EARLY VS LATE TREATMENT: THE CONTROVERSY REVIEWED

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Abstract : One area that causes much controversy in orthodontic treatment is the role of dentofacial orthopedics or orthodontic growth modification in the treatment of class II and class III malocclusion. The controversy is further compounded by the issue of timing, specifically whether it is more effective to provide treatment in 2 separate phases. Determining the relative merits of alternative treatments is complex, not only because of variability in initial conditions and treatment response, also because of differences between orthodontists in treatment beliefs, goals techniques and even skills. The concept and the necessity of early treatment are controversial. Some define it as removable or fixed appliance intervention in the deciduous, early mixed, or mid mixed dentition. Others place it in the late mixed dentition stage of development (before emergence of the second premolars and the permanent maxillary canines).

IndexTerms **– Controversy, Early vs Late, Orthodontics vs Orthopaedics.**

Introduction: The controversies of early vs. late relate to whether patients with Class II and Class III skeletal malocclusions should be treated in the early, late mixed, or preadolescent dentition. Those who support early growth modification believe the early correction or improvement of the skeletal discrepancy results in a shorter and an ultimately more stable result following comprehensive orthodontic treatment in the preadolescent dentition.

The clinician makes informed decisions with the patient and parents to choose the most appropriate time to initiate treatment while weighing potential cooperation, esthetics, likelihood of incisor trauma, and growth status as a patient-centered informed consent decision. In most cases, late transitional treatment is recommended because there is enough growth remaining, cooperation is adequate, all permanent teeth can be controlled after eruption, and growth will stabilize so that relapse is less likely to occur.

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Habit control, functional crossbite correction, and alleviation of possible crowding, especially in deep bite cases, should be initiated as soon as they are detected. A deficient maxilla (Class Ill) should be protracted (facemask) as soon as the upper permanent first molars erupt and often times, right after the eruption of the upper permanent incisors. True mandibular prognathism is best treated surgically after completion of growth. Mild mandibular prognathism can be effectively addressed in the deciduous dentition with chin cup therapy. Open and deep bite tendencies should be addressed by the late mixed dentition stage. Class II malocclusions, especially those requiring distal molar movement, may be best treated by non-extraction with a continuous treatment of 11/2 to 2 years that starts in the late mixed dentition, especially on the eruption of the upper first premolars. Finally, any limited treatment (single tooth crossbite, diastema, spacing) can be addressed individually per patient at any age.

Yang Y. Erica and Kiyak Asuman H. (1998)[1] conducted a study to understand orthodontist's perspectives on the best time to initiate treatment, factors that preclude early treatment, and experiences with compliance or adherence problems among their younger patients and the findings suggested that early orthodontic intervention is the norm, but practice characteristics affect treatment timing.

Proffit R. William (2006)[2] gave a review suggesting the factors required in determining the optimal timing for orthodontic treatment where he concluded that the two considerations that are important are effectiveness (how well does it work?) and efficiency (what is the cost-benefit ratio, with cost in its broader sense of the burden of treatment?). He stated that the gold standard for orthodontic treatment timing is during the adolescent growth spurt, starting in the late mixed or early permanent dentition. At that time, some growth (especially vertical growth) remains available to assist treatment, permanent teeth are available for final positioning, treatment usually ends as the adolescent growth spurt ends, and the shorter treatment time lowers the burden of treatment.

EARLY (MIXED DENTITION) TREATMENT

The concept and the necessity of early treatment are controversial. Some define it as removable or fixed appliance intervention in the deciduous, early mixed, or mid mixed dentition. Others place it in the late mixed dentition stage of development (before emergence of the second premolars and the permanent maxillary canines). The American Association of Orthodontists' Council of Orthodontic Education defines **interceptive orthodontics** as "that phase of the science and art of orthodontics employed to recognize and eliminate potential irregularities and malpositions in the developing dentofacial complex."

Early treatment is started either in primary or mixed dentition to enhance the dental and skeletal development before the eruption of the permanent dentition. Phase II treatment is accomplished when full complement of teeth is present to bring the teeth into ideal occlusion.

Not only is there disagreement as to what early treatment is, but also, for over 200 years, orthodontists have not been able to agree on its effectiveness. Like the extraction pendulum, the trends in mixed-dentition treatment have swung back and forth.

Growth modification is advocated as an early intervention in the timing of treatment and slow or nongrowing adolescents and adults are candidates for camouflage if facial esthetics is not compromised. One area that causes much controversy in orthodontic treatment is the role of dentofacial orthopedics or orthodontic growth modification in the treatment of Class II malocclusion. The controversy is further compounded by the issue of timing, specifically whether it is more effective to provide treatment in 2 separate phases. Phase I is treatment with a functional appliance, to correct the Class II skeletal discrepancy, when the child is 7 to 10 years old which is followed by phase II treatment with fixed appliances when the permanent dentition is established. Alternatively, growth modification treatment may be delayed until the late transitional dentition, when it is provided in 1 course of treatment, with an initial functional appliance phase.

Skeletal Class III malocclusions can be defined as a skeletal facial deformity characterized by a forward mandibular position with respect to the cranial base and/or maxilla. This facial dysplasia can be classified into mandibular prognathism, maxillary retrognathism or combinations of both, depending on the variation of the anteroposterior jaw relationships. Vertically, they can also be divided into two basic types depending on the vertical disproportions: long face and short face. Therefore it seems reasonable to assume that the skeletal framework of the Class III malocclusion must have been established before the pre pubertal growth period.

The orthopedic effects of chincap appliances, which were thought to improve facial growth in Class III patients with mandibular excess, became of great interest to clinical orthodontists in the 1960s. Since then, chincap therapy has been widely used as a method for treating developing Class III malocclusions in young patients.

Chincap force had several short-term orthopedic effects:

1. Redirection of mandibular growth
2. Backward repositioning of the mandible

3. Retardation of mandibular growth, and

4. Remodeling of the mandible and the temporomandibular joint.

Facemask basically consists of a rigid extra oral framework which takes anchorage from the chin or the forehead or both for the anterior traction of the maxilla using extra oral elastics which generate large amounts of force upto 1kg or more. It can be used in a growing patient having a prognathic mandible and a retrusive maxilla. It aids in pulling the maxillary structures forward and pushing the mandibular structures backward.

Before cephalometrics, it was believed that orthodontic appliances influenced growth and facial patterns. According to Kloehn children were often treated "for 6 or 8 years under the impression that we were stimulating growth of the mandible and facial bones." Although Nance advocated that "active treatment in the mixed dentition period is desirable only in Class III cases, cross bites, and Class II cases wherein facial appearance is markedly affected," he freed orthodontists from their hesitancy to treat patients before the development of the adult dentition.

Bercu Fischer[3] stated in **(1952)** that "early treatment is always desirable because tissue tolerance and the power of adjustment of the tissues are at or near their maximum. The optimum time to start treatment is when the roots of the temporary molars are about two-thirds resorbed."

Tweed warned against taking early treatment too lightly. He recommended eliminating abnormal swallowing and tongue habits as causative factors and using a Kloehn or similar headgear as needed throughout patients' growth periods. Moyers warned that "there is no assurance that the results of early treatment will be sustained and that 2-phased treatment will always lengthen overall treatment time. Early treatment not only may do some damage or prolong therapy; it may exhaust the child's spirit of cooperation and compliance."

Rationale for phase I therapy-

ANDRESEN & HAUPL CONCEPT

According to Andresen & Haupl, the bite is not opened beyond the postural rest position (i.e. no more than 4mms). Forward positioning of mandible induces Myotactic reflex actively and Isometric muscle contraction. These muscle contraction forces are transmitted by the appliance to move the teeth. Stimulate the lateral pterygoid muscle & retro discal pad thus bring about bone remodeling & condylar adaptation. Thus functional appliance relies mainly on the muscle activity during biting & swallowing &

thus works by using kinetic energy

HEREN, HARVOLD & WOODSIDE CONCEPT

Bite is opened approximately 12-15mm beyond the postural rest position. It induces stretching of soft tissues & the viscoelastic pull of the soft tissues are responsible for the appliance action. The power to produce alveolar remodeling is obtained from inherent elasticity of muscle, tendinous tissues & skin. Thus the appliance works by POTENTIAL ENERGY rather than kinetic energy (i.e. Myotactic reflex activity).

Goals and Benefits of phase I treatment

Phase I treatment serves many advantages which can help to reduce the maneuvers to be done in the phase II. It can sometimes, even help to eliminate the phase II treatment by guiding the growth and eruption of teeth. It gives a platform on which foundation of a sound dentition is placed. Some of the benefits of phase I treatment are:

1. Window of opportunity during growth

Certain jaw movements, such as widening of the upper jaw, should be done prior to fusion of the upper jaw bones which typically starts at age 8. Often by the time all the permanent teeth erupt, the procedures that would have required minimal growth modification during earlier years may require jaw surgery and/or extraction of permanent teeth and may result in compromised treatment results.

2. Decrease need to extract permanent teeth in the future

Child's jaws continue to grow to accommodate room for their molars. However, the space for child's anterior teeth is at its maximum at age 4. Between ages 4 and 12 about 4-8 mm of space (the width of a tooth) is lost naturally by mesial drifting of posterior teeth. Early treatment minimizes extracting permanent teeth by allowing the Orthodontist to modify the shape of the jaw, create more room and preserve needed space when primary teeth are still present.

3. Avoid or reduce need for facial/oral surgery later on

Decrease the chance of impacted (i.e. stuck, not erupting normally) teeth that may require future oral surgery. An Orthodontist can often eliminate the risk of future facial surgery with early treatment at a time when a child's facial growth can be modified.

4. Correct harmful habits

Habits such as thumb-sucking or tongue-thrusting can not only interfere with proper speech and chewing, but hey can also cause problems that, if untreated as a young child, could require jaw surgery later in life.

5. Decrease risk of tooth trauma

Research shows that early treatment could reduce the risk of trauma to protruded front teeth.

6. Improve psychological factors

Improved facial esthetics positively affects your child's outlook and attitude by increasing self-confidence and protecting him/her from being seen by peers as different.

As adults, we forget how unforgiving children are to others who appear 'different' from them when it comes to their appearance and/or speech. When we improve the appearance and function of children earlier in life, we help to increase their self-esteem.

7. Increase compliance

Younger patients tend to be more compliant and cooperative

8. Consistent and predictable elimination of phase II treatment

9. Greater stability

10. Superior facial esthetics

11. Maximize benefits of orthodontics

Having a solid foundation provides final orthodontic results (Phase 2) that are optimal with better stability and ideal facial esthetics. When all the facts are considered, the importance of early orthodontic treatment for young children becomes clear

12. Reduction in the duration and difficulty of subsequent therapy

Kevin O'Brien et al (2003)[4] evaluated whether early orthodontic treatment with the Twin-block appliance for the developing Class II Division 1 malocclusion resulted in any psychosocial benefits. Results showed that early treatment with Twin-block appliances resulted in an increase in self-concept and a reduction of negative social experiences. The subjects also reported treatment benefits that could be

related to improved self-esteem. Further research is needed to determine the extent to which these effects translate into social behavior and experiences.

John C. Voudouris, Donald G. Woodside, Gurkan Altun, Kuftinec, Gerassimos Angelopoulos and Paul J. Bourque (2003)[5] investigated the Changes in the condyle, the glenoid fossa, and the muscles of mastication in subjects undergoing continuous orthopedic advancement of the mandible with a Herbst-lock appliance. The unique combination of permanently implanted electromyographic electrodes, tetracycline vital staining, and histomorphometry represents a significant technological advancement in methods and materials. Together, they demonstrated different muscle-bone interaction results for functional appliances than those reported in previous studies.

Drawbacks of phase I treatment

The drawbacks of Phase I treatment include longer overall treatment time, loss of compliance, Greater risk due to prolonged treatment such as root resorption, white spot lesion, bone loss caries, Increased cost, Dilacerations of roots, Impaction of maxillary canines by premature uprighting of the roots of lateral incisors and Impaction of maxillary second molars.

Procedures performed in Phase I Treatment

1. Growth modification with the use of Headgears, Functional appliances, Face mask and Chin cap

2. Arch length discrepancy that can be corrected using Serial extraction, Arch expansion and Preservation of arch length

3. Open bite correction

4. Correction of tooth eruption disturbances

M.J.Trenouth (2002)[6] evaluated the cephalometric changes produced by the Twin Block appliance and found clinically significant changes (2 per cent and greater) in lower anterior (6.6 per cent) and posterior (4.6 per cent) face heights, upper incisor to maxillary plane (4.9 per cent), i.e. upper incisor retraction, and increase in mandibular length (Co-B 3.3 per cent, Co-Po 2.6 per cent, Ar-B 3.5 per cent, Ar-Po 2.2 per cent).

Bremen and Pancherz (2002)[7] conducted a study to assess the efficiency of early and late Class II Division 1 treatment in the mixed and permanent dentition. He concluded that treatment of Class II Division 1 malocclusions is more efficient in the permanent dentition (late treatment) than it is in the

mixed dentition (early treatment)

Wheeler et al (2002)[8] reported the effectiveness of early treatment with the headgear/biteplate and the bionator in patients with Class II malocclusion regardless of the mechanism of correction and to compare early-treatment results with changes over a similar time period in an observation group. Multivariate analysis suggested that headgear may be superior to bionator/biteplane in achieving a Class II correction during early treatment

Jean Y. Chen, Leslie A. Will and Richard Niederman (2002)[9] examined the hypothesis that functional appliances enhance mandibular growth in the treatment of skeletal Class II malocclusions and found no significant difference between the untreated control group and the group treated with functional appliances. However, for Ar-Pg and Ar-Gn, there was a significant difference between the control and the treated groups.

Kevin O'Brien[10] **et al** in **2003** did a randomized controlled trial to evaluate the efficacy of early intervention of class II malocclusion with twin block appliance where he concluded that early treatment with the twin-block appliance is effective in reducing overjet and severity of malocclusion although the small change in the skeletal relationship might not be considered clinically significant.

Phil Banks, Jean Wright and Kevin O'Brien (2004)[11] evaluated the effectiveness of incremental and maximum bite advancement during treatment of Class II Division 1 malocclusion with the Twin-block appliance in the permanent dentition where it was concluded that incremental bite advancement produced no advantages over maximum advancement.

Tarja Virkkula et al in (2009)[12] conducted a longitudinal randomized investigation to determine the long-term changes in the soft-tissue profile during orthodontic treatment when treatment is started with headgear (HG) in the early mixed dentition from which it can be concluded that early head gear treatment has only a minor effect on the soft-tissue profile. The main effects are on the thickness of the soft-tissue chin and the contour of the lower lip.

Urban Hagg et al (2003)[13] conducted a long term follow up study to investigate the outcome of treatment with reverse headgear in young individuals with reverse overjet and skeletal class III malocclusion due to maxillary deficiency. He concluded that early treatment of maxillary deficiency with reverse pull headgear resulted in positive overjet in all patients, but at long term follow up positive overjet was maintained only in two out of three patients. Therefore, patients developing negative overjet had comprehensive orthodontic treatment and remaining were considered for orthognathic surgery because of

unfavorable growth pattern.

Sugawara (2012)[14] compared the effects of early orthodontic intervention as the first phase of a 2-phase treatment v/s 1-phase fixed appliance treatment in identical twins over a period of 11 years. Facial and dental changes were recorded, and cephalometric superimpositions were made at 4 time points. In spite of the different treatment approaches, both patients showed identical dentofacial characteristics in the retention phase.

CONCLUSION

1. There is very little evidence in the literature to suggest the two phase treatment can significantly modify growth or eliminate the need for protracted phase two treatment nor can it be justified to result in fewer extractions or avoidance of orthognathic surgery.
2. Early phase one treatment is beneficial in reducing the incidence of incisors trauma and may be useful in correction of eruption disturbances
3. In conclusion, the objectives of any phase I treatment before eruption of all permanent teeth are to correct the skeletal discrepancy between the jaws and improve function and facial esthetics by allowing them to develop normally, to create an ideal overbite and overjet relationship, to align the anterior permanent teeth (incisors) and reduce the chance of trauma to these teeth, to improve the width of the dental arches and to reduce the risk for (1) extraction of permanent teeth on normal eruption of the full permanent dentition an (2) for surgery.

References:

1. **Erica YY, and H. Asuman Kiyak**: Orthodontic treatment timing: A survey of Orthodontists: *Am J Orthod Dentofacial Orthop* 1998; 113:96-103
2. **Proffit WR**: The timing of early treatment: An Overview: *Am J Orthod Dentofacial Orthop* April 2006: S47-S49.
3. **Fischer B**. Orthodontics: diagnosis, prognosis, treatment. Philadelphia: WB Saunders; 1952
4. **Kevin O'brien**: Effectiveness of Early Orthodontic Treatment with The Twin-Block Appliance: A Multicenter, Randomized, Controlled Trial. Part 2: Psychosocial Effects: *Am J Orthod Dentofacial Orthop* 2003; 124: 488-95.

5. **John C V, Donald GW, Gurkan A, Dr Med Dent, Mladen MK, DMD (Harv), Gerassimo, Angelopoulos and Paul JB:** Condyle-fossa modifications and muscle interactions during Herbst treatment, Part 1. New technological methods: *Am J Orthod Dentofacial Orthop* 2003; 123:604-13

6. **M.J.Trenouth:** Propotional changes in cephalometric distances during twin block appliance therapy: European Journal of orthodontics 24 (2002) 485-491.

7. **Bremon VJ and Hans P**: Efficiency of early and late Class 11 Division 1 Treatment: *Am J Orthod Dentofacial Orthop* 2002; 121:31-7

8. **Timothy TW, McGorray SP, Dolce C, Taylor MG and King GJ:** Effectiveness of early treatment of Class II Malocclusion: *Am J Orthod Dentofacial Orthop* 2002; 121:9-17

9. **Chen JY, Leslie A. Will, and Richard N:** Analysis of efficacy of functional appliances on mandibular growth: *Am J Orthod Dentofacial Orthop* 2002; 122: 470-6

10. **Kevin O'Brien**: Effectiveness of early orthodontic treatment with the Twin- block appliance: A multicenter, randomized, controlled trial. Part 1: Dental and skeletal effects: *Am J Orthod Dentofacial Orthop* 2003; 124:234-43.

11. **Phil B, Jean W and Kevin O'Brien:** Incremental versus maximum bite advancement during Twin-block therapy: A randomized controlled clinical trial: *Am J Orthod Dentofacial Orthop* 2004; 126:583-8

12. **Virkkula T, Kantomaa T, Julku J, and Pirttiniem P:** Long-term soft-tissue response to orthodontic treatment with early cervical headgear—a randomized study*: Am J Orthod Dentofacial Orthop* 2009; 135:586-96.

13. **Urban H, Agnes T, Margareta B, A.Bakr M. Rabie:** Long- Term Follow-Up of Early Treatment with Reverse Head- Gear: *European Journal of Orthodontics* 25 (2003) 95-102.

14. **Junji S, Zaher A, Hiromichi H, and Nanda R Sendai and Nagoya**: One-phase vs 2-phase treatment for developing Class III malocclusion: A comparison of identical twins: *Am J Orthod Dentofacial Orthop* 2012; 141: e11-e22.