Orthodontics and Dentofacial Development

Overview

Anatomy and Skeletal Growth

Development of Dentition

Diagnosis and Treatment Planning

Treatment

Retention and Relapse

Anatomy and Skeletal Growth

Growth of Naso-Maxillary Complex
- Develops postnatally entirely by intramembranous ossification
  - By apposition of the bone at the sutures
  - By surface remodeling
- The entire surface of the anterior maxilla
- Grows “out from under the cranium”
  - Down and forward
  - The sutures remain the same width, and the various processes become longer

Anatomy and Skeletal Growth

Growth of Mandible

Endochondral
- At the condyle
- Periosteal
- Down and forward growth
  - From the base of the cranium

Now let us talk about how we transition from primary molar occlusion to permanent molar occlusion.

When evaluating the relationship of the primary second molars, they are classified into three distinct categories: a flush terminal plane, distal step and mesial step.

Three categories: Flush Terminal Plane, Distal Step, and Mesial Step

Flush Terminal Plane (Developing a Class I Molar Relationship)
75% of the flush terminal planes will ultimately develop into a Class I molar relationship in the permanent dentition, still they must be observed critically because an abnormal Class II may develop.

Early Mesial Shift
(Developing a Class I Molar Relationship)
Flush primary second molars
Spaced primary dentition (primate spaces)
Normal eruption pattern - mandibular first molar migrates mesially to close primate space

Late Mesial Shift
(Developing a Class I Molar Relationship)
Flush primary second molars
Closed primary dentition (no primate spacing)
Class I via leeway space (man premolars smaller than primary molars)

Mesial Step
Class I or Class III
Dependent upon extent of step seen clinically and patient’s growth pattern
Refer for early evaluation (by 8 years)
Distal Step
Usually develops into Class II skeletal and dental malocclusion (~100%)
Flush terminal plane plus factors which reduce arch length
Refer for early evaluation

Class I Molar Relationship of the Maxilla to the Mandible
The normal anteroposterior relationship of the mandible to the maxilla. The mesiobuccal cusp of the permanent maxillary first molar occludes in the buccal groove of the permanent mandibular first molar.

Class 2 Molar Relationship of the Maxilla to the Mandible
The posterior relationship of the mandible to the maxilla.
The mesiobuccal cusp of the permanent maxillary first molar occludes mesial to the buccal groove of the permanent mandibular first molar.
Division 1
   Labioversion of the maxillary teeth.
Division 2,
   Linguoversion of the maxillary central incisor teeth.

Class 3 Molar Relationship of the Maxilla to the Mandible
The mesiobuccal cusp of the permanent maxillary first molar occludes distal to the buccal groove of the permanent mandibular first molar.

Etiology- Arch Length Reduction
Large carious lesions
Early loss of maxillary first or second primary molars
Ectopic eruption (especially maxillary first molar)

Diagnosis and Treatment Planning
Diagnostic Techniques
   Interview to establish C/C
   Review of the medical and dental history
   Physical growth evaluation
   Growth Charts
   Hand-wrist radiographs

Diagnosis and Treatment Planning
Social and Behavioral Evaluation
   Clinical Evaluation
   Oral Health
   Jaw and Occlusal function
   Evaluation of Facial Properties
      Developmental Age
      Facial Esthetics vs. Facial Proportions
      Frontal Exam
      Profile Analysis

Diagnosis and Treatment Planning
Diagnostic Records
   Intraoral photos
   Panoramic film
Regular dental care
No previous caries
No obvious pathology
Hx of fluoridation
Bitewings
Previous caries
Obvious caries

**Diagnosis and Treatment Planning**

**Indications**
- Psychosocial Problems
- Oral Function
- Relationship to Injury and Dental Disease

**Index of Treatment Need (IOTN)**
- Grade 5 – Extreme
- Grade 4 – Severe
- Grade 3 – Moderate
- Grade 2 – Mild
- Grade 1 – No Need

**Diagnosis and Treatment Planning**

**Contraindications**
- Poor oral hygiene and lack of cooperation.
- Lack of bony support for the dentition.
- Poor general or mental health.
- Lack of interest.

**Removable Appliances**

**Advantages**
- Can be removed for Social Situations
- Fabricated in the lab
- Allow growth guidance

**Disadvantages**
- Patient Compliance
- Inability of complex tooth movements

**Removable Appliances**

**Indications**
- Growth Modification
- Limited tooth movements
- Retention

**Removable Appliances**

**Passive Tooth-borne Appliances**

**Activator**
- Used in the mixed dentition to treat Class II division 1 malocclusion. It is a loose fitting appliance that fits on the maxilla and worn only at night.
- It transmits the tissue-forming functional stimuli from the activity of the tongue, lips, facial and masticatory muscles to the teeth, periodontal tissues, alveolar bone, and mandibular joint.
- The effect is to cause mandibular growth and open the bite 3-4mm. It is constructed to position the patient into a class I occlusion with the teeth 5mm apart using an anterior bite plane. A Hawley bow provides
stability.

Bionator
Used to correct class II malocclusion and anterior open bites, it can be used in the mixed dentition or early adult dentition stages.
Similar in function as an activator.

Removable Appliances
Herbst Appliance
Used in the treatment of skeletal class II occlusions, suggested for patients who do not readily cooperate with traditional removable appliance therapy.
Maxillary and mandibular arches are splinted with frameworks that are connected with a pin and tube devise that positions the mandible forward.
Stimulates mandibular growth in the growing patient.

Twin Block
Separate maxillary and mandibular splints cover the occlusal surfaces and contain ramps that position the mandible forward. Can be removable or fixed.

Crozat Appliance
Removable all-wire appliance used to correct many types of orthodontic problems.
Basic design is a TP bar in the maxilla and a lingual arch in the mandible. Various extensions, finger springs, loops, rests, and other devices to deliver required forces.
This appliance is used instead of the standard band/bracket system.

Diagnosis and Treatment Planning
Active Tooth-borne Appliances
Active plates for arch expansion – modifications of activators that contain jack screws, expansion screws or springs to move teeth.
Example: Sagittal Appliance – an arch lengthening appliance, contains jack screws that are activated to move teeth in an anterior/posterior direction along the crest of the alveolar ridges.
Common applications include uprighting anterior teeth in class II div 2 cases, or to provide molar distalization in closed class II malocclusions.

Fixed Appliances
Brackets and Bands
Greater control over tooth movement
Able to move teeth in all three dimensions
First order prescription – height of bracket adjusts for relative buccal-lingual position of teeth
Second order prescription – horizontal alignment of slot in the bracket adjusts for mesial-distal tilt of the teeth
Third order prescription – buccal-lingual tilt of bracket adjusts for relative buccal-lingual tilt of the teeth

Single Phase vs Multi-Phased
Single Phase is gold standard
Multiple phase treatment takes longer and costs more
Should offer a clear advantage in:
Esthetic
Development
Function
Trauma prevention

Interceptive
Between the ages of 7-11
Advantages of rapid change in skeletal and dental structures due to rapid growth
Growth modification
Typically followed up with comprehensive therapy between the ages of 12-18

Limited Therapy
Partial placement of brackets for a shorter amount of time
   Extrusion
   Molar uprighting
   Reduce crowding
   Close spaces
Fixed or removable appliances

**Comprehensive Therapy**
   Fixed appliances
   Longer period of treatment
   Divided into three phases
   Level and aligning
   Working phase
   Finishing
   Goal is to make the patients occlusion as ideal as possible

**Surgical vs. Non-surgical**
   Non-surgical known as “camouflage”
   Objective is to correct the malocclusion while making the underlying skeletal problems less apparent
   Class II patient camouflage well
   Class III and long face problems do not
      Correction of the malocclusion may make the skeletal problem worse

**Retention**
   Required for three reasons
   Gingival and periodontal tissues require time to reorganize – 3-4 months
   Soft tissues exert pressure and increase relapse potential
   Changes in growth may alter the final result
   **Timetable**
      Full time retention – 3-4 months
      Part time – up to a year inclusive of above time
      Patients who are not growing may require permanent retention as the tissues do not readily adapt to the new positions of the teeth.
   **Types**
      Removable – Hawley, Essix®
      Fixed – required for lower incisors during late growth, diastema maintenance, maintenance of pontic or implant space

**Relapse**
   Due to disruption of the PDL removing the active stabilization effect
   Immediately after removal of appliances teeth will be unstable
      Occlusal forces
      Soft tissue pressures

**Questions?**