

## Early Orthodontic Treatment – A Review

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### ABSTRACT:

Timing for the orthodontic treatment is always a debate among orthodontists. Few prefer adolescent age and few prefer mixed dentition period. The main goal of early orthodontic treatment is to improve skeletal and dental orthodontic problems either by preventing, intercepting or by correcting the existing malocclusion. Proper diagnosis should be done as the growth status plays most important role in commencement of treatment. Treatment execution can be done either in 1 phase or 2 phase therapy as it depends upon patient compliance, growth maturation status and severity of the malocclusion. Early correction of the malocclusion reduces the risk of increasing treatment complexity in the future and also improves esthetics and function. With the help of functional appliances and orthopedic appliances the elimination and correction of skeletal and dental discrepancies has been reduced. Most orthodontists agree that elimination of oral habits, orthopaedic treatment of class III malocclusion and posterior cross bites deserve treatment at an early age. Every effort is made to time the treatment appropriately to maximize the treatment benefit in the shortest period of time, as well as to improve self-confidence of patient.

**KEY WORDS:** early orthodontic treatment, growth maturation status, phase I treatment.

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### I. Introduction

Debate among orthodontists still exists in regard to the optimal time to initiate orthodontic treatment. Few prefer to treat during adolescent age whereas others intervene in the mixed dentition period. Dr. Charles Tweed in 1963 stated that “In other words, knowledge will gradually replace harsh mechanics and, in the not too distant future, the vast majority of orthodontic treatment will be carried out in the mixed dentition period of growth and development prior to the difficult age of adolescence.”

The main objective of orthodontic treatment is to minimize the amount of treatment and achieve maximum benefit for each patient, which becomes significant with early treatment i.e., treatment before completion of permanent teeth eruption (except 3<sup>rd</sup> molars).<sup>1</sup> Early orthodontic treatment is defined as the treatment initiated during the primary or mixed dentition with the purpose to prevent, intercept or correct a specific orthodontic problem or problems, also known as Phase I treatment.

The main goal of early treatment is to improve or correct orthodontic problems which might result in irreversible damage to the dentition and supporting structures and to prevent progression into a more severe orthodontic problem that would be more difficult to treat in Phase II. Treatment in the early age depends on the factors like patient's growth status (modification), patient cooperation, phases of treatment and treatment timing.<sup>2</sup> The advantages of the early treatment include improved patient socialization, better patient cooperation, early correction, requirement of extractions and orthognathic surgery is minimized. The disadvantages of the early treatment include chances for misdiagnosis, extended treatment time, greater cost and increased caries risk.

American Association of Orthodontics (AAO) recommends that child's first check-up with an orthodontist be performed when an orthodontic problem is first recognized, but no less than 7 years, as the child has enough permanent teeth for an orthodontist to evaluate the developing teeth and jaws. In most of the Class II cases, late transitional treatment is recommended because of enough growth remaining, adequate cooperation, all permanent teeth can be controlled after eruption, and growth will stabilize so that relapse is less likely to occur. One has to identify the period of most rapid growth determined from growth markers like height and weight, skeletal maturity indicators, age (pubertal, physiological, biochemical), growth charts to select the most predictable and productive timing of treatment. The basis for skeletal age assessment by radiographs is that different ossification centres appear and mature at different times and occur in predictable

sequence.<sup>4</sup> Indications of early orthodontic treatment include management of arch length discrepancy, eruption disturbances, interception of the habits and growth modification in Class II and Class III cases.

## II. Management of Arch Length Discrepancy

It is important to prevent crowding and achieve a better alignment of the permanent teeth. It includes procedures like serial extraction, arch expansion and arch length preservation.

### Serial extraction:

It is an orthodontic treatment procedure that involves the orderly removal of selected deciduous and permanent teeth in a predetermined sequence (Dewel 1969)<sup>5</sup>. Paison was the first person to point out the extraction procedure. Bunon in 1743, proposed the removal of deciduous teeth to achieve a better alignment of permanent teeth. Nance presented on his technique of 'progressive extraction' in 1940 and has been called as the father of 'serial extraction' philosophy in the United States. Hotz named the same procedure as "Guidance of eruption".

Diagnosis should be made in the early mixed dentition period. It is most effective in Class I malocclusions with marked irregularity of anterior teeth, premature loss of deciduous teeth, ectopic eruption of mandibular first deciduous molar, flaring of incisors, abnormal resorption of second deciduous molar, mid line deviation, displaced lateral incisors, gingival recession and alveolar destruction of labial surface of anterior teeth. In such cases decrease in tooth mass improves the alignment of anterior teeth and the gingival tissues. It is contraindicated in congenital absence of teeth, mild to moderate crowding, deep bite, open bite, severe Class II, III of dental/Skeletal origin, cleft lip and palate, spaced dentition, anodontia / oligodontia, midline diastema, dilacerations, extensive caries.

Most common side effects of serial extraction include tendency of bite to close following loss of posterior teeth (Dewel 1967)<sup>6</sup>, premolars fail to reach their normal occlusal level which might further lead to tongue thrusting habit, might affect facial esthetics as the lip line have greater convexity during early transitional stages than in mature dentition, unrestrained extraction will accentuate the prominence of nose by reducing skeletal development in dental area.

Most commonly extracted teeth are deciduous canine (C), deciduous first molar (D), and first premolar either extracted or enucleated. Three methods of serial extraction include Dewel's method, Tweed's method and Moyer's method.

### Arch expansion:

Expansion is one of the most noninvasive methods of gaining space. Expansion of the palate was first achieved by Emerson C. Angell in 1860. The transverse malocclusion should be treated early as growth ceases first in the transverse dimension. Expansion can be obtained by either rapid or slow expansion. The origin of slow expansion procedure was in United States by Angell (1860) who placed a screw appliance between maxillary premolars of a girl age 14.5 years and widened her arch one quarter inch in two weeks. In 1961 Haas reintroduced rapid maxillary expansion. The three factors on which rapid maxillary expansion depends are rate of expansion, form of appliance and age of patient.<sup>7</sup>

Causes for arch constriction include buccolingual discrepancies (either genetic or environmental), abnormal function (Graber and Harvold), cleft palate, asymmetrical growth. RME is indicated in cases with posterior cross bite with maxillary deficiency, Skeletal and dental Class II malocclusions, cleft palate, nasal stenosis, poor nasal airway, septal deformities, recurrent ear and nasal infection, allergic rhinitis, and also used as an adjunct with face mask therapy to loosen the maxillary suture attachment so as to facilitate protraction.<sup>8</sup>

Before mid-palatal suture ossifies, orthopedic forces may be applied to separate the suture and allow bone to fill the expanded mid palatal area. Once the suture closes, usually at about 16 yrs of age, decline in the ability of rapid palatal expansion occurs, so it is usually not recommended. Thus early transverse expansion in the mixed dentition is more stable than when expansion performed after the eruption of permanent teeth.

### Arch length preservation:

Space maintainers are fixed or removable appliances designed to preserve space created by the premature loss of primary tooth. They aid in preservation of primate space, integrity of the dental arches and also in preservation of normal occlusal planes. In case of anterior space maintenance, it should aid in esthetics and phonetics. Space maintainers are indicated when, the space after premature loss of deciduous teeth shows sign of closing, the space for permanent tooth should be maintained for two year or longer and to avoid supra eruption of a tooth from the opposing arch. They are contraindicated if the radiograph shows the succedaneous tooth to erupt soon, if space shows no sign of closing, when succedaneous tooth is absent and when one third of root of succedaneous tooth is already calcified. As an interceptive method, space gainers are used instead of

space maintainer when primary second molar is lost and the permanent 1<sup>st</sup> molar tend to tip mesially resulting in the loss of the archlength.<sup>9</sup>

It is very common in an orthodontic practice to encounter eruptive abnormalities like impacted, ectopically erupting, transposed, congenitally missing, and supernumerary teeth. The treatment plan should address these anomalies and soft tissue reactions to the movements should be considered.<sup>10</sup>

### III. Growth Modification

It is prudent to make use of the most active period of facial growth and compliance together making it ideal to start treatment in the mixed dentition period. As with headgear, it is fortuitous that the greatest amount of skeletal and dental growth occurs during the night time. It is always recommended to overcorrect the malocclusion to compensate for the remaining pattern of growth that may occur in the individual.

Class II and Class III malocclusions at the early age can be treated with the extra-oral or intraoral appliances which may be either removable or fixed based on the characteristics of the problem, such as anteroposterior discrepancy, age, growth status and patient compliance. Both 1-phase and 2-phase treatment protocols are considered effective approaches for treatment of these malocclusions. Extraoral appliances have been used to influence the maxillary and mandibular growth patterns by either inhibiting or redirecting their normal growth potentials in children before and during maximal pubertal growth.

Class II skeletal malocclusion might be because of prognathic maxilla, retrognathic mandible (size or positional) or combination of the both. Maxillary prognathism contributes only 10-15% of Class II malocclusions (McNamara). Using extra-oral forces with headgear, growth restriction or redirection of the maxilla can be done<sup>11</sup>. In 1861, Kingsley introduced headgear to apply extra-oral force using occipital anchorage. Different types of head gears include high pull, cervical pull, combipull headgear. Location of the anchorage unit determines the type of force that will be applied to the unit. It is used to redirect growth of the maxilla, distalization of upper molars, space maintenance after extraction, vertical control of posterior teeth and expansion or constriction posteriorly. Headgears are to be used for 14-16hrs/day for 6-8 months of duration. Recommended force values per side for early mixed dentition 150-250 gms, late mixed dentition 300-400 gms, full permanent dentition 400-600 gms, Retention in permanent dentition 150-400 gms.<sup>12,13</sup>

A retrognathic mandible is most common cause of Class II malocclusion either solely (60%) or in combination with maxillary prognathism (20%). Functional appliances are used as a mode of treatment in the early ages. The term "functional appliance" refers to a variety of removable appliances designed to alter the arrangement of various muscle groups that influence the function and position of the mandible in order to transmit forces to the dentition and the basal bone. Typically these muscular forces are generated by altering the mandibular position sagittally and vertically, resulting in orthodontic and orthopedic changes (Bishara and Ziaja 1989).<sup>14</sup>

Norman Kingsley (1879) developed the first appliance to position the mandible forward and named as "Bite Jumping appliance". Pierre Robin (1902) developed the earliest removable functional appliance "The Monobloc". Emil Herbst (1905) introduced a fixed pin and tube appliance. Viggo Andresen (1908) developed the Biomechanical retainer, which was later modified along with Karl Haupl to Activator. Rolf Frankel (1966) introduced a tissue borne appliance, the Functional Regulator. Functional appliances can be removable or fixed.

Adequate amount of overjet is essential for the advancement of the mandible, but it is not possible in case of Class II div 2 where prefunctional orthodontic therapy should be done to establish proper overjet by proclining upper incisors. This has to be followed by a 2-3 months of retention to prevent excessive movement of the incisors during the orthopedic phase. The best suited functional appliance should be delivered to the patient after recording the construction bite with desired vertical opening and sagittal advancement. Recommended time of wear is 12-16 hours in the evenings and nights for about 6-8 months.

Overcorrection of the existing problem should be done so that it compensates the relapse. For best results to obtain, the patient must be in peak growth stage i.e., CVMI 3 & 4.<sup>15,16</sup> In skeletal Class II cases with prognathic maxilla and retrognathic mandible, a combination of extraoral and intraoral appliances i.e., headgear along with functional appliances are usually preferred.

In Class III skeletal malocclusions evidence based research has led to many favorable conclusions for early treatment. Starting with Tweed, treatment timings can be as early as 4 years of age. Class III skeletal malocclusions can be because of retrognathic maxilla, prognathic mandible or combination of both. Growing patients with maxillary retrognathism should be considered for early expansion and development of the maxilla. Combination of rapid maxillary expansion and reverse headgears are usually recommended in these patients. Subsequently, a palatal bar can be used to stabilize the skeletal change, and then fixed appliance treatment can be commenced at approximately 12 years of age.

In early treatment of Class III malocclusion extraoral traction which pulls the maxilla anteriorly

functions in the direction of development. Unlike posterior movement of the mandibular arch, anterior movement of the maxillary arch appears to have a greater chance of stability. Maxillary protraction is recommended for skeletal Class III patients with maxillary deficiency. Protraction face mask therapy is very effective in growing patients less than 10 years of age. The optimal timing for intervention is at the time of eruption of the upper central incisors. Delaire and others used face mask for maxillary protraction. Petit later modified Delaire's concept by increasing the amount of force generated and thus reducing the overall treatment time. Protraction headgear results in forward growth of the maxilla at an early age exerting an extra oral force of 300 gm or more per side, causing significant changes in the circum maxillary sutures and in the maxillary tuberosity.<sup>17, 18</sup>

In Class III skeletal malocclusion with prognathic mandible, early treatment with a chin cup is to be done to provide growth inhibition or redirection and posterior positioning of mandible. There are two types of chin cup, the occipital pull chin cup that is used for patients with mandibular prognathism and the vertical pull chin cup that is used in patients presenting with a steep mandibular plane and excessive anterior facial height. Most studies recommend an orthopedic force of 300-500 gm per side. Patients are instructed to wear the appliance 14 hours/day. The orthopedic force is usually directed either through the condyle or below the condyle.<sup>19,20</sup> Removable appliances like reverse bionator, reverse twin block and FR III can also be used in treatment of Class III malocclusions, where construction bite should be taken by clinically retruding the mandible as much as possible, with the condyle occupying the most posterior position in the fossa. The vertical dimension is opened only enough to allow the maxillary incisors to move labially past the mandibular incisors for crossbite correction. The bite opening is kept to a minimum to allow lip closure with minimal strain. In reverse twin block, the blocks are reversed when compared to the standard twin block.<sup>15</sup> In Class III cases with prognathic mandible, even though treated early, show relapse and most of the cases go for orthognathic surgery in future.

#### IV. Open Bite

Graber has defined open bite as a condition where a space exists between the occlusal surfaces of maxillary and mandibular teeth in the buccal or anterior segments when the mandible is brought into habitual or centricocclusion. Etiology of Open bite include hereditary, epigenetic and environmental factors such as thumb, finger or foreign body sucking; abnormal tongue function, posture and size; faulty performance of associated musculature.

Presence of thumb or finger sucking up to 4-5yrs is considered to be normal. However, presence of this habit during mixed and permanent dentition causes flaring and spacing of maxillary anteriors, lingual positioning of lower anteriors, open bite and constriction of upper arch. Tongue thrusting habit, abnormal size of the tongue causes flaring of upper anteriors and results in open bite. Abnormal breathing habits because of nasal stenosis, septal deviation etc results in mouth breathing which inturn results in open bite. Control of abnormal habits and elimination of dysfunction should be given top priority in the deciduous dentition. In many instances open bite improves as soon as habit is stopped. Treatment with oral screening appliances or other habit breaking appliances is indicated in such cases. Growth modification with functional appliances or chin cap is possible but if treated at this early age, it is likely to recur relatively quickly when the active treatment is discontinued. However, in late mixed dentition environmental factors are less important than skeletal factors and in such cases growth modification is usually preferred over screening therapy.<sup>21</sup>

#### V. Conclusion

Early treatment helps to prevent, intercept and correct the malocclusion, improve esthetics and function. It helps to prevent increasing severity of the malocclusion in the adult stage and also reduces the complicated treatment procedures in the future. Proper diagnosis of the severity of malocclusion, patient growth maturation status, and patient compliance plays a major role in obtaining better results.

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