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The Journal of Dental Panacea

Journal homepage: https://www.jdentalpanacea.org/

Case Report

Early single-phase therapy for treatment of Class II malocclusion using conventional twin block appliance - A case report

Ankeeta Khadilkar[1]*, Vanashree Saple[1]

[1]Dept. of Paediatric Dentist, Unit of Dentistry, Bhabha Atomic Research Centre Hospital, Mumbai, Maharashtra, India

Abstract

Treatment timing of Class II malocclusion has been a perennial debate with merits and demerits of early two phase and adolescent single-phase modes of therapy being discussed extensively. The treatment timing of Class II malocclusion must take into consideration individual factors such as growth, presence or absence of dental crowding, risk of trauma, involvement in contact sports, peer teasing, pubertal trends of population, and ease of access to healthcare services before deciding on the most appropriate timing of treatment for each child. This article discusses the factors while presenting a case that was started and completed by early diagnosis and treatment by the "Early Single-Phase Therapy" mode. Such an approach benefits a certain section of cases that fit the criteria and must be encouraged to be incorporated in clinical practice.

Keywords: Class II malocclusion, Twin block, Treatment timing, Early treatment mandibular growth

Received: 12-03-2025; **Accepted:** 20-05-2025; **Available Online**: 25-07-2025

1. Introduction

Skeletal discrepancy of jaws in children and adolescents present themselves as disharmonious relationships in the positioning of maxilla and mandible with each other as well as in relation to the cranial base. Class II malocclusion is characterized by the forward positioning of maxilla in relation to mandible due to either prognathism of maxilla, retrognathism of mandible or a small sized mandible, or a combination of both.

The dogma of "form follows function" states that bone tissue adapts to the mechanical stresses placed upon it. In accordance with this law, altering the functional muscle environment surrounding the developing dentition can promote harmonious growth of the face hence having the potential of treating skeletal discrepancies.[1]

When the cause of malocclusion is a small, retrognathic mandible a mandibular repositioning appliance such as the traditional twin block, described by Clark in 1982 can be used to stimulate mandibular growth and redirect it in a more favorable manner.

The treatment of children presenting with this condition typically involves one of two approaches. The first provides treatment in two phases; one of intervention during the transitional dentition (Phase I) followed by a second definitive course of fixed appliance treatment in early adolescence (Phase II). There is usually a period of inactivity between the phases characterized by support and retention phase for maintaining the changes achieved in the Phase I intervention. The second approach involves providing a single course of comprehensive therapy during adolescence.[2]

In the recent few years, there has been considerable debate regarding the timing of treatment using myo-functional appliances. The proponents of "adolescent single-phase treatment" have listed the demerits of early treatment as increased cost of treatment, increased number of visits in "two phase method", less skeletal component in treatment and poorer final occlusion.[3]

*Corresponding author: Ankeeta Khadilkar
Email: ankeetak@gmail.com

https://doi.org/10.18231/j.jdp.2025.023

However, because such cases are more prone to dental trauma, have imbalance in the oral and perioral musculature and self-esteem issues, early intervention using the "two phase method" has been advocated. Merits of early treatment have been claimed to be that it normalizes the skeletal pattern of growth, eliminates abnormal function in the perioral musculature, improves facial profile and hence self-esteem, decreases the necessity for future extraction of permanent teeth, reduces occurrence of traumatic dental injuries and reduces the duration and complexity of fixed orthodontic treatment.[2]

We describe a third approach i.e. "Early Single-Phase Therapy". It involves the interception of developing Class II div 1 malocclusion in cases where minimal to no dental crowding is present by use of a myo-functional appliance such as a Clark's Twin Block in the transitional dentition i.e. only Phase I part of the "two phase method" and seeing the patient through to ideal occlusion. Treatment of these cases can be completed by using only myo-functional therapy without the need for future fixed orthodontic therapy emphasizing the need for early management in this category of patients. Albeit small, this section of patients must get screened and treated early and not being missed out is the objective of promoting "Early Single-Phase Therapy". The pediatric dentist is at a vantage position in the identification and correction of these conditions at an early age. Various factors affecting case selection have been detailed out in the discussion.

In this report, we describe one such case which was completed in a single phase (Phase I: Myo-functional phase only) i.e. "Early Single-Phase Therapy" and the need for Phase II treatment by fixed orthodontic treatment was foregone.

2. Case Presentation

An 8 years 11 months old female child reported to the Dental Unit of Bhabha Atomic Research Centre Hospital in April 2021 with the chief complaint of forwardly placed upper front teeth. Patient had a history of wheezing bronchitis, atopic dermatitis, mouth breathing in sleep and dental caries. There was no other relevant medical or dental history. On extraoral examination (**Figure 1**A-C), the patient had symmetrical mesoprosopic face, mesocephalic head shape with convex facial profile, incompetent lips with lip trap and deep mentolabial sulcus. Intraoral assessment (**Figure 2**A-E) revealed that the patient was in mixed dentition stage with Angle's Class II molar and canine relation on right side and Angle's Class I molar and canine relationship on the left side with a dental midline shift to the right side by approximately 2.5 mm. The patient had an overjet of 8 mm and overbite of 6 mm, proclined upper incisors with spacing. The upper and lower deciduous second molars were present with erupting 24. Interproximal caries noted between mandibular left deciduous molars may have contributed to some mesial drifting of second deciduous and first permanent molar on the left side. Ellis' Class I fracture noted on left permanent central incisor shows predilection of the patient to dental trauma. Orthopantomography (**Figure 4**A) revealed presence of unerupted tooth buds of permanent canines, first and second molars in all quadrants as well as lower third molars. On cephalometric analysis (**Figure 3**A) it was concluded that the patient has skeletal Class II jaw bases, retrognathic mandible, horizontal growth pattern, proclination of upper and lower incisors. The skeletal maturity was evaluated by means of the cervical vertebral maturation index (CVMI) staging. This method was chosen as it avoids the need for additional radiation exposure by hand wrist radiograph while having similar efficiency in predicting growth. The patient presented as Stage 2 of skeletal maturation which meant that the growth spurt was likely to take place approximately within a year from the radiograph and hence even though the chronologic age of the patient was a little less than 9 years, treating her early was essential.

2.1. Factors important for patient selection

1. A pre-requisite factor for successful treatment and possibly the most important one is having motivated, willing, sincere and compliant patients as well as parents.
2. Growing patient with possibility of pubertal growth spurt and peak mandibular growth occurring in treatment duration indicates maximum benefit with less chance of failure. The patient being in stage 2 CVMI was an ideal candidate for "Early Single-Phase Therapy".
3. Positive Visual Treatment Objective (VTO) indicates favorable results using myo-functional therapy.
4. Little to no crowding clinically, no arch length tooth material space discrepancy on radiographic and model analysis of the patient indicates more chance of success in single phase.

On the basis of clinical, radiographic examination and cephalometric findings, diagnosis of skeletal Class II jaw base with retrognathic mandible was made. Hence, to achieve the treatment objective of Class I skeletal bases, normal incisor inclination, pleasing facial profile, lip competency, Class I molar relation bilaterally and based on the clinical and cephalometric analysis, it was decided to treat this case by "Early Single-Phase Therapy" using twin block appliance.

2.2. Appliance fabrication steps

Alginate impressions were made for upper and lower arches. Wax bite registration was done in forward position of the mandible such that decrease in overbite and overjet together did not exceed 10 mm. A removable twin block appliance was fabricated in heat cure acrylic resin with an expansion screw in the upper member with Adam's claps on upper first permanent molars and labial bow whereas the lower member had ball end clasps in incisors and Adam's clasps on the primary molar thus leaving the lower first permanent molars unhindered for eruption.

2.3. Follow up protocol and Treatment progress

Twin block appliance was fabricated for the patient. The patient was seen at 24 hours for adjustment of the appliance for comfort in regard to any mucosal injuries, at 7 days of delivery of appliance when it was noted that compliance was achieved, monthly for 3 months during which pterygoid response seen at 1.5 months of wear after which selective trimming was started and the bimonthly after that. At 8 months of wear, molar and canine relation was significantly corrected along with correction of lip incompetency, lip trap and facial profile. At this stage, the patient was moved to bite jump appliance as support phase to settle in the permanent dentition occlusion during which the patient was followed up once in 3 months. At 2 year follow up, the patient was assessed by an orthodontist for need of fixed orthodontic therapy and after a discussion with patient, parent, pediatric dentist and orthodontist it was decided that fixed orthodontic therapy was not required. The patient was then given Hawley's retainers in upper and lower arches as retention phase. The retention phase was gradually tapered from fulltime wear to night time wear only. **Figure 1**D-F show the pleasing straight profile, whereas **Figure 2**F-J show well settled occlusion with over bite of 1.5 mm and overjet of 1 mm with Class1 molar relation bilaterally and well aligned upper and lower arches. **Table 1** shows the comparison of cephalometric analysis of preoperative and 2 year follow up values.

Figure 1: Comparison of pre-operative and post-operative extraoral views; **A-C:** Reveal convex profile pre-operatively and **D-F**: Reveal marked improvement and straight profile post-operatively

Figure 2: Comparison of pre-operative and post-operative intraoral viewsl **A-E:** Reveal increased overbite and overjet pre-operatively while 2F-2J reveal well settled final occlusion post-operatively

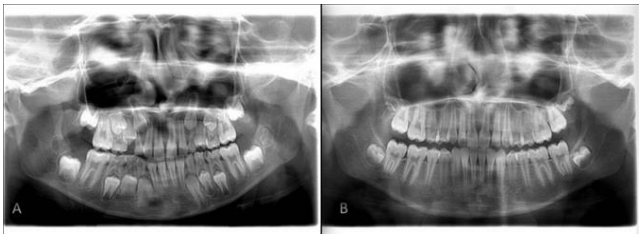

Figure 3: Comparison of Pre-operative and Post-operative Orthopantomogram Views; **A:** Reveals minimal space discrepancy with child in mixed dentition while **B:** Depicts well aligned arches and permanent dentition phase.

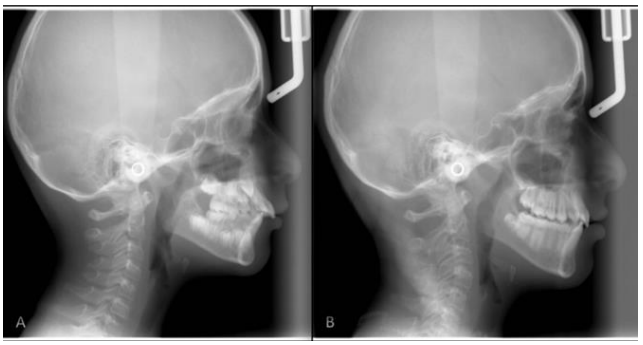

Figure 4: Comparison of pre-operative and post-operative lateral cephalometric views; **A:** Reveals incisor proclination and convex soft tissue profile pre-operatively while; **B:** Reveals straightening of incisor axial inclination with improved soft tissue profile post-operatively

Table 1: Cephalometric comparative analysis of preoperative and 2 year follow up values

Cephalometric/ Clinical Parameters	Preoperative	Postoperative
SNA	83	82
SNB	76	79
ANB	7	3
Wit's Appraisal	6 mm	4 mm
Interincisal angle	100	125
Overjet	8 mm	1 mm

It can thus be seen that by age 11 this case was treated completely with striking results using "Early Single-Phase Therapy".

3. Discussion

"Early Single-Phase Therapy" with myo-functional appliance alone requires timely diagnosis, availability of interceptive management facilities and suitable case selection. The inclusion criteria used by Singh et al.[4] for their study i.e. Class II skeletal relation of the jaws with relatively normal maxilla and retrognathic mandible, angle ANB 4^{o} or greater, full cusp Class II molar relationship on one side and end-on or greater on the other side, minimum or no dental crowding, normal to horizontal growth pattern with little or no vertical problems aptly describe the cases that may benefit from such an approach.

Although literature[5,6] suggests that the results from adolescent single-phase therapy with myo-functional + fixed orthodontic treatment has better results in terms of mandibular lengthening, ramus height, final occlusion, greater skeletal contribution to the correction of the molar relation, more posterior direction of condylar growth, the same studies also acknowledge the role of early correction.

In the study by O'Brien et al.[3] on treatment timing with twin block, 15% of the early treated patients did not require more complex fixed orthodontic procedures later. Another study by Bacetti et al. recognizes that early correction of a large overjet in severe skeletal Class II discrepancies may be indicated to reduce the risk of trauma to prominent incisors during adolescence.[7] According to Cohen[8] periods of fast growth both precede and follow the peak growth rate itself. Hence treatment that is given early i.e. before peak pubertal spurt, will take advantage of both these fast growth periods. Similarly, Petrovic et al.[9] suggest that the effectiveness of myo-functional appliances when used in the ascending portion of the individual pubertal growth spurt is maximum.

Worldwide onset of puberty has decreased by almost 3 months per decade from 1977 to 2013.[10] In a survey by Meher et al., it was found that 17.2% of women experienced an early age at menarche.[11] This secular trend in shifting of pubertal age to the left particularly in girls, also warrants a closer look at early assessment and probable intervention. Also, some normally growing individuals may not experience pubertal growth spurt i.e. polymorphism must also be taken into consideration and early treatment given might include the periods of growth throughout the growing age, lest it ceases. An important point to note in the particular case discussed in this article is that by the end of active phase the age of the patient was 9 years 6 months and at the end of support phase was 11 years 5 months by which time she had attained pubertal growth spurt. Had early intervention not been instituted, the advantage of tapping this growth would have been lost. This fact also highlights the importance of the shifting of pubertal age in females to the left.

The release of aberrant perioral muscular postures and establishment of a more balanced lip seal early on not only promotes better functional development but also offers the great advantage of promoting nasal breathing.

Another consideration is the bullying and teasing by peers of children with proclined incisors. Early correction of malocclusion may contribute positively by boosting the self-esteem. In the particular case described in this report, the improvement in confidence was overwhelming. Children involved in contact sports can also benefit from early treatment as they are more predisposed to traumatic injuries.

The decision of early treatment should consider open discussion with patients and parents regarding the pros and cons of early single phase, two phase and adolescent single-phase treatment options.[2] Fixed orthodontic therapy carries certain risks like enamel decalcification, root resorption, long duration of treatment, teasing by peers, increased cost of treatment, need for extraction of permanent teeth in some cases, etc. Hence, the section of patients that can profit from not having to go through fixed orthodontic therapy altogether must be carefully selected, assessed in a benefit risk ratio approach and offered the best treatment strategy curated for them.

3.1. Clinical implications

Treatment planning must take into consideration individual growth, circumstances and skeleto-dental criteria prior to deferring treatment to adolescence in a generic manner.

3.2. Limitations

Those cases with minor occlusal discrepancies such single tooth rotations will still have to undergo fixed orthodontic treatment. Cases with severe skeletal discrepancy although may not have dental crowding, but might require orthognathic surgery cannot be completed in single phase, the severity however can be reduced by myo-functional therapy.

4. Conclusion

This case highlights the importance of catering to that section of Class 2 malocclusion cases which can be treated early, without the need for fixed orthodontic therapy, in a single phase. Applying the 'one shoe fits all' approach using adolescent treatment timing may deprive this section of patients of benefits of early treatment.

Early screening visits to the pediatric dentist for evaluation of malocclusion must be encouraged and growth should be monitored periodically from an early age to determine the best timing for instituting myo-functional therapy if indicated. Further studies on guiding on how to establish individualized treatment plans as well as long term follow up of these cases to study factors such as relapse rates are needed.

As clinicians, we must emphasize the benefit of "Early Single-Phase Therapy" and evaluate patients' needs and formulate treatment plans accordingly.

5. Source of Funding

None.

6. Conflict of Interest

None.

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Cite this article: Khadilkar A, Saple V. Early single-phase therapy for treatment of Class II malocclusion using conventional twin block appliance - A case report. *J Dent Panacea*. 2025;7(2):105-109.