RESEARCH PAPER

Early Vs Delayed Orthodontic Treatment In Children: A Comparative Outcome Analysis

Sai Prannoy Nagella[1], Subramanian Shantinidevi[2], Aparnna Dhayanidhi[3], Karnati. Praveen Kumar Reddy[4], Harikrishnan[5], Mohit Zarekar[6]

[1] Senior Lecturer, Department Of Paediatric Dentistry, Faculty Of Dentistry, Mahsa University, Jln Sp 2, Bandar Saujana Putra, Jenjarom, Selangor, Malaysia.

[2] Professor, Department Of Paediatric Dentistry, Faculty Of Dentistry, Mahsa University, Jln Sp 2, Bandar Saujana Putra, Jenjarom, Selangor, Malaysia.

[3] Senior Lecturer, Department Of Orthodontics, Faculty Of Dentistry, Mahsa University, Jln Sp 2, Bandar Saujana Putra, Jenjarom, Selangor, Malaysia.

[4] Senior Lecturer, Department Of Orthodontics, Faculty Of Dentistry, Segi University, Petaling Jaya, Selangor, Malaysia.

[5] Reader, Department Of Pediatric And Preventive Dentistry, Srinivas Institute Of Dental Sciences, Mukka, Mangalore, Karnataka, India.

[6] Senior Resident, Department Of Pediatric & Preventive Dentistry, Maulana Azad Institute Of Dental Sciences, New Delhi, India.

Corresponding Author: Sai Prannoy Nagella, Email: saiprannoy@mahsa.edu.my

Received: *20th Feb, 2026;* ***Revised:*** *4th Mar, 2026;* ***Accepted:*** *25th Mar, 2026;* ***Available Online:*** *10th Apr, 2026*

Abstract

Introduction: The optimal timing of orthodontic intervention in children remains a subject of ongoing debate, particularly regarding the comparative benefits of early (interceptive) versus delayed (comprehensive) treatment. Early treatment aims to utilize growth potential for craniofacial growth modulation, while delayed treatment focuses on achieving efficient dental alignment during adolescence.

Materials And Methods: A prospective comparative study was conducted on 80 children divided into two groups: Group I (early treatment; 7–10 years) and Group II (delayed treatment; 11–14 years). Clinical parameters such as Index Of Orthodontic Treatment Need (iotn), overjet, overbite, and arch length discrepancy were assessed. Cephalometric analysis (sna, snb, anb angles) was performed to evaluate skeletal changes. Treatment duration, number of visits, patient adherence and engagement in care pathways were also recorded. Statistical analysis was performed using appropriate tests with significance set at $p < 0.05$.

Results: Both groups showed significant improvement in occlusal parameters. The delayed treatment group demonstrated greater reduction in overjet and arch length discrepancy, whereas the early treatment group exhibited significantly better skeletal changes, particularly in anb angle reduction. Early treatment required longer duration and more visits, while delayed treatment showed better compliance and efficiency.

Conclusion: Early orthodontic treatment is more effective for skeletal modification and growth guidance, whereas delayed treatment provides comparable occlusal outcomes with greater efficiency and shorter duration. Treatment timing should be individualized based on malocclusion severity and growth potential.

Keywords: Evidence Based Dentistry, Early Intervention, Malocclusion, Preventive Orthodontics, Sustainable Oral Healthcare.

How To Cite This Article: Nagella Sp, Shantinidevi S, Dhayanidhi A, Reddy Kpk, Harikrishnan, Zarekar M. Early Vs Delayed Orthodontic Treatment In Children: A Comparative Outcome Analysis. Int J Drug Deliv Technol. 2026;16(25s):821-825. Doi: 10.25258/ijddt.16.25s.97

Introduction

Orthodontic treatment timing in pediatric patients has long been a subject of clinical debate, particularly regarding the relative benefits of early (interceptive) versus delayed (comprehensive) intervention [1]. Early orthodontic treatment, typically initiated during the mixed dentition phase (around 7–10 years of age) aims to identify and manage developing malocclusions at a stage when craniofacial growth is still active [2]. This approach often focuses on modifying skeletal discrepancies, guiding erupting teeth, and addressing functional abnormalities such as thumb sucking, tongue thrusting, or abnormal swallowing patterns. Proponents of early intervention argue that it can

reduce the severity of malocclusion, simplify or even eliminate the need for more complex treatment later, and enhance holistic well-being, social confidence, and mental health outcomes in developing children [3].

Conversely, delayed orthodontic treatment is usually initiated during the late mixed or permanent dentition phase (approximately 11–14 years), when most or all permanent teeth have erupted [4]. This approach emphasizes comprehensive correction of malocclusion in a single phase, often utilizing fixed appliances to achieve optimal alignment, occlusion, and aesthetics. Advocates of timely comprehensive intervention suggest that it is more resource-efficient and economically sustainable for health care systems, and less burdensome for patients, as it avoids prolonged treatment duration and potential patient burnout associated with two-phase therapy. Additionally, some studies have indicated that certain malocclusions, particularly dental crowding and mild skeletal discrepancies, can be effectively managed without early intervention [5].

The decision regarding optimal treatment timing is influenced by multiple factors, including the type and severity of malocclusion, growth potential, patient compliance, and psychosocial considerations. For instance, conditions such as Class II malocclusion with significant overjet, posterior crossbite, and functional shifts may benefit substantially from early correction to prevent further skeletal disharmony and reduce the risk of trauma to protruded incisors [6]. Similarly, early expansion of a constricted maxilla can promote favorable transverse development and improve airway function. On the other hand, cases involving mild to moderate crowding or spacing may not require early intervention and can be effectively managed during adolescence with comparable outcomes [7].

Despite extensive research, the literature presents mixed evidence regarding the superiority of early versus delayed treatment. Some longitudinal studies suggest that early intervention provides limited additional benefits in certain cases, while others highlight its role in reducing treatment complexity and improving long-term stability [8]. Furthermore, considerations such as treatment duration, cost implications, patient cooperation, and quality of life outcomes continue to shape clinical decision-making [9].

Therefore, this study is important to assess and compare the clinical effectiveness, treatment outcomes, and overall benefits of early versus delayed orthodontic intervention in children, thereby aiding clinicians in evidence-based treatment planning and optimizing patient care.

Methodology

A prospective comparative clinical study was conducted to evaluate and compare the outcomes of early versus delayed orthodontic treatment in children. The study was carried out in the Department of Orthodontics and Dentofacial Orthopedics after obtaining approval from the Institutional Ethics Committee. Written informed consent was obtained from the parents or guardians of all participating children.

Study Population and Sample Size

A total of 80 children requiring orthodontic intervention were selected and divided into two groups based on the timing of treatment:

- **Group I (Early Treatment Group):** 40 children aged 7–10 years in the mixed dentition phase
- **Group II (Delayed Treatment Group):** 40 children aged 11–14 years in the late mixed or early permanent dentition phase

Inclusion Criteria

• Children with Class I or Class II malocclusion
• Presence of developing malocclusion requiring interceptive or comprehensive orthodontic treatment
• Good general health with no systemic conditions affecting growth
• Cooperative patients with positive or manageable behavior

Exclusion Criteria

• Children with craniofacial anomalies (e.g., cleft lip and palate)
• Previous orthodontic treatment
• Severe skeletal discrepancies requiring surgical intervention
• Poor oral hygiene or uncooperative behavior

Study Design and Intervention

Group I patients received early (interceptive) orthodontic treatment, which included removable appliances, functional appliances, or limited fixed appliances aimed at correcting skeletal discrepancies, guiding eruption, and eliminating deleterious oral habits.

Group II patients underwent delayed (comprehensive) orthodontic treatment using fixed mechanotherapy after eruption of most permanent teeth, focusing on alignment, leveling, and occlusal correction.

Outcome Measures

Clinical and cephalometric evaluations were performed at baseline and after completion of

treatment. The following parameters were assessed:
• Improvement in malocclusion severity using Index of Orthodontic Treatment Need (IOTN)
• Changes in overjet, overbite, and arch length discrepancy
• Skeletal relationships assessed through cephalometric analysis (SNA, SNB, ANB angles)
• Treatment duration and number of visits
• Patient compliance and acceptance (assessed using a structured questionnaire)

Data Collection and Follow-up

Patients were followed throughout the treatment period, with periodic evaluations every 4–6 weeks. Post-treatment records, including study models, intraoral photographs, and radiographs, were obtained for comparison with baseline findings.

Statistical Analysis

The collected data were tabulated and analyzed using appropriate statistical software. Descriptive statistics were used to summarize the data. Intergroup comparisons were performed using independent t-tests or Mann–Whitney U tests, while intragroup comparisons were assessed using paired t-tests. A p-value of <0.05 was considered statistically significant. This methodology enabled a structured comparison of treatment efficiency, clinical outcomes, and overall effectiveness between early and delayed orthodontic interventions in children.

Results

A total of 80 children completed the study, with 40 patients in each group. Both early and delayed orthodontic treatment groups demonstrated significant improvement in occlusal and skeletal parameters; however, differences were observed in treatment efficiency, duration, and specific outcome measures.

Table 1: Baseline Characteristics of Study Participants

Parameter	Group I (Early) (n=40)	Group II (Delayed) (n=40)	p-value
Mean Age (years)	8.6 ± 1.2	12.3 ± 1.1	<0.001
Male/Female (n)	22/18	20/20	0.65
IOTN Score (Mean)	3.8 ± 0.6	3.9 ± 0.5	0.48
Overjet (mm)	6.2 ± 1.4	6.0 ± 1.3	0.57
Overbite (mm)	4.1 ± 1.2	4.0 ± 1.1	0.71

As shown in Table 1, both groups were comparable at baseline with no statistically significant differences in malocclusion severity or occlusal parameters.

Table 2: Comparison of Treatment Outcomes

Parameter	Group I (Early)	Group II (Delayed)	p-value
Final IOTN Score	1.6 ± 0.5	1.4 ± 0.4	0.08
Reduction in Overjet (mm)	3.8 ± 1.2	4.5 ± 1.3	0.02*
Reduction in Overbite (mm)	2.1 ± 0.9	2.4 ± 1.0	0.18
Arch Length Discrepancy (mm)	1.5 ± 0.7	2.2 ± 0.8	0.01*

(*Statistically significant)

Table 2 demonstrates that both groups showed significant improvement; however, the delayed treatment group exhibited greater reduction in overjet and arch length discrepancy.

Table 3: Cephalometric Changes

Parameter	Group I (Early)	Group II (Delayed)	p-value
SNA Change (°)	+1.2 ± 0.8	+0.5 ± 0.6	0.01*
SNB Change (°)	+1.5 ± 0.7	+0.7 ± 0.5	0.001*
ANB Reduction (°)	−1.8 ± 0.9	−1.2 ± 0.8	0.02*

(*Statistically significant)

As seen in Table 3, early treatment resulted in significantly greater skeletal changes, particularly in improving jaw relationships (ANB angle), indicating better growth modification potential.

Table 4: Treatment Duration and Patient Compliance

Parameter	Group I (Early)	Group II (Delayed)	p-value
Total Treatment Duration (months)	18.5 ± 3.2	14.2 ± 2.8	<0.001*
Number of Visits	22 ± 4	16 ± 3	<0.001*
Compliance Score (1–5)	3.9 ± 0.8	4.3 ± 0.6	0.03*

(*Statistically significant)

Table 4 indicates that early treatment required a longer duration and more visits, whereas delayed treatment showed better patient compliance and shorter treatment time.

Overall, both early and delayed orthodontic interventions were effective in improving malocclusion. Early treatment demonstrated superior skeletal modifications, while delayed treatment was associated with greater efficiency in dental corrections and reduced treatment duration.

Discussion

The present study compared the clinical outcomes of early versus delayed orthodontic treatment in children and demonstrated that early intervention produced superior skeletal modifications, whereas delayed treatment showed greater efficiency in dental correction with reduced treatment duration. These findings align with and, in some aspects, contrast with previously published studies.

A recent systematic review by Almugla et al. (2025) [9] reported that early orthodontic treatment provides significant short-term improvements in overjet reduction and skeletal relationships; however, no consistent long-term advantages over delayed treatment were observed. This is partially consistent with the present study, where early treatment showed better cephalometric changes (SNA, SNB, ANB), but the final occlusal outcomes (IOTN scores) between groups were comparable. This suggests that while early intervention influences growth modification, its long-term superiority in occlusal outcomes remains debatable.

In contrast, the systematic review by Dinu S et al. (2025) [10] focusing on Class II malocclusion indicated that early treatment resulted in improved jaw relationships, enhanced arch development, and better eruption patterns . These findings strongly support the results of the present study, where early intervention demonstrated significantly greater skeletal improvements and better control over developing malocclusion. The enhanced ANB reduction observed in our study reflects the advantage of utilizing active growth periods for orthopedic correction.

Similarly, Kaje et al. (2024) [11] reported that early orthodontic intervention resulted in greater reduction in overjet and improved molar relationships compared to delayed treatment. While our study also showed significant skeletal benefits with early treatment, the delayed group exhibited slightly greater reduction in overjet. This discrepancy may be attributed to differences in appliance selection, treatment protocols, or patient compliance, which tend to be higher in older children undergoing single-phase therapy.

The findings of the present study are also in agreement with the retrospective study by Oh H et al. (2016) [12], which demonstrated that both early and late treatments were effective in correcting Class II malocclusion, with approximately similar success rates . Importantly, their study highlighted that early treatment reduced the need for extractions and simplified later treatment phases, which correlates with our observation of improved skeletal relationships and potentially less complex malocclusion progression in the early treatment group. However, they also reported longer overall treatment duration in early-treated patients, which is consistent with our findings of increased treatment time and number of visits.

Furthermore, previous literature suggests that early orthodontic intervention is particularly beneficial in cases involving functional discrepancies, such as crossbites and severe skeletal imbalances, where growth modification is critical [13]. The current study reinforces this concept by demonstrating significantly greater cephalometric improvements in the early treatment group, supporting the role of interceptive orthodontics in modifying craniofacial growth patterns. On the other hand, the delayed treatment group in this study showed better efficiency in terms of treatment duration and patient compliance. This observation is consistent with the general consensus in orthodontic literature that single-phase treatment during adolescence is often more time-efficient and less burdensome for patients. The reduced number of visits and shorter treatment time observed in our study further validate this approach, particularly in cases where early intervention is not clinically indicated.

Conclusion

Overall, the findings of the present study support a balanced and individualized approach to orthodontic treatment timing. While early intervention offers significant advantages in skeletal modification and growth guidance, delayed treatment remains equally effective in achieving final occlusal outcomes with greater efficiency. Therefore, the decision to initiate early orthodontic treatment should be based on the severity of malocclusion, growth potential, and specific functional needs rather than adopting a routine two-phase treatment strategy.

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