appliances

All **of the following are advantages of the indirect method of bonding brackets to a tooth over the direct method *EXCEPT* one. Which one is the *EXCEPTION*?**

• reduced chair-side time

• more precise location of brackets possible in the laboratory

• controlled thickness of the resin between the tooth and the bracket interface

• less technique sensitive

• easier clean-up during bonding and de-bonding

• better visualization in lab *(especially for lingual brackets)*

ORTHODONTICS

appliances

**Which of the following are considered functional appliances?
Select all that apply.**

• frankel

• bionator

• clark's twin block

• herbst

• activator

• quad-helix

ORTHODONTICS

• less technique sensitive

*** The indirect bonding technique is **more complex** and **technique sensitive** and requires extra precautions.

The procedure involves the following steps:

1. An accurate impression with alginate is taken and poured up with orthodontic model stone to be used as a working model.
2. Vertical lines are drawn on the teeth to aid in bracket placement and a separating media is applied.
3. The brackets are then loaded with a filled resin paste and cured.
4. After its initial set, individual positioning of a tray with silicone is prepared by applying it over the bracketed teeth on plaster model.
5. This whole set-up then is placed in warm water to dissolve the separating media.
6. The silicone tray is then removed from the plaster model with brackets embedded in it.
7. Brackets are cleaned under running water making sure that pads have cured resin.
8. Enamel is etched, conditioned and unfilled resin is applied. Unfilled resin is also applied to cured resin on the base of the bracket pads.
9. The silicone tray with embedded brackets is then positioned on the teeth being bonded and held in position until the initial set of the unfilled resin is reached.

Notes
1. The control of **"flash"** *(excess of resin)* not only makes clean up easy but also the controlled thickness of it accurately expresses the built-in prescription of the appliance.
2. Also, in situations where visibility is a problem *(e.g., lingual appliance),* this technique is almost always employed.

Important:

1. All orthodontic appliances obey Newton's Third Law: **There is an equal and opposite reaction to every action.**
2. For each appliance, the sum of the forces and the sum of the moments acting on it sum to zero.
3. Types of appliances
   - **Equal** and **opposite forces:** an elastic band stretched between two brackets produces equal and opposite forces *(the sum of the forces equals zero).*
   - **One-couple appliances:** inserted into a bracket at one end and tied as a point contact at the other end. A couple is produced only at the engaged end. The sum of the forces is zero.
   - **Two-couple appliances:** inserted into a bracket at each end. Both a couple and a force are produced at each end. The magnitude of the couple is largest at the end closer to the bend in the wire. The sum of the forces is zero.

- frankel
- bionator
- clark's twin block
- herbst
- activator

*** The **quad-helix** is a fixed appliance that consists of 4 helices *(2 anterior and 2 posterior).* Essentially, this appliance is used for **posterior cross-bite** cases with a digital-sucking habit.

Functional appliances are by definition ones that change the posture of the mandible, holding it open or open and forward. Stretch of the muscles and soft tissues creates pressures transmitted to the dental and skeletal structures, moving teeth and modifying growth. **They are used to treat Class II malocclusions.**

Functional Appliances *(in brief)* - **Classified as:**

- **Tissue borne:** The **Frankel** functional appliance is the only tissue borne functional appliance, which serves to expand the arch by "padding" against the pressure of the lips and cheeks on the teeth and postures the mandible forward and downward.
- **Tooth borne:**
  - **Activator:** advances the mandible to an edge-to-edge position to induce mandibular growth for the correction of Class II malocclusion. The maxillary teeth are prevented from erupting by the acrylic shelf while mandibular posterior teeth are free to erupt. This improves the deep bite seen in Class II cases.
  - **Bionator:** similar to the activator in function but its design is a trimmed-down version of the activator to make it more comfortable **to** wear.
  - **Herbst appliance:** it can be fixed or partially removable. A metal rod and a tube-telescopic apparatus is attached bilaterally to the maxillary first molars and mandibular first premolars. This helps to posture the mandible forward and induce growth. Jasper modified the appliance by replacing the telescopic apparatus with **a** flexible plastic open coil spring.
  - **Twin block appliance:** the two-piece acrylic appliance postures the mandible forward with help of occlusally inclined guiding planes and bite blocks. The vertical separation of the jaws is also configured by the height of the bite blocks. It postures the mandible forward to induce growth for correction of Class II malocclusions.

appliances

1. The photograph shows a maxillary fixed bilateral space maintainer. This type of space maintainer also is known as a:

2. If both primary canines were present, which of the following space maintainer(s) could be used in place of this appliance that cannot be used in this case?

- distal shoe
- nance appliance
- lingual holding arch
- hawiey retainer
- band and loop *(bilateral)*

ORTHODONTICS

appliances

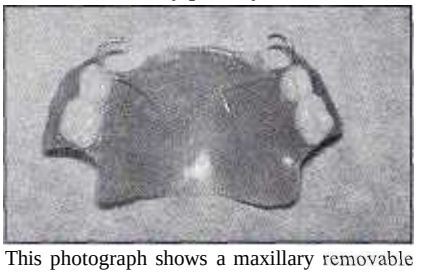
A headgear appliance is used for:

- anchorage
- traction
- both anchorage and traction
- neither anchorage or traction

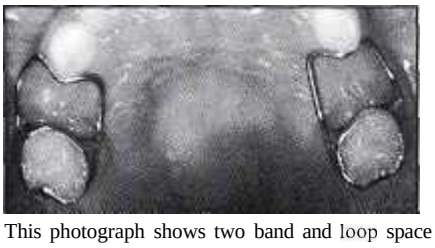
ORTHODONTICS

1. nance appliance
2. band and loop *(bilateral)*

Note the small acrylic button that will rest against the palatal tissue with the Nance appliance. Some clinicians object to the button since it can create tissue irritation. The Nance appliance is used in situations where **premature bilateral** loss of **maxillary primary teeth** has occurred.



This photograph shows a maxillary removable appliance, in this case a maxillary removable bilateral space maintainer. Note: Removable appliances are not commonly used because of problems with the appliance not being worn and the frequent incidence of breakage and loss.



This photograph shows two band and loop space maintainers, an example of the bilateral use of fixed unilateral band and loop space maintainers. These are very common types of unilateral space maintainers, and they often are used bilaterally.

Other appliances:

- **Lower lingual arch:** may be fixed or removable and is effective in maintaining mandibular leeway space while still allowing horizontal and vertical growth changes in the positions of molars and incisors.
- **Lip bumper:** is a removable appliance used in growing children to create and save the space necessary to accommodate the adult teeth without extraction. The lip bumper harnesses the natural forces of the muscles surrounding the lower teeth to broaden and lengthen the dental arch. By keeping the lip pressure away from the lower front teeth, the tongue pressure is allowed to gradually move the front teeth forward to "unravel" or align the crooked teeth. The constant pressure of the lower lip against the front pad of the lip bumper exerts a force to gently push the molar teeth backward. The lip bumper will gradually "stretch" the dental arch to make room for the erupting adult teeth.

• both anchorage and traction

*** **Anchorage** is used to **maintain** space. **Traction** is used to **create** space.

Headgear is used to modify growth of the maxilla, to distalize *(retract)* or protract maxillary teeth, or to reinforce anchorage.

Headgear is an **orthopedic appliance** that allows orthodontists to:

- Control growth of facial structures
- Use various designs *(cervical pull, straight pull, high pull, and reverse pull)*
- Use with growing patients

Headgear components:

- Force applied to first molars that are banded via a **facebow** with a **headcap** or a **neckstrap** for anchorage
- Facebow: Outer bow - different lengths
  Inner bow - sized, connects to the maxillary molars
- Headstraps: Cervical and high pull

Optimal usage of headgear:

- Worn regularly for 10-12 hours per day, minimum is 8 hours per day
- Normally, orthodontists suggest 14 hours/day
- Growth hormone released in the early evening
- Ideal to place headgear after dinner not before bedtime

Magnitude of Force:

- Ideal amount of force for orthopedic changes is 250-450 gm per side
- Ideal amount of force for teeth movement is 100-200 gm per side
- Most movement through intermittent forces
- Hyalinized bone around molars
- Mobility of molars is normal

Note: One of the greatest advantages of using extraoral anchorage *(i.e., headgear)* is that it permits posterior movement of teeth in one arch **without adversely** disturbing the opposite arch.

appliances

Which of the following are fixed orthodontic appliances? Select all that apply.

- lingual archwires
- whip-spring appliances
- palate-separating devices
- frankel's appliances
- edgewise mechanisms
- light-wire appliances

ORTHODONTICS

appliances

Which of the following materials are archwires commonly made of? Select all that apply.

- stainless steel
- beta titanium
- nickel-titanium
- vitalium

ORTHODONTICS

- lingual archwires
- whip-spring appliances
- palate-separating devices
- edgewise mechanisms
- light-wire appliances

*** Frankel's appliance is a **removable functional appliance** and is employed in cases of abnormal *(hyperactive)* soft tissue patterns.

Fixed orthodontic appliances offer **controlled** tooth movement in all 3 planes of space. **Examples include:** lingual archwirc, fixed space maintainers, palate-separating devices, the edgewise mechanism, light-wire appliances as well as other fixed appliances *(i.e., twin-wire appliance, universal appliance).*

Important: Removable orthodontic appliances are generally restricted to **tipping** teeth. Examples include:

- Attached removable appliances
  1. **Active** appliances
     - Extra-oral traction devices: head gears, face masks, chin cups
     - Lip bumpers
     - Active plates: Schwartz appliance, anterior spring aligners
     - Vacuum formed appliances
  2. Passive appliances
     - Bite planes, occlusal splints, retainers
- Loose removable appliances: functional appliances, functional jaw orthopedic appliances

Notes

1. For an orthodontic appliance to be effective in translating the roots of teeth, it must be capable of exerting a torque.
2. **Remember:** The 4 basic components of fixed appliance include: bands, brackets, archwires, and auxiliaries *(elastics or ligatures to hold the archwire in brackets).*
3. **Whip-spring appliances** are used to de-rotate one or two teeth.
4. One of the easiest movements to accomplish is **tipping incisors mesially.**

- stainless steel
- beta titanium
- nickel-titanium

The properties of an ideal wire material for orthodontic purposes can be described largely in terms of the following criteria. It should possess: (1) High strength (2) Low stiffness (3) High working range and (4) High formability

In addition, the material should be **weldable** or solderable, so that hooks or stops can be attached to the wire. Loops and helices are incorporated into archwires to increase the activation range.

Stainless steel wires are very popular because of their good mechanical properties, excellent corrosion resistance, and low cost. The typical formulation for orthodontic use has 18% chromium and 8% nickel. Note: Stainless steel exhibits the highest modulus of elasticity *(stiffness)* and lowest springback.

Nickel-titanium alloys offer a highly desirable combination of a very low modulus of elasticity and an extremely wide working range.

Beta titanium wires are also known as TMA *(titanium-molybdenum alloy)* wires. They offer a highly desirable combination of strength and springiness *(i.e., excellent resilience)* and reasonably good formability.

Note: Each of the major elastic properties *(i.e., strength, stiffness/springiness, and range)* is affected by a change in the length and cross section of a wire. Doubling the length of a wire decrease its strength by half, makes it 8 times less stiff, and gives it 4 times the range. Similarly, when the diameter of a wire is doubled, its strength is increased by 8 times, its stiffness by 16 times, and its working range is decreased by half.
Remember: Strength = Stiffness x Range

Very important: Deleterious effects of orthodontic force:

- Effects on the pulp: light forces should have little if any effect on the pulp; loss of vitality is very rare but has been seen in teeth that are moved with unusually heavy force. Note: Endodontically treated teeth are more prone to root resorption when orthodontically moved.
- Effects on root structure: root resorption is a potential side effect of orthodontic movement; heavy continuous forces have more potential to create root resorption than do light forces. Areas of resorption of both cementum and dentin of the root tend to fill in with new cementum so that the original form of the root is retained. Note: Only if the attack on the root surface produces large defects at the apex that eventually become separated from the root surface is repair of the damaged root impossible.
- Mobility of teeth: moderate mobility occurs and resolves with the completion of therapy.
- Pain: usually occurs within a few hours of initiation of force application and lasts for 2 to 4 days.
- Tissue inflammation: usually results from poor oral hygiene.

appliances

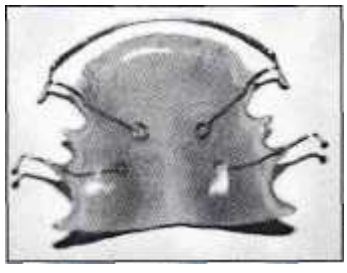
Which appliance is probably the most widely used today by orthodontists?

- the begg appliance
- the edgewise appliance
- the universal appliance
- none of the above

ORTHODONTICS

appliances

The Hawley retainer *(shown below)* is the most common retainer in orthodontics because it can use the palate for anchorage.



- both the statement and the reason are correct and related
- both the statement and the reason are correct but not related
- the statement is correct, but the reason is not
- the statement is not correct, but the reason is correct
- neither the statement nor the reason is correct

ORTHODONTICS

• the edgewise appliance

To overcome the deficiencies of the ribbon arch *(which was an earlier Angle appliance),* Angle reoriented the slot from vertical to horizontal and inserted a rectangular wire rotated 90 degrees to the orientation it had with the ribbon arch. thus the name "edgewise." The dimensions of the slot were altered to 0.022 x 0.028, and a 0.022 x 0.028 precious metal wire was used. These dimensions allowed excellent control of crown and root position in all three planes of space.

The contemporary edgewise appliance has evolved far from the original design while retaining the basic principle of a **rectangular wire in a rectangular slot.** Major steps in the evolution of edgewise appliances include:

- **Automatic rotational control:** this is accomplished either by using twin brackets on the labial surface, or single brackets with extension wings that contact the arch wire to control and correct rotations.
- **Horizontal control:** this is accomplished by varying the relative thickness of the bracket base for teeth of different thickness. Note: In the original edgewise appliance this was accomplished by applying first-order bends *(faciolingual bends)* in the arch wire.
- **Mesiodistal tip control:** is accomplished by angulating the bracket or bracket slot to provide the proper tipping movement for each tooth. **Note:** In the original edgewise appliance this was accomplished by applying second-order bends *(angled bends)* in the arch wire.
- **Torque:** is accomplished by having the bracket slots inclined to compensate for the inclination of the facial surface. Note: In the original edgewise appliance this was accomplished by applying third-order bends *(varying twist in segments of each rectangular arch wire)* in the arch wire.

Brackets are the attachments through which forces are applied to the teeth and they allow the placement of archwire and other accessories to bring about the desired tooth movement. The brackets most commonly used are the **Edgewise brackets** - single and double edgewise- and the **Begg brackets.** Edgewise brackets have an archwire channel which is rectangular in cross-section, with the largest dimension horizontally. These brackets can also be used with round cross-section archwires. The slot sizes commonly used are 0.022 inch *(0.55 mm)* and 0.018 inch *(0.45 mm).* The bracket has tie-wings on opposite sides of the archwire slot for engaging a ligature that is used to bind the archwire to the bracket.

The Begg **bracket** has a narrow slot where an archwire is loosely fitted and held in place with a locking pin. Unlike the Edgewise brackets, these Begg brackets can only be used with round cross-section archwires.

• both the statement and the reason are correct but not related

*** Multiple appliances can use the palate for anchorage. The true reason that the Hawley retainer is the most common is because of the variety of benefits it has and can have when used properly.

The palatal coverage of a removable plate like a Hawley retainer makes it possible to incorporate a bite plane lingual to the upper incisors to control the bite depth. This design consideration is important for any patient who once had an excessive overbite. This **palatal coverage** *(acrylic)* **is the major source of anchorage in the Hawley appliance.**

A Hawley retainer can be made for the **upper** or **lower** arch. The lower retainer is somewhat fragile and may be difficult to insert because of undercuts in the premolar region. **Note:** A patient may have **difficulty pronouncing** linguoalveolar consonants for a few days after receiving a maxillary Hawley appliance **until the tongue** adapts to the palatal coverage.

Major components of a removable appliance:

1. **Retentive component:** retains the appliance in function: consist of various clasps. The best example is Adam's crib.
2. A **framework or baseplate:** usually acrylic. This provides anchorage.
3. **Tooth-moving elements:** typically either springs or screws.
4. **Anchorage component:** resists force of active components *(e.g., Acrylic base-plate).*
5. **Active components or tooth moving components:** springs, screws or elastics.

Indications for removable appliances:

- **Retention** after comprehensive treatment
- Limited **tipping** movements
- **Growth modification** during the mixed dentition

Note: Components of anchorage can also bring about *(desired or undesired)* tooth movements.

appliances

An active finger spring of a removable appliance usually touches the tooth with a point contact. What is the most likely type of tooth movement produced in this situation?

- tipping
- extrusion
- intrusion
- translation

ORTHODONTICS

appliances

Prior to direct bonding,_____is used as an etching agent. Prior to placing bands,_____is used as an etching agent.

- nothing; 35-50% unbuffered phosphoric acid
- 35-50% unbuffered phosphoric acid; nothing
- nothing; 10-15% unbuffered phosphoric acid
- 10-15% unbuffered phosphoric acid; nothing

ORTHODONTICS

•tipping

The best method for tipping maxillary and mandibular anterior teeth is with finger springs. These finger springs are attached to a removable appliance. The most common problems associated with these simple removable appliances are lack of patient cooperation, poor design leading to lack of retention, and improper activation. An undesirable common side effect of a finger spring is the tendency for the root apex to move in the direction opposite from the crown.

Z-springs can also be used but they deliver excessively heavy forces and lack range of motion.

Important: Maxillary incisor rotation is not commonly treated during the stage of mixed dentition. It is best treated after all permanent teeth have erupted *(early permanent dentition).* This is usually accomplished with a simple removable appliance. However, if the incisor is in crossbite, it should be corrected as soon as possible *(while it is erupting).*

Notes

1. When using buccal coil springs to try and regain space by pushing a tooth mesially or distally, be careful because what commonly occurs is rotation of that tooth instead of actual movement.

2. The force generated in the spring is directly proportional to the distance (d) that an orthodontic spring is deflected and the radius (r) of the wire. It is inversely proportional to the length of the spring.

Precisely: $F \alpha \frac{d\, r4}{13}$

Excessive orthodontic force used to move a tooth may: (1) Cause hyalinization *(necrosis)* of the PDL membrane; (2) Cause undermining resorption; (3) Crush the periodontal ligament

Important: Periodontal disease during orthodontic therapy is preventable and is controllable and in continuous studies after orthodontic therapy has been completed, it has been shown that under the properly controlled regimen of treatment the destruction to the periodontal tissues of the teeth is not accentuated to a statistically significant degree as greater than that which occurs during the same interim without orthodontic therapy. Note: When a patient *(young or old)* is in active orthodontic treatment and the gingiva is inflamed, the dentist should encourage better oral hygiene. It may be useful to recommend the use of water irrigation devices to help flush food debris away from the brackets.

• 35-50% unbuffered phosphoric acid; nothing

*** When placing bands, either glass ionomer or zinc phosphate cements are used and do not require etching.

The tooth surface must not be contaminated with saliva, which promotes immediate remineralization, until bonding is completed; otherwise re-etching is required. Topical fluoride should not be used before etching because fluoride decreases the solubility of enamel. Remember: After etching, the tooth surface should have a frosted appearance. Note: 37% phosphoric acid is the most commonly used etching agent.

Indications for using bands instead of bonded brackets:

- To provide better anchorage for greater tooth movement
- For teeth that will need both lingual and labial attachment
- Teeth with short clinical crowns
- Tooth surfaces that are incompatible with successful bonding

Cementation of bands: Glass ionomer cements *(resin or non-resin based)* because of their fluoride releasing properties and retentive strengths are fast replacing Zinc phosphate cement. The cold slab is used for mixing regardless of which of the two cements is used *("frozen slab technique").* This allows the addition of a greater amount of powder into the cement liquid and thus produces a stronger cement.

Important: Anchorage is the word used in orthodontics to mean resistance to displacement. The " anchorage value" of any tooth is roughly equivalent to its root surface area *(which is the same as its periodontal ligament area).* Different anchorage situations include:

- Reciprocal tooth movement: is produced when two teeth or resistance units of equal size are moved against each other and move the same amount toward or away from each other.
- Reinforced anchorage: is accomplished by adding additional teeth to the unit to distribute the force over a larger root surface area in the anchorage unit. Note: Another method for reinforcing anchorage would be to add an extraoral force such as headgear or interarch elastics.
- Stationary anchorage: displacement of anchor teeth can be minimized by arranging the force system so that anchor teeth must move bodily *(translation)* if at all, while movement teeth are allowed to tip. This approach is called "stationary anchorage."
- Cortical anchorage: anchor teeth roots are moved into cortical bone which resorbs more slowly than does medullary bone. This situation may be encountered at an old extraction site, it can be almost impossible to close such an extraction site, because tooth movement is slowed to a minimum as the roots encounter cortical bone along the resorbed alveolar ridge.
- Implants for anchorage: implants can serve as anchorage for holding or moving teeth. The implant *(if stable)* will not move because it has no PDL.

appliances

An example of a maxillary permanent central incisor in crossbite is shown. In order to treat this condition properly, the dentist should do what?

- do nothing until all permanent teeth have erupted
- surgically reposition the central incisor
- correct the condition immediately with a simple appliance
- place a maxillary expander

ORTHODONTICS

appliances

Orthodontic forces can be treated mathematically as vectors.

Forces produce either translation *(bodily movement),* rotation, or a combination of translation and rotation, depending upon the relationship of the line of action of the force to the center of resistance of the tooth.

- both statements are true
- both statements are false
- the first statement is true, the second is false
- the first statement is false, the second is true

ORTHODONTICS

• correct the condition immediately with a simple appliance

Ideally, this anterior crossbite **should be corrected** before it reached the occlusal plane *(while it was erupting).* The most probable etiologic factor for this happening is prolonged retention of the primary maxillary incisors.

Cross-elastics from the maxillary lingual to the mandibular labial can be used to correct a single-tooth crossbite. A maxillary removable appliance can also be used. When elastics are used to move teeth they should be attached directly to the appliance components.

Anterior crossbite, particularly **crossbite of the incisors,** is rarely found in children who do not have a skeletal Class III jaw relationship. A crossbite relationship of one or two anterior teeth, **however,** may develop in a child who has good facial proportions. The maxillary lateral incisors tend to erupt to the lingual and may become trapped in that location, especially in the presence of severe crowding. In this situation, extracting the adjacent primary canines usually leads to spontaneous correction of the crossbite. It is important to evaluate the space situation before attempting to correct any anterior crossbite. If enough space is available to accomplish the movement, a maxillary removable appliance is usually the best mechanism to correct a simple anterior crossbite that requires a tipping movement.

Remember: Anterior crossbite in a primary dentition usually indicates a skeletal growth problem.

Note: The permanent anterior tooth that is **most often atypical** in size is the maxillary lateral incisor.

Elastics are available as rubber bands, elastic thread, and formed shapes for specific purposes. They are used to move teeth, to ligate archwires to brackets, for intermaxillary traction, and for separation. Elastics are always attached to brackets and archwires, **never** around a naked tooth.

- **Class I elastics *(intramaxillary):*** used for traction between teeth and groups of teeth within the same arch.
- **Class II elastics *(intermaxillary):*** usually are worn from a tooth in the anterior part of the maxilla *(i.e., the permanent canine)* to a tooth located in the posterior part of the mandible *(i.e., first permanent molar).* Used to correct Class II malocclusion.
- **Class III elastics *(intermaxillary):*** usually are worn from a tooth in the posterior part of the maxilla *(i.e., the permanent first molar)* to a tooth located in the anterior part of the mandible *(i.e., permanent canine).* Used to improve the overjet in an edge-to-edge or anterior crossbite situation.
- **Crossbite elastics:** are worn from the lingual of one or more maxillary teeth to the buccal of one or more teeth in the mandible to help correct crossbites.

• both statements are true

Orthodontic forces can be treated mathematically as vectors. When more than one force is applied to a tooth, the forces can be combined to determine a single overall resultant. Forces can also be divided into components in order to determine effects parallel and perpendicular to the occlusal plane, Frankfort horizontal, or the long axis of the tooth. Forces produce either translation *(bodily movement),* rotation, or a combination of translation and rotation, depending upon the relationship of the line of action of the force to the **center of resistance** of the tooth. The tendency to rotate is due to the **moment of the force,** which is equal to force magnitude multiplied by the perpendicular distance of the line of action to the center of resistance. The **only force system** that can produce **pure rotation** *(a moment with no net force)* is a **couple,** which is two equal and opposite, noncollinear but parallel forces. The movement of a tooth *(or a set of teeth)* can be described through the use of a center of rotation. The ratio between the net moment and net force on a tooth *(M/F ratio)* with reference to the center of resistance determines the center of rotation. Since most forces are applied at the bracket, it is necessary to compute **equivalent force systems** at the center of resistance in order to predict tooth movement. A graph of the M/F ratio plotted against the center of rotation illustrates the precision required for controlled tooth movement.

Principles of Biomechanics in Fixed Orthodontic Appliances:

- Force: is a load applied to an object that will tend to move it to a different position in space. A force has magnitude, point of application, and direction. Therefore, forces are represented and treated mathematically as vectors.
- **Center of resistance:** a point at which resistance to movement can be concentrated for mathematic analysis. In **single-rooted** teeth, the center of resistance is on the long axis of the tooth one-third to one-half the way from the alveolar crest to the apex. In **multirooted** teeth it is just apically to the furcation. **Note:** A force through the center of resistance causes all points of the tooth to move the same amount in the same direction. This type of movement is called **translation** or **bodily movement.**
- **Rotation:** occurs when a force is applied away from the center of resistance. The potential for rotation is termed a **moment. Note:** A force, applied by a bracket that **does not act** through the center of resistance, causes **rotation** of a tooth. This tendency to rotate is measured in **moments** and is called the moment of the force.
- **Couple:** is two equal and opposite, noncollinear but parallel forces. The result of applying two forces in this way produces **pure rotation without translation. Note:** Couples are usually applied by engaging a wire in an edgewise bracket slot.

appliances

Which of the following may cause extrusion of the maxillary first molars which can cause an open bite?

straight-pull headgear

reverse-pull headgear

cervical-pull headgear

high-pull headgear

ORTHODONTICS

cb&ob

Which condition is appropriately treated at an early age?

- deviated midline in the absence of a functional shift
- mild crowding of lower permanent incisors
- two deciduous molars nearly in crossbite
- posterior crossbite with a functional shift

ORTHODONTICS

• cervical-pull headgear

Cervical-pull headgear consists of a cervical **neck strap** *(as anchorage)* and a standard facebow inserting into the headgear tubes of the maxillary first molar attachments. The objectives of treatment with these types of headgear are to restrict anterior growth of the maxilla and to distalize and erupt maxillary molars. A **major disadvantage** of treatment using cervical headgear is possible extrusion of the maxillary molars. Likely results include: opening the bite, first molars will move distally and forward growth of the maxilla will decrease. **Indications:** Class II malocclusions with deep bite.

High-pull headgear consists of a high-pull headstrap and a standard facebow inserting into the headgear tubes of the maxillary first molar attachments. The objectives of treatment with these types of headgear are restriction of anterior and downward maxillary growth and/or molar distalization and control of maxillary molar eruption.These types of headgear have a more direct effect on the anterior segment of the arch. **Indications:** Class II malocclusions, with increased vertical dimension and minimal overbite.

Straight-pull headgear is similar to the cervical-pull headgear. However, this appliance places a force in a straight distal direction from the maxillary molar. Like cervical-pull headgear, the **indications** are Class II, Division 1 malocclusions *(when bite opening is undesirable).*

Reverse-pull headgear unlike all of the other headgears above, has an **extraoral component** that is supported by the chin, cheeks, forehead or a combination of these structures. It consists of two pads that rest on the soft tissue of these structures. These pads are connected to a midline framework and are adjustable. Side effects include downward and backward rotation of the mandible. **Indications:** Class III malocclusions *(where protraction of the maxilla is desirable).*

Chin cup *(chin cap):* are devices to utilize extra-oral traction to restrain or alter mandibular growth. **Indications:** Class III malocclusions *(due to excessive mandibular growth).*

Timing of Any Headgear Treatment:
- **Females:**
  - 8.5-10.5 years old
- Males
  - 9.5-11.5 years old

Side Effects of Headgear:
- Unwanted extrusion forces on maxillary molars *(typically found with cervical headgear)* will cause the mandible to move inferiorly and posteriorly
- Negates Class II correction
- May cause distal tipping of molars

• posterior crossbite with a functional shift

Posterior crossbite:
- Should be corrected as soon as possible
- Should be thoroughly diagnosed as to whether it is of a dental, functional or skeletal origin
- May be corrected with palatal expansion
- May be associated with a mandibular shift

It is important to **correct posterior crossbites** *(which are related to the transverse plane of space)* and mild anterior crossbites in the **first stage** of treatment, even if the permanent first molars have not yet erupted. Severe **anterior** crossbites, in contrast, are usually **not** corrected until the **second stage** of conventional treatment.

Important: The **most common type** of active tooth movement in the primary dentition is to correct a **posterior** crossbite *(transverse problem).*

Maxillary or palatal expansion appliances are used to correct **transverse** discrepancies by skeletal expansion of the midpalatal suture. **Appliances to correct crossbites:**

- **Hyrax appliance:** is the most commonly used type of appliance for rapid expansion *(0.5 mm/day).* It consists of a hyrax screw held in place with a wire framework that is attached to several upper teeth with cemented bands. The screw is activated by at least 0.25 mm daily *(one quarter turn).*
- **Haas appliance:** is both tissue and tooth-borne and has an extensive amount of palatal acrylic which acts on the palatal mucosa. It consists of bands that are cemented on maxillary first premolars and first molars. Two acrylic pads with a midline jackscrew are connected to the rest of the appliance.
- Hawley-type **removable appliance with a jack screw:** can be used for mild posterior crossbites in children.
- **Quad-helix, W-arch:** these consist of heavy stainless steel wire with four *(quad-helix)* or three *(W arch)* helices that are incorporated to increase the range and flexibility. They can be used to correct unilateral or bilateral crossbites and for correcting rotated molars.
- **Transpalatal arch *(TPA):*** is a thin wire that goes across the roof of the mouth from first molar to first molar. TPA is used to maintain expansion in the molars. An omega loop is typically included making the appliance useful in rotating and widening the molars.

Remember: A **skeletal** crossbite, as contrasted with a **functional** crossbite, usually demonstrates a **smooth closure** to centric occlusion.

cb&ob

Displaced teeth related to functional shifts occur in which of the following situations?
Select all that apply.

• posterior crossbite after prolonged thumb sucking

• class II, division I malocclusion

• anterior crossbite in mildly prognathic children

• an anterior open bite after prolonged thumb sucking

ORTHODONTICS

cb&ob

Maxillary expansion is often done to correct crossbites.

Tongue thrusting often causes crossbite.

• both statements are true

• both statements are false

• the first statement is true, the statement is false

• the first statement is false, the second is true

ORTHODONTICS

• posterior crossbite after prolonged thumb sucking
• anterior crossbite in mildly prognathic children

Prolonged sucking habits often produce a mildly **narrow maxillary arch** and a tendency toward **bilateral crossbite.** Children with this condition usually shift the mandible to one side on closure to gain better function, which can guide permanent molars, or later, premolars into a crossbite relationship.

A young child who has a tendency **toward a Class III malocclusion** will have end-to-end contact of the primary incisors. A **true anterior crossbite** in the primary dentition is **quite rare** because mandibular growth lags behind maxillary growth. The primary incisors wear down rapidly, and an anterior shift of the mandible to escape occlusal interferences rarely occurs until the permanent incisors begin to erupt. A pattern of anterior displacement of the mandible may develop when the permanent incisors come into contact, **however,** producing an anterior crossbite from the shift.

Notes

1. An **anatomic** crossbite *(skeletal),* as **contrasted** with a **functional** crossbite *(from thumb sucking),* usually demonstrates a smooth closure to centric occlusion.
2. A **functional** crossbite is usually caused by thumbsucking and **does not** demonstrate smooth closure into CO.
3. A corrected anterior crossbite is **best retained** by the normal incisor relationship that is achieved through treatment *(the overbite),* **not** appliances.
4. Class **III** relationships are more prevalent in **Asian** populations, whereas **Class II** relationships are more commonly found in **whites of northern European** descent.
5. **Reverse overjet,** suggesting a Class III malocclusion, is much **less frequent** than Class II in the U. S. population.

• the first statement is true, the second is false

***** Tongue thrusting** often causes **open bite.**

A crossbite occurs when some of the teeth wind up on the "wrong side of the track." A crossbite can be unilateral *(on one side)* or bilateral *(on both sides).* It also can occur anteriorly or posteriorly. Posterior crossbite can be either dental, as in a patient with adequate palatal width, or skeletal because of inadequate palatal width.

Orthodontic treatment to correct a crossbite in children should begin as early as possible. The first step, **"maxillary expansion,"** broadens the maxilla with an appliance called an "expander." Fixed to the roof of the mouth, the expander is widened each night for about 1 to 2 months with the turn of a key. The expander remains in the mouth for about 3 more months to allow the bone to harden in its new position.

Note: Braces may be put on the maxillary teeth while expansion is going on to eventually close the "gap-tooth grin" that will develop as the maxilla is being expanded. Once the expansion is complete, the child may need to wear a full set of braces for 1 to 2 years to achieve an ideal occlusion.

Remember:

- **Reverse overjet** or anterior crossbite is associated with Class III skeletal patterns with more than two maxillary anterior teeth in linguoversion.
- **Scissor bite or bilateral lingual crossbite** results from a narrow mandible or a wide maxilla. Milder cases may involve only maxillary first premolars. The severe cases may need either contraction of the maxilla or expansion of the mandible.

After palatal expansion, the following are observed:

- Diastema formation between central incisors
- Expansion of the nasal floor

cb&ob

Which of the following are not classic symptoms of a sucking habit? Select all that apply.

- anterior open bite
- crossbite
- expanded maxillary arch
- proclination of the maxillary incisors
- retroclination of the mandibular incisors
- a Class II malocclusion

ORTHODONTICS

cb&ob

An anterior crossbite should be corrected as soon as it is detected, because it is difficult to retain the corrected occlusion.

- both the statement and the reason are correct and related
- both the statement and the reason are correct but not related
- the statement is correct, but the reason is not
- the statement is not correct, but the reason is correct
- neither the statement nor the reason is correct

ORTHODONTICS

• expanded maxillary arch

*** Constriction of the maxillary arch occurs, **not** expansion.

Anterior open bite is the **most common** sequelae of a **digital sucking habit.** Unilateral cross bites can also occur. **Increased pressure** exerted by the buccinator muscles during sucking, on the maxillary arch, results in its constriction. The other mechanical forces cause the maxillary incisors to procline and the mandibular incisors to retrocline. As the hand rests on the chin, it retards growth of the mandible resulting in a Class II profile.

This patient demonstrates anterior open bite. The patient was a long-term vigorous thumb sucker, which resulted in the open bite. When you encounter cases of overjet and/or open bite, checking for a thumb, digit, or pacifier habit is recommended.

Notes

1. Most of the time the anterior open bite is **asymmetrical** with normal posterior occlusion.
2. Anterior open bites are **much more common** in African Americans than Caucasians, whereas deep bites are much more common in Caucasians.

Remember: An open bite is a malocclusion, or an abnormal bite, in which some teeth, usually the front teeth, cannot be brought into contact with the opposing teeth.

• the statement is correct, but the reason is not

Anterior crossbite of **one or more** of the **permanent incisors** may be evidence of a localized discrepancy and a condition that almost always should be treated in the mixed dentition state or **as soon as** it's discovered. It is most often associated with prolonged retention of a primary tooth. Delayed treatment can lead to serious complications, such as **loss of arch length.** The most essential factor related to correction of anterior crossbite is the space available mesiodistally. **It is easily retained once it is corrected.**

Important: A corrected anterior crossbite is **best retained** by the **normal incisor relationship** that is achieved from the treatment *(the overbite),* **not** from appliances.

Notes

1. The **premature exfoliation of a primary canine** may indicate an arch length deficiency.
2. The **premature loss of a primary mandibular canine** may cause a lingual collapse of the mandibular anterior teeth.
3. After **premature loss of a primary mandibular canine,** the space closes most rapidly from the lateral and lingual migration of the mandibular incisors.

An **anterior crossbite** in the **primary dentition** is often **indicative of:**
- A skeletal growth problem
- A developing Class III malocclusion

It can be the **result of:**
- A labially situated supernumerary tooth
- Traumatic injury
- Arch length discrepancy

cephalometrics

A patient's SNA angle is 78°. The SNB angle is 76°. This tells us that the maxilla is_____, the mandible is_____, and the skeletal profile is_____.

prognathic; retrognathic; class II

retrognathic; prognathic; class III

prognathic; prognathic; class I

retrognathic; retrognathic; class I

prognathic; prognathic; class II

retrognathic; retrognathic; class II

ORTHODONTICS

cb&ob

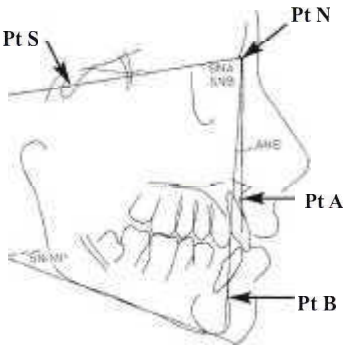
A "Poor man's Cephalometric Analysis" is performed via a:

- dental cast analysis
- facial profile analysis
- photographic analysis
- full face analysis

ORTHODONTICS

retrognathic; retrognathic; class I

The relative position of the maxilla to the cranial base is obtained by drawing two lines; one from the sella turcica *(S)* to nasion *(N)* and one from nasion to **Point A.** The angle made at the intersection of these two lines is the so-called SNA angle. Steiner indicates that in a good skeletal pattern this SNA angle should approximate 82°.



- SNA greater than 82° = maxillary prognathism
- SNA less than 82°= maxillary retrognathism

The SNB angle created by the intersection of line SN and NB defines the sagittal location of the mandibular denture base. Steiner considers an 80° angle compatible with skeletal harmony.

- SNB greater than 80° = mandibular prognathism
- SNB less than 80° = mandibular retrognathism

A third critical angle emphasized by Steiner analysis is the ANB angle. Steiner's norm for this angle is 2° or the difference between the norm for SNA and SNB.

- A Class I skeletal profile ANB angle = 2°
- ANB greater than 4° = Class II skeletal profile
- ANB less than 0° = Class III skeletal profile

Note: Dental arch form is ultimately determined by the interaction of environmental influences on the genetic pattern.

• facial profile analysis

The facial profile analysis delineates the same information as that obtained through lateral cephalometric radiographs. The difference lies in the detail obtained through the latter method, however, the former is considered a vital diagnostic technique for primary evaluation. It is a quick and simple *(also cheap)* technique which readily gives the following information:

1. Anteroposterior position/proportion of the jaws relative to each other
2. Lip posture *(competent/incompetent)* and incisor prominence
3. Vertical facial proportions
4. Inclination of the mandibular plane angle

Note: Within the lower third of anterior face height the mouth should be about one-third of the way between the nose and the chin.

Important: The **most stable area** from which to evaluate craniofacial growth is the **anterior cranial base.**

Notes

1. There is a **significant difference** in esthetics and cephalometric values among racial and ethnic groups.
2. Individual cephalometric measures, **by themselves,** should not be used to make a diagnosis. They should be used to explain or support a diagnosis based on all the data required to make a diagnosis.
3. Cephalometric measures **in themselves** are usually not considered problems, **but what they indicate may** be *(i.e., prognathic mandible, small maxilla, flared incisors, etc.).*
4. In **treatment planning:** impacted teeth are usually a high priority; within occlusal problems, interarch relationships usually take priority over intraarch relationships; habits *(i.e., thumbsucking, bruxism, etc.)* should also be considered.

cephalometrics

Which of the following correlate with a steep mandibular plane? Select all that apply.

- long anterior facial vertical dimension
- anterior open bite
- tendency toward a Class III malocclusion
- greater maxillary-mandibular plane angle

ORTHODONTICS

cephalometrics

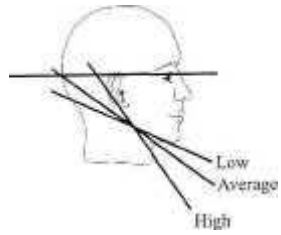
What is needed so that soft tissues are clearly visible on a lateral cephalometric radiograph?

- adjustment in kilovoltage
- adjustment in milliamperage
- a soft tissue shield
- a hard tissue shield
- nothing must be done to make soft tissues visible

ORTHODONTICS

› tendency toward a Class III malocclusion

The **mandibular plane angle** can be visualized clinically by placing a mirror handle or other instrument along the border of the mandible.



Important: A flat mandibular plane angle correlates with **short** anterior facial vertical dimensions *(height)* and **anterior deep bite** malocclusion.

The angle between the mandibular plane *(Go-Me line)* and the maxillary plane *(ANS-PNS line)* is called the **maxillary-mandibular plane angle** *(MMPA).* Its normal value is: 27°(+/- 4°). The greater value indicates a **longer** anterior face height.

There is also an interaction between face height and the anteroposterior position of the mandible; all other things being equal, a **long face** predisposes the patient to **Class II** malocclusion, a **short** face to **Class III** malocclusion.

• a soft tissue shield

The **lateral head radiograph** *(cephalometric x-ray)* must be compared with the "normal" lateral radiographs form an accepted norm. **Linear and angular measurements** are obtained utilizing known anatomical landmarks in the lateral head radiography of the patient. These measurements are then compared with those considered within normal limits and in that way enable the orthodontist to assess aberration in the dentition and jaw structures, which result in malocclusion.

Analysis of cephalometric radiographs is **not limited** to the hard structures such as bone and teeth, but also includes measurements of soft tissue structures such as the nose, lips and soft tissue chin.

Superimposition in longitudinal cephalometric studies is generally on a reference plane and a registration point. This will best demonstrate the growth of structures furthest from the plane and the point. The most stable area from which to evaluate craniofacial growth is the **anterior cranial base** because of its early cessation of growth.

Cephalometrics is **useful in assessing** tooth-to-tooth, bone-to-bone and tooth-to-bone relationships. Serial cephalometric films can show the amount and direction of growth.

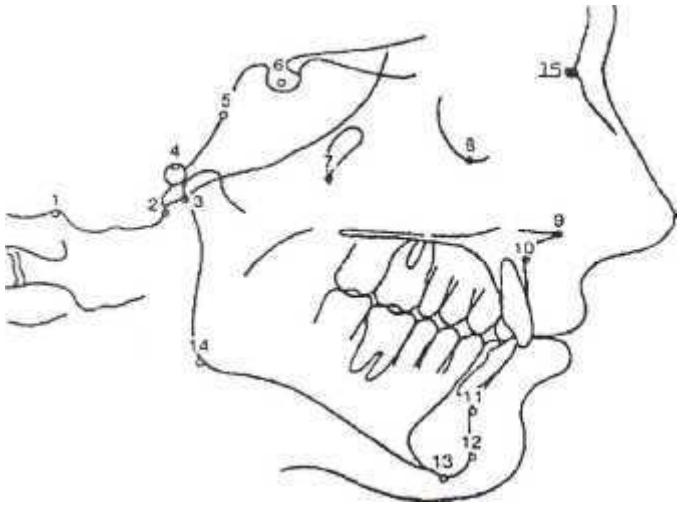
Note: A lateral cephalograph usually shows magnification with up to 7-8% magnification considered acceptable. The resulting double shadows are traced and the average is used for measurements.

Cephalometric studies show that, on the average:

- The maxilla, during growth, is translated in a downward and forward direction
- Mandibular growth stops after maxillary growth

cephalometrics

Identify the Frankfurt-Horizontal plane and the numbered points it uses for its origin.



ORTHODONTICS

general info

In predicting the time of the pubertal growth spurt, while treating jaw mal-relationships in a growing child, the orthodontist can get the most valuable information from:

wrist-hand radiograph

height-weight tables

presence of secondary sex characteristics

stage of dental development

ORTHODONTICS

***** The Frankfort-Horizontal plane is constructed by drawing a line connecting porion (4) and orbitale (8). This has been adopted as the best representation of the natural orientation of the skull.**

1. **Bolton** *(Bo):* highest point in the upward curvature of the retrocondylar fossa of the occipital bone.
2. **Basion** *(Ba):* lowest point on the anterior margin of the foramen magnum, at the base of the clivus.
3. **Articulare** *(Ar):* the intersection of three radiographic shadows, the inferior surface of the cranial base and the posterior surfaces of the necks of the condyles of the mandible.
4. **Porion** *(Po):* midpoint of the upper contour of the metal ear rod of the cephalometer.
5. **Spheno-occipital synchondrosis** *(SO):* junction between the occipital and basisphenoid bones.
6. **Sella** *(S):* midpoint of the cavity of sella turcica.
7. **Pterygomaxillary fissure** *(Ptm)*: point at base of fissure where anterior and posterior walls meet.
8. **Orbitale** *(Or):* lowest point on the inferior margin of the orbit.
9. **Anterior nasal spine** *(ANS):* tip of the anterior nasal spine.
10. **Point A** *(Subspinale):* innermost point on contour of premaxilla between anterior nasal spine and incisor tooth.
11. **Point B** *(Supramentale):* innermost point on contour of mandible between incisor tooth and bony chin.
12. **Pogonion** *(Pog):* most anterior point of the contour of the chin.
13. **Menton** *(Me):* most inferior point on the mandibular symphysis, the bottom of the chin.
14. **Gonion** *(Go):* lowest most posterior point on the mandible with the teeth in occlusion.
15. **Nasion** *(Na):* anterior point of the intersection between the nasal and frontal bones.

Important: The **most stable point in a growing skull** from a cephalometric standpoint is sella turcica, the center of the pituitary fossa in the cranial base.

. a wrist-hand radiograph - example shown below

The **physiologic age** or **developmental age** can be judged by finding out the **skeletal** development. The wrist-hand radiograph offers the **best aid** for this purpose. By looking at the ossification and development of the carpal bones of the wrist, the metacarpals of the hands and the phalanges of the fingers the orthodontist can have an idea about the chronology of skeletal development. Comparing the overall pattern observed in the hand-wrist radiograph, with age standards in a reference atlas, does this. **Important:** Dental age refers to the state of dental maturation.

Remember: The **ulnar sesamoid** or **hamate** bones are considered as **landmarks** to obtain an estimate of the timing of the **adolescent growth spurt.** Wrist-hand radiographs in the dental office can be obtained by using a standard cephalometric cassette and dental x-ray.

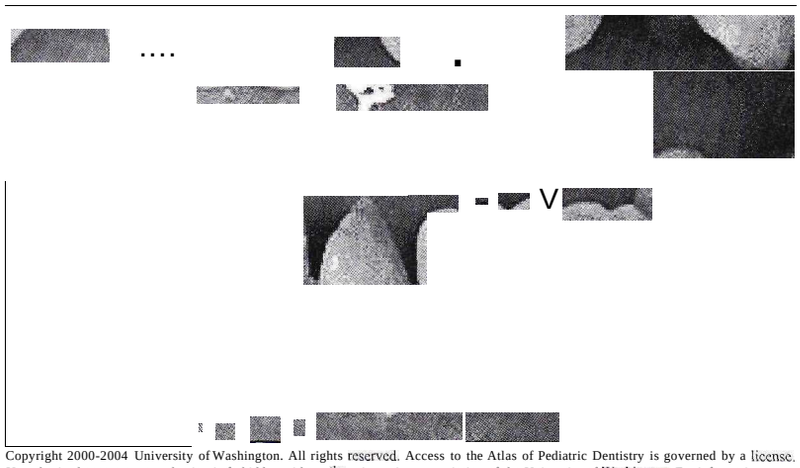
The state of physical maturity or skeletal development **correlates** well with the jaw growth. Orthodontists use this information to predict how much jaw growth can be expected.

Note: After sexual maturity much less growth is expected and therefore growth modification is not attempted.

Remember: Hand-wrist radiographs are less useful in evaluating whether growth has stopped or is continuing *(patient's position on growth curve).* Serial Cephalometric radiographs are used for this purpose.

general info

The anomaly depicted in the picture below is called a___
***** Be as specific as possible.**
Also think about the treatment options for this anomaly.



ORTHODONTICS

general info

During a serial extraction case, which teeth are *NOT* typically removed?

primary canines

> primary first molars

. permanent first premolars

- primary second molars

ORTHODONTICS

• mesiodens

A midline supernumerary tooth *(mesiodens)* in the mandibular arch is shown. Mesiodens usually occur in the maxillary arch. However, you will see them occasionally in the lower arch. Note the crowding of the mandibular permanent incisors. **Extraction of the mesiodens** is the treatment of choice. **Important:** For the best therapeutic result, orthodontic treatment to close the space may be necessary.

A midline supernumerary tooth *(mesiodens)* is present. Note that the maxillary right permanent central incisor is *(slightly)* rotated and that the direction of the roots of the central incisors is more flared. The central incisors most likely were deflected from their normal paths of eruption by the mesiodens. The mesiodens should be extracted.

To localize a supernumerary tooth or impacted tooth and its relationship to other teeth, you should take two or more periapical x-rays at different angles and an occlusal view film.

Conditions associated with **multiple** supernumerary teeth:

- Gardener's syndrome
- Down's syndrome
- Cleidocranial dysplasia
- Sturge-Weber syndrome

Note: Oligodontia/absence of one or more teeth, is more common in females than males. It is often associated with smaller than average tooth-size ratio.

• primary second molars

Serial extraction is the orderly removal of selected primary and permanent teeth in a predetermined sequence. It is indicated primarily in **severe Class I malocclusion** in the **mixed** dentition that has **insufficient arch length.** This procedure primarily benefits children who demonstrate an **arch-length discrepancy.**

Stages in serial extraction: The primary canines are the first to be removed, followed by the primary first molars, and then the permanent first premolars *(usually).* Six to fifteen months is the interval between extractions. To aid in support and retention during this time, a **lingual arch** should be used in the mandible and a **Hawley appliance** in the maxilla. This is usually followed by full orthodontic treatment. **Note:** The **key to success** is extraction of the first premolars **before** the permanent canines erupt.

In serial extraction procedures, concerns about **eruption sequence** are usually related to the eruption pattern of the **permanent mandibular canines** and **first premolars. Note:** After extraction of the maxillary first premolar in a serial extraction procedure, the maxillary canines path of eruption will usually be downward and backward.

Remember: Severe arch space deficiency in the **permanent dentition** *(over 10 mm)* will **almost always** require extractions to properly align teeth.

general info

Arrange the following procedures into their proper sequence for molar uprighting of a tooth requiring both a crown and crown lengthening?

• band

• complete crown preparation and fabrication

• complete crown lengthening procedure

• separate

• upright

ORTHODONTICS

general info

At age 9, young Jimmy needs his tooth #30 extracted due to caries. What is the proper space maintenance treatment?

• distal shoe on "T"

• band and loop on "T"

• removable partial denture

• no space maintenance is needed

ORTHODONTICS

1. separate
2. band
3. upright
4. complete crown lengthening procedure
5. complete crown preparation and fabrication

A common dental condition that can benefit from orthodontic treatment prior to prosthetic treatment is the **long-term loss** of a **mandibular permanent first molar.** The loss of the first molar results in tipping, migration and rotation of the adjacent teeth into the edentulous space. Note: The best way to upright a second molar that had drifted mesially is by **tipping its crown distally** and opening up space for a pontic to replace the missing first molar, rather than attempting to move the second molar mesially to close the space.

Important: A high mandibular plane angle is one of the **most significant** complications of molar uprighting, because if the molar is uprighted unsuccessfully, it can lead to an increased open bite and loss of anterior guidance.

A **normal angulation** of a molar is desirable since it:
- Improves the direction and distribution of occlusal forces
- Decreases the amount of tooth reduction required for parallelism of the abutments
- Decreases the possibility of endodontic, periodontic or more complex prosthodontic procedures
- Increases the durability of the restorations, due to better force distribution
- Improves the periodontal environment by eliminating plaque-retentive areas
- Improves the alveolar contour
- Improves crown-to-root ratio

• no space maintenance is needed — #31 has not erupted yet and it will tend to erupt close to the area of where # 30 had been

Nous

1. **If** a **permanent first molar** is extracted on a child **before** the eruption of the **permanent second molar,** the **best approach** is to allow the eruption of the second molar and the mesial drifting to occur naturally. This will fill in the space most of the time.
2. A space maintainer can be removed as soon as the permanent tooth begins to erupt through the gingiva. *(See picture below).*
3. The most reliable indicator of readiness of eruption of a succedaneous tooth *(and the need for a space maintainer)* is the extent of root development determined by radiographic evaluation. No space maintainer is required if eruption of the succedaneous tooth is imminent.

Very **important:**

1. The **most rapid losses** in the A-P distance of the arch is usually due to a mesial tipping and rotation of the permanent first molar **after removal** of the primary second molar.

2.When the primary second molar is lost, **always maintain** space until the arrival of the second premolar.

This photograph demonstrates a tooth partially erupting between the wires of a space maintainer. The space maintainer now can be removed.

general info

All of the following are types of tooth movement *EXCEPT* one. Which one is the *EXCEPTION*?

'tipping

translation

pulling

extrusion

intrusion

torque

• rotation

ORTHODONTICS

general info

A post-orthodontic circumferential supracrestal fibrotomy is performed to sever collagen fibers, thus reducing the tendency of a rotated tooth to re-lapse.

• both statements are true

• both statements are false

• the first statement is true, the second is false

• he first statement is false, the second is true

ORTHODONTICS

• pulling

The optimal force levels for orthodontic tooth movement should be just high enough to partially but not completely occlude blood vessels in the periodontal ligament. Both the amount of force delivered to a tooth and also the area of the periodontal ligament over which that force is distributed are important. The PDL response is determined not by force alone, but by force per unit area, or pressure.

The **periodontal ligament** is a well-organized connective fibrous tissue and remodels significantly during orthodontic movement. Under normal physiologic conditions, the PDL is rich in collagen fibers organized to resist the forces of mastication.

Important: On the side **toward** which the tooth is being moved, you will find **"osteoclastic activity"** that results in bone **resorption.** This is called the **pressure** or **compression** side. On the side of the root **from** which the tooth moves, you will find **"osteoblastic activity"** that results in bone **apposition.** This is called the **tension** side.

Types of tooth movement that can be accomplished with orthodontics:

1. **Tipping:** the crown moves in one direction while the root tip is displaced in the opposite direction due to rotation or pivoting of the tooth around the axis of resistance or axis of rotation *(located somewhere in the apical one-third of the root).* This creates two areas of compression and tension. Most readily accomplished with a removable appliance. **Accomplished most easily with anterior incisor teeth.**
2. **Translation** *(bodily movement):* a force through the center of resistance causes all points of the tooth to move the same amount in the same direction. This type of movement is called **translation** or **bodily movement.** This creates one area of compression and one area of tension. **Very difficult to accomplish.**
3. **Extrusion:** displacement of the tooth from the socket in the direction of eruption.
4. **Intrusion:** movement into the socket along the long axis of the tooth. **Very difficult to accomplish.**
5. **Torque:** controlled root movement labiolingually or mesiodistally while the crown is held relatively stable *(mesial-distal root movement is also termed "uprighting").*
6. **Rotation:** the **only force system** that can produce **pure rotation** *(a moment with no net force)* is a **couple,** which is two equal and opposite, noncollinear but parallel forces. Recurring tooth rotations after orthodontic correction occur because of the persistence of the elastic supracrestal gingival fibers *(mainly free gingival and transseptal fibers).* **Important: Need adequate retention to prevent relapse.**

Crown movement occurs when a force is applied at the bracket and a small couple is also applied to partially negate the tipping of the crown caused by the force. The center of the rotation is at the **root apex.**

Root movement occurs when a force is applied at the bracket and an even larger couple is applied to more than negate the tipping of the crown caused by the force. The center of rotation is at the **crown** of the tooth.

• both statements are true

One of the most important aspects of orthodontic therapy is **retention.** After malposed teeth have been moved into the desired position, they must be mechanically supported until the hard and soft tissues have been thoroughly modified — both in structure and in function — to meet the demands of the new position. Once the desired occlusal results are achieved and the hard tissues are in normal function, the next step is to maintain or to modify the soft tissues in the retention phase. **Important:** Most clinicians believe that the **collagen fibers in the supra-alveolar tissue** are significantly responsible for the relapse of orthodontically **rotated teeth** as well as the redevelopment of spaces between orthodontically moved teeth.

Remember: Collagen fibers are the primary components of the attached gingiva. When teeth are orthodontically moved, the fibers stretch like rubber bands to adjust to the new position. **However,** like rubber bands, they have a strong tendency to return to their former position, pulling teeth with them as they go.

The **circumferential supracrestal fibrotomy** is a minor surgical procedure. A simple incision in the sulcus is made to the crest of the bone. This incises all of the collagen fibers that are inserted into the root of the tooth. By cutting the collagen fibers, **two** things are accomplished:

1. Eliminate the potential for relapse due to collagen fiber retraction.
2. Allow new fibers to form that will help retain the tooth in its new position.

Note: Post-orthodontic circumferential supracrestal fibrotomy is **most often** performed on a rotated **maxillary lateral incisor.**

general info

Which of the following are part of the rationale for retention in orthodontics *(accomplished with fixed or removable retainers)!*
Select all that apply?

- allow for reorganization of the gingival and periodontal tissues
- minimize changes due to growth
- maintain teeth in unstable conditions

ORTHODONTICS

general info

The cranial vault is made up of a number of flat bones that are formed by _____, _____ cartilaginous precursors.

- endochondral bone formation; with
- intramembranous bone formation; without
- both endochondral and intramembranous bone formation; with
- both endochondral and intramembranous bone formation; without

ORTHODONTICS

• allow for reorganization of the gingival and periodontal tissues
• minimize changes due to growth
• maintain teeth in unstable conditions

Maintaining the treatment result following orthodontic treatment is one of the most difficult aspects of the entire treatment process. Retention is necessary in orthodontics for the following reasons:

1. The **gingival** and **periodontal tissues** are affected by orthodontic tooth movement and require time for **reorganization** when the appliances are removed.
2. Changes produced by growth **may alter** the orthodontic treatment result.
3. The teeth may be in an **inherently unstable position** after the treatment, so that the soft tissue pressures constantly produce a tendency for relapse.

In the **last situation,** gradual withdrawal of an orthodontic appliance is of no value. The only possibilities are accepting relapse or using permanent retention. **Fortunately,** only the first two reasons apply to most orthodontic patients, and maintaining the position of the teeth until remodeling of the supporting tissues is completed and growth has essentially ceased allows a stable orthodontic result without further retention.
Note: Retention is accomplished with either fixed or removable retainers.

Remember:

• The correction of an **anterior crossbite** is easily retained after orthodontic correction by the overbite achieved during treatment.
• Supracrestal **fibers** are commonly associated with relapse following orthodontic rotation of teeth.

Notes
1. Significant reorganization of the PDL occurs in 3 to 4 months, and full-time retention is **critical** during this time.
2. Part-time retention is recommended up to a year and often longer.

• intramembranous bone formation; without

In the cranial vault, the growth process is entirely the result of periosteal activity at the surfaces of the bones. Remodeling and growth occur primarily at the periosteum-lined contact areas between skull bones, the skeletal **sutures,** but periosteal activity also changes both the inner and outer surfaces of these plate-like hones. Although the **majority of growth** in the cranial vault occurs at the **sutures,** there is a tendency for bone to be **removed from the inner surface** of the cranial vault, while at the same time **new bone is added on the exterior surface.**

In contrast to the cranial vault, the bones *(i.e., ethmoid, sphenoid, and occipital bones)* of the **cranial base** are formed initially in **cartilage** and are later transformed by **endochondral ossification** to bone. As ossification proceeds, bands of cartilage called **synchondroses** remain between the centers of ossification. These important growth sites are the **synchondrosis** between the sphenoid and occipital bones, or spheno-occipital synchondrosis, the **intersphenoid** synchondrosis, between the two parts of the sphenoid bone, and the **sphenoethmoidal** synchondrosis, between the sphenoid and ethmoid bones. Eventually, these synchondroses become inactive. **Note:** The bones of the cranial base are not affected to a great degree by growth of the brain *(since they are endochondral bones).*

Notes
1. After age 6, the greatest increase in size of the mandible occurs **distal to the first molars.**
2. The condyle of the mandible grows by **proliferation of cartilage.**
3. The chief factor in the formation of the alveolar process is the **eruption of teeth.**
4. Arch length space for the eruption of permanent mandibular second and third molars is created by **resorption at the anterior border of the ramus.**
5. At birth the greatest dimension of the face is **width.**
6. After a tooth has been moved from one position to another, the resulting bone is **transitional bone.**
7. The dependence of tooth development and tooth eruption upon growth of bone and bones is **considerable.**
8. Growth of the cranial base generally **precedes** growth of the jaws.

Important: Mandibular growth is in the downward and forward directions. Growth in the **condyle** increases the anterior-posterior *(downward and forward pattern of growth)* dimension of the mandible.

general info

Once bone is formed, it grows by:

- interstitial growth only
- appositional growth only
- both appositional and interstitial growth

> degenerative changes into bony structures

ORTHODONTICS

general info

Cartilage differs from bone in that cartilage can increase in size by:

- apposition
- sutural expansion
- interstitial growth
- endosteal remodeling

ORTHODONTICS

• appositional growth only

*** Which is growth by the addition of new layers on those previously formed.

Bone formation begins in the embryo where **mesenchymal cells** differentiate into either fibrous membrane or cartilage. This leads to **two paths** of bone development:

1. **Intramembranous** ossification is so called because it takes place in membranes of connective tissue. **Osteoprogenitor** cells in the membrane differentiate into osteoblasts; a collagen matrix is formed which undergoes ossification.

Note: The **maxilla** and **mandible as** well **as** the **cranial vault** are formed this way.

2. **Endochondral** ossification is how the remainder of the skeleton forms and takes place within a hyaline cartilage model. Cartilage cells are replaced by bone cells *(osteocytes replace chondrocytes),* organic matrix is laid down and calcium and phosphate are deposited. This type of ossification is principally responsible for the formation of short and long bones. **Note:** The ethmoid, sphenoid and occipital bones *(bones of the cranial base)* form this way.

Notes

1. The growth of the **cranial vault** occurs almost entirely in response to growth of the brain. **Remember:** The bones of the **cranial base** are not affected to a great degree by growth of the brain *(since they are endochondral bones).*

2. Growth of the cranial base is primarily the result of endochondral growth and bony replacement at the synchondroses, which have independent growth potential.

3. The greatest period of cranial growth occurs between **birth and 5 years of** age.

4. In **fetal life** , at about the third month, the head takes up almost 50% of the total body length. **At birth,** the head is 30% of the body. In the **adult,** the head represents about 12% of the total body length—all of these changes, which are part of the normal growth pattern, reflect the **"cephalocaudal gradient of growth."**

5. In determining a patient's skeletal growth pattern, the most important factor is **heredity.**

6. Remodeling of bone occurs on **both** endosteal and periosteal surfaces.

7. Remodeling of bone results in the histologic structures called **osteons.**

8. Deposition and resorption **may not** occur in equal amounts.

• interstitial growth

Growth of **cartilage** occurs in two ways:

1. **Appositional** by the recruitment of fresh cells, chondroblasts, from perichondral stem cells and the addition of new matrix to the surface.

Note: The perichondrium consists of a fibrous outer layer and chondroblastic inner layer.

2. **Interstitial** by the mitotic division of, and deposition of more matrix around, chondrocytes already established in the cartilage. Examples of sites that grow by interstitial growth include the **mandibular condyle,** nasal septum and spheno-occipital synchondrosis.

Note: The "V" **principle of growth** is illustrated by the mandibular condyle.

Important: Cartilage tissue is **pressure tolerant** and able to provide flexible support because it is **avascular** and contains an **intracellular matrix** of proteoglycans.

Growth of **bone:**

• **Appositional:** below the covering periosteal layer of bone. Periosteum consists of a fibrous outer layer and a cellular inner layer of osteoblasts, which lay down bone. Because of its **rigid structure,** interstitial growth is not possible.

*** Do **not confuse** bone **growth** with bone **formation.** Bone forms by either endochondral ossification or intramembranous ossification.

It is a truism that growth is strongly influenced by genetic factors, but it can also be significantly affected by the environment, in the form of nutritional status, degree of physical activity, health or illness, and a number of similar factors. **Three major theories** have attempted to explain the determinants of craniofacial growth:

1 Bone, like other tissues, is the primary determinant of its own growth.

2. Cartilage is the primary determinant of skeletal growth, while bone responds secondarily and passively

3. The soft tissue matrix in which the skeletal elements are embedded is the primary determinant of growth, and both bone and cartilage are secondary followers. **Note:** This theory is known as the **functional matrix theory.**

The **major difference** in the theories is the location at which **genetic control** is expressed. The first theory implies that genetic control is expressed **directly** at the level of the bone, and therefore its locus should be the periosteum. The second theory or cartilage theory suggests that genetic control is expressed in the cartilage, while bone responds passively to being displaced. This indirect control is called **epigenetic.** The third theory assumes genetic control is mediated to a large extent outside the skeletal system and occurs only in response to a signal from other tissues.

general info

The sole function of the alveolar process is to support the teeth, which is why it resorbs if a permanent tooth is extracted.

- both the statement and the reason are correct and related
- both the statement and the reason are correct but not related
- the statement is correct, but the reason is not
- the statement is not correct, but the reason is correct
- neither the statement nor the reason is correct

ORTHODONTICS

general info

Bone deposition in the region is responsible for the lengthening of the maxillary arch.

- palate
- tuberosity
- incisor
- zygomatic

ORTHODONTICS

• both the statement and the reason are correct and related

The bone of the alveolar process **exists only to support the teeth.** If a tooth fails to erupt, alveolar bone never forms in that area; and if a tooth is extracted, the alveolus resorbs after the extraction until finally the alveolar ridge completely atrophies.

The space between **the** jaws into which the teeth erupt is generally considered to be provided by **growth at the mandibular condyles** *(especially the molars).* The condyle is a **major site** of vertical growth in the mandible. Many arguments have been made about the condyles function in mandibular growth. Most authorities agree that soft-tissue development carries the mandible forward and downward, while **condylar growth** fills in the resultant space to maintain contact with the base of the skull.

In infancy, the ramus is located at about the spot where the primary first molar will erupt. Progressive posterior remodeling creates space for the second primary molar and then for the sequential eruption of the permanent molar teeth More often than not, however, this growth ceases before enough space has been created for eruption of the third permanent molar, which becomes impacted in the ramus. **Note: After age 6, the greatest increase in size of the mandible occurs distal to the first molars.**

Important: In contrast to the maxilla **both** endochondral and periosteal activity are important in **growth of the mandible.** Cartilage covers the surface of the mandibular condyle at the TMJ. Although this cartilage is **not like** the cartilage at an epiphyseal plate or a synchondrosis, hyperplasia, hypertrophy, and **endochondral replacement** do occur there. All other areas of the mandible are formed and grow by direct surface **apposition** and **remodeling.**

Remember: Growth of the mandible occurs at the mandibular **condyle** and along the **posterior surface** of the ramus. The body of the mandible grows longer by periosteal **apposition** of bone on its **posterior** surface, while the ramus grows higher by **endochondral replacement** at the **condyle** accompanied by **surface remodeling** *(on the anterior surface of the ramus).*

To summarize the growth of the maxilla and mandible:

Notes

1. Growth of the maxilla and its associated structures occurs from a combination of growth at sutures and direct remodeling of the surfaces of the bone.
2. The maxilla is translated downward and forward as the face grows, and new bone fills in at the sutures. Growth of the surrounding soft tissues seems to be important.
3. Growth of the mandible occurs by both endochondral proliferation at the condyle and apposition and resorption of bone at surfaces.
4. The mandible is translated in space by the growth of muscles and other adjacent soft tissues and that addition of new bone at the condyle is in response to the soft tissue changes.

• tuberosity

The bony maxillary arch lengthens horizontally in a posterior direction. Bone has been deposited on the posterior-facing cortical surface of the **maxillary tuberosity.** Resorption occurs on the opposite side of the same cortical plate, which is the inside surface of the maxilla within the maxillary sinus.

Important: The maxilla develops postnatally entirely by **intramembranous** ossification. Since there is no cartilage replacement, growth occurs in two ways: (1) by **apposition** of bone at the sutures that connect the maxilla to the cranium and cranial base and (2) by **surface remodeling.**

Notes

1. The maxilla **migrates downward and forward** away from the cranial base and undergoes significant **surface remodeling.** This surface remodeling includes **resorption** of bone **anteriorly** and **apposition** of bone **inferiorly.**
2. Much of the anterior movement of the maxilla is negated by **anterior resorption,** and downward migration is augmented by **inferior apposition** of bone.
3. As growth of surrounding soft tissues translates the maxilla downward and forward, opening up space at its superior and posterior sutural attachments, new bone is added on both sides of the **sutures.**
4. As the maxillary tuberosity grows and lengthens posteriorly, the whole maxilla is simultaneously carried anteriorly.
5. The amount of forward displacement exactly equals the amount of posterior lengthening.

The counterparts to the bony maxillary arch development include:

- The nasomaxillary complex
- The anterior cranial fossa
- The palate
- The body of the mandible

general info

An 18-year-old patient presents back to you complaining of crowding of his lower anterior incisors. You explain that this is because of:

- late mandibular growth
- pressure from third molars
- maxillary tooth-size excess
- trauma
- an oral habit he must have

ORTHODONTICS

general info

What percentage of 6-year-old children have a median *(maxillary)* diastema?

- **78%**
- **98%**
- **49%**
- less than **25%**

ORTHODONTICS

• late mandibular growth

The current concept is that **late incisor crowding** develops as the mandibular incisors, and perhaps the entire mandibular dentition, move distally relative to the body of the mandible late in mandibular growth.

Late incisor crowding **does occur** in individuals with no third molars at all, and so the presence of these teeth is not a critical variable — the **extent of** late mandibular growth is a **critical** variable.

Cephalocaudal gradient of growth: simply means that there is an axis of increased growth extending from the head toward the feet. When the facial growth pattern is viewed against the perspective of the cephalocaudal gradient, it is not surprising that the **mandible,** being further away from the brain, tends to **grow more** than the **maxilla,** which is closer. **Remember:** The **mandible** can and does undergo **more growth** in the late teens than does the maxilla.

Scammon's **growth curves** point out **four major tissue systems** of the body and a percentage of adult attainment at 20 years of age. The curve for **lymphoid tissue** which reaches 200% of adult attainment at or around age twelve. The lymphoid tissues then undergo a decrease in size until they reach 100% in adulthood. The **neural tissues** reach about 90% of their adult attainment at roughly 9 years of age and finally at age 20 are at adult attainment. **General body tissue** growth follows a direct line to age twenty and finally the **genital tissues** begin their growth at puberty which is around age fourteen.

Important:

1. The **maxilla,** follows a pattern closer to that of **neural tissues** than does the mandible.
2. The **mandible** grows later and follows a pattern closer to that of **genital tissues.**

Growth velocity curves show that growth in height is very rapid after birth but decelerates quickly to a lower, more consistent level in childhood. Growth accelerates again around puberty before slowing and virtually stopping at maturity. **Key point:** The timing of growth spurts is important in orthodontics.

Notes

1. The average peak growth for girls is around age 12, for boys it is around age 14.
2. Generally speaking, the earlier the growth spurt, the shorter the duration of the growth spurt and the less overall the growth will be.
3. Girls will generally start growth sooner, grow for a shorter amount of time, and will grow less than boys.
4. Because of time and variability, chronologic age often is not a good indicator of the individual's growth status.

98%

' It is prevalent in 49% of 11-year-old children.

The cause of a **median diastema** could be any of the following:

- A tooth-size discrepancy
- A mesiodens
- An abnormal frenum attachment
- A normal stage of development

The spaces **tend** to **close** as the permanent canines erupt. The greater the amount of spacing, the less the likelihood that a maxillary central diastema will totally close on its own. As a **general guideline,** a maxillary central diastema of 2 mm or less will probably close spontaneously, while total closure of a diastema initially greater than 2 mm is unlikely. **Note:** If the space is 2 mm or less and the maxillary laterals are in a good position, it is most likely the result of a normal developmental process.

If it is caused by an **abnormal frenum,** it is best to align the teeth **orthodontically** and then do a **frenectomy.** Usually this is not done until the permanent canines erupt.

Accepted methods of **closing** a diastema:

- Using a **lingual arch** with finger springs
- Using a **Hawley appliance** with finger springs
- Using cemented **orthodontic bands** with inter-tooth traction

Note: Space closure is **least likely to occur** following early loss of a **primary maxillary central incisor.**

Notes

1. In the United States, **clefting of the lip and/or palate** occurs in 1 of 700 - 1,000 births, making it the most common craniofacial birth defect.
2. The **lip and primary palate** begin to develop at four to five weeks gestational age. The two medial nasal swellings and the maxillary swellings fuse to form the upper lip. Failure of this fusion results in cleft lip. Clefts of the lip are more frequent in males. Cleft lip involvement is more frequent on the left side than the right.
3. The **secondary palate** develops at approximately nine weeks developmental age. The paired palatal shelves arise from the intraoral maxillary processes. These shelves, originally in a vertical position, reorient to a horizontal position as the tongue assumes a more inferior position. The palatal shelves fuse with one another and with the primary palate anteriorly, which, in turn arises from the fusion of maxillary and mandibular processes. Failure of fusion results in a cleft palate. Cleft palate is more frequent in females.

general info

The length of the mandibular arch is longer than the maxillary arch.

The difference is only about 2 mm.

• both statements are true

• both statements are false

• the first statement is true, the second is false

• The first statement is false, the second is true

ORTHODONTICS

general info

The most commonly impacted tooth is the mandibular canine.

The longer a tooth has been impacted, the more likely it is to be ankylosed.

• both statements are true

• both statements are false

• the first statement is true, the second is false

• the first statement is false, the second is true

ORTHODONTICS

• the first statement is false, the second is true

Remember: The maxillary arch is **slightly longer** in length compared to the mandibular arch. The reason is the sum of the M-D diameter of the **maxillary** permanent teeth is approximately **128 mm,** whereas the sum of the M-D diameter of the **mandibular** permanent teeth is approximately **126 mm.**

Notes

1. Permanent teeth move **occlusally** and **buccally** while erupting.
2. Also, during active tooth eruption there is **apposition** of bone on all surfaces of the alveolar crest and on the walls of the bony socket.
3. The grand design of the human face is the result of **remodeling** and **displacement** which interact to produce the final result.
4. Displacement and remodeling can occur in opposite directions.
5. The **functional matrix theory** *(the 3rd theory on the back of card #34)* holds that:
   - Soft tissue is primary
   - Bone is responsive to soft tissue
   - Deglutition *(mandibular function)* influences mandibular growth
   - The soft tissues of the brain expand thus pacing growth of the flat bones of the skull
6. The growth in width of the jaws is generally completed before the adolescent growth spurt begins.
7. The growth in length of the jaws continues through the growth spurt.

• the first statement is false, the second is true

*** The **maxillary canine** is the **most commonly** impacted tooth.

Failure of a permanent tooth to erupt **may cause** damage to roots of other teeth and also **create** a severe orthodontic problem. Orthodontic consultation is indicated when first observed on an x-ray. An impacted canine or other tooth in a teenage patient can usually be brought into the arch by orthodontic traction after being surgically exposed. In older patients, there is an **increasing risk** that the impacted tooth has become **ankylosed.** Even adolescents have a risk that surgical exposure of a tooth will lead to ankylosis.

In treatment planning for an **impacted tooth,** three principles should be followed:

1. The prognosis should be based on the **extent of displacement** and the **surgical trauma** required for exposure.
2. During **surgical exposure,** flaps should be reflected so that the tooth is ultimately pulled into the arch **through keratinized** tissue, **not through** alveolar mucosa.
3. Adequate **space** should be provided in the arch **before** attempting to pull the impacted tooth into position.

Note: Research suggests the **association** of **impacted** canines with **missing** lateral incisors or shortened roots of lateral incisors. The distal aspect of the root of lateral incisors guides the eruption of canines.

general info

If a permanent maxillary first molar has erupted ectopically against the distal root surface of a primary second molar, what would be the treatment of choice?

• disking the distal of the primary first molar

•an appliance incorporating a finger spring to move the primary second molar mesially

• a brass wire placed between the primary second molar and permanent first molar

• extraction of the primary second molar

ORTHODONTICS

general info

1. The time required to upright a molar can vary from:

2. The time required to stabilize the molar can vary from:

• 2-3 weeks

• 1-2 months

• 2-6 months

• 6-12 months

• 2-3 years

ORTHODONTICS

> a brass wire placed between the primary second molar and permanent first molar

This **separating device** *(brass wire)* will cause the permanent first molar to be tipped distally.

Ectopic eruption occurs when a tooth **erupts in the wrong place.** It is most likely to occur in the eruption of maxillary first molars and mandibular incisors. Its occurrence is much more common in the maxilla and is often associated with a developing skeletal Class II pattern. It is seen in about 2-6% of the population and spontaneously corrects itself in about 60% of cases.

If the eruption path of the **maxillary first molar** carries far too mesially at an early stage, the permanent molar is unable to erupt and the root of the primary molar may be damaged. The mesial position of the permanent molar means that the arch will be crowded unless the child receives treatment. **Remember:** This mesially inclined position of the permanent molar makes it susceptible to decay. If it shows signs of caries, extract the adjacent primary second molar immediately. The resultant space can then be maintained as part of orthodontic treatment.

Ectopic eruption of **mandibular lateral incisors,** which occurs more frequently than mandibular first molars, may lead to transposition of the lateral incisor and canine. A poor eruption direction of the canine, sometimes leading to impaction, is observed often but usually is due to the eruption path being altered by a lack of space.

1. 6-12 months
2. 2-6 months

*** A severely tipped molar or one that requires mesial movement to shorten the pontic space requires a longer treatment time.

A **fixed edgewise orthodontic appliance** is usually used for molar uprighting. The bracket slot size of 0.022 inch allows a wide range of wire sizes to be used. The alternate slot size is 0.018 inch, which can also upright the molar, but limits the wire sizes available. The tipped second molar should be banded because of the considerable posterior masticatory forces produced can easily shear off bonded brackets.

Facts about molar uprighting:

- A severely lingually tipped mandibular molar is **more difficult** to control and upright properly.
- Molar uprighting treatment in **high angles cases** will tend to result in excessive bite opening *(increases vertical dimension of occlusion).*
- **Stabilization** should last until the **lamina dura** and **PDL** reorganize. This ranges from approximately 2 months *(simple uprighting)* to 6 months *(uprighting plus osseous surgery, grafts, etc.).*
- **Retention** *(stabilization)* can be provided by an appliance or by a well-fitting provisional restoration, which will stabilize the tooth positions. This will allow for reorganization of the PDL.

Note: Slow progress in molar uprighting in an adult patient is **most likely** due to occlusal interferences.

When an **orthodontic force** is applied to a tooth, **two scenarios** can develop depending on whether the force is **heavy** or **light:**

- **Heavy force:**
  - **Initial period** *(from seconds to weeks):* causes " **hyalinization"** *(blood supply is lost and results in necrosis)* and **"undermining resorption"** *(osteoclasts attack the lamina dura from the underside of the lamina dura).* When this occurs an inevitable delay in tooth movement occurs.
  - **Secondary period of tooth movement** *(after the above happens):* the PDL heals and there is secondary tooth movement. **Note: It is best to avoid excessive orthodontic force.**
- **Light force:** the use of light forces causes smooth continuous tooth movement **without** formation of a significantly hyalinized zone in the PDL. Osteoclasts attack the adjacent lamina dura, removing bone in the process of **"frontal resorption"** which begins tooth movement. As a result teeth start to move earlier and in **a** more physiologic way than do teeth subjected to heavy forces.

Important: For a tooth to move, **osteoclastic** cells must be formed, which will remove bone from the area adjacent to compression of the PDL. **Osteoblasts** also must form new bone on the tension side, but the timing of **osteoclastic,** not osteoblastic, **activity is critical.**

malocclusion

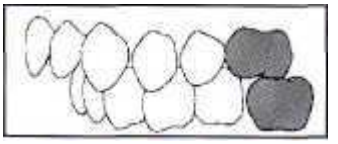
Match the dental arch relationships on the left with the correct depiction of the relationship on the right.

normal occlusion

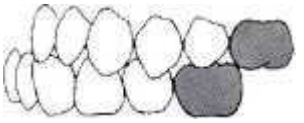
class I malocclusion

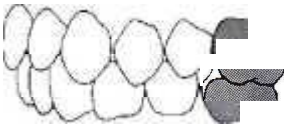
class II malocclusion

class III malocclusion

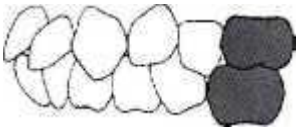


B





D



ORTHODONTICS

malocclusion

Which of the following are signs of incipient malocclusion? Select all that apply.

lack of spacing in primary dentition

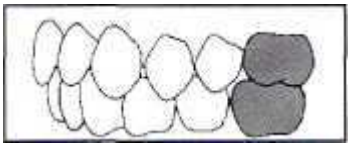
• crowding of permanent incisors in mixed dentition

• premature loss of mandibular primary canines

• larger than normal primary teeth

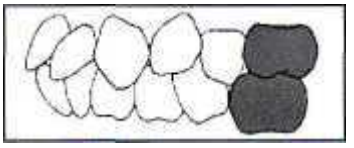
ORTHODONTICS

Normal occlusion = **C**



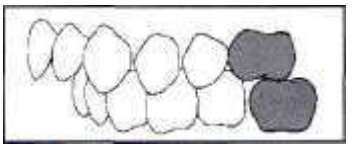
The triangular ridge of the **mesiobuccal cusp** of the maxillary first molar articulates in the **buccal groove** of the mandibular first permanent molar.

Class I malocclusion = D



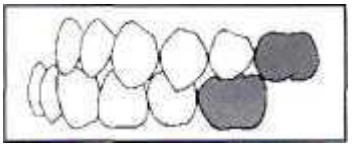
Class I malocclusion has the normal molar relationship **but** the incorrect line of occlusion.

Class II malocclusion = **A**



Class **II** malocclusion has the mandibular molar placed **behind** or posterior to the maxillary molar.

Class III malocclusion = **B**



Class **III** malocclusion has the mandibular molar placed **forward** or anterior to the maxillary molar.

- lack of spacing in primary dentition
- crowding of permanent incisors in mixed dentition
- premature loss of mandibular primary canines

There may be a disproportion between the size of the maxilla and mandible or between the jaws and tooth size resulting in overcrowding of teeth or in abnormal bite patterns. Supernumerary teeth, malformed teeth, impacted or lost teeth and teeth that erupt in an abnormal direction may contribute to malocclusion. Less frequent causes of malocclusion include habits such as thumb sucking or tongue thrusting.

Signs of incipient malocclusion:

- The lack of interdental spacing in the primary dentition
- The crowding of the permanent incisors in the mixed dentition
- The premature loss of the primary canines, particularly in the mandibular arch

Notes

1. The significance of the **lack of spacing** relates to the increased mesiodistal width of the permanent teeth.
2. Arch perimeter does increase after eruption of the incisors. However, it is a small increase in the maxilla, and essentially non-existent in the mandible. Therefore, the minimal arch growth does not usually contribute to further dental alignment.
3. The **premature loss** of the **mandibular primary canine** reflects insufficient arch size in the anterior region. As such, the crowns of the lateral incisors, during eruption, impinge on the roots of the primary canines causing them to resorb. When the canine is shed, the midline will shift in the direction of the lost tooth. You will have lateral and lingual migration of the mandibular incisors.
4. The **maxillary anterior primary** teeth are about 75% of the size of their permanent successors.
5. The **mandibular anterior primary** teeth are, on average, about 6 mm narrower mesiodistally than their successors.

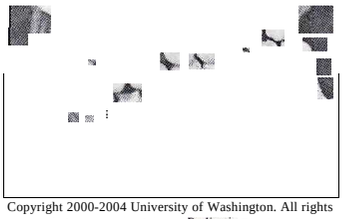
Remember: An **anterior crossbite** in a primary dentition usually indicates a **skeletal** growth problem.

At birth, the alveolar processes are covered by **gum pads,** which soon are segmented to indicate the sites of the developing teeth *(called gum pad stage).* The **maxillary arch** is horseshoe-shaped and the gums tend to extend buccally and labially beyond those in the mandible; furthermore, the **mandibular arch** is posterior to the maxillary arch when the pads contact.

malocclusion

Which Angle Classification does the arrangement of the anterior teeth in this frontal view of study casts most likely represent?

- class I
- class II, division 1
- class II, division 2
- class III



ORTHODONTICS

malocclusion

A patient presents to your office claiming that they have "Long Face Syndrome" based on what he learned on WebDDS.com. The man has obvious mouth breathing as noted by your morning patient who sat next to the man in the waiting room. What malocclusion are you immediately thinking that he has?

- dental open bite
- skeletal open bite
- dental cross bite
- skeletal cross bite

ORTHODONTICS

• class II, division 2

Class II, Division 2 is a malocclusion in which the body of the mandible and its superimposed dental arch are also in distal relationship to the maxilla, and the molar and canine occlusion are the same as Class II, Division 1 type. The distobuccal cusp of the maxillary first molar occludes in the buccal developmental groove of the mandibular first molar, and the maxillary canines occlude mesial to the mandibular canines. The big difference between Division I and Division II is in Division II the maxillary laterals have tipped labially and mesially.

Remember: Class II, Division 1 = maxillary incisors *(centrals and laterals)* are in extreme labioversion. Anterior teeth are most likely to be fractured in children with this type of mixed dentition malocclusion.

Notes

1. There is no set rule as to when a malocclusion should be treated. The age at which it is treated depends on the problem involved.
2. Malocclusions are more identifiable in children 7 to 9 years old because the eruption of permanent incisors reveals tooth-arch length discrepancies.

• skeletal open bite — sometimes called the "Long Face Syndrome"

The following factors are associated with chronic mouth breathing:

- Narrow face
- Narrow oropharyngeal space
- Chronic rhinitis: inflammation of the mucous membranes of the nose
- Chronic tonsillitis
- Allergies
- Deviated nasal septum

Note: The earliest possible diagnosis of this open bite is essential because the condition is not self-correcting and usually worsens with time. Anterior open bites can be classified as a form of apertognathism *(which means open bite deformity).*

malocclusion

Angle's Class I occlusion represents_____% of the population. Angle's Class II occlusion represents_____%. While Angle's Class III occlusion represents the remainder.

- 40; 55
- 50; 45
- 60; 35
- 70; 25

ORTHODONTICS

malocclusion

What cephalometric analysis measurement is characteristic in Class I malocclusions?

- SNA angle of > 84°
- SNB angle of < 78°
- ANB angle of < 4°
- none of the above

ORTHODONTICS

• 70; 25

Classification of Human Occlusion *(Angle's):*

- **Class I: most common** *(about 70 % of the population).* The triangular ridge of the mesiobuccal cusp of the maxillary first molar articulates with the buccal groove of the mandibular first molar. The maxillary central incisors overlap the mandibulars. Maxillary canine lies **between** the mandibular canine and first premolar. Class I is associated with an orthognathic *(straight)* facial profile where the nose, lips, and chin are harmoniously related. It is most commonly caused by a discrepancy between tooth structure and the amount of supporting bone length.
- **Class II: less common** *(about 25 %).* The mesiobuccal cusp of the maxillary first molar falls approximately **between** the mandibular first molar and the second premolar *(the buccal groove of the mandibular first molar articulates posteriorly to the mesiobuccal cusp of the maxillary first molar).* The lower jaw and chin may also appear **small and withdrawn.** The mandibular incisors occlude even more posterior to the maxillary incisors so they may not touch at all. Maxillary canine is **mesial** to mandibular canine. Class II is associated with a retrognathic *(convex)* facial profile.
- **Class III:** the **least common** *(less than 5 %).* The mesiobuccal cusp of the maxillary first molar falls approximately **between** the mandibular first molar and second molar. *(the buccal groove of the mandibular first molar articulates anteriorly to the buccal cusp of the maxillary second premolar).* The chin may also protrude like a **bulldog's does.** The mandibular incisors overlap **anterior** to the maxillary incisors. The maxillary canine is **distal** to mandibular canine. Class III is associated with a prognathic *(concave)* facial profile.

Note: The **nasolabial angle** is the angle between the base of the nose and the upper lip, it should be perpendicular or slightly obtuse.

• **ANB angle of < 4°**

*** **Remember:** An **SNA** Angle of > 84° indicates maxillary prognathism, An **SNB** angle of < 78° indicates mandibular retrognathism and an **ANB** angle of < 4° indicates a harmonious skeletal profile. **Note:** The ANB angle describes the relation of the maxillary and mandibular denture bases.

Severe malocclusion may compromise all aspects of oral function. There may be difficulty in masticating if only a few teeth meet, and jaw discrepancies may force adaptive alterations in swallowing. It can be difficult or impossible to produce certain sounds in the presence of severe malocclusion, and speech therapy may require some preliminary orthodontic treatment. Referral to a speech therapist is **helpful** because both patient and parents are likely to benefit from the counseling. Even less severe malocclusions tend to affect mastication, swallowing and speech; not so much by making the function impossible as by requiring physiologic compensation for the anatomic deformity.

Steiner Analysis: Average Angles	
Angle	Mean
SNA	82.0
SNB	80.0
ANB	2.0
SN-GoGn	**32.0**

malocclusion

A concave profile is associated with a Class III occlusion.

It is also termed a retrognathic profile.

- both statements are true
- both statements are false
- the first statement is true, the second is false
- the first statement is false, the second is true

ORTHODONTICS

malocclusion

Which of the following terms can be used to describe a Class II malocclusion?

- retrognathism only
- overbite only
- underbite only
- overbite or retrognathism
- underbite or prognathism

ORTHODONTICS

• the first statement is true, the second is false

***A **concave** profile is also termed **prognathic.** Although the maxilla can be termed prognathic and/or retrognathic, when no clarification is given these terms refer to the mandible.

Notes

1. An **orthognathic** profile is one in which the nose, lips and chin are harmoniously related. This relationship is usually accompanied by a **Class I dental occlusion.**
2. **A prognathic** profile is one in which the mandible is markedly forward of the maxilla giving a **concave** midfacial appearance. This is often indicative of a **Class III malocclusion.** The maxillary incisors will most likely be tipped lingually.
3. A **retrognathic** profile is one in which there is a protruding upper lip or the appearance of a recessive mandible and chin, or **convex** profile. The convexity is due to the relative prominence of the maxilla compared to the mandible. The mandibular incisors will most likely be tipped forward. This relationship is usually accompanied by a **Class II malocclusion.**
4. As children **mature** their profiles become **less convex.**
5. Speech is affected in severe malocclusions along with other oral functions *(i.e., swallowing and mastication).* For example, patients with a skeletal Class III malocclusion sometimes have difficulty pronouncing "f" and "v" sounds.

Important: A bimaxillary dentoalveolar protrusion means that in both jaws the teeth protrude. This condition is seen in facial appearances in 3 ways: excessive separation of the lips at rest *(incompetence),* severe lip strain *(needed to bring the lips into closure),* and prominence of lips in the profile view.

• overbite or retrognathism

Those malocclusions in which there is a **"distal"** relationship of the mandible to the maxilla make up **Class II.**

Divisions of Class II malocclusions are as follows:

• **Class II, Division 1:** a distal relationship of the buccal groove of the mandibular first permanent molar to the mesiobuccal cusp of the maxillary first permanent molar **along with the maxillary incisors** *(centrals and laterals)* in extreme labioversion *(protruded).*

• **Class II, Division 2:** a distal relationship of the buccal groove of the mandibular first permanent molar to the mesiobuccal cusp of the maxillary first permanent molar **along with the maxillary laterals being tipped labially and mesially** *(sometimes actually overlapping the centrals).* The maxillary centrals are usually retruded somewhat.

*** **Subdivisions:** when the distoclusion occurs on **one side** of the dental arch only, the unilateral distoclusion is referred to as a **subdivision** of its division.
For example:

• **Class II, Division 1 Subdivision Left/Right:** the designated side of the maxillary arch is in a Class II relationship with its occluding mandibular quadrant while the **other side** is in a Class I relationship. The protruded maxillary incisors *(centrals and laterals),* maxillary overjet, and other anterior aberrations, are usually confined to one side of the maxillary arch.

malocclusion

Which of the following is the least common?

- class I malocclusion
- class II malocclusion
- class III malocclusion
- normal occlusion

ORTHODONTICS

malocclusion

Which Angle Classification is shown in this set of study casts?

- class I
- class II, division 1
- class II, division 2
- class III

ORTHODONTICS

• class III malocclusion

Class **III** malocclusions are those in which the body of the mandible and its superimposed dental arch are in a mesial relationship to the skull base and maxilla. The maxillary first molar therefore occludes distal to the mandibular first molar, while the maxillary canine is in an exaggerated distal relationship to the mandibular canine. The mandibular incisors are usually tipped lingually and forward to the maxillary incisors. Also characteristic of the **"true"** Class III malocclusion is the prognathic mandible. Class III subdivision is a Class III relationship of the teeth on one side with a Class I relationship on the other side.

A pseudo-class **III** malocclusion is one in which the mandibular incisors are forward of the maxillary incisors when in centric occlusion, however, the patient has the ability to bring the mandible back without strain so that the mandibular incisors can touch the maxillary incisors *(this ability is often considered diagnostic).* This type is therefore a **milder form** of the **"true"** Class **III** malocclusion and more amenable to conservative orthodontic movement than the "true" Class III malocclusion which often requires surgical correction.

Different etiological factors have been suggested in pseudo-Class III malocclusion:

Dental factors:

- Ectopic eruption of maxillary central incisors
- Premature loss of deciduous molars

Functional factors:

- Anomalies in tongue position
- Neuromuscular features
- Naso-respiratory or airway problems

Skeletal factors:

- Minor transverse maxillary discrepancy

Note: It has also been suggested that these sequelae occur more frequently in subjects with a prognathic mandible *(primary cause)* and the mandibular shift can be considered a functional *(environmental)* factor, therefore the postnatal causative factors may not be the primary cause.

• class II, division 1

In most cases **Class II, Division 1 malocclusions,** the body of the mandible and its superimposed dental arch are in a **distal relationship** to the maxilla and the maxillary incisors are usually in a labial axial inclination. In addition, the relationship of the maxillary first molars and canines to their mandibular counterparts is such that the **distobuccal cusp** of the maxillary first molar occludes in the buccal developmental groove of the mandibular first molar and the **maxillary canines occlude mesial to the mandibular canines.** Besides the labial axial inclination of the maxillary incisors *(overjet),* various aberrations in the individual alignment of the teeth *(for example, crowding)* can be superimposed upon this class.

Remember: Class **II, Division 1 Subdivision Left/Right** includes malocclusions, which have **one side** of the maxillary arch in a Class II relationship with its occluding mandibular quadrant, while the **other side** is in a Class I relationship. The maxillary overjet or other anterior aberrations are usually confined to **one side** of the maxillary arch.

Note: Relative to **a heterogeneous population,** the incidence of malocclusion in a homogeneous population generally is lower.

malocclusion

The existence of a forward shift of the mandible during closure to avoid incisor interference is found in:

- "true"class III malocclusions
- "pseudo"class III malocclusions
- "sunday bite"
- all of the above

ORTHODONTICS

malocclusion

The most common cause of Class I malocclusion is:

- an abnormal frenum
- uneven growth of the arches
- mandibular incisor crowding
- discrepancy between tooth size and supporting bone

ORTHODONTICS

• "pseudo" class III malocclusions

Mesio-occlusion *(Class III malocclusion)* is an anteroposterior dentoalveolar relationship characterized by a more anterior position of the mandibular dentition compared to the maxillary dentition. Clinically, there are two types of mesio-occlusion. The first type is considered to be a positional form, as a result of a mesial displacement of the mandible into an anterior position and has been named in a different ways *(pseudo, functional or apparent).* The other form of mesio-occlusion is a true skeletal Class III. The characteristics of this malocclusion result from a combination of skeletal and dentoalveolar features.

Note: In order to **avoid** the interference of teeth, a patient may adopt a **jaw position** on closure, which is **forward to normal.** This may look like a Class III position in the absence of a true skeletal Class III relationship. Hence termed "pseudo Class III malocclusion." In most cases they have an edge-to-edge bite. Mandibular incisors are forward of maxillary incisors in centric occlusion but the patient can bring the mandible back without strain so that the mandibular incisors touch the maxillary incisors.

The **benefits** attributed to the **treatment** of pseudo-Class III malocclusion in the **mixed** dentition are:

- Preventing unfavorable growth of skeletal components *(in fact, early treatment of anterior crossbite can help to minimize adaptations that are often seen in severe late adolescent malocclusion)*
- Preventing functional posterior crossbite and habits, such as bruxism that can develop from anterior or posterior interferences
- Gaining space for eruption of canines *(lack of space could be caused by retroinclination of upper incisors frequently found in pseudo or Class III malocclusion)*
- Avoiding the risk of periodontal problems to mandibular incisors caused by the traumatic occlusion due to the crossbite.

Note: The **"Sunday bite"** is a term given to the forward postural position of the mandible which is adopted by people with Class II profiles in an effort to improve their esthetics.

• discrepancy between tooth size and supporting bone

The cephalometric analysis of the **Class I occlusion** would indicate an ANB angle of less than 4 degrees signifying a harmonious skeletal profile and sagittal harmony between the maxillary and mandibular dental arches. The **most common cause** of Class I malocclusion is a discrepancy between tooth structure and the amount of supporting bone (length). Perhaps the **most prevalent** characteristic of Class I malocclusion is **crowding** *(i.e., insufficient alveolar arch length to accommodate all teeth in ideal alignment and in a good sagittal position).*

When a diagnosis is made that **crowding does exist** and this crowding exceeds 4 mm in the mandibular arch, extractions are often required to attain an excellent, stable result. **However,** the decision whether to extract teeth depends greatly on a space analysis performed on the mandible. **The patient should be referred to the orthodontist for this analysis.**

In general:

- When the space lacking is **less than 4 mm,** in most cases it can be obtained by carefully stripping some interproximal enamel from each of the anterior teeth
- A space deficiency **exceeding 4 mm** usually indicates extraction for correction of the malocclusion

Notes

1. **Physiologic occlusion:** although not necessarily an ideal or Class I occlusion, it is an occlusion that adapts to the stress of function and can be maintained indefinitely.
2. **Pathologic occlusion:** cannot function without contributing to it's own destruction. It may manifest itself by any combination of: excessive wear of the teeth without sufficient compensatory mechanisms,TMJ problems, pulpal changes ranging from pulpitis to necrosis and periodontal changes.
3. Tooth movement caused by pathologic conditions is termed **pathologic tooth movement.**

misc.

Which of the following is/are generalized causes of failure of tooth eruption or delayed tooth eruption?
Select all that apply.

• hereditary gingival fibromatosis

• down syndrome

• rickets

• hyperparathyroidism

ORTHODONTICS

misc.

One or more of the following statements regarding the effect of environmental influences during growth and development of the face, jaws and teeth are true.
Select all that apply.

« patients who have excessive overbite or anterior open bite usually have posterior teeth that are infra- or supra-erupted respectively

> a non-nutritive sucking habit leads to malocclusion only if it continues during the mixed dentition stage

• negative pressure created within the mouth during sucking is not considered a cause of constriction of the maxillary arch

• "adenoids" which lead to mouth breathing, cannot be indicted with certainty as an etiologic agent of a long-face pattern of malocclusion because studies show that the majority of the long-face population have no nasal obstruction

ORTHODONTICS

- hereditary gingival fibromatosis
- down syndrome
- rickets

*** This condition can result in the **premature exfoliation** of primary teeth.

The generalized eruption failure or "primary failure of eruption" is caused by the failure of the eruption mechanism itself. Bone resorption proceeds normally, but involved teeth simply do not follow the path that has been cleared. The involved teeth do not erupt spontaneously and are not amenable to any orthodontic recourse. This condition is rare.

The **localized** causes of failure of eruption or the delayed eruption of the teeth include:
- Congenital absence
- Abnormal position of the crypt
- Lack of space in the arch *(crowding)*
- Supernumerary teeth
- Dilacerated roots

Remember: Anodontia, diagnosed in a 5 year old child, primarily affects the growth of the **alveolar bone** *(as opposed to the midface, maxilla, or mandible, etc.).* *** The bone of the alveolar process **exists only to support the teeth.** If a tooth fails to erupt, alveolar bone never forms in that area; and if a tooth is extracted, the alveolus resorbs after the extraction until finally the alveolar ridge completely atrophies.

- patients who have excessive overbite or anterior open bite usually have posterior teeth that are infra- or supra-erupted respectively
- a non-nutritive sucking habit leads to malocclusion only if it continues during the mixed dentition stage
- negative pressure created within the mouth during sucking is not considered a cause of constriction of the maxillary arch
- "adenoids" which lead to mouth breathing, cannot be indicted with certainty as an etiologic agent of a long-face pattern of malocclusion because studies show that the majority of the long-face population have no nasal obstruction

Notes

1. A sucking habit that is **stopped prior** to mixed dentition has not been shown to lead to malocclusion.
2. The negative pressure created within the mouth during sucking is **not** what causes the maxillary constriction. It is the force from the buccinator muscles that does.

misc.

Which of the following statements are true?
Select all that apply.

- in the maxillary arch, the primate space is located between the central incisors and lateral incisors
- in the maxillary arch, the primate space is located between the lateral incisors and canines
- in the mandibular arch, the primate space is located between the canines and first molars
- in the mandibular arch, the primate space is located between the lateral incisors and canines

ORTHODONTICS

misc.

Primary molar relationships are known as:

- class relationships
- step relationships
- primitive relationships
- occlusion relationships

ORTHODONTICS

- in the maxillary arch, the primate space is located between the lateral incisors and canines
- in the mandibular arch, the primate space is located between the canines and first molars

*** Spacing is normal throughout the anterior part of the primary dentition, **but is most noticeable** in these two locations.

These primate spaces are normally present from the time the teeth erupt. Developmental spaces between the incisors are often present from the beginning, but become somewhat larger as the child grows and the alveolar processes expand. Generalized spacing of the primary teeth is a **requirement** for proper alignment of the permanent incisors. This spacing is **most frequently caused** by the growth of the dental arches.

If spacing is present, there is a possibility that **drifting** of the adjacent teeth will occur if there is a loss of a primary incisor. However, if there is **no spacing present** and the primary anterior teeth were in contact before the loss, a collapse in the arch after the loss of one of the primary incisors is almost certain.

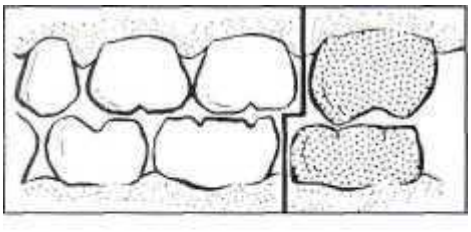
Important: This is not true in the case of a lost permanent incisor. Space closure occurs rapidly whether spacing is present or not prior to the loss. Space maintenance would be indicated.

Remember: One of the **most common causes of malocclusion** is inadequate space management following the early loss of primary teeth.

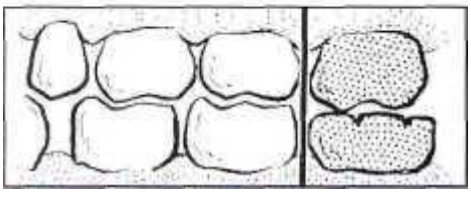
Primary dentition stage:

- Starts with the eruption of the primary teeth and lasts until the first permanent tooth erupts
- Boys precede girls in total number of teeth erupted until 15 months, then girls surpass boys and remain ahead throughout completion of the primary dentition
- The mesiolingual cups of the maxillary molars occludes in the central fossae of the mandibular molars, and the incisors are vertical, with minimal overbite and overjet. The mandibular second primary molar usually is somewhat wider mesiodistally than the maxillary, giving rise, typically, to a **flush terminal plane** at the end of the primary dentition stage.
- When the terminal plane is straight until the arrival of the first permanent molars, the latter are usually guided into an ideal **end-to-end relationship** considered "normal" for whites in North America.
- Interproximal cavities, sucking habits, or the skeletal pattern may produce a **"step"** rather than a flush terminal plane
- **Distal step:** the mandibular terminal plane is **distal** to the maxillary terminal plane
- **Mesial step:** the mandibular terminal plane is **mesial** to the maxillary terminal plane

- step relationships



The primary molar relationship shown in the figure to the left is a **mesial-step** relationship, as the distal surface of the lower second primary molar is mesial to the distal surface of the upper second primary molar. The mesial-step molar relationship allows for the first permanent molars to erupt into a normal occlusion immediately on eruption. Note that the permanent molars are in a normal Class I occlusion.



This figure demonstrates the **flush-terminal-plane** relationship for primary molars. The distal surfaces of the maxillary and mandibular second primary molars are in an end-to-end relationship.

In these cases *(the flush-terminal-plane),* the first permanent molars do not erupt immediately into a normal relationship. As you can see, the first permanent molars are in a Class II relationship. The Class II relationship usually is temporary until the second primary molars are lost and the permanent molars move into a Class I relationship. This occurs at approximately age ten or eleven and is called the **late mesial shift.** Both the mesial-step and flush-terminal-plane relationships usually result in the development of a **Class** I permanent molar occlusion, although the flush-terminal-plane relationship can result in a Class II relationship if the late mesial shift **does not** occur. Another step relationship involves a situation where the distal surface of the mandibular primary second molar is located to the distal of the distal surface of the maxillary primary second molar. This is termed a **distal-step** relationship. In these cases, the permanent molars erupt into a Class II relationship. **Important:** The **terminal plane** relationship of **primary second molars** determines the future anteroposterior positions of permanent first molars.

misc.

Leeway space is a calculated difference between primary and permanent tooth size.

There is typically more leeway space in the maxillary arch.

- both statements are true
- both statements are false
- the first statement is true, the second is false
- the first statement is false, the second is true

ORTHODONTICS

misc.

A periapical radiograph of primary tooth M shows tooth #22 overlapping half of the root. The patient is not in the chair, so you cannot palpate to determine on which side tooth #22 is erupting. What would you presume?

- tooth #22 is erupting distally
- tooth #22 is erupting mesially
- tooth #22 is erupting lingually
- tooth #22 is erupting facially

ORTHODONTICS

• the **first** statement is true, the second is false

*** There is typically more leeway space in the **mandibular** arch.

Important:

1. The primary anterior teeth *(incisors and canines)* are narrower than their permanent successors mesiodistally.
2. The primary molars are wider than their permanent successors mesiodistally.

*** This size difference has clinical significance. The difference is called the **leeway space.**

The **mandibular** leeway space averages **about 2.5 mm on each side** while the **maxillary** leeway space averages **about 1.5 mm on each side.** The important factor is that **some space will be available** in the posterior part of the mouth. This leeway space serves to at least accommodate the permanent canines, which are generally larger than the primary canines.

During the **canine-premolar** transition period, the **permanent first molars** generally move mesially into the leeway space after the primary second molars are shed, thus causing a **loss** in arch length.
Note: This is referred to as **"the late mesial shift of a permanent first molar."**

Notes

1. On occasion, the permanent incisors "spread out" due to spacing. This is referred to as the **"ugly duckling stage"** of development. With the eruption of the permanent canines, the spaces often will close. As a **general guideline,** a maxillary central diastema of 2 mm or less will probably close spontaneously, while total closure of a diastema initially greater than 2 mm is unlikely.
2. The permanent dentition stage begins when the last primary tooth is lost.
3. For the **maxilla and mandible:** Growth in the width is completed first, then growth in length, and finally growth in height.
4. Maxillary and mandibular **arch widths increase** and this is completed before the adolescent growth spurt
5. The dental arch **perimeter *(length)* decreases** a surprising amount during the late adolescent and young adult periods due to the late mesial shift of the permanent molars into the leeway space, the mesial drift tendency of the posterior teeth in general, and the lingual positioning of the incisors.
6. **Increases in the vertical height** of the jaws and face continue until 17 or 18 in girls and in the early twenties in boys.

• tooth # 22 is erupting facially

Sometimes the permanent mandibular canines erupt facially relative to the primary canines. However, often they are right in line with the primary canines. If there are problems in eruption, these teeth can be displaced either lingually or labially, but usually they are displaced labially if there is not enough room to accommodate them within the arch.

Notes

1. The mesial inclined plane of the primary maxillary canine articulates with the distal inclined plane of the primary mandibular canine. This is the normal relationship.
2. In both the maxillary and mandibular arches, the permanent incisor tooth buds lie lingual as well as apical *(inferior)* to the primary incisors. The result is a tendency for the mandibular permanent incisors to erupt somewhat lingually and in a slightly irregular position. This occurs even in children who have normal dental arches and normal spacing within the arches.
3. Permanent teeth normally move occlusally and buccally while erupting.
4. Remember: The maxillary arch is slightly longer *(approximately 128 mm)* than the mandibular arch *(approximately 126 mm).*

misc.

A 6-year-old patient and her mother present to your office. Her mom's chief complaint is "My kid's overbite makes her look like Bugs Bunny, her front teeth hide her lower lip." What is wrong with the mom's statement?

• she is mixing up overbite and overjet

• she is mixing up overbite and open bite

• she is mixing up overbite and negative overjet

• she is mixing up her cartoon characters

ORTHODONTICS

misc.

Which of the following teeth are required for a dentist to perform a Moyers' mixed dentition analysis?

mandibular first molars

maxillary first molars

mandibular incisors

maxillary incisors

ORTHODONTICS

• she is mixing up overbite and overjet

*** This is a common layperson mistake. **Overjet** is in the anterior-posterior dimension, whereas **overbite** is in the vertical direction.

Overbite
(deep bite)

Overbite is the vertical overlapping of the maxillary anterior teeth over the mandibular anterior teeth. Overbite is generally in the range of 10% to 20% but can vary up to 50%.

Overjet

Overjet is the horizontal projection of the maxillary anterior teeth beyond the mandibular anterior teeth *(labial axial inclination of the maxillary incisors).* Normal overjet is 2-3 mm.

• mandibular incisors

A mixed dentition analysis *(transitional dentition analysis)* determines **space available versus space required.** The analysis is based on a correlation of tooth size; one may measure a tooth or a group of teeth and predict accurately the size of the other teeth in the same mouth.

In the **Movers' mixed dentition analysis,** the size of the unerupted canines and premolars is predicted from knowledge of the size *(mesiodistal width)* of the **mandibular incisors** that have already erupted into the mouth early in the mixed dentition. The maxillary incisors are not used in any of the predictive procedures, since they show too much variability in size.

Note: The **mandibular incisors** are measured to predict the size of maxillary as well as mandibular posterior teeth.

If mandibular anterior crowding is noted during the mixed dentition phase, the most appropriate approach to management is to take study models and perform an arch length analysis. This mandibular incisor crowding usually results from a **tooth size-arch length discrepancy.**

Mixed dentition stage:

- That period during which primary and permanent teeth are in the mouth together, the **earliest** indication of a mixed dentition consists of the **primary** dentition and the **permanent mandibular first molars.**
- Supervision of a child's development of occlusion is most critical during this mixed dentition stage.
- From a clinical point of view, there are two very important aspects to the mixed dentition period:
  1. The utilization of the arch perimeter
  2. The adaptive changes in occlusion that occur during the transition from one dentition to another.
- The **alveolar process** is one of the most actively adaptable areas of bone growth during the period of transition between the dentitions. Therefore, it is an **ideal time** for most major orthodontic intervention.
- **Normal characteristics of the mixed dentition stage:** molar and canine relationships are Class I; leeway space is present; well-aligned incisors or up to moderate crowding of the incisors; proximal contacts are tight.
- The **total leeway space** is the important clinical consideration and the **method of utilization** of the leeway space is the **key factor** in the transitional dentition.

misc.

Which of the following is false concerning a mixed dentition analysis? Select all that apply.

• it is used to predict the amount of crowding after the permanent teeth erupt

• it determines space available vs. space required

• the analysis is based on a correlation of tooth size

• it is performed during the mixed dentition

• it is performed with a boley gauge, study models and a prediction table

• analysis is done for each quadrant

ORTHODONTICS

• **analysis is done for each quadrant**

*** This is **false;** analysis is done for **each arch.**

Procedure for mixed dentition analysis:

1. Measure the mesial-distal diameter of the mandibular incisors and add them together
2. Measure the space available for the mandibular incisors
3. Subtract #1 from #2

*** A negative number **indicates crowding** in the incisor region

4. Measure the space available for the canine and premolars on each side of the arch
5. Calculate from the prediction table the size of the canine and premolars
6. Subtract #5 from #4 on each side

*** Once again, a **negative** number **indicates crowding**

*** At this point, there will be **3 numbers:**

- The number for incisor crowding or excess space
- The number for the right canine and premolar crowding or excess space
- The number for the left canine and premolar crowding or excess space

*** **Add the three numbers:**

- A **negative** number = crowding
- A **positive** number = space

Note: For the **maxillary arch,** use the mandibular incisors to predict the size of the maxillary canines and premolars. Follow the same steps as described for **mandibular** teeth.