PEDIATRIC ORTHODONTICS

INCLUDES PRINCIPLES AND APPLICATIONS OF:
EARLY TREATMENT
WITH FOCUS ON CLASS II, DIVISION 1 MALOCCLUSION

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Goals: This series of lectures should enable the resident to:
1. Define early treatment in reference to chronological and biological ages.
2. Understand the normal development of the occlusion and how to intercept interferences with that development.
3. Understand the potential and limitations of early treatment of various malocclusions.
4. Understand the principles of diagnosis and treatment planning of occlusal problems as well as the types of mechanotherapy that can be utilized for their correction.

Objectives: The resident should know:
1. The interferences that may affect normal development of the dentition in its arch and occlusal components.
2. The types of sagittal (Class I anterior protrusion, Class II, Class III -pseudo vs. true) vertical (deep bite, open bite) and transverse (midline deviation, posterior crossbite) that may benefit from early treatment.
3. When to prevent, intercept, or correct a developing problem, and determine the limitations of intervention.
4. Know the consequence of early treatment or delayed treatment.
5. The evidence available for modalities of early treatment and its timing in the primary, transitional (early/mid versus late), and permanent dentition.
6. The findings from available key clinical trials on Class II division 1 malocclusion.
7. The mechanotherapy involved, with in dept-knowledge of selected modalities.
8. How habits help develop and/or maintain certain malocclusions, and ways to manage these habits.

COURSE DURATION AND SCOPE: This course is part of the Early Treatment series that includes research studies on Class II treatment. The course is scheduled in the Spring of the first year and/or the Fall of the second year. It is given at a 2-hour session on a weekly basis for at least 5 sessions. A prerequisite to this course is the course on Development of the Dentition.
POLICY ON EXAMINATIONS: At least 2 biannual examinations (progress and final) are given for all courses, if a course spans the entire year. If classes terminate before the end of a semester, the final examination is given at the semi-annual examination that is closest to the end of the course, unless the course director schedules the final examination earlier. During a course, any number of progress tests or assignments may be given. Their cumulative weight in proportion to the final grade may not exceed 50%.

PEDIATRIC ORTHODONTICS

--- SUMMARY OUTLINE ---
INTRODUCTION
- CONCEPTS ON MODALITIES OF TREATMENT AND TIMING OF TREATMENT
  - CLINICAL TRIALS
  - GENERAL TRENDS AND INDIVIDUAL VARIATIONS
  - IMPLICATIONS OF RESEARCH FINDINGS ON TREATMENT OF CLASS II AND CLASS I MALOCCLUSIONS

--- COURSE OUTLINE ---

Introduction
Goals of early treatment of malocclusion
- Prevent the development of malocclusion: avoid potential interferences with normal development
- Intercep the development of malocclusion: remove existing interferences [already developing malocclusion].
- Correct an already developed malocclusion: before the cessation of facial growth

Underlying Assumptions
- Dealing with bite problems at one or various times during a child’s growth: Issue of timing treatment
- Knowledge of normal growth of jaws (relation to somatic growth), teeth, and developing relation between occlusion and jaws
- Coordinating time of treatment with optimal time of growth: Issue of growth prediction.

1. EARLY ORTHODONTIC TREATMENT OF OCCLUSAL PROBLEMS
   CONCEPTS ON MODALITIES AND TIMING OF TREATMENT
1. MANAGEMENT OF SAGITTAL OCCLUSAL PROBLEMS

A. Class I, anterior protrusion

   Condition
   Treatment

B. Distoclusions

   a. Class II, anterior protrusion (Class II, Division 1).
      
      Condition:
      - association with oral habits
      - existence of an underlying skeletal problem. In this instance, *early treatment is almost invariably the initial phase in a series of two or more therapeutic phases ending with the use of full or partial fixed orthodontic appliances in the permanent dentition.*
      - skeletal and dentoalveolar components

      Treatment
      
      Whether the malocclusion is of a skeletal, dento-alveolar, or combined origin, treatment approaches have relied on similar rationales, perhaps underlying a practical inability to treat a distoclusion with complete control of its skeletal and neuromuscular components while the dental system is comparatively easier to manage.

      - mechanotherapy: depending on whether the maxilla alone, or both jaws, are targeted:

        (i) head gear, attached to the molars or to a removable appliance (Thurow appliance).

        Numerous types of headgear: vary in direction of extraoral traction relative to occlusal plane, that is, relative to the center of resistance of the anchoring teeth or group of teeth.

        Three major types:

        1. cervical pull with distal and vertical extrusive force components and a general direction of pull below the occlusal plane;
        2. high pull with distal and intrusive force components and a direction of pull above the occlusal plane; and
        3. straight pull headgear with a distal retractive force moving maxillary teeth along the occlusal plane.

      Distal movement of molars is easier with a cervical pull headgear because of the lesser resistance to molar extrusion than intrusion. Two major effects of headgear therapy: are the direct influence on maxillary growth, and the indirect effect on mandibular position and, therefore, on the relationship between maxillary and mandibular structures.

        (ii) ACCO (Acrylic Cervical Occipital Anchorage) or similarly designed (Cetlin) appliances: distitalize posterior teeth into
achieved through the forces particularly in mandible.

Dentoalveolar changes widely documented. Controversies on mode of action revolve mainly around their role in stimulating mandibular growth. Following possibilities advanced: 1. the mandible surpasses its growth potential;

2. mandibular growth is accelerated;

These hypotheses assume that the individual growth potential can be predicted within reasonable accuracy.

3. mandible is merely positioned forward and subsequent growth, if (“catches up”) to this position.

This hypothesis assumes that (a) occlusal interdigitation plays an important role in maintaining the mandible in the forward position, and (b) the most important effect of a functional appliance is the distal force on the maxillary complex. This effect is achieved through the forces transferred to the maxillary teeth and bone by the appliance.

(iv) Combinations of headgear and functional appliances.

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b. **Class II, Division 2**

**Condition:**
- original description by EH Angle.
- variations and classifications (Jarabak: four types including Class I, division 2; Ghafari and Street: four basic types of Class II, Division 2 malocclusion, based on the inclination of the maxillary incisors, the mandibular plane, and the interincisal angle.).

**Treatment**
- distoclusion: with headgear, ACCO, or combined therapy if distal movement of maxillary molars is needed. A functional appliance, when indicated, often requires aligning the maxillary incisors to allow an adequate mandibular forward positioning.
- overbite: interception might require early extraction of the maxillary primary canines for orthodontic inhibition of vertical drift of the incisors.

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Early treatment of a Class II, Division 2 malocclusion should prevent a worsening of the anterior deep bite which, in severe cases, may be accompanied by an inhibited vertical drift of the posterior teeth and an accentuation of the chin (“chin button”).
c. **Observations on the evaluation of the early treatment of distooclusions**

Factors influencing evaluation of early treatment summarized as differences in populations and appliances, and differences in and/or inadequacies of methodology used in clinical studies.

1. Early treatment of distooclusions mostly transforms a Class II malocclusion to a Class I malocclusion, not a Class I normal occlusion.
2. Criteria to note success often lacking, for success must be evaluated at different levels within the same occlusion. Often, correction of molar occlusion temporally separate from achievement of canine neutoclusion and/or overjet.
3. Malocclusion must be clearly defined, to eliminate any “noise” in the selection process of a study’s population. (Class II malocclusion refers to Class II molar relationship regardless of the canine occlusion? Existence of a skeletal problem?).

C. **Anterior Crossbite**

a. **Dental crossbite**

Condition usually affects one or two incisors in otherwise normal occlusion. Treatment: correct inclination of involved tooth/teeth; two essential considerations: **space requirements and overbite**. Prerequisite: provide space for alignment.

- **mechanotherapy**: removable plates with finger springs; fixed and removable inclined planes.

b. **Dento-alveolar crossbite**

Condition involves crossbite of a group of teeth, usually all four incisors, in a seemingly Class III or “super Class I” occlusion (also known as a pseudo-Class III or functional anterior crossbite).

Treatment considerations include proper positioning of affected teeth, and disocclusion of anterior teeth if deep overbite.

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**Early correction of this crossbite is important to prevent its stabilization in the permanent dentition and avoid hindrance of anterior maxillary alveolar growth.**

- **mechanotherapy**: fixed orthodontic appliances; inclined planes; “sagittal” removable appliances (procline maxillary anterior teeth by periodic activation of jackscrew built into plate); functional appliances (effect seems limited; chin cup (success seems contingent on severity of crossbite, depth of the bite, and patient’s cooperation.

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d. **Anterior crossbite with underlying skeletal discrepancy**.

Condition: “True” Class III malocclusion: rarely, if ever, resolved by orthodontic means, and in most cases surgical correction is required, normally after or towards the end of mandibular growth (skeletal ages of 16-18 years in females, 18-20 years in males).

Treatment: Treatment approaches include the extended use of a chincup, the “Delaire mask” or reverse headgear, or both.

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**Major problem with early treatment: ability to forecast malocclusion’s development. Yet early treatment may reduce the severity of the malocclusion by minimizing associated problems such as crowding of the maxillary arch. If left uncorrected, problem may have to be treated later by tooth extractions (usually premolars) that contract a maxillary arch already constricted relative to the mandibular arch. The use of a**
palatal expander is often indicated, after accurate diagnosis of transverse occlusal relationships is necessary.

2. MANAGEMENT OF VERTICAL OCCLUSAL PROBLEMS

A. Deep overbite
   Condition: dentoalveolar.
   Treatment: correction leads to an increased overjet; aims at enhancing eruption of posterior teeth, while maintaining height of incisors, especially if underlying skeletal hypodivergency.
   -mechanotherapy:
     a-removable appliance with anterior bite plate; retraction of incisors to reduce overjet with same appliance (stretching elastics against incisors).
     b-fixed appliances: partial banding/bonding of permanent first molars and incisors; “intrusive” arch promotes extrusion of molars (easier achieved) and intrusion of the incisors (consider increasing posterior anchorage e.g. with palatal bar or headgear, particularly when tendency to skeletal vertical hyperdivergency.

   True intrusion is difficult to achieve; however, in a growing individual, stabilization of the incisors is considered a relative intrusion since their vertical movement is impeded relative to the other teeth.

B. Anterior open bite
   Condition: usually associated with a habit (digit sucking or tongue thrust).
   Treatment:
   1- correct habit
   2- treatment rationales:
      -increase overbite (“close” bite) by favoring extrusion or proper eruption of anterior teeth.
      -stabilize or depress posterior teeth (particularly in skeletal hyperdivergent patterns).
      -mechanotherapy: appliance, such as tongue crib, may eliminate associated habit while effecting bite closure; fixed appliances; high-pull headgear; bite block (hard – acrylic- or soft –rubber); incorporated magnets; vertical pull chin cup (no definite evidence).
      -special consideration for skeletal hyperdivergency: blocked airways must be examined may need removal.

In many patients with underlying skeletal problems, early treatment with orthodontic appliances is compensatory at best, and surgical correction would be considered later. If early therapy is successful, retention of results through the end of active facial growth is indicated.

3. MANAGEMENT OF TRANSVERSE OCCLUSAL PROBLEMS

A. Posterior crossbite
   a. A single tooth crossbite
- Condition: buccal or lingual, involves a tipping of the affected maxillary or mandibular tooth.
- Treatment: correct inclination of malaligned maxillary, mandibular or both teeth (not indicated for a single primary molar in crossbite).
- Mechanotherapy: crossbite elastics; removable appliance with finger spring or jack screw; fixed appliances.

b. **Posterior segment of an arch is in crossbite.**
- Condition: unilateral and bilateral crossbites.
- If unilateral: differentiate between true or anatomic (occlusion similar in IC=RC) unilateral crossbite and functional crossbite (mandible shifts laterally to side of crossbite from IC to RC); therefore bilateral component in RC, an indication for bilateral treatment.
- Treatment: depending on severity dental buccal tipping, dentoalveolar, or palatal expansion.
- Mechanotherapy: Porter or W appliance, Quad helix, a removable plate with expansion jack screw, fixed appliances with a spring or a jack screw (Haas or Hyrax types), expanded archwires in banded orthodontic appliance.

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**Uncorrected, the mandibular lateral shift may become permanent: an asymmetry of the corpus and the condyle might follow (not definitively proven). The shift often is caused by an occlusal interference of the primary canines for a more convenient occlusion with the posterior crossbite. Reduction of the occlusal interference may eliminate the mandibular deviation and should be attempted prior to the expansion, particularly in cases of mild constriction of the maxillary arch.**

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c. **Bilateral crossbites** can also be anatomic (CO=CR) or have an additional functional component (mandibular shift to the side of the crossbite). But differentiation is academic since bilateral expansion required in both cases.

d. **Posterior crossbite where maxillary molars are in full buccal position relative to the mandibular opposing teeth** (Brodie syndrome).
- Condition: Rare and difficult to manage.
- Treatment: often implies constricting maxillary arch, rather than expanding mandibular arch, but sometimes both. *Constriction of the maxillary arch may require a later extraction of permanent teeth (usually premolars), or in case of distoclusion, additional space may be provided by distal movement of the molars.*

B. **Midline deviation**
Between the dental arches are discussed.
- Diagnosis: establish whether a skeletal deviation exists, if so, whether it is true or functional. Functional deviation associated with posterior crossbite and corrected simultaneously. If true skeletal midline discrepancies, rule out any pathology within the mandible or of the condyles.

4. **Controversies on timing treatment**
Opinions of orthodontists on early treatment vary widely:
1- start therapy as early as the developing malocclusion is identified as natural forces brought to normal function.
2- no advantage to be gained.
3- justified if orthodontist can achieve either definite interception of malocclusion or meaningful reduction of severity to affect outcome and/or length of later complete correction.

Problem: predicting facial development. Insofar as the individual patient deviates significantly from the average, success can be limited. Limitations increase with malocclusions involving skeletal discrepancies.

Timing of treatment:
Value of early treatment versus waiting until permanent dentition erupted demonstrated. Controversy as to how early.
Primary dentition: controversial, no evidence, but demonstrated for limited types of malocclusion.
Mixed dentition: two-phase treatment versus one stage two-phase-treatment. See clinical trials section.

2. CLINICAL TRIALS: DESIGN, SET-UP, AND FINDINGS

1. DESIGN OF TRIALS
   - Retrospective versus retrospective.
   - Inclusion and exclusion criteria
   - Protocol

2. FINDINGS
   - Facial changes.
   - Occlusion
   - Cephalometric changes
   - Conclusions on modalities of treatment
   - Conclusions on timing of treatment

Findings from a prospective randomized clinical trial indicated that treatment of Class II, division 1 malocclusion was as effective in late childhood as in mid-childhood. Optimal timing of treatment would be in the late mixed dentition before the loss of the primary second molars. Practical implications of the findings are emphasized with clinical illustrations, specifically the effect on treatment timing of saving the leeway space, and taking advantage of differential growth between the jaws. General guidelines are weighed in consideration of the concept of early treatment as one-phase treatment, and whether this concept can be generalized in view of epidemiologic findings and individual variation.
3. GENERAL TRENDS AND INDIVIDUAL VARIATIONS
IMPLICATIONS OF RESEARCH FINDINGS ON TREATMENT OF CLASS II AND CLASS I MALOCCLUSIONS

1. GENERAL TREND
   -Treat in late mixed dentition to take advantage of growth events:
      -dental: E space
      Loss of second primary molars: an indicator of space loss and potential modification in molar occlusion
      -skeletal: growth (before adolescent spurt).
      Adolescent growth spurt: an indicator of the beginning of decrease in the rate of growth (not total cessation, but on average, what is left is comparatively less in amount and predictability)

2. EARLIER INTERVENTION
   -Occlusal and developmental conditions requiring earlier intervention:
      -functional crossbite
      -trauma (related to severe overjet)
      -psychosocial development (related to severe overjet)
      -early loss of primary teeth
      -discrepancy between requirements of dental age and skeletal age

3. EPIDEMIOLOGIC FINDINGS
   - support trend in majority of patients

4. MANAGEMENT OF HABITS ASSOCIATED WITH OCCLUSAL PROBLEMS

1. Relation of vertical occlusal problems to sagittal (and transverse) problems.
2. Differentiation between skeletal, dentoalveolar and dental deep or open bite.

1- TONGUE THRUST

A. Swallow Patterns
   a. Infantile swallow pattern
   b. Transitional swallow pattern
   c. Adult swallow pattern

B. Types of tongue thrust
a. Subtelny's classification - (on basis of diagnosis)
b. Moyer's classification - (on basis of etiology)
c. Ghafari's classification - (on basis of treatment)

C. Analysis by Proffit et al. (1978, 1993)
- Transitional swallow patterns from infantile through adult swallow pattern.
- Tongue pressures in speech and swallowing not significantly different in tongue thrusters and non-thrusters.
- In patients with incisor protrusion, the amount of anterior pressure is inversely related to the amount of anterior protrusion.
- Tongue pressures directed horizontally against the teeth by tongue thrusters are not sufficient in force or duration to push teeth into a new position.
- Orthognathic surgery patients adapt tongue pressure and contact patterns to the environment created, usually within a one year span.
- Tongue and lip pressures never balance during swallowing and tongue pressures are always several times higher (Lear and Moorrees, 1969).
- Tongue and lip pressures over time do not balance out to create an "equilibrium".
- The functional activities of the tongue are not important determinants in tooth position, but an anterior resting tongue position and associated vertical pressure against the anterior teeth can contribute to or maintain an anterior open-bite malocclusion (Proffit and Mason).

D. Malocclusions associated with tongue thrust

E. Treatment

2- THUMB (FINGER) SUCKING

1. Prevalence of malocclusion significantly higher in children with sucking habits than in those without the habits at 3 and 12 years of age (Popovich and Thompson, A., J. Orthod., 1973).
2. In children in whom thumb or finger sucking ceased before the age of 6 years, prevalence of malocclusion was not higher than with children with no history of sucking habits (op. cit.)

3. Malocclusions associated with digit sucking

4. Methods for controlling the habit:
   a. Prevention- behavioral approach
   b. Positive reinforcement
   c. Aversive conditioning techniques
3- RELATION BETWEEN DIGIT SUCKING AND TONGUE THRUST

REFERENCES


ADDITIONAL REFERENCES