

Original Research

Impact of early orthodontic intervention on dental crowding in children: A prospective study

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ABSTRACT:

Purpose: This prospective study aims to evaluate the effectiveness of early orthodontic intervention on dental crowding in children. Early intervention, commonly referred to as interceptive orthodontics, targets malocclusion and crowded teeth during the mixed dentition phase to prevent future complications. This study assesses the degree of dental crowding before and after early orthodontic treatments. **Methods:** A total of 100 children, aged 7-10 years, were recruited for the study. The subjects were divided into two groups: Group A (intervention) received early orthodontic treatment such as space maintainers, arch expansion, and partial braces, while Group B (control) did not receive any intervention during the mixed dentition phase. Dental casts and panoramic radiographs were taken at baseline and after two years to assess changes in dental arch dimensions and crowding. Measurements were performed using the Little's Irregularity Index (LII) and arch perimeter analysis. The data were analyzed using paired t-tests and repeated measures ANOVA. **Results:** The study found a significant reduction in dental crowding in Group A compared to Group B ($p < 0.05$). The arch perimeter increased by an average of 2 mm in the intervention group, while no significant change was noted in the control group. The LII values were also markedly lower in Group A, suggesting that early orthodontic intervention effectively reduced the severity of crowding. **Conclusion:** Early orthodontic intervention has a positive impact on preventing and reducing dental crowding in children. Timely correction during the mixed dentition phase allows for improved dental arch alignment and prevents future complications that may require more complex orthodontic treatments. This study highlights the importance of early diagnosis and intervention to address dental crowding in pediatric patients.

Keywords: Early orthodontic intervention, Dental crowding, Mixed dentition, Space maintainers, Arch expansion

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INTRODUCTION

Dental crowding is a common malocclusion issue observed in children and adolescents. It occurs when there is insufficient space in the dental arch to accommodate all teeth in their proper alignment. This misalignment can lead to functional problems such as difficulty maintaining oral hygiene, increased risk of dental caries, gum disease, and poor aesthetics [1]. Early orthodontic intervention, often referred to as interceptive orthodontics, addresses dental crowding

during the mixed dentition phase (ages 7-10 years), aiming to prevent more severe malocclusion issues later in life [2].

The primary goal of interceptive orthodontics is to reduce the severity of malocclusions and, in many cases, prevent the need for complex treatment in adolescence or adulthood. Treatments such as space maintainers, arch expansion devices, and partial braces are commonly used to create space in the dental arch, allowing for better alignment of

permanent teeth as they erupt [3]. This proactive approach takes advantage of the child's growth phase to achieve favorable results with less invasive measures [4].

Several studies have shown that early orthodontic interventions can result in improved dental alignment, enhanced oral function, and better long-term outcomes [5]. However, some orthodontists prefer delaying treatment until the permanent teeth have fully erupted, arguing that early intervention may not always be necessary [6]. Despite this, evidence increasingly supports the benefits of treating crowding early, particularly in preventing severe malocclusions [7].

This prospective study aims to assess the impact of early orthodontic intervention on dental crowding in children. By evaluating changes in dental arch dimensions and crowding severity over two years, this study will provide valuable insights into the efficacy of interceptive orthodontics in managing dental crowding, thereby contributing to the ongoing discussion regarding the optimal timing for orthodontic intervention in pediatric patients.

MATERIALS AND METHODS

Study Design and Population

This prospective study was conducted on 100 children, aged 7-10 years, who were divided into two groups: Group A (n=50) received early orthodontic intervention, while Group B (n=50) served as the control group without intervention. Children with severe craniofacial anomalies or systemic conditions affecting dental development were excluded from the study.

Intervention

Group A received early orthodontic interventions, including space maintainers, arch expansion devices, and partial braces, depending on their specific malocclusion needs. The treatment plan was customized for each child based on the severity of their dental crowding and arch development.

Data Collection

Baseline dental records, including dental casts and panoramic radiographs, were obtained for all participants. After two years, post-treatment records were taken to assess the changes in dental arch dimensions and crowding. Dental crowding was measured using Little's Irregularity Index (LII) and arch perimeter analysis.

Statistical Analysis

The data were analyzed using paired t-tests to compare baseline and post-treatment values within each group. A repeated measures ANOVA was performed to assess the differences between the intervention and control groups over time. Statistical significance was set at $p < 0.05$.

RESULTS

Arch Perimeter Changes: In Group A (intervention), the average arch perimeter increased significantly compared to Group B (control). Group A showed a mean increase of 2.0 mm in arch perimeter over the two-year study period, while Group B had no statistically significant changes. This demonstrates the effectiveness of early orthodontic intervention in creating additional space for proper alignment of teeth.

Table 1: Arch Perimeter Changes (mm) Over 2 Years

Group	Baseline (Mean \pm SD)	Post-Treatment (Mean \pm SD)	Change (Mean \pm SD)	p-value
Group A	68.5 \pm 3.2	70.5 \pm 3.4	+2.0 \pm 0.5	<0.001
Group B	68.2 \pm 3.3	68.3 \pm 3.2	+0.1 \pm 0.2	0.453

Group A showed a significant increase in arch perimeter compared to Group B, where the changes were not statistically significant.

Little's Irregularity Index (LII) Changes: The LII score, which measures anterior dental irregularity, was significantly reduced in Group A after two years of early orthodontic intervention. Group A exhibited a reduction in LII from a baseline mean of 6.5 to 3.2 after treatment. In contrast, Group B showed no significant change, with a minimal reduction from 6.4 to 6.1.

Table 2: Little's Irregularity Index (LII) Changes Over 2 Years

Group	Baseline (Mean \pm SD)	Post-Treatment (Mean \pm SD)	Change (Mean \pm SD)	p-value
Group A	6.5 \pm 1.2	3.2 \pm 1.0	-3.3 \pm 0.8	<0.001
Group B	6.4 \pm 1.1	6.1 \pm 1.0	-0.3 \pm 0.2	0.374

Group A exhibited a substantial reduction in LII compared to Group B, where the reduction was negligible.

Tooth Eruption Patterns: Children in Group A showed a more favorable eruption pattern of permanent teeth compared to Group B. This pattern contributed to better overall dental alignment in Group A, with fewer cases of overlapping teeth post-treatment.

Table 3: Eruption Patterns of Permanent Teeth After 2 Years

Group	Proper Alignment (%)	Malaligned (%)	Overlapping (%)	p-value
Group A	85%	10%	5%	<0.001

Group B	60%	25%	15%	0.045
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DISCUSSION

The results of this study demonstrate the effectiveness of early orthodontic intervention in managing dental crowding in children. The significant reduction in Little's Irregularity Index (LII) and the increase in arch perimeter observed in the intervention group highlight the benefits of interceptive orthodontics during the mixed dentition phase [1, 2].

Interceptive orthodontic treatments, such as space maintainers and arch expansion devices, have long been advocated as preventive measures for dental crowding [3]. By addressing malocclusions early, clinicians can create adequate space for the proper eruption of permanent teeth, reducing the need for more invasive treatments later in life [4]. The findings of this study align with previous research, which has shown that early interventions result in improved dental alignment, reduced crowding, and better long-term outcomes [5].

One of the key advantages of early intervention is its ability to influence the growth and development of the dental arches. During the mixed dentition phase, children experience significant changes in their dental and skeletal structures [6]. By guiding this development through orthodontic treatments, clinicians can correct malocclusions before they become more severe. This study demonstrated that early interventions led to increased arch perimeter and improved alignment of the anterior teeth, preventing the crowding of permanent teeth [7].

However, the decision to pursue early orthodontic treatment should be individualized based on the severity of the malocclusion and the child's growth potential [8]. Not all cases of dental crowding require immediate intervention, and some may benefit from a "wait and watch" approach, where treatment is delayed until the permanent teeth have erupted. The control group in this study, which did not receive early treatment, showed only a slight increase in dental crowding over the two-year study period, suggesting that in some cases, dental crowding may remain stable without intervention [9].

Despite the positive outcomes of early orthodontic treatment, there are some limitations to this study. The relatively short follow-up period of two years may not capture the full extent of dental and skeletal changes that occur during adolescence. Future studies with longer follow-up periods are needed to assess the long-term stability of early orthodontic interventions [10]. Additionally, compliance with treatment protocols plays a crucial role in the success of early interventions. Children who fail to adhere to their prescribed orthodontic regimens may experience suboptimal results, as seen in a small percentage of participants in this study [11-15].

These findings support the value of early orthodontic intervention for improving dental outcomes and suggest the need for further research into long-term results.

CONCLUSION

Early orthodontic intervention during the mixed dentition phase can significantly reduce dental crowding and improve dental arch alignment in children. By addressing malocclusions at a young age, interceptive treatments create space for proper tooth eruption and reduce the need for more extensive orthodontic procedures in the future. However, the decision to pursue early treatment should be based on individual factors, including the severity of crowding and growth potential. Long-term studies are needed to further evaluate the stability of early orthodontic outcomes.

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