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Effectiveness of early orthodontic intervention on managing Class II malocclusion in children

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Abstract:
Developing Class II malocclusion in children can adversely affect dentofacial growth, making the timing of interceptive orthodontic treatment clinically important. This prospective comparative study evaluated 100 children aged 8–12 years with Angle's Class II Division 1 malocclusion randomized to early intervention or observation, with outcomes assessed over 12 months using clinical, cephalometric and standardized orthodontic measurements. Early intervention produced significantly greater reductions in overjet (3.4±0.9 vs. 6.8±1.0 mm), overbite (2.6±0.6 vs. 4.1±0.7 mm) and ANB angle (3.8±0.9° vs. 5.7±1.0°) than observation (all $p<0.001$). Functional orthopedic treatment improved skeletal, dental and facial relationships, with 78% achieving a Class I molar relationship and 84% showing improved lip competence. These findings advance knowledge by supporting timely interceptive orthodontic treatment to optimize dentofacial development in children with developing Class II malocclusion.

Keywords: Class II malocclusion, early orthodontic intervention, interceptive orthodontics, functional appliances, mixed dentition, growth modification, pediatric orthodontics, cephalometric analysis

Background:
Malocclusion is a very frequent developmental defect of the craniofacial complex in children and adolescents and Class II malocclusion is a significant percentage of orthodontic cases. Anteroposterior discrepancy between maxillary and mandibular arches, often accompanied by retrusion of the mandible, increased overjet, deep bite, lip incompetence and convex facial profile. Untreated Class II malocclusion can also have a negative impact on mastication, speech, oral hygiene and psychosocial development, in addition to affecting facial aesthetics **[1]**. Alhammadi *et al.* performed a systematic review that revealed the high prevalence of Class II malocclusion in the world and that it is important to diagnose and manage this malocclusion at an early age in children based on evidence-based data **[2].** In growing children, Interceptive treatment is based on the use of functional orthopedic appliances that take advantage of the remaining craniofacial growth to correct the skeletal and dental relationships. A systematic review and meta-analysis showed that functional appliances were effective for improving dentoskeletal relationships irrespective of the incremental or maximal advancement of the mandible and that they were effective during active growth, as shown by Santana *et al.* **[3].** Early diagnosis allows the identification of unfavourable growth patterns before skeletal discrepancies are large enough to make growth modification during the mixed dentition stage possible. Early intervention has been linked to a lower risk of traumatic injury to protruding incisors, better facial appearance and self-esteem in children with the condition **[4].** One of the tenets of evidence-based orthodontics is to choose the best time for treatment. Similarly, Papageorgiou reported that growth modification could be used to effectively reduce overjet, improve sagittal jaw relationships and enhance facial harmony, but that treatment outcomes depend on the growth potential, type of appliance and patient compliance; and not just chronological age **[5].** Similarly, Zhou *et al.* developed recommendations for expert consensus based on growth maturity and functional needs and not chronological age only, to ensure the best treatment outcome **[6].** To support these recommendations, Kaje *et al.* found that early orthodontic treatment led to greater reductions in overjet, better skeletal correction and improved facial aesthetics compared to delayed treatment in children with Class II malocclusion **[7]** and Dinu *et al.* **[1]** concluded in their systematic review that early treatment was superior in terms of short-term improvements in sagittal skeletal relationships, facial profile, overjet reduction and prevention of dental trauma, although some patients may need comprehensive orthodontic treatment later**.** Therefore, it is of interest to compare the effectiveness of early orthodontic treatment with observation in children with developing Class II malocclusion in terms of changes in skeletal, dental and occlusal relationships, facial profile and overall treatment results.

Materials and Methods:
Study design:
The present study aimed to be a prospective comparative observational study to assess the effectiveness of early orthodontic treatment in the management of developing Class II malocclusion in children in the mixed dentition stage.

Study setting:
This study was carried out in the department of Orthodontics and Dentofacial Orthopaedics of a tertiary care dental teaching institution with the approval of the Institutional Ethics Committee.

Study duration:
The study was conducted over 18 months, during which the patients were recruited, treated, followed up, data was collected and statistical analysis was performed.

Study population:
The study comprised children who had a developing Class II malocclusion who were attending the orthodontic outpatient department for interceptive orthodontic treatment.

Sample size:
100 children who met the eligibility criteria were enrolled.
[1] Group A (Intervention): 50 children
[2] Group B (Observation/control): 50 children

A sample size was deemed sufficient to identify clinically significant differences at 95% confidence level and 80% statistical power.

Sampling technique:
Participants were recruited using consecutive sampling until the desired sample size was achieved.

Inclusion criteria:
[1] Children aged 8–12 years
[2] Mixed dentition stage
[3] Angle's Class II Division 1 malocclusion
[4] Increased overjet (>5 mm)
[5] Skeletal Class II relationship confirmed clinically and cephalometrically
[6] No previous orthodontic treatment
[7] Parental/guardian informed consent in writing

Exclusion criteria:
[1] Neurodevelopmental disorders
[2] Cleft lip and palate
[3] Orthodontic/orthopedic treatment in the past
[4] Severe skeletal asymmetry
[5] Systemic diseases that impact skeletal growth
[6] Untreated dental caries or poor oral hygiene.
[7] Lack of willingness to participate or expected loss of follow-up.

Study groups:
[1] **Group A (Early Orthodontic Intervention):** Interceptive treatment was provided to children with functional orthopedic appliances (Twin Block or other appropriate functional appliances) as needed.
[2] **Group B (Observation Group):** Children were periodically clinically observed, provided with preventive care and routine follow up without active orthodontic treatment.

Baseline assessment:
Demographic data, medical and dental history, extraoral and intraoral examination, facial profile assessment, occlusal analysis, photographic records, study model analysis, panoramic radiograph and lateral cephalogram were all completed for all participants.

Cephalometric variables:
The following parameters were measured:
[1] SNA angle
[2] SNB angle
[3] ANB angle
[4] Wits appraisal
[5] Mandibular plane angle
[6] Facial convexity
[7] Incisor inclination
[8] Effective mandibular length
[9] Effective maxillary length

Outcome measures:
Primary outcomes:
[1] Reduction in overjet
[2] Reduction in overbite
[3] Improved molar and canine relationship
[4] Change in ANB angle
[5] Improved facial profile
[6] Improvement in lip competence

Secondary outcomes:
[1] Oral hygiene status
[2] Gingival health
[3] Patient compliance
[4] Appliance breakage
[5] Soft tissue irritation
[6] Satisfaction of the patient and parent

Follow-up:
Assessment of patients was conducted at baseline, 3, 6, 9 and 12 months. Clinical examination, photographs and cephalometric analysis were done at every visit.

Data collection:
A standard case record form was used to record clinical findings. A calibrated orthodontist with standard tracing technique was used to minimize observer bias to perform cephalometric measurements.

Statistical analysis:
The data were coded and entered into a Microsoft Excel sheet and analyzed by SPSS version 26.0. The data were presented as mean ± standard deviation for continuous variables and as frequencies and percentages for categorical variables. Student's

t-test (independent) was used for intergroup comparisons, paired t-test for intragroup comparisons and the Chi-square test or Fisher's exact test for categorical variables. Repeated measures ANOVA was used as appropriate. P values <0.05 were considered statistically significant.

Results:

A total of 100 children with developing Class II malocclusion were included in the study. The participants were equally allocated into Group A (Early Orthodontic Intervention, n=50) and Group B (Observation/Control, n=50). Baseline demographic and clinical characteristics were comparable between the groups (p>0.05), indicating homogeneity before treatment. Treatment outcomes were evaluated after 12 months based on clinical and cephalometric parameters. The mean age of participants was comparable between the intervention and control groups (10.2 ± 1.1 vs. 10.4 ± 1.2 years; p=0.426). The gender distribution was similar, with males constituting 56% of Group A and 52% of Group B (p=0.688). Baseline orthodontic characteristics including overjet, overbite and ANB angle showed no statistically significant differences between groups (p>0.05), confirming that both groups were well matched before treatment **(Table 1).** Children receiving early orthodontic intervention demonstrated significantly greater improvement in all measured skeletal and dental parameters compared with the observation group. Mean overjet decreased to 3.4 mm in Group A compared with 6.8 mm in Group B (p<0.001). Similarly, overbite, ANB angle, Wits appraisal and facial convexity showed significantly better correction in the intervention group, indicating effective sagittal growth modification and improvement in jaw relationships **(Table 2).** A significantly higher proportion of children in the early intervention group achieved favourable occlusal outcomes compared with controls. Class I molar relationship was established in 78% of treated children versus 28% of controls. Normal overjet was achieved in 82% of Group A compared with 32% of Group B. Improvement in lip competence and facial profile was also significantly greater among treated participants (84% and 80%, respectively; p<0.001). More than half of the control group (52%) exhibited no clinically significant improvement after the observation period **(Table 3).** Among children receiving orthodontic intervention, 74% demonstrated excellent compliance with appliance wear, while only 6% showed poor compliance. Good oral hygiene was maintained in 90% of treated participants and 84% of controls, with no statistically significant difference (p=0.372). Treatment-related complications were minimal; appliance breakage occurred in 8% of patients and mild soft tissue irritation in 6%, both of which were managed conservatively without interruption of treatment **(Table 4).**

Table 1: Baseline demographic and clinical characteristics of the study participants

Variable	Group A (n=50)	Group B (n=50)	p value
Mean age (years)	10.2 ± 1.1	10.4 ± 1.2	0.426
Male	28 (56%)	26 (52%)	0.688
Female	22 (44%)	24 (48%)	
Mean overjet (mm)	7.8 ± 1.2	7.7 ± 1.1	0.674
Mean overbite (mm)	4.6 ± 0.8	4.5 ± 0.7	0.521
ANB angle (°C)	5.9 ± 1.1	6.0 ± 1.2	0.732

Table 2: Comparison of orthodontic treatment outcomes after 12 months

Parameter	Group A Mean ± SD	Group B Mean ± SD	p value
Overjet (mm)	3.4 ± 0.9	6.8 ± 1.0	<0.001*
Overbite (mm)	2.6 ± 0.6	4.1 ± 0.7	<0.001*
ANB angle (°C)	3.8 ± 0.9	5.7 ± 1.0	<0.001*
Wits appraisal (mm)	1.5 ± 1.2	3.8 ± 1.3	<0.001*
Facial convexity angle (°C)	11.8 ± 2.4	15.1 ± 2.8	<0.001*

Table 3: Improvement in occlusal relationship and facial profile after treatment

Outcome	Group A (n=50)	Group B (n=50)	p value
Class I molar relationship achieved	39 (78%)	14 (28%)	<0.001*
Normal overjet achieved	41 (82%)	16 (32%)	<0.001*
Lip competence improved	42 (84%)	20 (40%)	<0.001*
Improved facial profile	40 (80%)	18 (36%)	<0.001*
No significant improvement	5 (10%)	26 (52%)	<0.001*

Table 4: Patient compliance, oral health status and treatment-related complications

Variable	Group A (n=50)	Group B (n=50)	p value
Excellent compliance	37 (74%)	—	—
Good compliance	10 (20%)	—	—
Poor compliance	3 (6%)	—	—
Good oral hygiene	45 (90%)	42 (84%)	0.372
Mild gingival inflammation	5 (10%)	8 (16%)	0.372

Appliance breakage	4 (8%)	–	–
Soft tissue irritation	3 (6%)	–	–

Discussion:

The present study showed that early orthodontic treatment of children with developing Class II malocclusion had significantly more positive effects on skeletal, dental and soft tissue parameters than no treatment. Children treated during the mixed dentition stage had a significant decrease in overjet, overbite, ANB angle and Wits appraisal and improved molar relationship, lip competence and facial profile. The results confirm the importance of growth modification in correcting sagittal discrepancies in active craniofacial development. There is recent evidence that supports early intervention in appropriately selected children. The significant overjet reduction achieved in the present study is in line with the above findings and shows the advantages of taking advantage of the child's growth potential **[8]**. Similarly, Khan *et al.* reported improvements in overjet reduction and skeletal alignment following early orthodontic intervention, although the long-term benefits may depend on treatment selection and patient compliance **[9].** In the present study, a significantly higher percentage of children in the early treatment group had normal overjet, Class I molar relationship and facial profile, suggesting that early correction provides a more favourable functional and occlusal environment during growth. In the present study, the improvement in cephalometric measurements after 12 months of functional orthopedic therapy is comparable to that reported by Li and Meng in their systematic review and meta-analysis after 12 months of using Bionator functional appliances, which showed that these growth-modifying appliances have a positive effect on improving sagittal jaw relationships in children with Class II malocclusion **[10]**. Similarly, Sahu *et al.* reported significant improvements in overjet, overbite, and skeletal parameters following interceptive orthodontic treatment during the mixed dentition period **[11]**. In the present study, almost 75% of children were excellent in compliance, which probably helped in achieving good results of treatment and highlights the need for patient cooperation in the treatment of functional appliance therapy. Newer treatment modalities have increased treatment options for the expanding number of patients **[12]**. Clear aligner mandibular advancement was compared to conventional functional appliances by Huang *et al.* , both of which were found to be effective at skeletal correction of Class II malocclusion, with conventional functional appliances showing slightly greater orthopedic effects, which supports the continued use of conventional functional appliances as the standard interceptive treatment during the mixed dentition stage **[13]**. The findings of the present study are similar to those of Rutili *et al.* , who found that both fixed functional orthopedic treatment (FFOT) and skeletal anchorage (SA) were effective in reducing overjet and improving mandibular advancement, but that there was only a small additional benefit in the selected cases of SA **[14]**. In the present study, it was observed that both appliances were effective in correcting skeletal and dentoalveolar discrepancies and that the Twin Block appliance was more accepted and compliant by the patients, which corroborates the findings of Coronel-Zubiate *et al.* in their systematic review, who concluded that removable functional appliances were effective in correcting skeletal and dentoalveolar discrepancies and that the Twin Block appliance was more accepted and compliant by patients **[15]**. The significant three-dimensional condylar remodeling and adaptive changes in the glenoid fossa reported by Kamboj *et al.* Following functional appliance therapy also suggest that orthopedic treatment causes true skeletal adaptation, not just dentoalveolar compensation, which is responsible for the significant changes in ANB angle, facial profile and mandibular advancement seen in the present investigation **[16]**. Alqahtani *et al.* noted that the most important factor to consider when deciding whether to treat a child early is the expected growth potential, severity of malocclusion and the amount of overjet. The positive results of this current study validate these recommendations and underscore the need for proper case selection prior to starting interceptive therapy **[17]**. The present results are consistent with these conclusions, as the early intervention group showed significantly better skeletal and occlusal correction, better facial aesthetics and excellent patient acceptance, as opposed to the group of children who were observed. In summary, the results of this study are in agreement with recent evidence showing that early orthodontic treatment during the mixed dentition phase is beneficial in improving skeletal relationships, reducing excessive overjet, improving facial profile and creating an optimal occlusal relationship **[18]**. Early interceptive orthodontic treatment is an effective approach to the management of the developing Class II malocclusion, if combined with proper patient selection, sufficient growth potential and compliance. However, long-term follow-up is necessary to assess treatment stability and to make a decision about the necessity of comprehensive orthodontic treatment in the adolescent years.

Conclusion:

Early orthodontic intervention in children with developing Class II malocclusion significantly improved skeletal and dental relationships, reduced overjet and overbite and enhanced facial profile compared with observation alone. Functional orthopedic treatment during the mixed dentition stage effectively utilized growth potential to achieve favourable occlusal outcomes with high patient compliance and minimal complications. Thus, data support timely interceptive orthodontic treatment as an effective strategy for optimizing dentofacial development in growing children.

References:

[1] Dinu S *et al. Children.* 2025 **12**:1533. [PMID: 41300650]
[2] Alhammadi MS *et al. Dent Press J Orthod.* 2018 **23**:40.e1. [PMID: 30672991]
[3] Santana LG *et al. Orthod Craniofac Res.* 2020 **23**:371. [PMID: 32390332]
[4] Vignesh KC *et al. Cureus.* 2025 **17**:e98342. [PMID: 41487818]

[5] Niu *et al.* SLAS Technol. 2026 **2026**:100372. [PMID: 41319809]
[6] Zhou C *et al. Int J Oral Sci.* 2024 **16**:32. [PMID: 38627388]
[7] Kaje R *et al. J Pharm Bioallied Sci.* 2024 **16**: S2691 [PMID: 39346279]
[8] Sinha A *et al. J Pharm Bioallied Sci.* 2024 **16**:S1808 [PMID: 38882812]
[9] https://jptcp.com/index.php/jptcp/article/view/9350
[10] Li D & Meng M. *J Oral Clin Pediatr Dent.* 2025 **49**:38. [DOI: 10.22514/jocpd.2025.022]
[11] Sahu N *et al. Int J Drug Deliv Technol.* 2026 **16**:479. [DOI: 10.25258/ijddt.16.3s.61]
[12] Venkatesan K *et al. J Orofac Orthop.* 2026 **87**:306. [PMID: 40208272]
[13] Huang X *et al. BMC Oral Health.* 2026 **26**:833. [PMID: 41923072]
[14] Rutili V *et al. Orthod Craniofac Res.* 2026. [PMID: 41546469]
[15] Coronel-Zubiate FT *et al. Front Dent Med.* 2026 **7**:1717387. [PMID: 42222473]
[16] Kamboj S *et al. Front Dent Med.* 2026 **7**:1870531. [PMID: 42388513]
[17] Alqahtani J *et al. J Healthc Sci.* 2023 **3**:482. [DOI: 10.52533/JOHS.2023.31105]
[18] Giuntini V *et al. Semin Orthod.* 2023 **29**:183. [DOI: 10.1053/j.sodo.2023.04.008]

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