla M.
Post-surg ---------- 50-0
Pre-surg ---------- 49-11

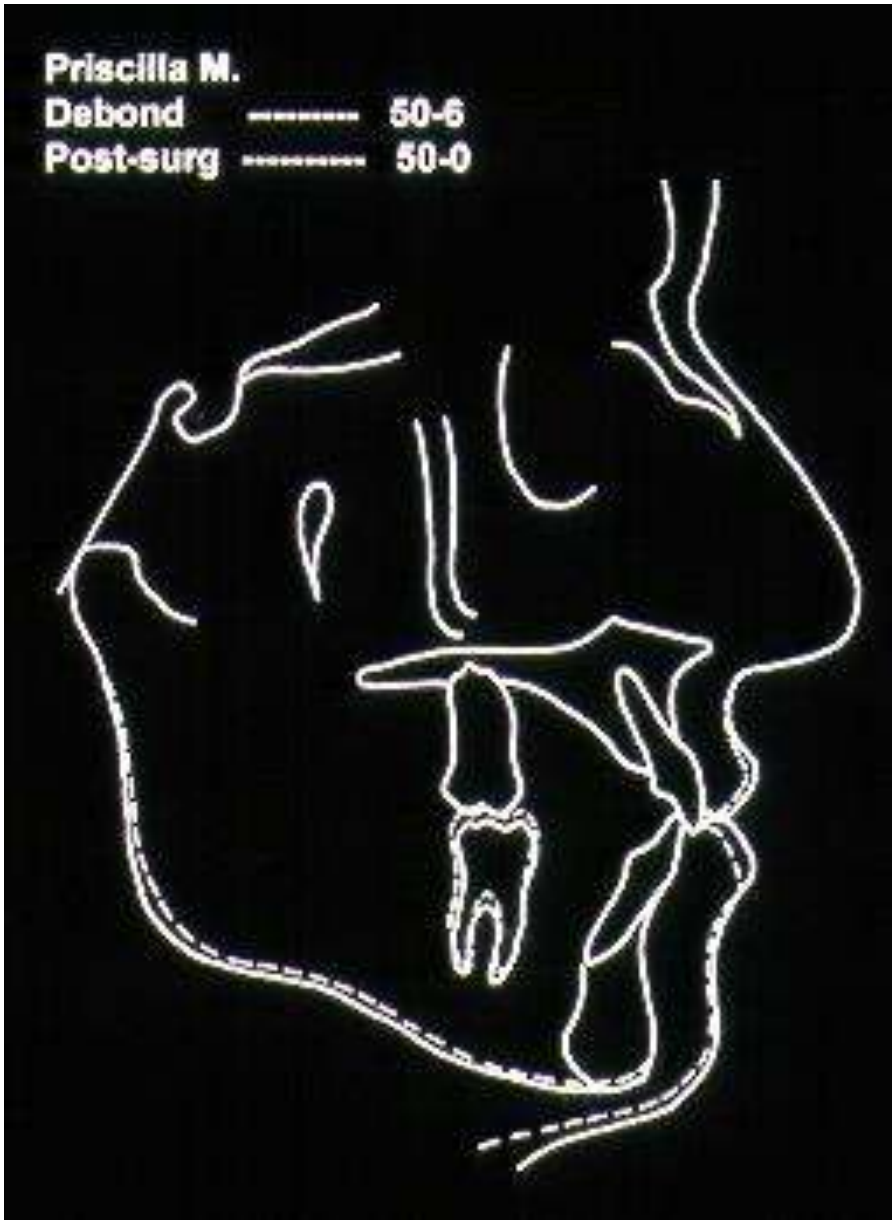
Priscilla M. Age:50-0 Post-Surg.

Priscilla M. Age:50-6 Debond



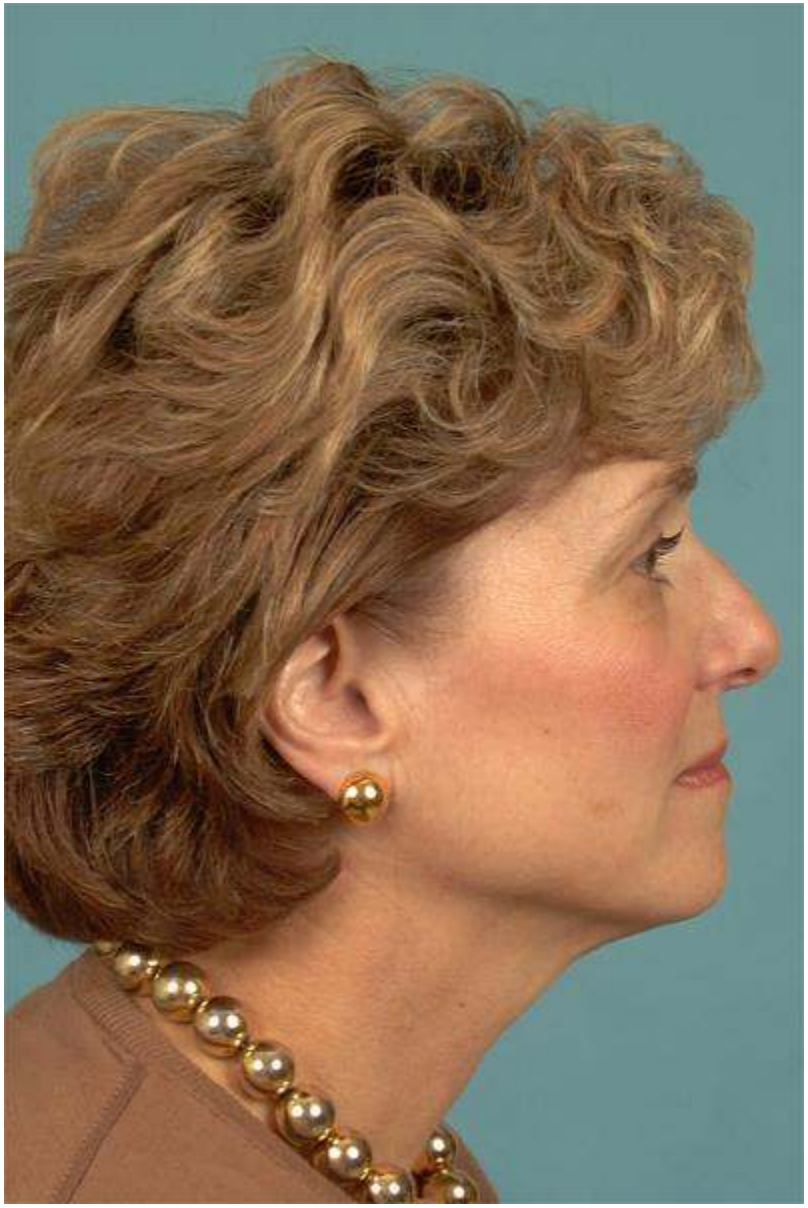


Priscilla M. Age:50-6 Debond


Priscilla M.
Debond ------- 50-6
Post-surg ------- 50-0

Priscilla M. Age:50-9 New bridge

Priscilla M. Age: 54-9 5 year recall



Priscilla M. Age: 54-9 5 year recall

PRINCIPLES OF ORTHODONTICS II

Review of Diagnosis and Treatment Planning In Orthodontics

Lauren Morris, DMD

REVIEW OF DIAGNOSIS AND TREATMENT PLANNING IN ORTHODONTICS

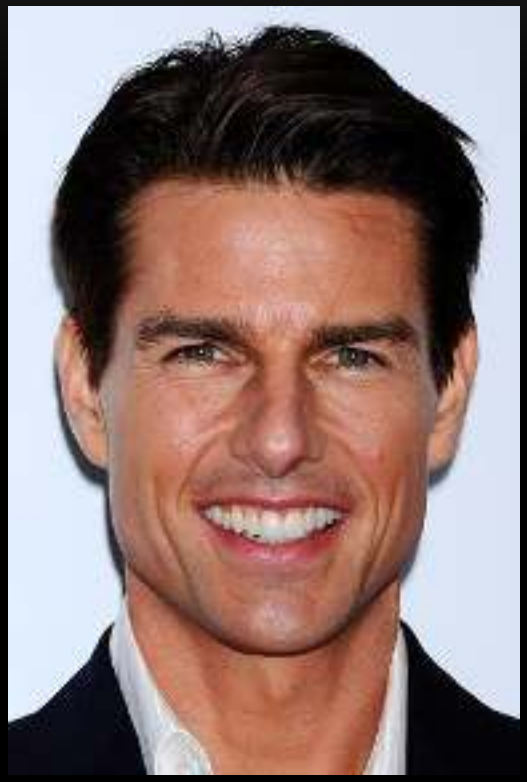
GATHERING THE DATA FOR PROBLEM-ORIENTED DIAGNOSIS

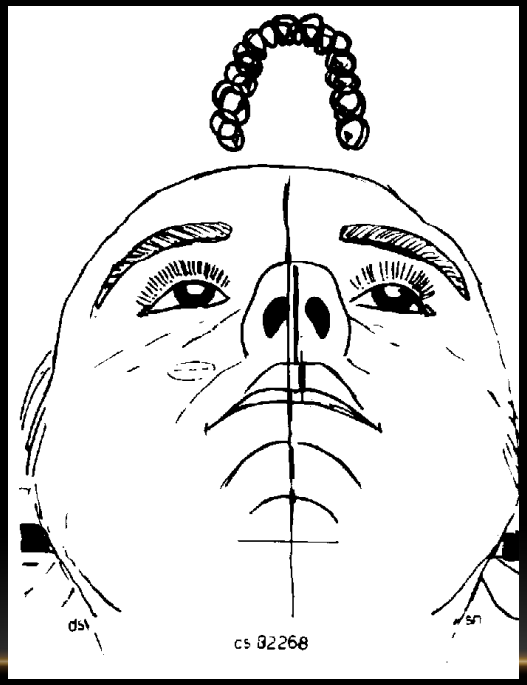
- Medical History and Chief Complaint
- Growth Potential
- Clinical evaluation
  - Facial analysis
  - Occlusal analysis
- Cephalometric analysis
- Evaluating jaw size and proportion
  - Tooth size analysis / Arch length discrepancies

FACIAL ANALYSIS

- Transverse problems: Facial asymmetry
- Antero-posterior problems
- Vertical problems

TRANSVERSE: SYMMETRY APPRECIATION

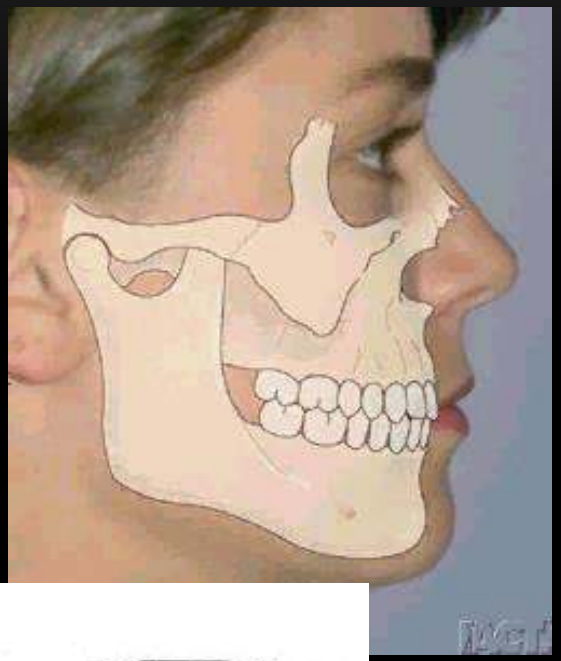


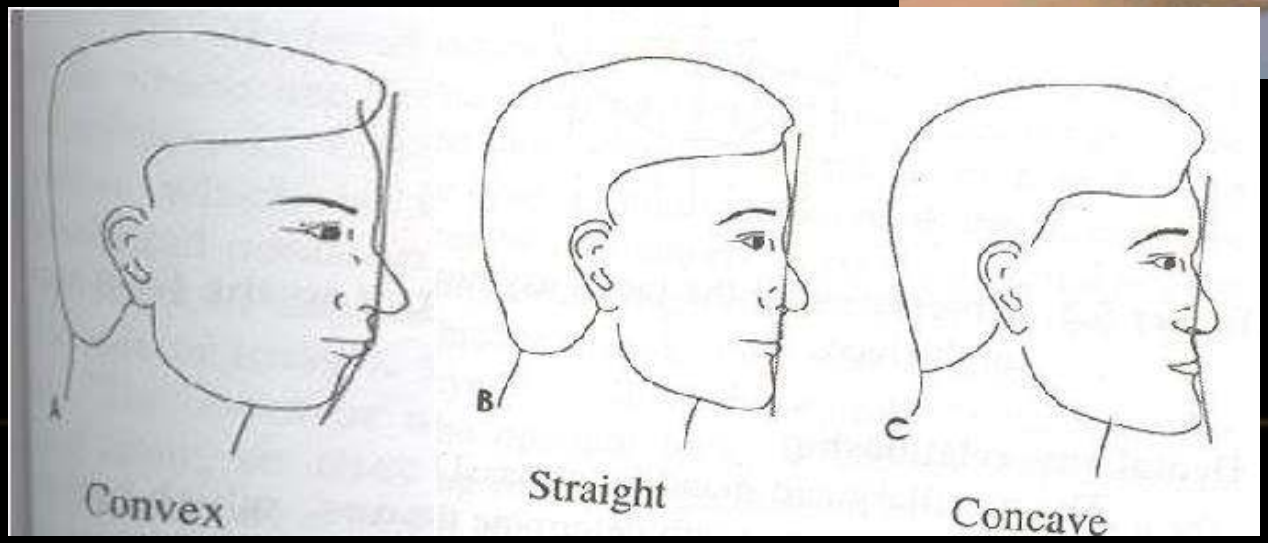


ANTERO-POSTERIOR

- Facial profile:

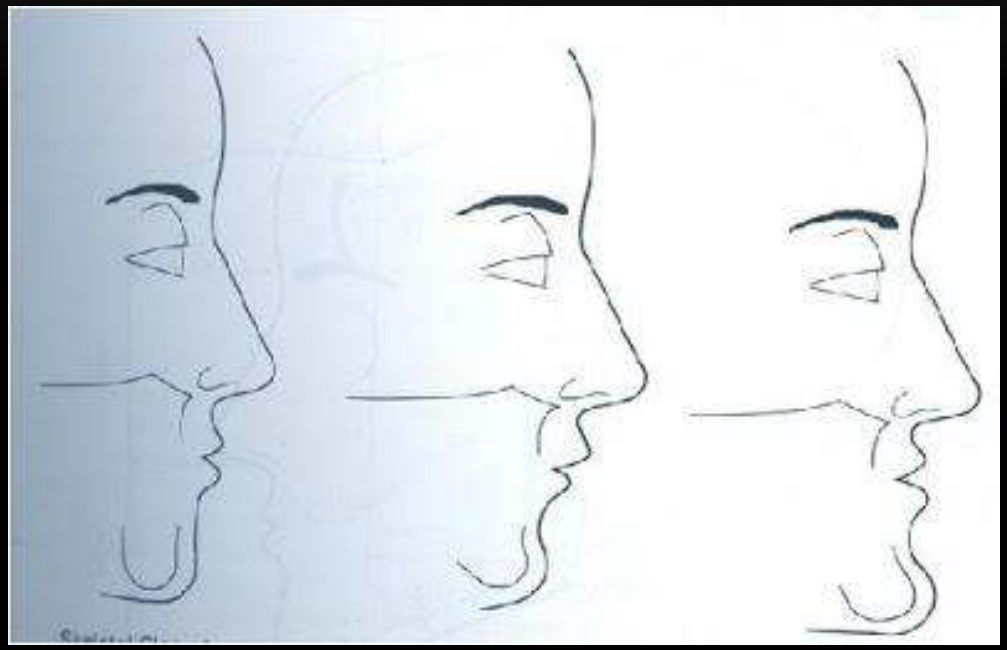
  Evaluation of the profile will help anticipate the skeletal and occlusal relations.





ANTERO-POSTERIOR

- **Antero-posterior problems**
  - **Skeletal Class I**
  - **Skeletal Class II**
  - **Skeletal Class III**



- **Treatment options**
  - **Growth modification**
  - **Camouflage treatment**
  - **Surgical treatment**

CAMOUFLAGE TREATMENT

- Excessive dental protrusion
- Excessive dental retrusion

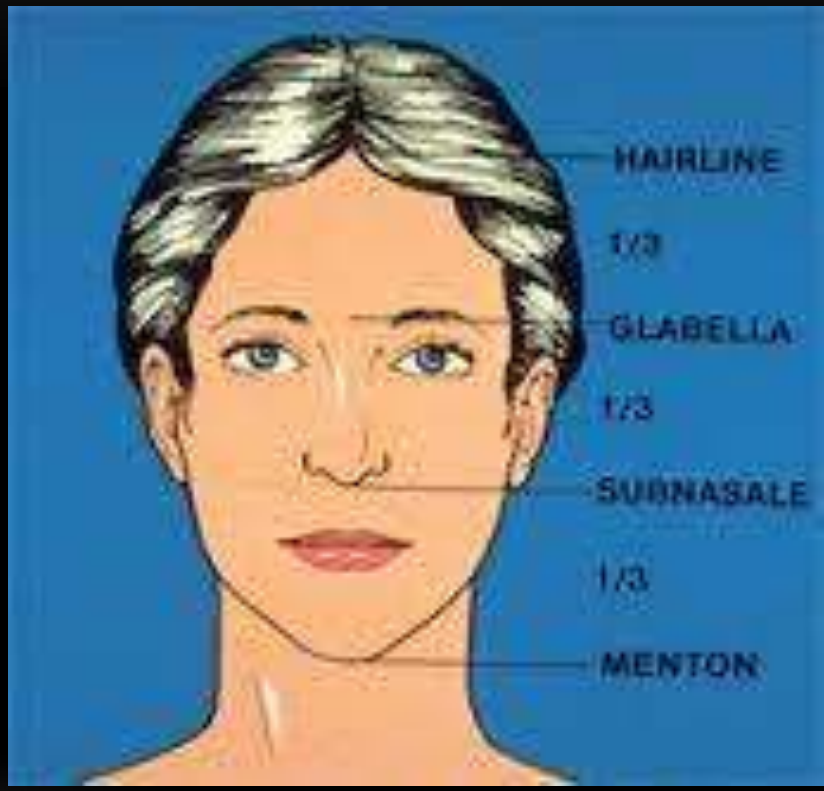
⇓

Comprehensive treatment

+ Extraction of teeth

VERTICAL

- Facial Thirds
  - Upper 1/3:
    - Trichion to Glabella
  - Middle 1/3:
    - Glabella to Subnasale
  - Lower 1/3:
    - Subnasale to Menton



VERTICAL PROBLEMS

Brachycephalic

- Short broad face
- Associated with:

- Maxillary vertical deficiency

- Class II deep bite

VERTICAL PROBLEMS

Dolichocephalic

- Long narrow face
- Associated with:

  - Vertical maxillary excess

  - Often deficient zygomatic width

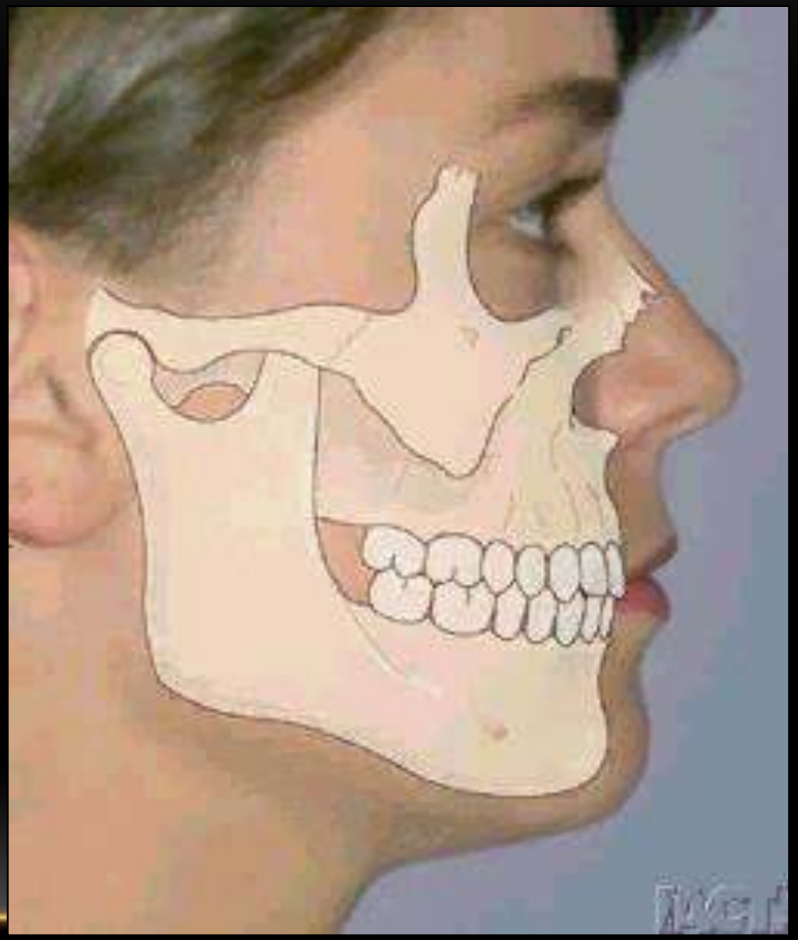
  - Openbite

OCCLUSAL ANALYSIS

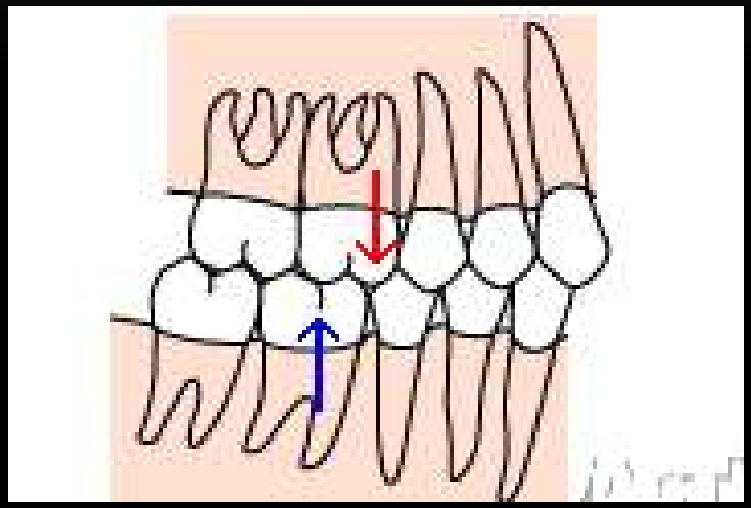
- Transverse:
  - Midlines
  - Posterior crossbites
- Antero-posterior:
  - Angle classification **
  - Overjet or anterior crossbite
- Vertical:
  - Overbite

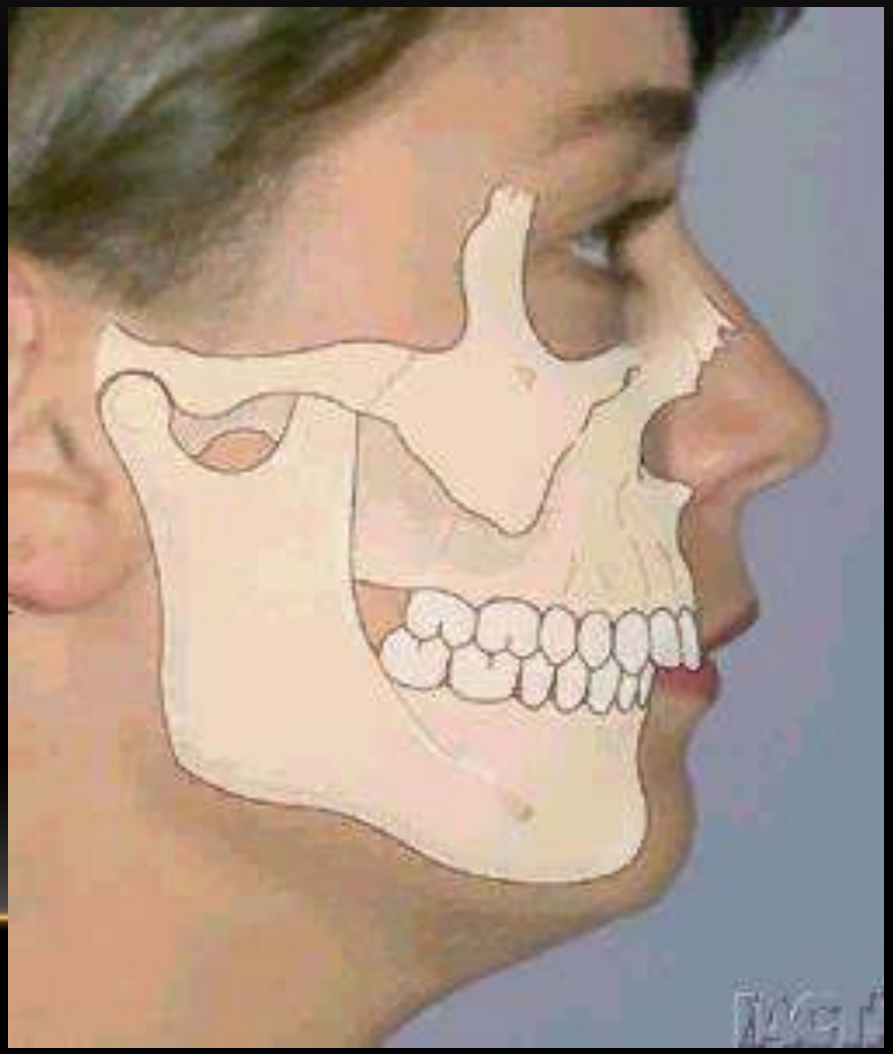
CLASS I

- Mesiobuccal cusp of upper first molar should be on buccal groove of lower first molar.



CLASS II, SUBDIVISION 1





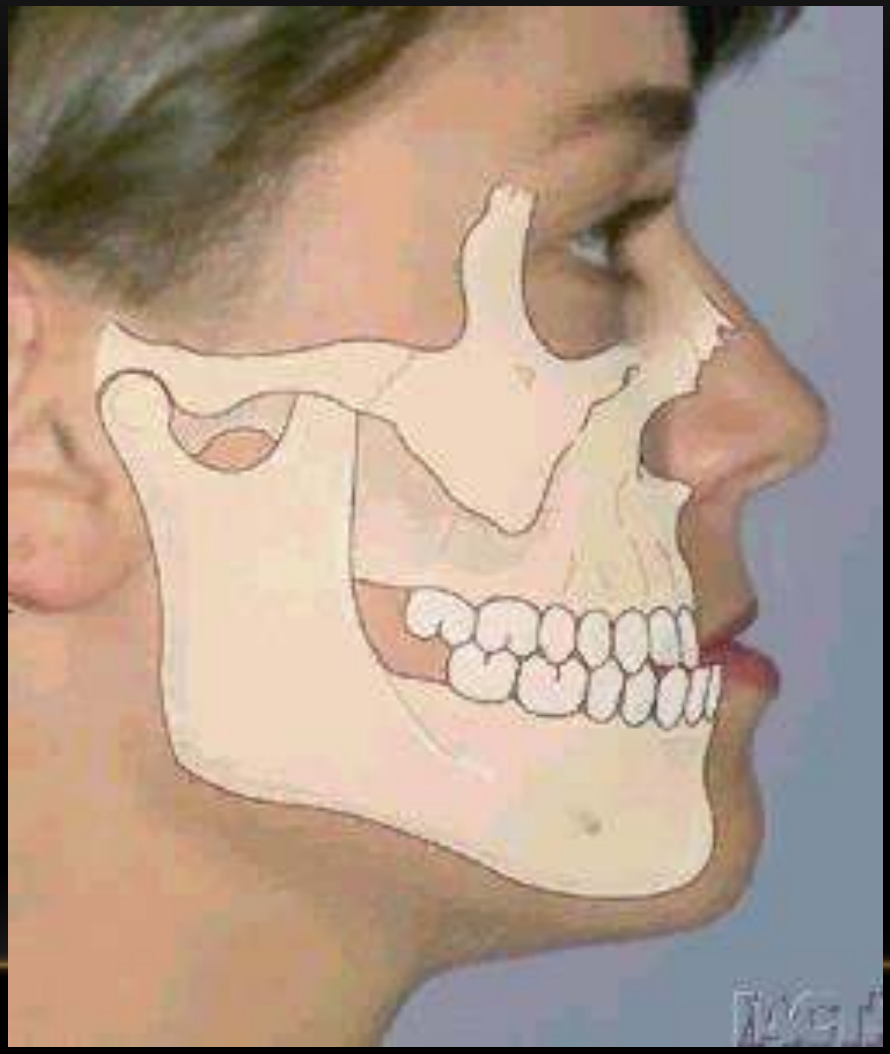
- Large Overjet
- Increased risk of fracturing anterior teeth

CLASS II, SUBDIVISION 1

CLASS II. SUBDIVISION 2

CLASS II, SUBDIVISION 2

CLASS III



CLASS III

CEPHALOMETRIC ANALYSIS

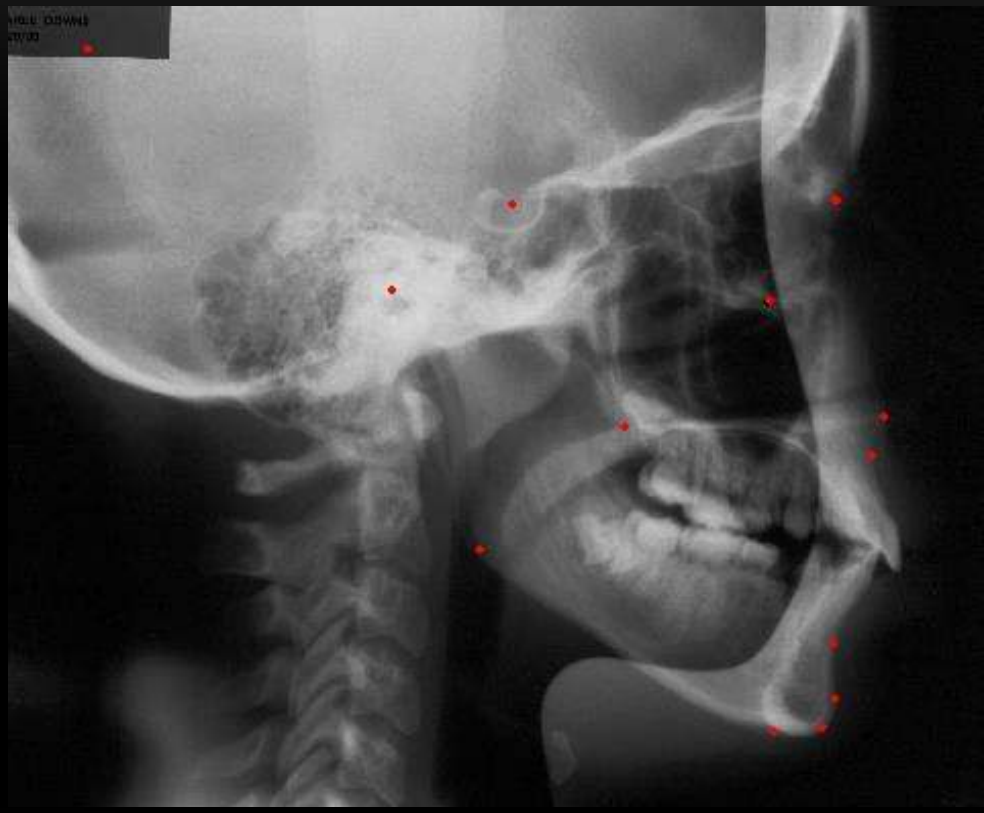
- What does cephalometrics do for the diagnosis?
  - A primary goal of clinical cephalometric radiography has been to determine the relationship of parts and spatial relation of the teeth to the jaws.
  - Different analyses are necessary because different clinicians look at different parameters in arriving at a diagnosis.

CEPHALOMETRIC ANALYSIS

- Cephalometric radiographs are always standardized. The distance from the x-ray source to the subject's midsagittal plane is **5 feet.***
- Cephalometrics is used for:
  - Diagnosis
  - Treatment planning
  - Evaluation of treatment results

LATERAL CEPHALOMETRIC LANDMARKS

- Po(porion), the midpoint of either the upper contour of the external auditory canal or the upper contour of the metal ear rod of the cephalometer.
- S (sella), the midpoint of the cavity of sella turcica.
- Na (nasion), the anterior point of the intersection between the nasal and frontal bones.
- Or (orbitale), the lowest point on the inferior margin of the orbit.
- ANS (anterior nasal spine), the tip of the anterior nasal spine.
- Point A, the inner most point on the contour of the premaxilla between ANS and the upper incisor.
- Point B, the innermost point on the contour of the mandible between the incisor and the bony chin.



LATERAL CEPHALOMETRIC LANDMARKS

- Pog (pogonion), the most anterior point on the contour of the chin.
- Gn (gnathion), the center of the inferior contour of the chin between menton and pogonion.
- Me (menton), the most inferior point on the mandibular symphysis, bottom of the chin.
- Go (gonion), the contour of the inferior contour of the mandibular angle.

STEINER ANALYSIS

- Cecil Steiner, 1950's
- Linear and angular measurements
- Sella-Nasion is reference plane

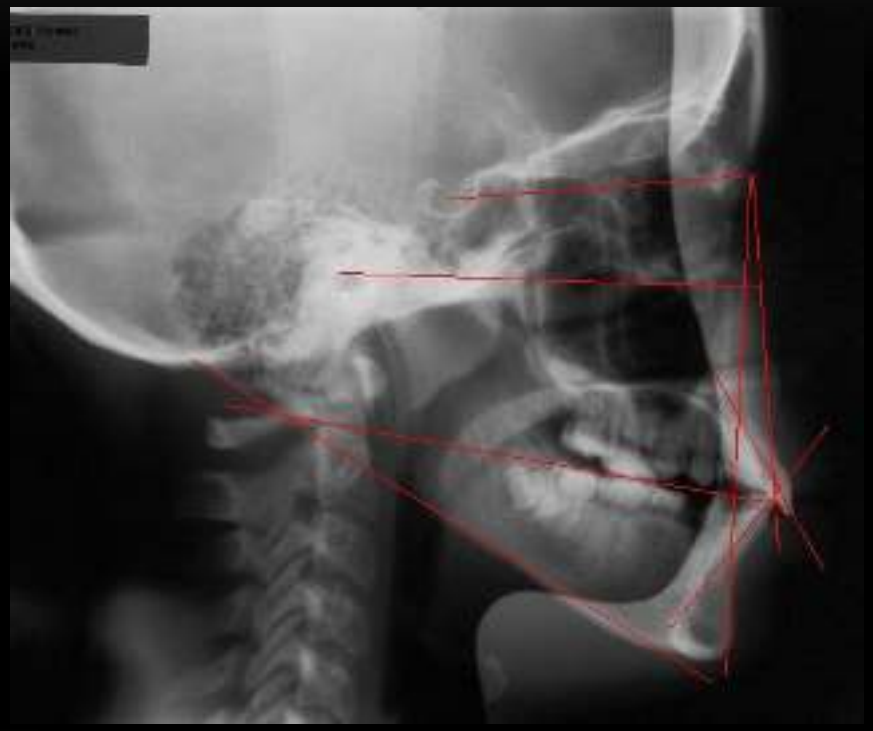
STEINER ANALYSIS

SNA:

- Anterior-posterior position of Maxilla to cranial base
- Norm: 82°
- 84-maxillary protrusion
- 80-maxillary retrusion

SNB:

- Anterior-posterior position of Mandible to cranial base
- Norm: 80°
- 83 – mandibular skeletal protrusion
- 77 – indicates retrusion



STEINER ANALYSIS

ANB:

- Anterior-posterior position of maxilla to mandible
- Norm: 2°
  - SNA: 82°
  - SNB: 80°

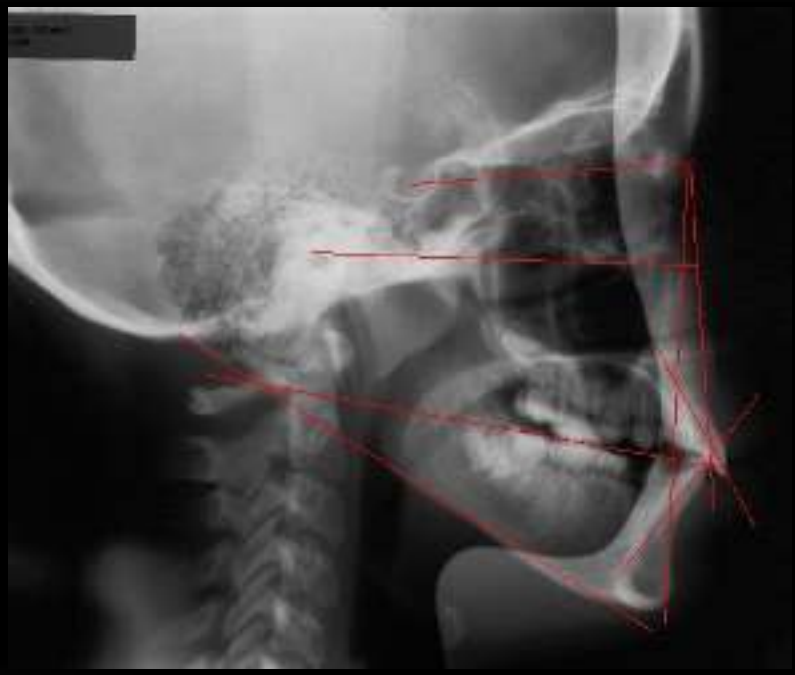
EXAMPLES

- ANB 6°
  - SNA: 82°
  - SNB: 76°
- Possible clinical implications:
  - Large overjet
  - Class 2

- ANB -5°
  - SNA: 82°
  - SNB: 87°
- Possible clinical implications:
  - Negative overjet
  - Class 3

STEINER ANALYSIS

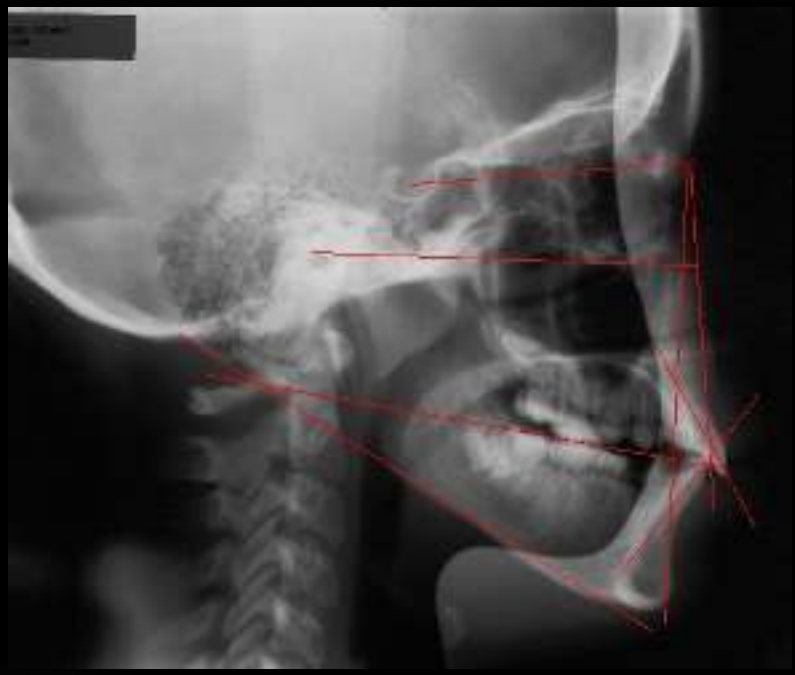
- Maxillary dentition to the mandibular dentition
- Norm: 130°
- Greater angle indicates upright teeth
- Lesser angle indicates protrusion
- Palatal Plane: ANS to PNS



STEINER ANALYSIS

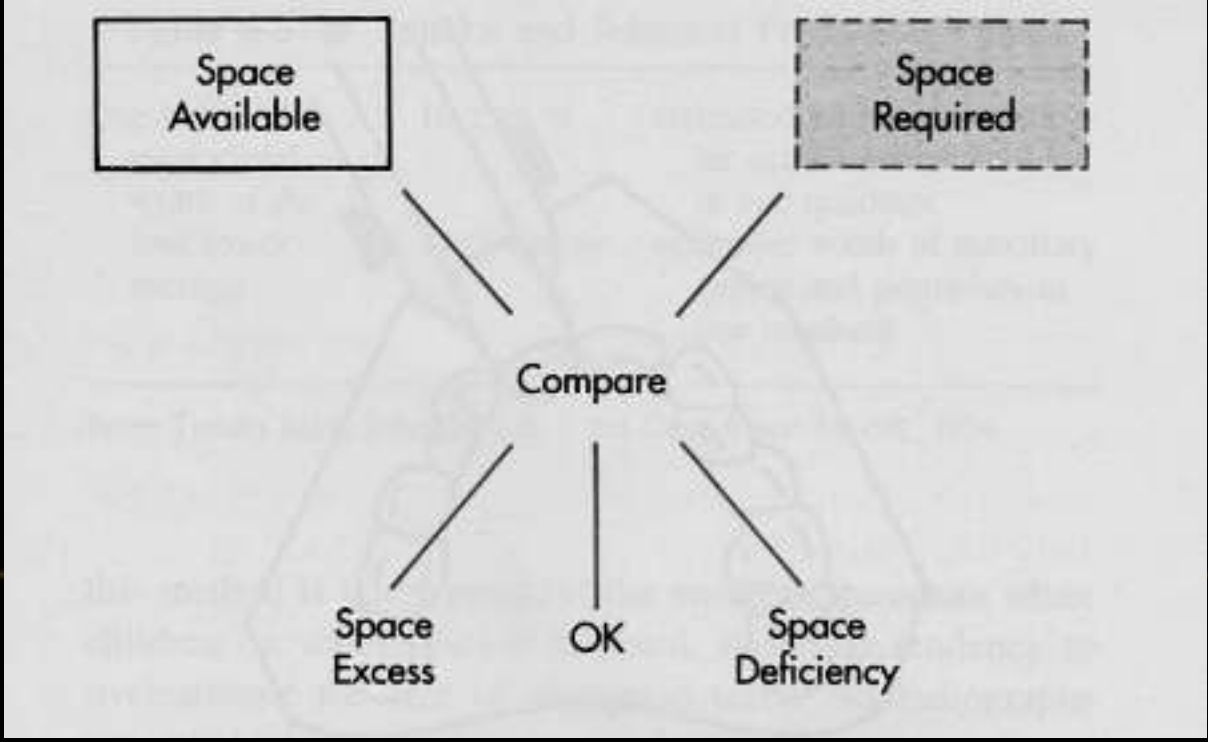
- Vertical relationships:
  - SN to GoGn
    - Mean: 32°

- High angle vs low angle



PRINCIPLES OF SPACE ANALYSIS

- Analysis of space within the arch
- A comparison of the amount of space available and the space required for proper alignment



PRINCIPLES OF SPACE ANALYSIS

Space Available:

- Measure the **arch** from first molar to the other, over the contact points and incisal edge of the incisors
  - Example: Take a piece of wire and contour it to the line of occlusion and the straightening it to be measured

Space Required:

- Measure the mesial-distal width of each **tooth**, including the first molars.
- Add all of the widths together.

Cast Analysis

- Asymmetries of a single arch
- Spacing – diastemas
- Crowding
- Rotations

EXAMPLE OF ASYMMETRIC CAST

TYPES OF SPACE ANALYSIS

- Tanaka-Johnson: Mixed dentition analysis
- Moyers: Mixed dentition analysis
- Bolton: Tooth size analysis

TANAKA-JOHNSON PREDICTION

- Uses the sum of the width of lower incisors to also predict the width of the unerupted canines and premolars.
- No radiographs or prediction charts used.
- Convenient and easy.
- Accuracy – 75%

TANAKA-JOHNSON (CONT.)

- Take sum of the width of the lower incisors.
- Divide by 2.
- Add 10.5 mm in Mandible
- Add 11.5 mm in Maxilla
- That final length has a 75% chance of fitting between the first permanent molar and lateral incisor.

MOYERS ANALYSIS

- Uses the sum of the width of the lower incisors.
- Takes that total to a prediction chart that will estimate on a percentage what space is needed for the unerupted or erupted premolars and canines per quadrant.

Percentile	19.5	20	20.5	21	21.5	22	22.5	23	23.5	24	24.5	25	25.5
Boys													
Maxilla													
75	20.3	20.5	20.8	21.0	21.3	21.5	21.8	22.0	22.3	22.5	22.8	23.0	23.3
50	19.7	19.9	20.2	20.4	20.7	20.9	21.2	21.5	21.7	22.0	22.2	22.5	22.7
35	19.3	19.6	19.9	20.1	20.4	20.6	20.9	21.1	21.4	21.6	21.9	22.1	22.4
Present values	19.2	19.4	19.5	19.6	19.8	19.9	20.1	20.2	20.4	20.5	20.7	20.8	20.9
Mandible													
75	20.4	20.6	20.8	21.0	21.2	21.4	21.6	21.9	22.1	22.3	22.5	22.8	23.0
50	19.5	19.7	20.0	20.2	20.4	20.6	20.9	21.1	21.3	21.5	21.7	22.0	22.2
35	19.0	19.3	19.5	19.7	20.0	20.2	20.4	20.6	20.9	21.1	21.3	21.5	21.7
Present values	17.8	18.0	18.2	18.4	18.6	18.8	19.0	19.2	19.4	19.6	19.8	20.0	20.3
Girls													
Maxilla													
75	20.4	20.5	20.6	20.8	20.9	21.0	21.2	21.3	21.5	21.6	21.8	21.9	22.1
50	19.6	19.8	19.9	20.1	20.2	20.3	20.5	20.6	20.8	20.9	21.0	21.2	21.3
35	19.2	19.4	19.5	19.7	19.8	19.9	20.1	20.2	20.4	20.5	20.6	20.8	20.9
Present values	18.9	19.0	19.2	19.3	19.4	19.5	19.7	19.8	19.9	20.0	20.2	20.3	20.4
Mandible													
75	19.6	19.8	20.1	20.3	20.6	20.8	21.1	21.3	21.6	21.9	22.1	22.4	22.7
50	18.7	19.0	19.2	19.5	19.8	20.0	20.3	20.5	20.8	21.1	21.3	21.6	21.8
35	18.2	18.5	18.8	19.0	19.3	19.6	19.8	20.1	20.3	20.6	20.9	21.1	21.4
Present values	17.6	17.8	18.0	18.2	18.4	18.6	18.8	19.0	19.2	19.4	19.6	19.8	20.0

BOLTON ANALYSIS

- Used as a diagnostic tool.
- Determine arch compatibility.
- Helps determine the size of a possible prosthetic replacement if needed.
- The ideal overall ratio has been determined to be 91.3%.

1. Total Arch Ratio

Sum Mandibular 12 ____ mm / Sum Maxillary 12 ____ mm x 100 = ____ % Mean 91.3

Max. 12	Mand. 12
85	77.6
86	78.5
87	79.4
88	80.3
89	81.3
90	82.1
91	83.1
92	84.0
93	84.9

Max. 12	Mand. 12
94	85.8
95	86.7
96	87.6
97	88.6
98	89.5
99	90.4
100	91.3
101	92.2
102	93.1

Max. 12	Mand. 12
103	94.0
104	95.0
105	95.9
106	96.8
107	97.8
108	98.6
109	99.5
110	100.4

If Ratio exceeds 91.3 : ____ (Actual Mand. 12) − ____ (Correct Mand. 12) = ____ (Excess Mand. 12)

If Ratio is less than 91.3 : ____ (Actual Max. 12) − ____ (Correct Max. 12) = ____ (Excess Max. 12)

2. Anterior Ratio ____

EXAMPLE OF BOLTON DISCREPANCY

PRINCIPLES OF TREATMENT PLANNING

- Problem list aids in:
  - Determining the importance of each finding
  - Establishing treatment solutions and goals
  - Developing an optimal treatment plan

Principles of Treatment Planning

1. Problem list in priority order
2. Establishing treatment goals
3. Treatment possibilities
4. Cost/risk vs benefit analysis
5. Choice of mechanotherapy

TREATMENT POSSIBILITIES

- Consider each problem individually.
- Treatment possibilities for each problem.
- Begin with the highest priority.
- Choose the choice that will agree with the treatment for other problems on the list.

GOALS OF ORTHODONTIC TREATMENT

- Function
- Esthetics
- Stability

QUESTIONS?

Histology of Tooth Movement

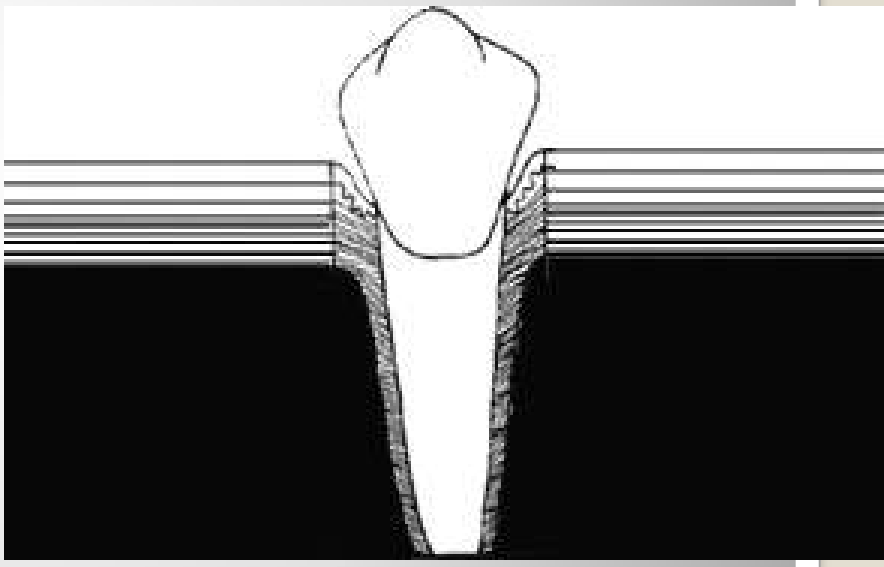
Erick J. Lund DDS

Things to know:

1. Know how drugs (particularly NSAIDS) can affect tooth movement
2. You need at least 4 hours of pressure for tooth movement to occur
3. Force levels for various tooth movements (ie intrusion requires the least amount of pressure)
4. Know the difference between light, continuous forces and heavy forces (ie heavy forces lead to sterile necrosis, hyalinization, undermining necrosis and pain). Look at the graph.
5. The role of osteoclasts and osteoblasts in tooth movement
6. Pressure tension theory vs. piezoelectric theory

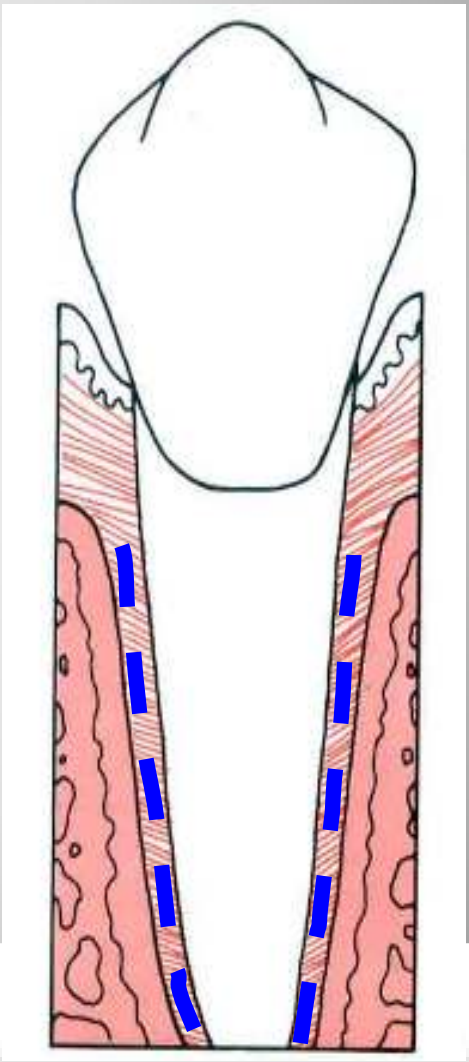
Outline

- **PDL-components & function**
- Theories of tooth movement
- Events in tooth movement – light vs. heavy forces
- Types of tooth movement
- Classifications of force duration
- Drug Effects
- Types of Anchorage
- Deleterious effects of Ortho



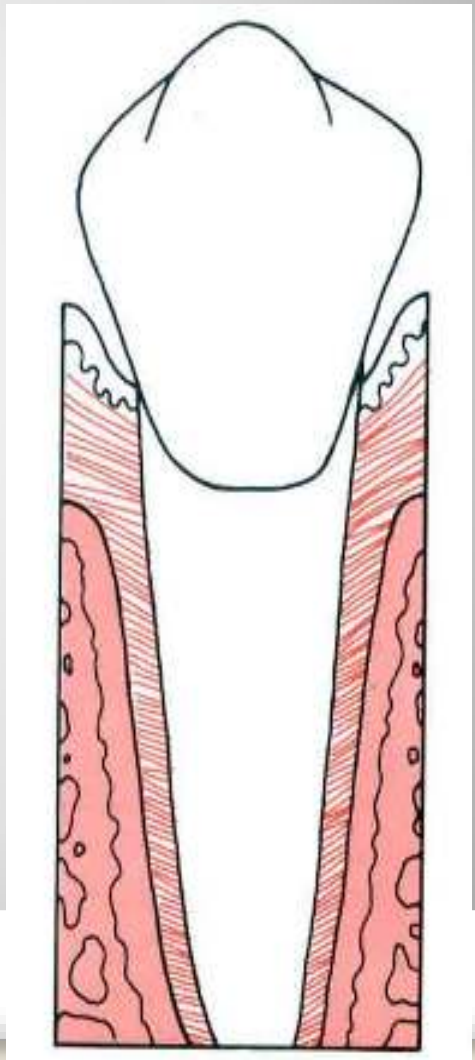
Periodontal Ligament: Structure and Function

- ~1/2 mm around entire tooth
  - keeps the tooth in the bony socket
- Components
  - Collagen
  - Cellular elements
  - Tissue fluids



Periodontal Ligament: Structure and Function

- Collagen
  - Constantly remodeled/renewed by FIBROBLASTS
  - Parallel and angled (bone DOWN to cementum)
    - fibers insert into ***cementum*** and dense bony plate called ***lamina dura***

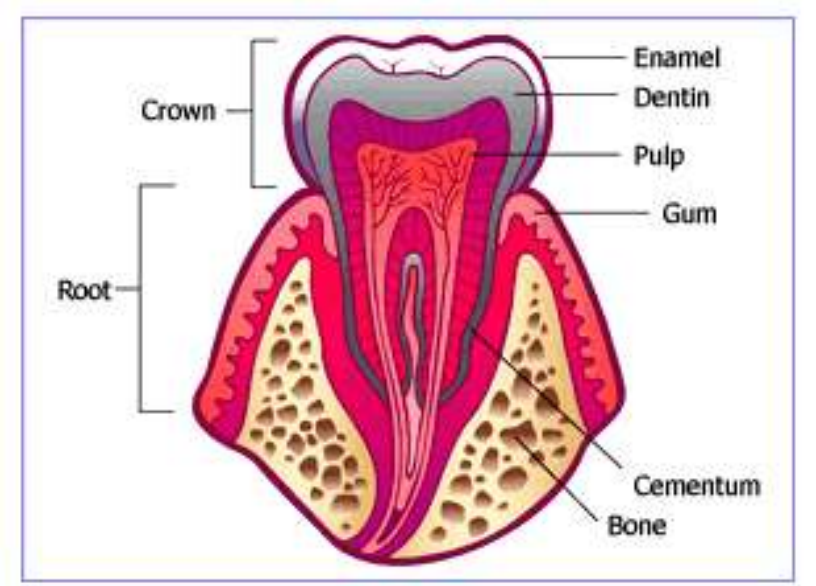


Periodontal Ligament: Structure and Function

- Cellular elements
  - Vascular
  - Mesenchymal cells
    - undifferentiated → become fibroblasts and osteoblasts
  - Neural
    - Perception of pain → Unmyelinated free endings
    - Complex receptors for proprioception (pressure and position)
  - Osteoblasts and Cementoblasts
  - Cementoclasts and Osteoclasts are multinucleated giant cells (monocyte origin)
    - very different from their "blastic" counterparts

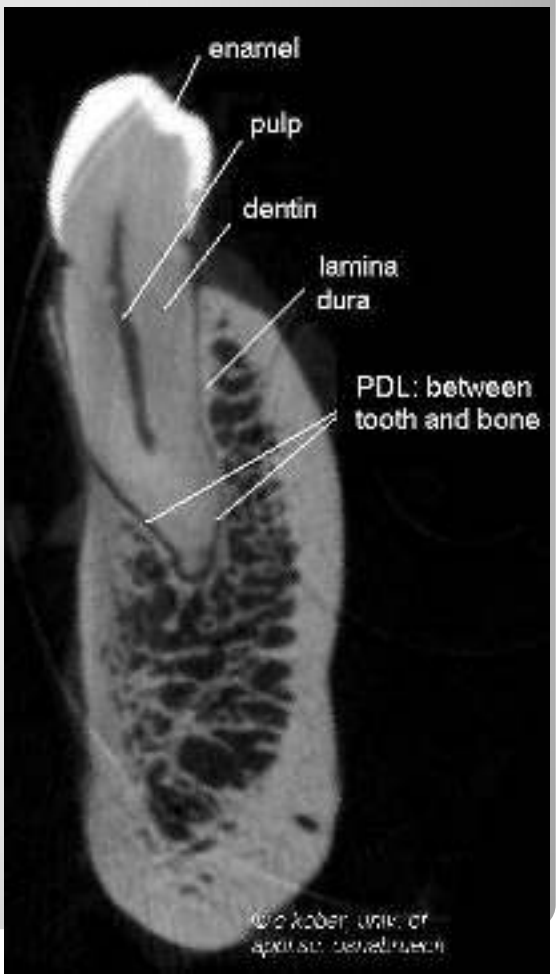
Periodontal Ligament: Structure and Function

- Tissue Fluid
  - Fluid in the PDL helps it act as a shock absorber



Periodontal Ligament: Structure and Function

- Tooth is anchored to the surrounding **alveolar bone** by the **periodontal ligament**.
- Alveolar bone directly surrounding the tooth cavity is called the **cribriform plate (called the *lamina dura* radiographically)**
- Collagen fibers insert into the **bundle bone** of the cribriform plate.
- The bone underlying the gingiva is called **cortical plate.**
- Cribriform and cortical plates are both compact bone, and are separated by spongy bone in the center of alveolar bone.



Periodontal Ligament: Structure and Function

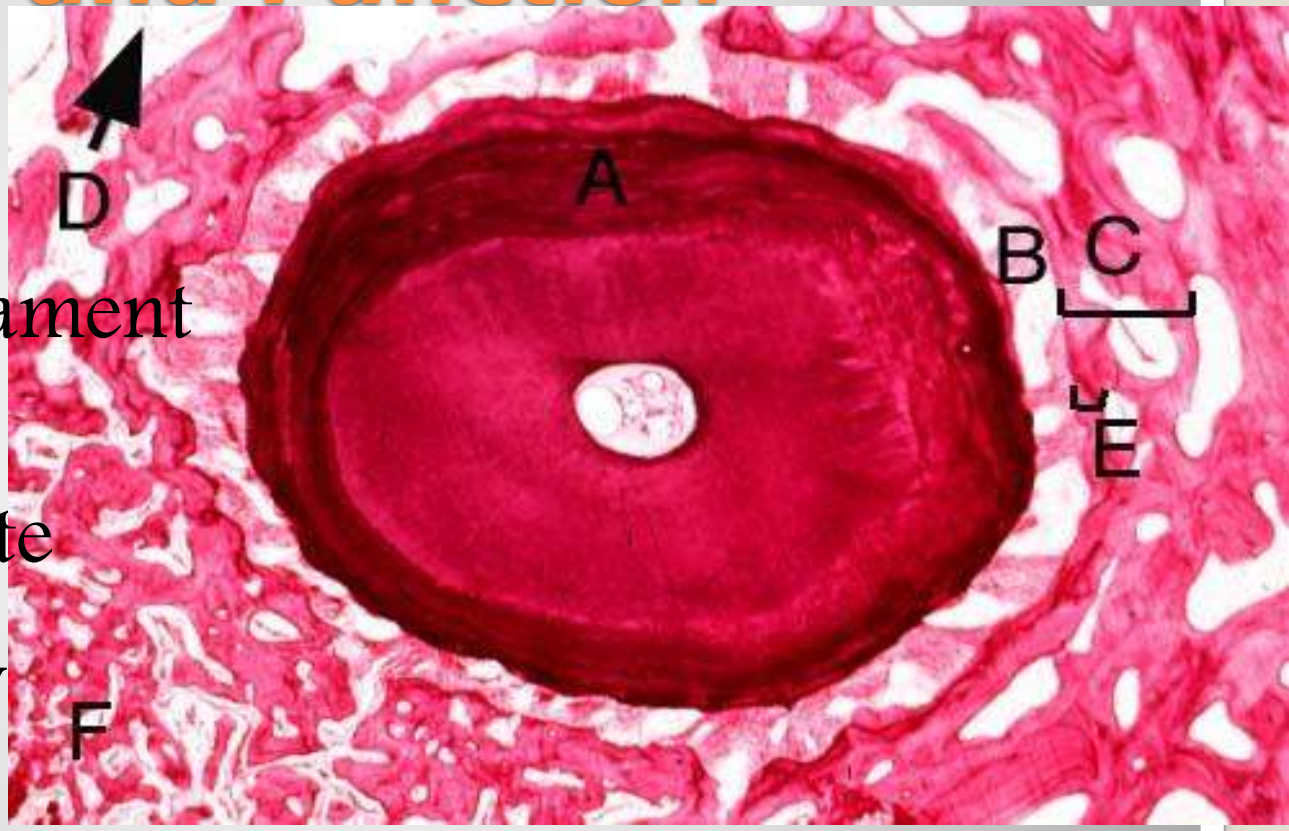
A. Cementum

B. Periodontal ligament

C. Cribriform plate

D. Marrow cavity of spongy bone

E. Bundlebone



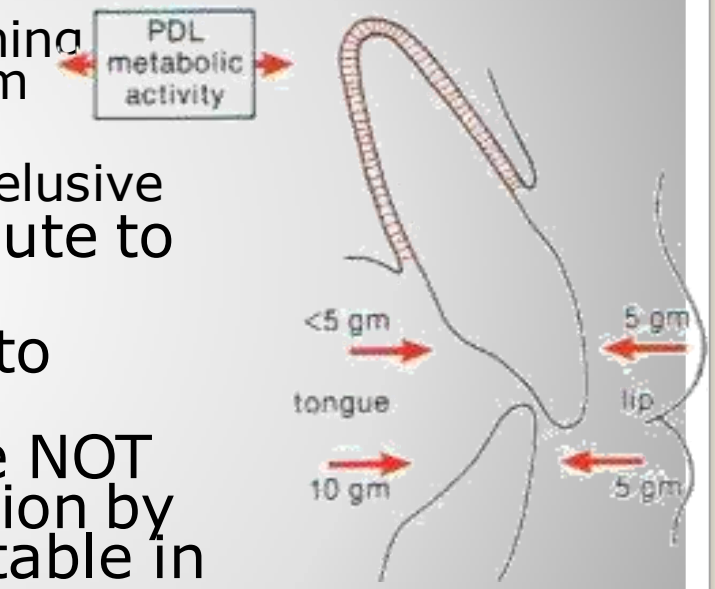
F. Spongy bone

Response of PDL to normal function

- During chewing teeth contact for 1 sec or less
- Forces during chewing→ 1-2 kg (soft food) up to 50 kg (hard food)
- Tooth displacement is prevented by the PDL fluid
- Forces are TRANSFERRED to bone
- Body of mandible bends as mouth is open/closed
- Bone bending causes piezoelectric currents → stimulate bone repair/regeneration
- Excessive pressure squeezes fluid out, PDL gets squished → pain after 3-5 sec
- Prolonged force causes remodeling of adjacent bone

Role of PDL in Eruption and Stabilization

- Eruption seems to depend on metabolic events within PDL
  - formation, cross-linkage and shortening fibers provides propulsive mecahnism
  - Post-emergent only
  - Pre-ermergent mechanism remains elusive
- This mechanism may also contribute to stabilization
- PDL apparently generates forces to maintain equilibrium
- Forces of lips, cheeks, tongue are NOT always equal → ACTIVE stabilization by the PDL explains why teeth are stable in the presence of unbalanced forces
- *ACTIVE stabilization* implies a THRESHOLD for orthodontic movement
- Active stabilization can overcome forces of a few grams at most (5-10 gm/cm^2)



Cache Valley Utah

Outline

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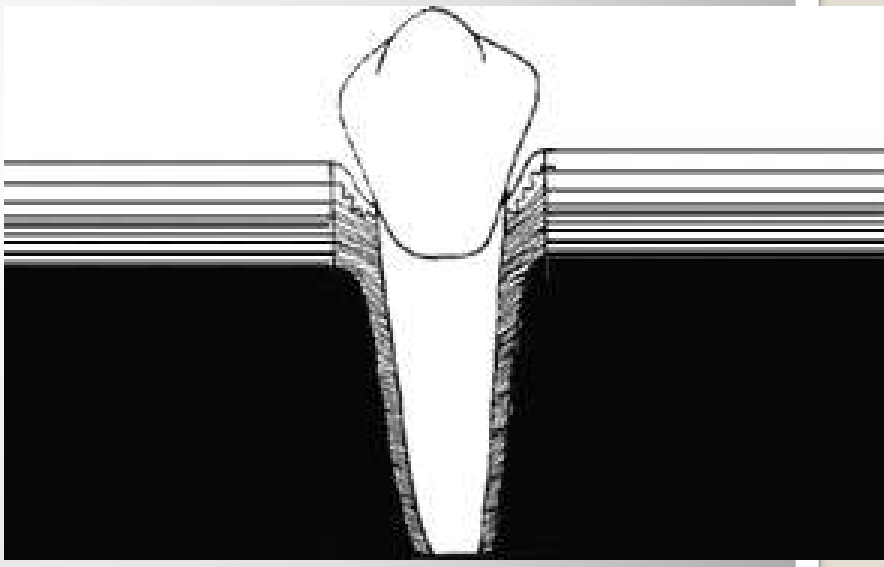


Two Theories of Tooth Movement

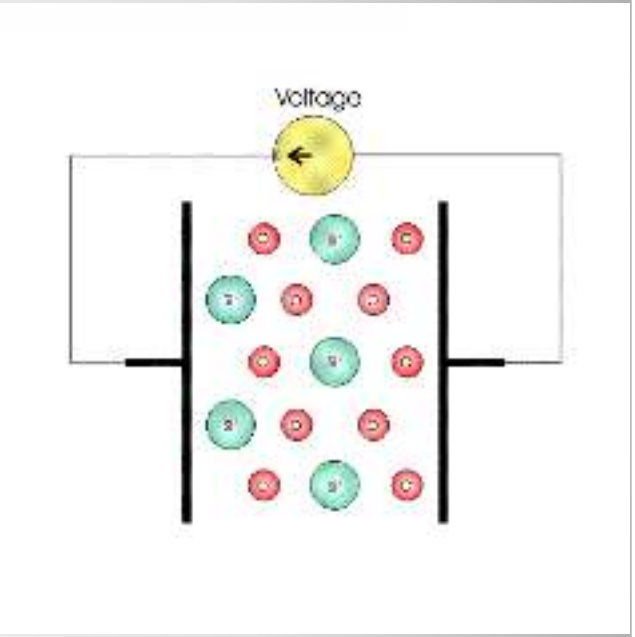
#1 Biologic Electricity – changes in bone metabolism controlled by *electric signals* produced when alveolar bone flexes and bends

#2 Pressure Tension – alterations in *blood flow* through PDL causes cells to produce chemical messengers

- pressure reduces size of BVs
- tension would increase size of BVs

Biologic electricity/ Piezoelectricity Theory

- Phenomenon seen in crystalline materials
  - Deformation/bending causes a flow of electrons
- Bone and collagen have piezoelectric properties
- Unusual characteristics of piezoelectric signals…
  - Quick decay rate (decays even if force is maintained)
  - Equivalent signal, opposite in direction when force is released

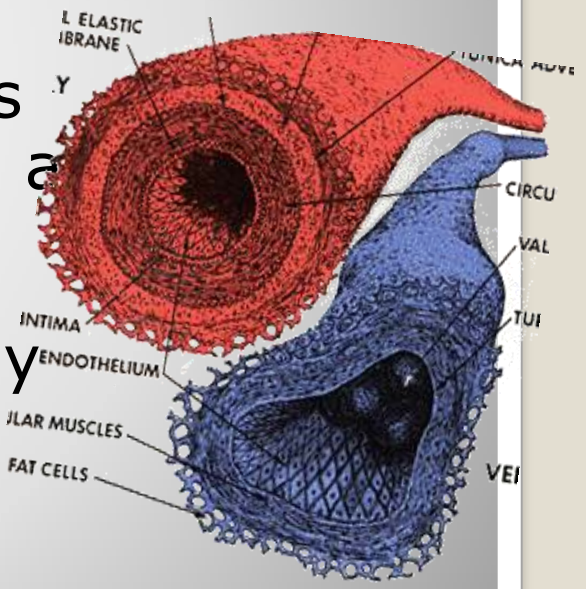


Biologic electricity/ Piezoelectricity Theory

- Stresses induced during chewing likely maintain bone around teeth
- Stress = signals → key to skeletal maintenance, otherwise skeletal atrophy
- Continuous force → stress generated signals don't come into play
  - Would suggest ortho would require a vibrating force → not the case
- ***BL: stress generated signals have little if anything to do with orthodontic tooth movement***
- "BIOELECTRIC POTENTIAL" → active cells produce electronegative charges that are proportional to how ACTIVE they are
- Can modify cellular activity by adding outside electric signals which affect receptors and/or membrane permeability
- Experiments show that low voltage direct current applied to ALVEOLAR BONE caused a tooth to move faster than without current

Pressure Tension Theory

- Chemical rather than electric signals are the stimulus for tooth movement
- Blood flow decreases in pressure areas, increases in tension areas
- Changing the blood changes the extracellular environment of the cells
- For example, oxygen would increase a blood flow increased
- These changes directly or indirectly cause the release of other biologically active agents



4 Stages in Tooth Movement

- 1)Matrix Strain & Fluid Flow
  - Occurs in both PDL and Bone
  - Strain in bone induces canalicular fluid flow
    - results in shear stress on osteocytes ⇨ apoptosis
    - induces recruitment of osteoclasts
    - initiating bone resorption process

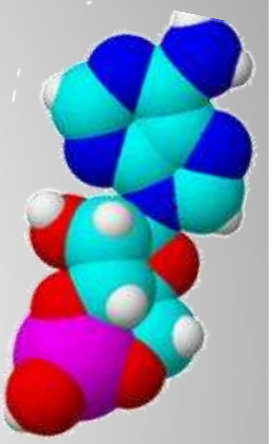
4 Stages in Tooth Movement

- 2) Cell deformation
  - Directly and indirectly by fluid flow
    - fibroblast produce cytokines and matrix metalloproteinases (MMPs)
      - Collagen degradation occurs on both resorption and deposition sides
    - Osteoblasts release prostaglandins

4 Stages in Tooth Movement

- 3) Cell activation and Differentiation
  - PDL- fibroblasts and osteoblasts Bone- osteocytes
    - First osteoblasts must degrade non-mineralized layer of osteoid through MMP activity before osteoclasts can attach to bone surface.
  - **Cell Mediators & 2nd Messengers…**
  - **Cytokines**- produced by osteocytes activate osteoclast precursors in PDL at resorptive site
  - **NO-** produced by osteocytes and osteoblasts on appositions side which inhibits osteoclast activity/differentiation
  - **RANKL-** and receptor RANK stimulate further differentiation of osteoclasts
  - **Osteoprotegerin-** decoy receptor for RANKL stopping further differentiation
  - **Osteopontin (OPN)-** specific integrins that mediate attachment of osteoclasts.
  - Deposition side **alkaline phosphatase, osteocalcin, among other non-collagenous matrix proteins** stimulate osteoblast differenation, which then inturn produce **NO**)

How long until you see these signs of cellular activation?



- Takes 4 hours to detect an increase in cAMP (second messenger) → need to wear removable appliance for at least that long
- 2nd Messengers in tooth movement
  - Interleukin-1beta
  - Prostaglandin E
  - Inositol phosphates
  - Nitric oxide (NO)

4 Stages in Tooth Movement

- 4) Remodeling
  - Osteoclasts appear in the PDL 36-72 hrs after force is applied
  - Upregulation of collagen found at both resorption and apposition sides following tooth movement
  - But type of collagen is different
    - much higher increase of collagen type I found on apposition side.

Midwestern University, AZ

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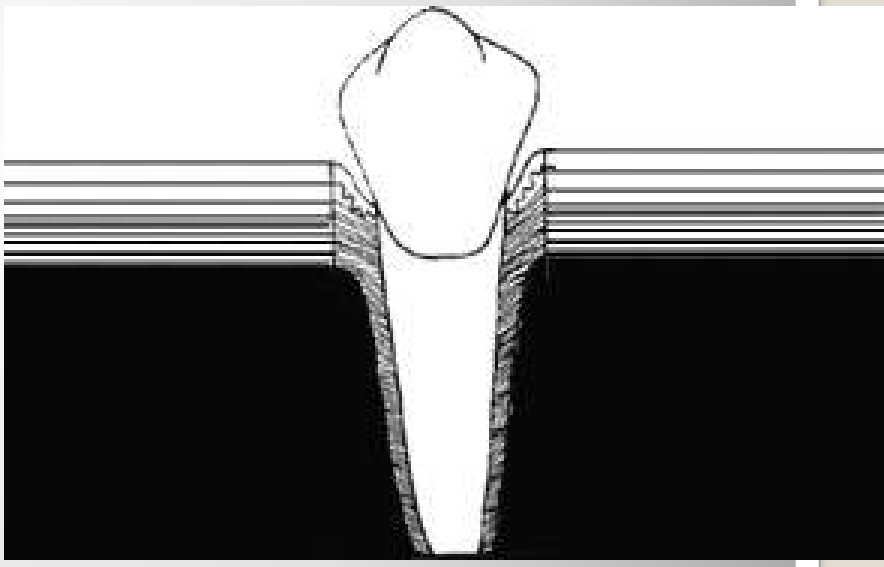
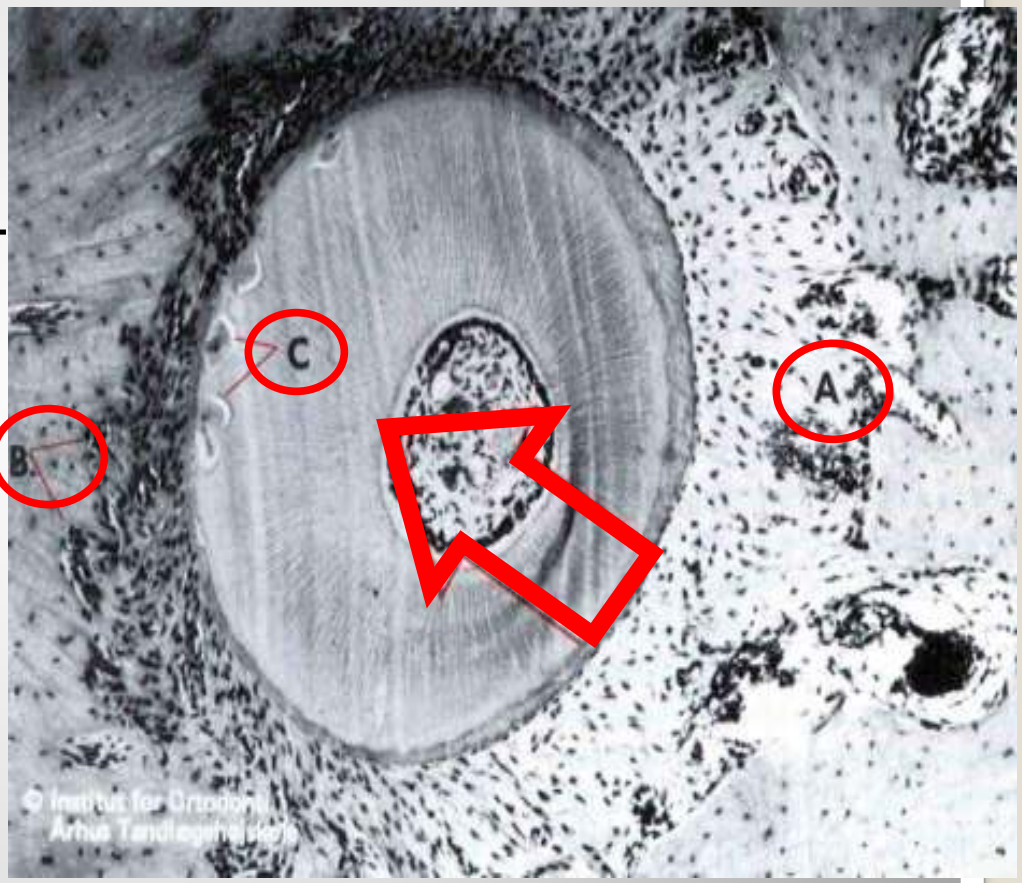


Events of tooth movement

- LIGHT FORCE
  - Osteoclasts attack the lamina dura → FRONTAL RESORPTION of bone
  - Can take 48 hours for first osteoclasts appear in PDL in response to mechanical deformation of the PDL
  - Osteoblasts LAG BEHIND, which causes PDL enlargement, but eventually form bone on tension side and remodel on pressure side



A. Dilation of BV and osteoblastic activity

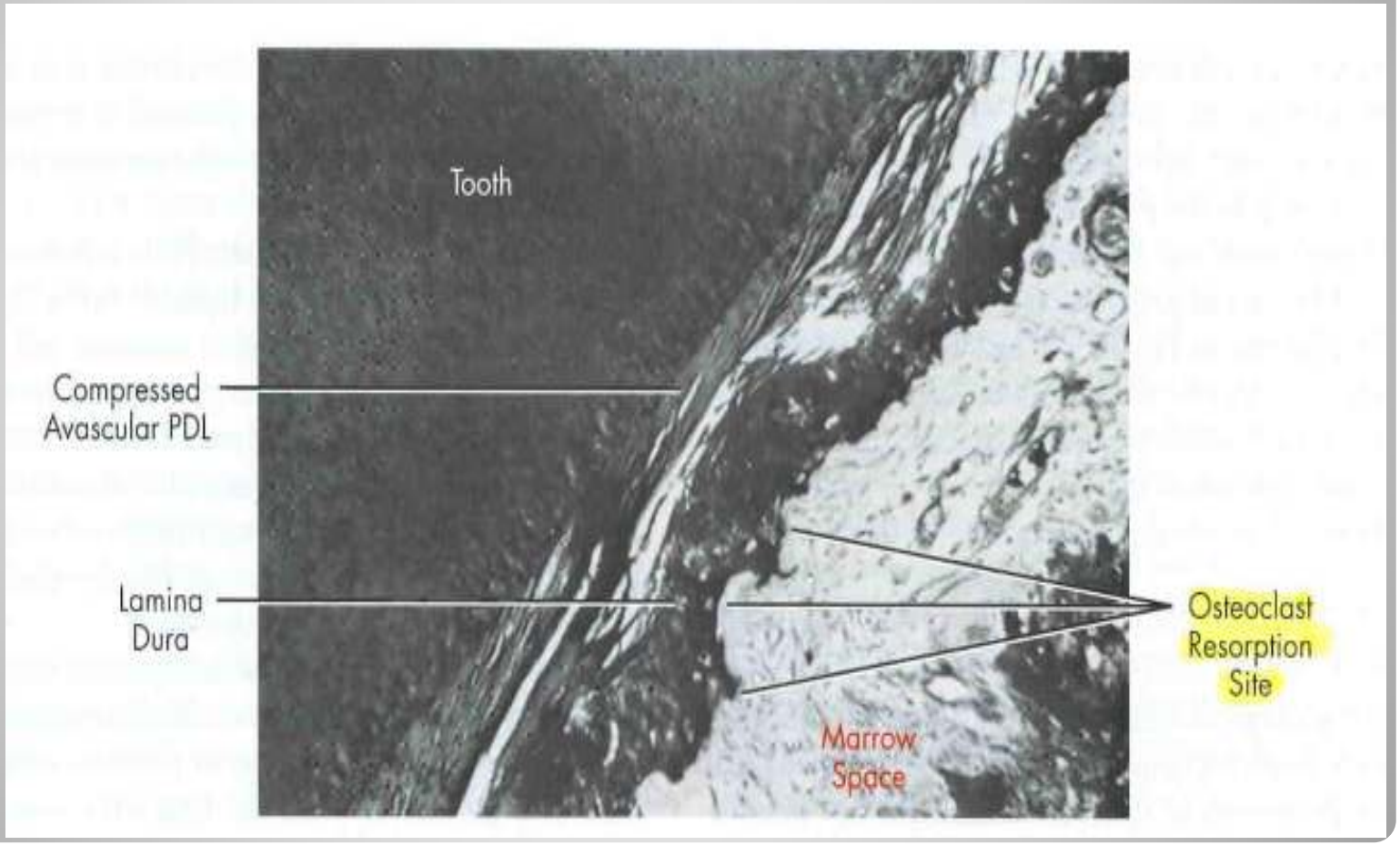
B. Osteoclasts removing bone

C. Areas of beginning root resorption (which may be repaired later..)

Events of tooth movement

- HEAVY FORCE
  - excessive force occludes BVs and cells die → ***sterile necrosis***
  - HYALINIZED – avascularized area of PDL
  - This sterile necrosis/hyalinization requires cells from adjacent undamaged areas to remodel the bone
  - After several days, osteoclasts (from adjacent bone marrow spaces) attack below the lamina dura → UNDERMINING RESORPTION
  - Costs more time to move:
    1. delay in stimulating differentiation of cells within the marrow
    2. thickness of bone must be removed

Undermining Resorption



Light Pressure Time Line

Time	Event
<1 sec	PDL fluid is incompressible, alveolar bone bends, a piezoelectric signal is generated
1-2 sec	PDL fluid is expressed, tooth moves within the PDL space
3-5 sec	Blood vessels within the PDL partially compressed on pressure side, dilated on the tension side
Minutes	Blood flow altered, oxygen tension begins to change
Hours	Metabolic changes occur
4 hours	Increased cyclic AMP, cellular differentiation begins within PDL
2 days	Tooth movement beginning as osteoclasts/osteoblasts remodel the bony socket

Heavy Pressure Time Line

Time	Event
<1 sec	PDL fluid is incompressible, alveolar bone bends, a piezoelectric signal is generated
1-2 sec	PDL fluid is expressed, tooth moves within the PDL space
3-5 sec	Blood vessels within the PDL occluded on pressure side
Minutes	Blood flow cut off to compressed PDL area
Hours	Cell death in compressed PDL area
3-5 days	Cell differentiation in adjacent narrow spaces, undermining resorption begins
7-14 days	Undermining resorption removes lamina dura adjacent to compressed PDL, tooth movement occurs

Time Course

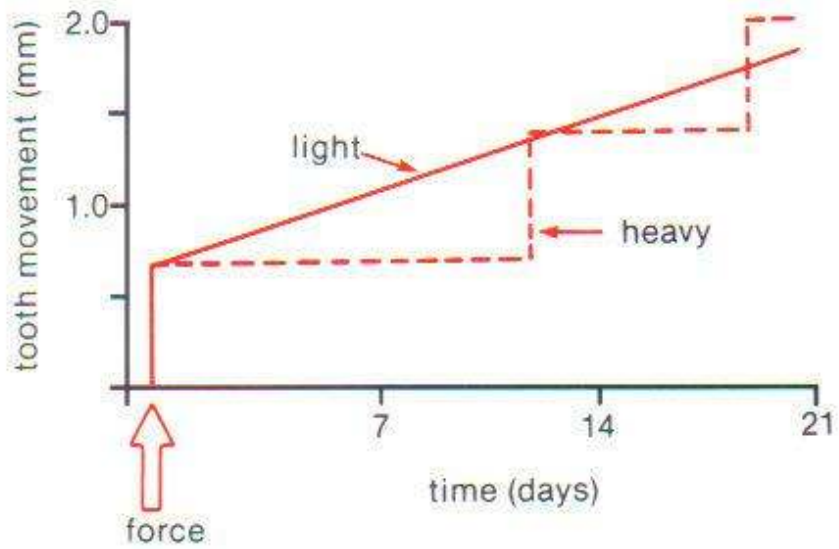


FIGURE 9-8 Diagrammatic representation of the time course of tooth movement with frontal resorption vs. undermining resorption. With frontal resorption, a steady attack on the outer surface of the lamina dura results in smooth continuous tooth movement. With undermining resorption, there is a delay until the bone adjacent to the tooth can be removed. At that point, the tooth "jumps" to a new position, and if heavy force is maintained, there will again be a delay until a second round of undermining resorption can occur.

Appointment Timing Rationale

- Why wait at least 3 weeks to see your patient and reactivate the appliance?
  - IF the force is LIGHT → continuous frontal resorption and no need for further activation
  - IF the force is HEAVY → undermining resorption takes 7-14 days and an equal or longer time is needed for PDL regeneration and repair

1 Year AEGD – Ft. Jackson SC

Outline

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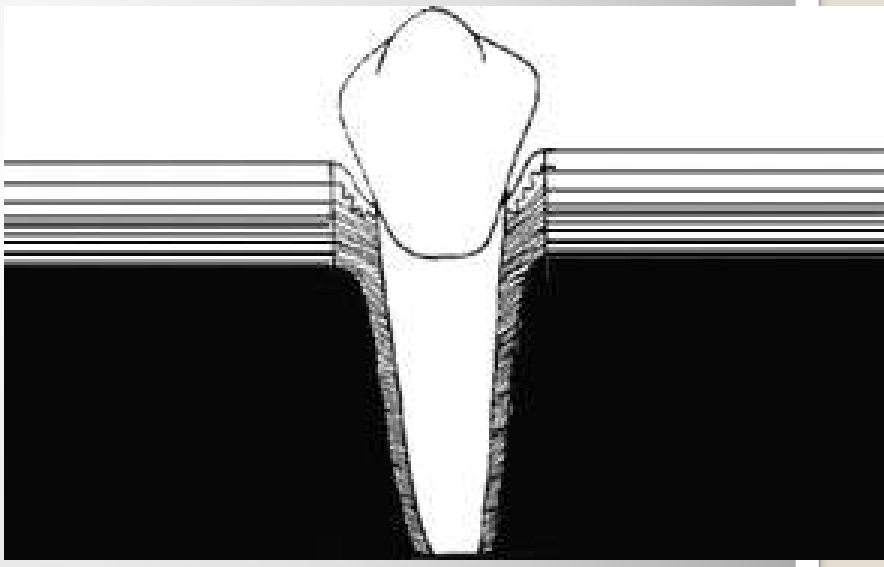
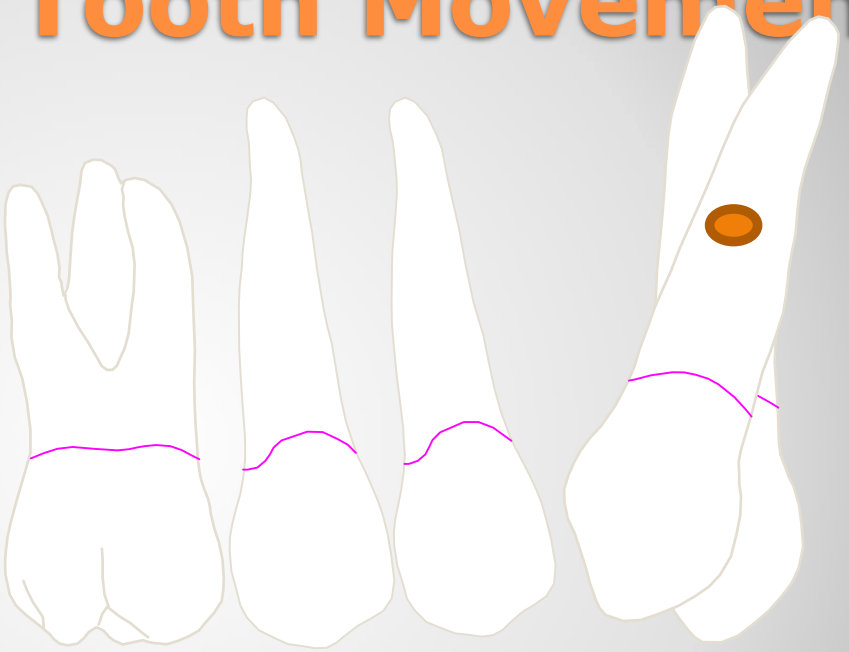


Review of Biomechanic Terms

- Center of Resistance- the point through which the line of force will produce pure translation (bodily movement)
- Center of Rotation- the point which rotation actually occurs
- Moment- tendancy to rotate (M=fd)
  - Force x Distance from Center of Resistance
- Couple- two forces equal in magnitude and opposite in direction
  - Produces pure rotation

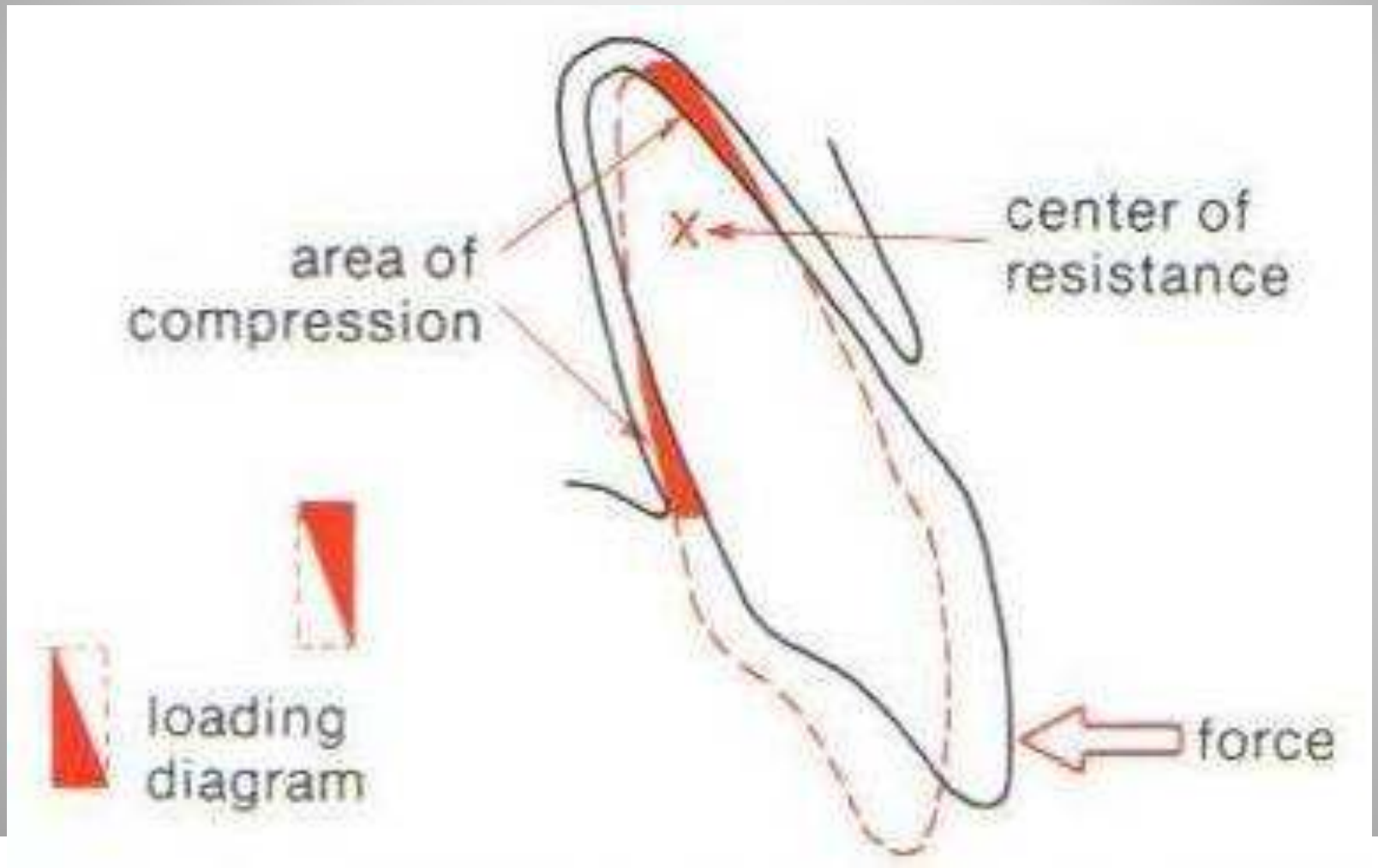
Types of Tooth Movement

- *Tipping*
  - *Uncontrolled*
  - *Controlled*
- Translation
- Rotation
- Extrusion
- Intrusion

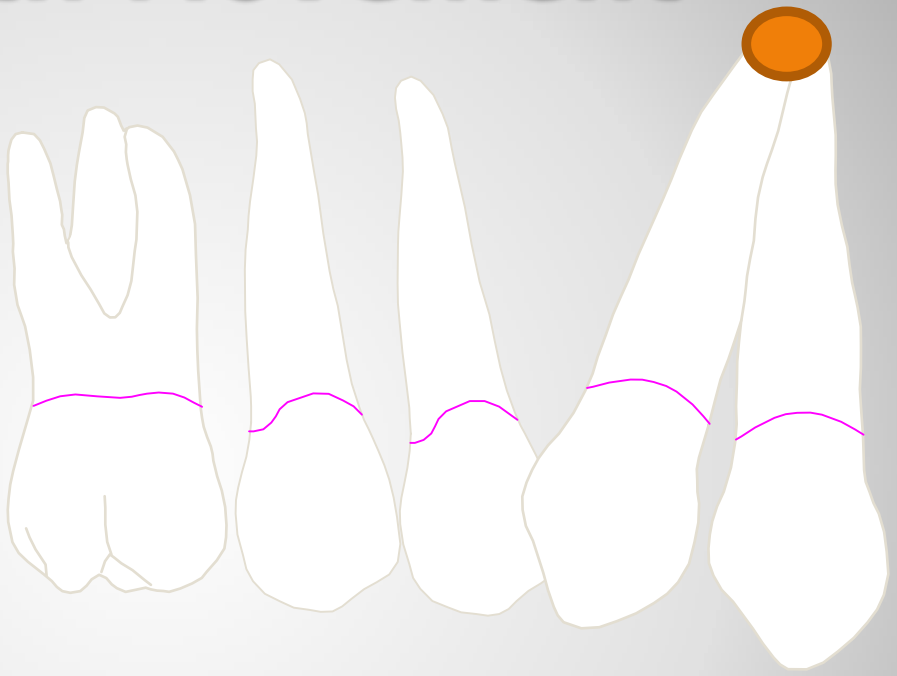


- 35-60 g
- Root and crown moving in opposite directions
- $C_{rot}=C_{res}$

Tipping


area of
compression
X
center of
resistance
loading
diagram
force

Types of Tooth Movement

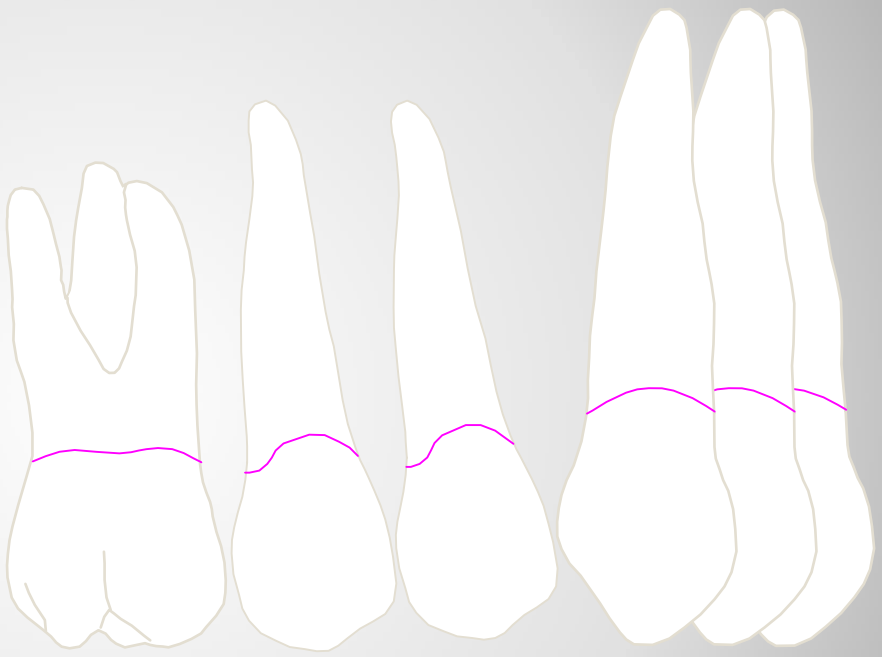


- *Tipping*
  - *Uncontrolled*
  - *Controlled*
- Translation
- Rotation
- Extrusion
- Intrusion

- 35-60 g
- Crown and root moving in same direction
- root apex<C_{rot} <infinity

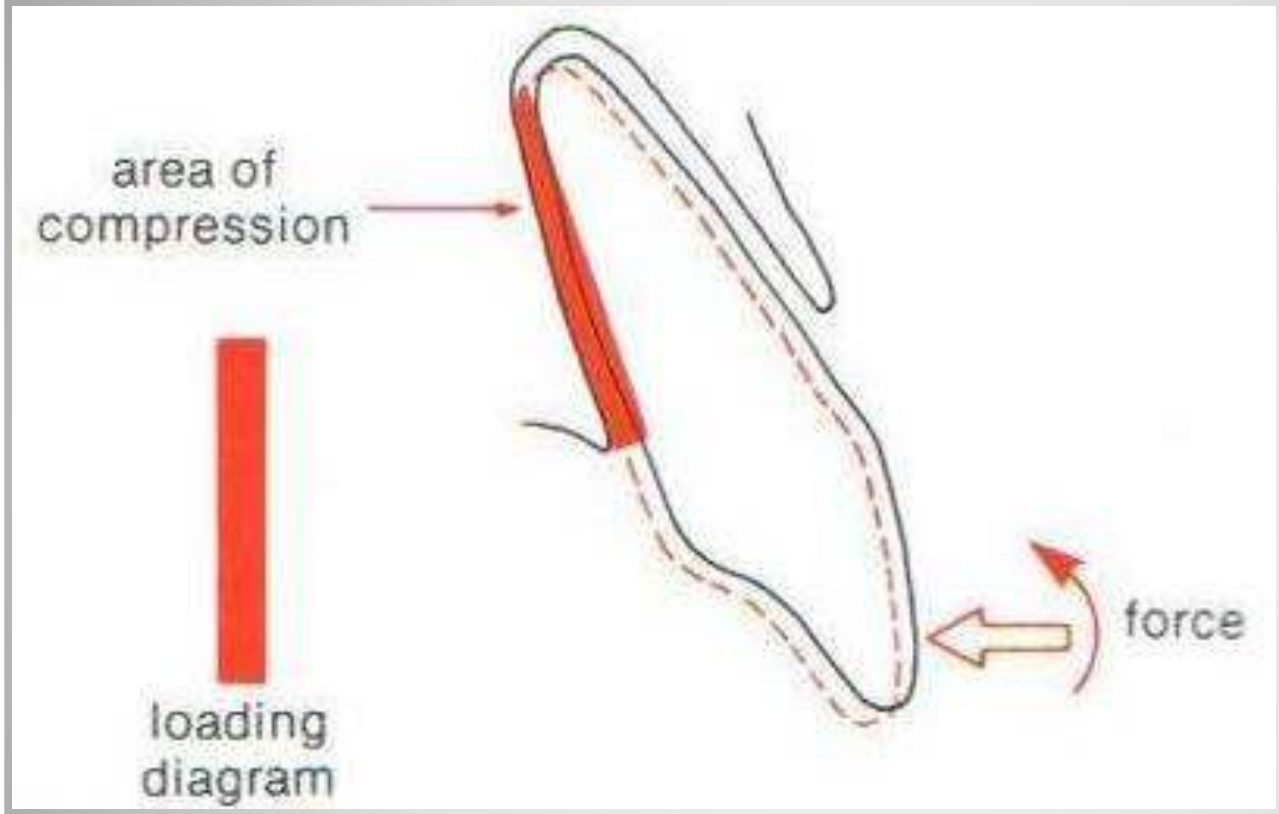
Types of Tooth Movement

- Tipping
- *Translation*
- Rotation
- Extrusion
- Intrusion



- 70-120 g
- 2 forces on a crown-couple created at bracket in opposite direction of force
- C_{rot} at inifinity

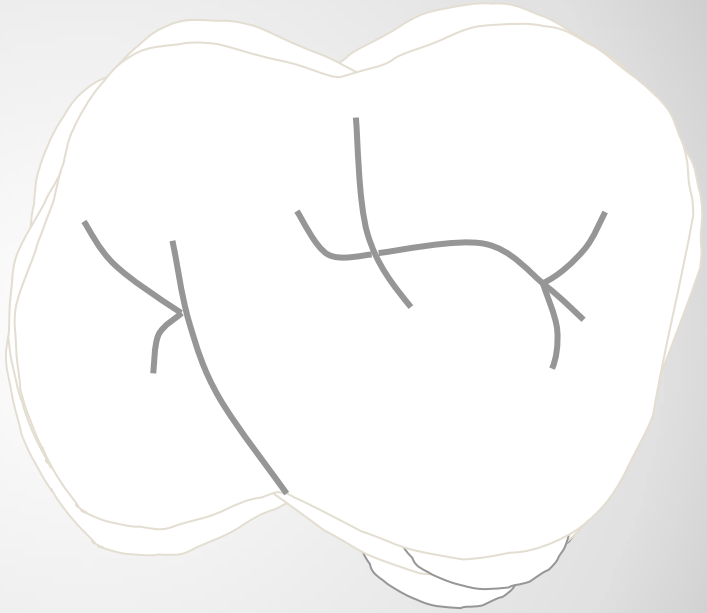
Translation



- Larger force distribution= more surface area for recruitment of resorptive cells

Types of Tooth Movement

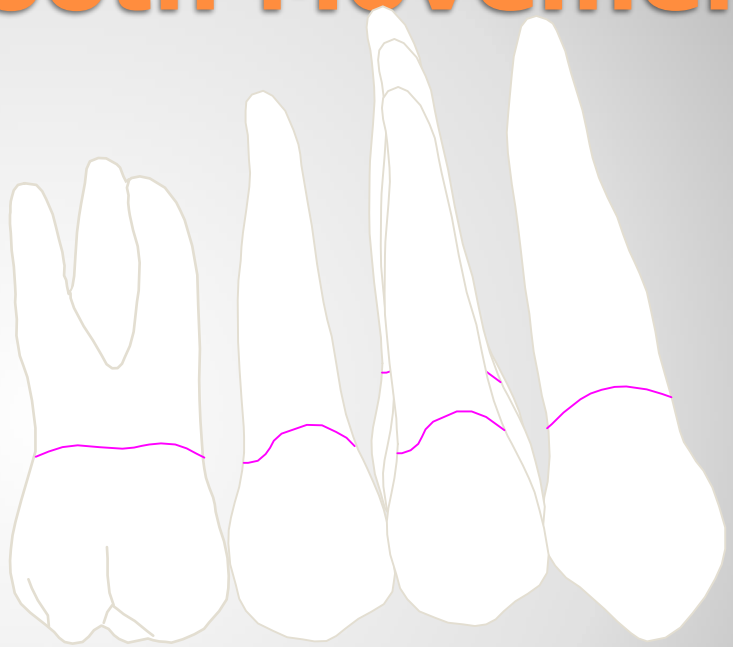
- Tipping
- Translation
- *Rotation*
- Extrusion
- Intrusion



❁ 35-60 g

Types of Tooth Movement

- Tipping
- Translation
- Rotation
- *Extrusion*
- Intrusion



❁ 35~60 g

Types of Tooth Movement

- Tipping
- Translation
- Rotation
- Extrusion
- *Intrusion*

- only 10~20 g
- require extremely light forces and frequently interrupted to prevent root resorption

Optimal Force?

- Optimal force levels…
  - Maximize the cellular response
  - Maintain the vitality of the tissue
- Studies have found that there is a range of forces or pressures that produces maximum tooth displacement
- Very difficult thing to clinically test
  - Inability to estimate stress distribution in PDL
  - Lack of experimental control over the type of movement (tipping vs translation)
  - Differences in individuals own biological response

San Antonio, TX

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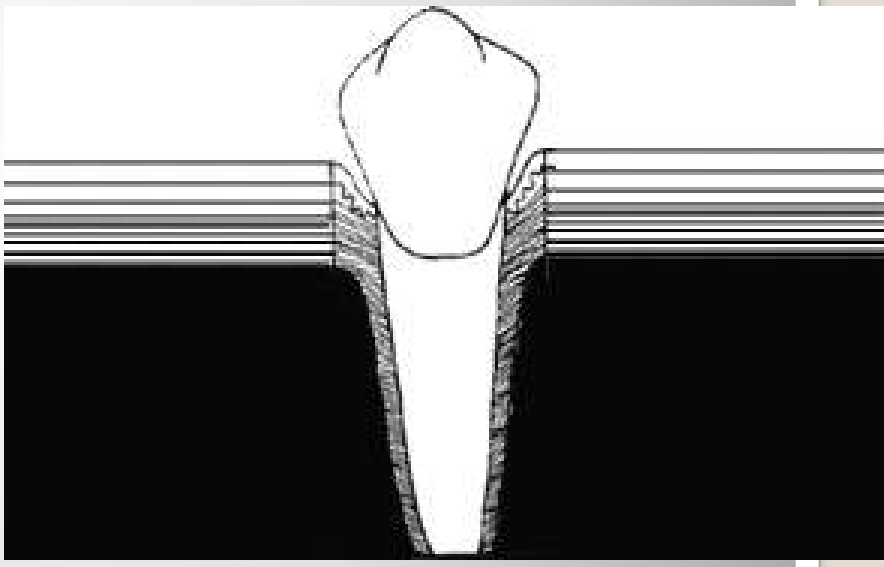
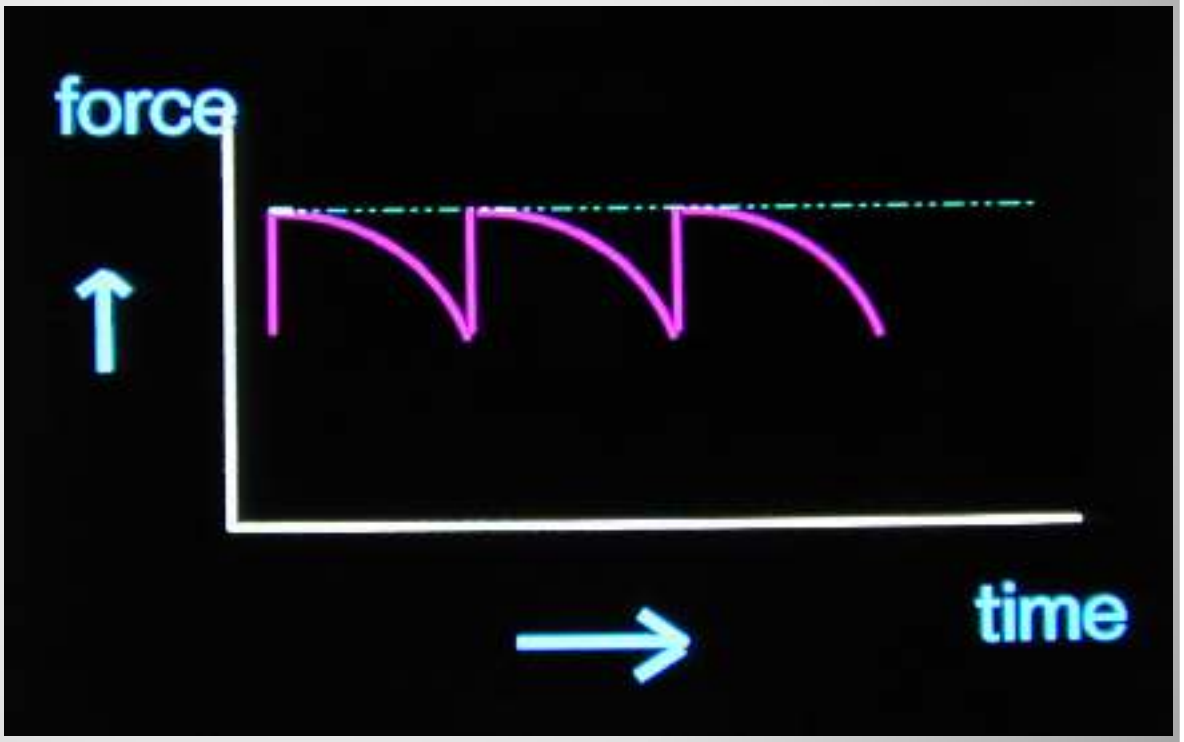
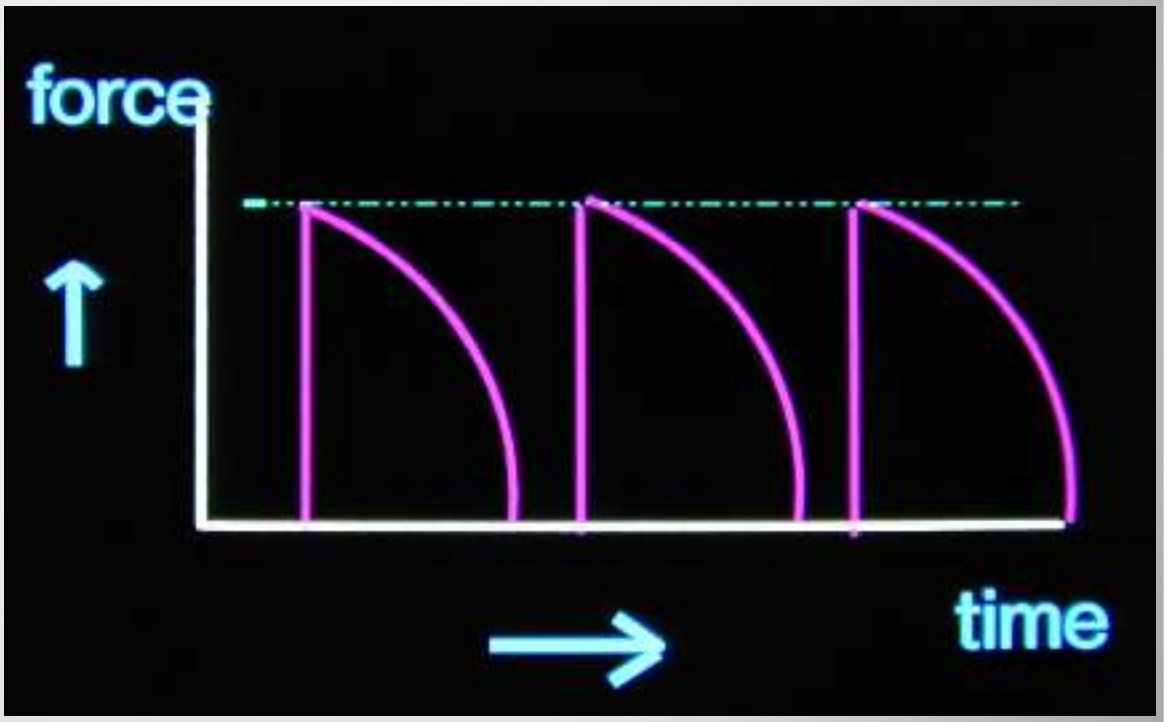


Classifications of Force Duration

- Classification based on RATE of DECAY
- Continuous
  - Force maintained at a fraction of original from one visit to the next
- Interrupted
  - Force declines to 0 between appointments
- Intermittent
  - Force levels decline abruptly to 0 intermittently, then return to original some time later

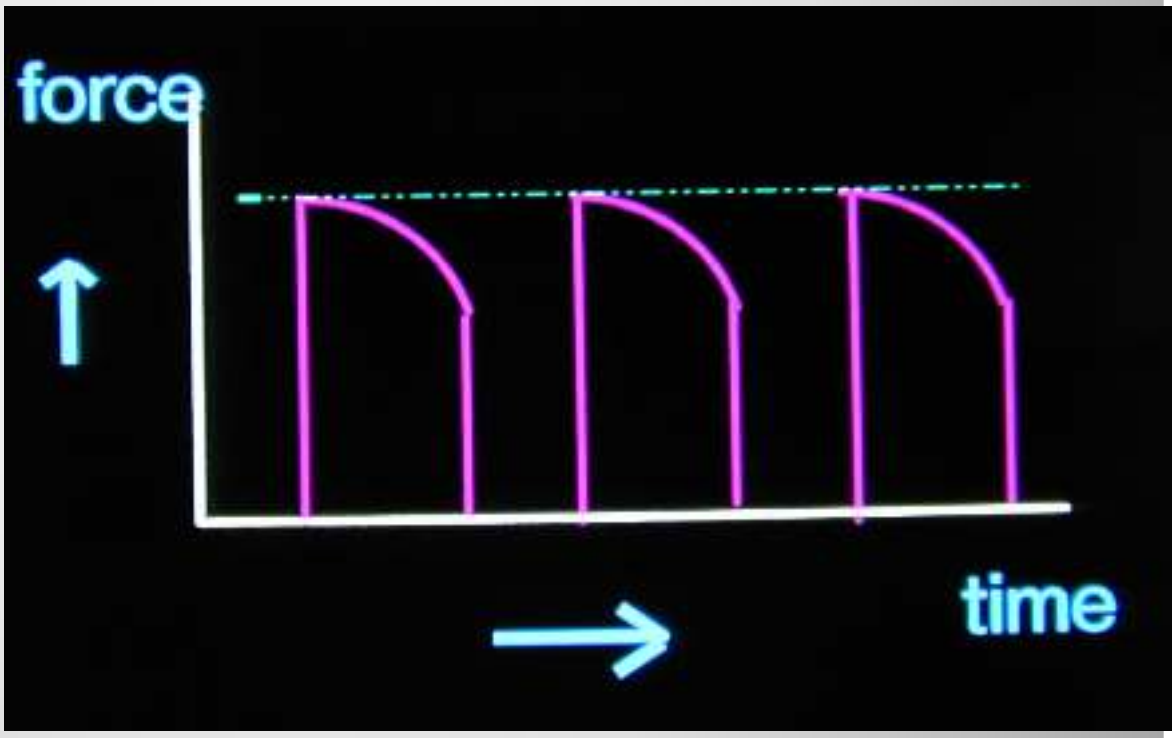


Continuous Force



Interrupted Force

elastics



Intermittent Force

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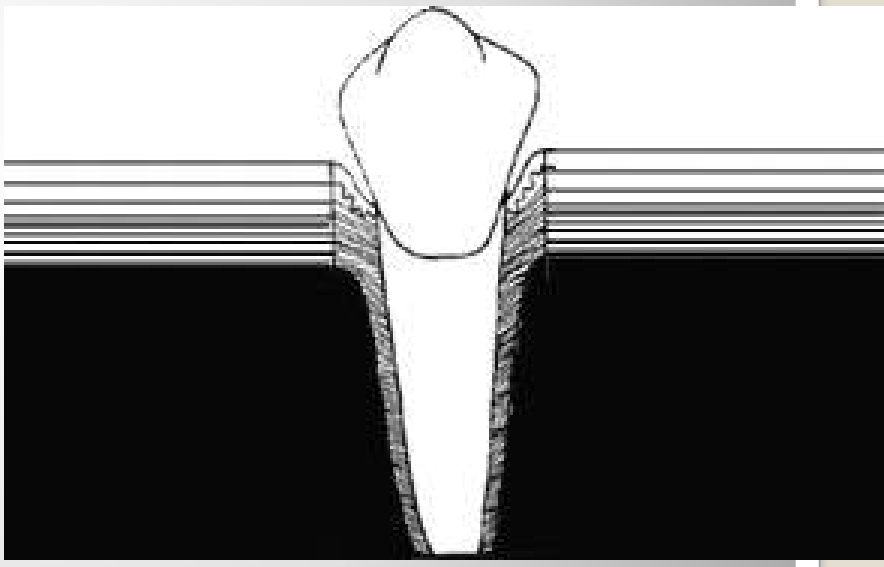

Drug Effects (Published Findings)

- Common (NSAIDS) drugs, such as aspirin & ibuprofen -reduce tooth movement both in rate and amount.
  - this of course is the product of their strong inhibitory effect on localized prostaglandins
  - Prostaglandin injected into PDL → increases rate of movement (painful, feels like a bee sting)
- Acetaminophen- no effect on tooth movement
  - should be the analgesic of choice during orthodontic treatment.

Drug Effects (Published Findings)

- Corticosteriods
  - inhibit tooth movement in acute administrations while promoting tooth movement in chronic administrations
- Bisphosphonates-selectively inhibit osteoclasts
  - commonly used to treat metabolic bone diseases
  - several clinical reports have been published on significant decreased in tooth movement in patients taking bisphosphonates. (Clinicians should be aware of this effect in chronically medicated patients prior to initiating orthodontic treatment)
  - recent investigations looking into topical application of bisphosphonates suggesting potential use to aid in anchorage of teeth
    - results were promising but further studies are required before these could be used clinically.

Systemic Effects

- Estrogen- reduced tooth movement in response to this hormone
  - known that estrogen inhibits production of cytokines involved in osteoclastic activation
  - has been suggested that young women taking oral contraceptives and postmenopausal elderly women might experience reduced tooth movement during orthodontic treatment
- Thyroid hormones, Parathyroid hormones, and Vit D
  - increase tooth movement

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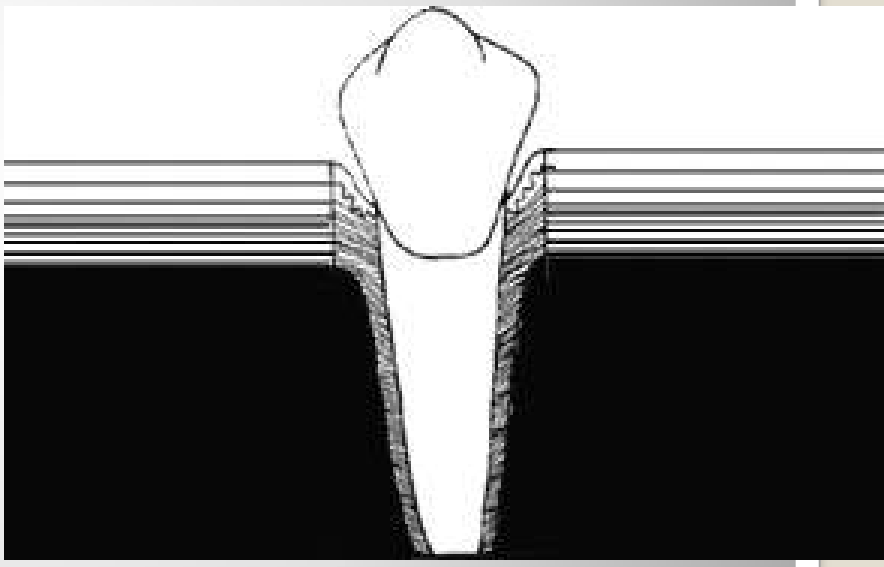


Anchorage

- Anchorage is resistance to unwanted tooth movement
- Types
  - Reciprocal tooth movement
  - Reinforced anchorage
  - Stationary anchorage
  - Cortical anchorage

"Anchorage Value"

- Function of root surface

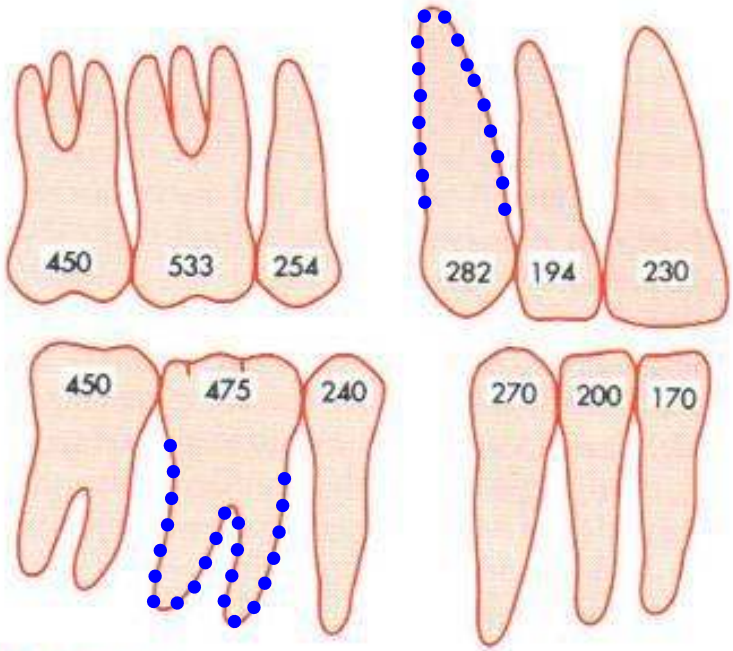
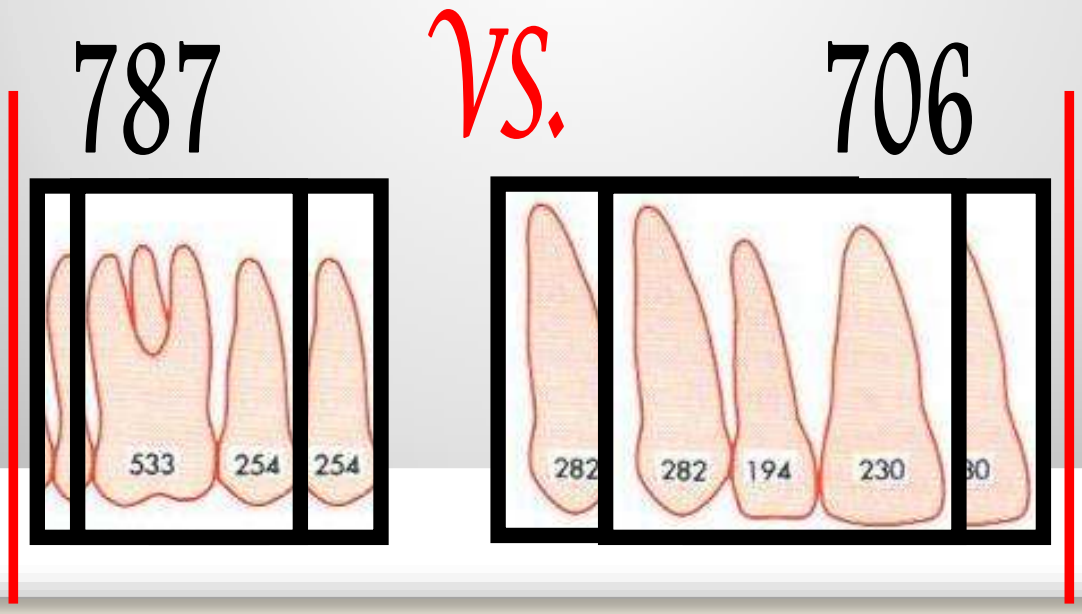


FIGURE 9-16 The "anchorage value" of any tooth is roughly equivalent to its root surface area. As this diagram shows, the first molar and second premolar in each arch are approximately equal in surface area to the canine and two incisors. (Modified from Freeman DC: *Root surface area related to anchorage in the Begg technique*, Memphis, 1965, University of Tennessee Dept. of Orthodontics, M.S. Thesis.)

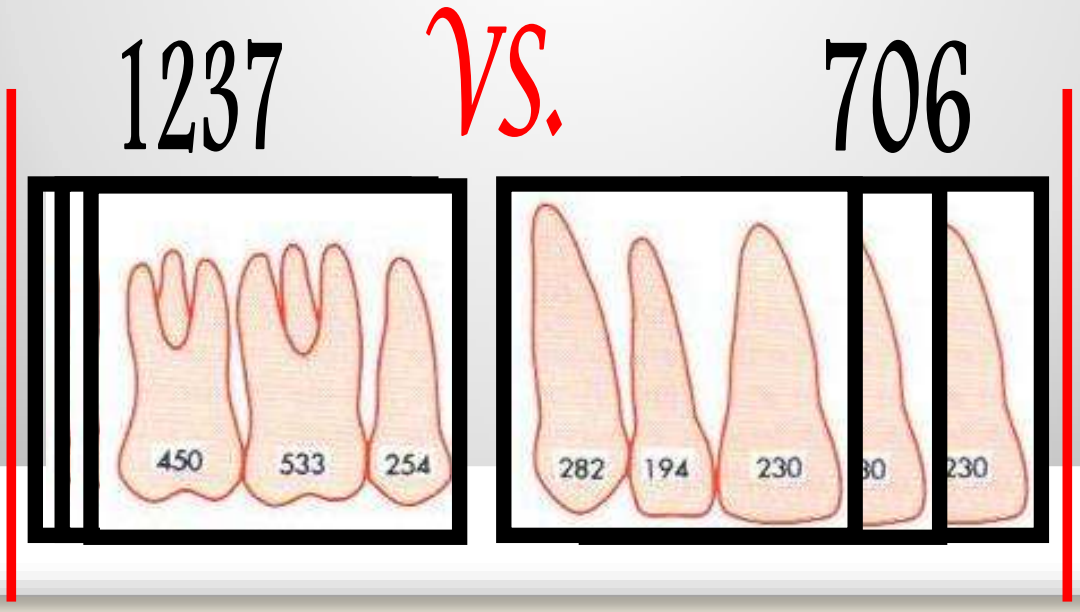
Reciprocal Tooth Movement

- Forces applied to 2 “units” or groups of teeth are <u>equal</u>
- Pit 3 anterior teeth against 2 posterior teeth



Reinforced Anchorage

- Reinforcing anchorage is the addition of more resistance units
- Example: if you want to bring the anteriors back, posterior anchorage should include the PMs and molars



Use force levels to control anchorage…

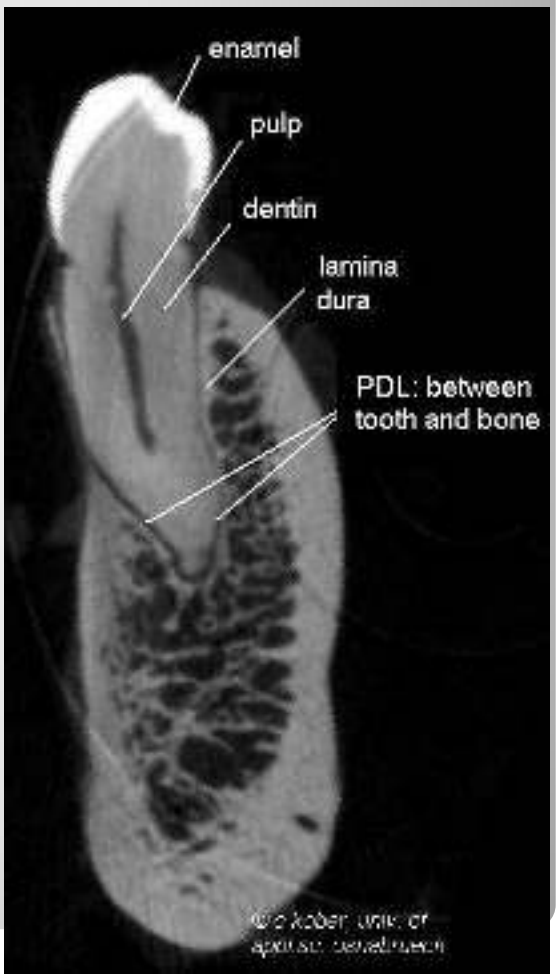
- Maximum anchorage- lighter forces used to preserve the anchorage units
- Moderate anchorage- heavier forces can be used and will allow greater tooth movement with equal portions of space closure from anterior and posterior (need to overcome the anchor unit threshold)

Stationary Anchorage

- Pitting bodily movement of one group of teeth against tipping of another (tipping followed by uprighting later)
- Set up: posterior can only translate, anteriors can tip → tipping requires less force
- Critical that forces be kept low and out of the optimum range for translation

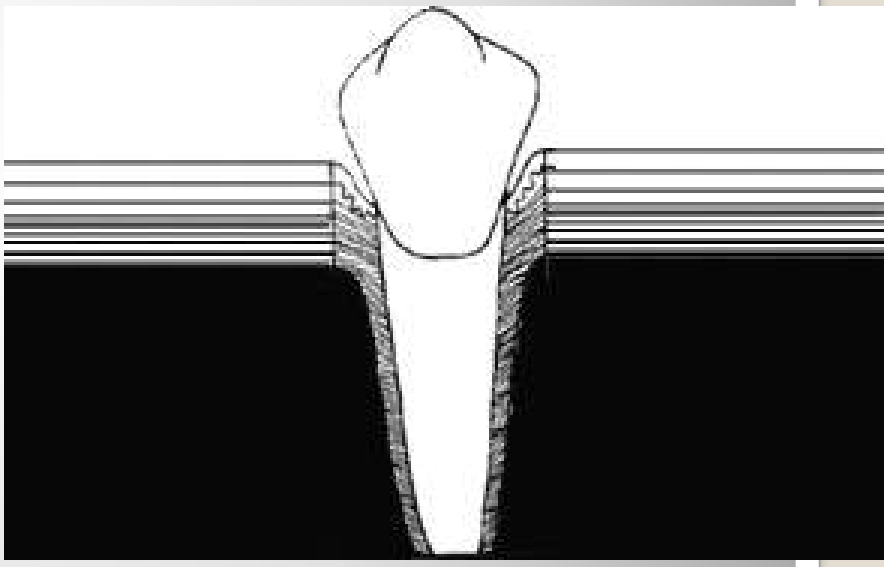
Cortical Anchorage

- Cortical bone is more resistant to resorption, resists remodeling
- Difficult to move teeth through cortical bone that has formed in an OLD extraction site
- Be Careful- Forcing roots against the cortical plate could cause root resorption



Outline

- PDL-components & function
- Theories of tooth movement
- Events in tooth movement – light vs. heavy forces
- Types of tooth movement
- Classifications of force duration
- Drug Effects
- Types of Anchorage
- **Deleterious effects of Ortho**



Deleterious Effects of Ortho

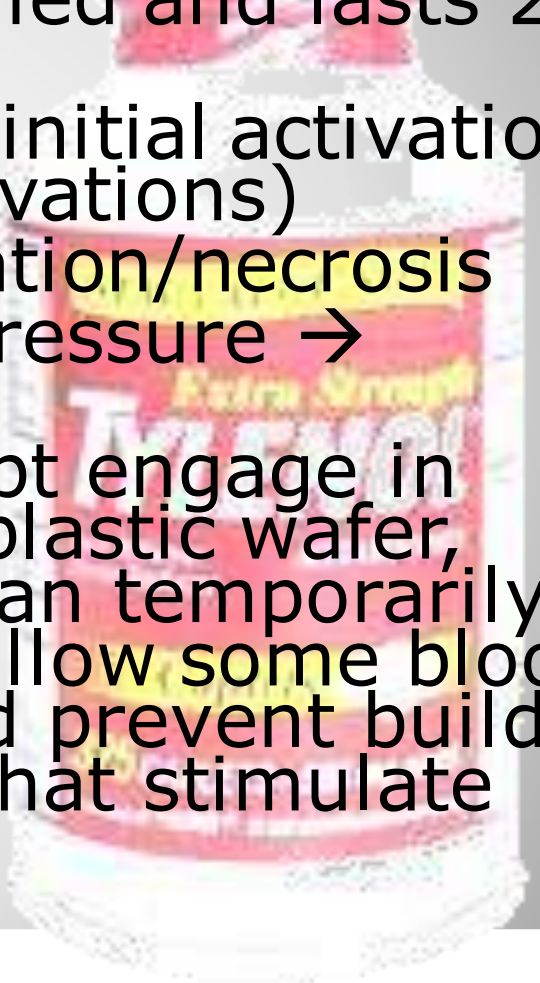
- Mobility and pain
- Pulpal effects
- Root structure
- Alveolar bone height

Mobility and Pain

- Ortho movement requires remodeling of BONE and reorganization of PDL
- Widened, disorganized PDL → mobility
- Fibers detach (reattach later)
- Moderate increase in mobility is expected
- Heavy forces → undermining resorption → mobility
- Take extremely mobile teeth out of occlusion and stop ortho force until mobility decreases
- Mobility can usually correct without permanent damage

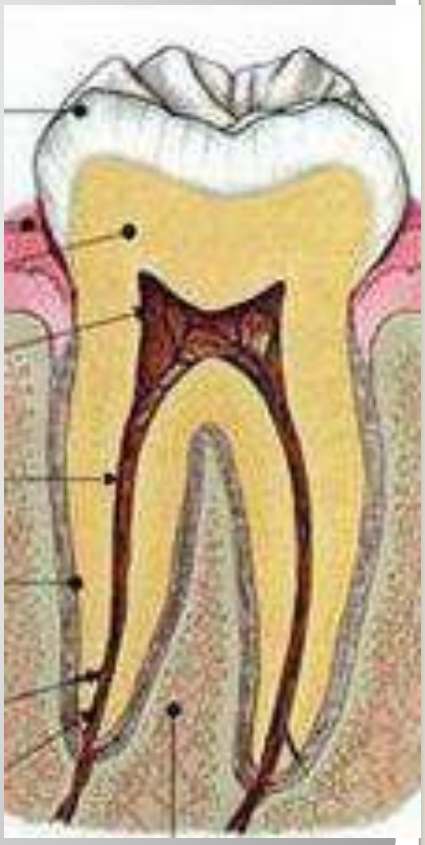
Mobility and Pain

- Appropriate force → pain develops several hours after forces are applied and lasts 2-4 days
- Pain is usually worst after initial activation of an appliance (not reactivations)
- Pain is caused by hyalinization/necrosis
- Increased tenderness to pressure → inflammation at apex
- With light force → having pt engage in repetitive chewing (gum, plastic wafer, etc.) during first 8 hours can temporarily displace teeth enough to allow some blood into compressed areas and prevent build-up of metabolic products that stimulate pain receptors



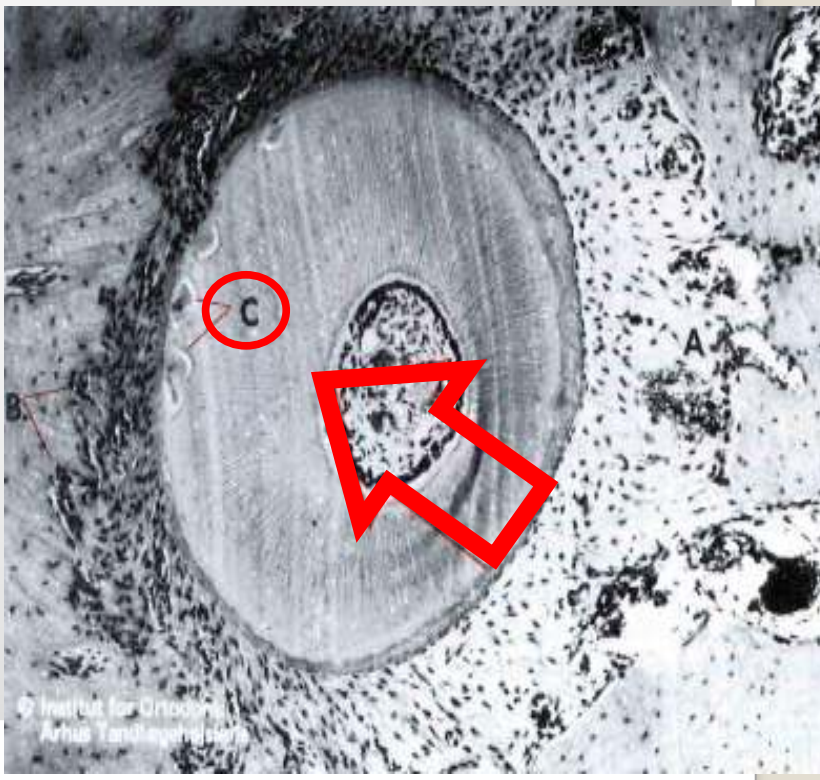
Effects on the Pulp

- Pulpal reactions to movement are minimal → initially mild pulpitis
- Loss of vitality if you move teeth outside alveolar bone
- Poor control of forces can occasionally kill a tooth
  - Abrupt movement of apex could sever root BVs
- No contraindication to moving endodontically treated teeth
- Studies show that endo teeth are NOT more prone to root resorption as was once believed



Effects on Root Structure

- Root remodeling *always* occurs during orthodontic movement
- Shortening of root occurs when clast cells create cavities
  when attacking cementum
- Loss of root occurs primarily
  at apex (teeth do not become thinner)



Forms of Resorption

- Moderate Generalized Resorption
  - Almost all patients will have some loss of root length at the end of treatment → 0.5-1 mm
  - Maxillary incisors affected more than other teeth
- Severe Localized Resorption
  - >20% of root in 3-4% of orthodontic pts
  - Risk is greatest for maxillary incisors
  - 20 fold increased risk if incisors are forced against cortical plate
    - Likely during camouflage of Class II (torqued into cortical plate) or Class III (tipped against lingual cortical plate)

Associated Factors

- Root shape
  - Conical roots with pointed apices
  - Dilacerations
  - History of trauma
- Length of Tx
- Distance of movement
  - Upper PM extractions (ant. teeth)
- Family History
  - Genetic infuence
  - Defect in cementum repair mechanism (cementoblasts)

Things to know:

1. Know how drugs (particularly NSAIDS) can affect tooth movement
2. You need at least 4 hours of pressure for tooth movement to occur
3. Force levels for various tooth movements (ie intrusion requires the least amount of pressure)
4. Know the difference between light, continuous forces and heavy forces (ie heavy forces lead to sterile necrosis, hyalinization, undermining necrosis and pain). Look at the graph.
5. The role of osteoclasts and osteoblasts in tooth movement
6. Pressure tension theory vs. piezoelectric theory

QUESTIONS?

Problems in the Mixed Dentition

Erin Wilberg D.D.S.

OBJECTIVE

- Identify potential problems early and treating/referring those problems

Origin of Problems?

- Nonskeletal Problems
- Skeletal Problems

Space-Related Problems

Two major causes:

1. Interferences with eruption

2. Lack of adequate space for alignment

Eruption Problems

Over-Retained Primary Teeth can lead to altered eruption patterns

- A permanent tooth should replace its primary predecessor when approximately **three-fourths of the root** of the permanent tooth has formed.

- A primary tooth that is retained beyond this point should be removed.

Eruption Problems

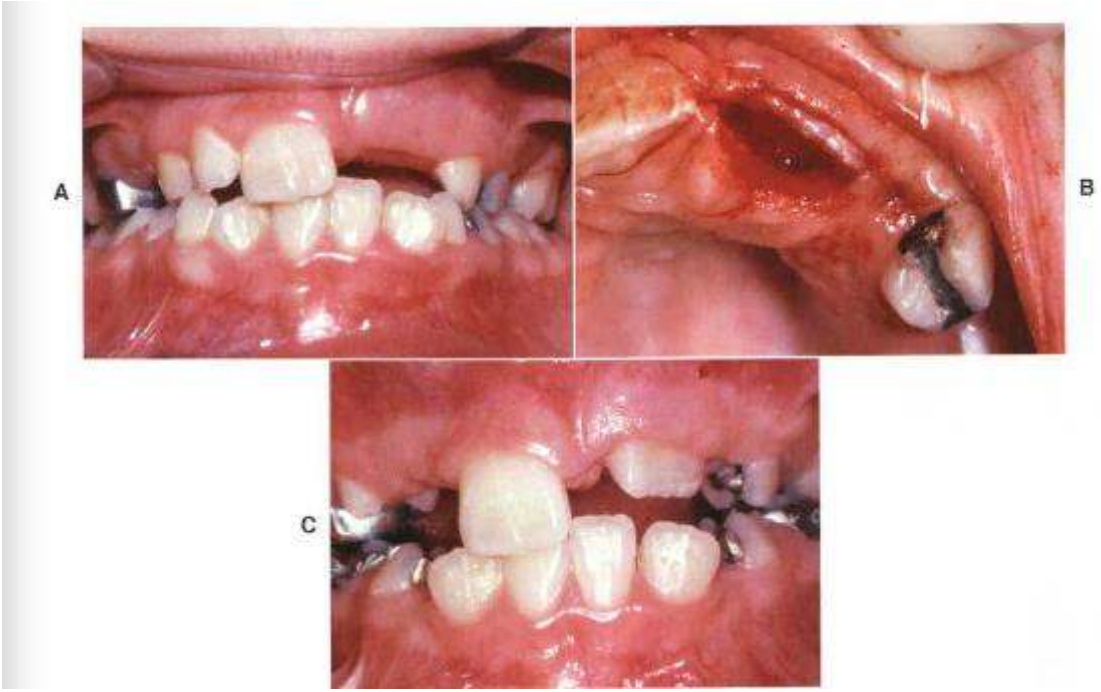
Supernumerary teeth

- Disrupt normal eruption of other teeth and disrupt alignment and spacing
- Extract before problems arise
- The most common location for supernumerary teeth is the **anterior maxilla**.

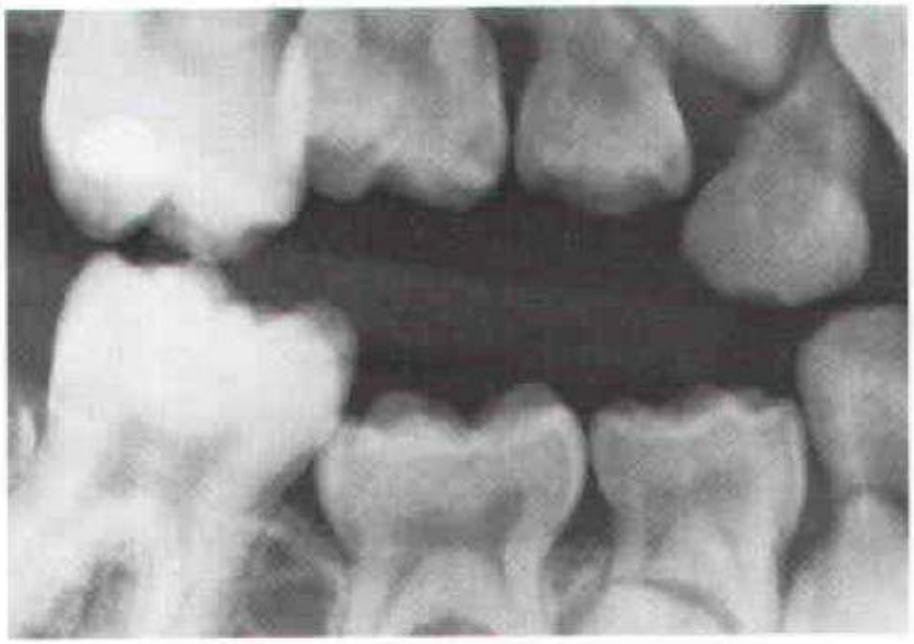
Eruption Problems

Delayed Incisor Eruption

- Can be caused by thick overlying keratinized tissue which formed due to premature loss of the primary incisors



Eruption Problems



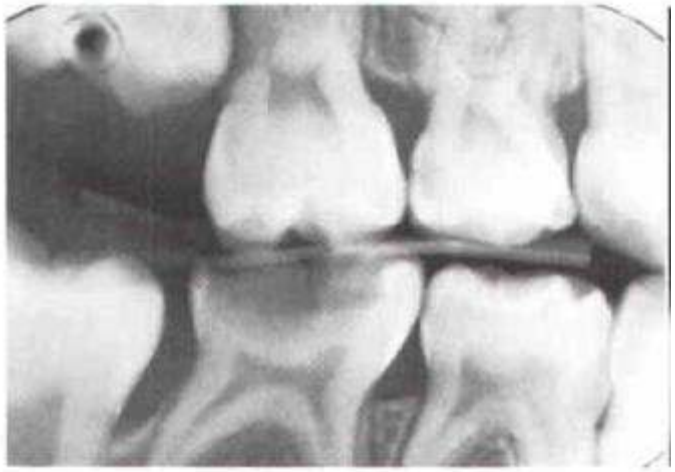
Ankylosed teeth

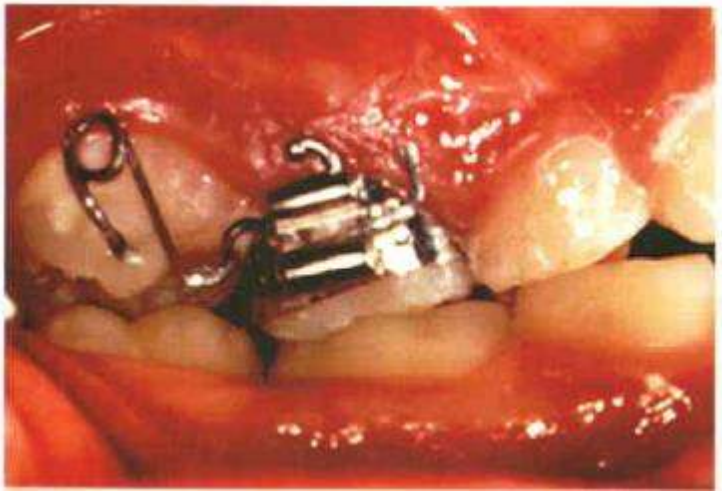
- Can delay the erupting permanent tooth
- Maintain it until interference with eruption
  - Extract it and place a space maintainer

Eruption Problems

Ectopic eruption

- When a permanent tooth causes resorption of a primary tooth other than the one it is supposed to replace or resorption of an adjacent permanent tooth





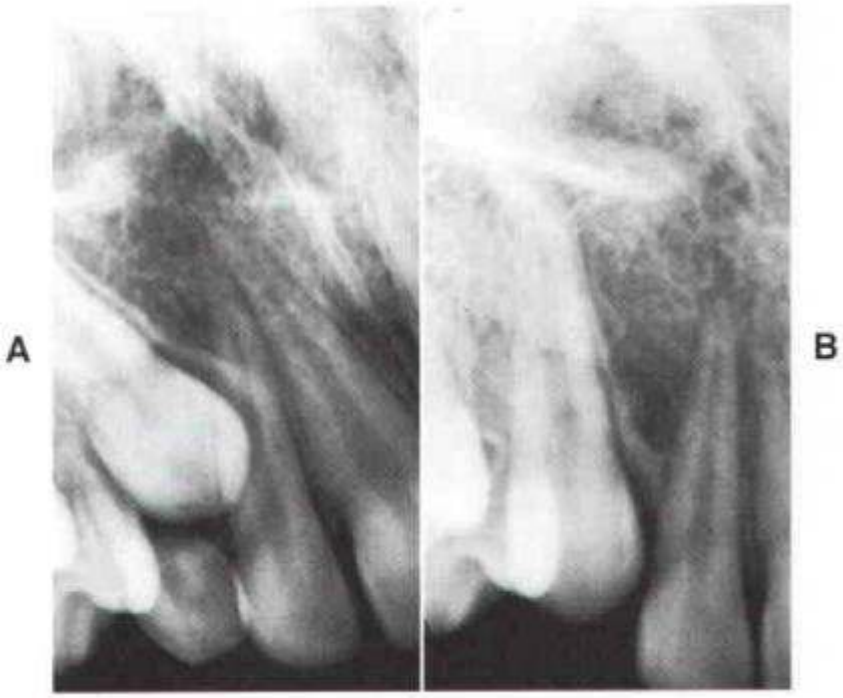
Ectopic Eruption of Maxillary Canines

- Can lead to either or both of two problems:

1. Impaction of the canine and/or
2. Resorption of permanent lateral roots

- <u>At age 10</u>, if the primary canine is not mobile and there is no observable or palpable facial canine bulge, a panoramic, occlusal, or periapical radiograph is indicated.

- If the permanent canine crown overlaps **more than half (>50%)** of the lateral incisors root**, extraction of the primary canine is indicated**.



Spacing Problems

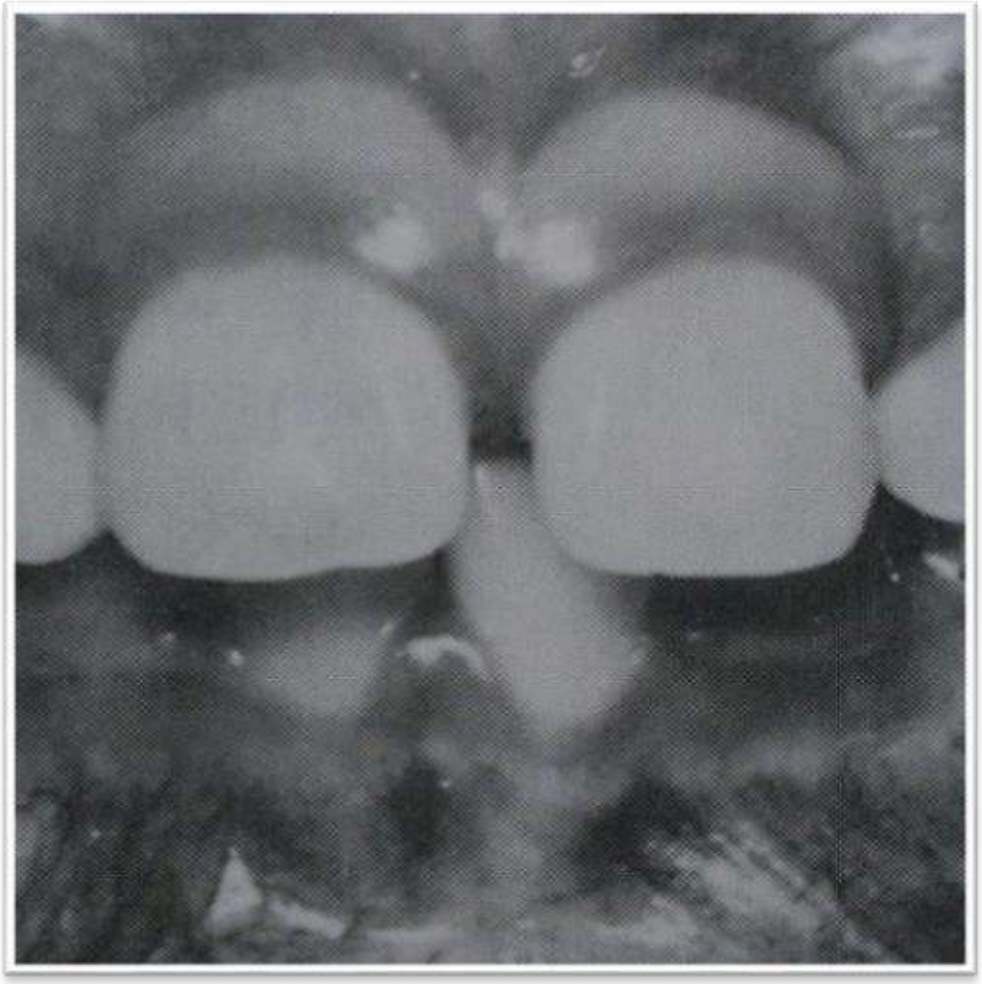
- Excess Space
  - Generalized Spacing of Permanent Teeth
    - Unless the space presents an esthetic problem, wait to allow eruption of the remaining permanent teeth before closing the space

Spacing Problems

Maxillary Midline Diastema

- A small (<2mm) diastema is not necessarily an indication for orthodontic treatment.

- Greater than 2mm: closure is unlikely and will probably require orthodontic intervention



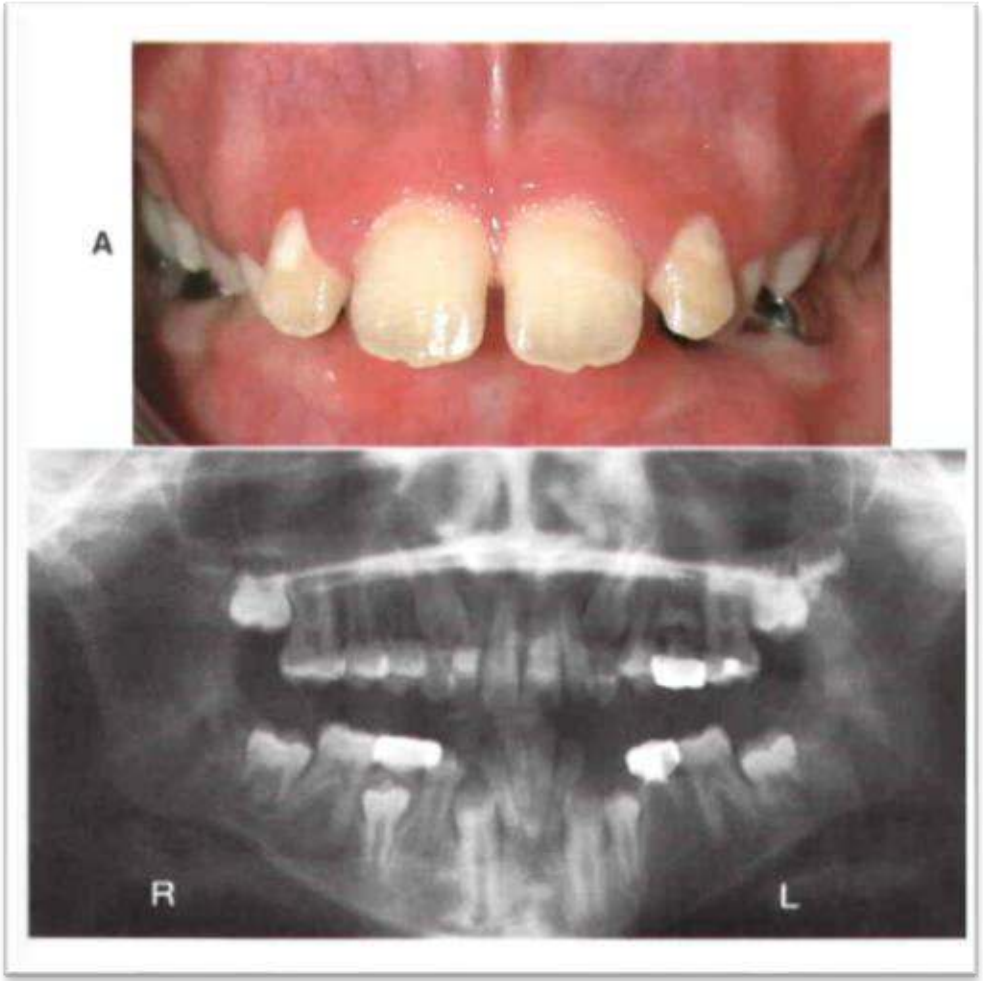
Spacing Problems

Maxillary Midline Diastema

- When a larger diastema (>2mm) is present, a midline supernumerary tooth or intrabony lesion must always be suspected.
  - Check radiographs!

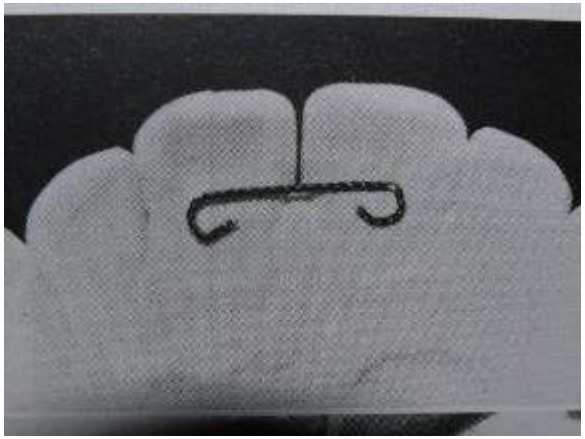
- <u>If diastema is due to large frenum attachment, frenectomy is performed AFTER space closure.</u>

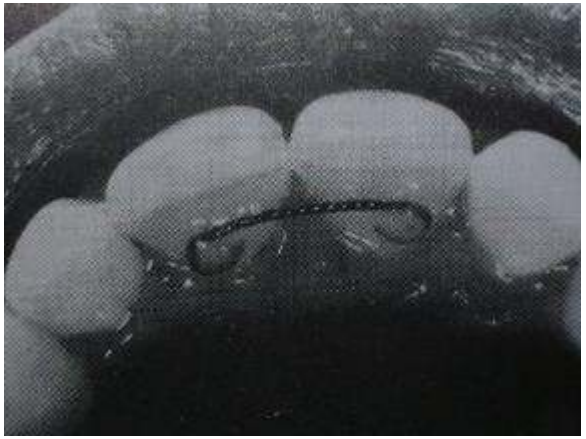
Ugly Duckling Stage



Retention of Diastemas

- A fixed retainer is indicated to maintain the closure of a space between teeth
- Fixed retainers are used most commonly when a diastema between maxillary central incisors has been closed
  - Space opens up quickly when the retainer is removed
  - Removable retainer is not a good choice for prolonged retention of a diastema





Spacing Problems

Premature Tooth Loss with Adequate Space

- Early loss of a primary tooth presents a potential alignment problem because drift of permanent or other primary teeth is likely unless prevented.

Space maintenance is needed when:

- A primary first or second molar is missing
- There will be more than a 6-month delay before the permanent premolar erupts
- There is adequate space

- Fixed appliances are preferred over removable because it eliminates the factor of patient cooperation

Early loss of teeth

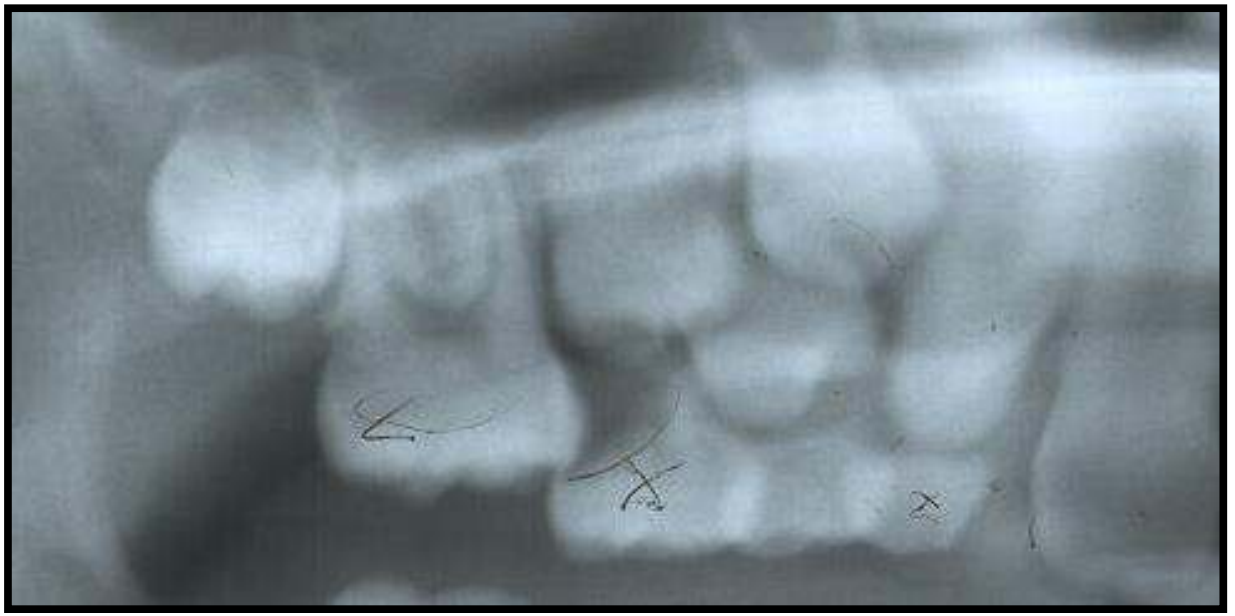
Can be due to:

- Caries

Early loss of teeth

Can be due to:

- Caries
- Ectopic Eruption



Early loss of teeth

Can be due to:

- Caries
- Ectopic Eruption
- Trauma
- Any other reason!

Space Management Strategies

- Needed whenever the first permanent molar shows a tendency to come forward a distance in excess of the leeway space because of premature loss of a deciduous molar or canine.

What is Leeway Space?

- The difference between the size of the larger primary molars and the smaller permanent premolars is called "leeway space" or sometimes "e" - space.

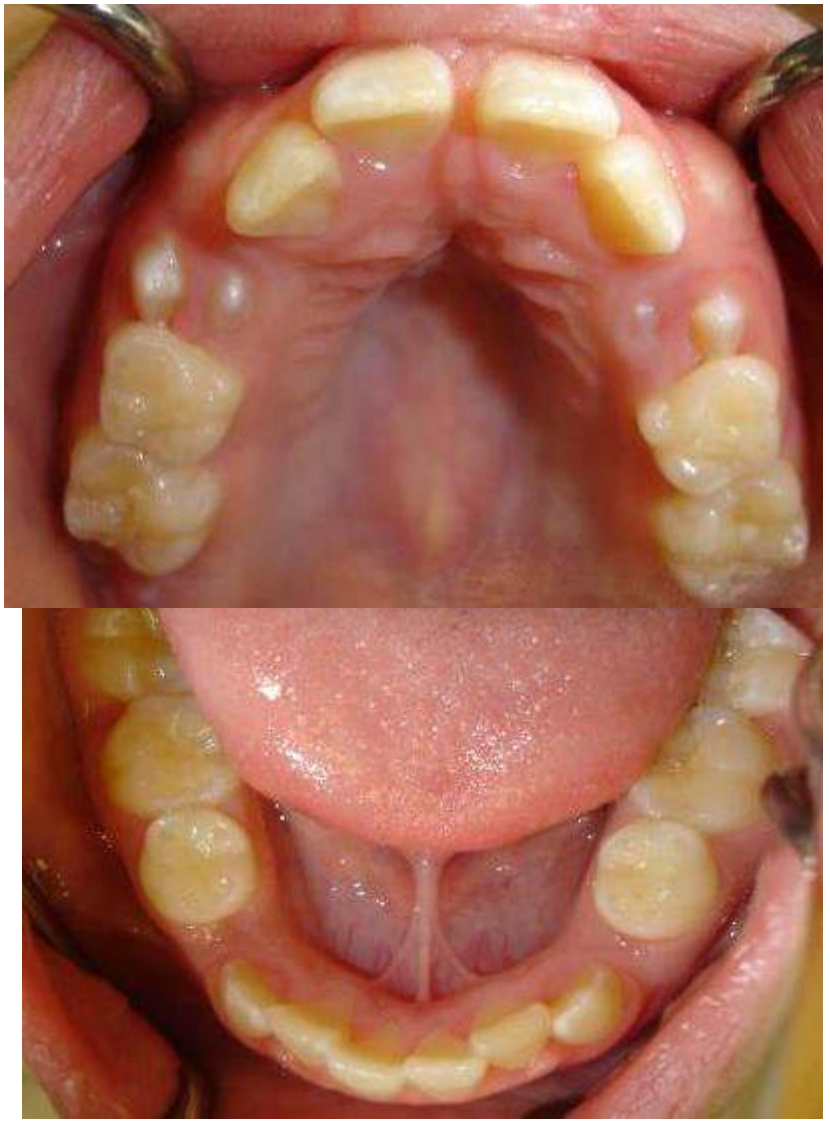
How much?

- Only **1.5 mm** in the maxilla PER SIDE
- Typically **2.5 mm** in the mandible PER SIDE

Maintain or Regain Space?

- Do a….

SPACE ANALYSIS!



Space Analysis

Amount of space available

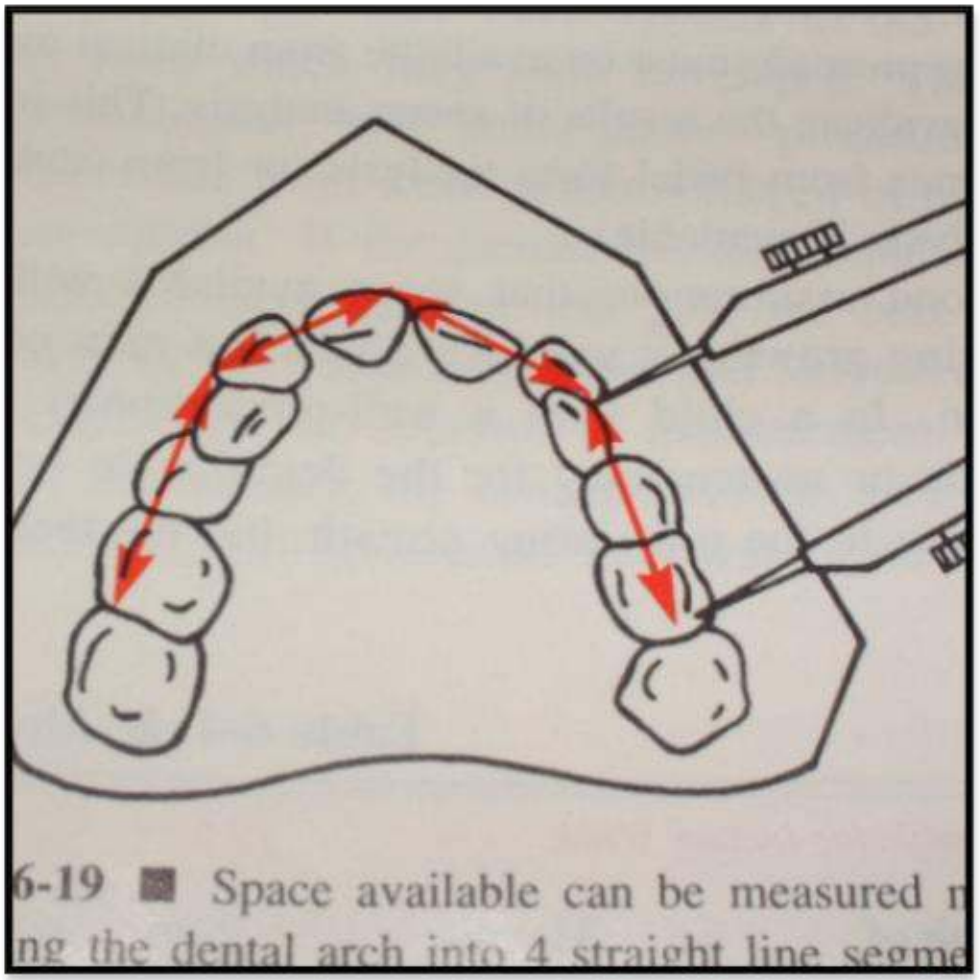
vs

Amount of space needed

Space Analysis

Space available:

- Measure the arch length
- Mesial of 1st permanent molar to contralateral 1st permanent molar

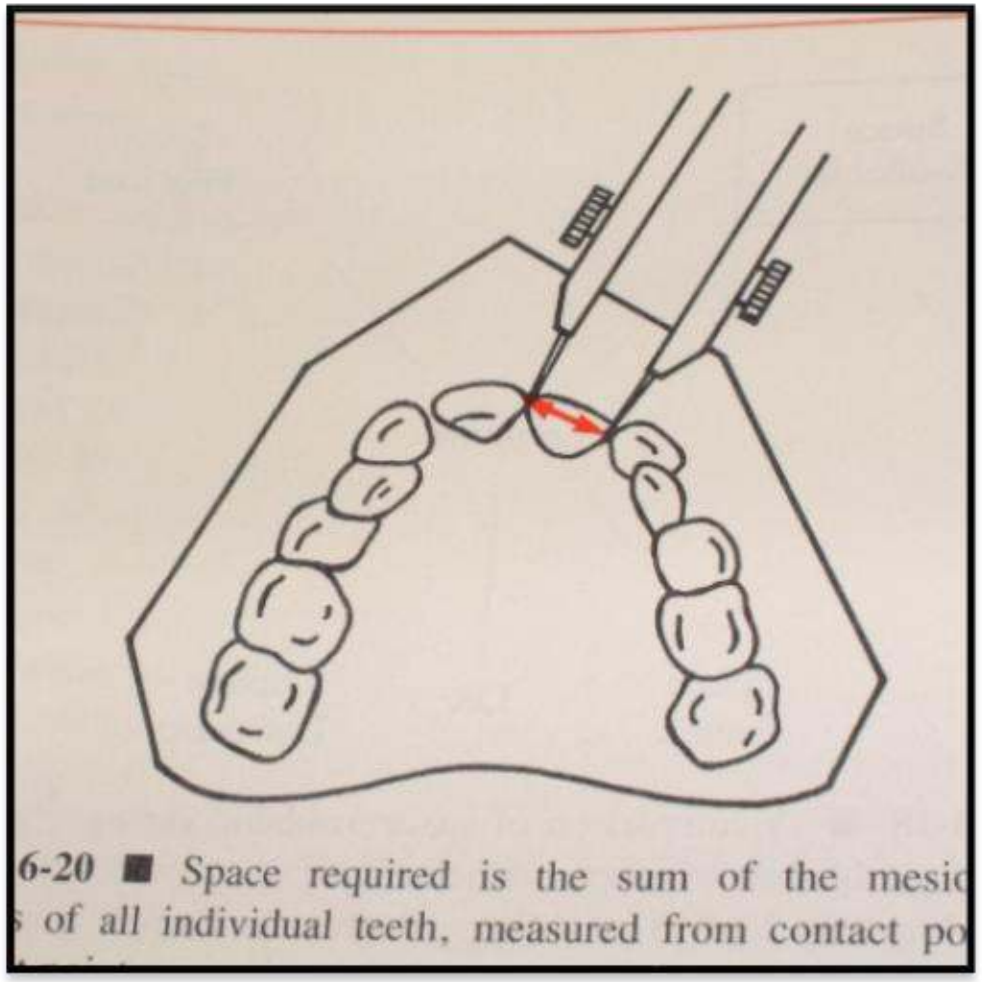


Space Analysis

Space needed:

- Add together the widths of each tooth

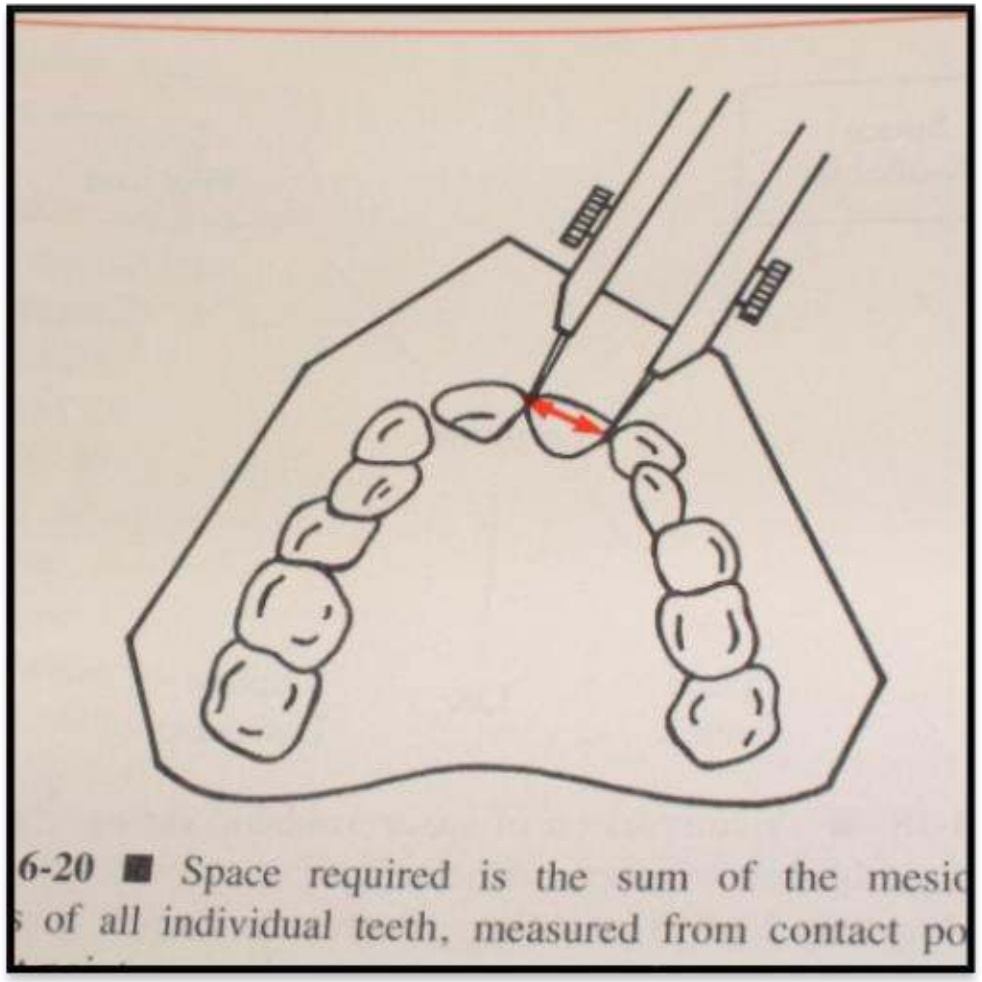
- If tooth is unerupted, you can estimate the width using
  - Radiographs
  - Proportionality tables
    - Moyers
    - Tanaka and Johnston



6-20 ■ Space required is the sum of the mesio
of all individual teeth, measured from contact po

Space Analysis

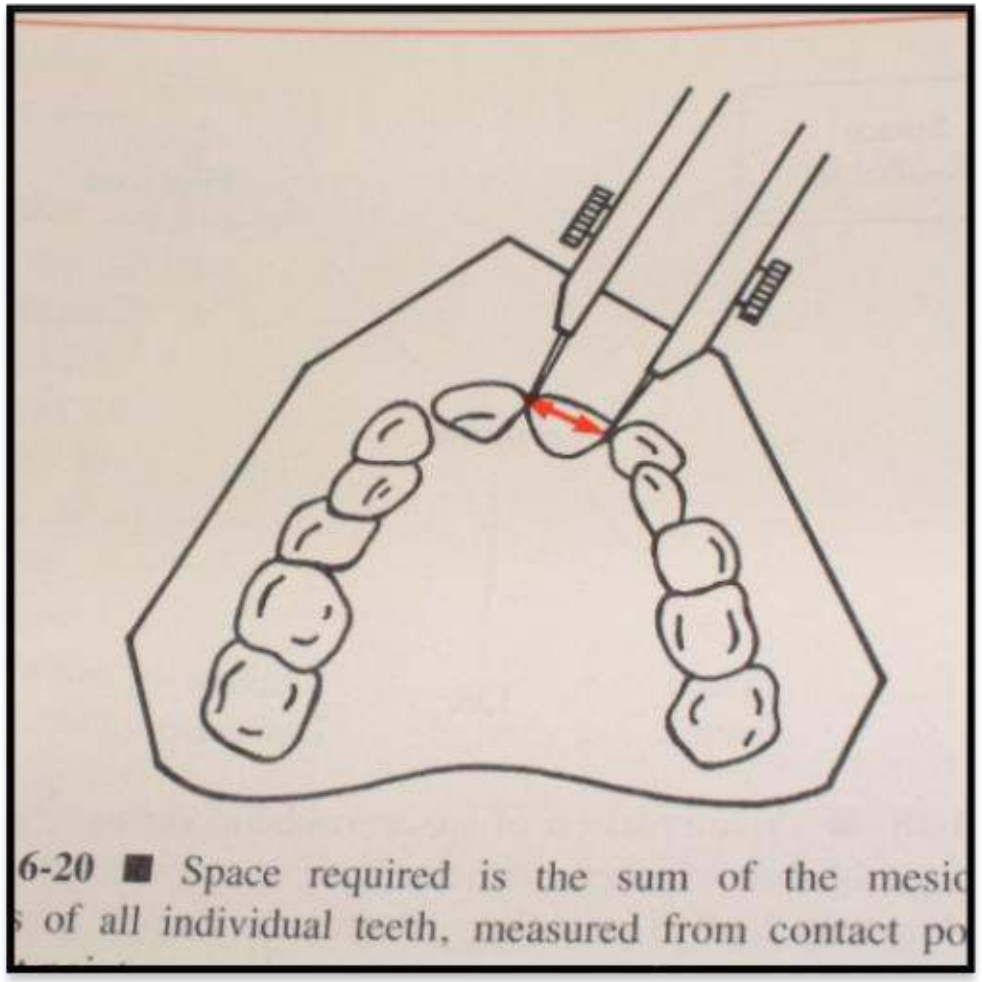
- Space needed-Space available=arch length discrepency
- If no arch length discrepency you can maintain space
- If arch length discrepency exists you may need to regain space with orthodontics



Space Analysis

Compare arches:

- Add together tooth mass of each arch and compare
- Bolton Analysis
  - Tooth size proportionality between arches
  - Indicates tooth size discrepency
    - Ex. Peg laterals



6-20 ■ Space required is the sum of the mesio
of all individual teeth, measured from contact po

Space Management Strategies

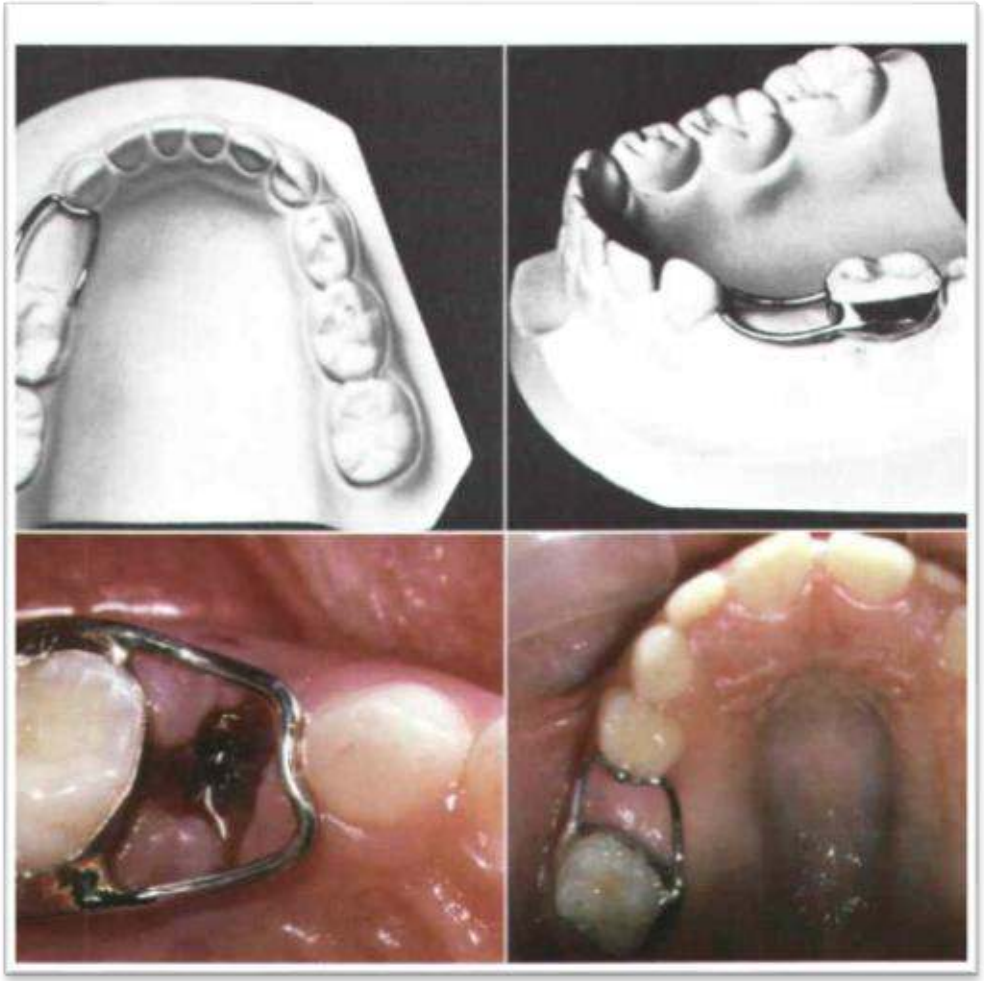
- Before teeth are lost, evaluate restorability
- Keep it simple: try to restore teeth where possible because…
- THE BEST SPACE MAINTAINER IS A TOOTH

Examples of space maintainers

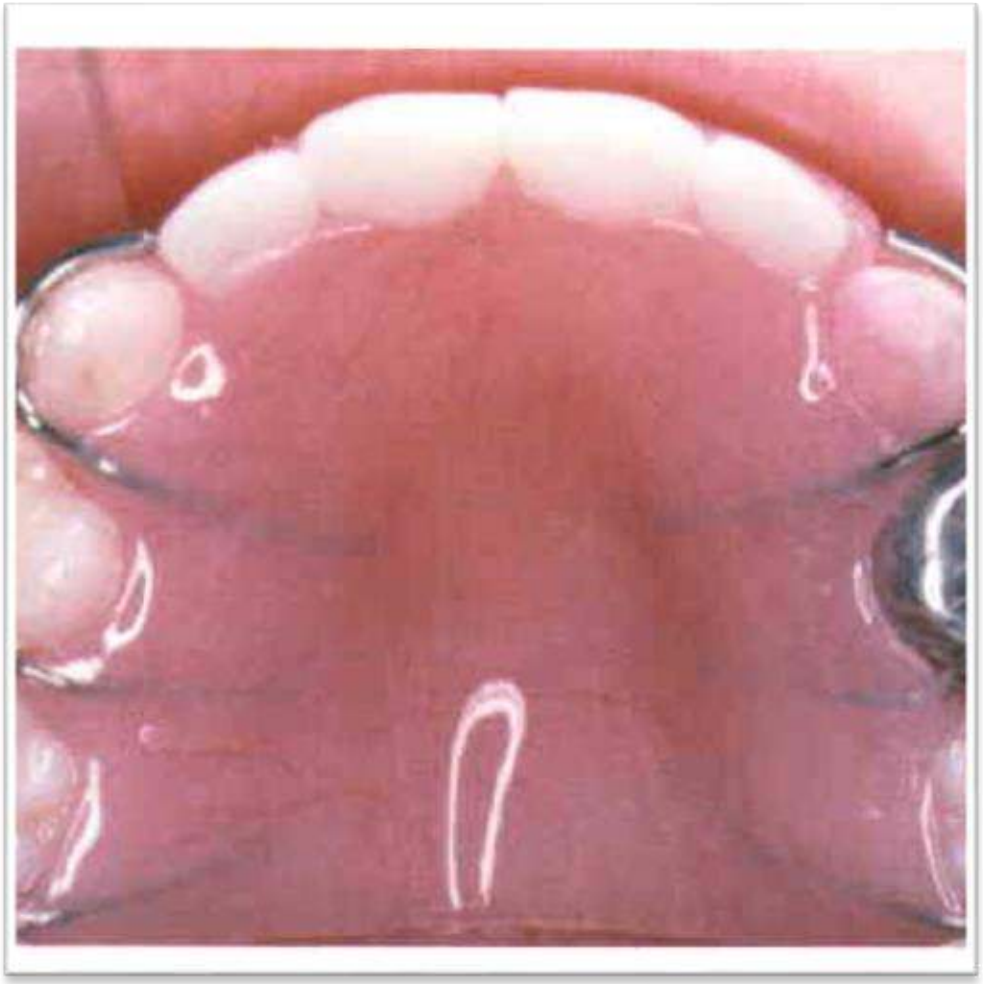
- Band and loop
- Partial denture space maintainers
- Distal shoe
- Lingual arch

Band and Loop

- Space maintenance in the posterior segments.
- Should be restricted to holding the space of one tooth

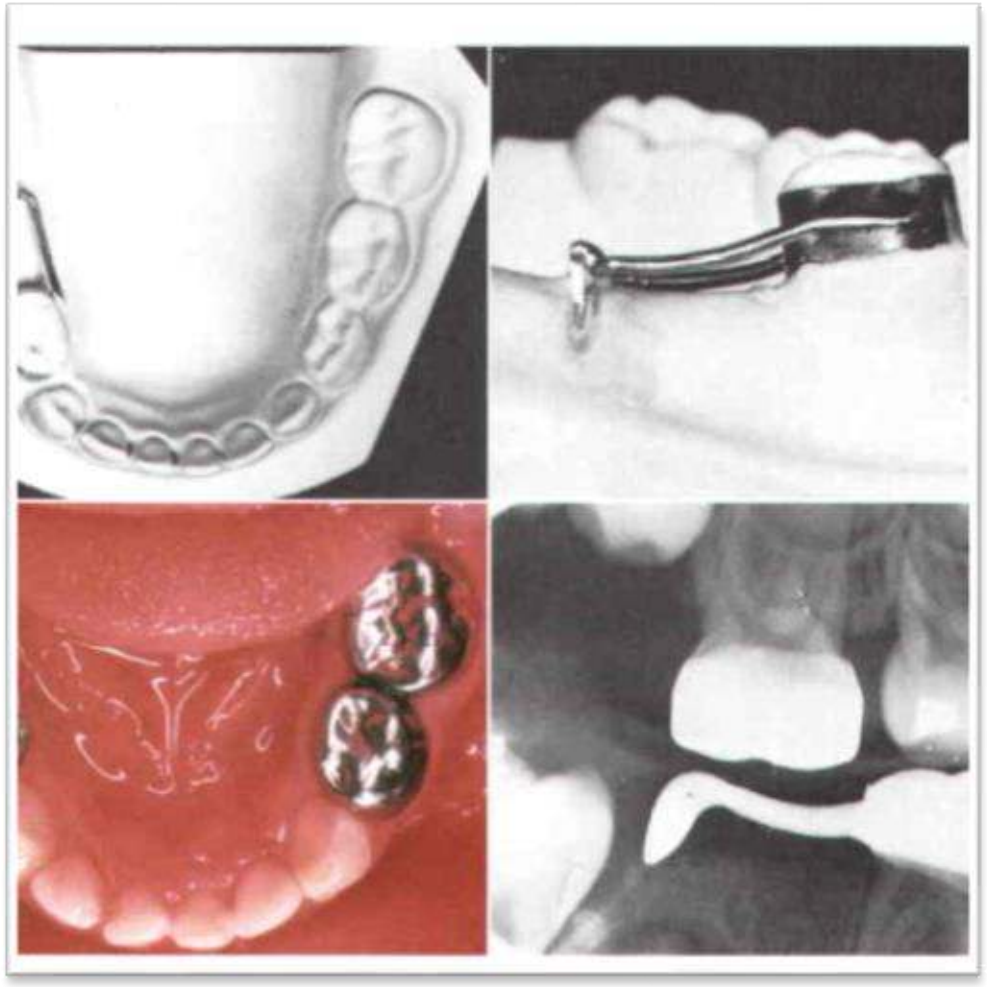


Partial Denture Space Maintainers



Distal Shoe

- Primary second molar is lost before eruption of the permanent first molar



Lingual arch

- Indicated for space maintenance when **multiple primary posterior teeth are missing** and the **permanent incisors have erupted**

Lingual arches

- A lingual arch helps:
  - Preserve arch length
  - Avoid midline shifts (when spurs are present)
  - MUST HAVE ALL INCISORS ERUPTED!!!!

Maxillary lingual arches

Nance arch (left)

- Advantage: more anchorage from the palate
- Disadvantage: soft tissue irritation can be a problem

Transpalatal arch (right)

- Best indicated when one side of the arch is intact and several primary teeth are missing on the other side

Localized Space Loss (3mm or less): Space Regaining

- Generally, **space is easier to regain in the maxillary than in the mandibular arch**.
- Up to 3 mm of space can be reestablished
- >3mm usually requires comprehensive treatment to achieve acceptable results

Moderate and Severe Generalized Crowding

- Children with moderate crowding and inadequate space in the early mixed dentition face one of two choices:
  - Some permanent teeth will need to be extracted
    or
  - Either the arch will need to be expanded to accommodate the permanent teeth

- In the presence of severe crowding, limited treatment of the problem will not be sufficient and permanent tooth extraction is most likely the best alternative

Occlusal relationship problems

Crossbites:

-Skeletal Origin

-Dental Origin

Occlusal relationship problems

Crossbites of Dental Origin:

- due solely to displacement of teeth
- usually affect only some of the teeth in an area of the arch
- less severe than cross-bites due to skeletal discrepancies

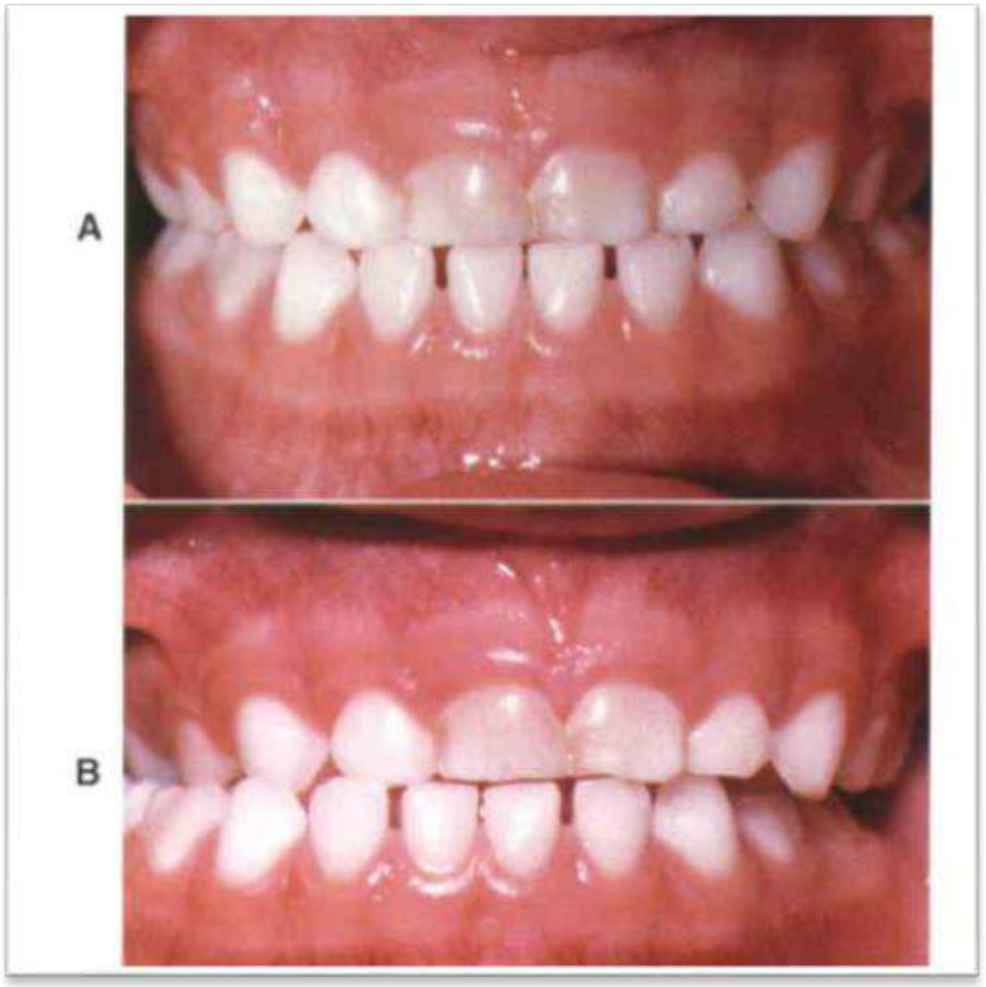
Treatment

1. Equilibration to eliminate mandibular shift
2. Expansion of a constricted maxillary arch
3. Repositioning of individual teeth to deal with intra-arch asymmetries

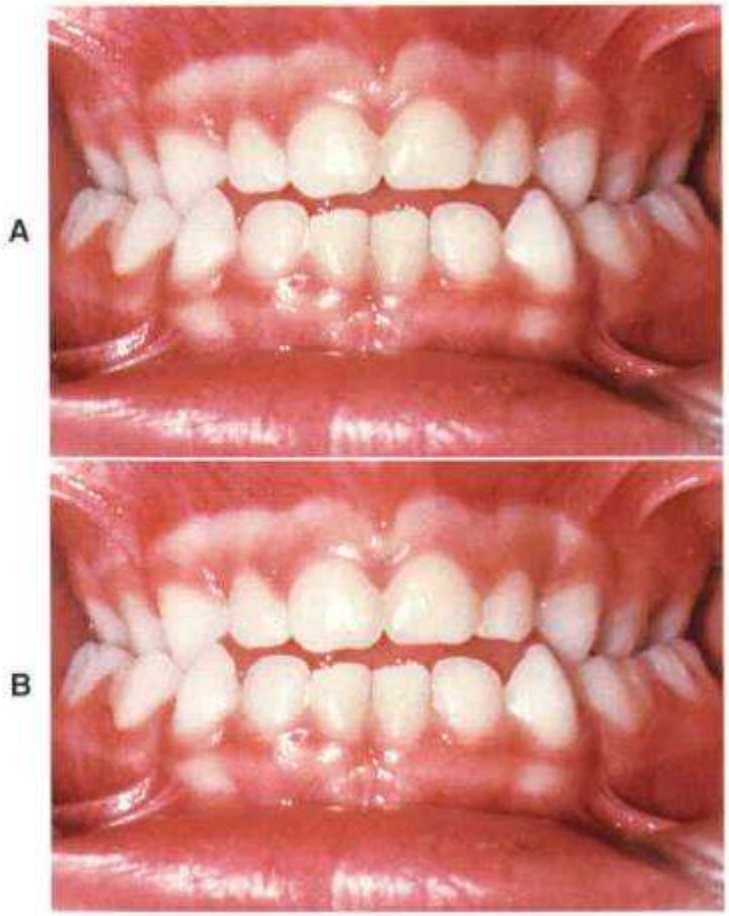
Equilibration to eliminate mandibular shift

A. Initial Contact

B. Shift into centric occlusion.

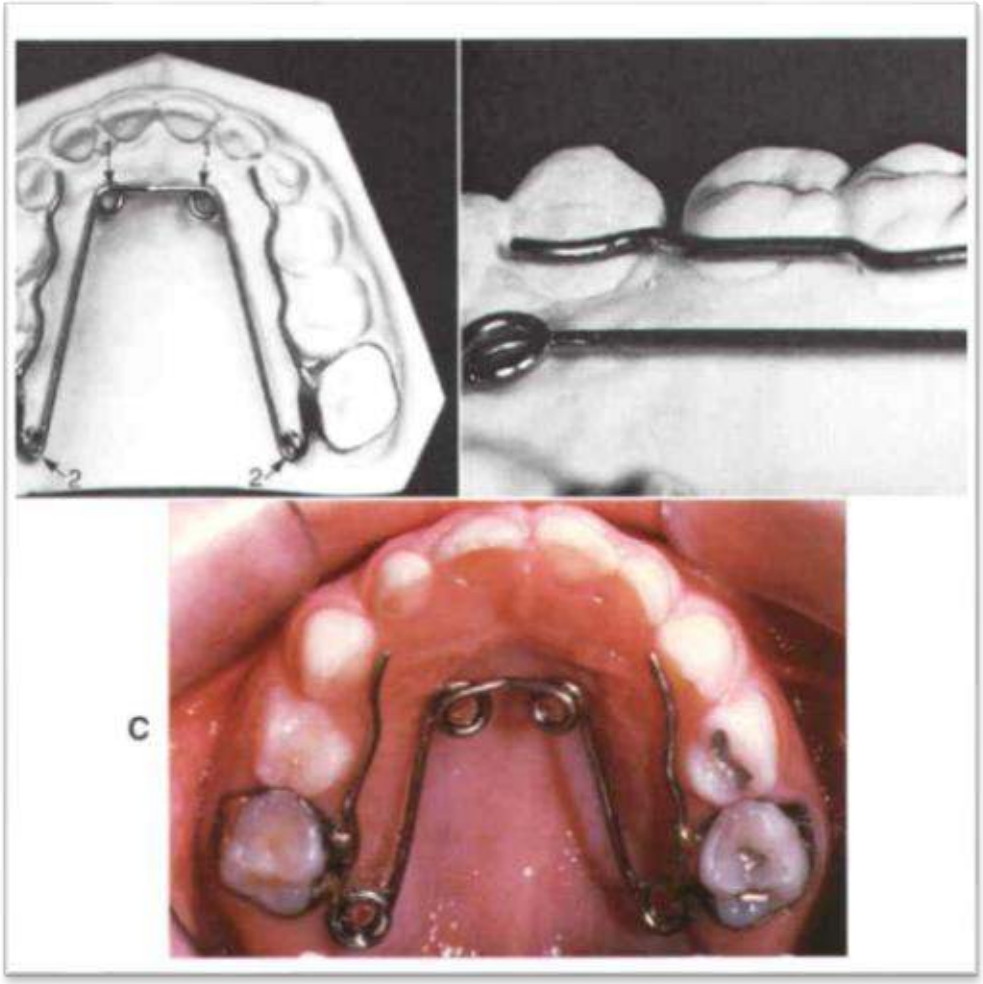


Constricted maxillary arch



Quad Helix

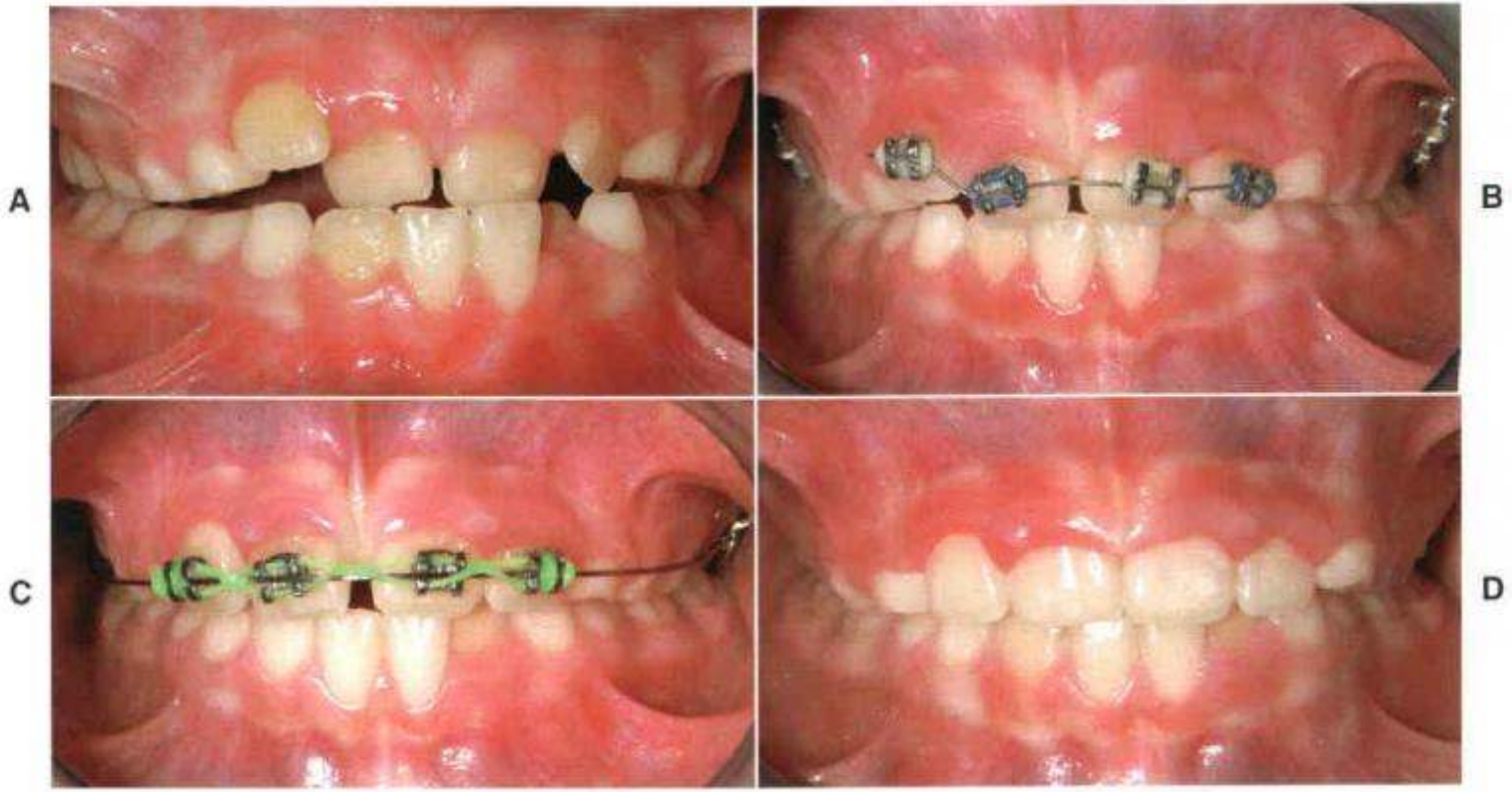
- Used to correct bilateral maxillary constriction



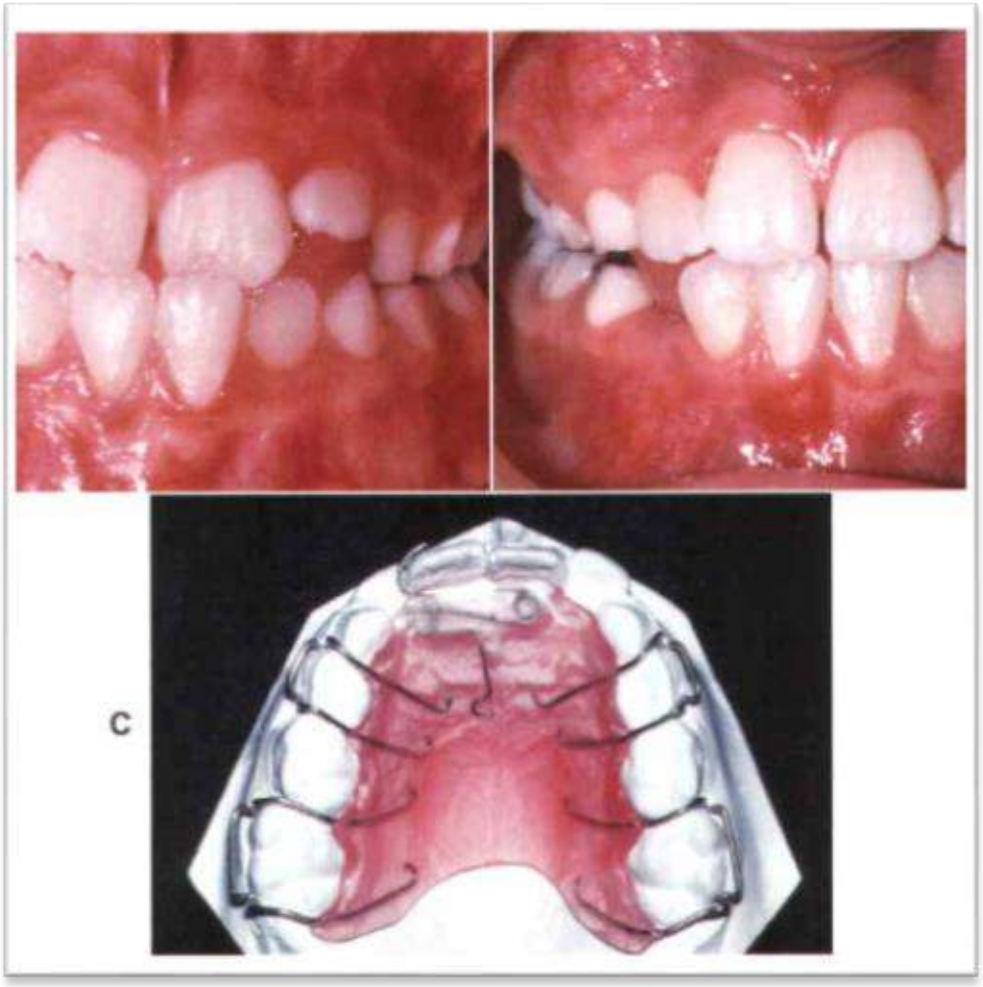
Anterior Crossbites

- Most common etiologic factor for non-skeletal anterior crossbites is lack of space for the permanent incisors.
- Best treated with a 2x4 appliance or a removable appliance with finger spring

2x4 Appliance

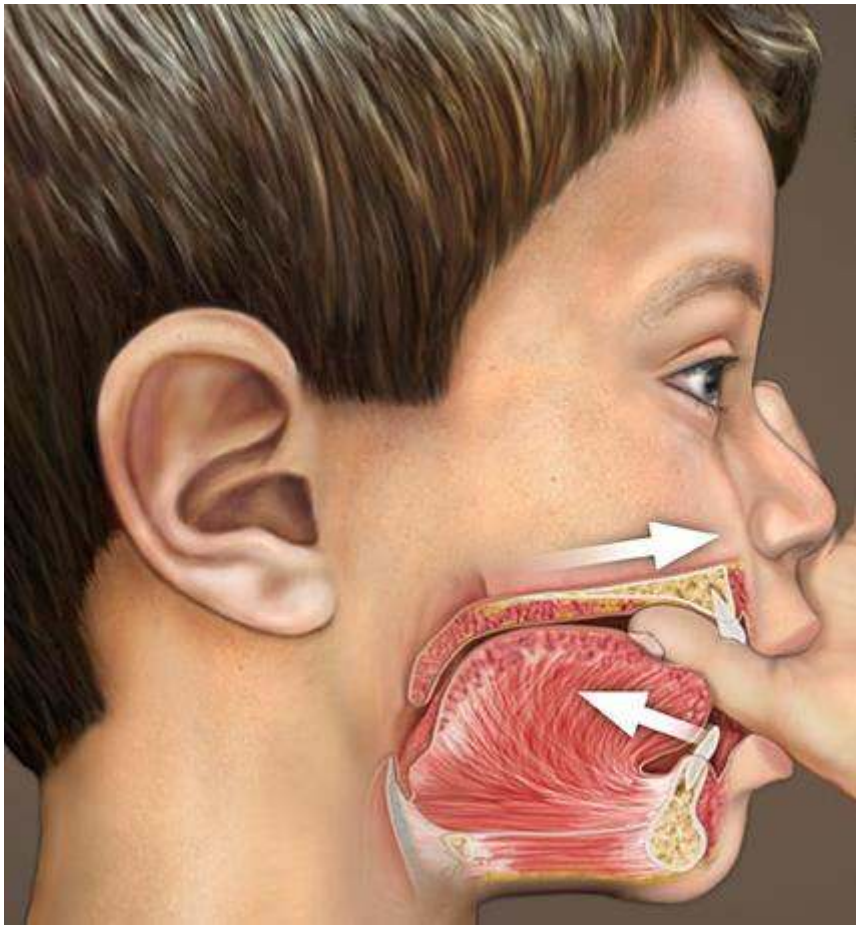


Hawley retainer w/ finger spring



Digit Sucking Habits

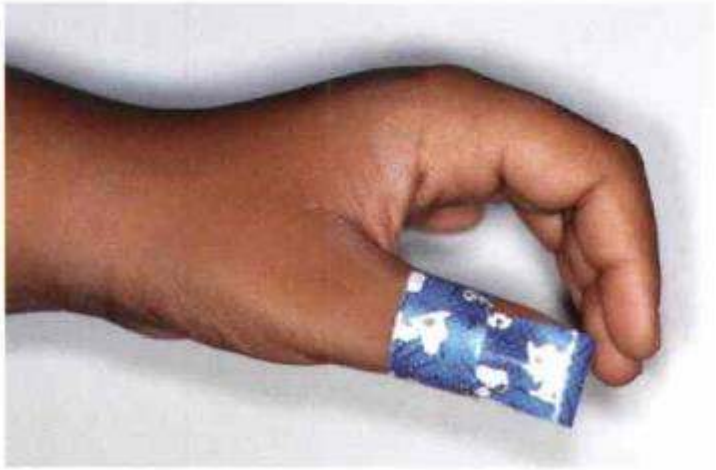
- Effect depends on frequency (hours per day) and duration (months/years)
- Maxillary incisors are tipped facially, mandibular incisors are tipped lingually, and eruption of some incisors is impeded
- Overjet increases and overbite decreases

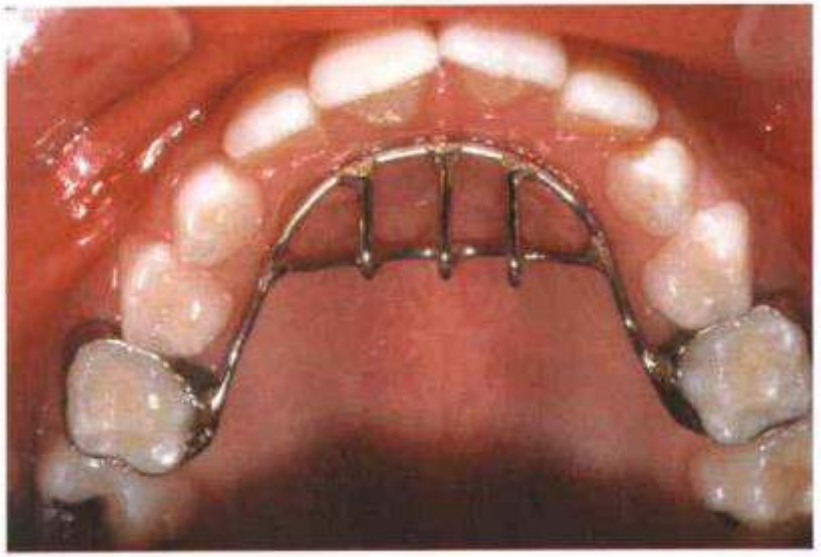


A. Open bite due to finger sucking habit

B. Several months after cessation of finger sucking, the openbite has spontaneously closed.

Non-dental intervention vs appliance therapy





QUESTIONS???

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Early/Mixed Dentition

Treatment Principles of Space Problems in the Sagittal Plane

- Robert Yu, DDS
- 1st Year Ortho Resident

- Proffit Chap 13


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What is Early Treatment?

- Treatment in either the primary or mixed dentitions that is performed to enhance the dental skeletal development or fix minor dental problems before the eruption of the permanent dentition.

Why does the AAO recommend screenings for all children by age 7?

Why age 7?

- Posterior occlusion is established when the first molars erupt. This allows evaluation of:
  - Anterior-posterior and transverse occlusal relationships
  - Functional shifts due to posterior malocclusion can be detected

Why age 7?

- Incisors have begun to erupt allowing the evaluation of:
  - crowding
  - anterior cross-bites
  - Deep-bites
  - Open-bites
  - habits
  - some facial asymmetries

Why age 7?

- Panoramic radiographic evaluation may allow detection of:
  - Missing teeth
  - Impacted teeth
  - Supernumerary teeth
  - Cysts and other radiographic pathology

What cases benefit from early tx?

- Transverse problems
- Anterior Cross-bites
- Openbite
- Habits
- Ectopic eruption of molars and canines
- Class II and Class III cases
- Premature loss of deciduous teeth Moderate to severe crowding
- Deep overbite with palatal impingement
- Large diastema
- Large overjet
- "Gummy Smiles"

What are the benefits to the patient?

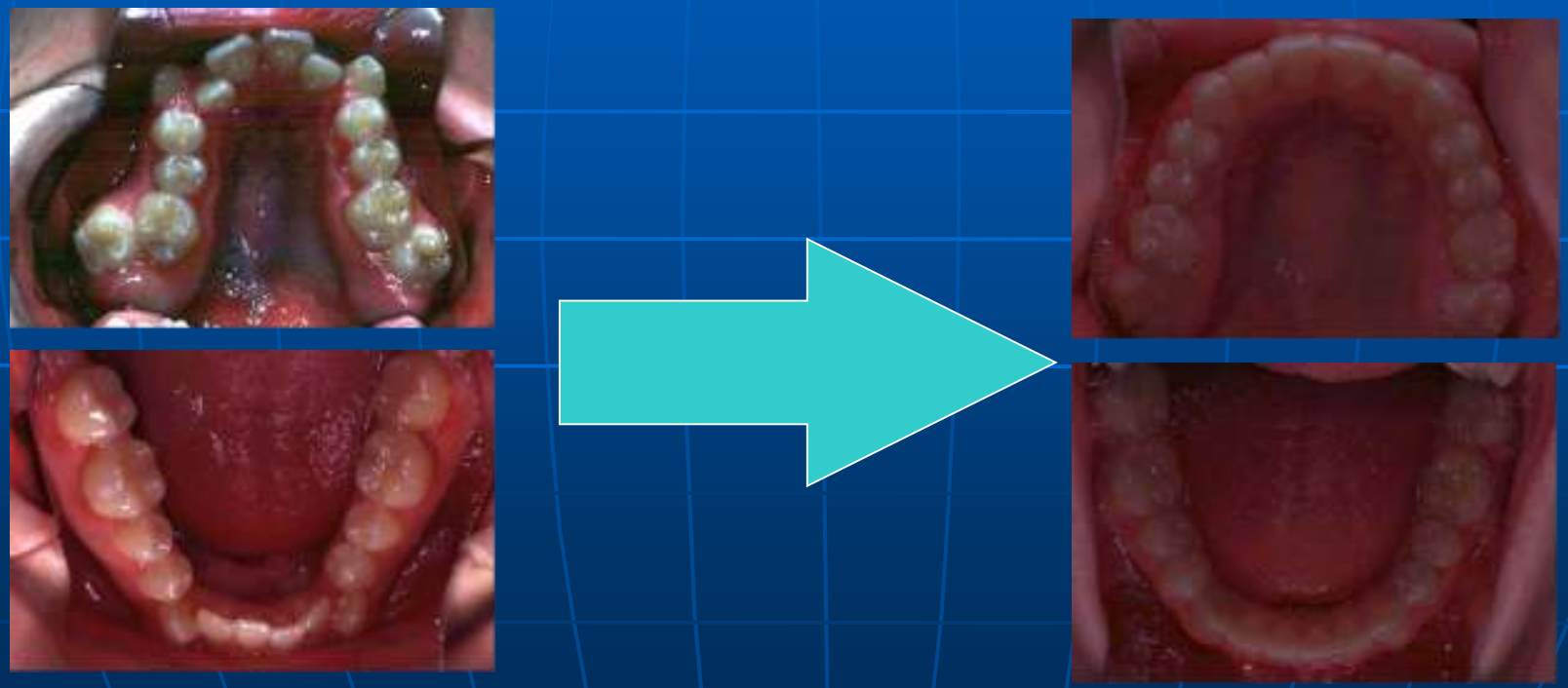
- Improved pt self-esteem and parent satisfaction
- Decrease need for future extraction of permanent teeth
- Resolution of developing malocclusion
- Decreased chance of ectopic eruption of teeth
- Decreased tx time in permanent dentition
- Decreased iatrogenic damage to permanent teeth
- establish a patient baseline

What are the benefits to the orthodontist?

- Increases tx options for orthodontist
- Better use of growth potential
- Reduced need for extraction
- Better patient compliance
- Greater satisfaction with final result

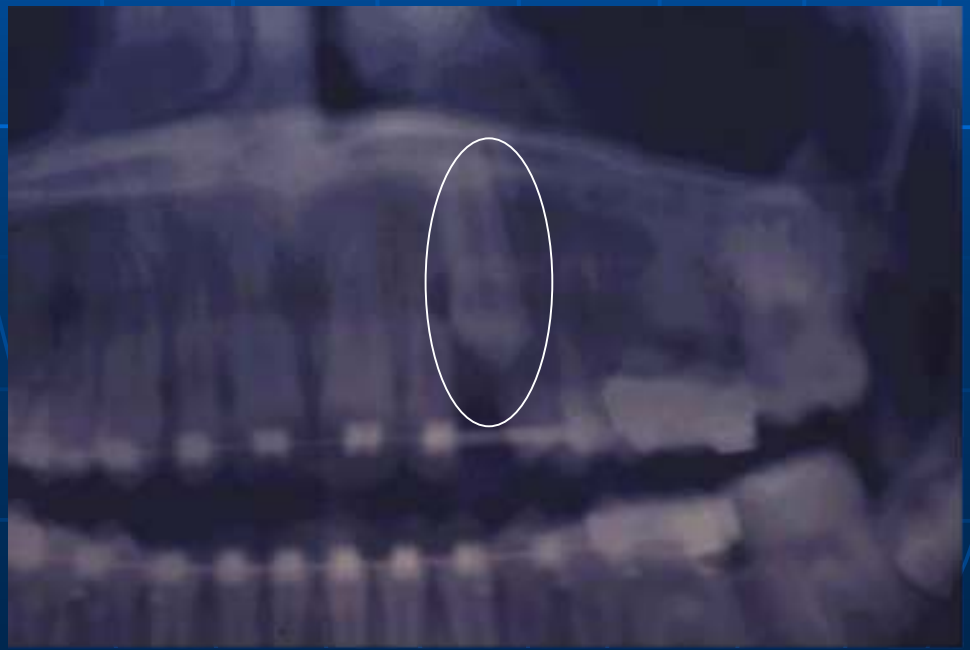
Benefits of Early Treatment

- Harmonize width of arches



Benefits of Early Treatment

- Improve eruption patterns
  - Especially maxillary canines
- Reduce likelihood of impacted teeth



Benefits of Early Treatment

- Lower risk of trauma to upper incisors

Figure 10B (below). Patient CA after treatment (including tomograms), age 13-2.

Benefits of Early Treatment

- Correct harmful oral habits
  - Thumb (digit) sucking
  - Tongue thrust swallowing
  - Mouth breathing

Tongue Thrust

Benefits of Early Treatment

- Preserve or gain space for permanent teeth
  - Lower lingual arch
  - Nance
  - Pendulum
  - Lip Bumper

Benefits of Early Treatment

- Influence jaw growth in a positive manner
- Treatment possibilities
  - Headgear / Biteplate
  - Functional Appliances
  - Protraction Face mask

Benefits of Early Treatment

- Improve some speech problems
- Simplify and/or shorten treatment time of later orthodontic treatment

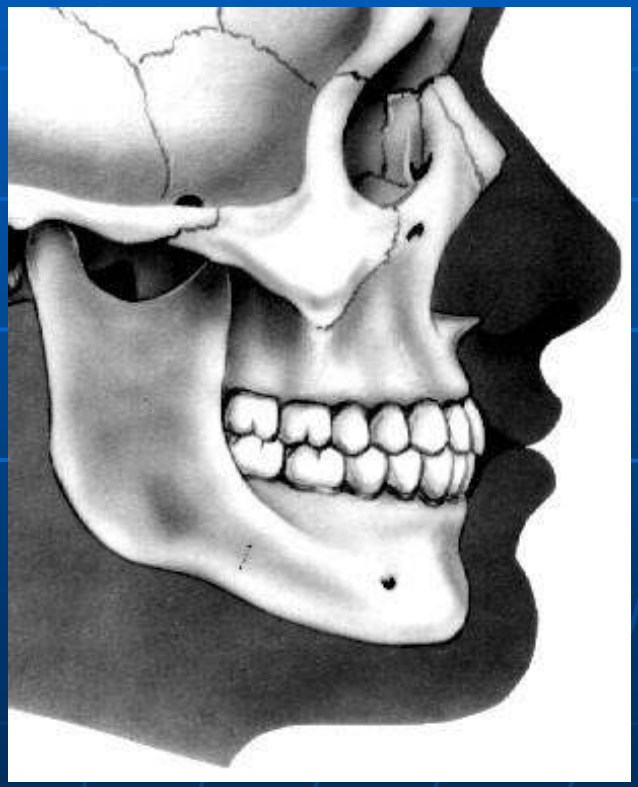
  (somewhat controversial)

Is the total treatment time the same, longer, or shorter the early tx?

- There is a consensus that the total treatment time is longer when considering the observation period between the two stages.

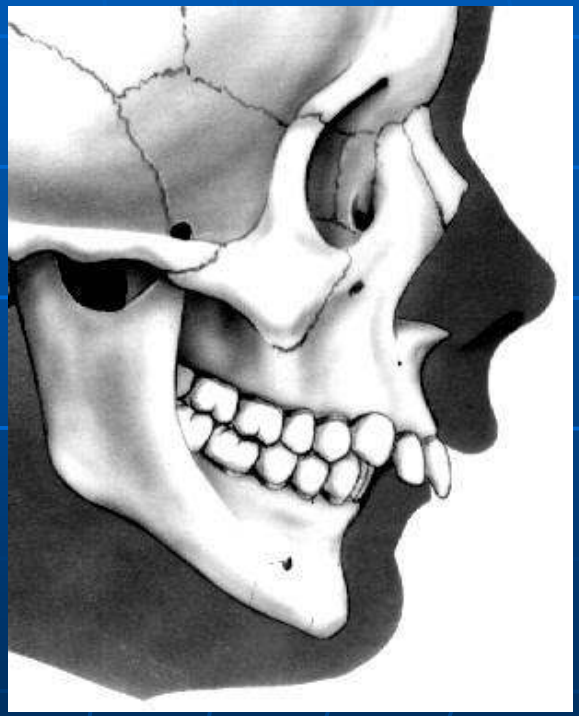
Timing of early intervention

- Class I tooth size/arch size discrepancy problems- 8-9 years old
- Normally initiated after the lower four incisors and the upper central incisors have erupted
- Treatment strategies: space maintenance, serial extraction, or orthopedic expansion protocols are used



Timing of early intervention

- Class II malocclusion with mandibular deficiency
- Treatment timing delayed until the late mixed dentition period
- Greater mandibular growth response with functional appliances during the circumpubertal growth period



Timing of early intervention

- Class II malocclusion identified in the 6 to 8 year : treatment may be initiated immediately to handle any intra-arch problems
- Most wait until late mixed dentition to treat patient in one stage.

Timing of early intervention

- Class III malocclusion diagnosed in late deciduous or early mixed dentition: Treatment may be earlier than it is for the Class I
- Optimal time for treatment: with the loss of the upper deciduous incisors and the eruption of the upper permanent central incisors

Class II Tendency patients Sagittal problems

- Most frequent a-p discrepancy
- Kinds of Class IIs
  - Maxillary prognathism
  - Mandibular retrognathism
  - Combination of above

Class II Tendency patients

- Class II div I
- Usually constricted maxilla
- V shaped arch form

Class II Tendency patients

- Class II Div II
- Deep bite
- Retroclined Maxillary 1's and proclined Maxillary 2's

Indications for Class II deep overbite treatment

- Esthetics
- Profile
- Smile
- Freeing growth inhibition of the mandible

  Class II, Div II
- Prevention of long-term periodontal damage
- Lower incisors into palatal tissue

Treatment Modalities

- Inhibit maxillary growth
- Redirect maxillary growth
- Move the maxilla distally
- Stimulate mandibular growth
- Translate maxillary posteriors distally (distalizing appliance ie. Distal jet, Hilgers distalizing appliance, Wilson appliance)
- Surgery

You have three choices

- Modify Growth
- Surgery
- Extract teeth (camouflage)

Mixed dentition Class II Treatment

- Headgear
- Functional appliances
- Class II elastics, jasper jumper, forsus

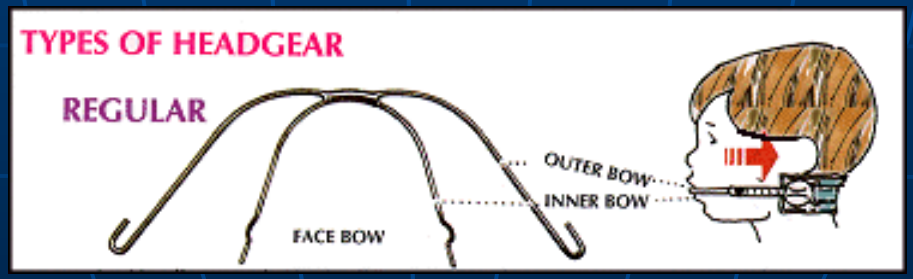
Figure 4. Attachment via sectional wires.

Headgear “Tried and True”

- Cervical Pull
- High Pull
- Combination Pull
- Reverse-pull

Headgear

- Two major components:
- Intraoral (facebow)
- Extraoral (neck strap, chin cup)
- Extra oral component is what generally categorizes the type of headgear
- Extraoral anchorage: permits posterior movement of teeth in one arch without adversely disturbing the opposite side
-

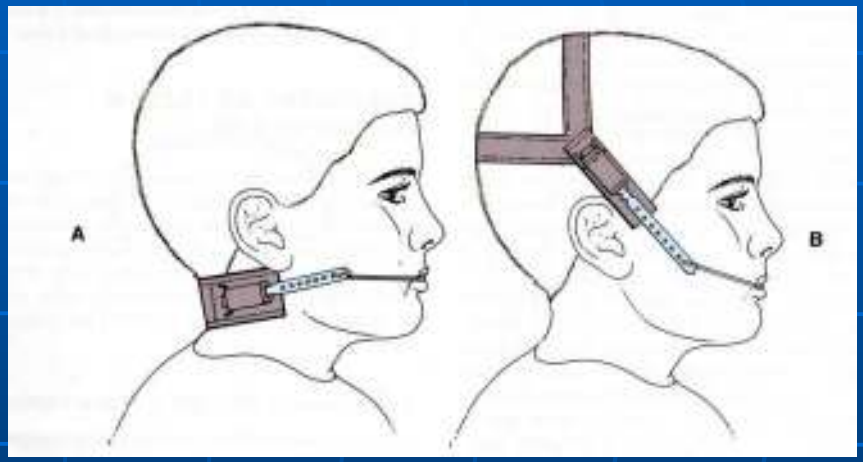


Headgears

- Cervical pull headgear
- Produces a distal and downward force against the maxillary teeth and the maxilla
- Disadvantage: extrusion of the maxillary molars
- Cervical Pull – Class II deep bite.

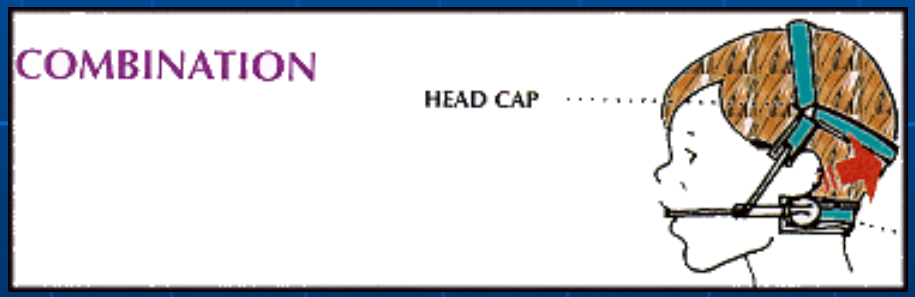
Headgear

- High-Pull headgear
- Produces a distal and upward force on the maxillary teeth and maxilla.
- Indicated for Class II div I open bite



Headgear

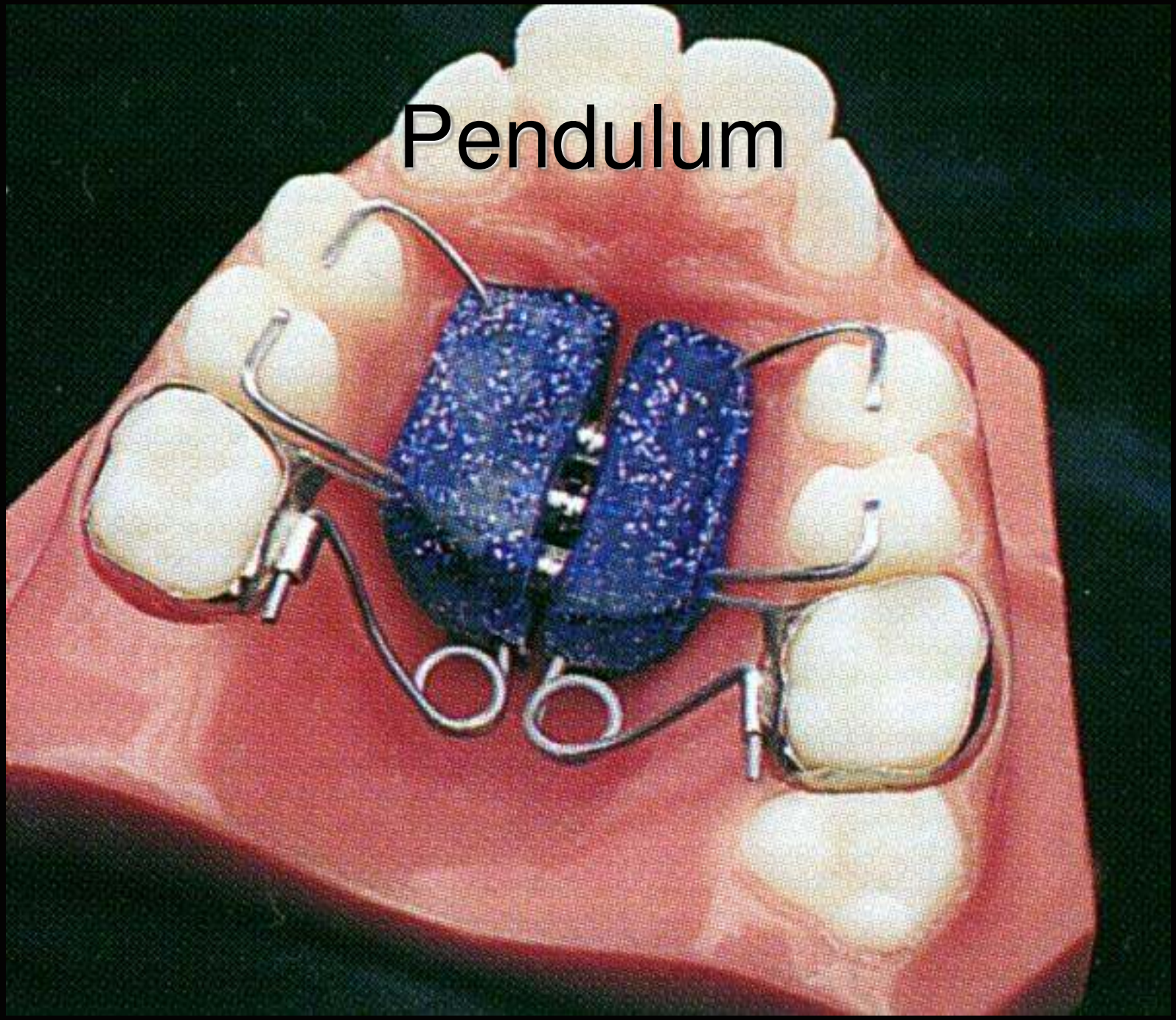
- Straight pull headgear
- Produces a straight distal direction of force



What's new and why?

- Non- compliant
- Non-extraction Treatment

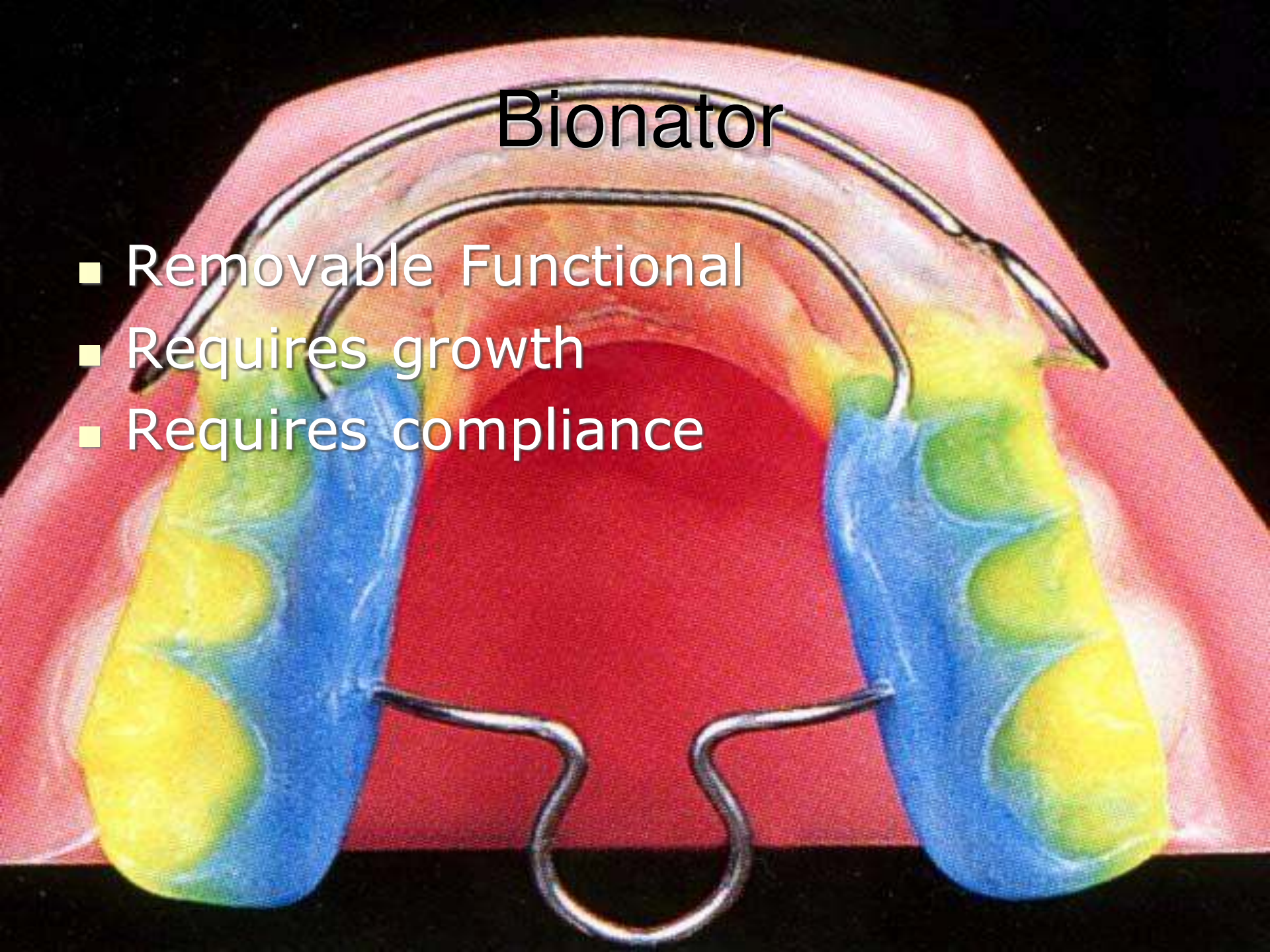
Pendulum



Pendulum

Herbst

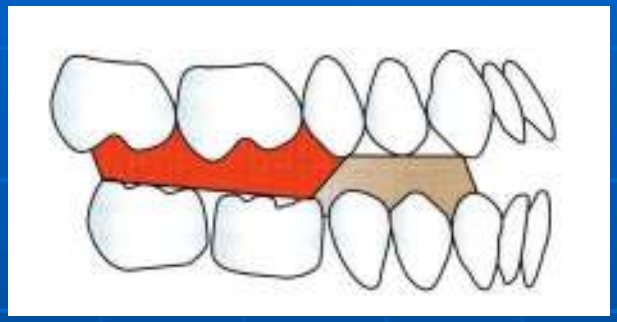
Bionator

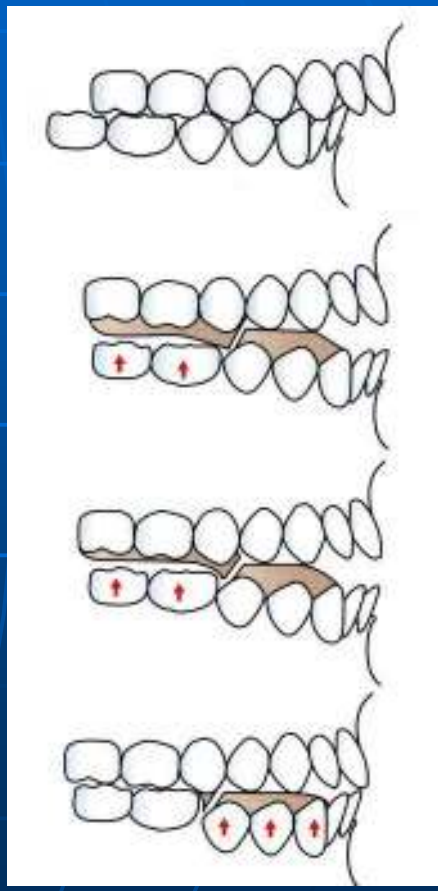


- Removable Functional
- Requires growth
- Requires compliance

Twin Block

- removable
- works well in mixed dentition with a COMPLIANT patient.



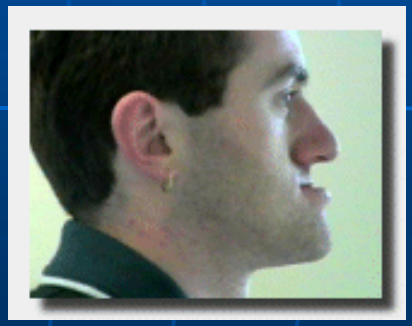


MARA (mandibular anterior reposition appliance)

MARA appliance has the same mechanical effects of the Herbst

True Class III (skeletal dysplasia)

- Most Class III's have a strong hereditary component
- Frequency of Class III is low 1%-3%
- Mandibular hypertrophy
- Maxillary deficiency
- Combination of both



Types of Class III

- Dentoalveolar malrelationship, anterior crossbite, correct early
- Mandibular prognathism, maxillary incisors tipped labially and mandibular incisors tipped lingually- Chin cup therapy
- Underdeveloped maxilla, normal SNB, early treatment successful

Treatment modalities

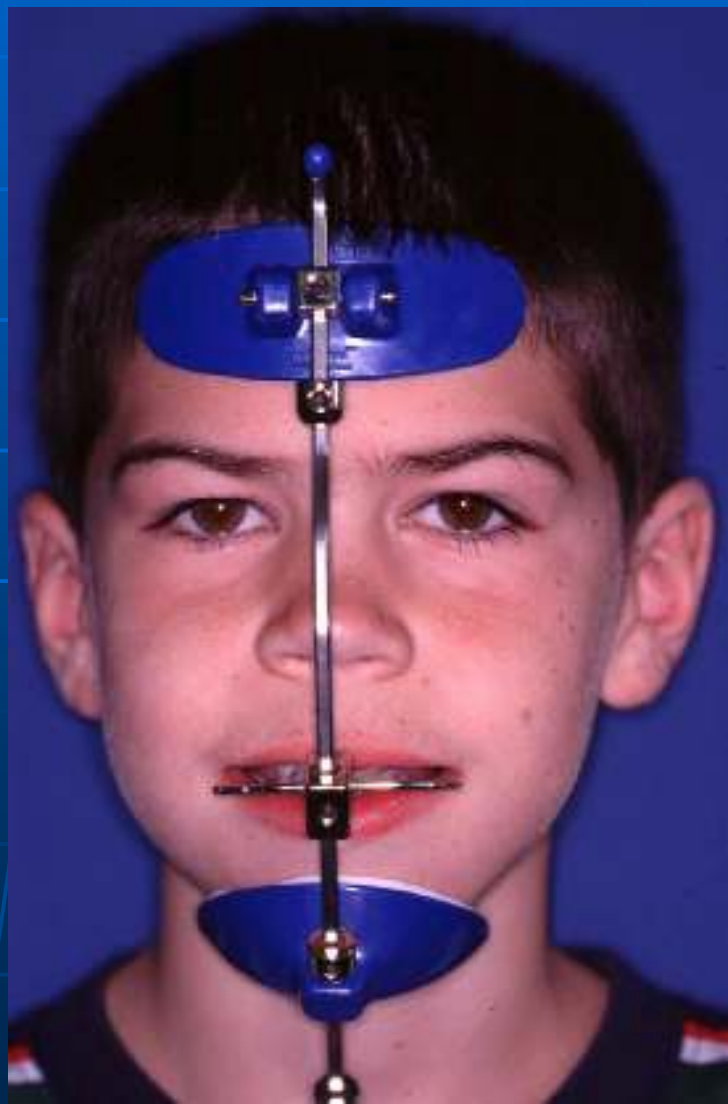
- Growth modification
- Extraction (camouflage)
- Surgery

Treatment modalities

- Growth modification
- Chincup therapy (mandibular prognathism)
- Face mask therapy (maxillary skeletal retrusion, maxillary dentoalveolar retrusion, decreased lower anterior facial height)
- Functional appliances (Frankel III, maxillary skeletal retrusion)

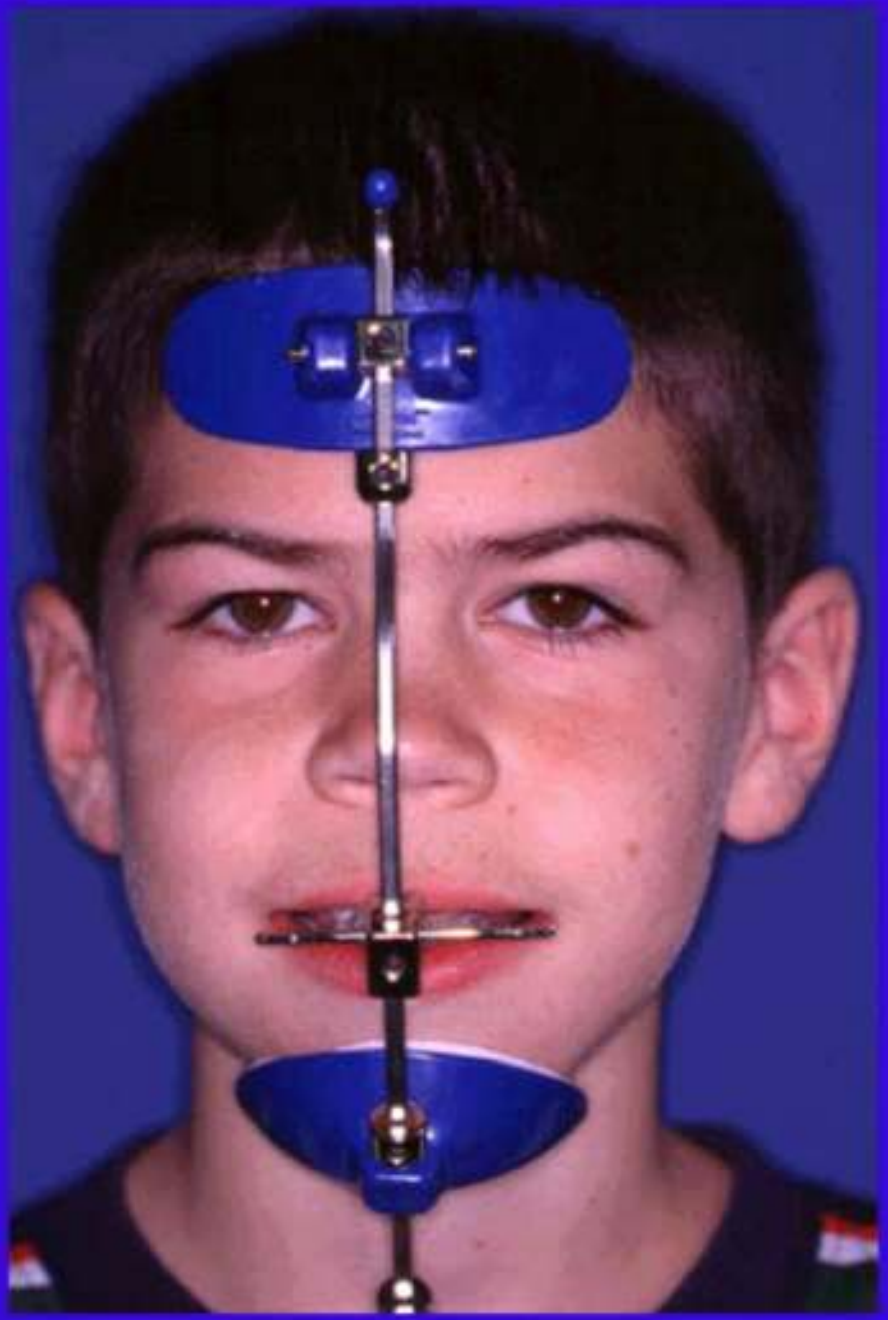
Class III Treatment

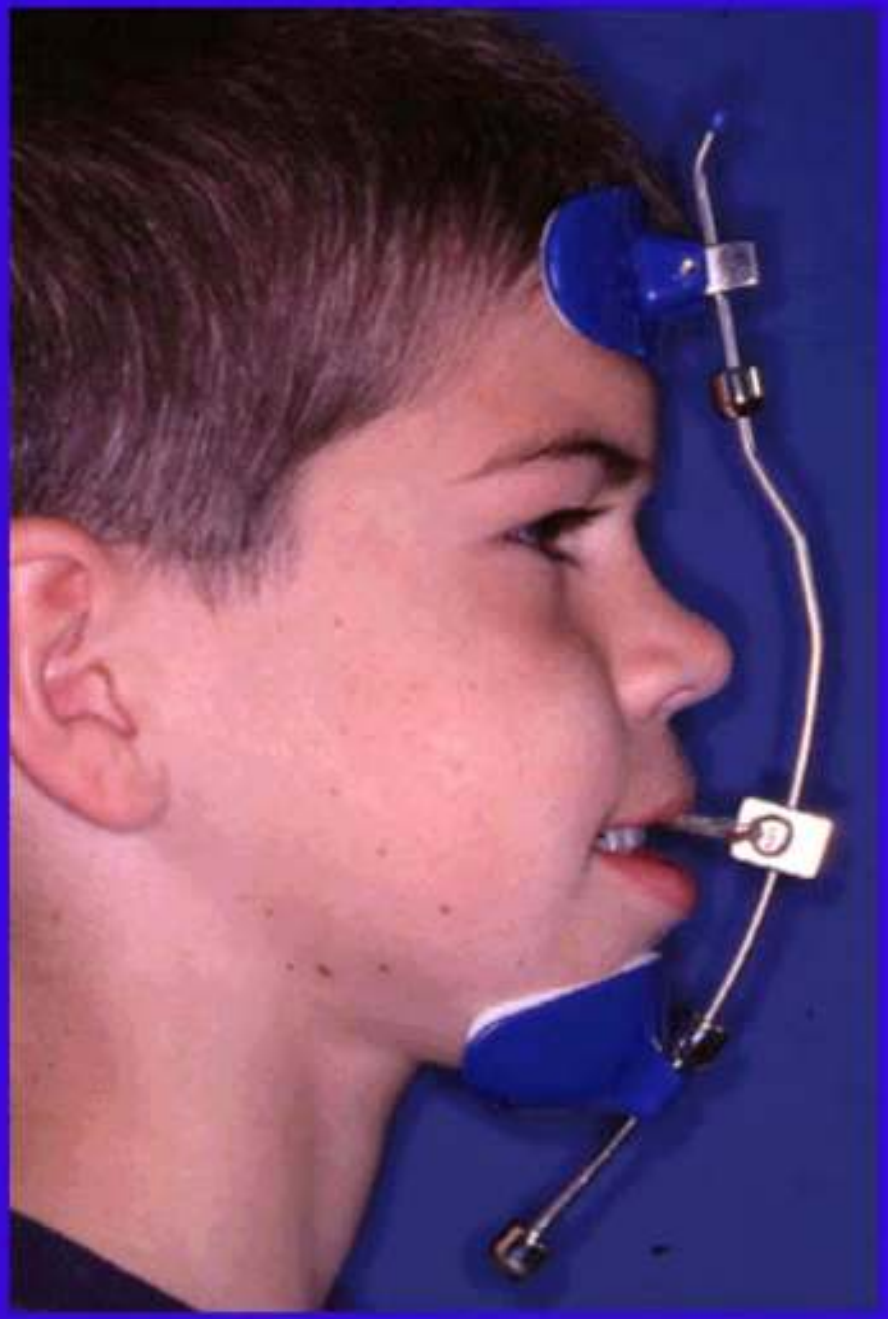
- Chin Cup
- Protraction Face Mask
- Best time 7- 9 years

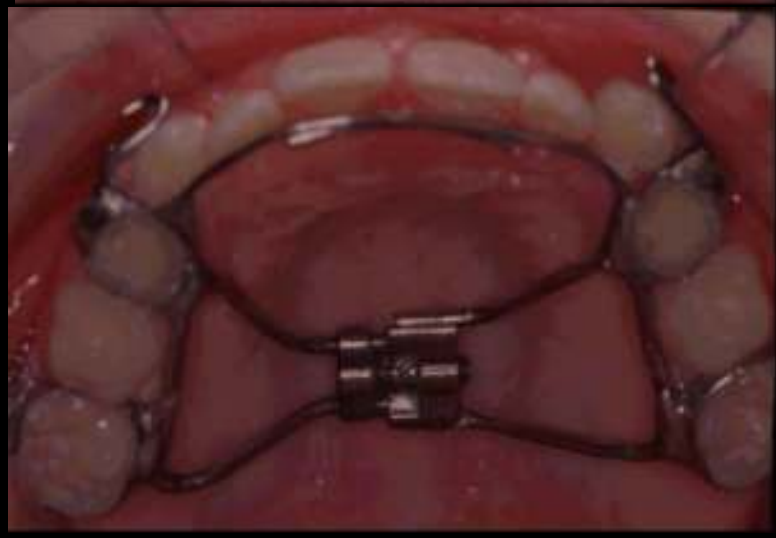


Face Mask Therapy

Kyle S. 9-12-96
Age 9





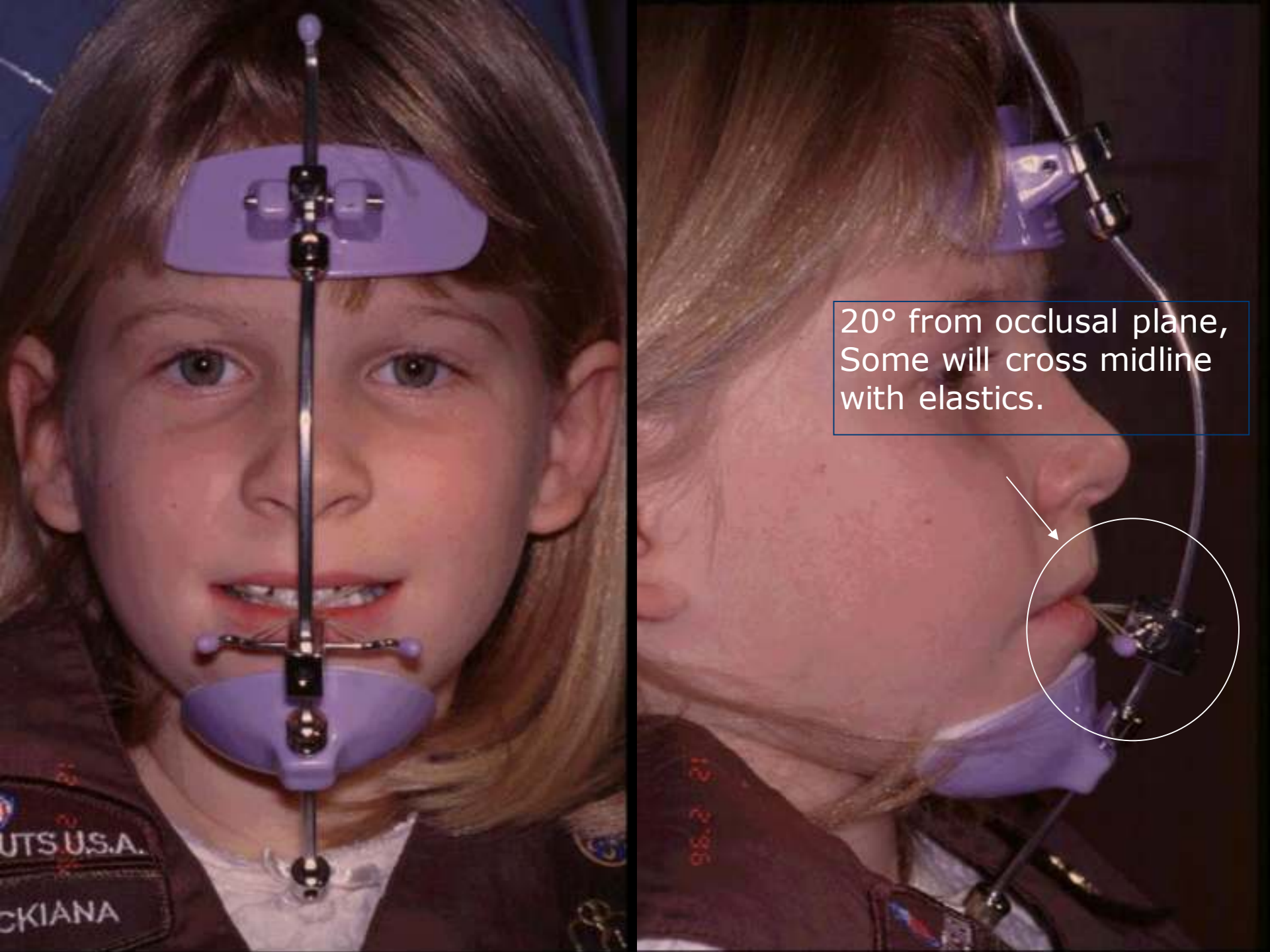


9-12-96
10-21-96

Protraction face mask 14hrs per day x 1 month

Cephs after five months of protraction

Tosha Huffman
9-5-96
Age 8


20° from occlusal plane,
Some will cross midline
with elastics.

9-5-96

Tosha Huffman

5-19-97

Correction of anterior crossbite

- Lower anterior acrylic splint with incisor guide plane
- Hawley type appliance with finger spring and bite plane
- Fixed appliances
- Best to treat in 2 stages

Correction of anterior crossbite

- Good chance of success if mandible in CR is edge to edge with maxillary teeth
- When teeth are at risk for potential trauma

Early treatment summary

- Early treatment benefits include:
- Better results
- Least treatment time
- Optimal cost in terms of money, patient cooperation
- Parent satisfaction

Questions?

Midterm Exam

- 40 multiple choice questions
- Review Lecture Notes

Treatment of Early Problems

Rodney Torres, DMD
University of Louisville

What is Early Treatment?

- Treatment of orthodontic problems in the primary and/or mixed dentition
  - Occlusal Relationship Problems
  - Eruption Problems
  - Space Problems

- AAO recommends that children should receive an orthodontic evaluation no later than **age 7**

Why Early Treatment?

- Certain treatments can only be done at an early age
  - Ex: Facemask therapy
- Correction of harmful oral habits
- Guide permanent teeth into a more favorable position
- Esthetic/Psychosocial
- Best way to correct a problem is to prevent it from happening!

Evaluation of Patient

- Thorough review of medical/dental history
- Radiographs (PAN)
- Clinical Examination
  - Physical appearance
    - Facial esthetics
  - Developmental status
    - Growth disorders
  - Extra/Intra Oral Examination
    - TMJ
    - Teeth/Occlusion

Clinical Signs

Clinical Signs

- Early or late loss of baby teeth (6 months)
- Difficulty in chewing or biting
- Thumb-sucking
- Crowded, misplaced or blocked-out teeth -> space problems
- Jaws that are too far forward or back
- Syndromes – Cleft, Treacher Collins, hemifacial microsomia, Crouzons, CCD
- Biting the cheek or biting into the roof of the mouth
- Protruding teeth (trauma potential, esthetics)
- Upper and lower teeth that don't meet, or meet in an abnormal way
- An unbalanced facial appearance
- Supernumery or cong. Missing teeth

Posterior Crossbite

- can be due to a narrow maxilla (i.e., to skeletal dimensions) or due only to lingual tipping of the maxillary teeth.
- Important to evaluate in CR to obtain true relationship
- If the child shifts on closure or if the constriction is severe enough to significantly reduce the space within the arch, early correction is indicated.
- Treatment:
  - Expansion of constricted maxillary arch
  - Occlusal equilibration to eliminate mandibular shift
- Midpalatal suture fuses during adolescence
  - Correct early!

Posterior Crossbite

FIGURE 11-11 Minor canine interferences leading to a mandibular shift. **A,** Initial contact. **B,** Shift into centric occlusion. The slight lingual position of the primary canines can lead to occlusal interferences and

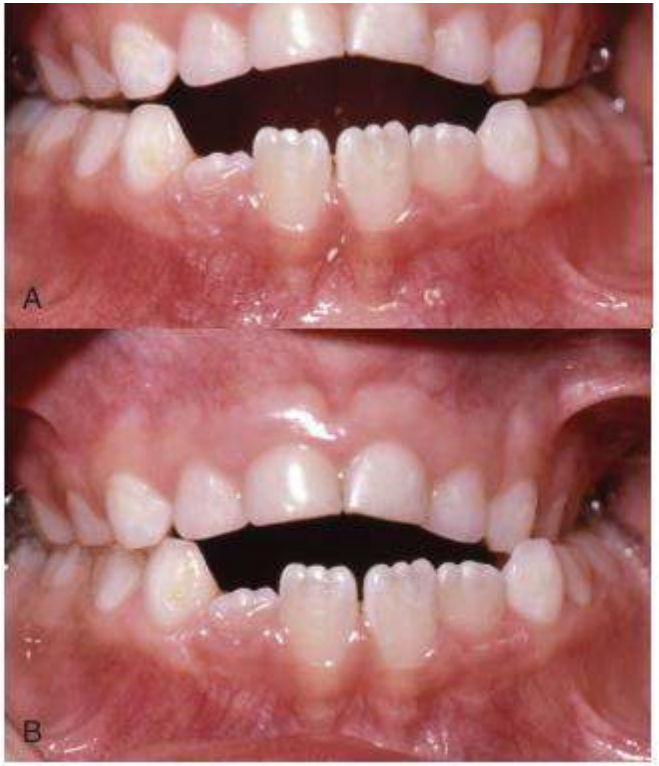


FIGURE 11-12 Moderate bilateral maxillary constriction. **A,** Initial contact. **B,** Shift into centric occlusion. Moderate bilateral maxillary constriction often leads to posterior interferences upon closure and a

Posterior Crossbite

FIGURE 11-14 The W-arch appliance is ideal for bilateral maxil expansion. **A,** The appliance is fabricated from 36 mil wire and solde to the bands. The lingual wire should contact the teeth involved in crossbite and extend not more than 1 to 2 mm distal to the ban molars to eliminate soft tissue irritation. Activation at point 1 produces posterior expansion and activation at point 2 produces anterior expansion. **B,** The lingual wire should remain 1 to 1.5 mm away from the marginal gingiva and the palatal tissue. **C,** This W-arch is being used to correct a bilateral constriction in the primary dentition.

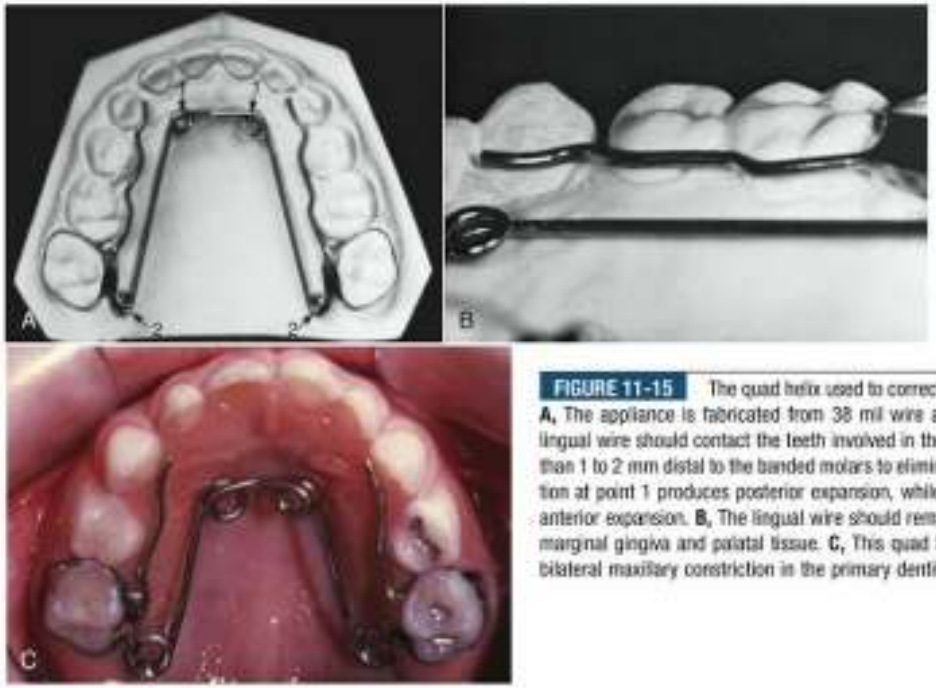


FIGURE 11-15 The quad helix used to correct bilateral maxillary constriction. **A,** The appliance is fabricated from 38 mil wire and soldered to the bands. The lingual wire should contact the teeth involved in the crossbite and extend no more than 1 to 2 mm distal to the banded molars to eliminate soft tissue irritation. Activation at point 1 produces posterior expansion, while activation at point 2 produces anterior expansion. **B,** The lingual wire should remain 1 to 1.5 mm away from the marginal gingiva and palatal tissue. **C,** This quad helix is being used to correct a bilateral maxillary constriction in the primary dentition.

Posterior Crossbite

FIGURE 11-16 W-arches, quad helixes, and habit appliances often leave indentations in the superior surface of the tongue *(arrows)*. These often remain after appliance removal for up to 1 year. No treatment is recommended, but patients and parents should be warned of this possibility.

FIGURE 11-17 **A,** Posterior crossbites should be overcorrected until the maxillary posterior lingual cusps occlude with the lingual inclines of the mandibular buccal cusps, as shown here, and then retained for approximately 3 months. **B,** After retention, slight lingual movement of the maxillary teeth results in normal occlusion.

Anterior Crossbite

- Rarely found in children who do not have a skeletal Class III jaw relationship but can arise from lingual tipping of the incisors or crowding as they erupt.
- Important to distinguish between skeletal and dental anterior crossbite.
- True Class III vs. Pseudo-Class III (anterior functional shift during closing (CR to CO))
- Skeletal
  - Which jaw at fault? Deficient maxilla or excessive mandible?
- Dental
  - Removable appliances
  - 2x4, 2x6 appliance
  - Extraction of primary teeth
  - Treated early: limit jaw movement, abrasion, gingival recession.

Anterior Crossbite

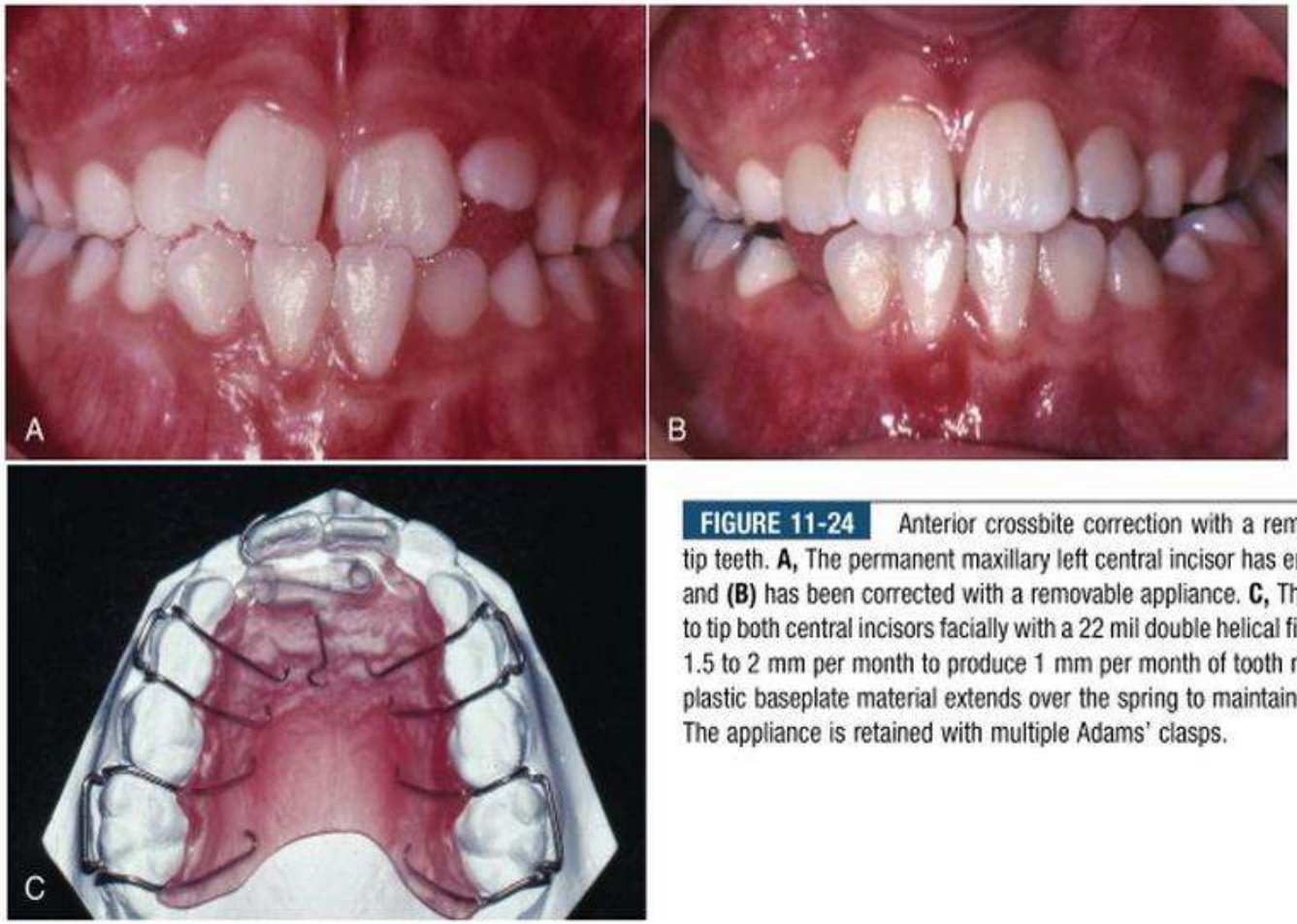
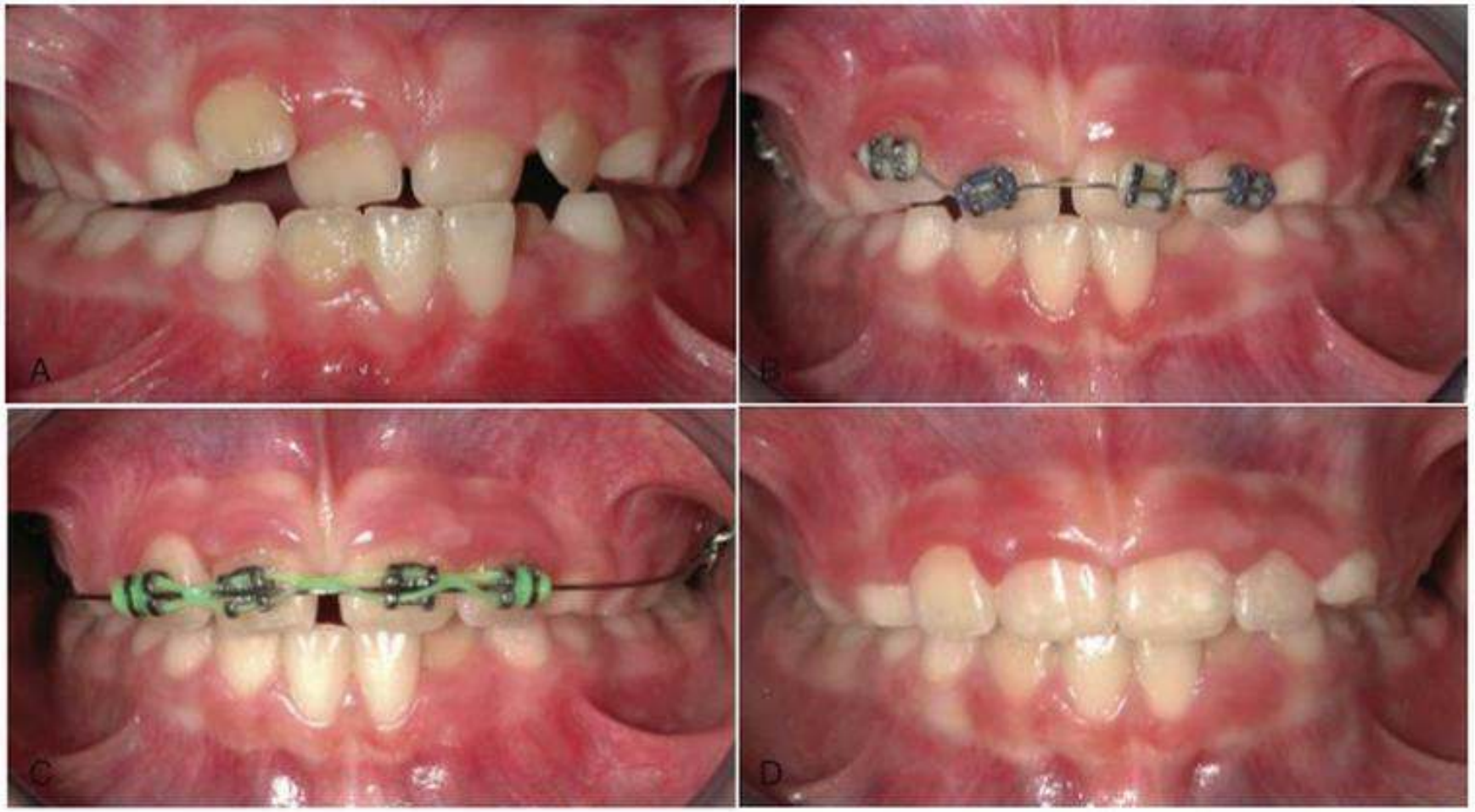


FIGURE 11-24 Anterior crossbite correction with a removable appliance to tip teeth. **A,** The permanent maxillary left central incisor has erupted into crossbite and **(B)** has been corrected with a removable appliance. **C,** This appliance is used to tip both central incisors facially with a 22 mil double helical fingerspring activated 1.5 to 2 mm per month to produce 1 mm per month of tooth movement. Note that plastic baseplate material extends over the spring to maintain its vertical position. The appliance is retained with multiple Adams' clasps.

2x4 Appliance



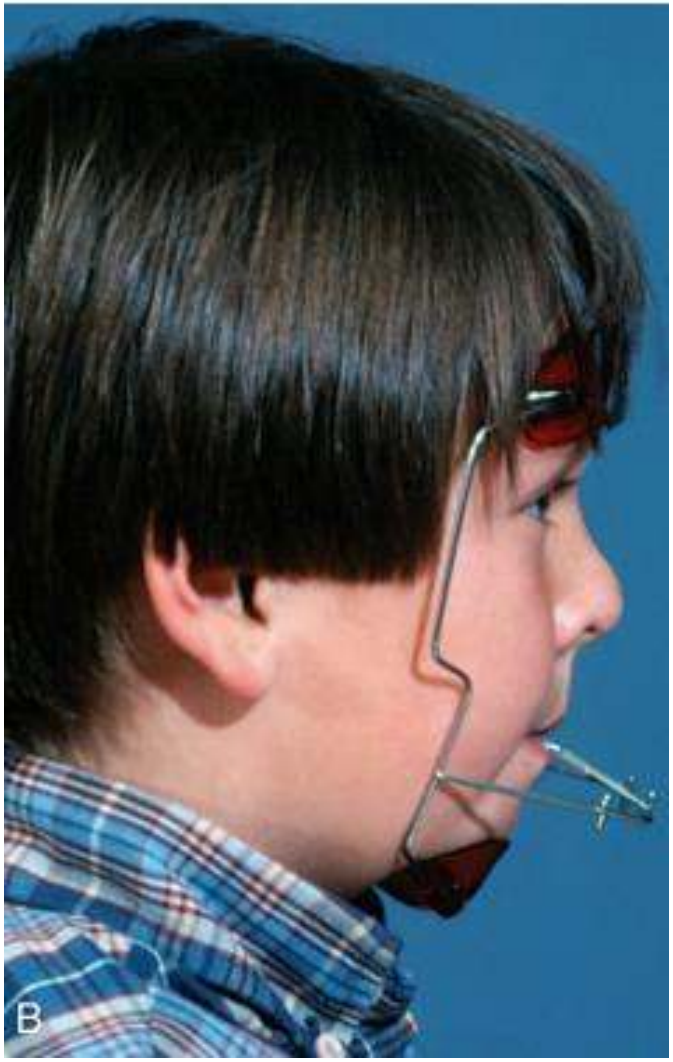
Anterior Crossbite

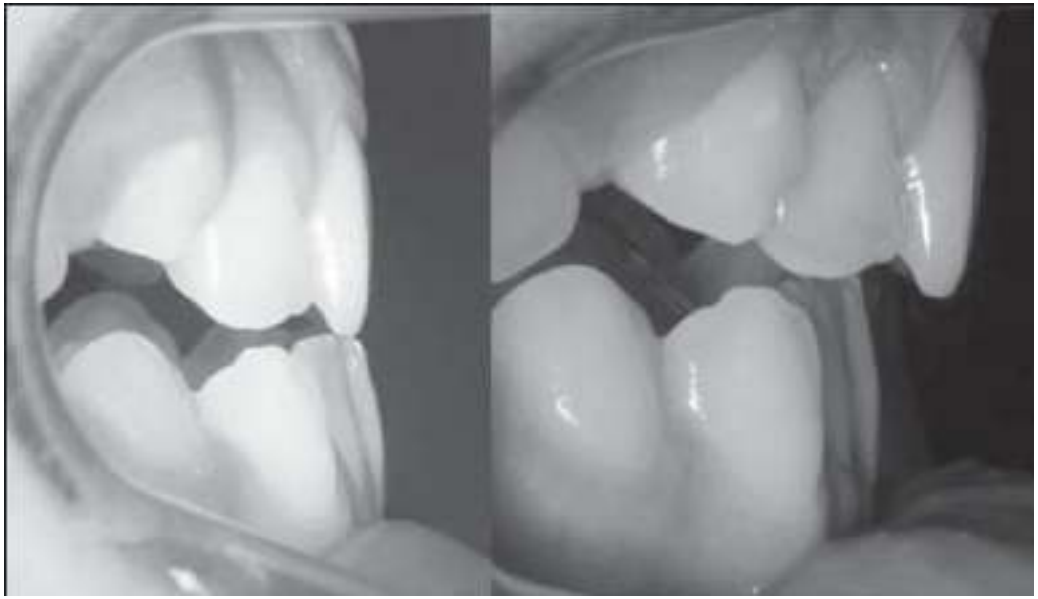
- Class III skeletal discrepancy in AP dimension
  - Maxillary deficiency (maxilla too far back)
    - Sutures connecting maxilla to other craniofacial structures can be manipulated to correct discrepancy
    - Treat using Facemask therapy (Reverse-pull headgear)
      - Age 7-9 (after this, becomes very difficult to correct)
      - If not corrected, patient most likely will need surgery in future
    - Bone plates (used around age 10-12)
      - Possible option if patient presents for tx when older
      - May provide intermediate alternative treatment
      - Promising, but more research is needed

Anterior Crossbite

- Class III skeletal discrepancy in AP dimension
  - Mandibular excess (mandible too far forward)
    - Unfortunately, limited treatment options
    - Refer to orthodontist for evaluation
    - Most likely will need orthognathic surgery

Facemask Therapy





Bone Plates

Anterior Open Bite

- 3 Possible causes:
  - normal transition when primary teeth are replaced by the permanent teeth
  - Habit
  - Skeletal
- Usually due to thumb-sucking habit
  - If still present, instruct/inform patient to discontinue oral habit
  - Anterior open bite will usually resolve on its own if habit is stopped early enough
  - If patient does not stop, can utilize habit appliance therapy
- Dental effects of chronic thumb sucking beyond age 5
  - Posterior crossbite – narrowed maxillary width
  - Linguo-version of mandibular incisors
  - Labial inclination/displacement of maxillary incisors and increased overjet with spacing
  - Over-eruption of posterior teeth
  - Open bite

Anterior Open Bite

- Skeletal effects in digit habit patients:
  - Rotation of the mandible down and back
  - Lowered mandibular posture
  - Class II apical base relationship
  - Anterior distortion of maxillary anterior alveolar process

FIGURE 11-28 **A** to **D,** Photos at 1-year intervals of a child who stopped sucking his thumb at the time of the first photo. Gradual closure of the open bite, without a need for further intervention, usually occurs in patients with normal facial proportions after habits stop. **E,** If a sucking habit persists, a crib of this type can be used to help extinguish the habit. A crib is most effective in a child who wants to stop the thumb- or finger-sucking and accepts the crib as a reminder not to do so.

Anterior Open Bite

Habit Appliance

GURE 11-29 An adhesive bandage can be applied over the end e finger to remind the child not to suck and to reduce the enjoyment. bandage should be anchored at its base for retention with waterproof , so that it will stay in place if sucking is still attempted. (Courtesy 3. Joo.)

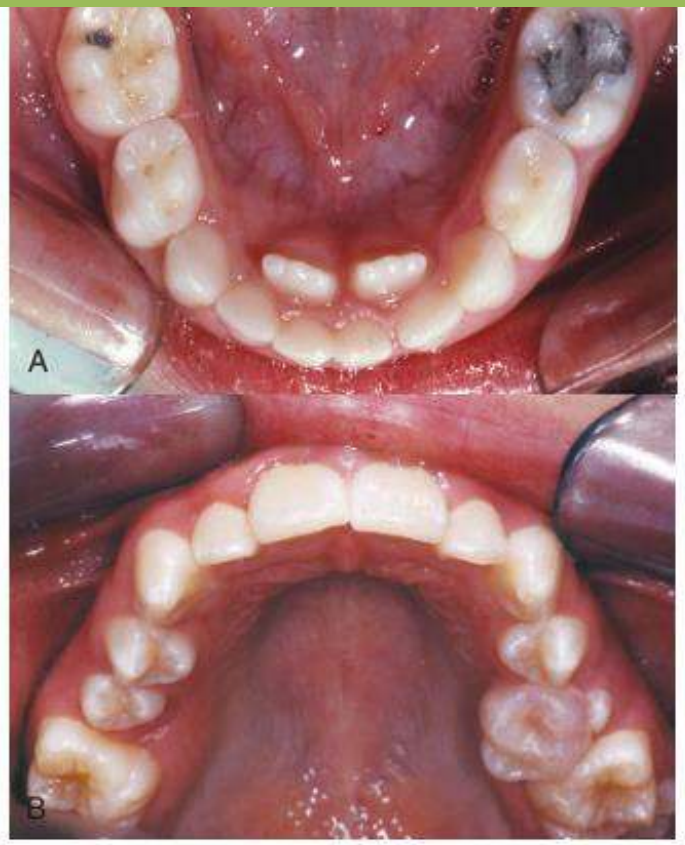
FIGURE 11-30 A cemented habit crib made of 38 to 40 m can be used as a reminder to interrupt a finger-sucking habit. The ance can be cemented to either primary or permanent molars and be extended anteriorly to interfere with the finger position during su The amount of overbite will also help determine the appliance po

Eruption Problems

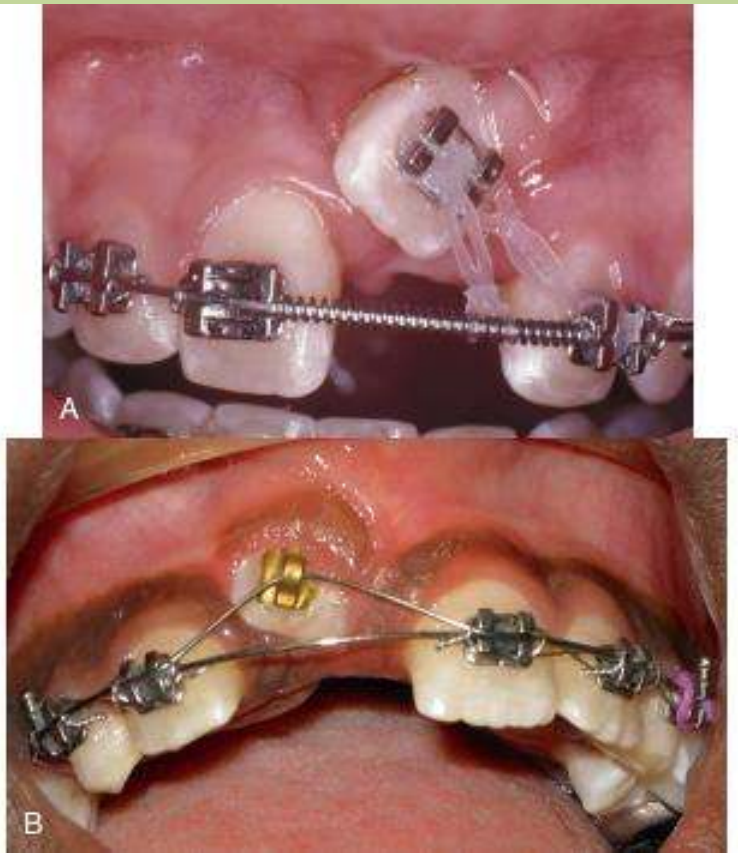
- Asymmetric dental development
  - Asymmetric eruption (one side ahead of the other by 6 months or more) is significant
  - Over-retained Primary Teeth
  - Delayed Incisor Eruption
  - Ankylosed Primary Teeth
- Ectopic eruption
  - Permanent tooth causing resorption of adjacent primary or permanent teeth – Max molars and canines.
- Supernumerary Teeth
- Missing permanent teeth
  - Maxillary laterals and mandibular second premolars most common to be congenitally missing

Eruption Problems

Over-retained Primary Teeth



Delayed Incisor Eruption



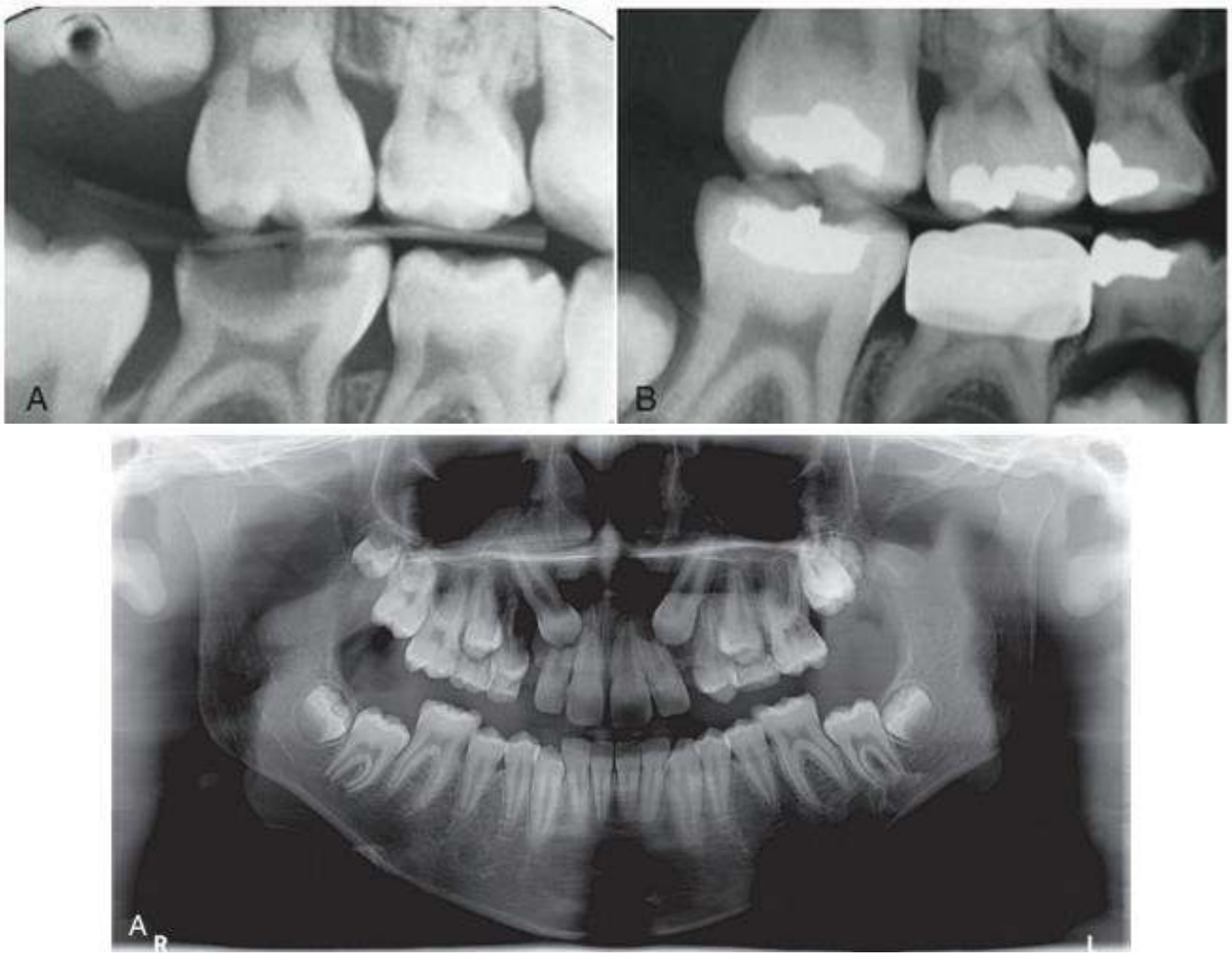
Eruption Problems

Ankylosed Primary Teeth

FIGURE 11-47 If they have no successors, ankylosed primary teeth should be carefully removed when vertical discrepancies begin to develop. It is better to allow permanent teeth to drift into the edentulous space and bring bone with them, and then reposition the teeth prior to implant or prosthetic replacement, so that large periodontal defects, such as those adjacent to the primary molars in this patient, do not develop.

Eruption Problems

Ectopic Eruption



Eruption Problems

Supernumerary Teeth

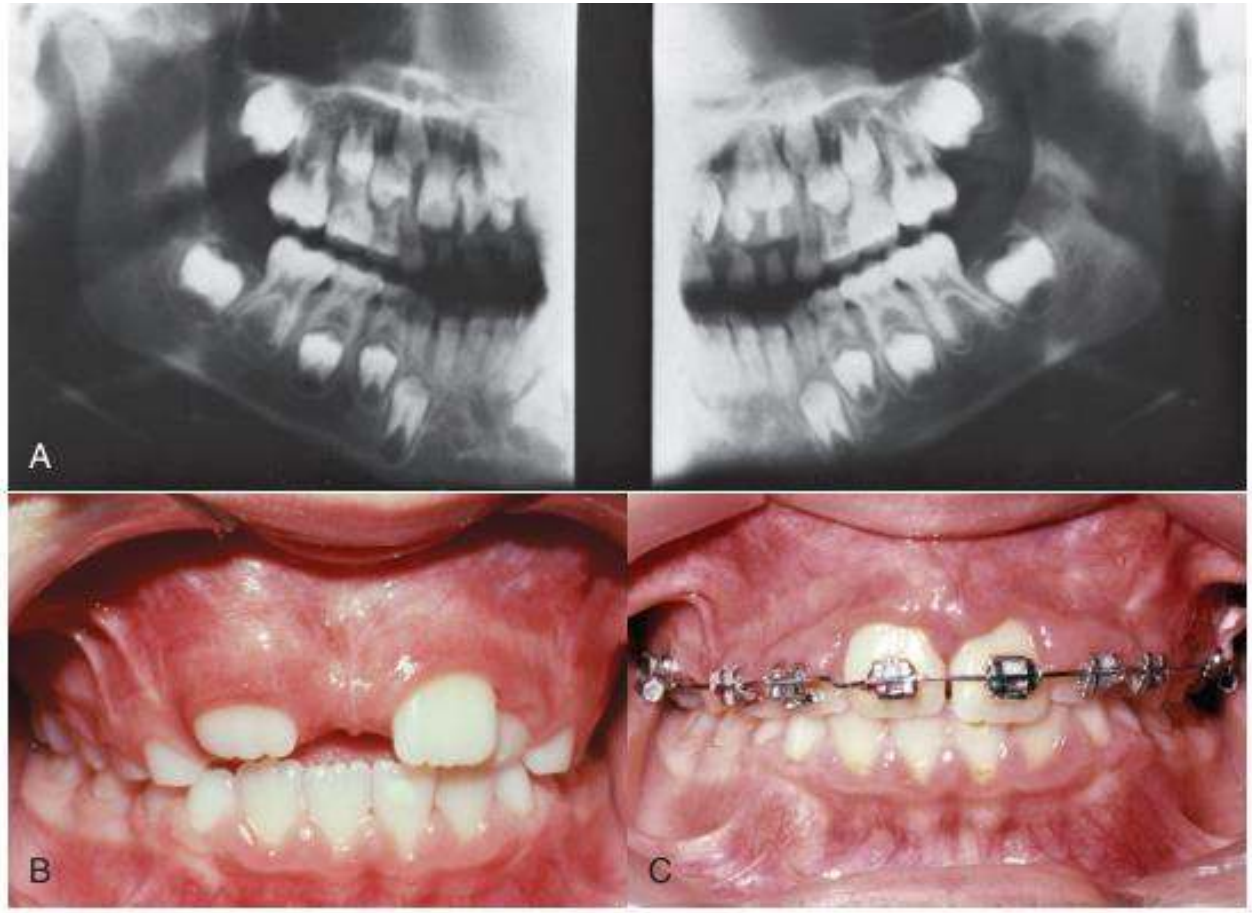


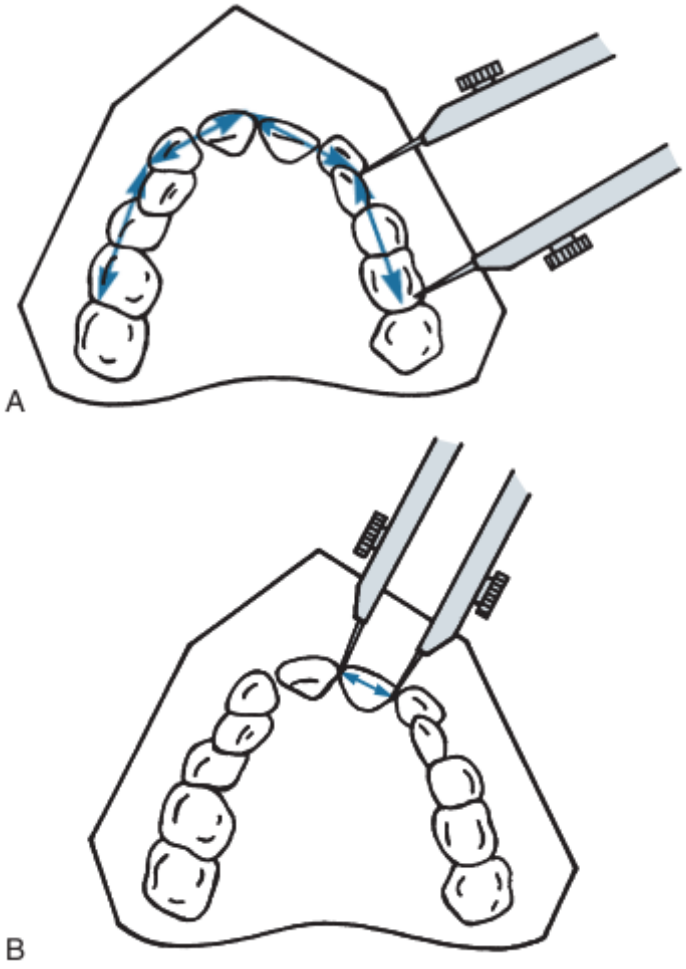
FIGURE 11-43 Multiple supernumerary teeth in the anterior maxilla, although rare, can cause spacing and delayed eruption of anterior teeth. **A,** This patient has an exceptionally wide diastema and delayed eruption of the maxillary lateral incisors. **B,** The panoramic radiograph reveals three supernumeraries of various shapes and orientations. Conical and noninverted supernumeraries usually erupt, whereas tubercle-shaped and inverted ones do not. **C,** The supernumeraries were removed, the diastema closed, and the incisors were aligned with fixed appliances after they erupted.

Eruption Problems

Congenitally missing permanent teeth

Space Problems

- Comparison must be made between space available vs space required to determine arch perimeter discrepancy
- Space available = arch perimeter
- Space required = sum of mesiodistal widths of teeth
- Space available – Space required
  - If > 0, there is spacing present
  - If < 0, there is crowding present



Space Maintenance

- Estimate size of unerupted teeth
  - Radiographs
  - Proportionality Tables
    - Tanaka Johnson
    - Moyers Analysis
- Premature loss of primary teeth can lead to space problems
  - Due to drifting of other teeth into spaces
  - Need to maintain space!
- If permanent successor will erupt within 6 months, space maintainer is not necessary
  - Remember teeth will erupt when root formation is 1/2 to 2/3 complete

Space Maintainers

- Band-and-loop
- Partial denture space maintainer
- Distal shoe
- Lingual arch
- Nance
- TPA

Band-and-Loop

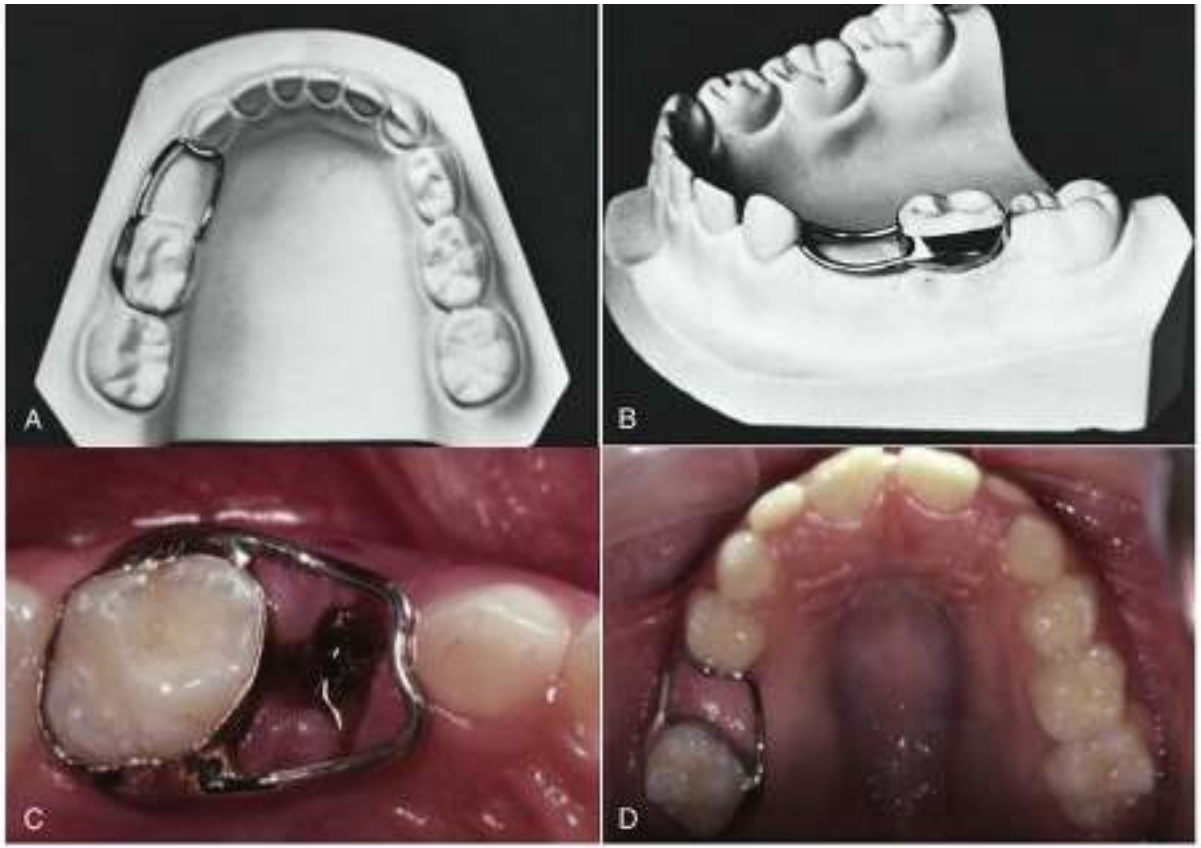


FIGURE 11-52 A band-and-loop space maintainer is generally used in the mixed dentition to save the space of a single prematurely lost primary molar. It consists of a band on either a primary or permanent molar and a wire loop to maintain space. **A,** The loop portion made from 36 mil wire is carefully contoured to the abutment tooth without restricting lateral movement of the primary canine and **(B)** the loop is also contoured to within 1.5 mm of the alveolar ridge. The solder joints should fill the angle between the band and wire to avoid food and debris accumulation. **C,** A completed band-and-loop maintainer in place after extraction of a primary first molar. **D,** An occlusal rest, shown here on the primary first molar, can be added to the loop portion to prevent the banded teeth from tipping mesially.

Partial Denture Space Maintainer

FIGURE 11-53 In a young child, a removable partial denture is used to replace anterior teeth for esthetics. At the same time, it can maintain the space of one or more prematurely lost primary molars. For this patient, the four incisors are replaced by the partial denture. Multiple clasps, preferably Adams' clasps, are necessary for good retention. Both the clasps and the acrylic need frequent adjustment to prevent interference with physiologic adjustment of primary teeth during eruption of permanent teeth. The C-clasps on the primary canines provide limited retention and are good examples of clasps that need continued careful attention.

Distal Shoe

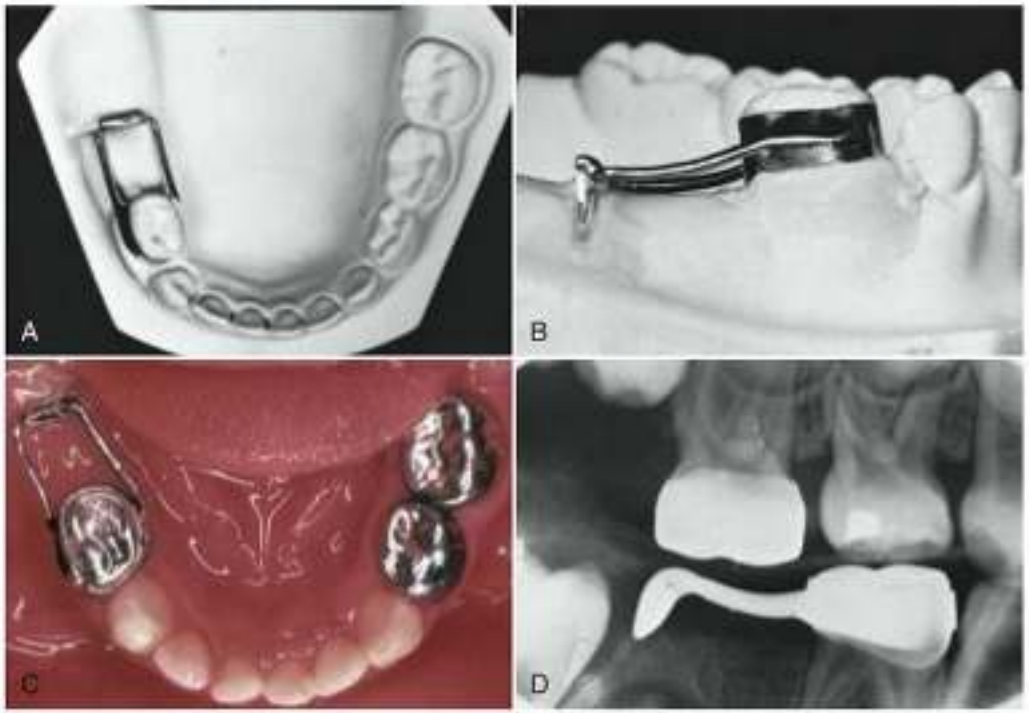


FIGURE 11-54 The distal-shoe space maintainer is indicated when a primary second molar is lost before eruption of the permanent first molar and is usually placed at or very soon after the extraction of the primary molar. **A,** The loop portion, made of 36 mil stainless steel wire, and the intraalveolar blade are soldered to a band so the whole appliance can be removed and replaced with another space maintainer after the permanent molar erupts. **B,** The loop portion must be contoured closely to the ridge since the appliance cannot resist excessive occlusal forces from the opposing teeth. **C,** This distal-shoe space maintainer was placed at the time of extraction of the primary second molar. **D,** The blade portion must be positioned so that it extends approximately 1 mm below the mesial marginal ridge of the erupting permanent tooth to guide its eruption. This position can be measured from pretreatment radiographs and verified by a radiograph taken at try-in or postcementation. An additional occlusal radiograph can be obtained if the faciolingual position is in doubt.

Lingual Arch/Nance/TPA

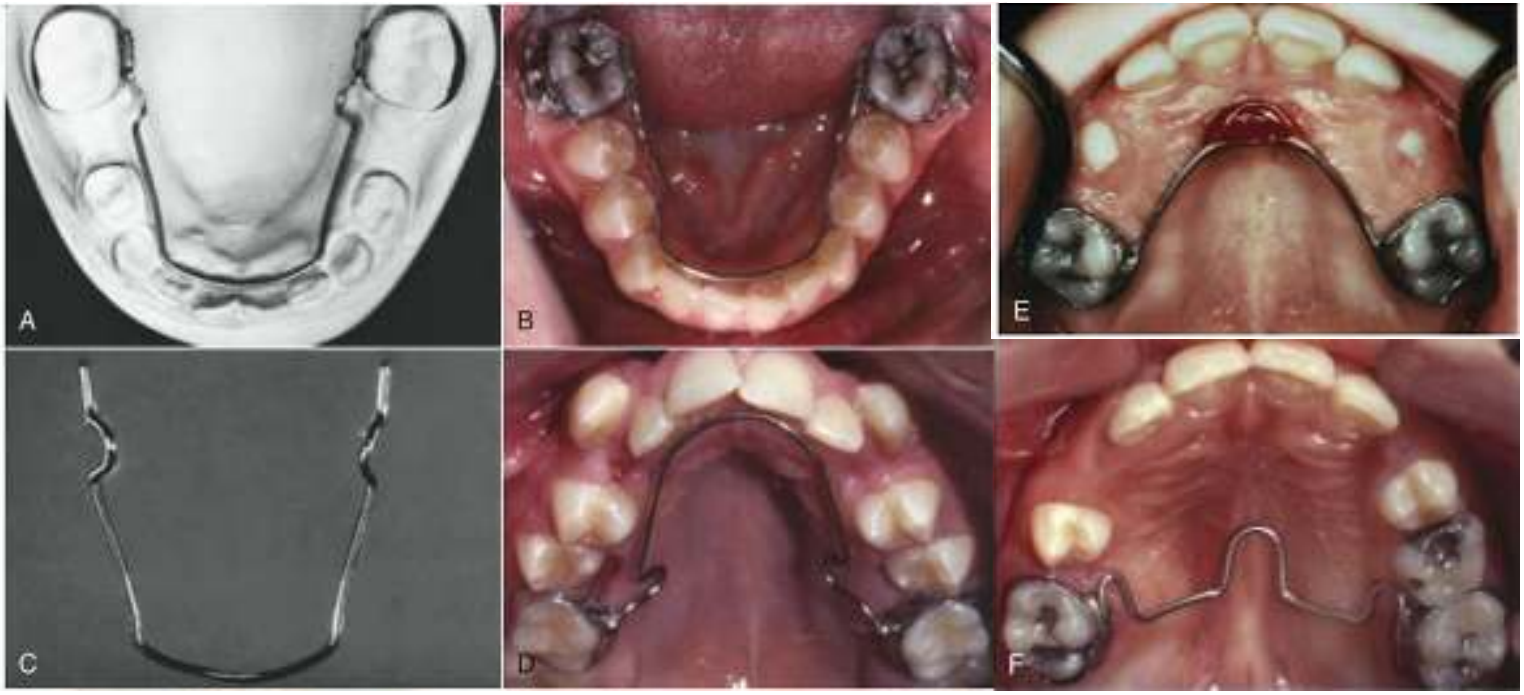


FIGURE 11-55 A lingual holding arch usually is the best choice to maintain space for premolars after premature loss of the primary molars when the permanent incisors have erupted. **A,** The lingual arch is made of 36 mil wire with adjustment loops mesial to the permanent first molars. **B,** This soldered lingual arch successfully maintained the space for the premolars. **C,** The lingual arch is stepped away from the premolars to allow their eruption without interference, which results in a keyhole design. The wire is also 1.5 mm away from the soft tissue at all points. **D,** A maxillary lingual arch is used when the overbite is not excessive, or **(E)** a Nance arch with an acrylic button in the palatal vault is indicated if the overbite is excessive. The palatal button must be monitored because it may cause soft tissue irritation. **F,** The transpalatal arch prevents a molar from rotating mesially into a primary molar extraction space, and this largely prevents its mesial migration. Several teeth should be present on at least one side of the arch when a transpalatal design is employed as a sole space maintainer.

Class II Problems

- Class II skeletal discrepancy in AP dimension
  - Maxillary excess (maxilla too far forward) or mandibular deficiency (mandible too far back)
    - Treatment is not necessarily needed at an "early" stage
    - However, if patient appears to have skeletal discrepancy, it is best to refer to orthodontist for evaluation
    - Typically will present with excess overjet
    - Various treatment modalities:
      - Headgear, functional appliances (MARA/HERBST), etc.

Summary

- Incisor crowding & irregularity → no tx until the mixed dentition
- Missing molars → space maintenance
- Missing anterior teeth → space maintenance not needed (can be done for esthetics)
- Posterior crossbite → correct with expansion or occlusal adjustment/equilibration
- Anterior crossbite with anterior shift → treat
- Skeletal AP and vertical problems → tx usually done only in very severe problems (Class III maxillary deficiency); class II rarely treated.
- Communication with your orthodontist is key!!

+

Thank you

Orthodontic Extraction Patterns

Andrew Baker, DDS
University of Louisville
2nd Year Orthodontic Resident
March 7, 2016

Objectives

- Historical Perspectives
- Contemporary Perspectives
- Contemporary Guidelines
- Various Extraction Patterns
- Indications for Extraction

Historical Background

- The debate dates back to the early 1900's.
- Emphasis was placed on the alignment of teeth and the correction of facial proportions
  - Little attention was paid to occlusion.
  - Extractions for mal-alignment of crowded teeth was the norm.
  - In an era when an intact dentition was rare, details of occlusal relationships were considered unimportant.

Historical Background

- In the early 1900's, Dr. Edward Angle developed orthodontics as a specialty & believed in a non-extraction philosophy.

Historical Background

Angle's beliefs:

- People are inherently capable of obtaining an ideal relationship of all 32 teeth.
- If all teeth are placed in ideal occlusion, physiologic forces will stimulate bone growth around each tooth creating ideal dental arches.
- This theory of bone growth led Angle to believe skeletal problems could be corrected with simple elastics.

Reasons for Extractions

- Gain space to align crowded teeth
- Reduce dental protrusion (flaring)
- Camouflage skeletal discrepancies
- Correct midline discrepancies
- Preparation for orthognathic surgery

Alternatives to Extractions

- Expansion of the arch to create space

Alternatives to Extractions

- Expansion of the arch to create space
- Interproximal reduction (IPR)

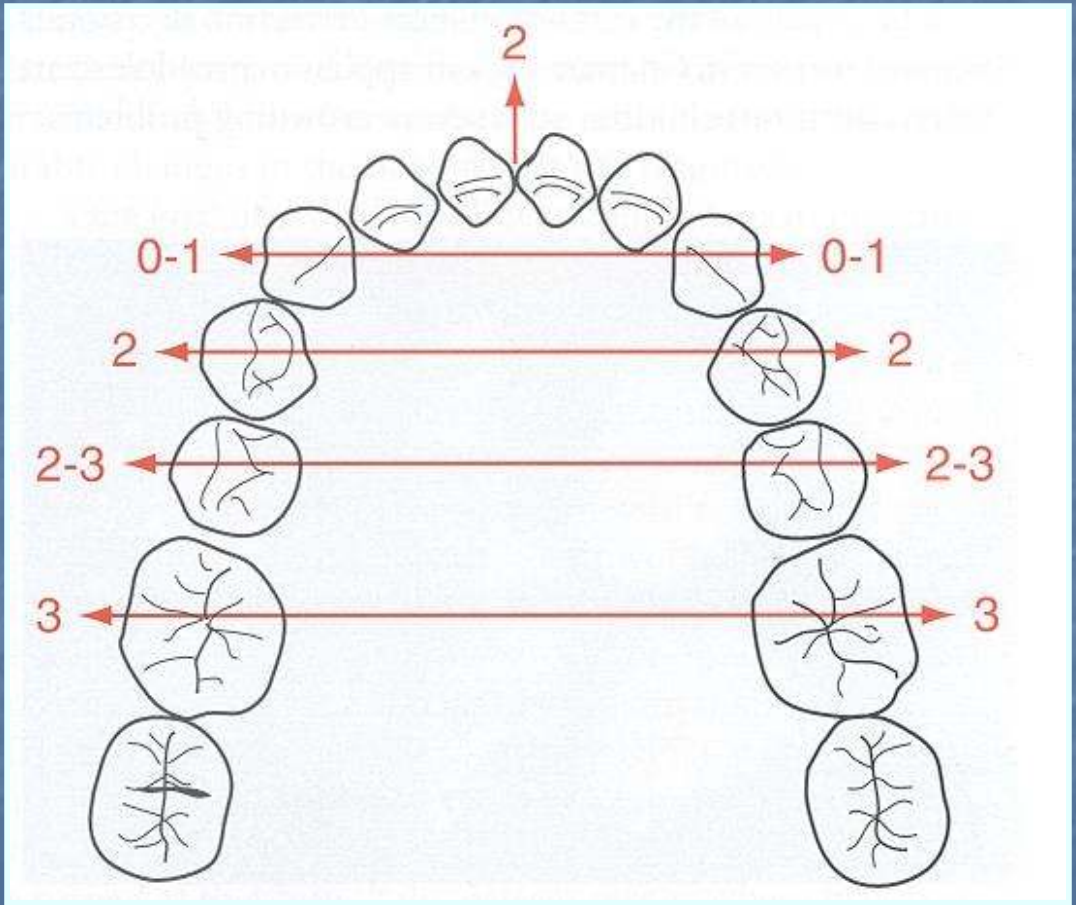





Problems to Consider with Expansion

- Relapse potential

Relapse Potential



Proffit, Contemporary Orthodontics, 3rd Edition. P255

Problems to Consider with Expansion

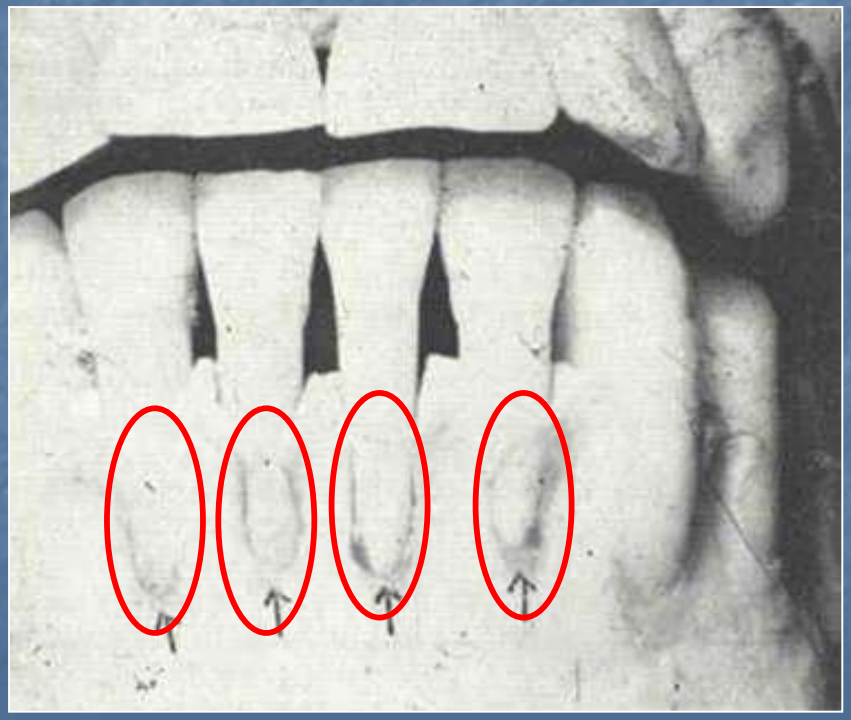
- Relapse potential
- Periodontal concerns

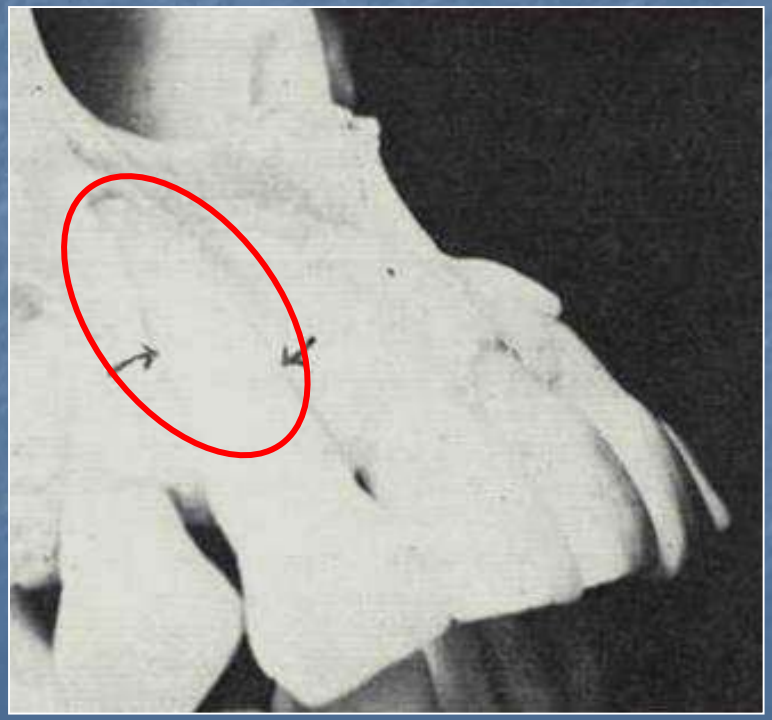
Periodontal Concerns

- Gingival stripping/recession

Periodontal Concerns

- Fenestration of roots





Problems to Consider with Expansion

- Relapse potential
- Periodontal concerns
- Open bite tendency

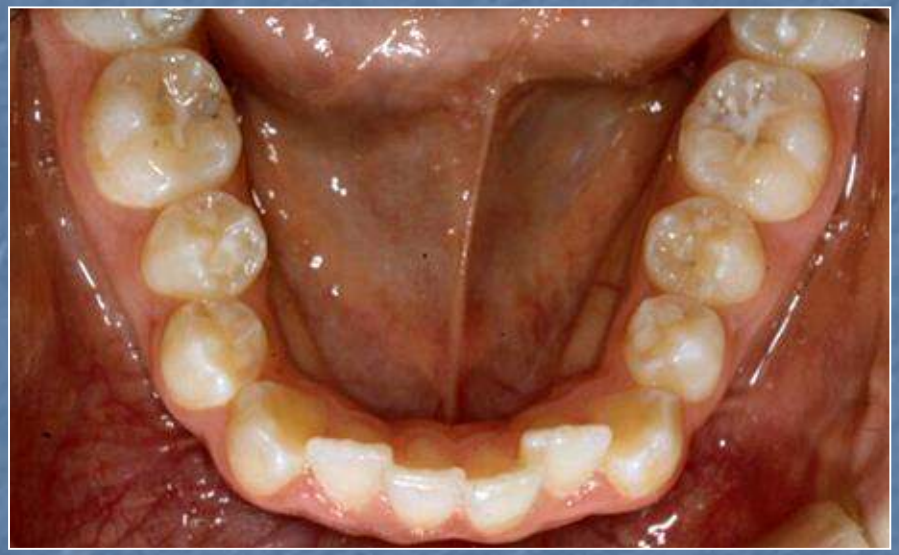
Anterior Open Bite

Contemporary Extraction Guidelines Based on Crowding

- <4 mm crowding: Rarely indicated
- 5-9 mm crowding: EXT or non-EXT
- >10 mm crowding: Almost always

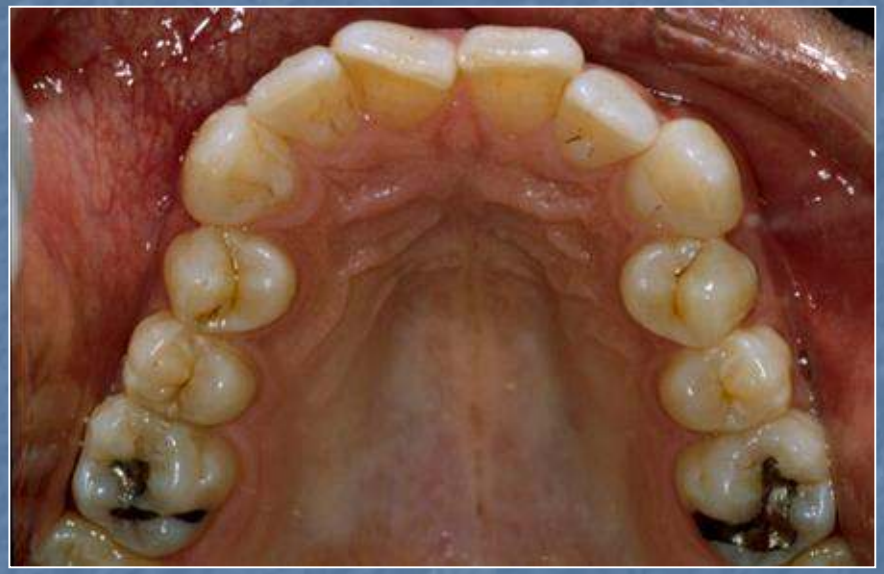
Proffit, Contemporary Orthodontics, 3rd Edition. P256

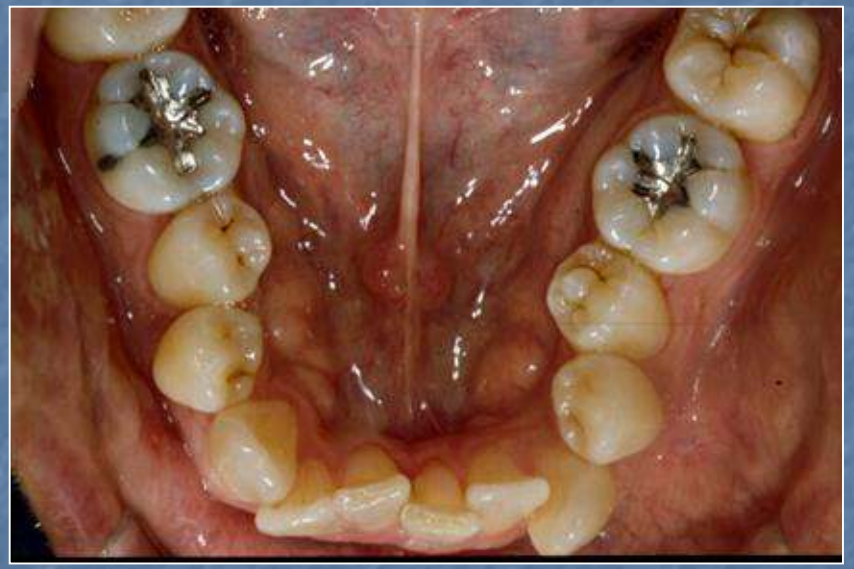
Crowding 4mm or Less: Non-Extraction



Crowding of >10mm: Extraction

Crowding 5 to 9mm: EXT or Non-EXT ?





Always consider the patient's FACIAL PROFILE to make a proper diagnosis

Extraction or non-extraction?

5-9mm
of
crowding

Contemporary Extraction Guidelines in Borderline Cases

- A non-extraction Tx plan should be the first choice in the borderline cases
- Success depends on both the hard and soft tissue characteristics of the patient, as well as, the final incisor position.
- Fixed lingual retainers can be a great help in maintaining alignment in those borderline patients who did not receive extractions and may be at higher risk for relapse.

Contemporary Extraction Guidelines in Borderline Cases

- Long-term function and stability should not be sacrificed just to save some premolars.
- A good orthodontists knows that failing to extract on patients that truly need EXT causes some very poor outcomes in orthodontic treatment.

Once Extractions Are Declared Necessary the Big Question is…

Which Teeth Do We Choose?

We First Have To Determine The Patient's Dental And Skeletal Classification.

Skeletal Classifications

- Class I: Straight profile
  - Orthagnathic maxilla & mandible

Skeletal Classifications

- Class I: Straight profile
- Class II: Convex profile
  - Large maxilla
  - Small mandible
  - Combination

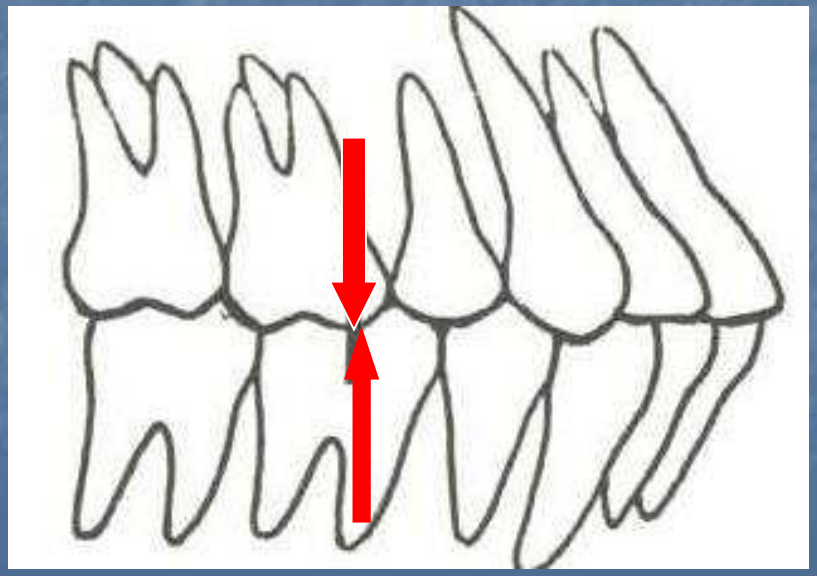
Skeletal Classifications

- Class I: Straight profile
- Class II: Convex profile
- Class III: Concave profile
  - Small maxilla
  - Large mandible
  - Combination



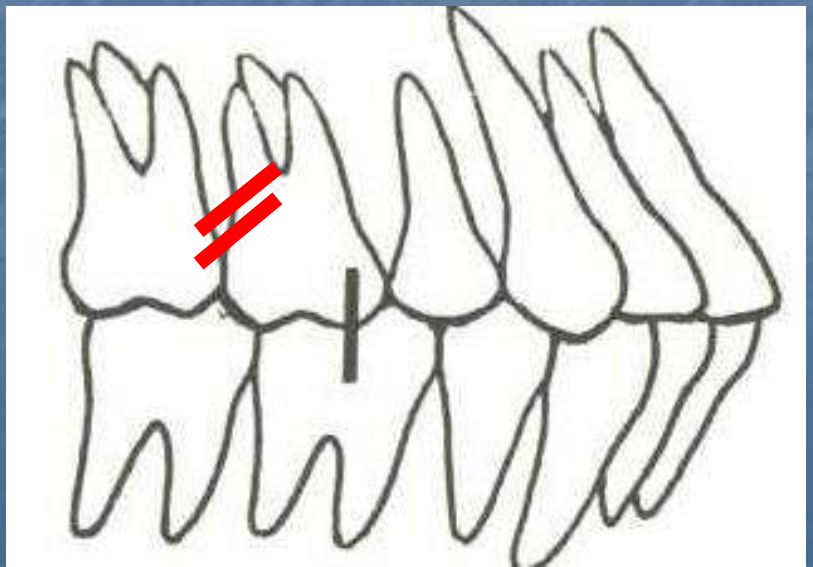
Dental Classifications

- Class I Molar: Mesial buccal cusp of max 1st molar occludes with buccal groove of mand 1st molar



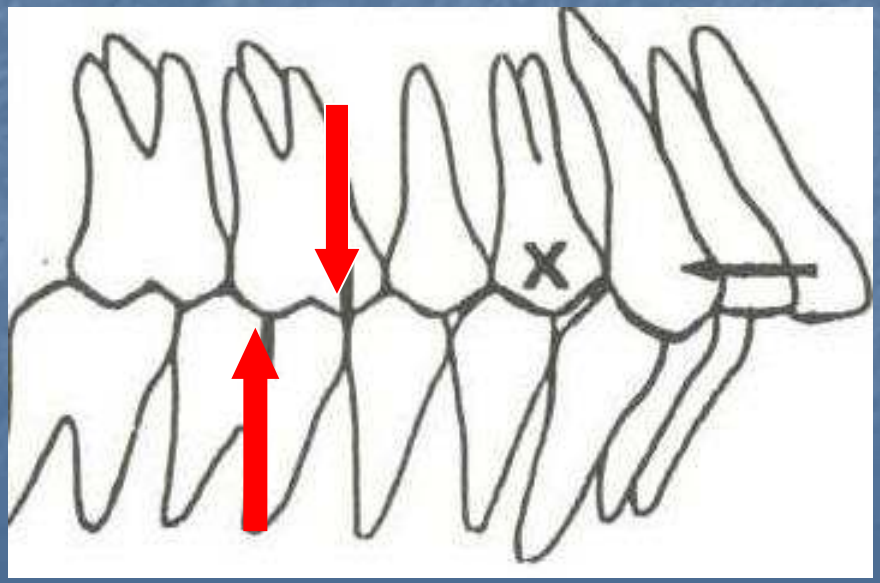
Dental Classifications

- Class I Canine: Mesial incline of max canine occludes with the distal incline of mand canine & max canine cusp tip occludes with occlusal embrasure between mand canine & 1st premolar



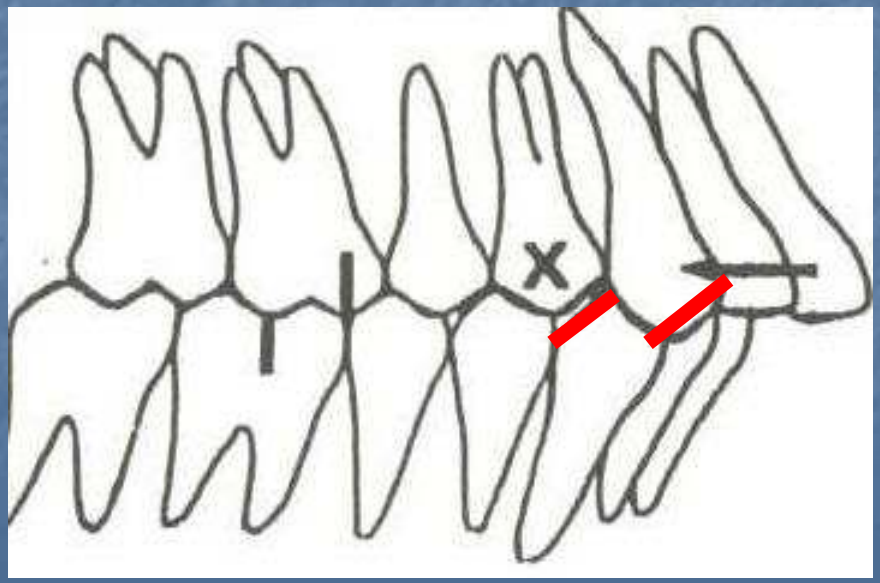
Dental Classifications

- Class II Molar: Mesial buccal cusp of max 1st molar occludes mesial to buccal groove of mand 1st molar



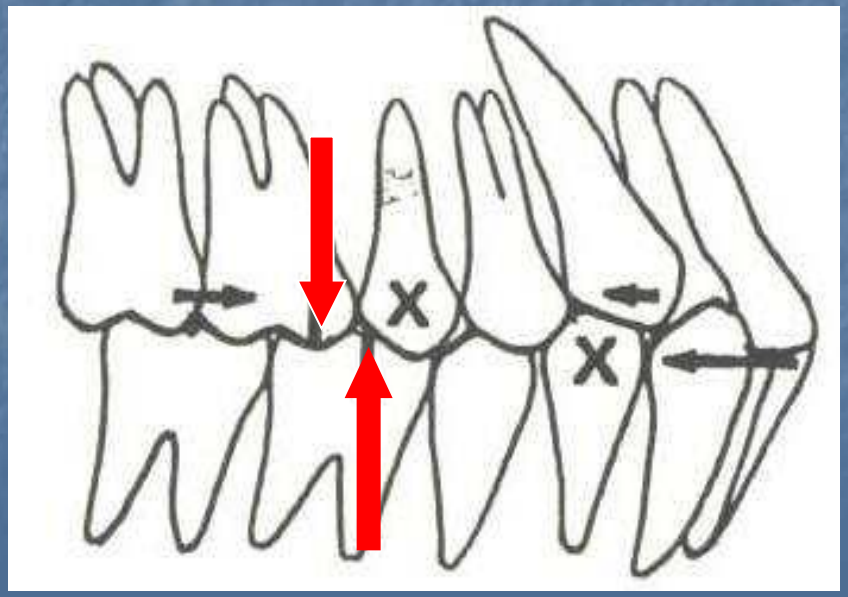
Dental Classifications

- Class II Canine: Mesial incline of max canine occludes mesial to the distal incline of mand canine



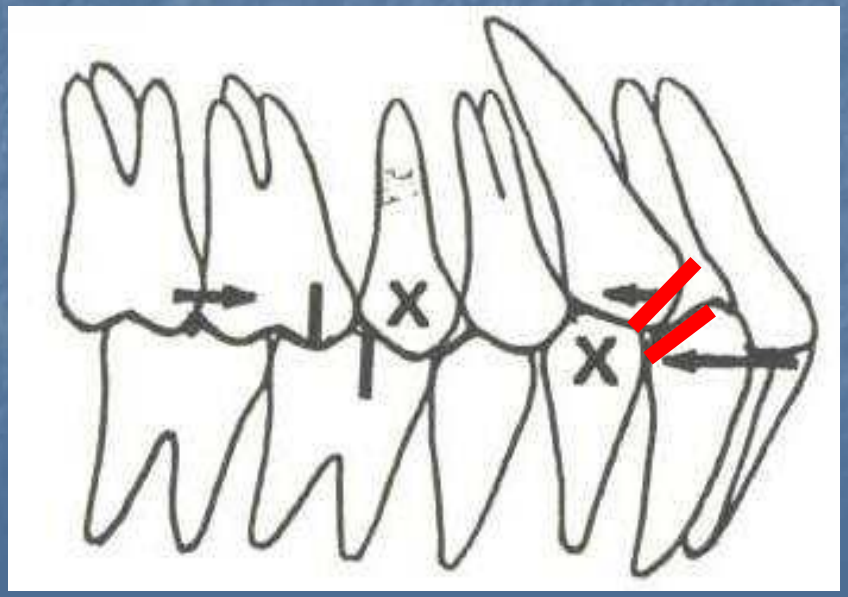
Dental Classifications

- Class III molar: Mesial buccal cusp of max 1st molar occludes distal to buccal groove of mand 1st molar



Dental Classifications

- Class III Canine: Mesial incline of max canine occludes distal to the distal incline of mand canine



Extraction Patterns

- Class I crowding (moderate to severe)
- Class I with excessive protrusion
- Class II
- Class III
- Other patterns for special situations
- Serial Extractions in the Mixed Dentition

Class I crowding (Mod-Severe)

- If extractions are necessary it is usually best to extract all four 1st premolars.
- The crowding is in the anterior so we create space near the crowding by extracting the 1st premolars.

Class I with Excessive Protrusion

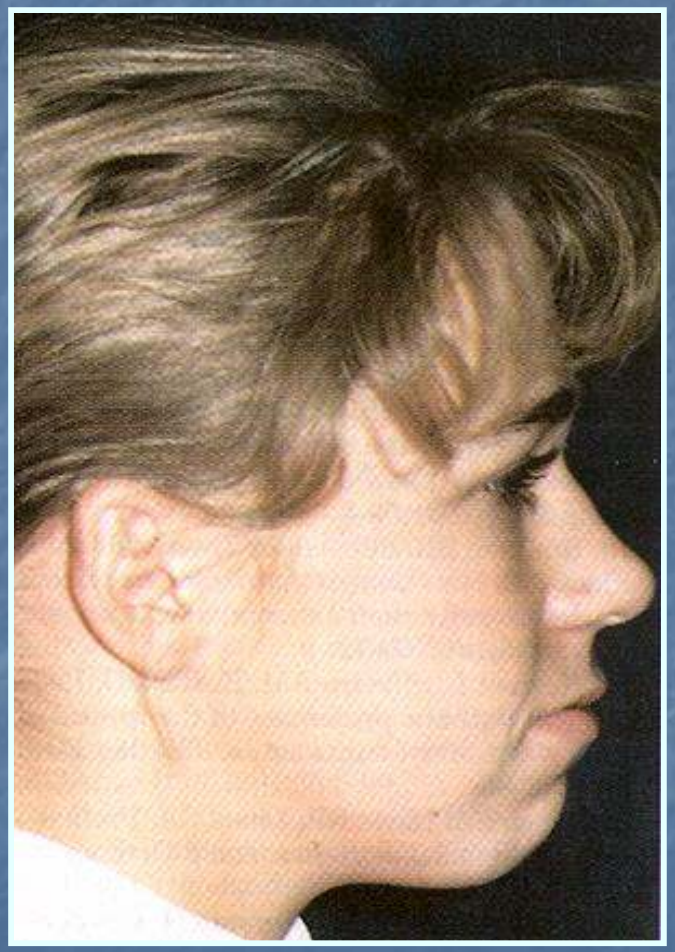
- This is analogous to Class I with crowding, but instead of the anterior teeth becoming crowded they flare out during eruption.
- These patients have to strain to get their lips closed.
- Four 1st premolars are chosen for extraction, so that the anterior segments can be retracted into the space; thus reducing the protrusion.

Characteristics of Protrusive Profile

- Lip fullness

Characteristics of Protrusive Profile

- Lip fullness
- Mentalis stain

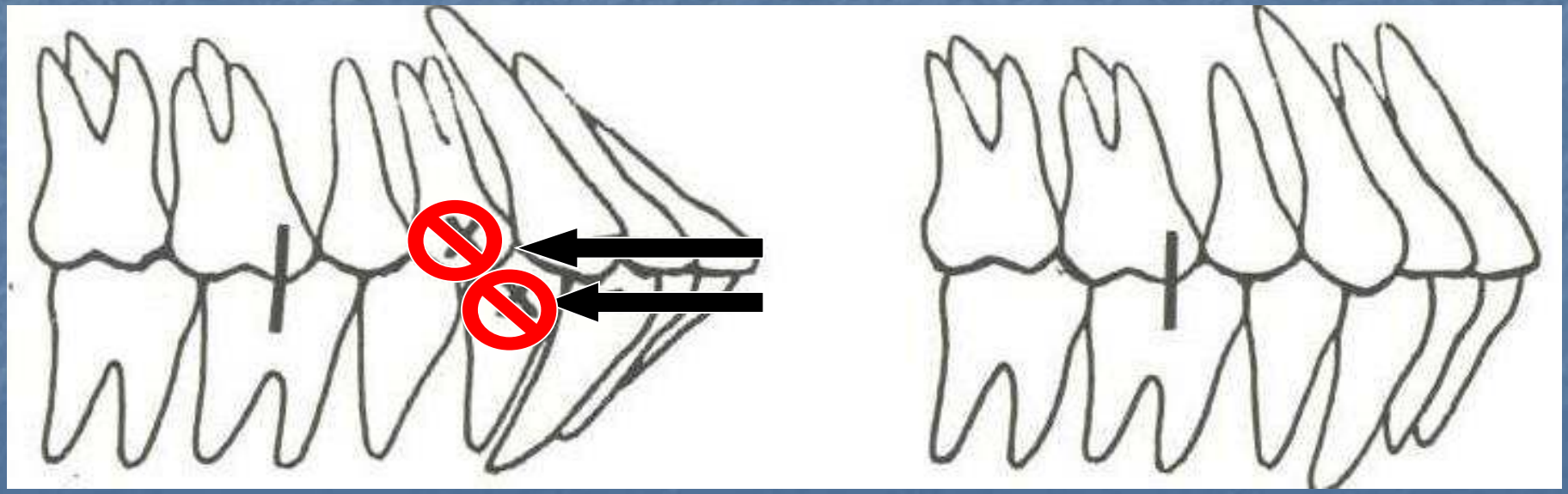


Characteristics of Protrusive Profile

- Lip fullness
- Mentalis stain
- Lip incompetence

Class I Dentoalveolar Protrusion

- Extraction of max & mand 1st premolars
- Retraction of anterior segments

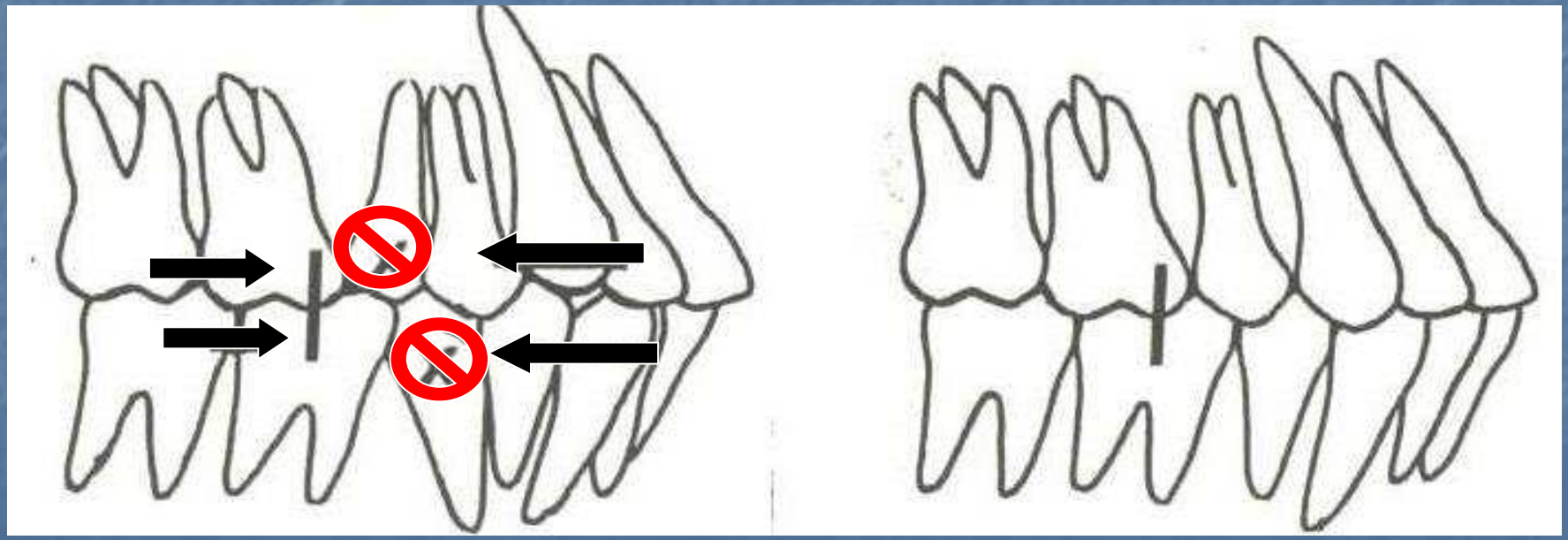


Class I crowding (Mod-Severe)

- We may extract all four 2nd premolars if we want to reduce effects on the soft tissue profile.
- Patients with thin lips are more susceptible to the "dished-in" appearance so we should avoid bringing incisors and lips back any further.

Class I crowding, Straight Profile

- Extraction of max & mand 2nd premolars
- Reciprocal closure of EXT spaces



Class II Extraction Patterns

- First determine if etiology is dental or skeletal
- If the etiology is skeletal determine the severity
  - Severe cases go for surgery
  - Mild-moderate, patient has the option of functional appliances, surgery or extractions to "camouflage" the skeletal problem
- If the skeletal component is Class I and the teeth have drifted into a dental Class II, there is usually crowding and a need for extraction.

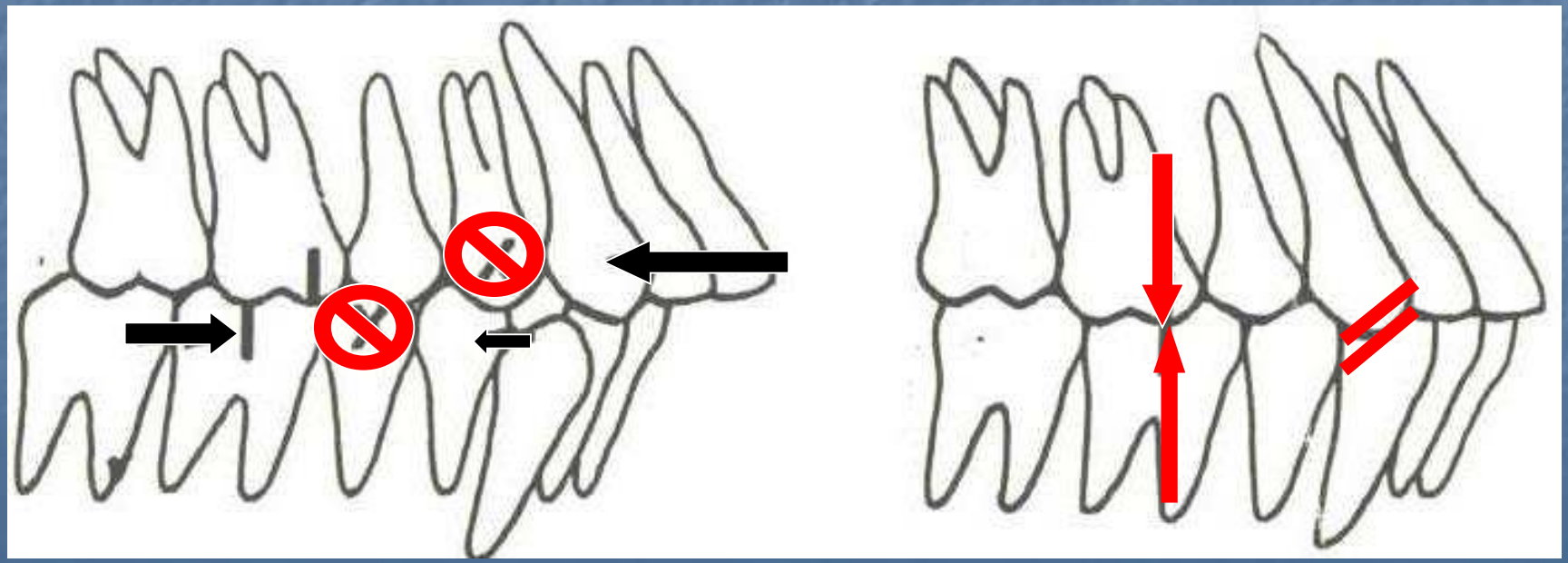
Class II Extraction Patterns

- To correct Class II dental crowding or Class II skeletal problems with extractions, we usually choose the Maxillary 1st premolars and Mandibular 2nd premolars.

- This pattern allows us to differentially move the molars and canines into Class I relationship.

Class II, Division I or II

- Extraction of max 1st & mand 2nd premolars
- Retract maxillary anterior segment
- Protract mandibular posterior segment

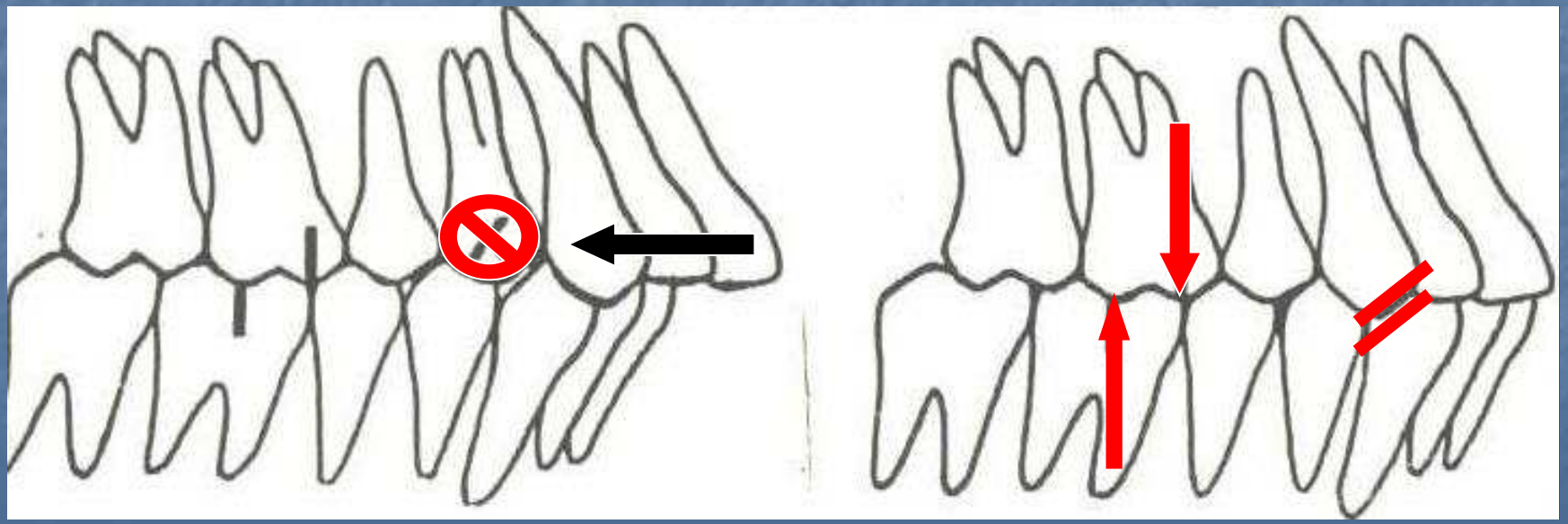


Class II Extraction Patterns

- If the patient is non-growing, has a good mandible (not requiring surgery) with little mandibular crowding, and 5-10mm of excess overjet, we may elect to extract Maxillary 1st premolars only.
- If the patient has >10mm overjet, surgery is better.

Class II Extraction Patterns

- Extraction of max 1st premolars only
- Retract maxillary anterior segment
- Finish Class II molar & class I canine

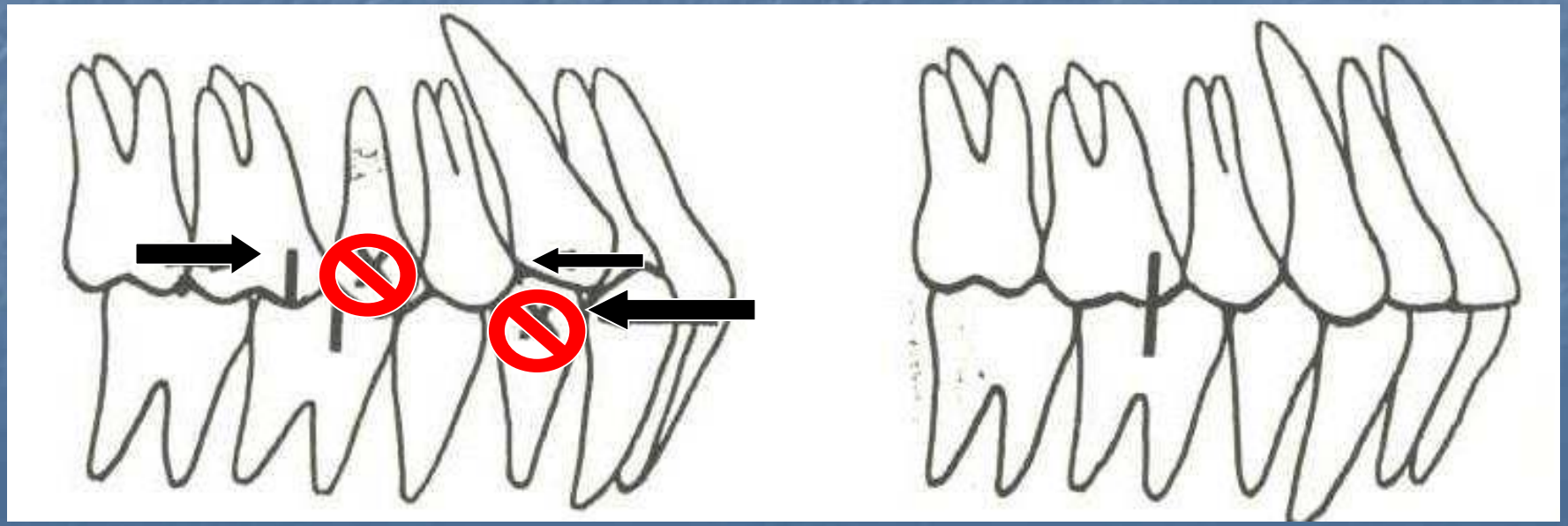


Class III Extraction Patterns

- Class III situations are normally caused by an underlying skeletal problem.
- Many of these cases go to surgery, but mild cases may be "camouflaged" with extractions.
- The choice of extractions in many of these cases are maxillary 2nd premolars & mandibular 1st premolars. Again, this pattern allows us to differentially move teeth into Class I.

Class III Extraction Patterns

- Extraction of max 2nd & mand 1st premolars
- Retract the mandibular anterior segment
- Reciprocal closure in the maxilla

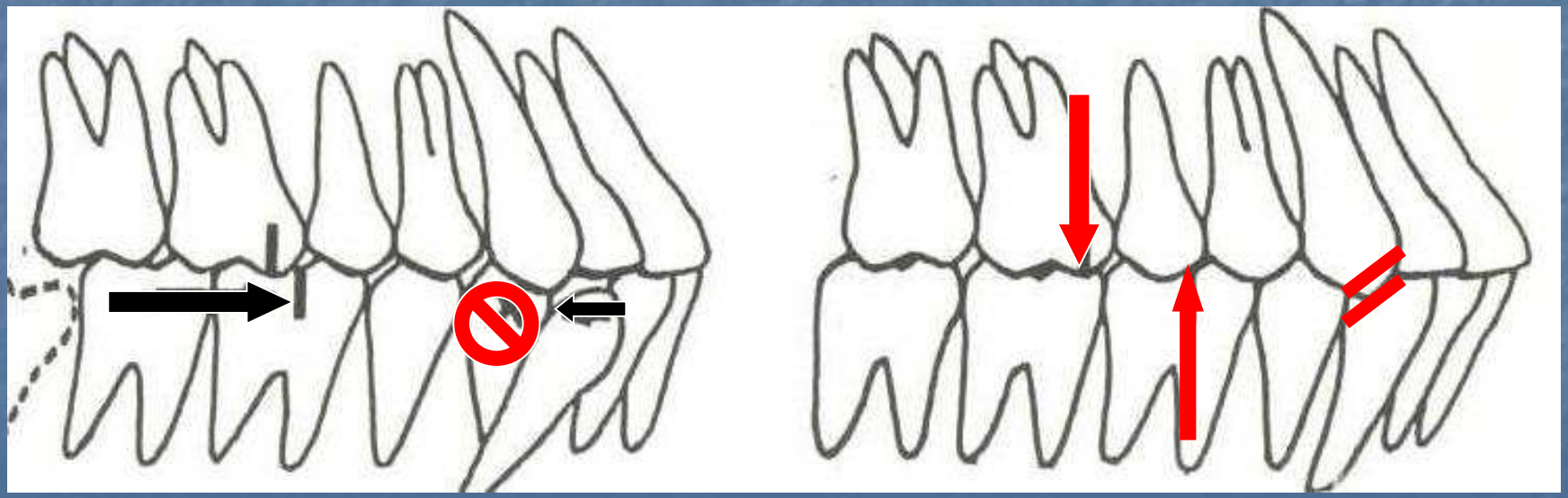


Class III Extraction Patterns

- If the Class III is very mild, the maxillary arch is not crowded and there is moderate to severe mandibular crowding; lower 1st premolars alone or a single lower incisor may be extracted.

Class III Extraction Patterns

- Extraction of mand 1st premolars only
- Reciprocal closure of EXT space
- Finish Class III molar & class I canine



Other Patterns

- One or two premolars may be extracted on the left only or right only so as to shift the dental midline to the center of the face. Usually for asymmetric patients.
- All second molars may be extracted to help correct Class II and/or close an open-bite. The third molars are counted on to erupt later and take the second molar position. This is rarely done anymore.

Other Patterns

- If orthognathic surgery is planned to correct a severe Class II or Class III and the patient also needs extractions, the normal extraction pattern for that case may be reversed. This makes the Class II or III worse prior to surgery, thus the surgical move is maximized. This allows for a greater change in the facial esthetics.

Serial Extractions

- Definition: The timed sequence of extraction of primary and, ultimately, permanent teeth to relieve severe crowding (>10mm).

Profitt

Serial Extractions

- Philosophy based on increasing available space for the erupting permanent teeth by extracting certain deciduous teeth
- Allows the teeth to erupt over the alveolus and through keratinized tissue (rather than buccal/lingual displacement)

Serial Extractions

- Originally advocated as a method to treat severe crowding and eliminate any future need for appliance therapy.
- However, nearly all patients still require fixed appliance therapy for ideal results.
- Serial extraction as a treatment modality has lost popularity recently

Indications for Serial Extractions

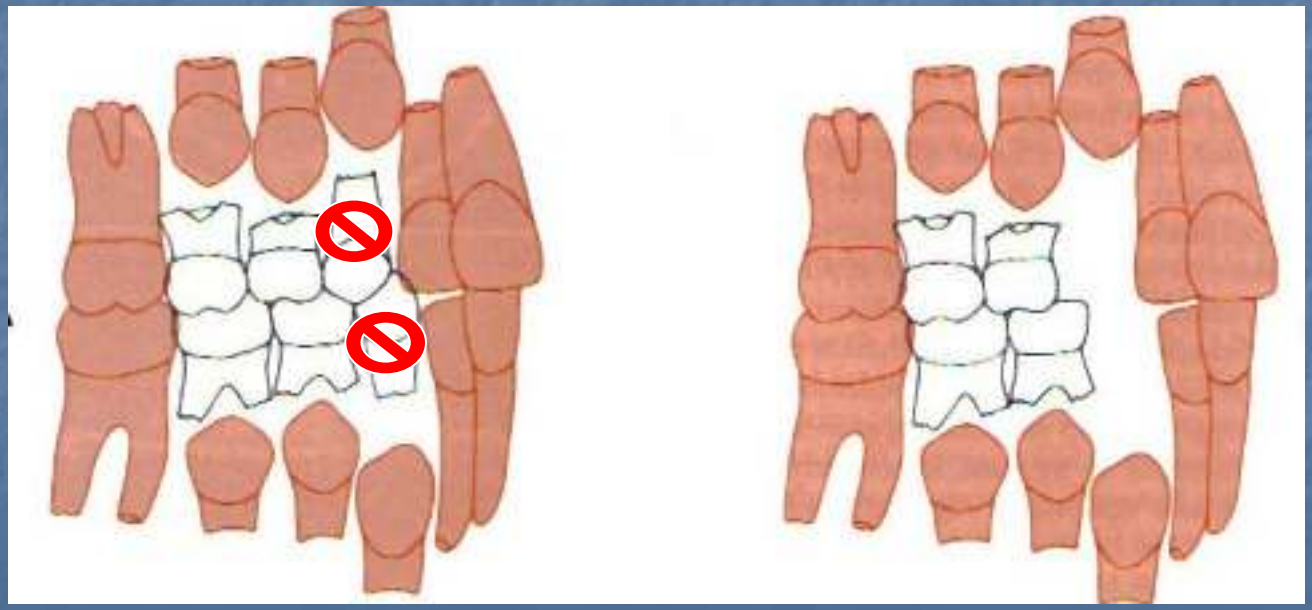
- Family history of severe crowding
- Well aligned, closely approximated primary dentition (no diastemas or primate spaces & very small prim. teeth) with Class I molar relationship
- Gingival recession/alveolar destruction on labial of one or more mandibular incisors seen by age 8/9 y/o.

Indications for Serial Extractions

- Severe mesial tipping or ectopically erupting 6's
- Early loss of mandibular deciduous canines
- Fanned out U/L permanent incisors (due to crowded out unerupted perm canines)
- Abnormal resorption of primary teeth
- Permanent cuspids erupting buccally

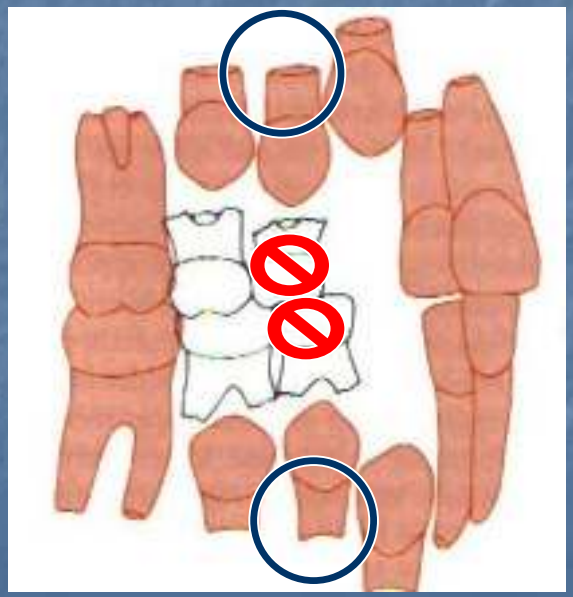
Serial Extraction Pattern

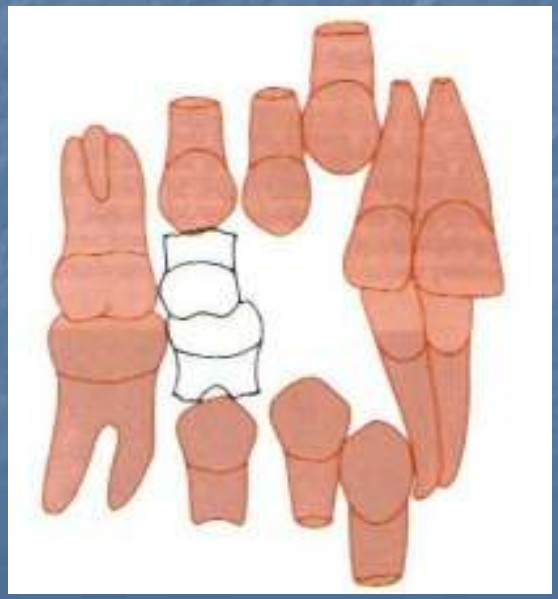
- **Step 1**: EXT of primary canines (as perm. laterals erupt)



Serial Extraction Pattern

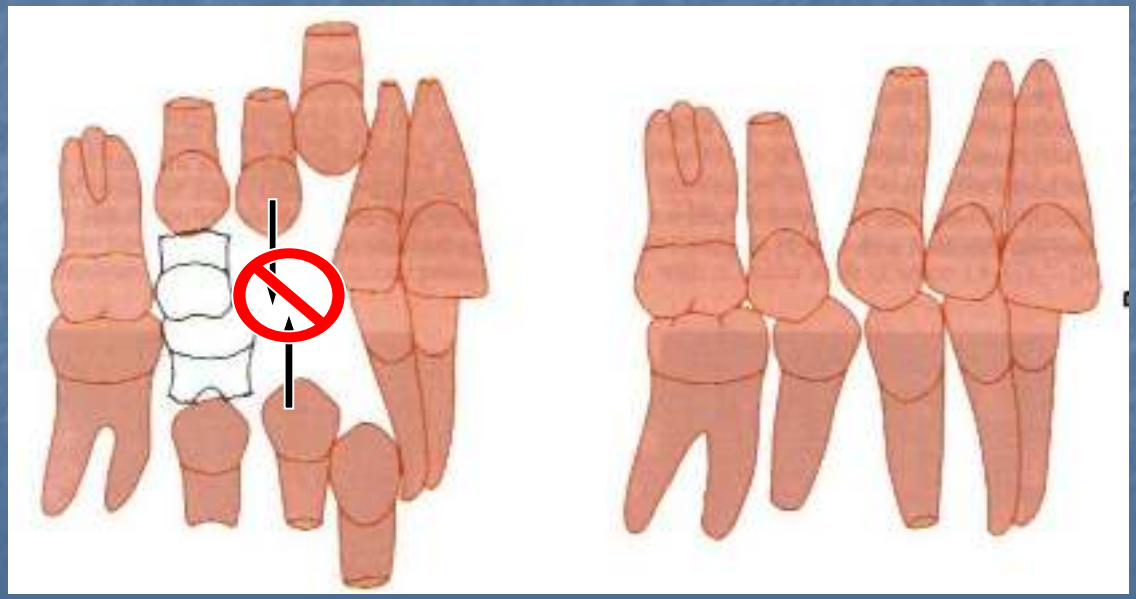
- **Step 2**: EXT of primary 1st molars when 1/2 - 2/3 root formation of 1st premolar is seen radiographically





Serial Extraction Pattern

- **Step 3**: Once 1st premolars have erupted they are EXT to allow canines to erupt into 1st premolar EXT sites



Serial Extraction Pattern

* Good vertical position of the canine root is one of the key reasons to pursue serial extraction during mixed dentition rather than waiting until the permanent dentition has fully erupted to extract the premolars.

Summary of Extraction Patterns

- **Class I (Moderate to severe crowding)**: Usually U/L 1st premolars, but may be U/L 2nd premolars to minimize soft tissue change.
- **Class I (Excess Protrusion):**

  U/L 1st premolars
- **Class II:** Usually U 1st premolars & L 2nd premolars. May be only U 1st premolars in non-growing patients that have a good mandible with minimal crowding but have

  5-10mm of excess overjet.
- **Class III:** Usually U 2nd premolars & L 1st premolars. May be only L 1st premolars or a single mand incisor if situation is perfect.

Conclusion

- Extractions: Essential option for orthodontic Tx of many patients.
- Non-extraction if possible, but NOT extracting in some patients is worse than the loss of four teeth.
- Indiscriminate expansion: Can cause relapse, periodontal problem or possible open bite.
- Guidelines: Depends on esthetics & stability
- An Orthodontist should not be an Extractionist or Non-extractionist. All factors must be evaluated prior to choosing to extract or not. Every case is different and unique.

Questions?

Treatment Considerations in Orthognathic Surgery

Patient selection and treatment options

- Dental Problems
- Skeletal Problems

Malocclusions present as dental, skeletal or a combination of both

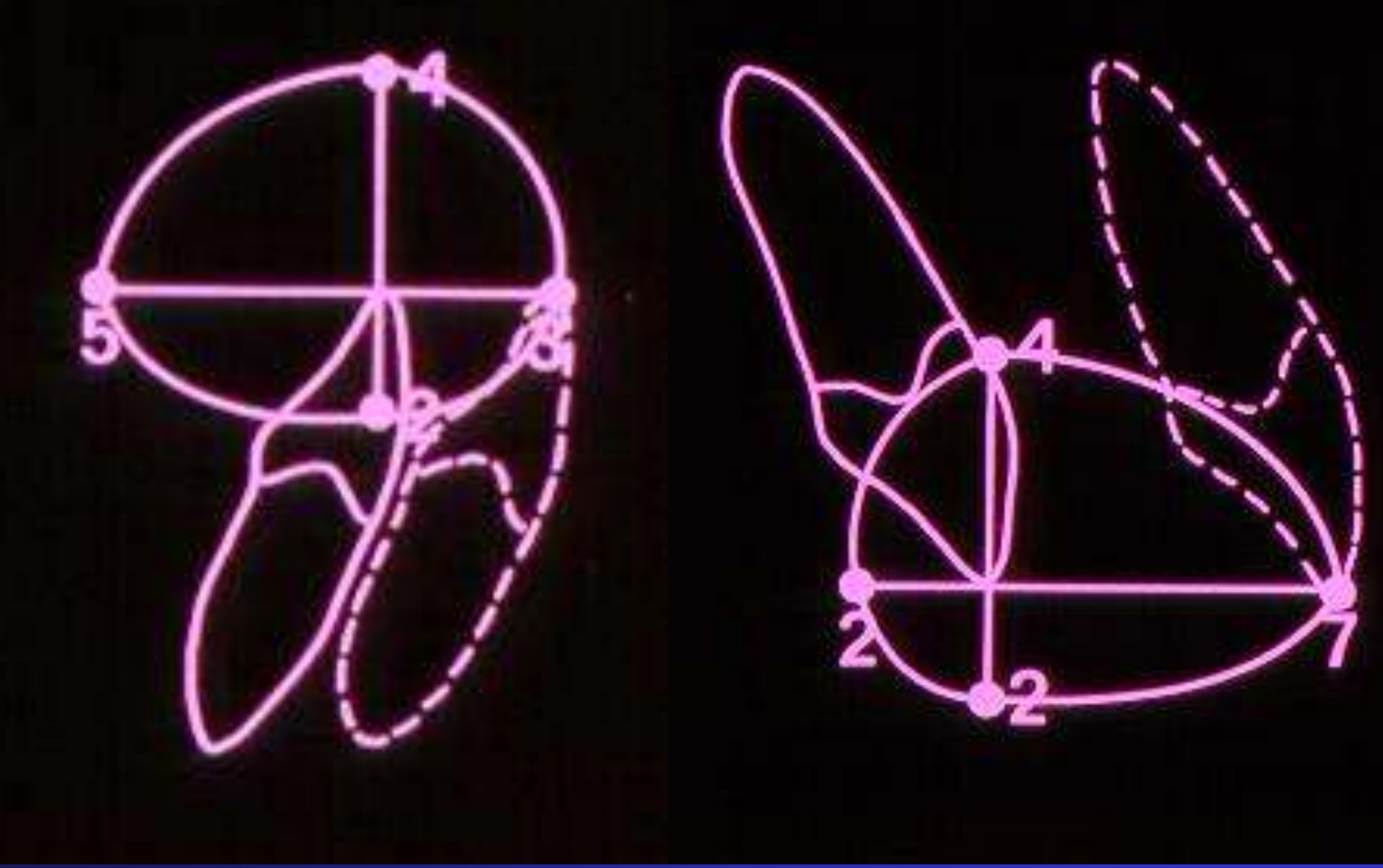
Patient selection and treatment options

Pt Considerations

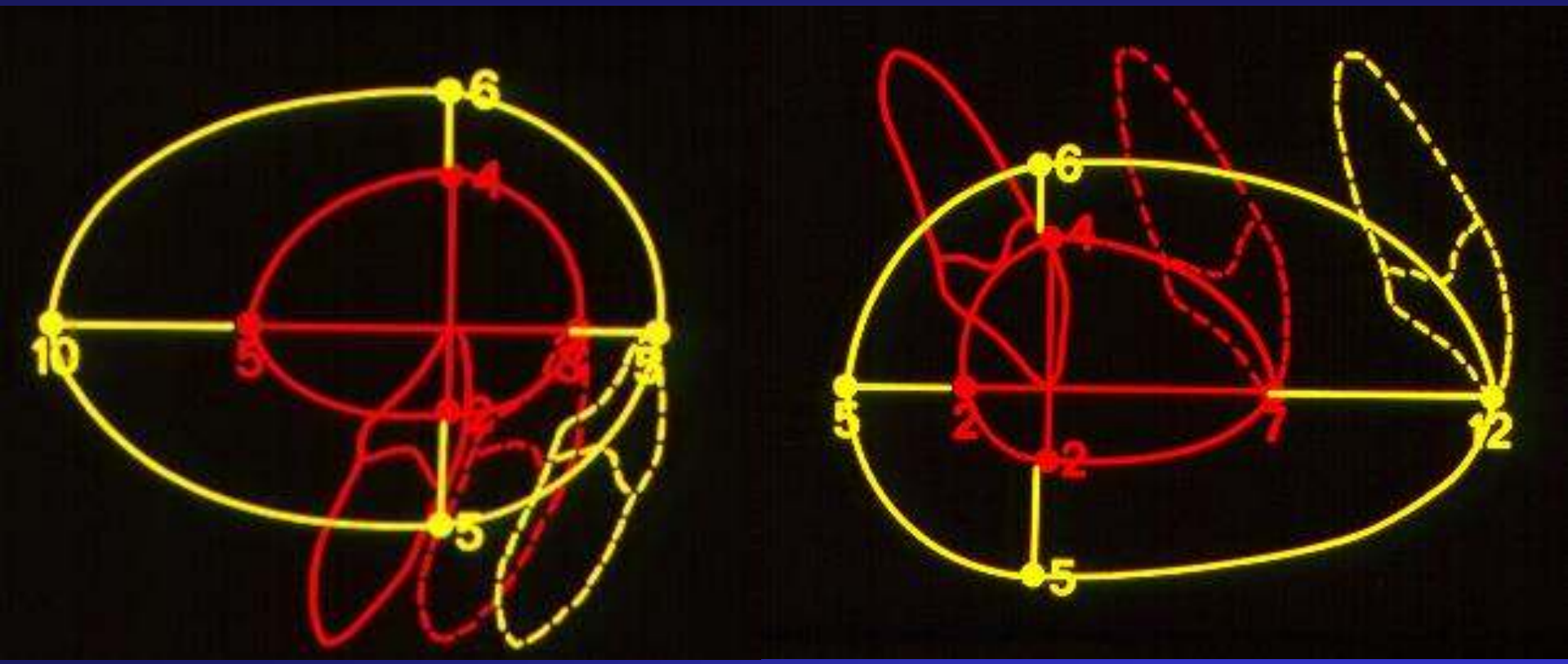
- Age of the patient
- Type of skeletal problem
- Severity of skeletal problem

Tx Options:

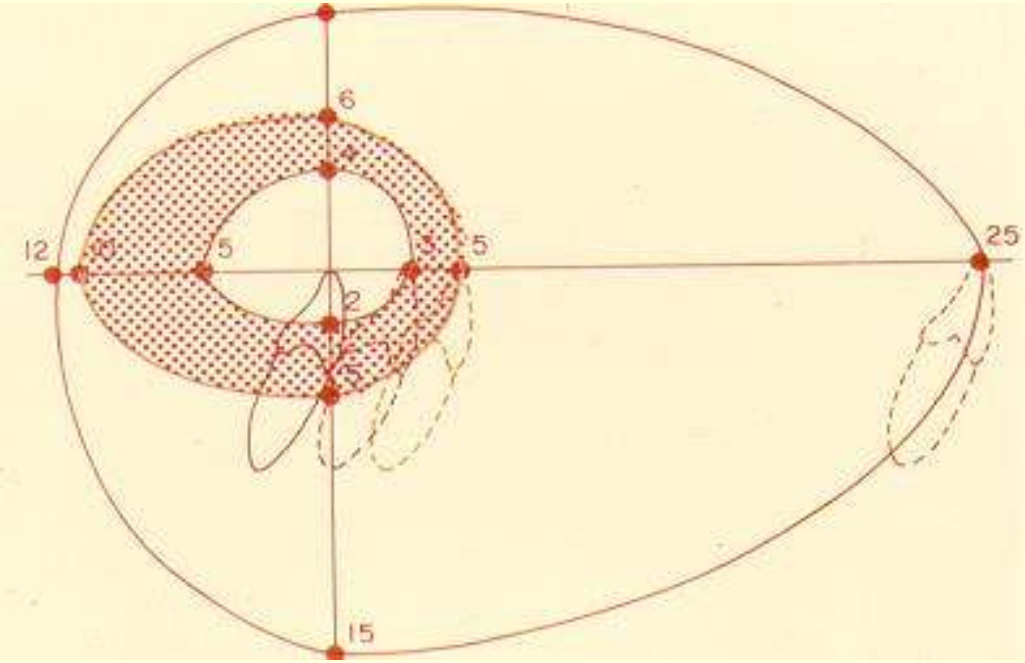
- Growth Modification
- Camouflage
- Orthognathic surgery

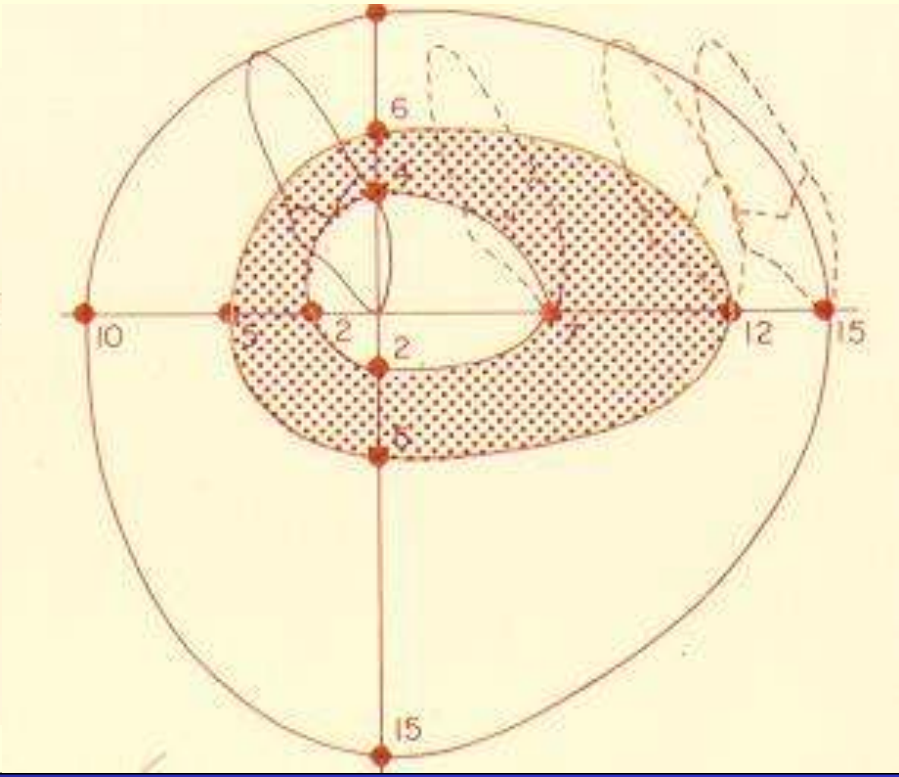


Orthodontic tooth movement alone



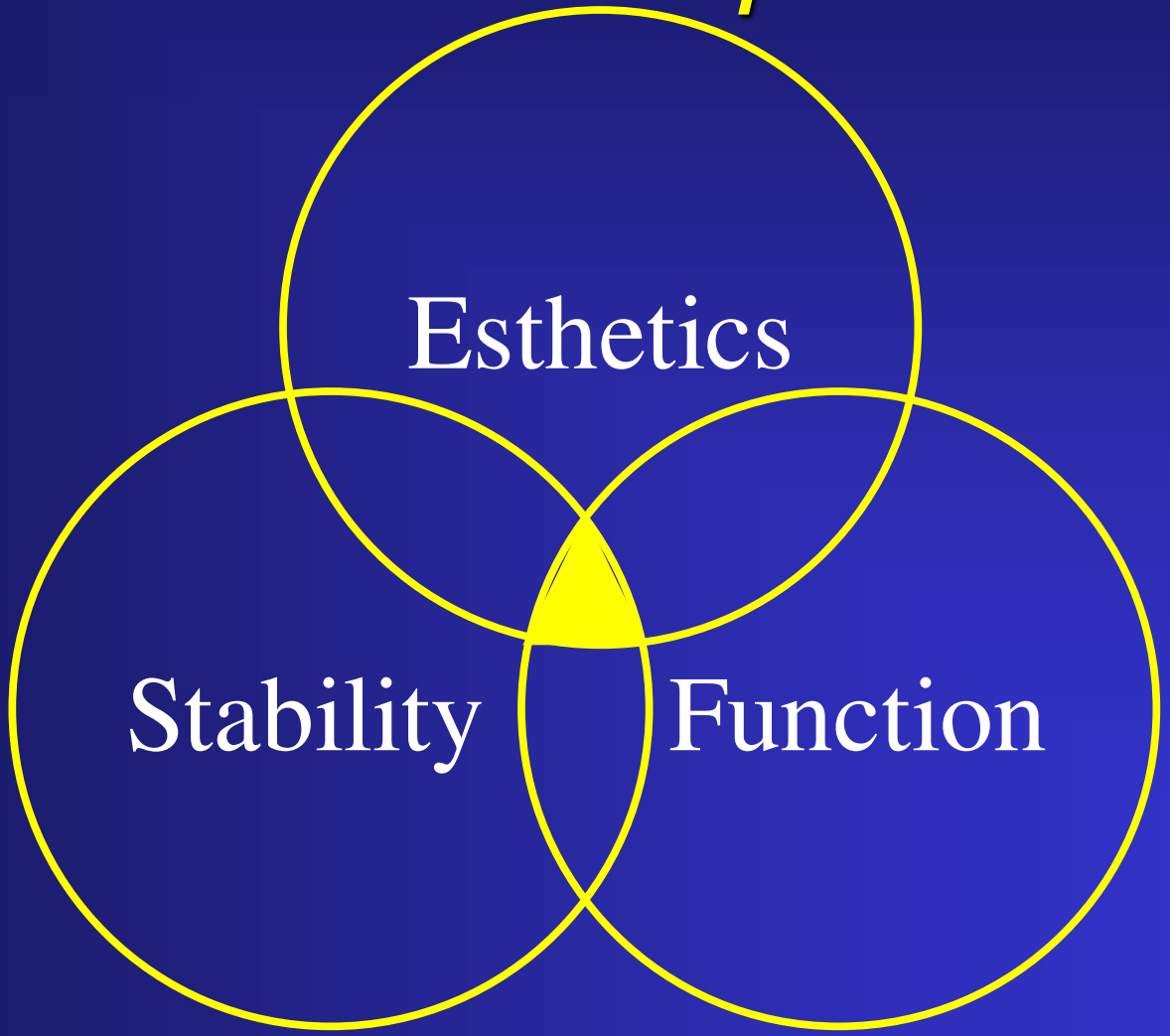
Orthodontic tooth movement (red)
plus growth (yellow)





What's the indication for surgery? Being outside the envelope of orthodontic possibility--which changes with age

Patient selection and treatment options



What factors influence dental and facial esthetics?

- Presence of a Smile
- Your Smile Line
- The amount of gum tissue that you show when you smile
- The width of your smile
- Your midlines
- Facial proportions
- Facial symmetry
- Age

Growth Modification

- Patient must be growing
  - Head gear
  - Herbst appliance
  - Twin block
  - And all the others…

Problems:

- Class II division 1 malocclusion
  - Mild crowding
  - skeletal mandibular deficiency
  - open bite tendency

Plan:

- orthodontic growth modification: Herbst appliance for 9 months followed by braces

Camouflage

- Orthodontic treatment only
- Move the teeth to hide the skeletal problem
- Enhance skeletal compensations

- Facial esthetics are potentially compromised
- Stability and function may be potentially compromised

Problems:

- Class II division 2 malocclusion
  - crowded, lingually tipped max incisors
  - skeletal mandibular deficiency
  - deep bite anteriorly

Plan:

- orthodontic camouflage: extract max 1st premolars, retract / intrude incisors

Diana S. -- age 18

Hierarchy of surgical stability

Data from:

University of North Carolina
Dentofacial Program

>3000 patients with initial records.

>1300 patients with at least one year postsurgical follow-up.

NIH Grant supported and the largest repository of orthognathic data

Hierarchy of surgical stability

MORE

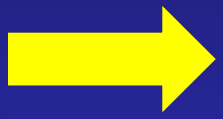
STABLE/ PREDICTABLE

LESS

Maxilla up
Mandible forward
Maxilla forward
Mx up + Mn forward
Mx forward + Mn back
Mandible back
Maxilla down
Maxilla wider

Clearer view of stability

Distance of movement has little effect



Maxilla up
Mandible forward
Maxilla forward
Mx up + Mn forward
Mx forward + Mn back

Superior repositioning of the maxilla is the most stable orthognathic procedure

Clearer view of stability

Two limitations:

(1) Stability less after about 8 mm advancement

(2) Rotational pattern makes a difference

Maxilla up
Mandible forward
Maxilla forward
Mx up + Mn forward
Mx forward + Mn back

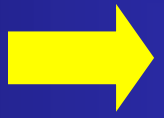
The most successful mandibular advancement: short face with rotation of the chin down

Clearer view of stability

Two limitations:

(1) Longer move less stable

(2) Forward plus down often desired



Maxilla up
Mandible forward
Maxilla forward
Mx up + Mn forward
Mx forward + Mn back
Maxilla down

Maxillary surgery:
the best way to treat Class III problems

Clearer view of stability

Limitations:

(1) Longer move less stable

(2) Somewhat less predictable than ideal

Maxilla up
Mandible forward
Maxilla forward
Mx up + Mn forward
Mx forward + Mn back

Two-jaw surgery: especially needed for combined a-p and vertical excess problems

Clearer view of stability

What's the difficulty with the problematic procedures?

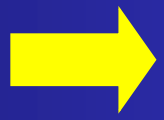
Largely a problem of controlling ramus inclination at surgery

Maxilla up
Mandible forward
Maxilla forward
Mx up + Mn forward
Mx forward + Mn back
Mandible back
Maxilla down
Maxilla wider

Clearer view of stability

What's the difficulty with the problematic procedures?

Limited by muscle force, soft tissue stretch



Maxilla up
Mandible forward
Maxilla forward
Mx up + Mn forward
Mx forward + Mn back
Mandible back
Maxilla down
Maxilla wider

Surgical Orthodontic treatment planning

- Follow the guidelines of stability and relax soft tissue.
- But, for esthetics, some stretching of soft tissue may be desirable at the cost of stability.

Surgical Orthodontic treatment planning

- Orthodontic preparation for surgery must include *removal* of dental compensation (decompensation) for the skeletal deformity
- For this reason, orthodontic preparation for surgery often is the reverse of conventional orthodontic treatment

Surgical Orthodontic treatment planning

- Class III extraction pattern
  - Maxillary premolars
  - Decompensates flaring
  - Increase maxillary surgical movement
  - Finish with class II molars
- Class II extraction pattern
  - Mandibular premolars
  - Decompensates flaring
  - Increases mandibular surgical movement
  - Finish with class III molars

In Class II patients,
it may be necessary to
extract <u>Lower</u> premolars
Or use class III elastics

In Class III patients,
it may be necessary to
extract <u>upper</u> premolars
Or use class II elastics

Surgical Orthodontic treatment planning (Vertical Planning)

- To increase facial height
  - Mandibular osteotomy
  - Rotate chin down, gonion up
- To decrease facial height
  - Maxillary LeFort osteotomy
  - Rotate chin and gonion up

For a short face, deep bite Class II patient, where the orthodontist puts the lower incisor determines the ultimate face height

Surgical Orthodontic treatment planning

- Deep bite patients tend to have:
  - Post surgical leveling.
  - If extractions are done, some extraction space is left open prior to surgery.
  - The patient after surgery has a significant posterior open bite which the orthodontist closes via vertical elastics.
  - This increases the lower facial height of the deep bite patient.

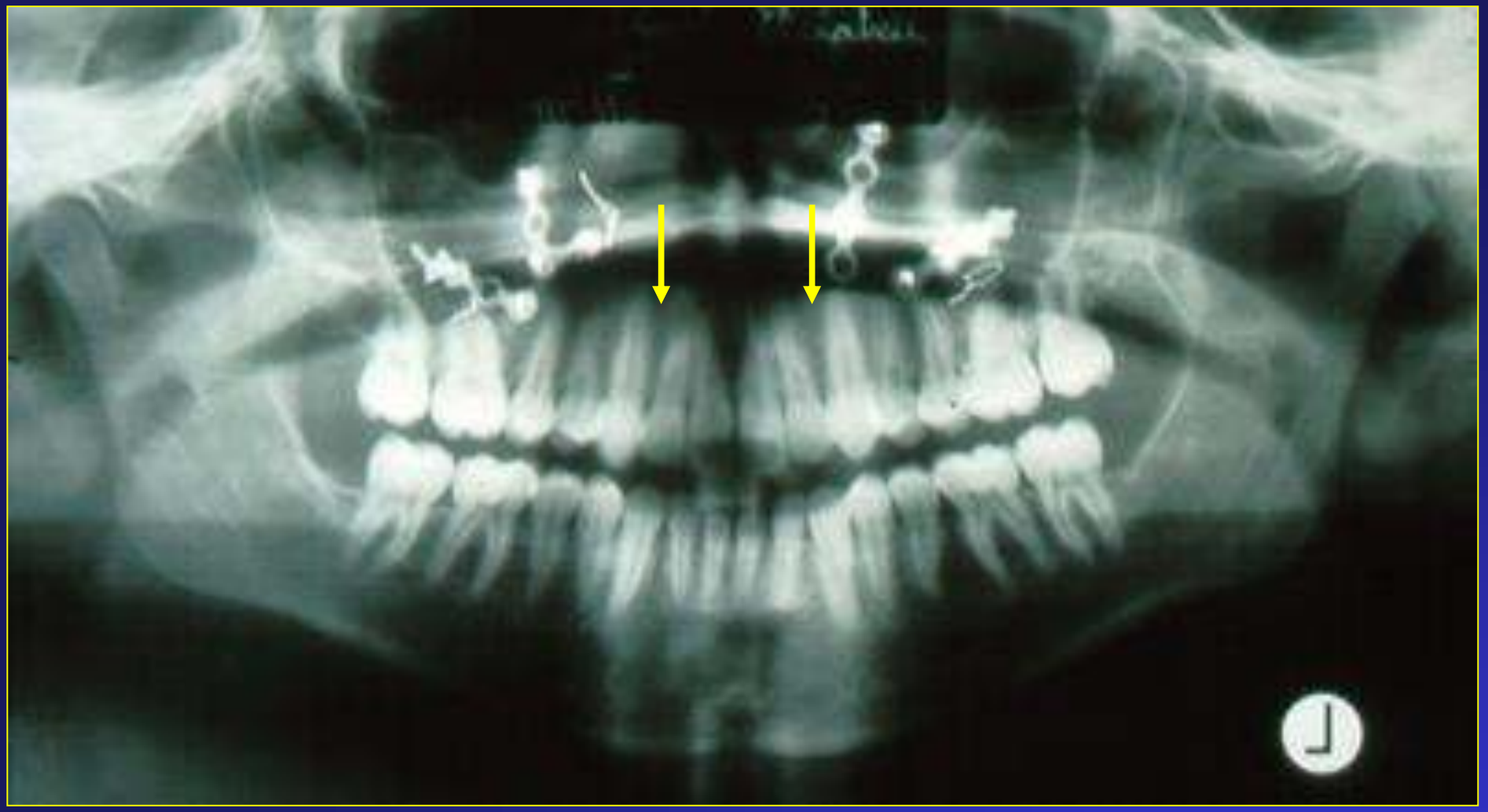
Surgical Orthodontic treatment planning

- Open bite patients tend to have:
  - Pre surgical leveling or surgical assisted leveling.
  - Tends to make the open bite significantly worse prior to surgery.
  - This allows the surgeon to establish the proper vertical dimension on the patient during surgery.

Osteotomy site

Skeletal open bite, prepared for surgical leveling of maxilla

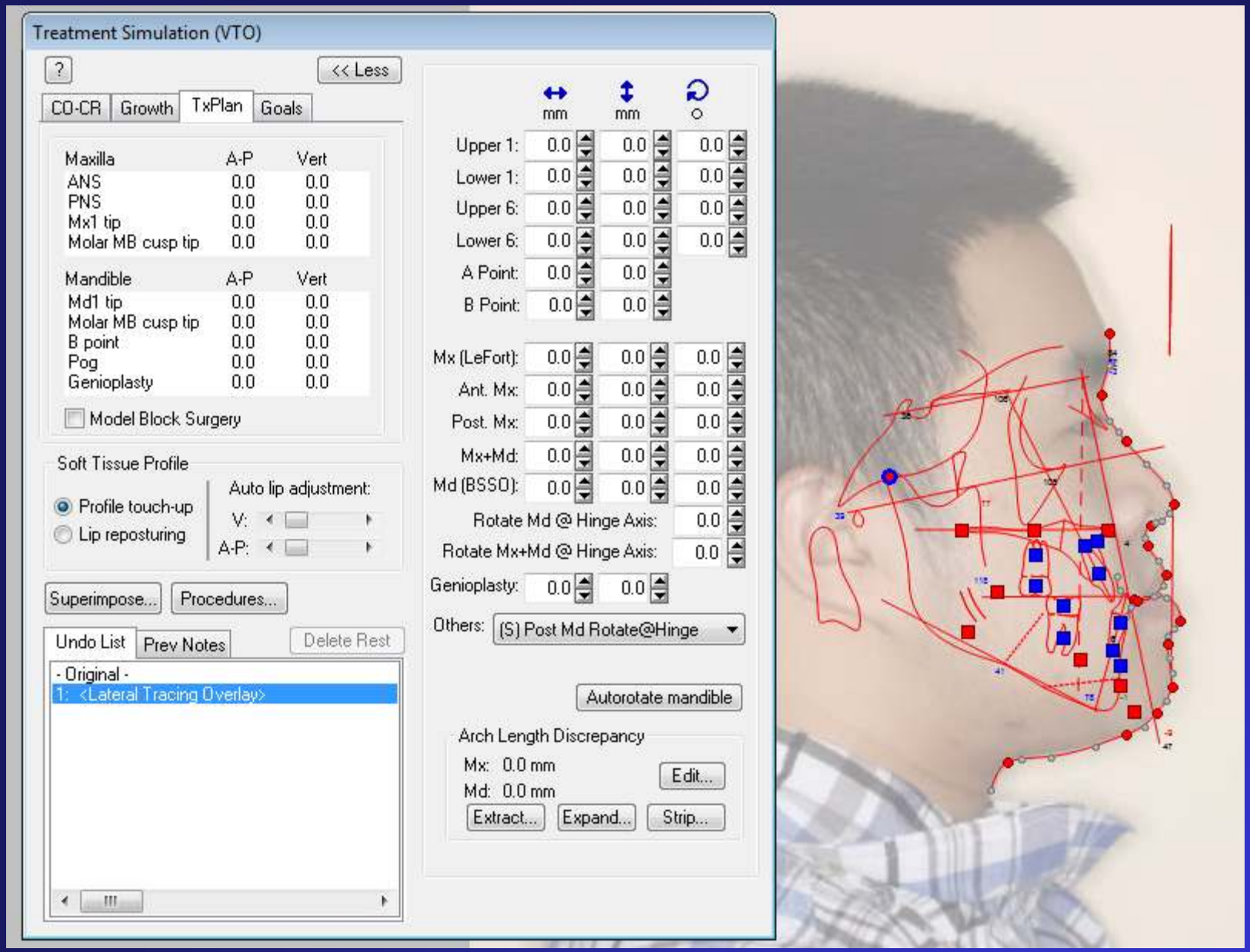
Postsurgical finishing after surgical leveling



Note the root divergence at the segmental osteotomy site

Bringing it together with digital treatment simulation

- Evaluate the potential stability of the possible surgical movements
- Use prediction techniques to evaluate potential outcomes
- Improve communication with the patient


Treatment Simulation (VTO)
?
<< Less
CO-CR
Growth
TxPlan
Goals
Maxilla A-P Vert
ANS 0.0 0.0
PNS 0.0 0.0
Mx1 tip 0.0 0.0
Molar MB cusp tip 0.0 0.0
Mandible A-P Vert
Md1 tip 0.0 0.0
Molar MB cusp tip 0.0 0.0
B point 0.0 0.0
Pog 0.0 0.0
Genioplasty 0.0 0.0
Model Block Surgery
Soft Tissue Profile
Profile touch-up
Lip reposturing
Auto lip adjustment:
V:
A-P:
Superimpose...
Procedures...
Undo List
Prev Notes
Delete Rest
- Original -
1: <Lateral Tracing Overlay>
mm
mm
Upper 1: 0.0 0.0 0.0
Lower 1: 0.0 0.0 0.0
Upper 6: 0.0 0.0 0.0
Lower 6: 0.0 0.0 0.0
A Point: 0.0 0.0
B Point: 0.0 0.0
Mx (LeFort): 0.0 0.0 0.0
Ant. Mx: 0.0 0.0 0.0
Post. Mx: 0.0 0.0 0.0
Mx+Md: 0.0 0.0 0.0
Md (BSSO): 0.0 0.0 0.0
Rotate Md @ Hinge Axis: 0.0
Rotate Mx+Md @ Hinge Axis: 0.0
Genioplasty: 0.0 0.0
Others: (S) Post Md Rotate@Hinge
Autorotate mandible
Arch Length Discrepancy
Mx: 0.0 mm
Md: 0.0 mm
Edit...
Extract...
Expand...
Strip...

Pre-Surgical Orthodontics

- *ORTHODONTIC APPLIANCE CONSIDERATIONS*

  - Edgewise, 18 or 22 slot
  - Headgear tubes max 1st molars
  - Auxiliary tubes max/mand 1st molars
  - No other special requirements
  - *Would you use porcelain brackets?*
  - *Would you use bonded brackets on 6's and 7's?*

Pre-Surgical Orthodontics

- *Establish incisor position*

Anterio-Posterior

Either exactly where they should be
at completion, or slightly over treated

CLASS II: UPPERS SLIGHTLY PROTRUSIVE
LOWERS SLIGHTLY RETRACTED

CLASS III: THE REVERSE

Pre-Surgical Orthodontics

- *Establish incisor position*

Antero-Posterior

Either exactly where they should be at completion, or slightly over treated

Vertical

No recent orthodontic extrusion (relapse tendency)

Pre-Surgical Orthodontics

- Obtain arch compatibility

Vertical -- *watch second molars*

LEVEL/DEPRESS LOWER 2ND MOLARS

DON'T ELONGATE UPPER 2ND MOLARS

Pre-Surgical Orthodontics

- Obtain arch compatibility

Transverse -- *watch arch form*

CANINE WIDTHS MAY NEED ADJUSTMENT

Several sets of study models taken prior to surgery will expose potential pitfalls

If the 2nd molars or canines are in the way at time of surgery the surgeon will correct by grinding in the operating room.

Pre-Surgical Orthodontics

- WHAT CAN WAIT UNTIL AFTER SURGERY?
  - *Extrusion (leveling)*
  - *Root paralleling*
  - *Minor crossbites (<1/2 cusp)*

- ***WHAT DO YOU HAVE TO DO BEFORE?***
  - *Intrusion*
  - *A-P incisor positioning*
  - *(Everything necessary to set it up for finishing in 6 months postsurgery)*

Final Surgical Planning

- When is the patient ready for surgery?

When the Orthodontist thinks the patient is ready for surgery!

Final Surgical Planning

- Stabilizing Archwires
  - Generally, stainless steel and fully engaged
- Soldered or welded lugs on the archwires
- Final records
- Final surgical prediction
- Model surgery (done by surgeon)

Final Surgical Planning

- Stabilizing Archwires

GOAL: Prevent tooth movement

Full dimension edgewise

18 slot: 17 x 25 steel

22 slot: 21 x 25 TMA or steel

Final Surgical Planning

Integral hooks on cast brackets

EASY TO KNOCK BRACKET OFF IN O.R.

Soldered (or welded) lugs on arch wires

LAB TIME NEEDED--but very good for surgeon

Slide-on hooks on arch wires

EASY TO USE--easy to distort arch wire

Kobayashi hooks

NOT STIFF ENOUGH--too easy to bend?

Soldered surgical lugs

Final Surgical Planning

So what should the orthodontist use?

Whatever makes the surgeon happy!

Final Surgical Planning

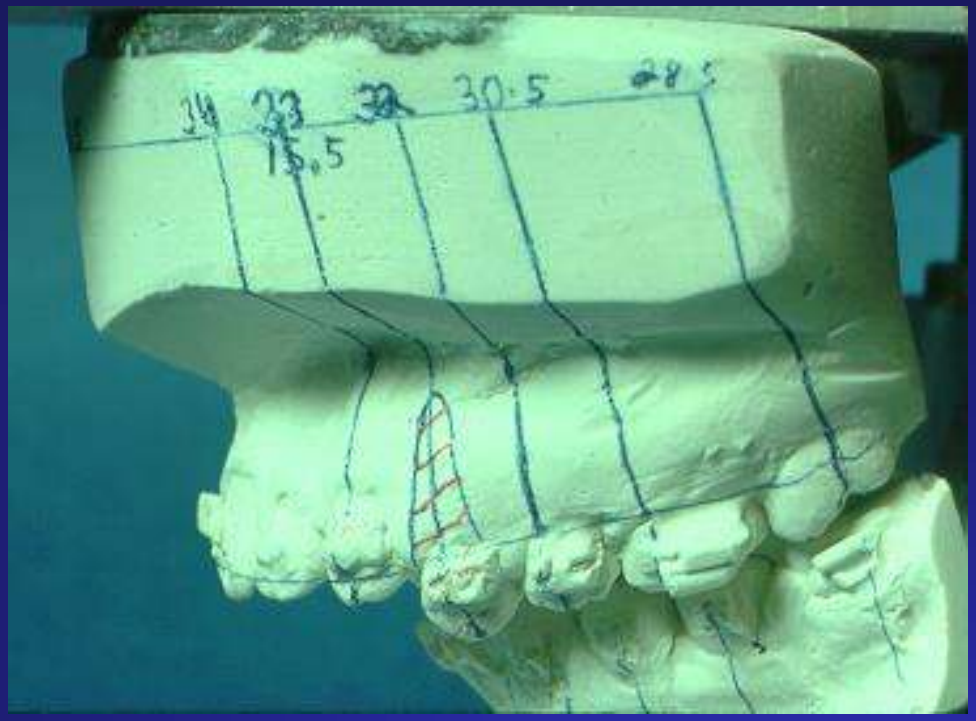
- Pre Surgical Records
  - *Ceph, pan*
  - *Photos*
  - *Articulator-mounted casts?*
- Final Planning
  - *Cephalometric prediction*
  - *Model surgery*

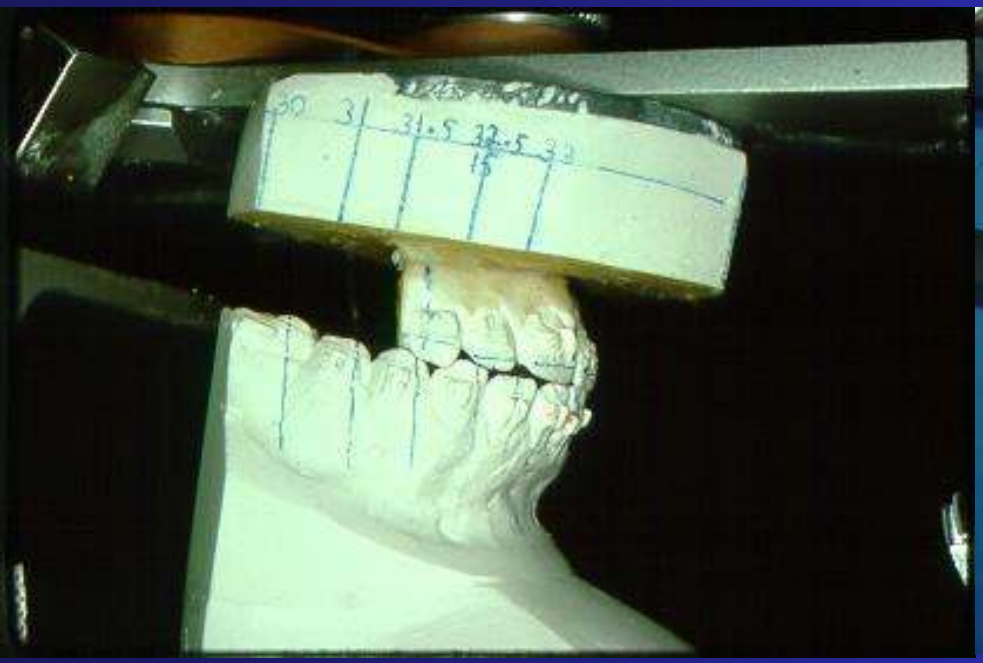
Surgeon or orthodontist

can do cephalometric prediction

Surgeon

should do model surgery


30.5
15.5



Final Surgical Planning

It's important
for the orthodontist
to see the results
of the model surgery

Details of the occlusion that make no difference to the surgeon can greatly affect time in finishing

Final Surgical Planning

- Surgical Splint

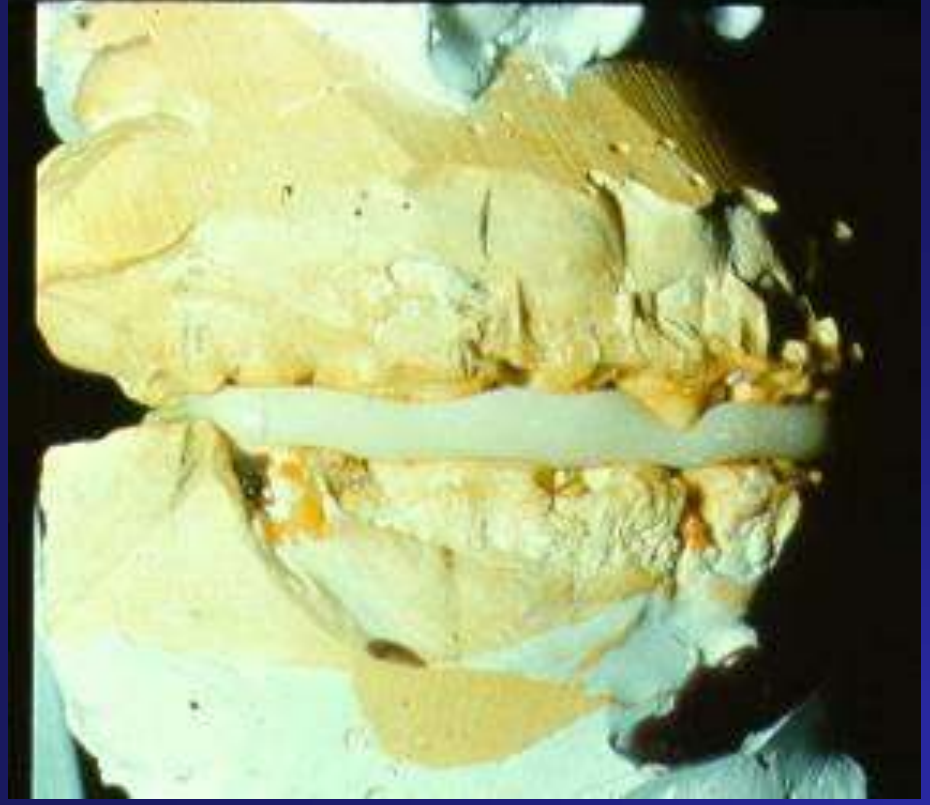
  Advantages:

  less reliance on surgeon's judgment as to placement in the O.R.

  less presurgical orthodontics needed

  Guideline:

  <u>thin</u> splint preferred



TO AVOID SPLINT PROBLEMS:

1) Casts mounted firmly (plaster)

2) Stabilizing arch wires placed well before splint impression

- ***Full dimension steel wires 4-6 weeks before surgery***

- ***Splint impressions 1-2 weeks before surgery, while arch wires are in lab having lugs soldered***

3) Thin, not thick splints

Pre-surgical Delays

- Late decision for surgical tx
- Waiting for completion of growth
- Tooth movement(?)
- Communication with surgeon
- How to level, stabilize, etc.
  - Experience factor

Pre-Surgical Orthodontics

- Do only what is necessary!

As a general rule, it should not take more than a year to get a patient ready for orthognathic surgery.

A complete and thought out orthodontic plan is critical to a successful surgical outcome

Post-surgical Delays

- inadequate presurgical preparation
- surgical problem, tooth movement needed to compensate
- how to ….

Early replacement of stabilizing arch wires is the most important single step in finishing

Postoperative Expectations

Lots of swelling.

Short term paresthesia of infraorbital nerve (maxilla) and inferior alveolar nerve (mandible).

Significant pain is uncommon due to paresthesia.

Usually 1 overnight hospital stay per jaw.

Potential Complications

Long term sensory impairment - more common in BSSO. 20% of young patients with increasing incidence with age.

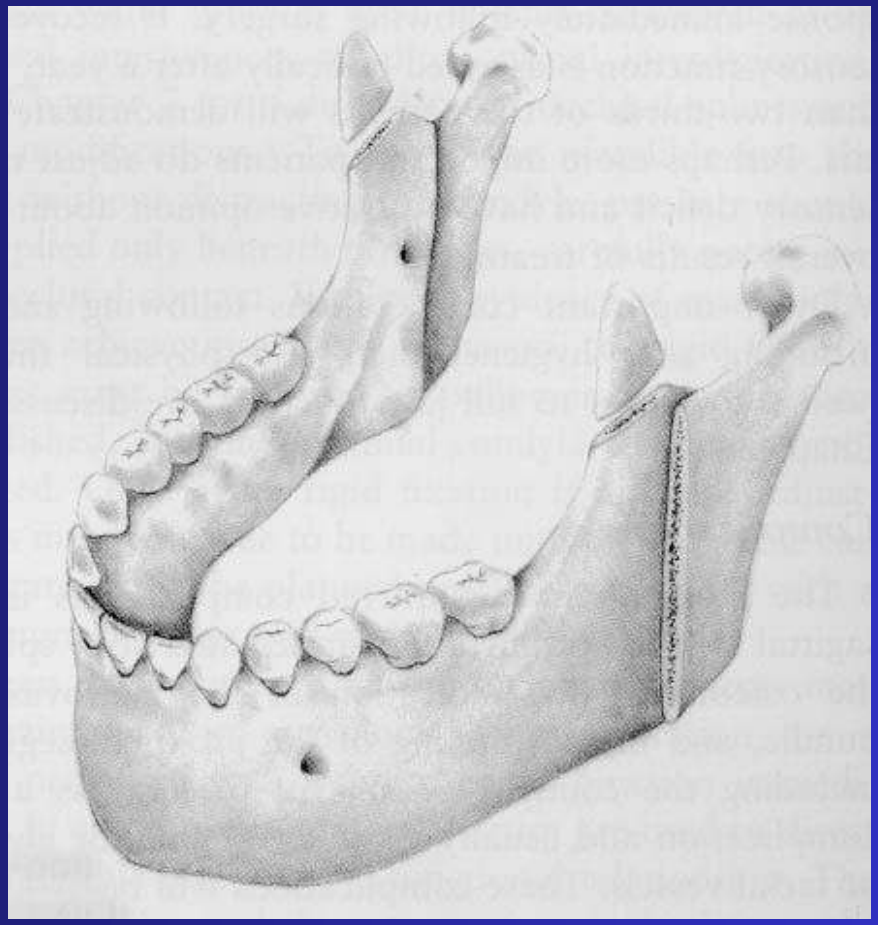
Relapse - condylar distraction, condylar resorption, soft tissue strain.

Mandibular Techniques

Intraoral Vertical Ramus Osteotomy (IVRO)

Advantages	Disadvantages
Lower incidence of nerve injury	Requires MMF
	Setback only

Vertical Ramus Osteotomy



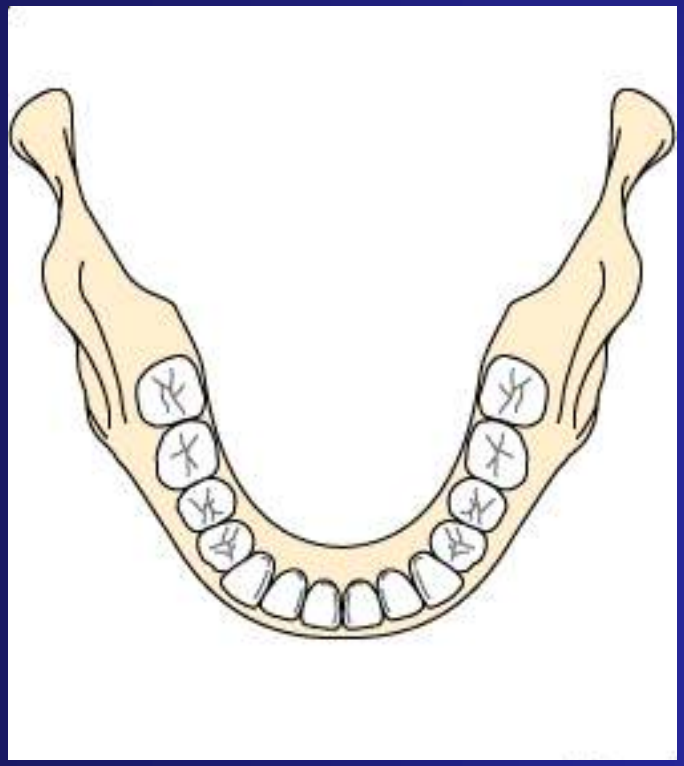
Mandibular Techniques

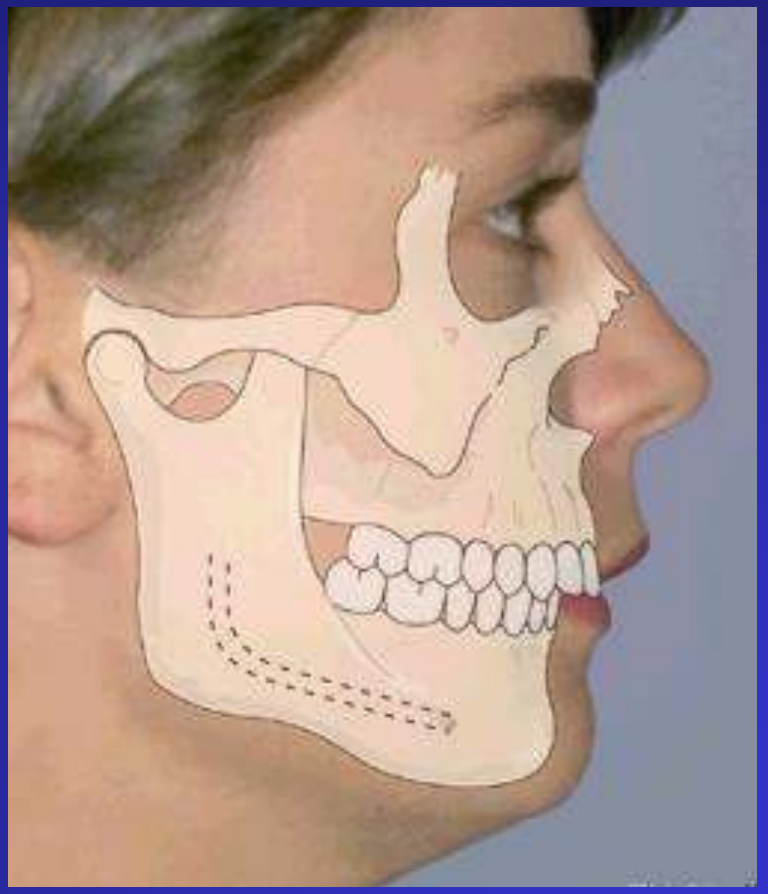
Bilateral Sagittal Split Osteotomy (BSSO)

Advantages	Disadvantages
Versatility	Nerve Injury
MMF usually not necessary	

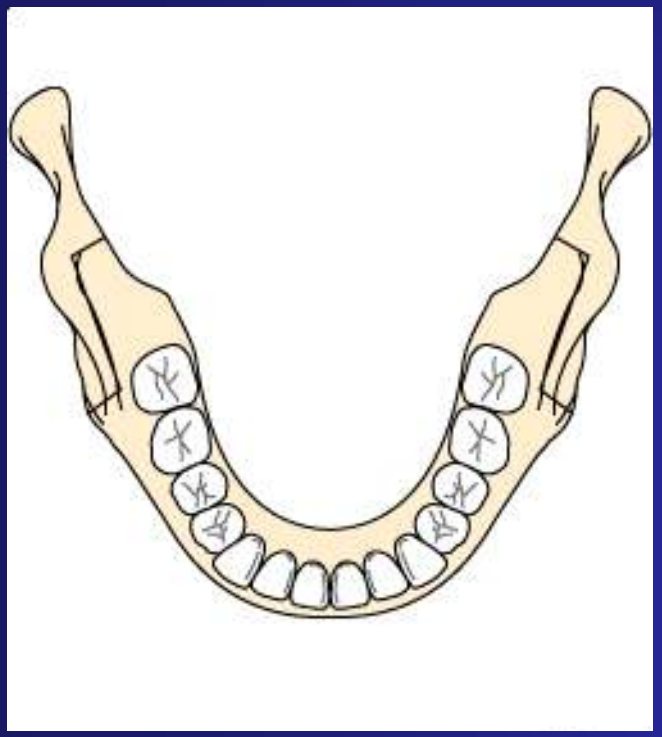
Consider the mandible, a-p and vertical

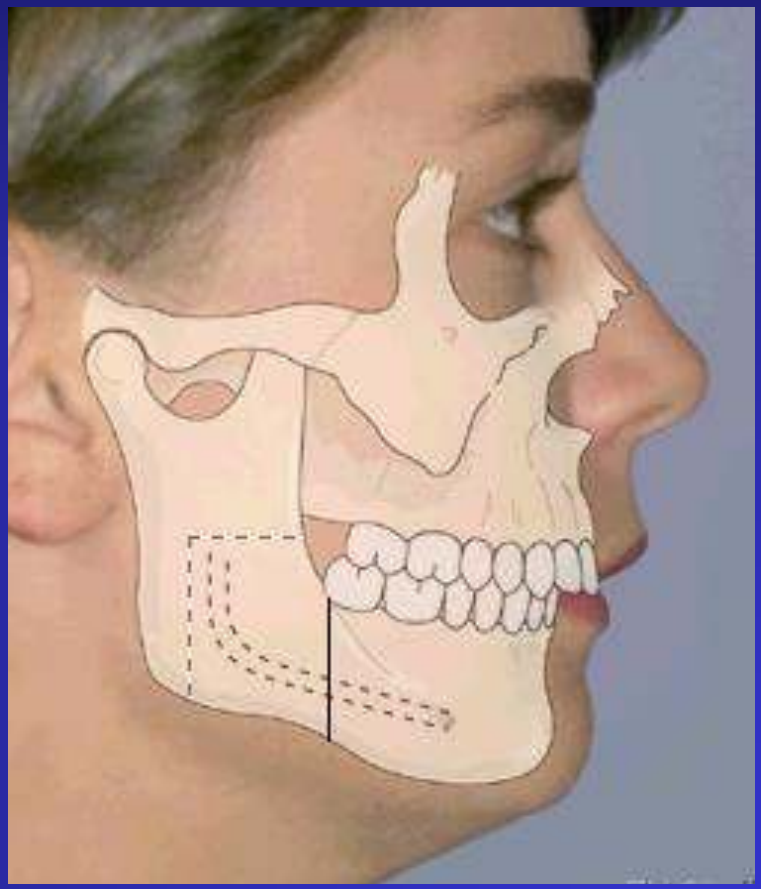
Bilateral Sagittal Split Osteotomy



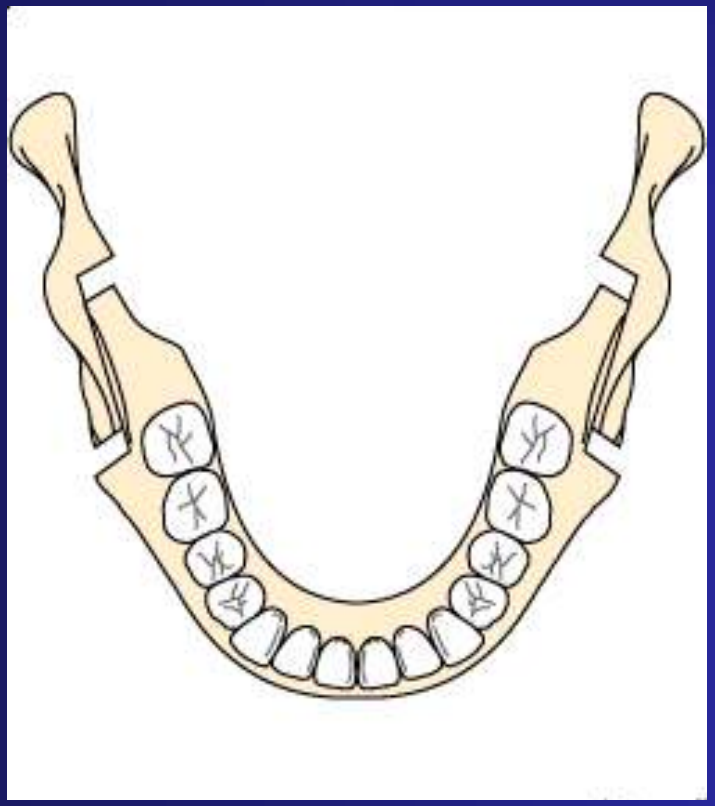


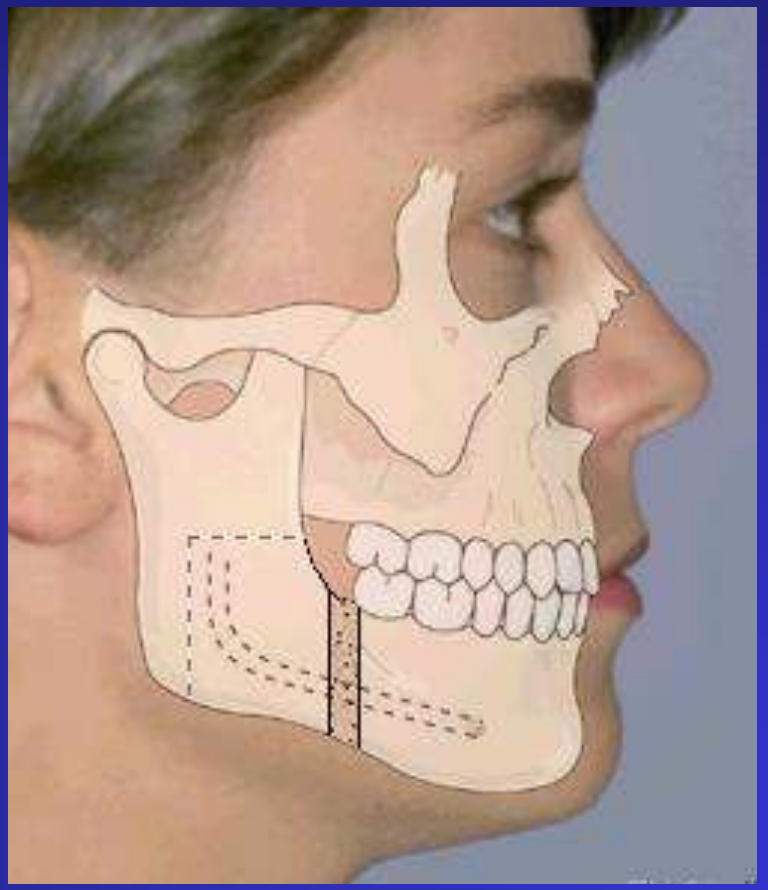
Bilateral Saggital Split Osteotomy



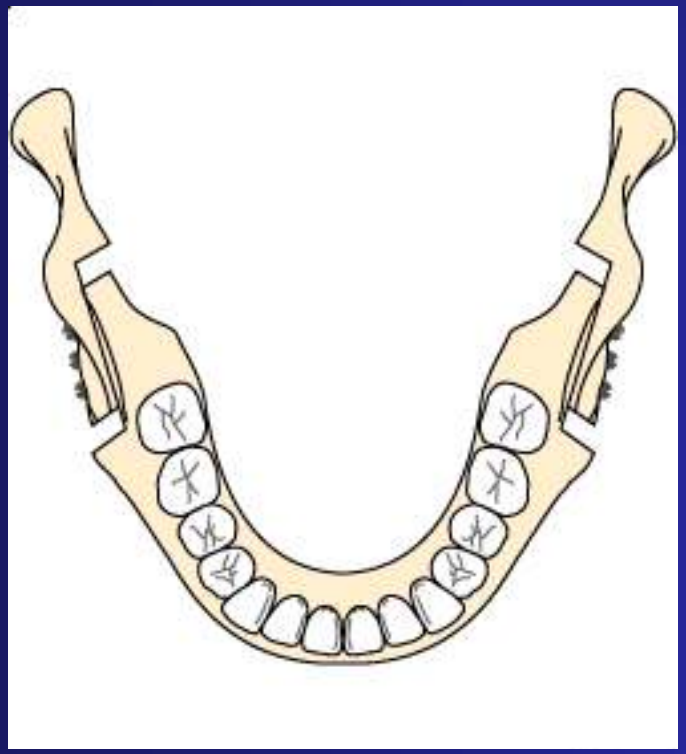


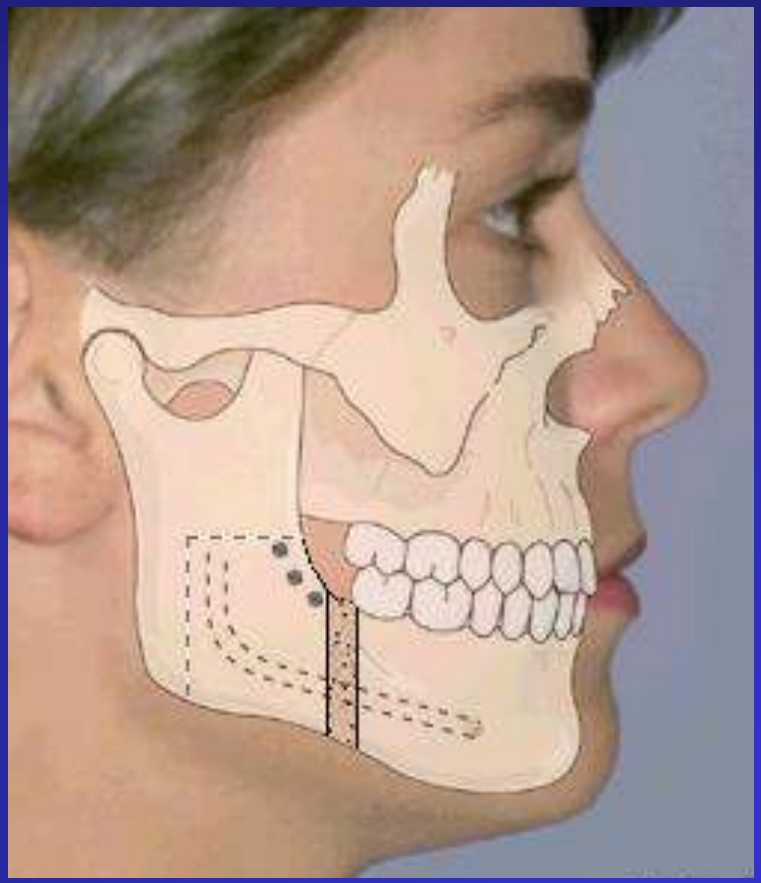
Bilateral Saggital Split Osteotomy





Bilateral Saggital Split Osteotomy



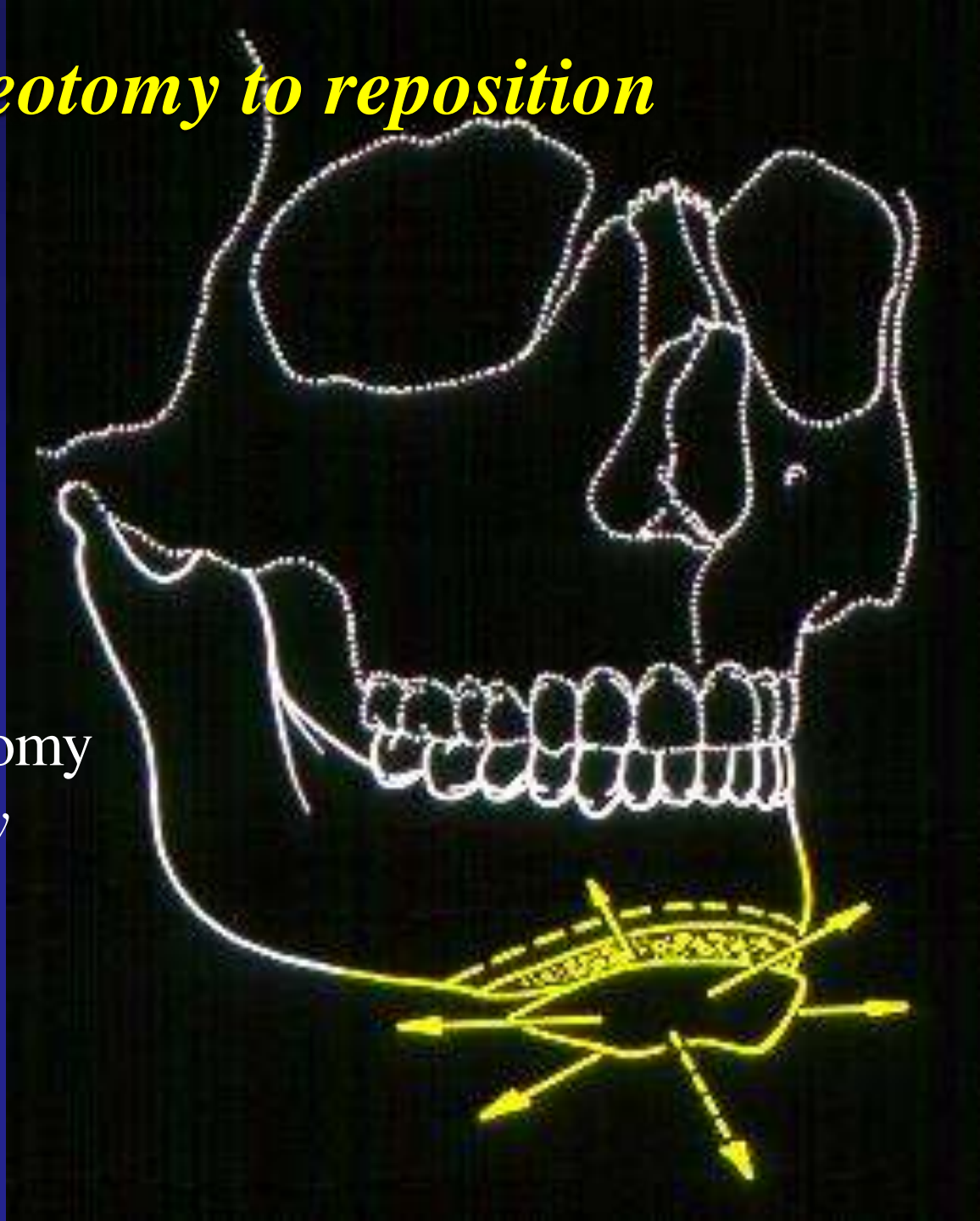


Mandibular Techniques

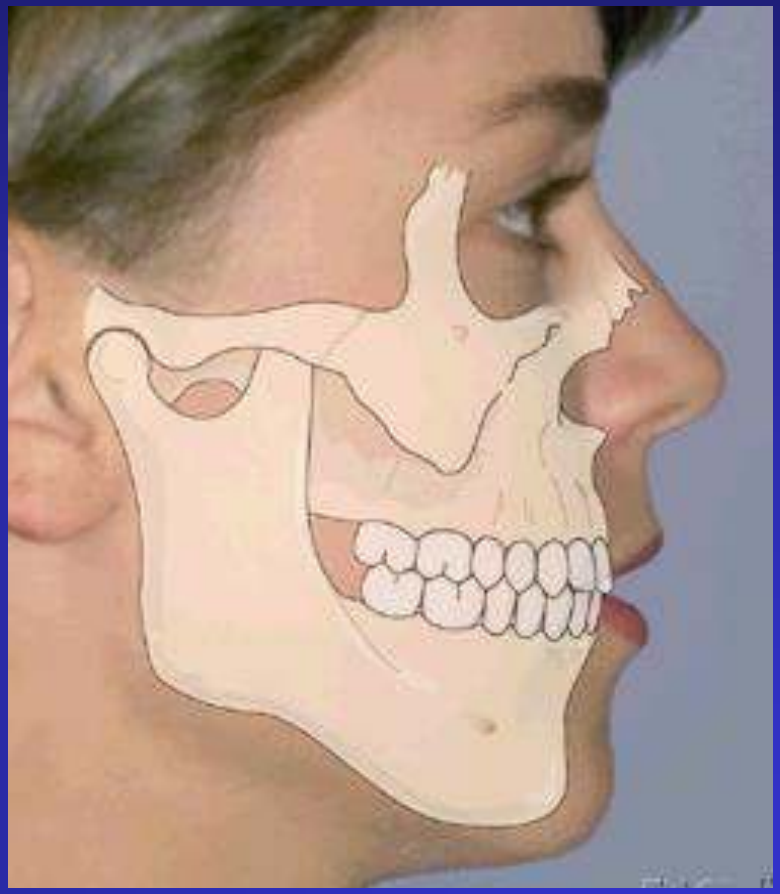
- Genioplasty
  - Osteotomy vs. implant
  - Osteotomy is highly versatile allowing for movement of the chin in all directions.
  - Implant can only augment chin.
  - Reports of bone resorbtion under implants.

Lower border osteotomy to reposition

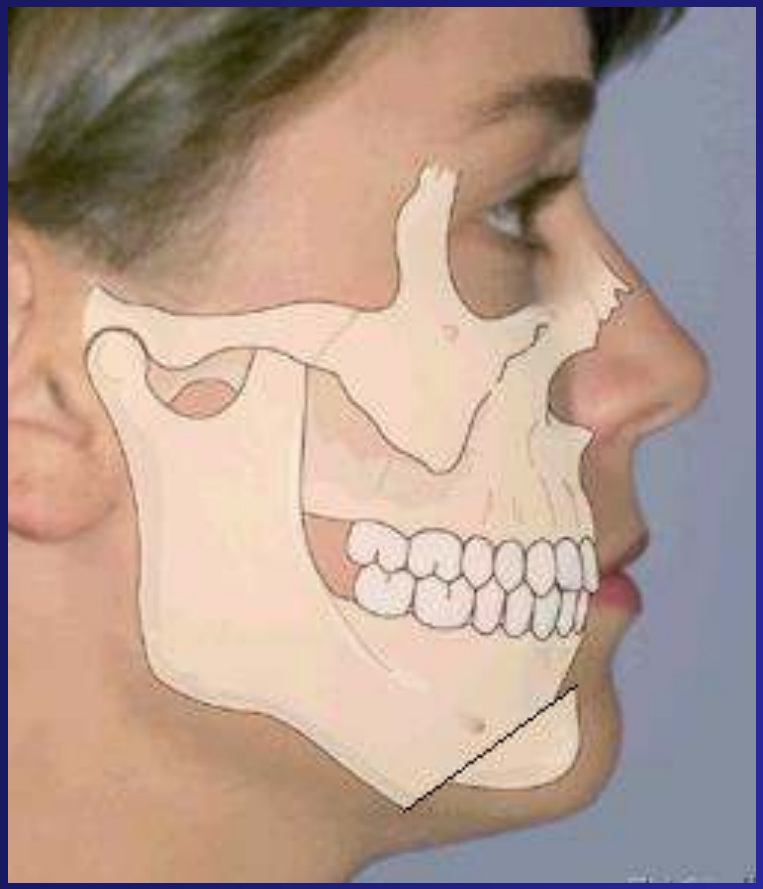
UP (Wedge reduction)
FORWARD
*Lower border osteotomy or implant *osteotomy preferred*)
TRANSVERSELY (Back)

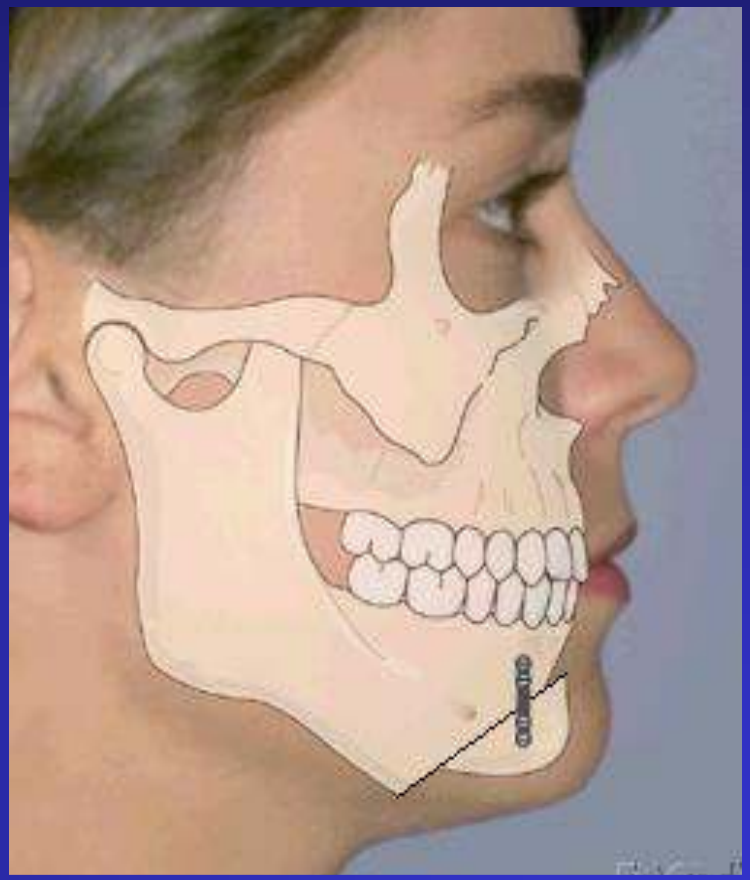


Genioplasty



Genioplasty





Maxillary Techniques

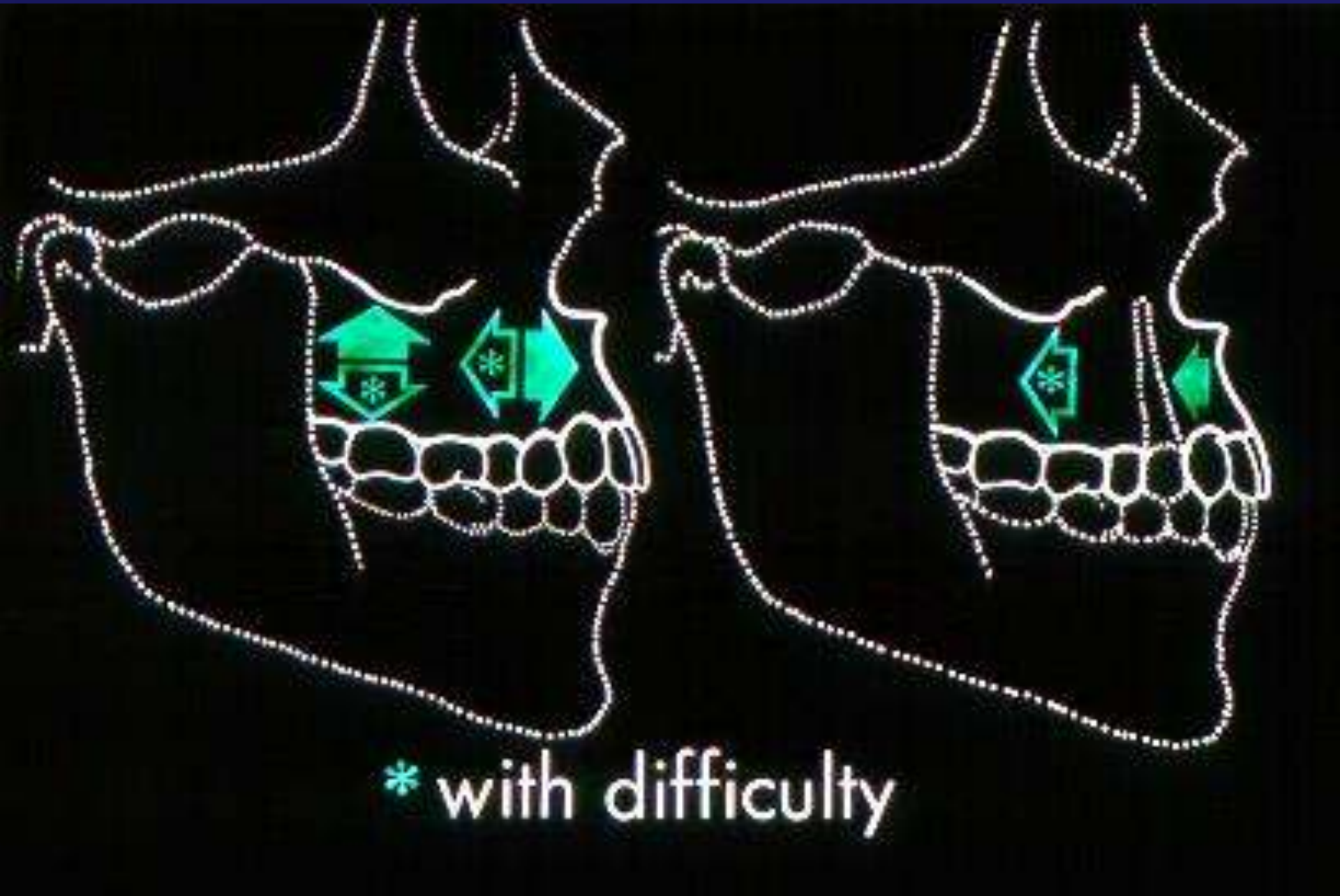
LeFort Osteotomy

- High degree of versatility - move superior, inferior, anterior, posterior.

- Movements limited by anatomic structures, soft tissue.

- Large movements require grafting.

Consider the maxilla, a-p and vertical...



Maxillary Techniques

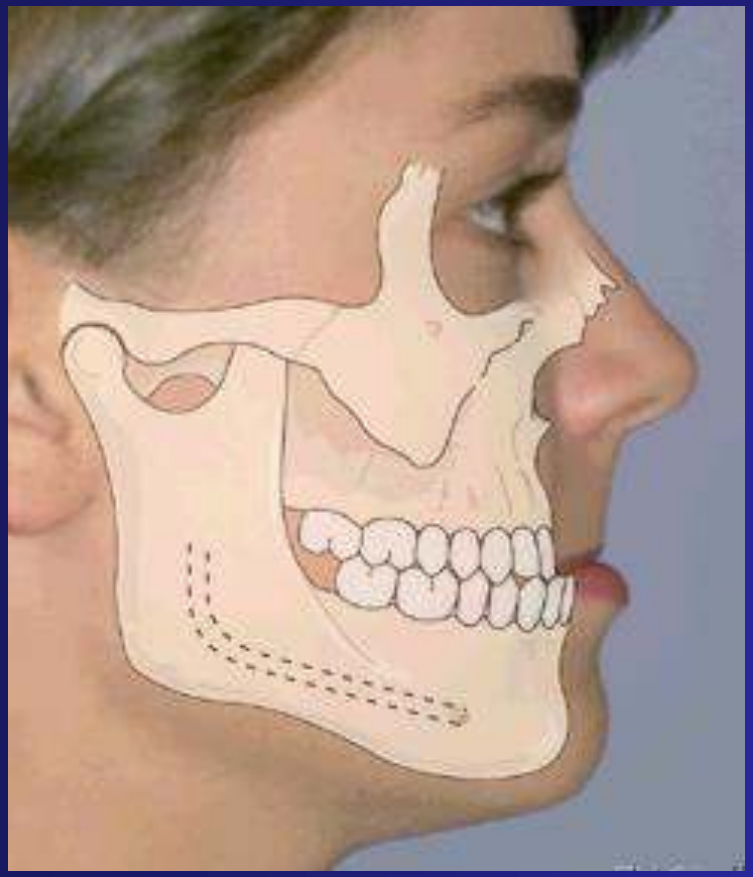
LeFort Osteotomy

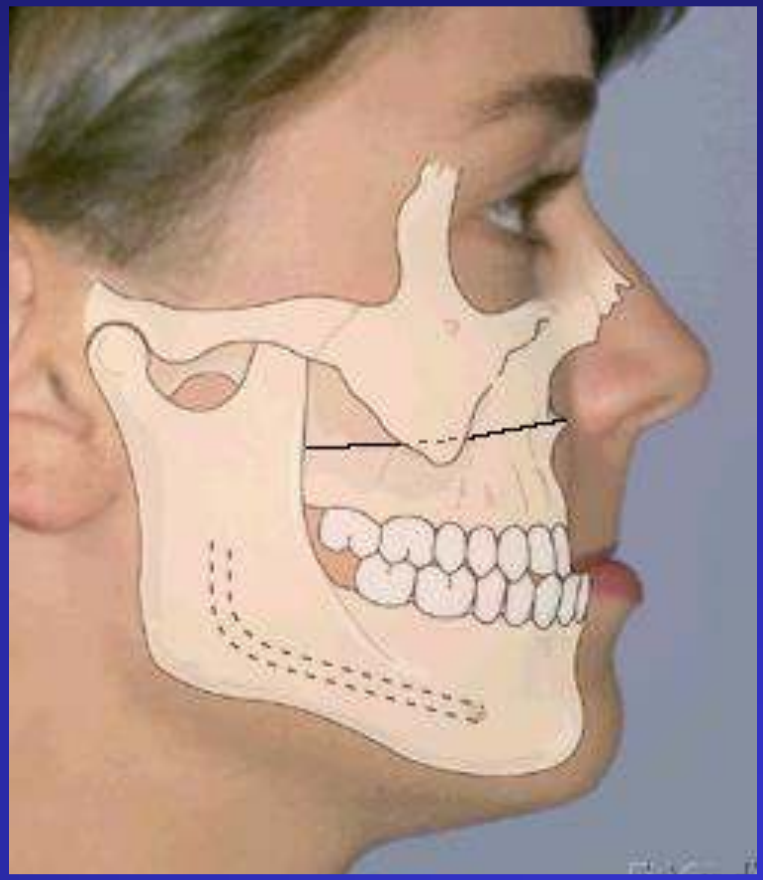
Blood supply from palatal soft tissue pedicle.

Dental injury is rare if osteotomy is kept 5mm above apices.

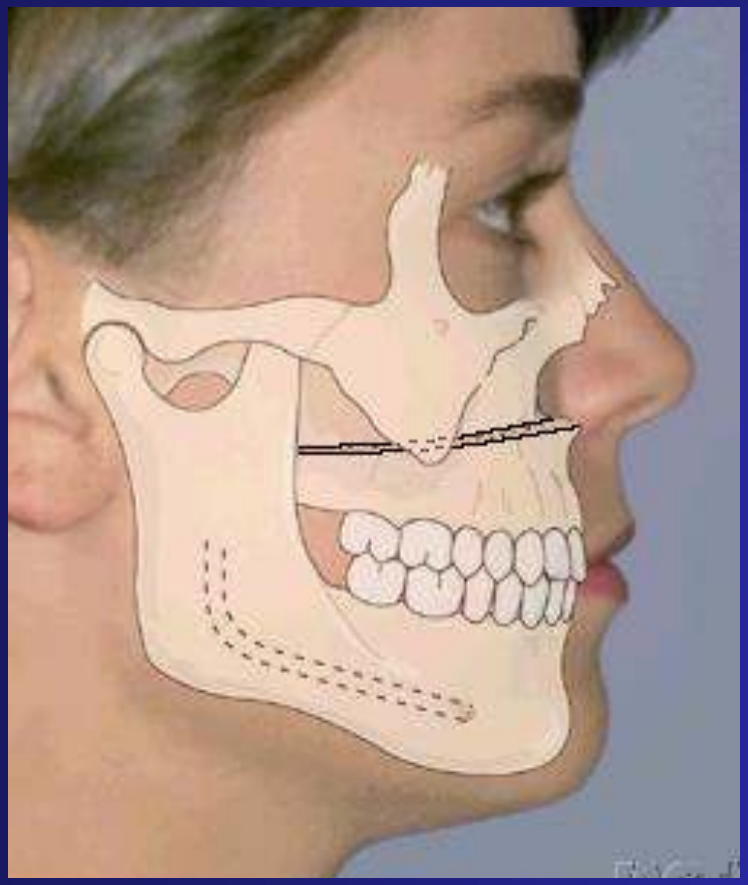
May be segemented into 2-3 pieces.

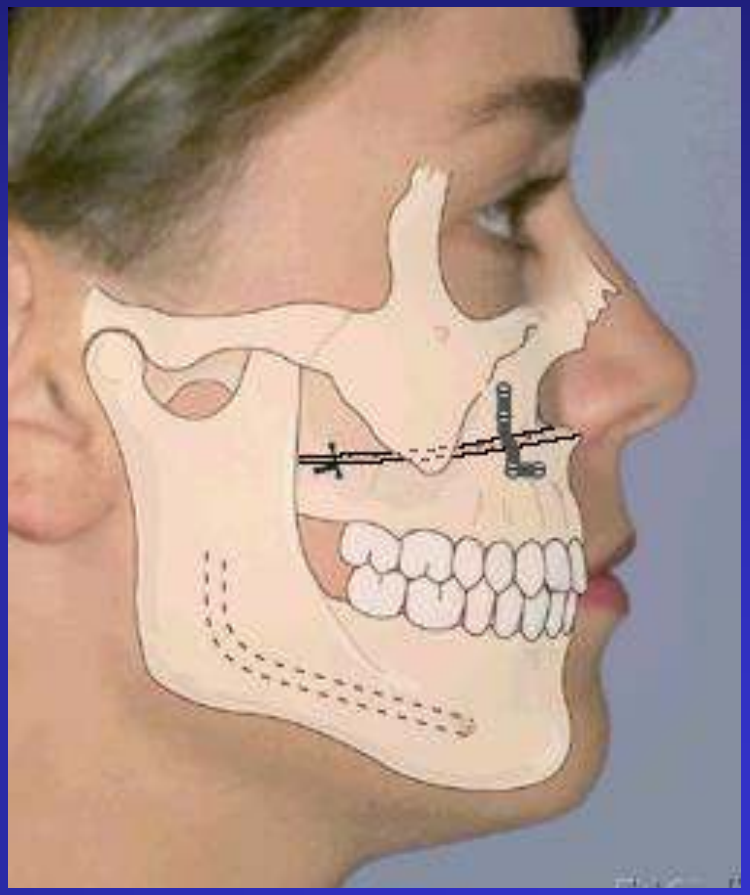
LeFort I Osteotomy

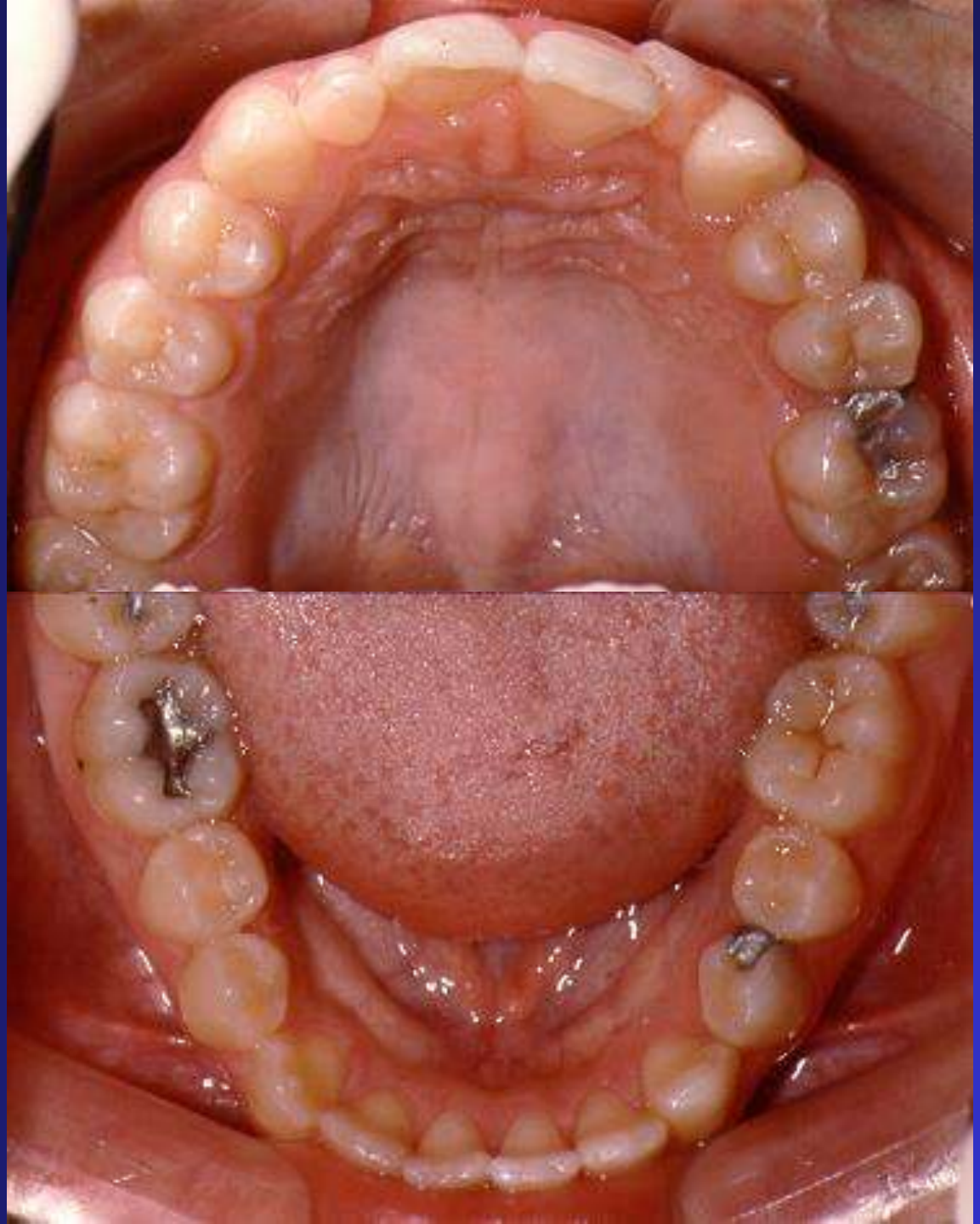


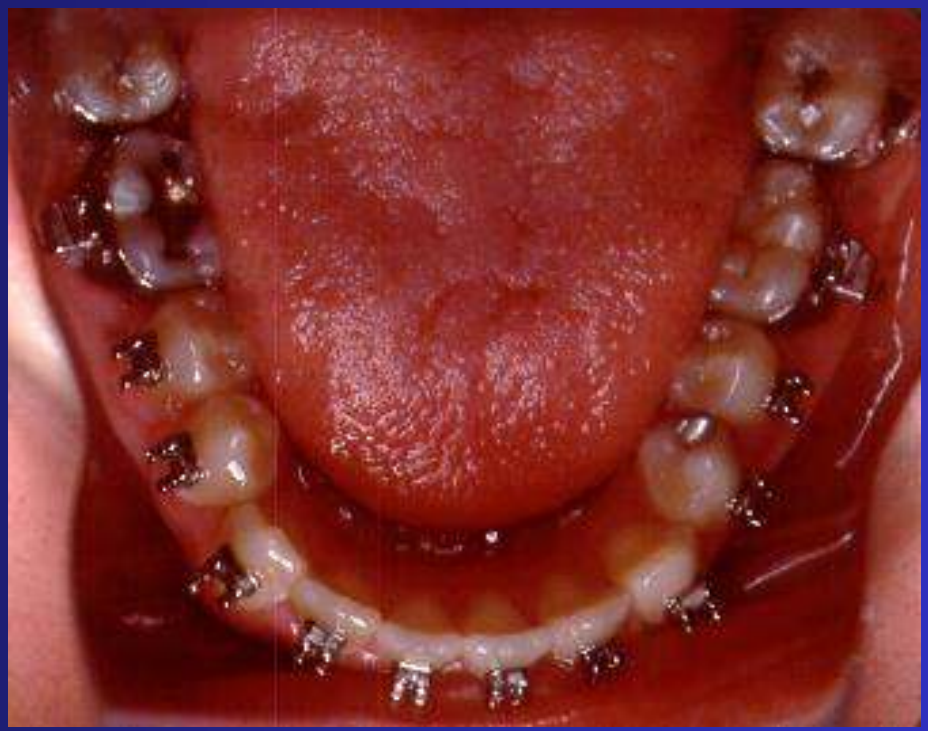


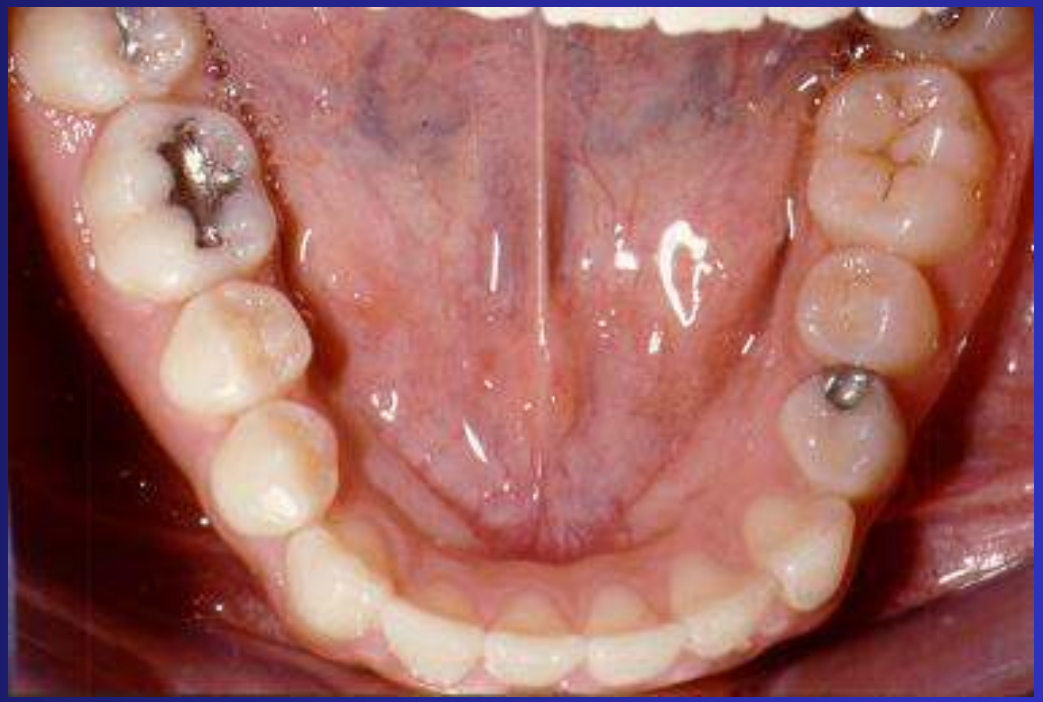
LeFort I Osteotomy











Transverse Discrepancy

Choices to surgically widen maxilla:

- Surgically-assisted rapid palatal expansion followed by LeFort osteotomy
- Segemental LeFort osteotomy

Surgically-assisted RPE vs. Segmental Osteotomy

- Surgically-assisted RPE – two surgeries, better stability?

- Segmental LeFort osteotomy – one surgery, amount of expansion limited by soft tissue.

Surgically-assisted RPE vs. Segmental Osteotomy

Pattern of expansion is different.

RPE: *(surgically assisted or not)*

Opens on a posterior hinge --

more expansion at premolars than molars.

Segmental Maxillary Osteotomy:

Opens on an anterior hinge --

more expansion at molars than premolars.

Two-Jaw Surgery

Indications

- Deformities in both maxilla and mandible.

- Deformity in one jaw requiring a large, unstable movement.

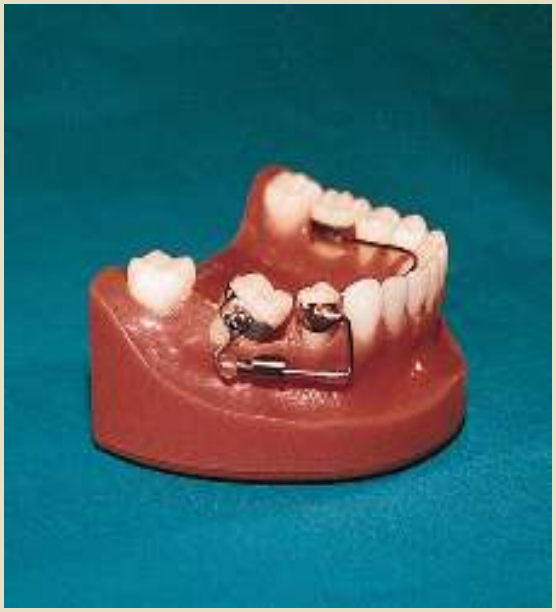
ANY QUESTIONS ?

- Molar Uprighting
- Impacted and Ectopic Canines
- Forced Eruption

Luisa Betancur DMD

MOLAR UPRIGHTING

Molar Uprighting



Reason:

-Loss of 1st molar without space maintenance

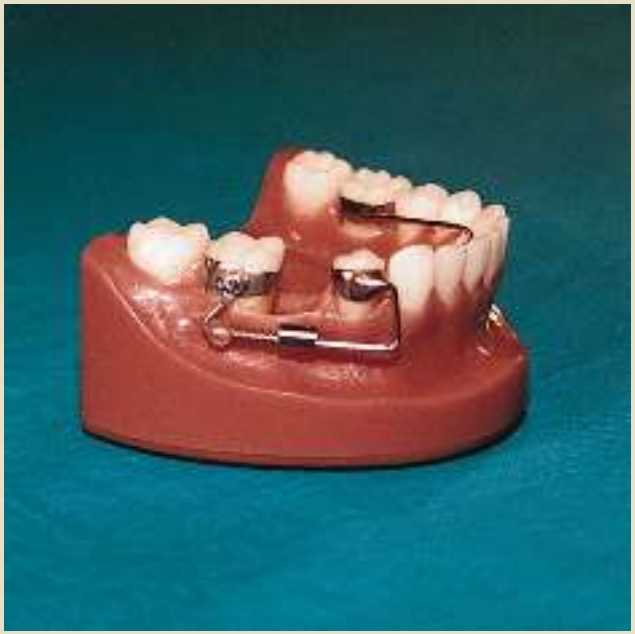
Problems:

-Deep pockets

-Plaque control

-Axial inclination

Molar Uprighting



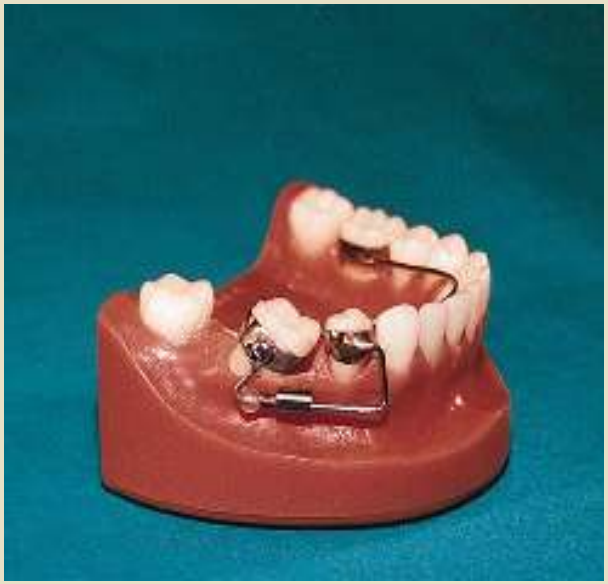
Objectives

- 1) Restore normal tooth position
- 2) Improve periodontal health
- 3) Simplify restorative efforts and enhances prosthetic designs

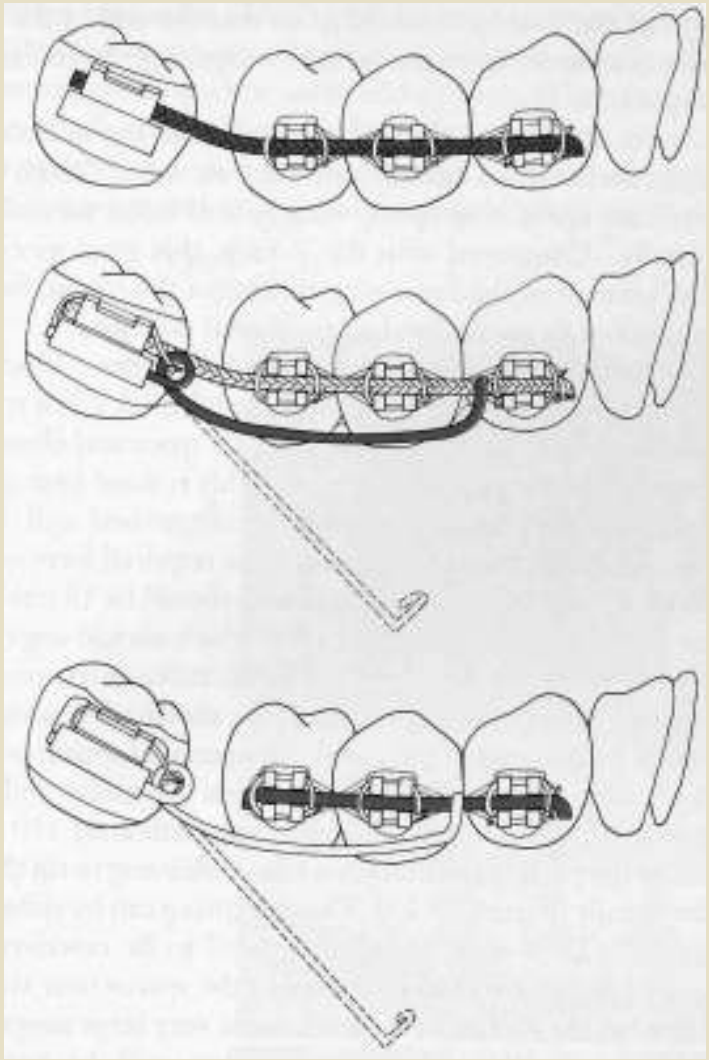
Pretreatment Considerations

- Remove third molars?
- Where should the crown go and where should the root go?
- Final occlusion
- Close spacing first

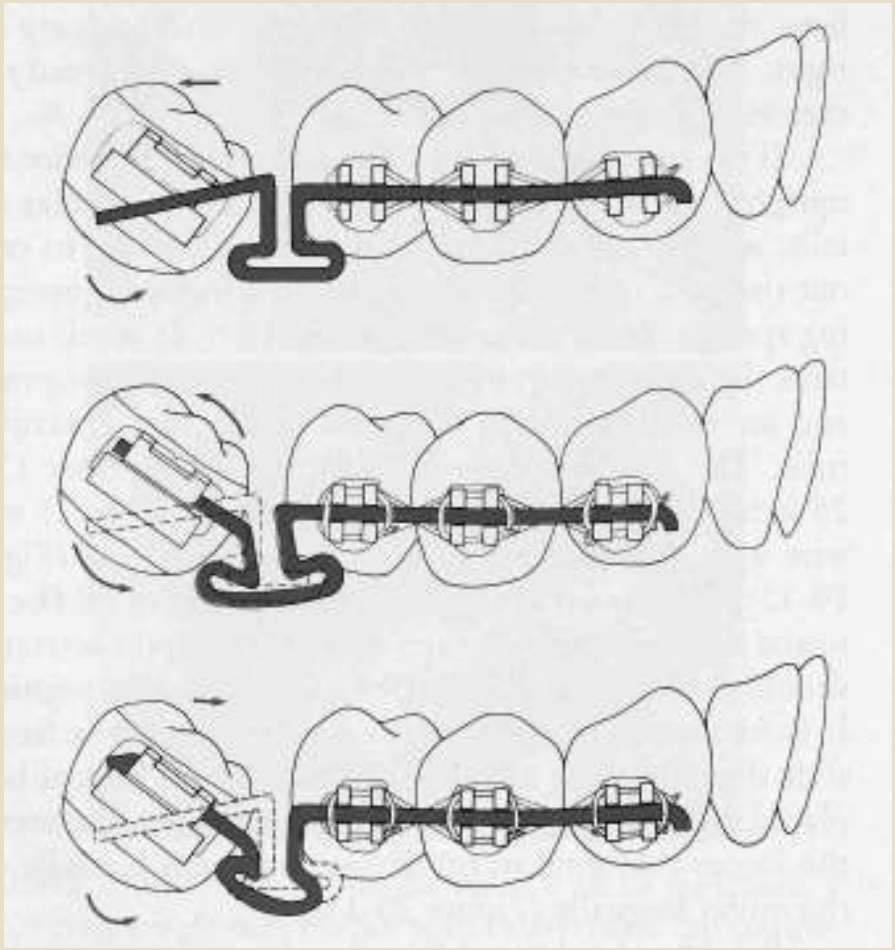
Methods



- Should include a stabilizing anterior segment
  - Lingual arches, bands and bonds
- Helical uprighting springs with LLAs
- T-loop springs with LLAs
- Compressed coil springs
- NiTi wire



Helical Uprighting



T-Loop Uprighting

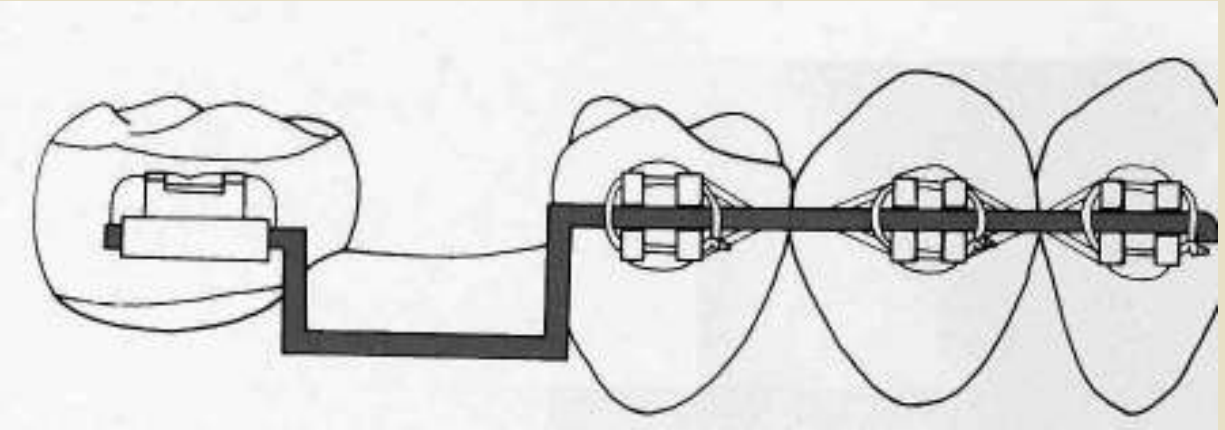
Clinical problems

- Soft tissue irritation from loops.
  - Keep them parallel and 1mm buccal to soft tissue
- Excess mobility may occur with over activation or occlusal interferences.
  - Use bite plate
- Plaque retention and/or poor home care
  - OHI

Treatment time

- Simple uprighting by tipping can be completed in 8-10weeks.
  - Occlusal interferences can prolong treatment.
- Uprighting with mesial root movement can take up to 20-24 weeks.

Retention



- It is important to allow reorganization of the PDL.
- Fixed prosth within 6 weeks of uprighting

IMPACTED AND ECTOPIC CANINES

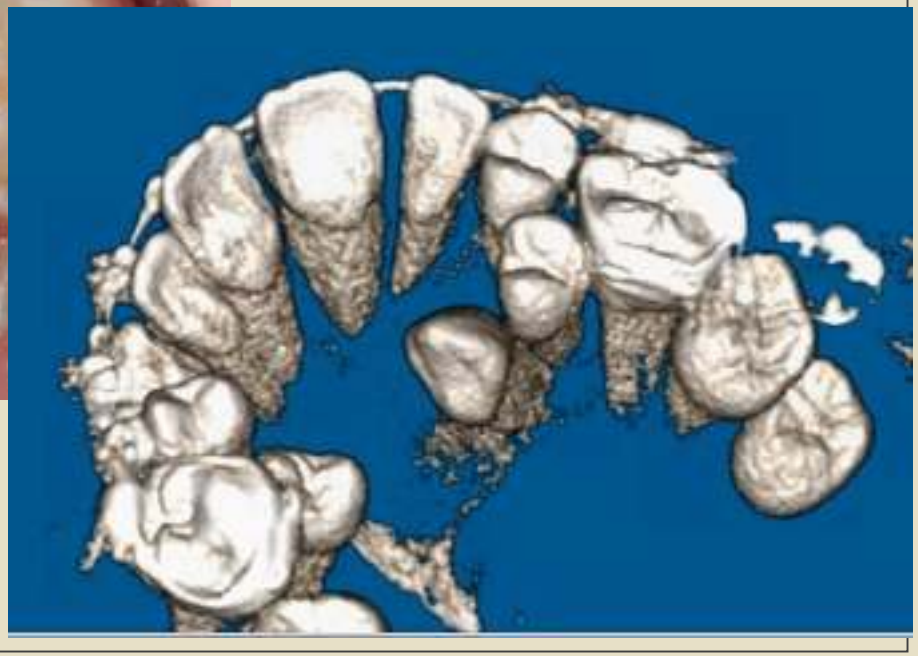
Impaction versus Ectopia ★

Impaction: A tooth that has failed to erupt or is partially erupted

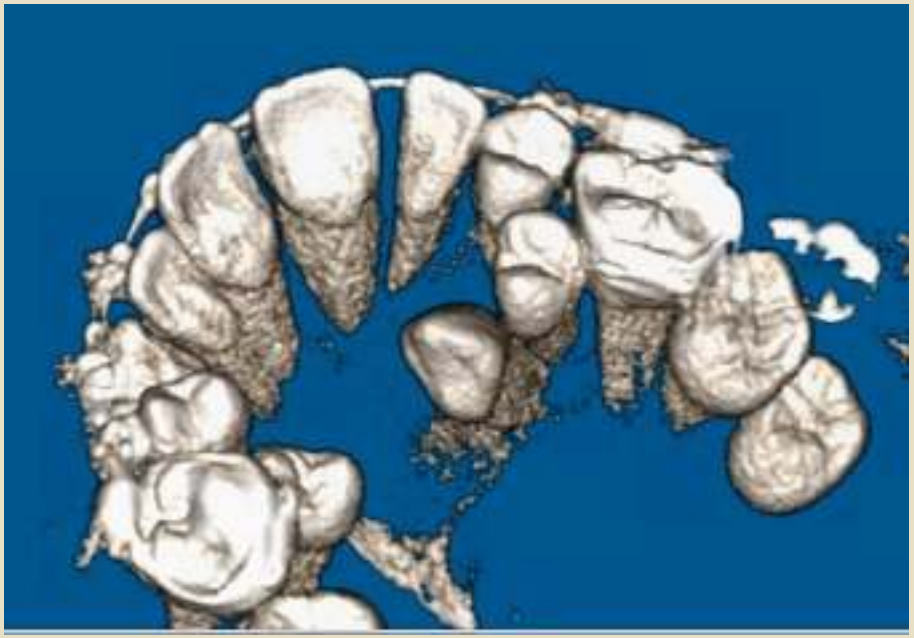
Ectopia: Eruption in an abnormal position (ie. Transpositions)

Ectopic eruption leading to a transposition

Ectopic eruption

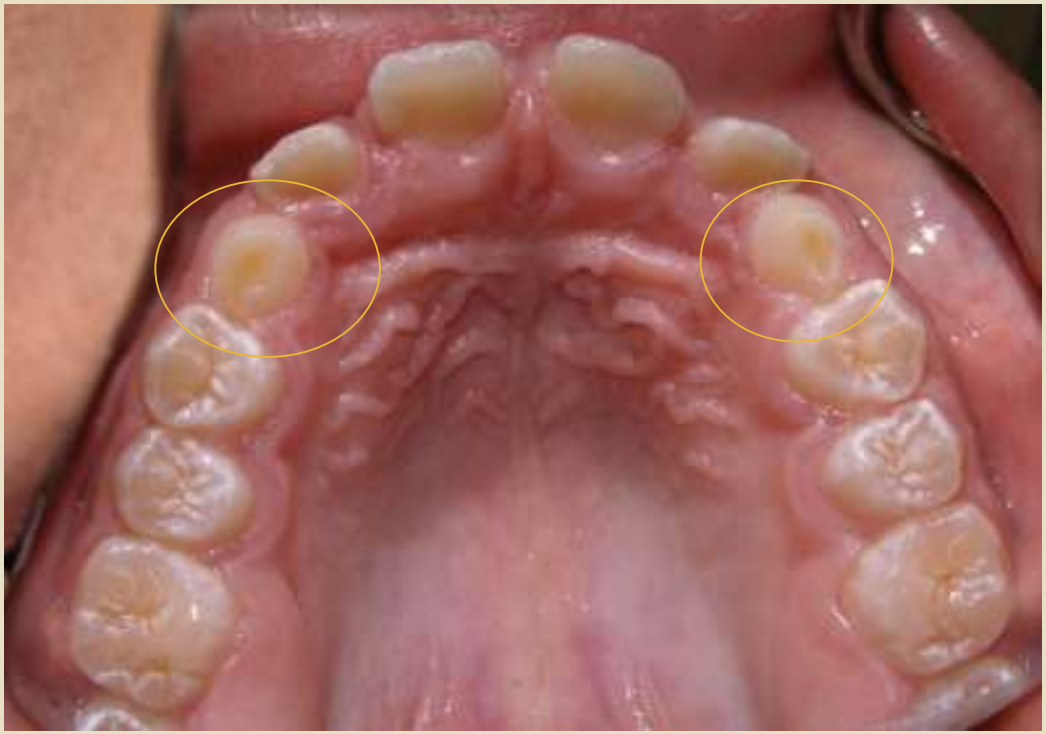


Impaction



- Know the possible etiologies of impacted teeth
- Understand the force systems involved in bringing in an impacted tooth
- Know the anchorage requirements used in treatment of an impacted tooth

Impactions



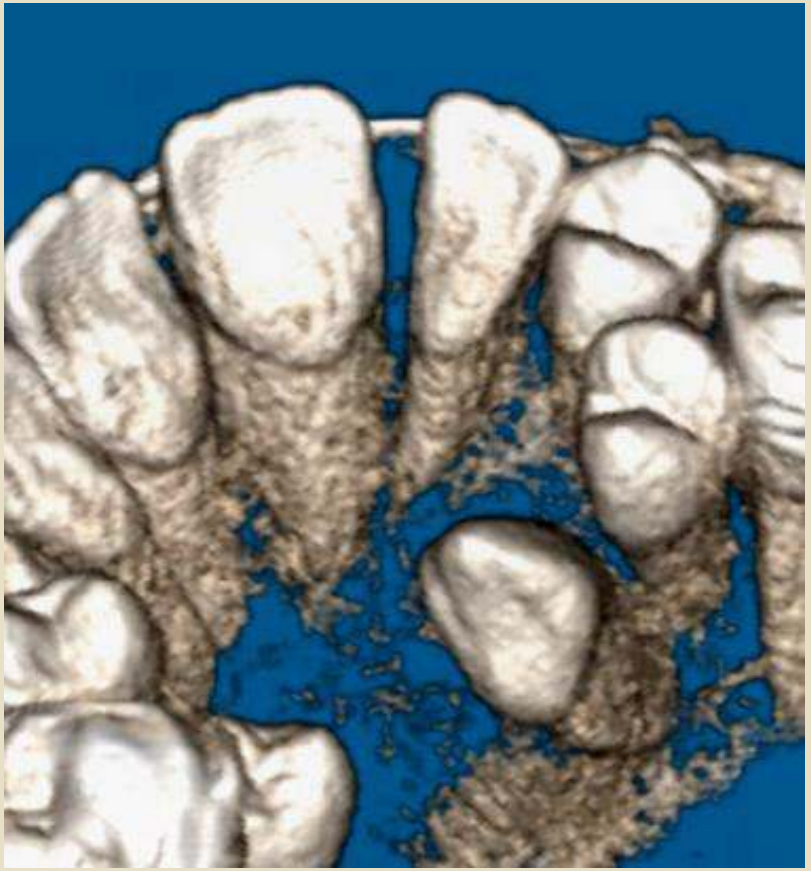
- **Excluding third molars**, Maxillary canines are the most commonly blocked out or impacted teeth; followed by 2nd premolars

Prevalence ★

- Females more than males
- Maxillary more than mandibular
- Left more than right
- Impaction more likely on palatal than facial

Frequency

1. Mandibular third molar
2. Maxillary canine
3. Maxillary third molar
4. Mandibular and maxillary second bicuspids
5. Maxillary central incisors



Impaction Facts

- Labial impactions, usually vertical (due to loss of space)
- Palatal impactions, usually horizontal
- Root resorption of adjacent teeth
- Dentigerous cyst (and ameloblastoma)

Importance of cuspids in the dental arches

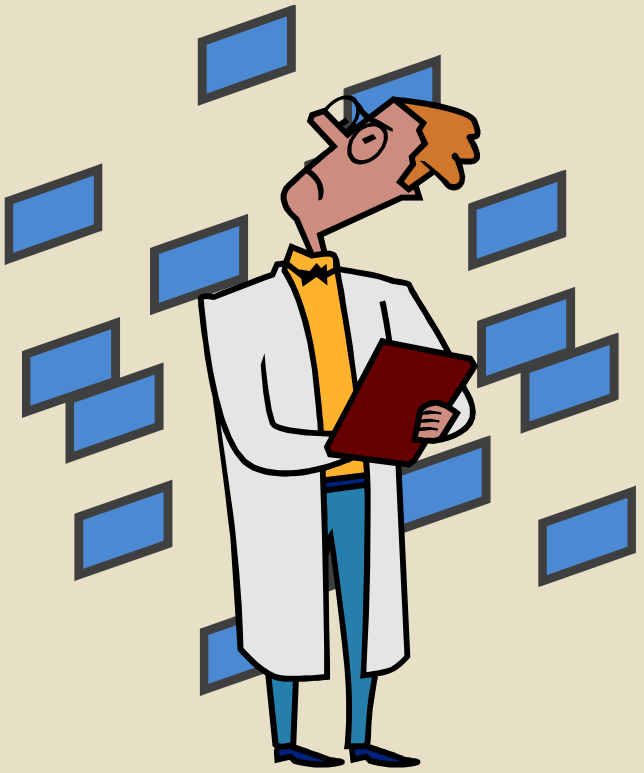
- One per quadrant
- Cornerstone of arch
- Occlusal relief
- Facial support

Permanent Canine Development

- First evidence of calcification, 4-5 months
- Crown formation 5-6 years
- Eruption 11-12 years
- Root completed 13-15 years

Causes of Canine Impaction

- Genetic or ethnic
- Retained deciduous
- Space deficiency
- Short lateral roots
- Abnormal eruption sequence
- Trauma to primary tooth bud
- Premature root closure
- Eruption into cleft



Clinical signs

- Delayed eruption of canine (failure to erupt by age 14)
- Prolonged retention of primary canine
- Elevation of soft tissue either labially or palatally
- Distal migration of lateral incisors without midline shift

Facial

- Arch length deficiency (crowding)
- Detected earlier than palatal
- Easier to manage
- May be transposed

Palatal

- No arch length deficiency
- Watch for 6 month difference from contralateral canine
- Treat early

Localization

- Determine location before initiating treatment
- Obtain all needed diagnostic information
  - (x-rays, photos, palpation)

Localization

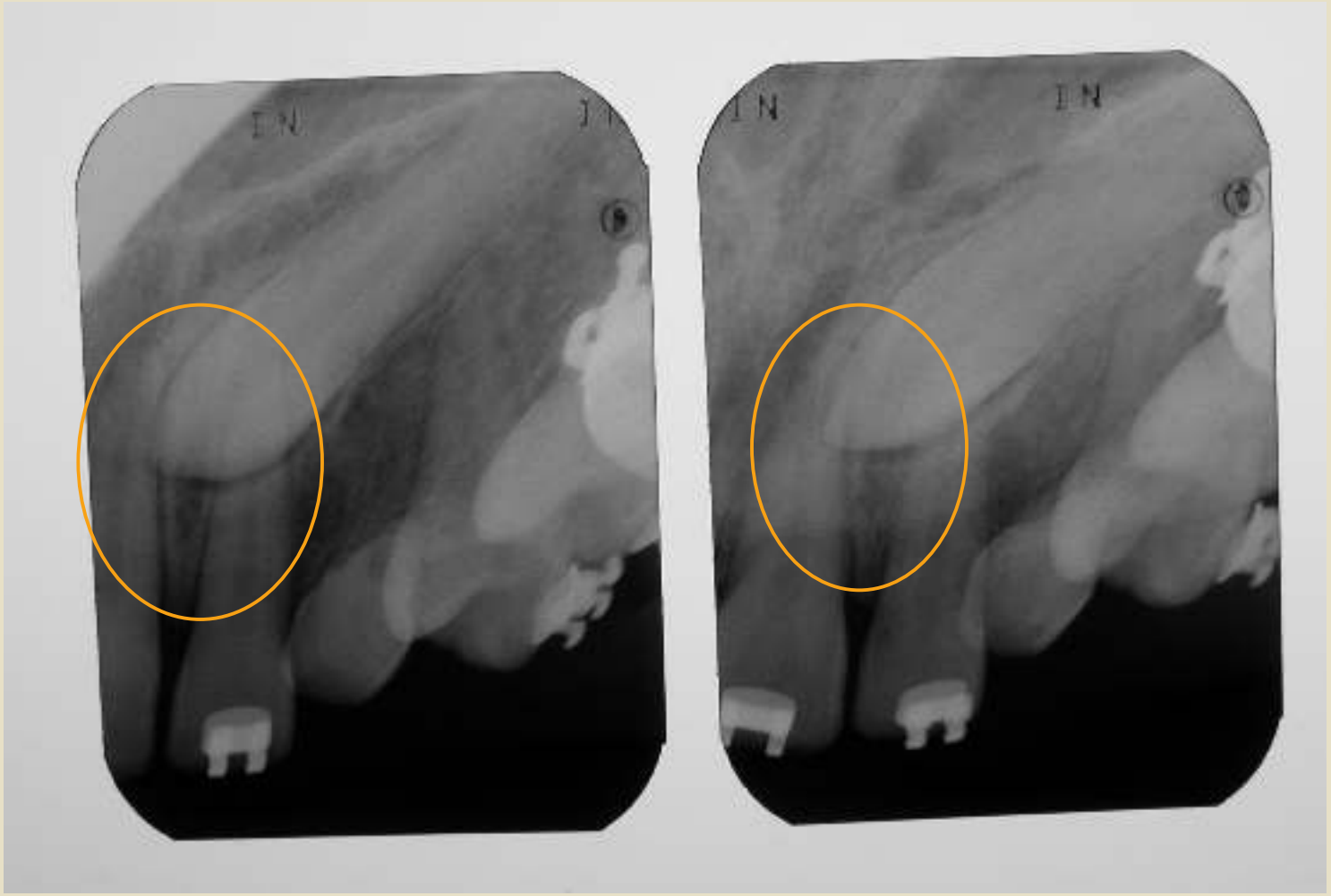
SLOB rule: same lingual opposite buccal

Take the first PA straight on and the second to the mesial or distal

Localization

- Clark's rule (SLOB rule): If the cuspid moves in the same direction as the tube head when 2 periapical films are taken in the same horizontal plane (second film more distal than first) then the cuspid is on the palatal side. If the cuspid moves in the opposite direction then it is on the facial. If there is little or no movement the cuspid is in a mid alveolar position.

Same (both mesial)= lingual (palatal impaction)



Straight On

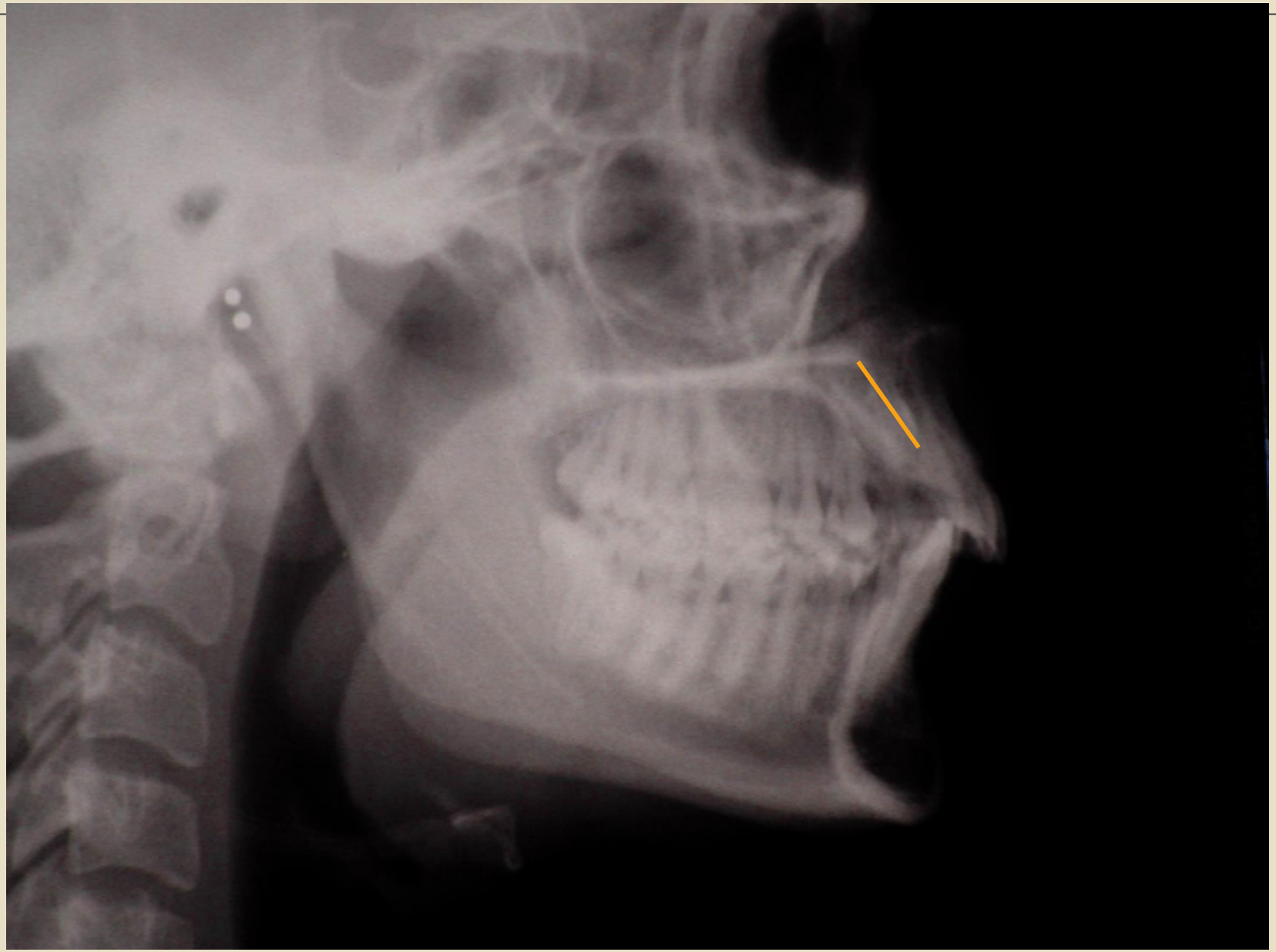
Mesial Shift

Panorex

Impactions in the palate will generally appear larger and more blurry than the contralateral canine.

Localization

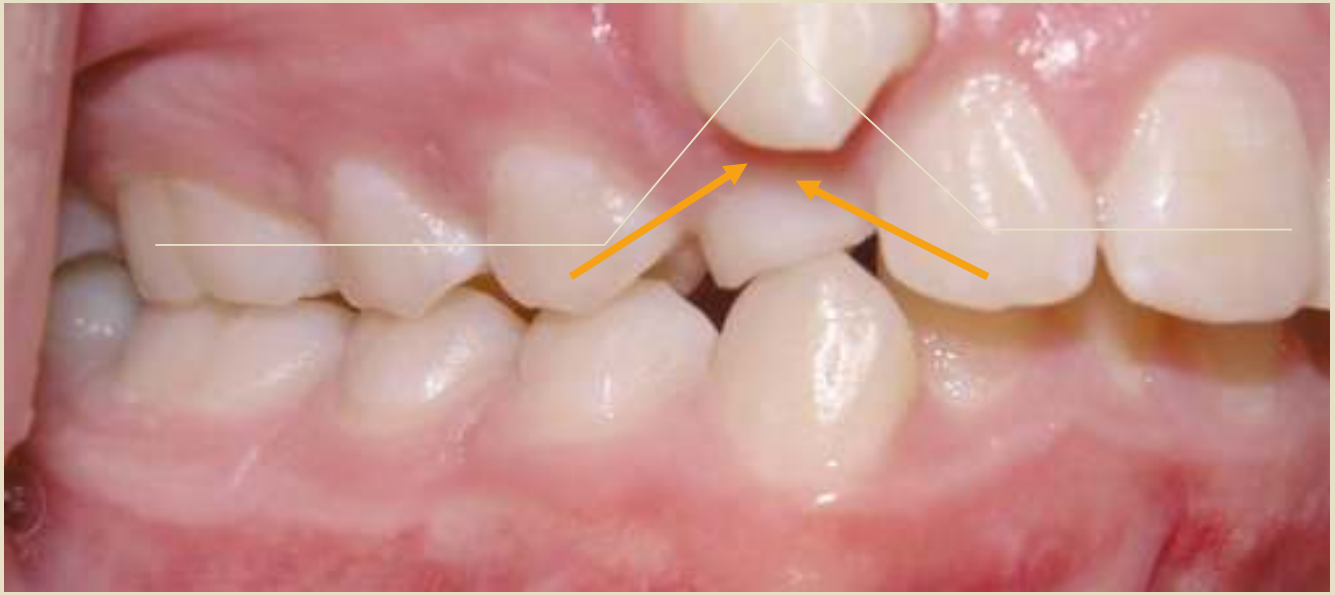
- Cephalogram: Buccal (facial) impactions appear vertical and coronal to the apices of the anterior teeth. Palatal impactions appear horizontal and apical to the anterior teeth



Facial impaction (vertical and coronal to apices of ant teeth)

Treatment choices

- Exposure and natural eruption
- Exposure and orthodontics
- Extraction and premolar substitution
- Reimplantation



- When facial usually need just simple uprighting and extrusive mechanics, anchorage preservation is chief concern

Palatal

- Stabilize arch and make space (TPA, heavy archwires)
- Expose
- Force palatal
- Force labial
- Labial root torque

Initial

Attachments to cuspids

- Important to utilize proper bonding techniques
- Ensure that bond is to crown not root
- Usually placed by periodontist/OS

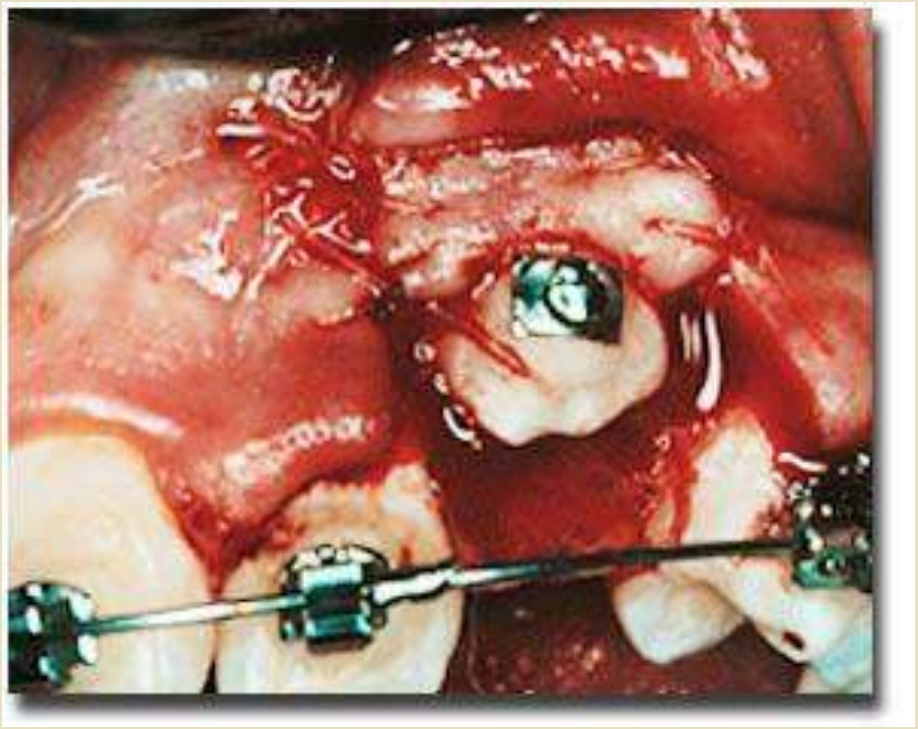
Clinical hints

- Identify impactions early
  - X-rays, clinical exam
- Extract primary canine
  - To facilitate eruption

Clinical hints

1. Palatal impactions usually require exposure surgery
2. Determine prognosis of impaction before extracting primary teeth
3. You want to establish good anchorage and space for the impacted tooth before bringing into the arch
4. You want to apply traction to the tooth immediately following exposure (no later than 2-4 weeks)

Soft tissue considerations (Facial)



- Flap design
  - Preserve attached gingiva
  - Closed eruption or apically repositioned flaps
  - Adequate exposure for bonding

Soft tissue considerations (Palatal)

- Full thickness flap
  - Open or closed eruption
- Good hemostasis
- Bone removal if necessary

FORCED ERUPTION

Forced Eruption

Needed for extrusion in:

- Subgingival problems (perio defects, fractures)
- Tooth removal
- Crown lengthening
- Aid in eruption (commonly in impacted centrals)

Extrusion

- Rapid (heavy)
  - Tooth movement only (ie. Crown lengthening)
- Slow (light)
  - Tooth and bone (orthodontic extrusion)

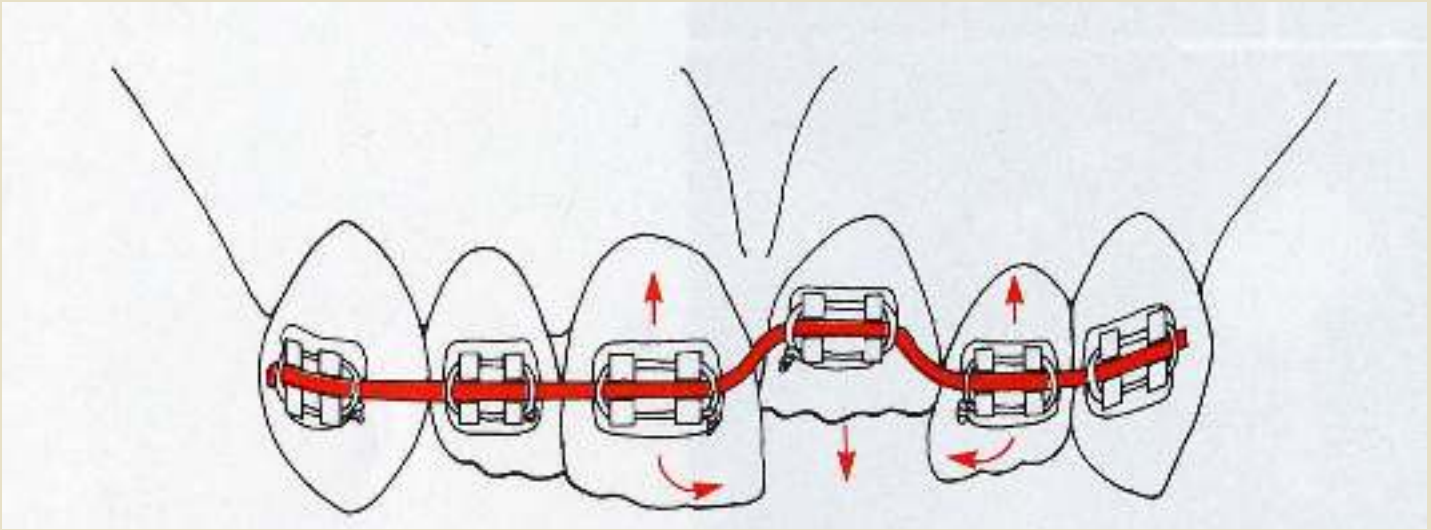
Why extrude a tooth?

- To make it more restorable
- Place margins on sound tooth
- Preserve the biological width
- Get a good impression
- Esthetics

Contraindications

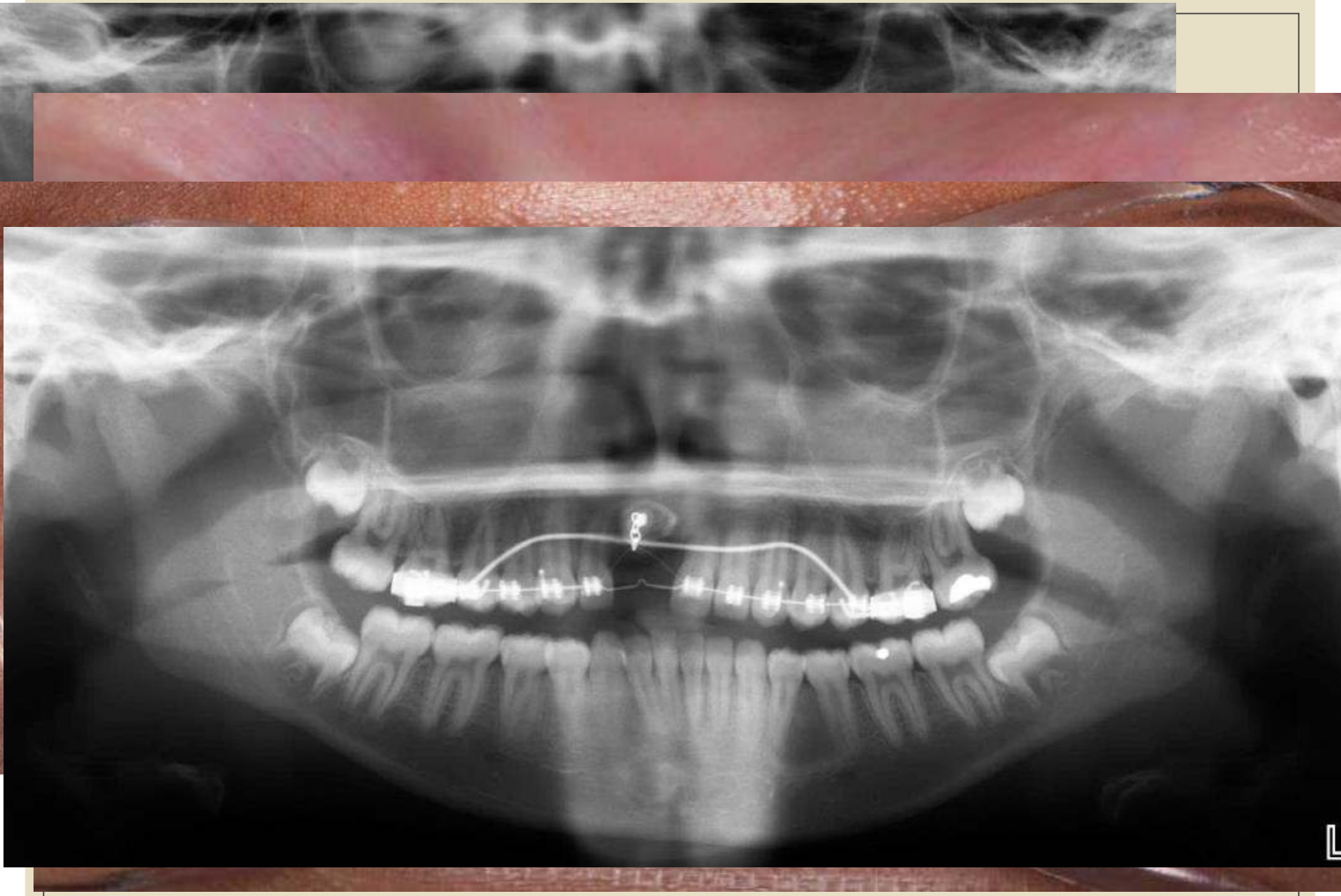
- Fx below the gingival third
- Poor OH
- Failing RCT
- Root too short after extrusion , < 1:1
- Poor root structure (resorption)
- Creation of furcation problems

Extrusion basics



1. First establish anchorage
2. Bond attachments (buttons or cemented post)
3. Deliver force (can be via wires or elastics)
4. Light forces if you want bone to follow tooth (1mm a month)
5. Follow ups with perio/endo may be necessary


Intraoral Center



The End

Oral Habits
Etiology and Therapy

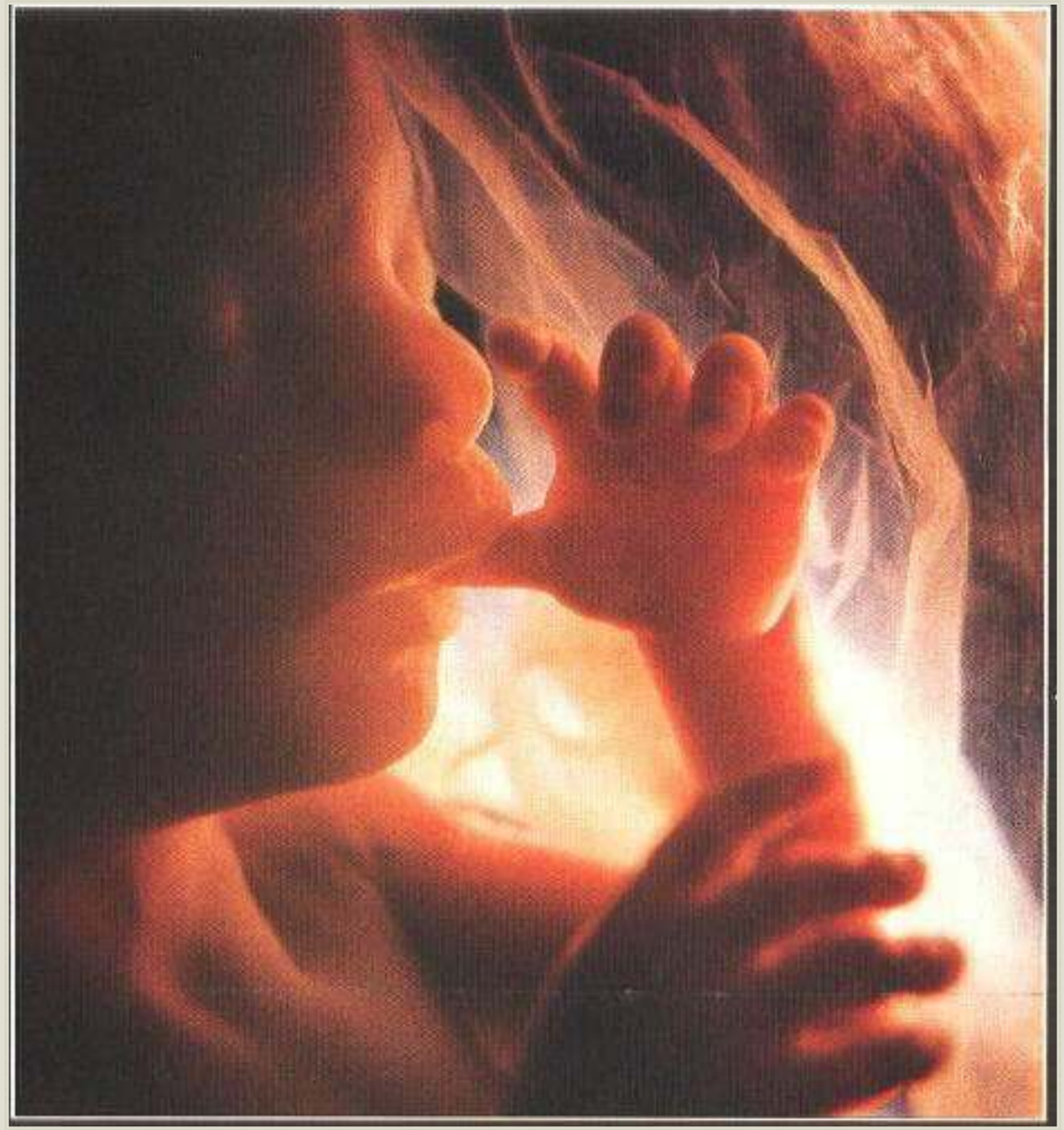
Brett Finkelmeier, DDS
University of Louisville

Outline

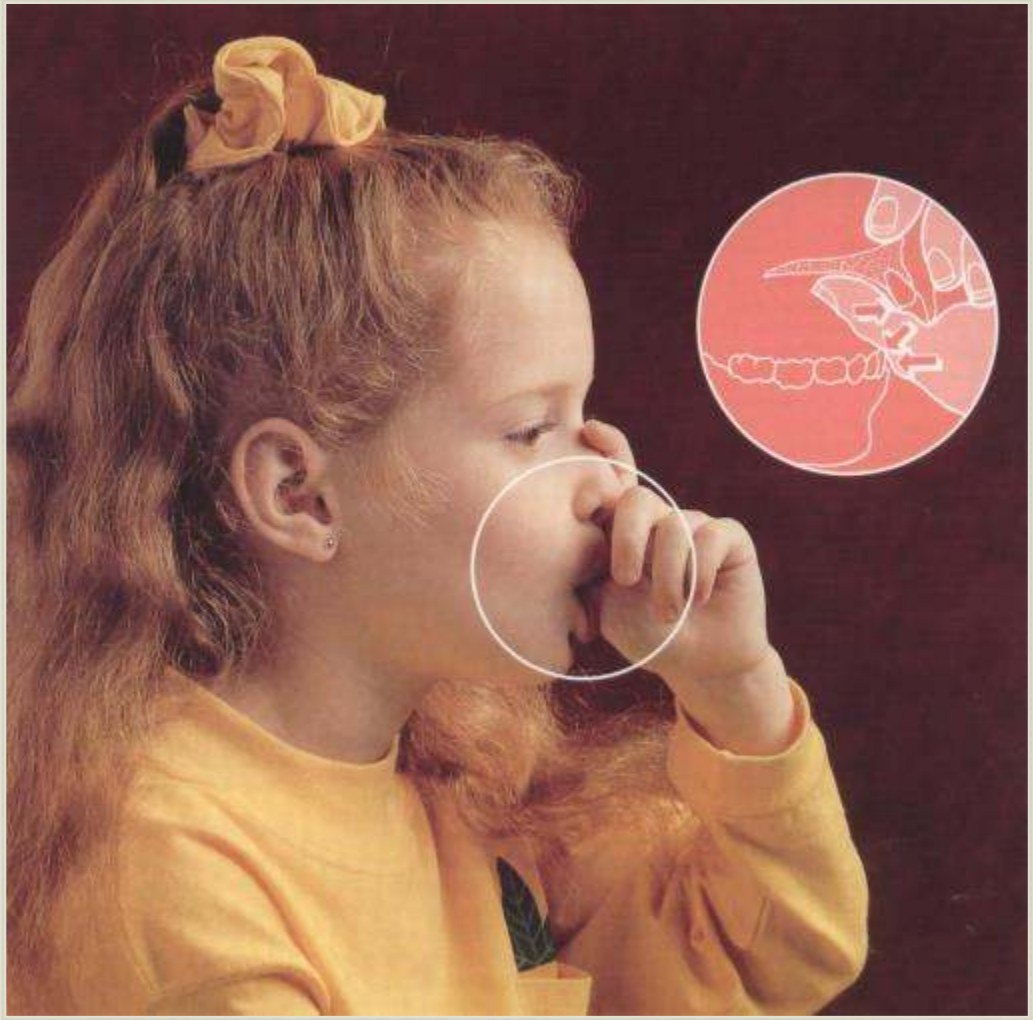
- Etiology & Theory
- Dental & Skeletal Effects
- Abnormal Oral Habits
- Treatment
- Case Example
- Sample Questions

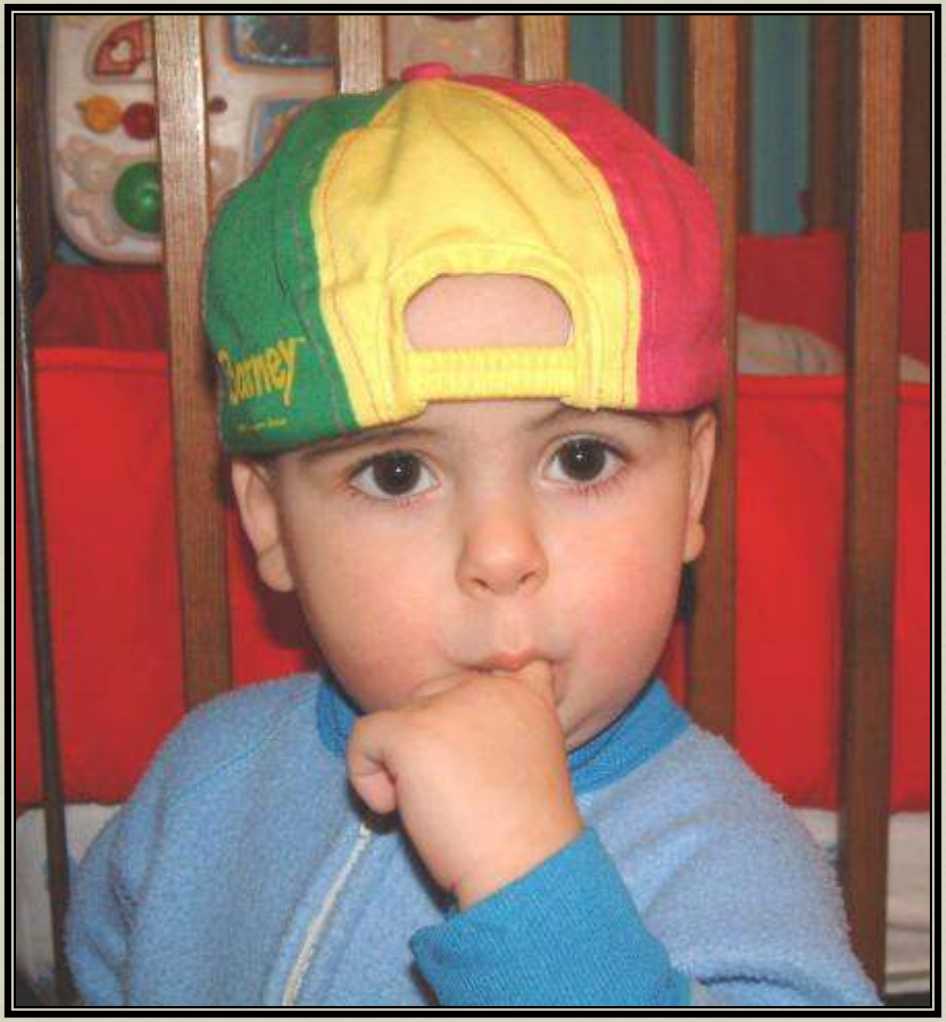
Etiology & Theory

- Repeated forceful sucking of the digit with associated strong buccal and lip contractions
- Incidence
  - No correlation to socioeconomic level
  - Boys = Girls
  - 1 year ~ 50%
  - 6 - 15 years ~ 20%



Oral Habits – Digit Sucking





Types of Sucking Response

- Nutritive
  - Needed to survive

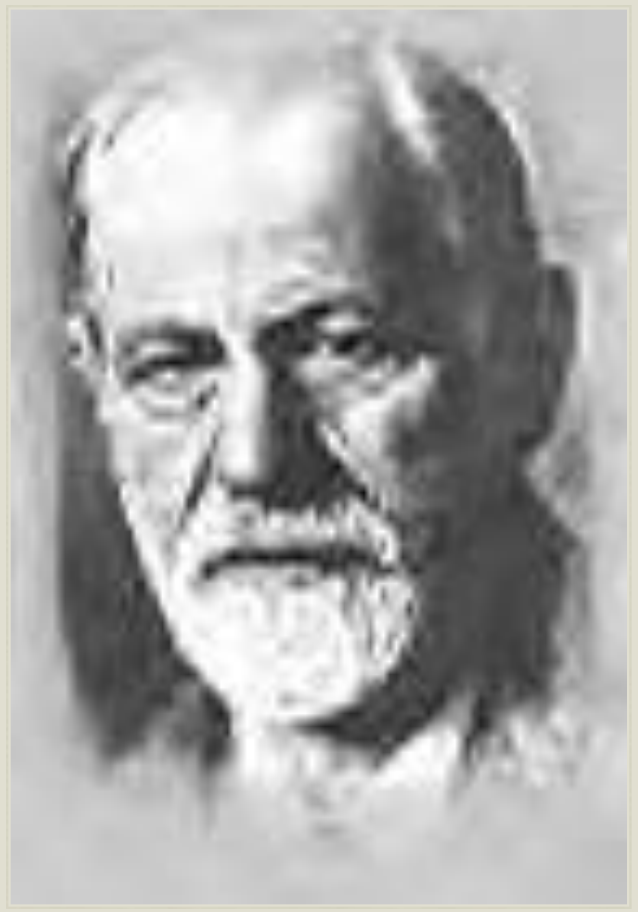
Types of Sucking Response

- Non-Nutritive
  - Sucking of a digit or pacifier not related to the ingestion of nutrients
  - Prevalence 50 -70% in the first year of life
  - Most stop by age 4 before it becomes a habit

Types of Sucking Response

- Chronic
  - Continues after age 4
  - Distortion of dento-alveolar structures

Chronic Sucking - Theory



- Freudian psychological theory
  - Habit associated w/pleasurable stimuli early in life
  - Due to underlying psychological disturbance

Freud, S. Nervous and Mental Diseases Publishing Co.,1918

Chronic Sucking - Theory

- Learning theory
  - Simply a learned pattern of behavior
  - No underlying emotional/psychological cause

Effects of Chronic Sucking

- Genetics/Growth
  - Can make an existing malocclusion worse
- Three modifying factors:
  - Frequency
  - Intensity
  - Duration

Burlington Growth Studies (1961-1989)

- Significant association between class II malocclusion and persisting digit habit
- Class II malocclusion increased from:
  - 21.5% at age 3-4 years
  - 41% at 12 years

Popovich, F. Progress Report Series No.1, Univ of Toronto

Dental and Skeletal Effects

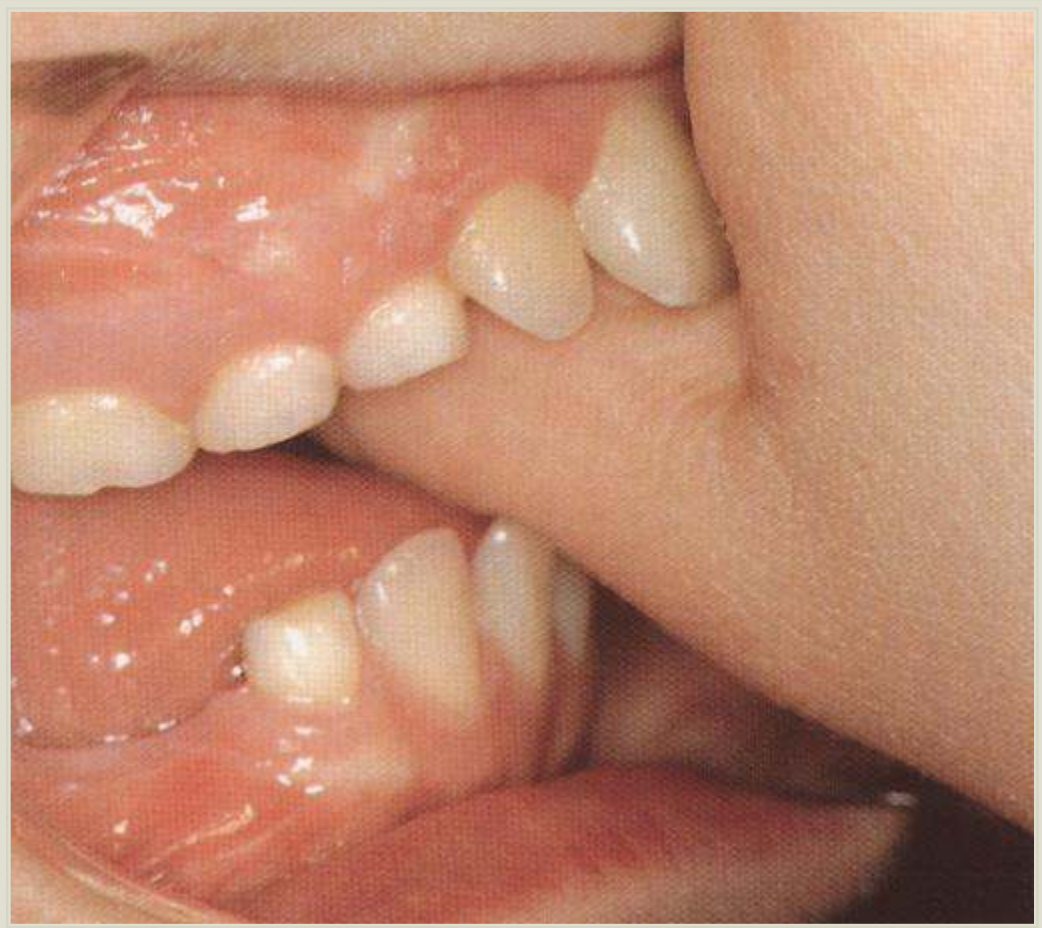
- Relationship between chronic non-nutritive sucking and malocclusion
- Possible effects may be divided into two categories:
  - Dental
  - Skeletal

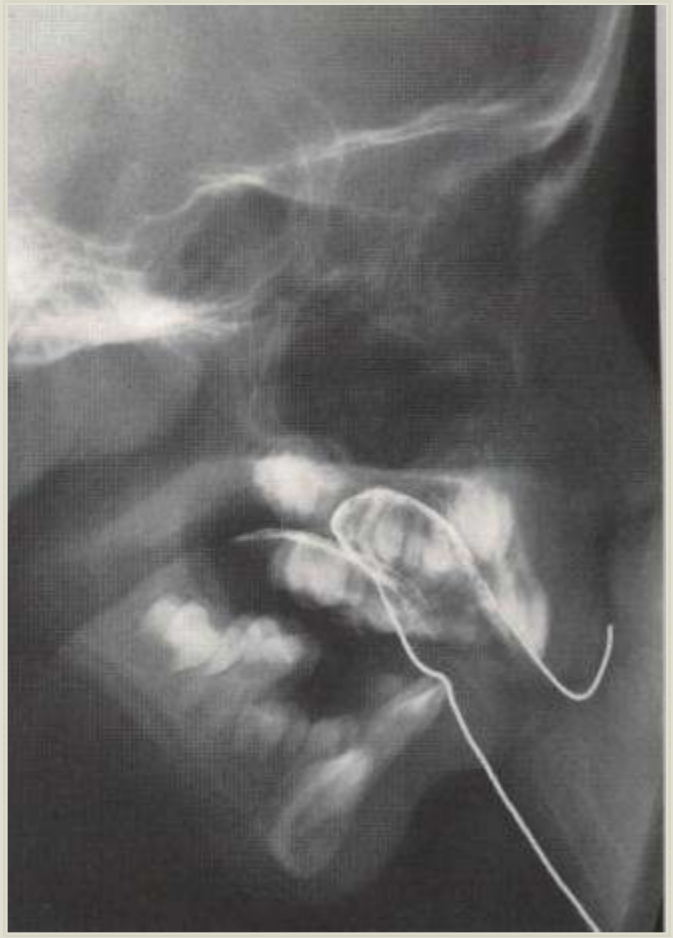
Dental Effects

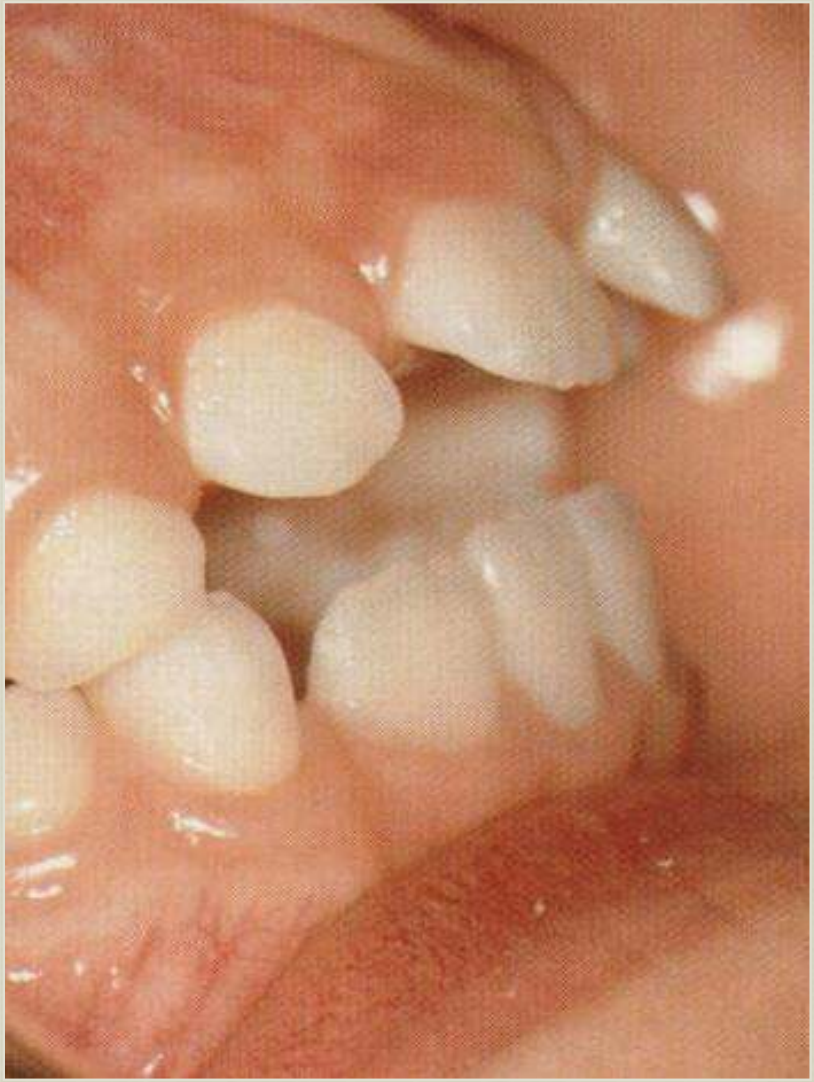
- Labial inclination/displacement of maxillary incisors (increased overjet)
- Linguo-version of mandibular incisors
- Over-eruption of posterior teeth
- Class II molar relationship
- Decreased overbite of anterior teeth (anterior open bite)
- Posterior crossbite (constricted maxillary arch)

Dental Effects

- Labial inclination/displacement of maxillary incisors leads to increased overjet with spacing

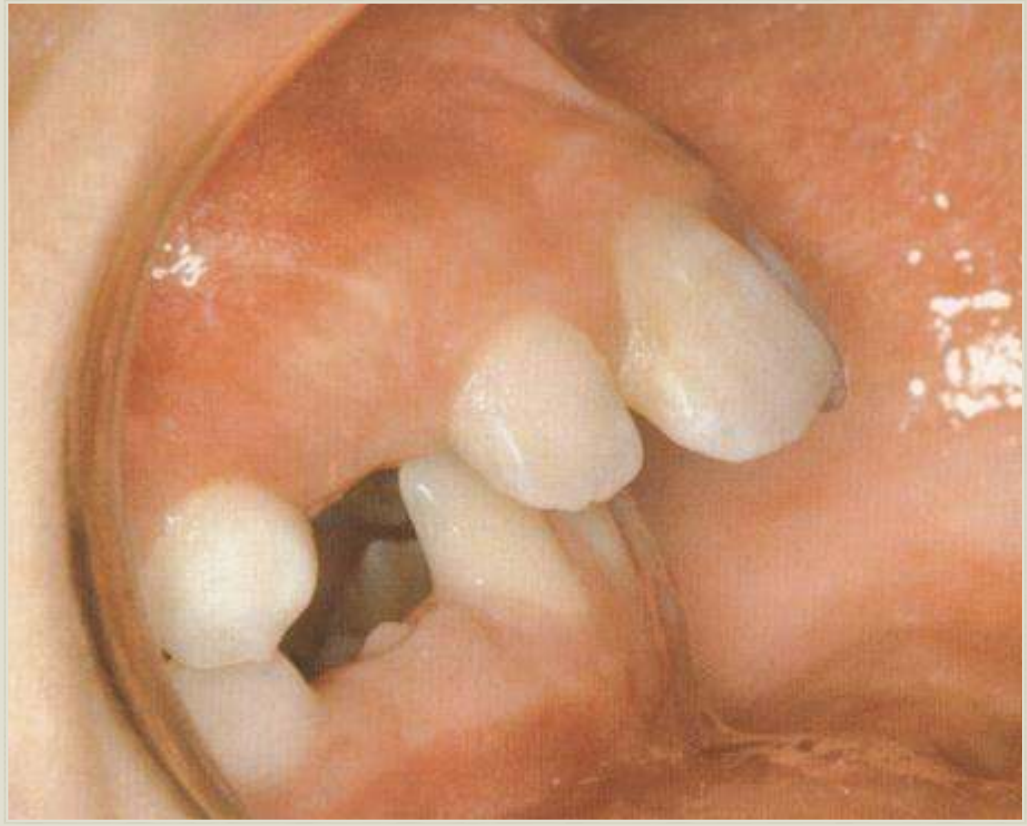






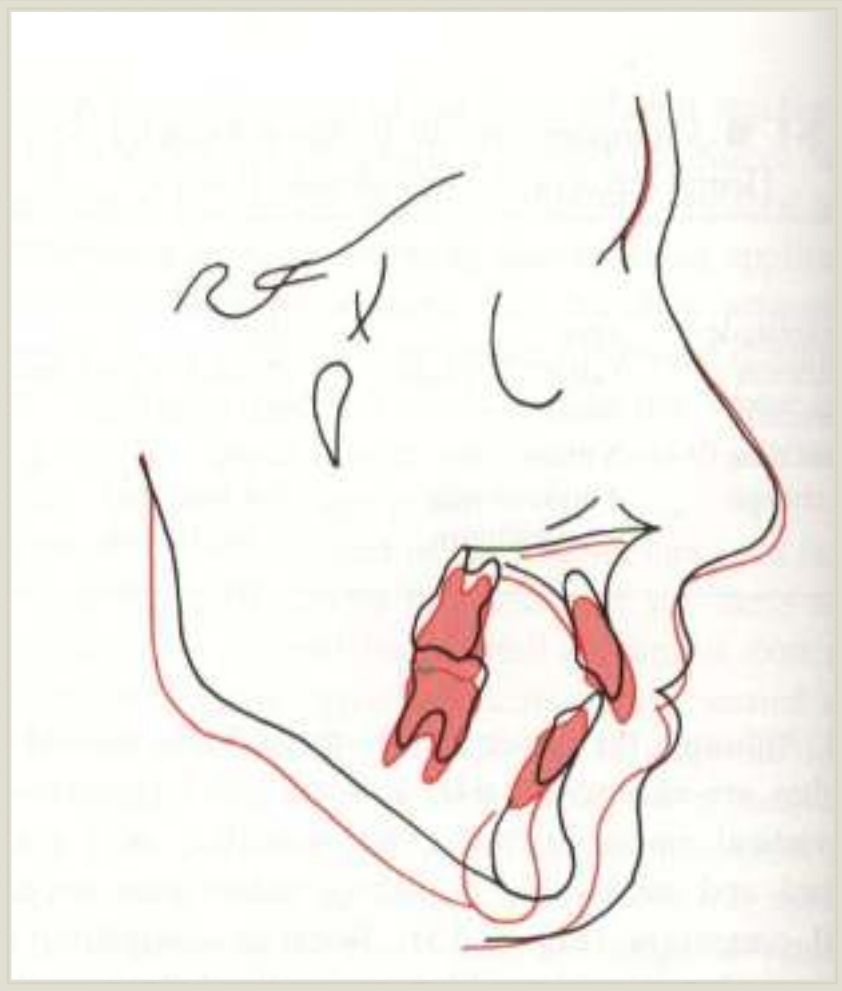
Dental Effects

- Linguo-version of mandibular incisors



Dental Effects

- Over-eruption of posterior teeth
- Class II molar relationship

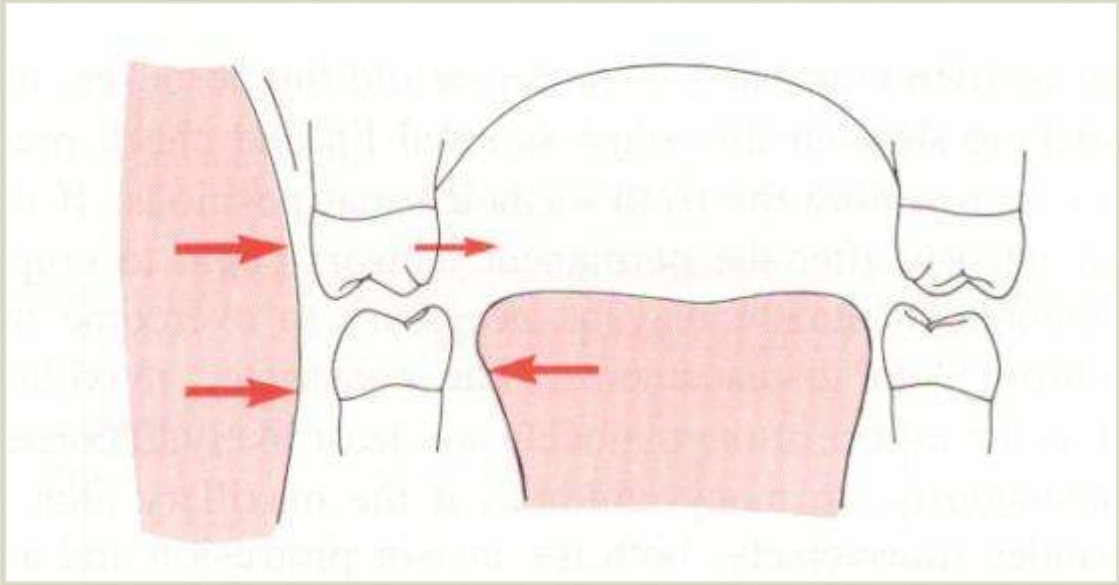


Dental Effects

- Decreased overbite of anterior teeth (anterior open bite)

Dental Effects

- Posterior crossbite, which leads to a constricted maxillary arch



- Failure of maxillary arch to develop in width due to alteration in balance between cheek and tongue

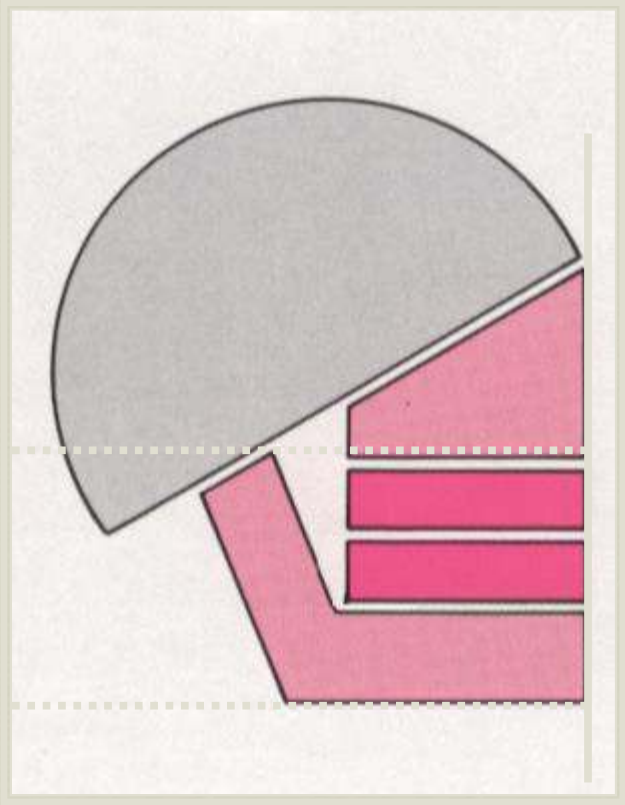
Proffit, Contemporary Orthodontics, 1993; 127

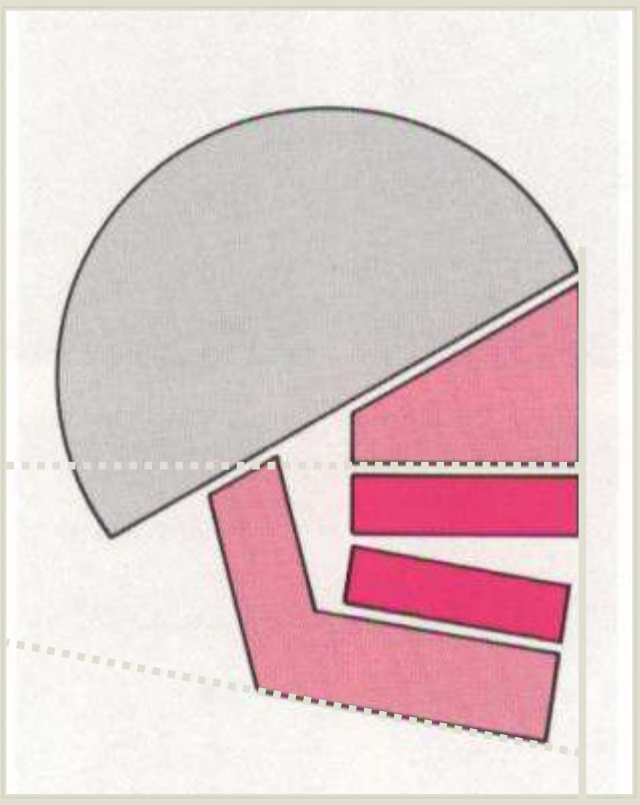
Skeletal Effects

- Lowered mandibular posture and autorotation
- Class II apical base relationship
- Anterior and superior distortion of maxillary anterior alveolar process

Skeletal Effects

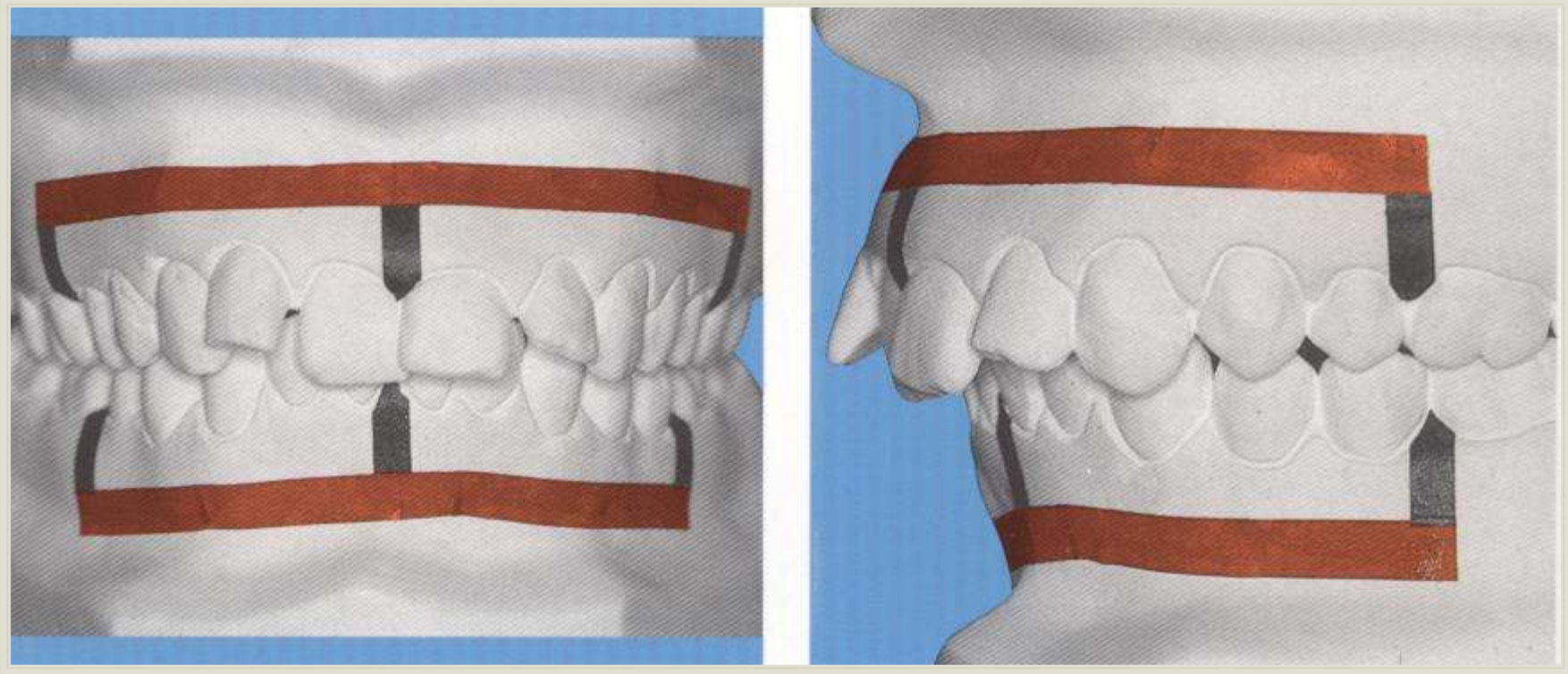
- Lowered mandibular posture and autorotation



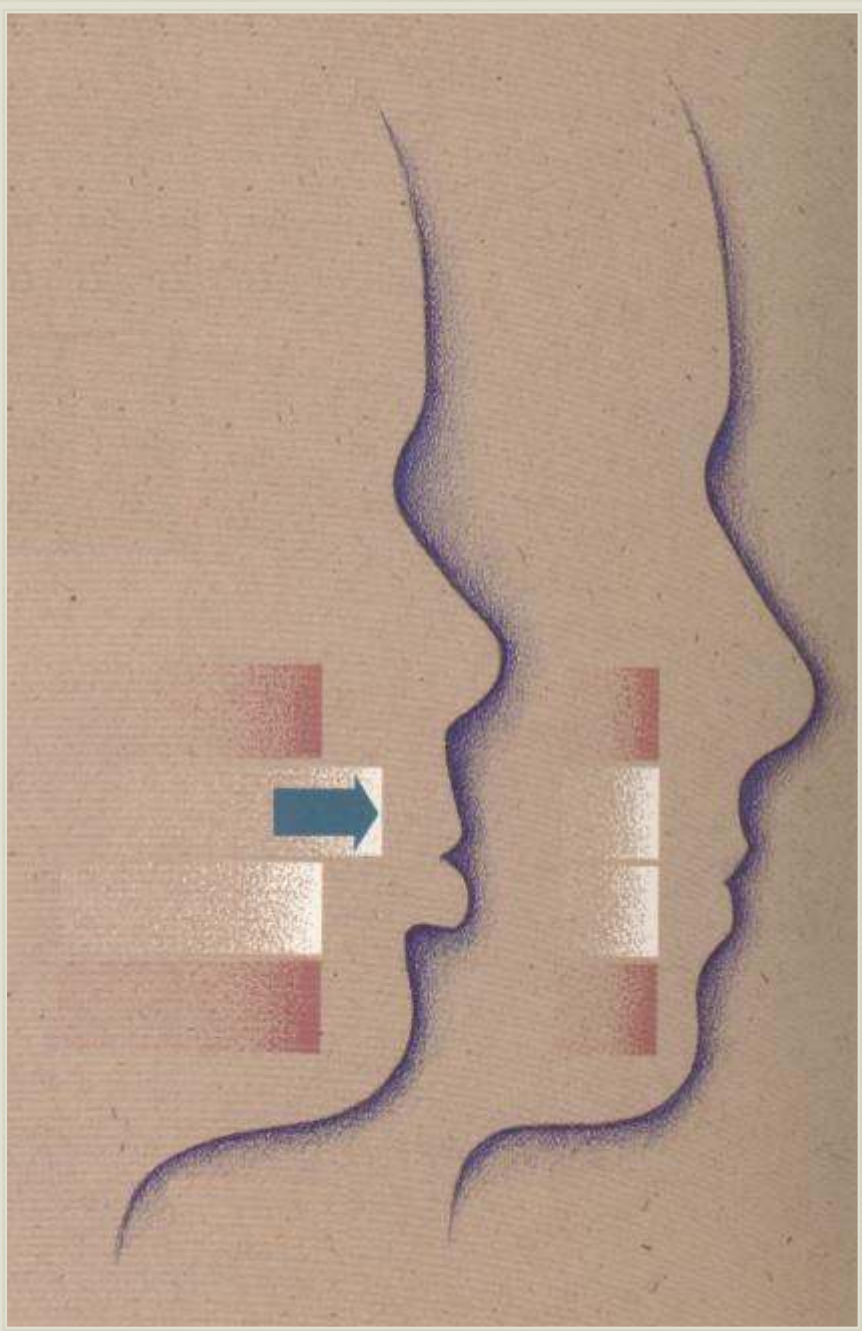


Skeletal Effects

- Class II apical base relationship



According to Rees, 1953



Class II molar and apical base relationships may be exacerbated

Skeletal Effects

- Anterior and superior distortion of maxillary anterior alveolar process

Abnormal Oral Habits

- Tongue Dysfunction
- Swallowing Patterns
- Lip Habits

Tongue Dysfunction

- Abnormal tongue, perioral and facial muscle posture and activity during swallowing and/or at rest

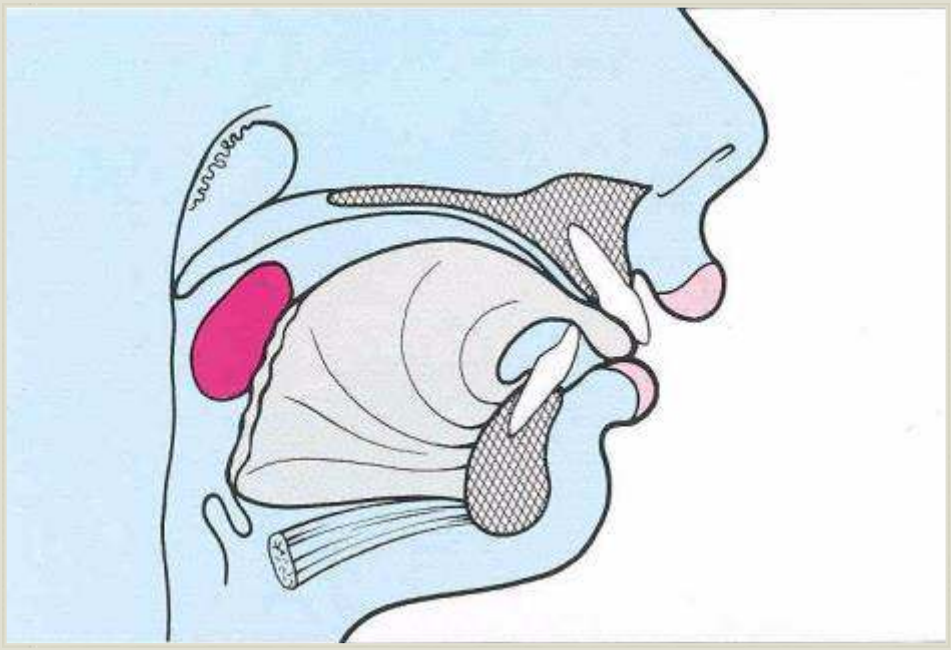
Tongue Dysfunction

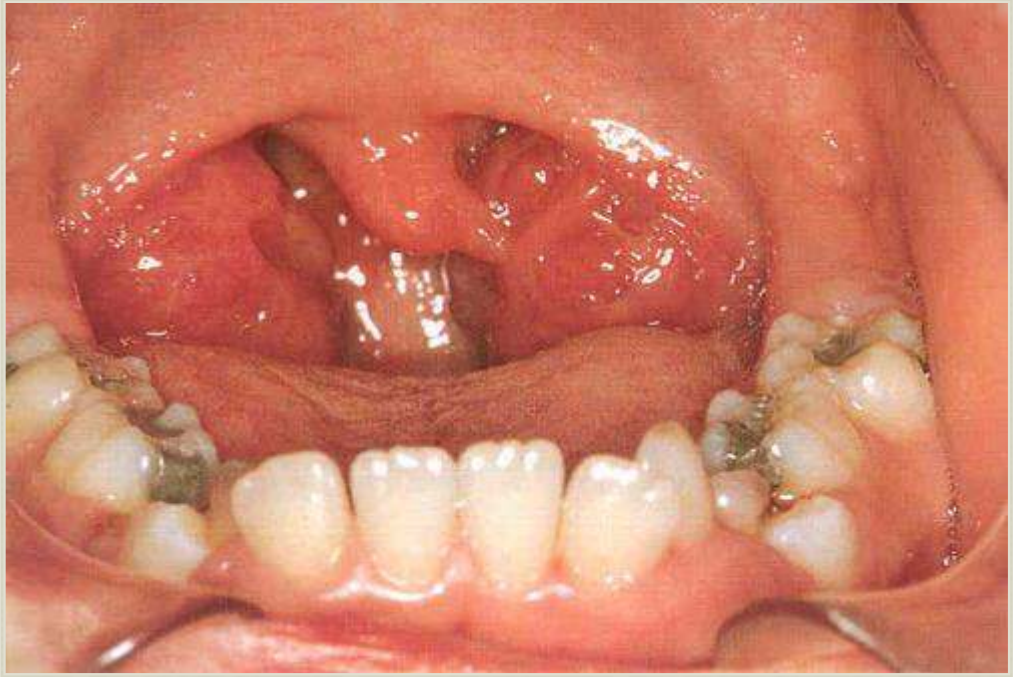
- Compensation made necessary by the altered oral environment created by the original habit
- Persistent tongue posture or thrust may then prevent spontaneous correction of, or even exacerbate, the existing malocclusion

Variations of Tongue Posture

- Tongue problems may result from:
  - excessive epipharyngeal lymphoid tissue
  - large tongue
  - skeletal open bite
  - neurological deficit

Tongue Dysfunction

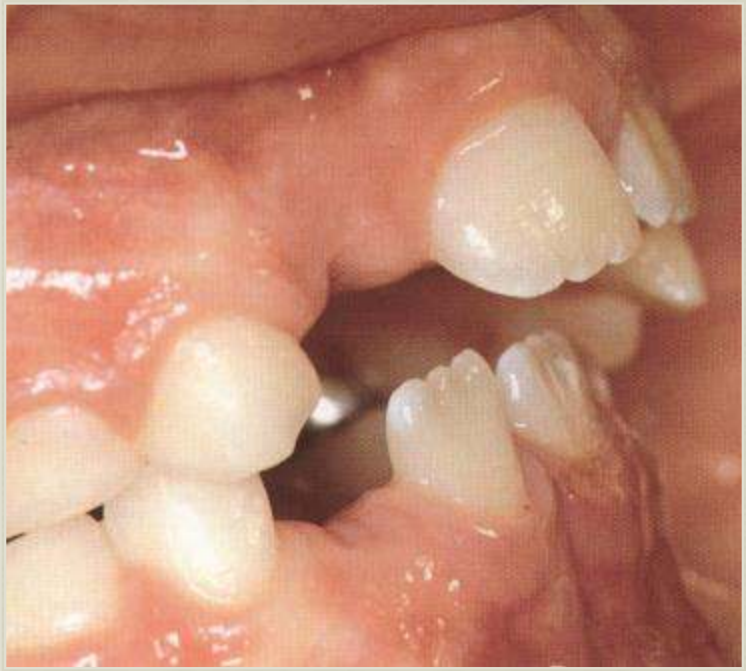


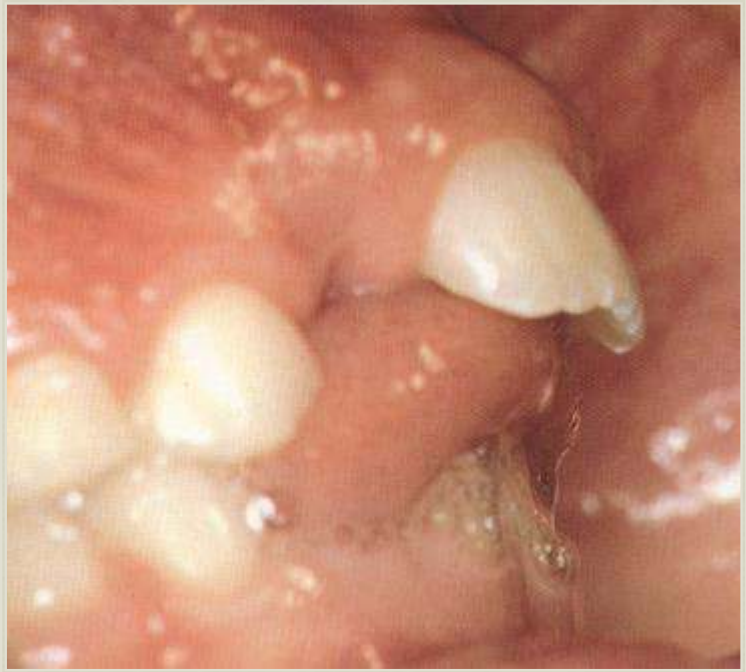


Rakosi, et.al., Orthodontic Diagnosis, 1993

Tongue Dysfunction

- Tongue dysfunction persists and prevents the malocclusion from being restored to normal





Tongue Dysfunction

- Anterior
- Lateral
- Complex

Tongue Dysfunction

- Anterior tongue thrust
  - Impedes vertical eruption of anterior teeth

Tongue Dysfunction

- Lateral tongue thrust
  - Maintains lateral open bite

Tongue Dysfunction

- Complex tongue thrust
  - Teeth only occluding posteriorly on molars

Aberrant Swallowing

- "With the increase in overjet that accompanies so many finger sucking habits, normal swallowing patterns become increasingly difficult… Perioral muscle aberrations, compensatory tongue thrust during swallowing and abnormal mentalis activity may accelerate the malocclusion."

Graber, Am J Ortho 1959; 45:259-64

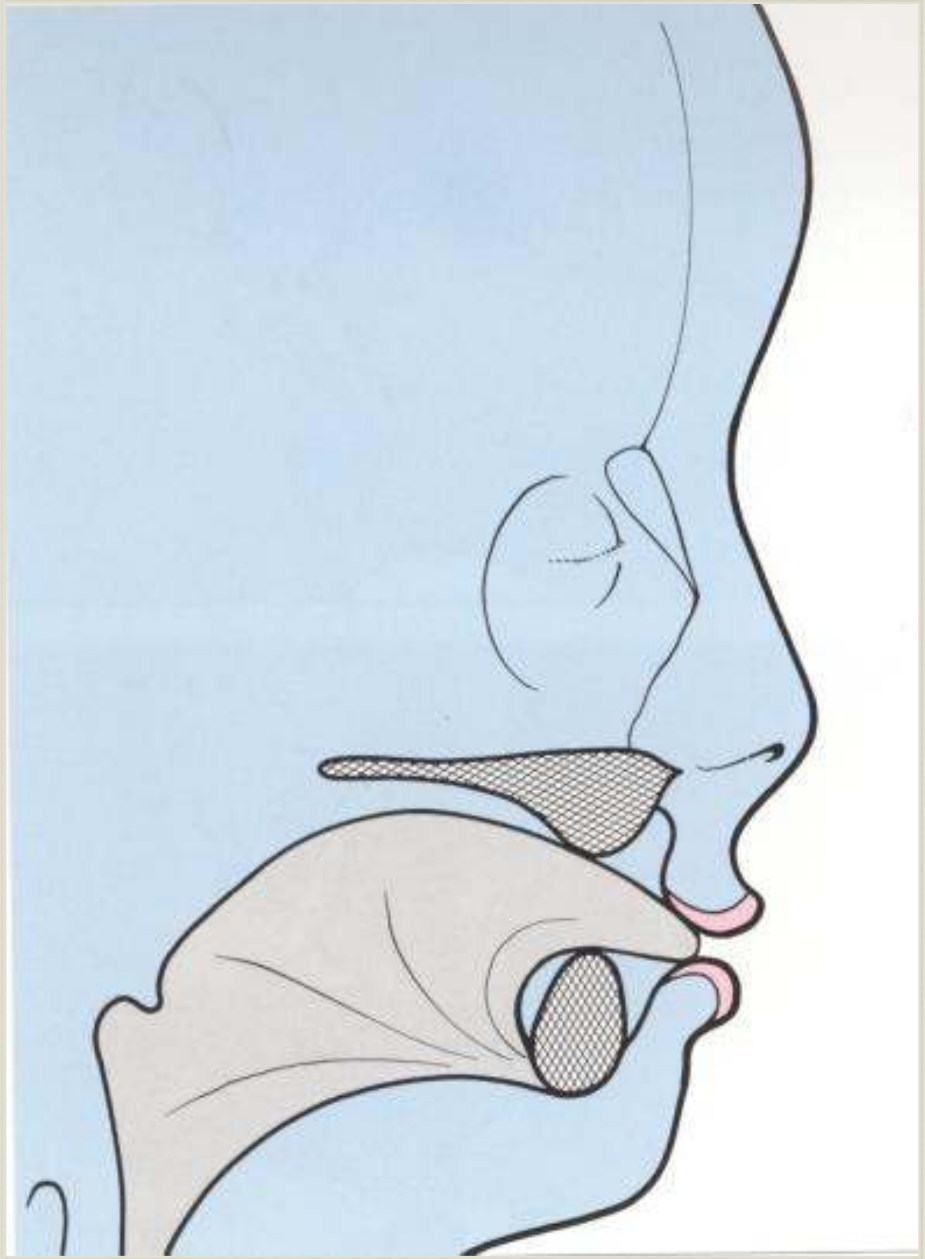
Aberrant Swallowing

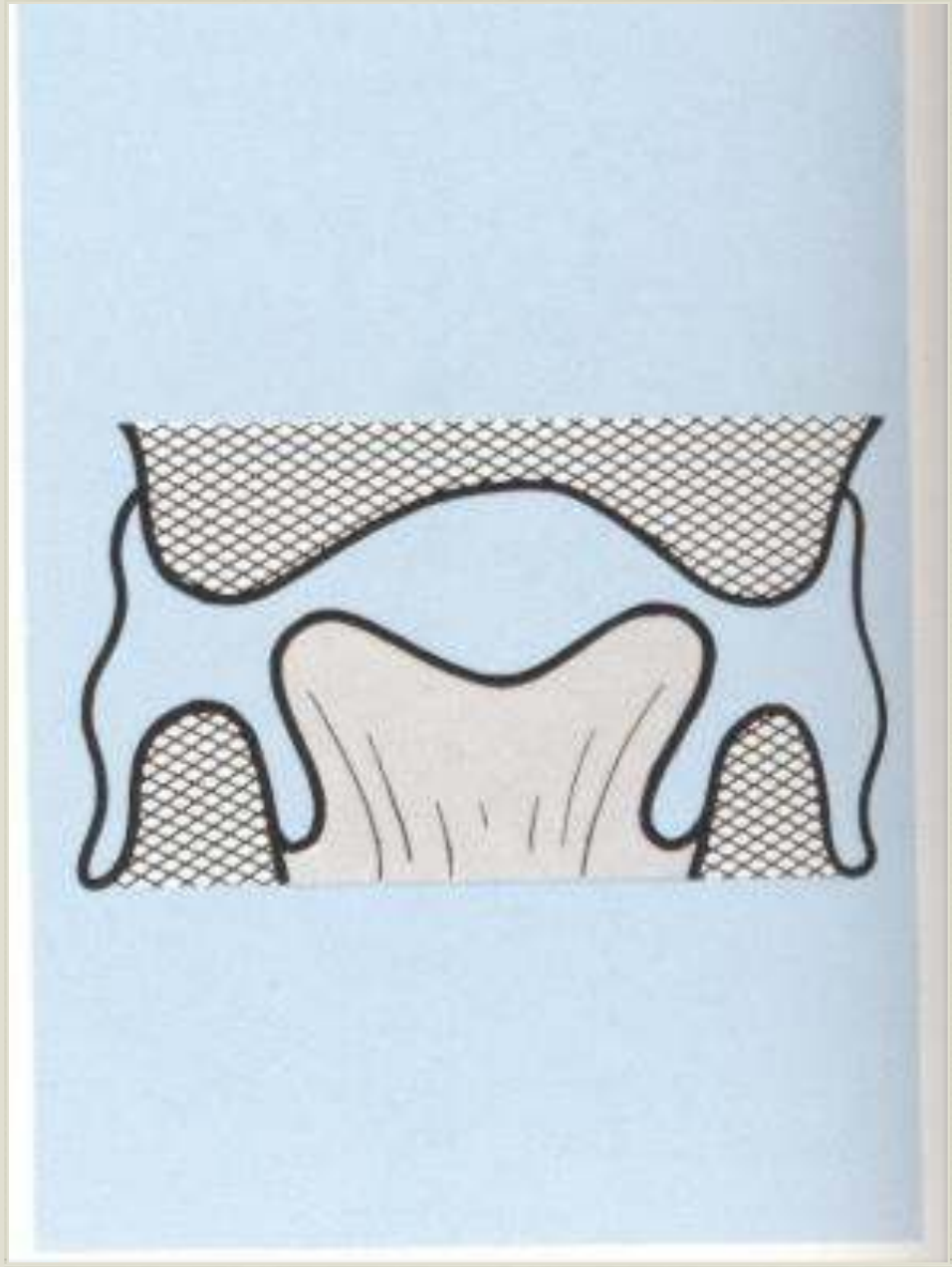
- "…this creates an opening for the manifestation of protrusive tongue activity during swallowing."

Subtelny, Angle Ortho 1973;43:347-83

Swallowing Patterns

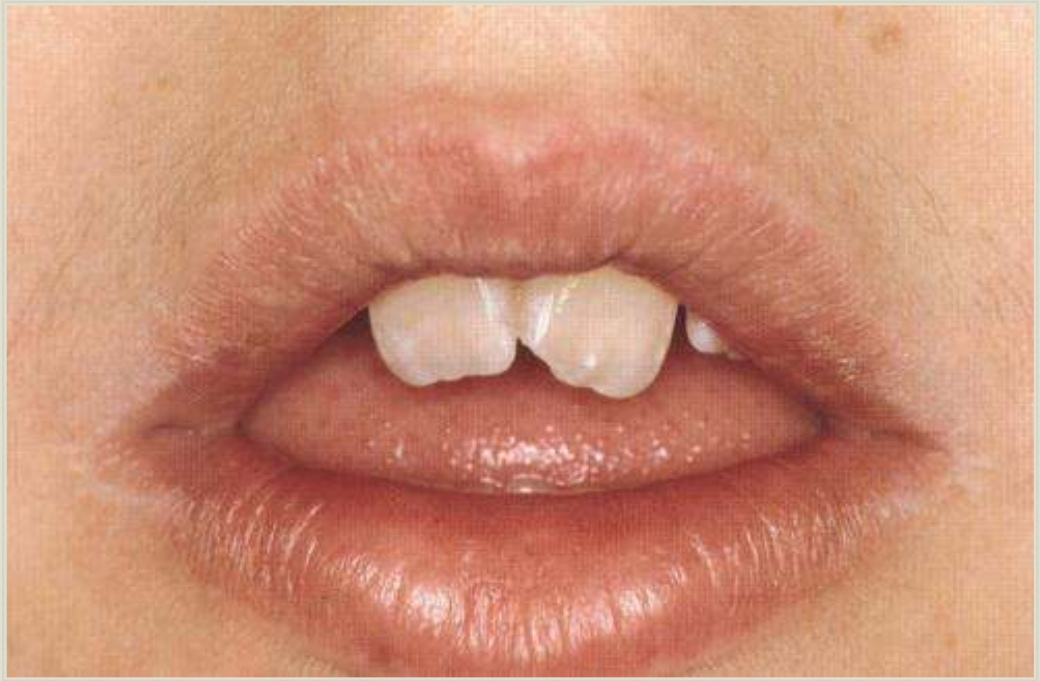
- Infantile Swallowing Pattern
  - Normal until ~ 4 years old
  - Jaws apart during swallowing
  - Tongue pushed forward and placed between gum pads
  - Tongue is positioned low in mouth





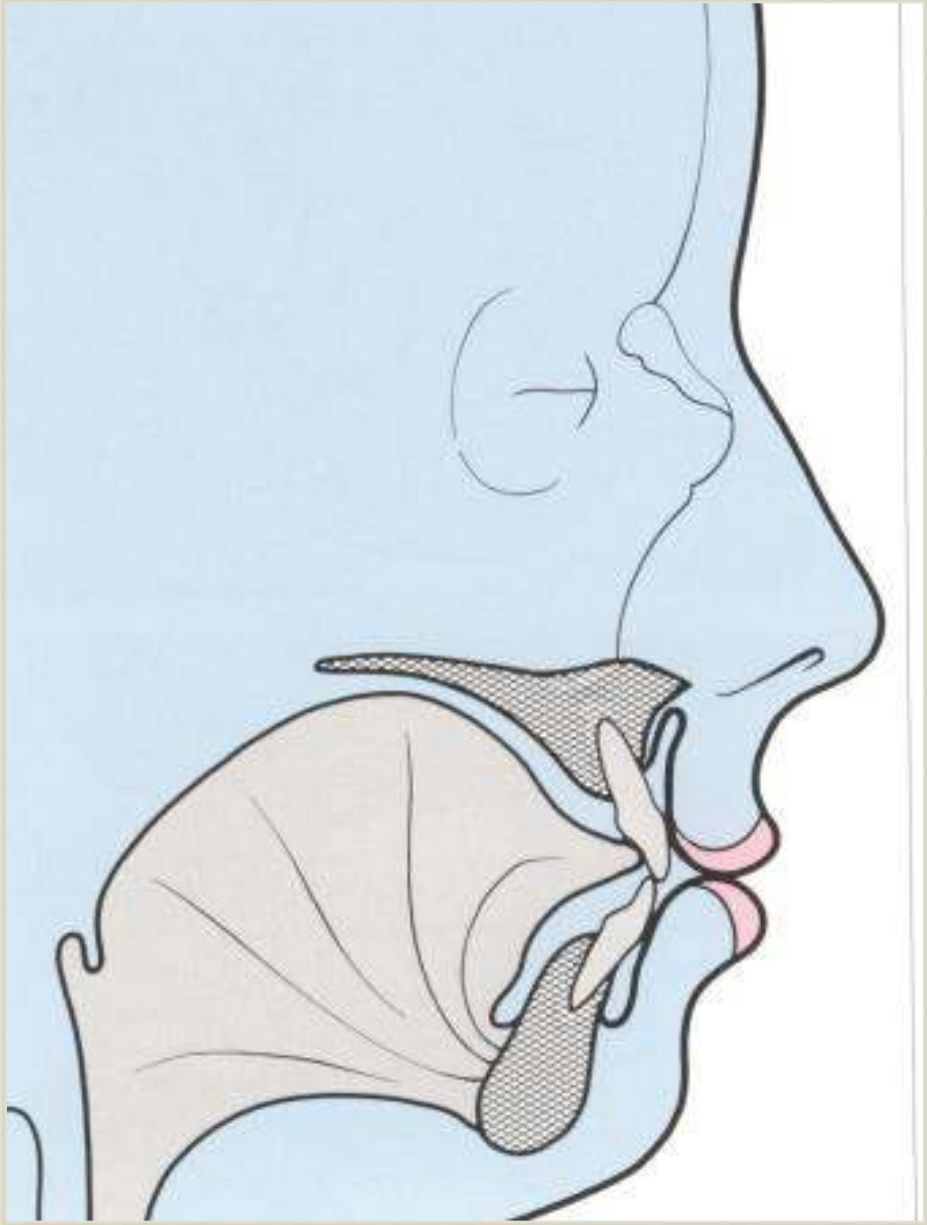
Rakosi, et.al., Orthodontic Diagnosis, 1993

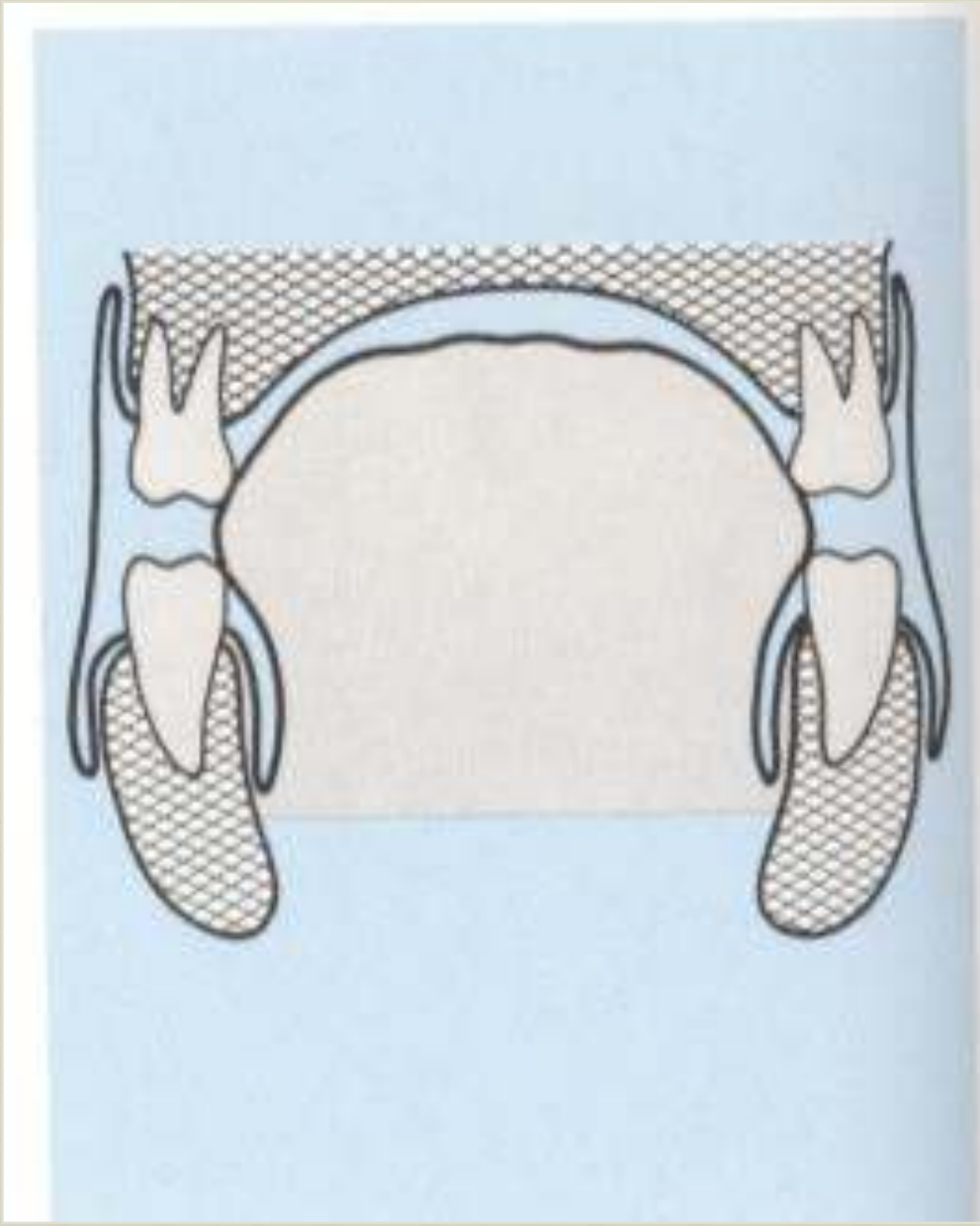
Swallowing Patterns



Swallowing Patterns

- Adult Swallowing Pattern
  - Begins with eruption of primary dentition
  - Normal by age 4 or 5
  - Decreased use of peri-oral muscles
  - Teeth and lips being in contact
  - Tongue remaining within the confines of dental arches





Rakosi, et.al., Orthodontic Diagnosis, 1993

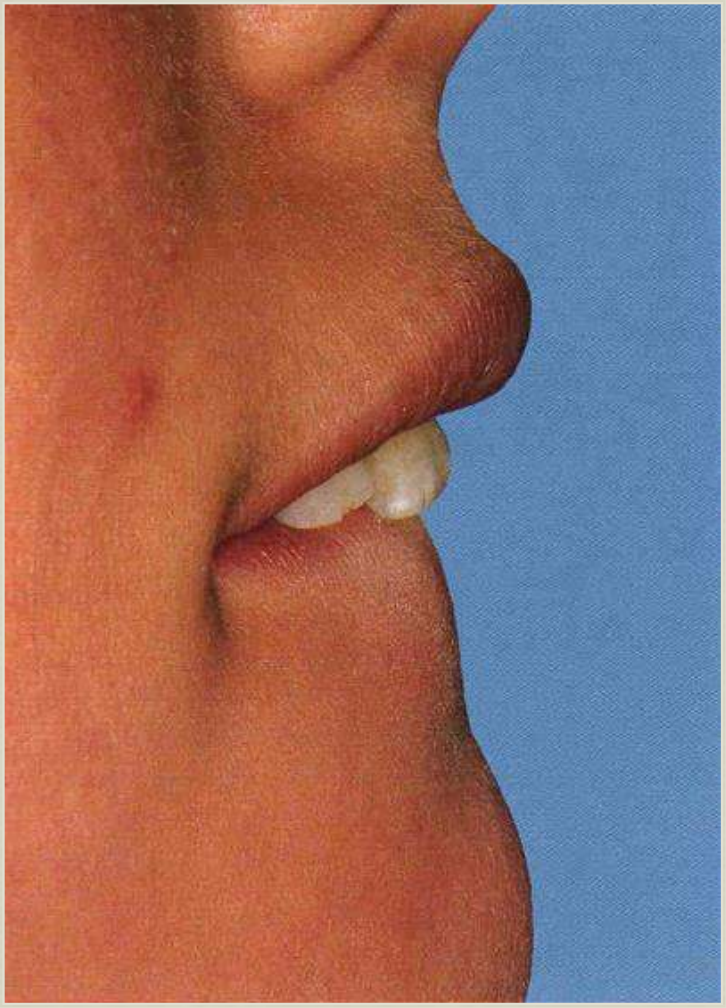
Lip Habits

- Lip sucking
- Lip thrust
- Cheek sucking/biting

Lip Sucking

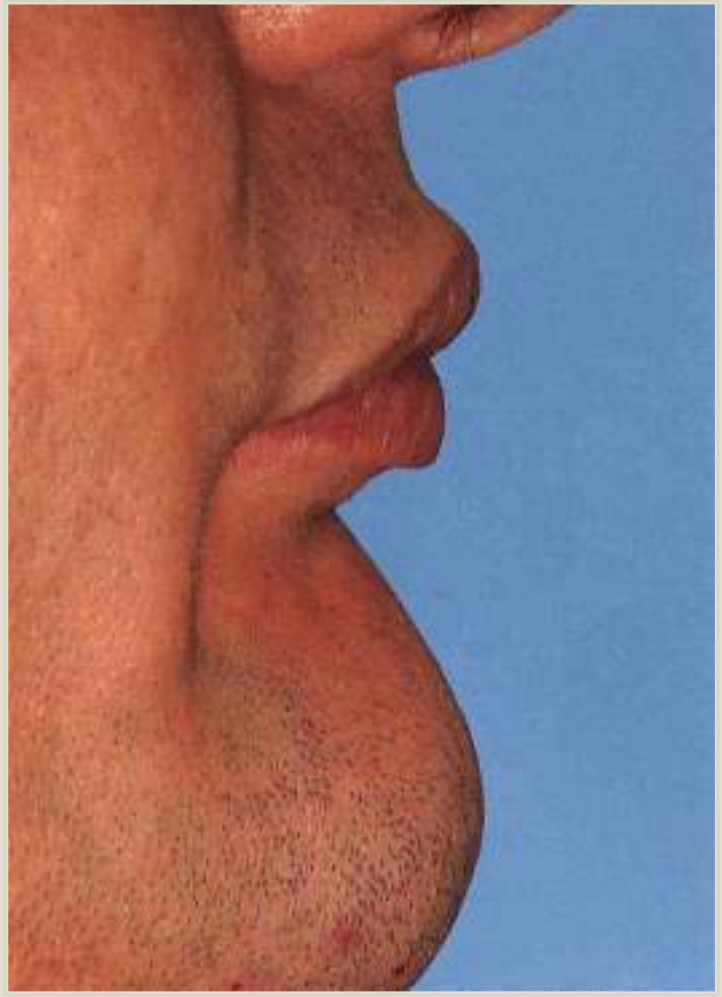
- Lip-sucking
  - Causes further protrusion of the upper incisors and impedes the forward development of the lower anterior alveolar process.

Lip Sucking



Lip Thrust

- Lip thrust
  - Hyperactivity of mentalis



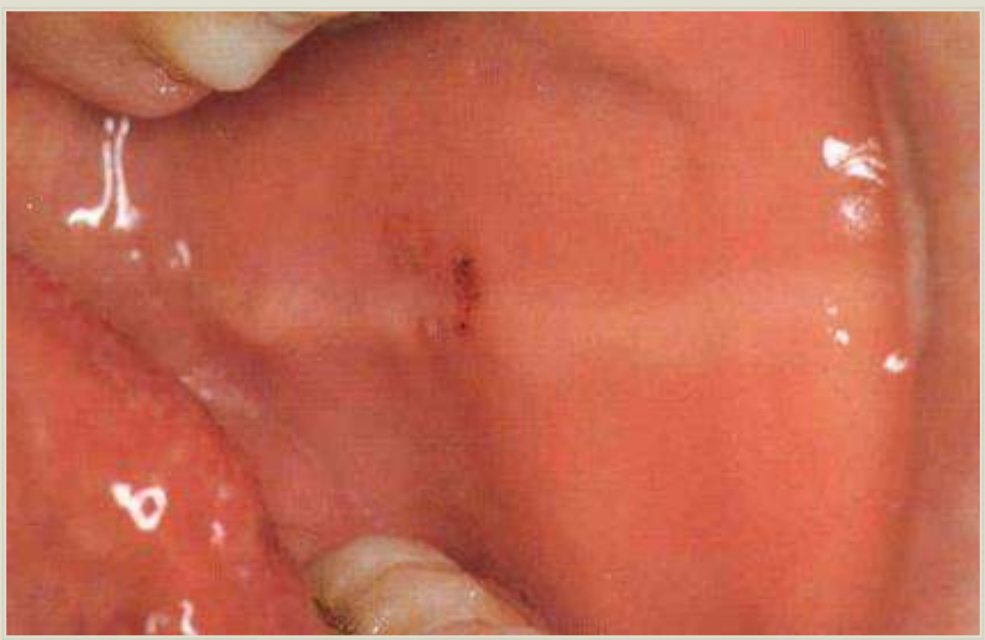
Lip Thrust

- Lip thrust – lingual inclination of incisors

Cheek Sucking/Biting

- Cheek sucking or biting
  - Hyperfunction of buccinator
  - Can promote lateral open bite or deep overbite due to soft tissue interposed between occlusal surfaces

Cheek Sucking/Biting



Treatment

- If habit is ceased by the time the permanent dentition begins to erupt, then usually there are no detrimental effects
- Additionally, many of the changes can be self-correcting
- However, some effects may persist (transverse discrepancy)

Treatment

- Decision to treat chronic non-nutritive sucking or tongue thrusting habits should be based on:
  - Is the habit causing or enhancing the malocclusion?
  - Will cessation of the habit allow for self-correction?
  - Will cessation prevent the malocclusion from worsening or progressing?
  - Is the child mature enough to accept treatment?

Treatment

- Child must be aware that there is a problem and have the desire to stop
- Begin with simplest forms of therapy:
  - Behavior Therapy
  - Motivational Books
  - Band-Aid
  - Gloves/Socks

Treatment - Infants

- Pacifier
  - Decreases occurrence of chronic habit
  - Advantage - parent can limit use (and "lose it")
  - Disadvantage - cause more severe malformation
  - Physiologic Pacifiers
    - No real evidence that these work

Popovich and Thompson, Am J Ortho 1973;63: 148-55

Physiologically Designed Pacifiers

Treatment - Toddlers

- No direct dental or social harm
- Treatment
  - Don’t encourage
  - Don’t discourage too vigorously
  - Seek reason for its use
  - Distraction

Treatment - Preschoolers

- Encourage toys, games, friends or outdoor activities
- Television

Treatment – School-Aged Children

- Habit practiced in privacy
- No spontaneous improvement as permanent teeth erupt
- Malocclusion will get worse if habit persists

Behavior Modification

- Reward
  - as suggested by the child
- Chart progress
- Positive reinforcement
- Devise a strategy

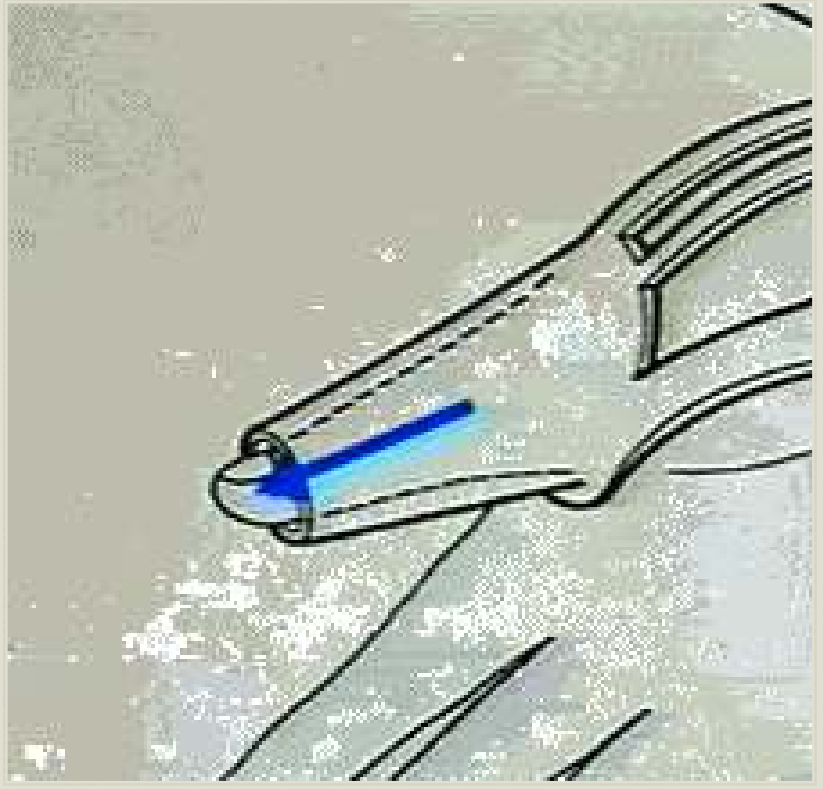
Emotional Support

- Parent and Dentist
  - Reassurance
  - Patience

Treatment

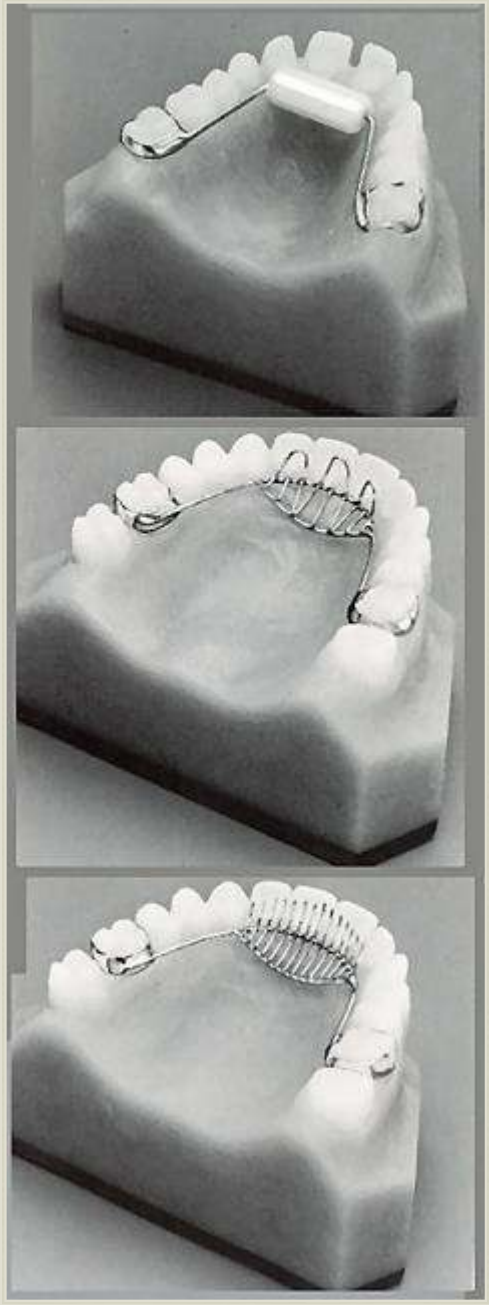
- "Motivational aids"

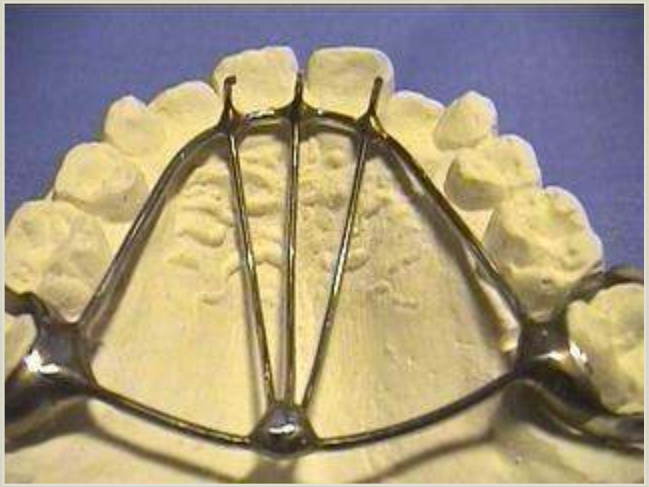
There are some “motivational aids” available on the market, like this “thumbguard”.

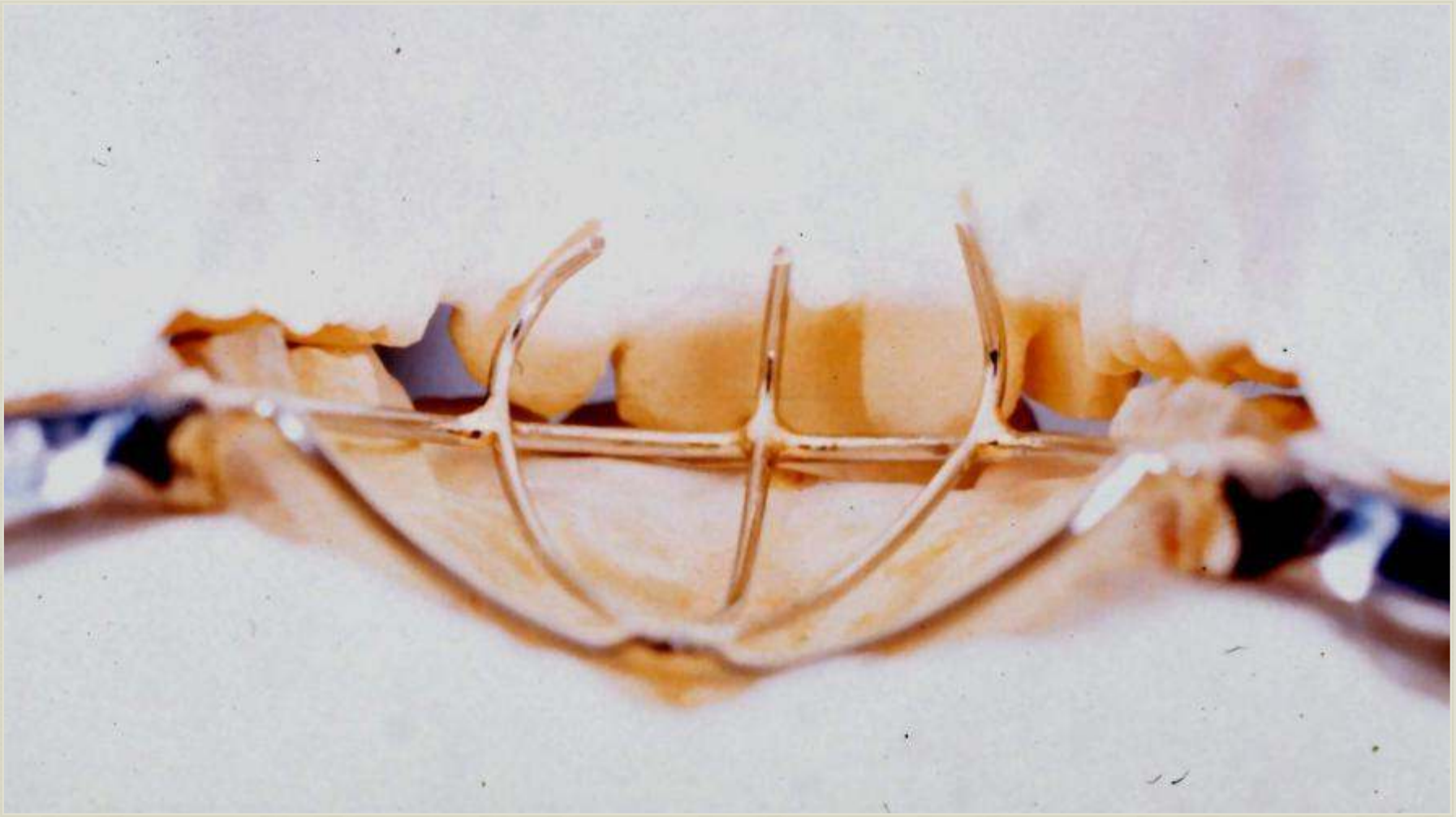


www.thumbguard.com

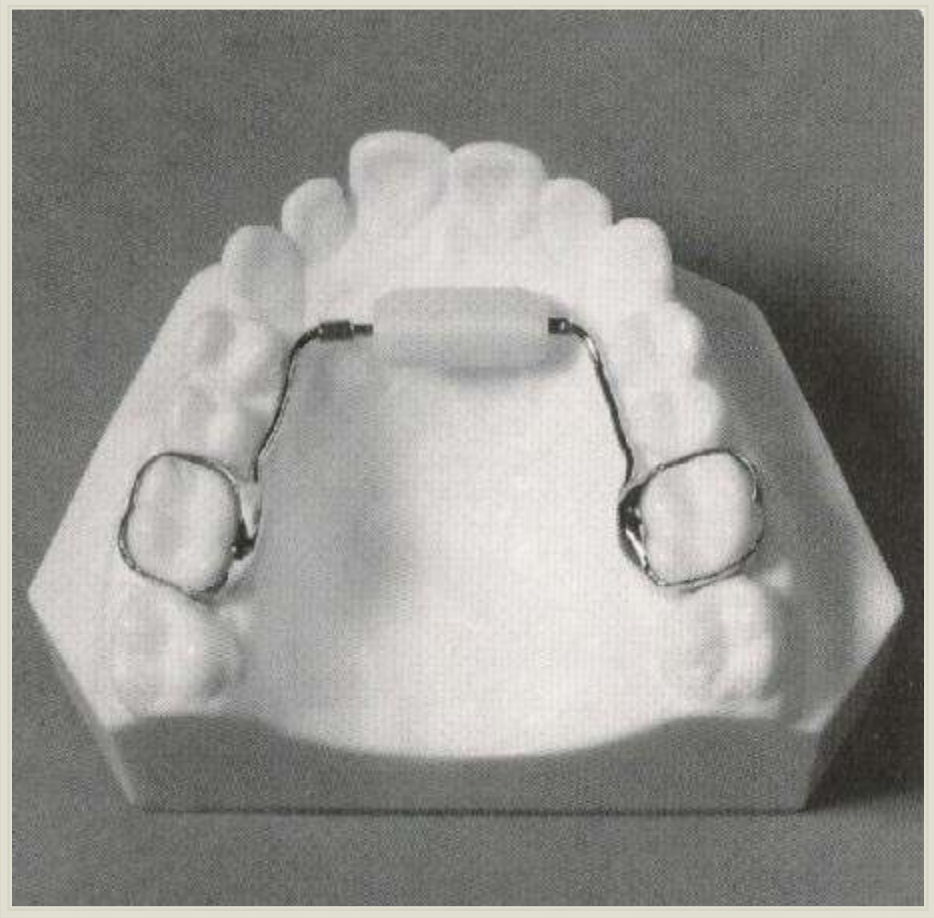
Habit Appliances







Bluegrass Roller- invented by Bruce Haskell, DMD, PhD at the University of Louisville Orthodontic Department



“How long do I have to wear this thing?”

- At follow-up, children who received crib with spurs for:
  - 3 months had a 34% failure rate
  - 6 months had a 16% failure rate
  - 10 months had a 9% failure rate

Haryett, et.al., Am J Ortho, 57, Feb 1970, 164-178

Case Presentation


Facial Profile


Facial Profile Smiling


Facial Front


Facial Front Smiling


Occlusal Upper


Occlusal Lower

Sample Questions

Question 1

- You are a primary care dentist. A mother inquires about her 3 year old son who sucks his thumb "too much." What would you do?
- A) Advise her to stop worrying about the habit at this age, revisit at age 7 to ensure habit has stopped
- B) Place a fixed lingual arch with sharp spurs
- C) Place a removable appliance with crib device
- D) Tell her to punish him if this continues

Question 2

- Which of the following is NOT a skeletal effect seen in digit habit patients?
- A) Rotation of the mandible down and back
- B) Lowered mandibular posture
- C) Class II apical base relationship
- D) Posterior/inferior distortion of maxillary anterior alveolar process

Question 3

- Unusual tongue posture may be caused by which of the following?
- A) Large lymphoid tissue
- B) Large tongue
- C) Skeletal open bite
- D) All of the above
- E) None of the above

Question 4

- To adequately correct a digit habit with a tongue crib, the minimum amount of time the patient should wear the crib is?
- A) one month
- B) three months
- C) six to nine months
- D) two years

Question 5

- Which of the following is NOT considered a type of sucking response?
- A) Reactive
- B) Non-nutritive
- C) Chronic
- D) Nutritive

Question 6

- Dental effects due to a chronic thumb sucking habit persistent beyond age five years of age include all of the following EXCEPT?
- A) Labial inclination/displacement of maxillary incisors and increased overjet with spacing
- B) Over-eruption of posterior teeth
- C) Increased overbite of anterior teeth
- D) Linguo-version of mandibular incisors
- E) Posterior crossbite