Long-term Clinical Effectiveness of Early Versus Late Orthodontic Intervention

Seo Yeon Bang
Bali Island School Grade 12

Abstract

Orthodontic treatment is primarily associated with cosmetic purposes; however, its effects extend beyond aesthetics. Treatment often involves choosing between intervening early in the mixed dentition stage and delaying treatment until the full development of the permanent dentition. This project aims to compare the long-term clinical effectiveness of early versus late orthodontic intervention and explore how each approach influences long-term oral health and physiological development. Total treatment duration, long-term stability, and efficacy in addressing common dental issues, such as malocclusions, overjets, and crossbites, will be evaluated for each treatment option. While acknowledging that each approach provides different potential advantages and challenges depending on the specific case, by comparing the two approaches, this project aims to provide insight into whether early or late orthodontic intervention may be the more appropriate decision for achieving the best long-term outcomes for a patient.

Introduction & Background

Key Terms

Dentition: Dentition is a dental term used to describe the development, arrangement, and condition of teeth in the mouth. It describes the number, type, and positioning of a person's teeth across different stages of life, including the natural process of tooth eruption and alignment in the jaws (Thygesen, 2025).

Molars: Molars are the teeth located at the very back of the mouth, designed for crushing and chewing food. Adults commonly have 12 molar teeth, which include the wisdom teeth (Teeth, 2023).

Premolar: Premolars, also known as bicuspids, are the teeth located between the canines and molars. Serving as the "transitional teeth," they have features of both canines and molars (Teeth, 2023).

Incisor: The incisors are the most visible teeth in your mouth and have a single, narrow edge that assists in cutting into food when you bite. Usually, people have four incisors in each upper and lower jaw (Teeth, 2023).

Maxilla: The maxilla is a structure of the facial skeleton, making up the bony foundation of the midface, containing the maxillary sinuses (Maxilla, n.d.).

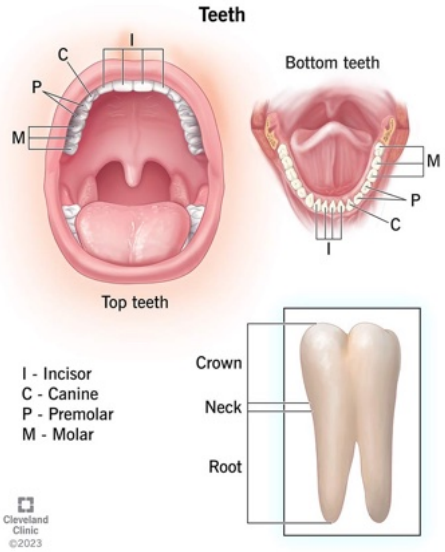

Figure 1. *Diagram of permanent tooth anatomy and tooth types.* Reprinted from (Teeth, 2023)

Midline: The dental midline is defined as a vertical, imaginary line that ideally divides the upper and lower dental arches into two equal parts. For optimal dental aesthetics, the line should fall directly between the two upper and lower incisors (Dental Midline, n.d.).

Figure 2. Image of dental midline.
Reprinted from (Jamilian, 2019)

Dentofacial: Dentofacial orthodontics refers to a specialty that focuses on the relationship between the teeth "dento" and the face "facial," treating both teeth and facial structure, including the jaw (What Is Dentofacial Orthopedics?, 2024).

Enamel: Tooth enamel is the durable protective outer layer of the teeth, shielding the tooth crown and inner layers from damage (Tooth Enamel, 2025).

Periodontal tissue: Periodontal tissue describes the tissue surrounding the teeth that supports and attaches the teeth to the jawbone (Tsuchida & Nakayama, 2022).

Cephalometry: Cephalometry is the scientific measurement and study of the dimensions of the head, in relation to specific reference points, used mainly for assessing facial growth and development. It is a commonly used diagnostic technique in clinical orthodontics and is considered as a reliable method of measurement (Cephalometry, n.d.).

Orthodontic relapse: This is the tendency of teeth to return to their original positions after orthodontic treatment (Ali, n.d.).

Occlusion: In dentistry, occlusion refers to the alignment of teeth when a person bites down, focusing on how the upper and lower teeth meet and function together (Classification of Occlusion, n.d.).

Malocclusion: A malocclusion is when the upper and lower teeth are misaligned and do not fit together properly it is noted as a malocclusion. Criteria to evaluate a malocclusion include: The fit of the molar teeth together, how the canine (cuspid) teeth fit together, and the position of teeth relative to each other. There are different classifications of malocclusion. The main types include Class I malocclusion, which is used when the bite is relatively aligned and the cusps and fossae are properly aligned. However, there is still a slight misalignment. Class II Malocclusion refers to when the upper front teeth are significantly overlapping or protruding over the lower teeth, and either the upper or lower jaw is misaligned. The protrusion that is occurring is described as "overjet" (Classification of Occlusion, n.d.). Class III malocclusion is when the jaw is overdeveloped, and the lower teeth stick out significantly

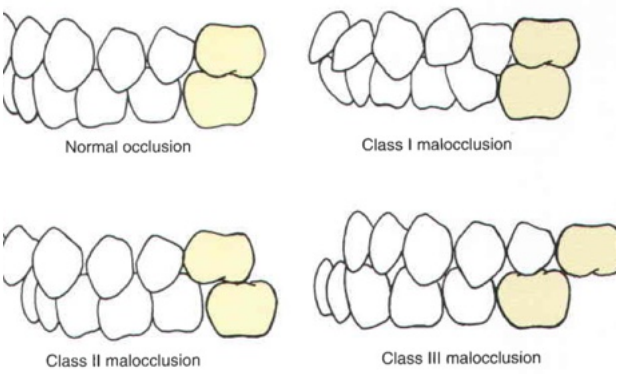

Figure 3. *Malocclusion classification.*
Reprinted from (*Do You Know What Occlusion Class You Have?*, n.d.)

beyond the upper anterior teeth. This is also referred to as an "underbite" (Malocclusion, 2024).

Figure 4. *Image of overjet.* Reprinted from (*Overjet Correction*, n.d.)

Overjet: Overjet refers to a type of malocclusion that occurs when the upper front teeth protrude out further excessively, creating horizontal overlap (Overjet, 2024).

Overbite: Overbite is the vertical overlap that occurs when the upper front teeth overlap the lower front teeth more than they should (Overjet, 2024).

Figure 5. *Image of overbite.* Reprinted from (*Overbites – Why Do They Need Correction?*, n.d.)

Crowding: Crowding is a condition that occurs when there is insufficient space for all permanent teeth to erupt, resulting in teeth larger than the dental arch (Classification of Occlusion, n.d.).

Deep bite: Deep bite is a type of malocclusion that occurs during an overbite when the upper front teeth extend too far over the lower front teeth. It often results in the complete covering of the lower teeth (Classification of Occlusion, n.d.).

Anterior Open Bite: Anterior open bite (AOB) is a condition in which there is a lack of vertical overlap or contact between the upper and lower front teeth, resulting in misalignment when the mouth is closed. It is commonly classified into three main types: dental AOB, skeletal AOB, and functional AOB (Hsu et al., 2024, 1328).

Figure 6. *Image of anterior open bite.* Reprinted from (*Does Tongue Thrusting Create Anterior Open Bites?*, n.d.)

Crossbite: Crossbite is a dental misalignment in the relationship between the upper and lower teeth. Crossbite is classified into two main types: anterior crossbite and posterior crossbite. Anterior crossbite is when the upper incisors come behind the lower incisors. Whereas, posterior crossbite is when the posterior teeth sit inside the lower teeth when biting (Brizuela et al., 2024).

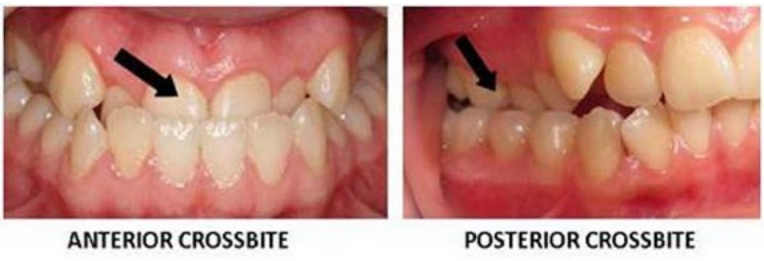

Figure 7. *Image of anterior and posterior cross bite.* Reprinted from (Fagu, 2016)

Purpose of orthodontic treatment beyond aesthetics

Having perfectly aligned teeth has benefits beyond having a nice smile. Aligned teeth also play an important role in oral health and overall well-being. Proper bite alignment, improved oral

hygiene, speech improvement, more effective digestion, and greater self-confidence explain the importance of dental alignment:

Properly aligned teeth allow the proper positioning of the upper and lower jaw alignment when you chew, bite, and speak. This can reduce the risk of issues such as temporomandibular joint (TMJ) disorders, abnormal enamel wear, jaw pain, and headaches (Orthodontics Beyond Aesthetics: The Health Benefits You Should Know, 2024).

Crowded or crooked teeth can result in difficulty in effectively cleaning all surfaces of the teeth during brushing and flossing. Straight teeth allow better access to all tooth surfaces which reduces the risk of cavities, gum disease, and bad breath (Orthodontics Beyond Aesthetics: The Health Benefits You Should Know, 2024).

Dental alignment can affect tongue placement, which can affect speech patterns, such as when producing certain sounds, such as “s” or “the”. Therefore, having straight teeth improves clarity in speech (Orthodontics Beyond Aesthetics: The Health Benefits You Should Know, 2024).

Proper chewing is a crucial part of the digestion process. Misaligned or crooked teeth can prevent the proper chewing of food, which can result in problems during the digestive process (Orthodontics Beyond Aesthetics: The Health Benefits You Should Know, 2024).

Having aligned teeth can impact various aspects of life, including social interactions and personal confidence. An improved dental appearance contributes to a higher self-esteem, which can affect a person’s personal and professional relationships (Orthodontics Beyond Aesthetics: The Health Benefits You Should Know, 2024).

Stages of dental development

Human dental development is divided into three main dentition stages: primary, mixed, and permanent (Mixed Dentition, n.d.).

Primary dentition is the stage that begins during infancy with the eruption of the first tooth. This stage typically occurs around 6 months and is completed when all primary teeth erupt, which occurs between 2 and 6 years of age (Management of the Developing Dentition and Occlusion in Pediatric Dentistry, 2024). The process of these first teeth erupting is also known as “teething” (Tooth Eruption/Development Stages, n.d.).

Mixed dentition is the transition stage between primary and permanent dentition and generally occurs between ages 6 and 12 years. This stage begins from the eruption of the first permanent tooth, usually at 5-6 years to the replacement of the last primary tooth at 12-13 years. However, amongst individuals, the timing of eruption may vary considerably. During mixed dentition, is when the first molars erupt while the primary teeth are being replaced by permanent teeth. Both the upper and lower dentitions continue to erupt until they establish contact, allowing for effective chewing. Even after functional occlusion is achieved, teeth may shift and erupt in response to the facial growth that occurs during childhood and adolescence (Mixed Dentition, n.d.). However, this stage can also be further divided into the early mixed and late mixed dentition (Management of the Developing Dentition and Occlusion in Pediatric Dentistry, 2024).

Permanent dentition, which usually occurs at 10-12 years of age, is when all baby teeth are lost, and 28 adult teeth remain. At around 21 years of age, the third molars, also known as the "wisdom teeth" will erupt. Following their eruption, those who have reached permanent dentition will have 32 teeth in total (Tooth Eruption/Development Stages, n.d.).

Orthodontic treatment most commonly occurs during early adolescence, typically in the mixed dentition stage. However, intervention may also occur earlier in the mixed dentition stage, later during the permanent dentition stage, or even later into adulthood. As a result, these variations in timing have led to an ongoing debate of whether early or late orthodontic intervention is more effective and considered the "right" choice.

The debate of early versus late orthodontic intervention

The benefits of early intervention of orthodontic treatment include identifying and managing malocclusions before extreme severity, which could potentially simplify any later phases of treatment. Other benefits of early treatment include improved oral hygiene by making teeth easier to clean by addressing dental crowding. Additionally, early correction of visual dentofacial irregularities can provide psychological benefits, especially for children who are experiencing bullying or teasing due to their facial appearance. From a functional perspective, functional and orthopedic appliances tend to be more effective during periods of active growth, as intervening later can result in limited skeletal changes (Hamidaddin, 2024, 86).

Based on the professional opinions of 159 orthodontists of the American Board of Orthodontics, intervening at an early stage presents benefits including improved growth control, enhanced patient self-esteem and parent satisfaction, more stable outcomes, reduced extent of treatment needed for the permanent dentition, and minimized periodontal tissue and tooth enamel damage (Lopes et al., 2015). The source evaluated their findings and noted that, although multiple authors had expressed optimism about early treatment regarding clinical efficacy, reduced mechanotherapy, and increased stability, many of their statements were based solely on personal experience and case reports (Lopes et al., 2015).

In contrast, many clinicians still prefer to postpone treatment until the development of all permanent teeth, rather than during the mixed dentition state, due to the belief that there is no major difference in outcomes between early and late intervention. This is based on the fact that late treatment eliminates the unpredictability associated with residual growth. Also, there remains a debate about the long-term advantages of early treatment, with much of the available research mainly focusing on Class II malocclusions and less attention on other conditions like crossbites, extractions, or anterior and posterior crossbite (Hamidaddin, 2024, 86-87).

Moreover, a study by Al-Shayea in 2014 collected survey data via an electronic questionnaire completed by 52 clinicians. Among the respondents, the mean years of experience was 15.7 (±9), with a range of 2-33 years and they represented different orthodontic programs across the US, Europe, and Saudi Arabia. The highest percentage of the age range of orthodontists treating their patients was in the adolescent age range (12-18-year-old), standing at 42.2%. It was followed by children aged 8-11 (30.8%), adults older than 18 years (21.2%), and the lowest percentage being young children aged 6-8 (3.8%) (Al-Shayea, 2014).

While early intervention offers biological and psychosocial advantages, late treatment provides greater predictability and efficiency. Together, these findings demonstrate the variability in clinical practice among orthodontists for different conditions and illustrate the ongoing debate regarding the ideal timing of orthodontic treatment. This study aims to answer the question, “How does early orthodontic intervention compare to late intervention in terms of long-term clinical effectiveness?”

Defining long-term clinical effectiveness in orthodontic intervention

Traditionally, the success of orthodontic treatment has been evaluated in terms of improvements in esthetics, occlusion, and function, as well as minimal post-treatment changes. However, a shift in perspective emphasizes how treatment affects patients' overall well-being and quality of life, including self-esteem, dental self-confidence, and social impact.

In the past, orthodontic research has mainly focused on short-term clinical outcomes, such as treatment efficacy and short-term post-treatment stability. Though these factors are essential for indicating the immediate success of the treatment itself, these improvements alone only provide a limited perspective. Evaluating only clinical outcomes overlooks the broader impacts of orthodontic treatment on patients' quality of life. Orthodontic treatment can affect patients’ lives in various ways, including self-esteem, well-being, social interactions, and long-term post-treatment outcomes (Mohammed et al., 2025).

Long-term clinical effectiveness cannot solely be based on immediate orthodontic correction, as it is essential to also evaluate long-term psychosocial aspects and consider factors such as the stability of results over time, patient well-being, and long-term maintenance issues, including relapse.

Methods

This systematic review focused on the following question: How does early orthodontic intervention compare to late intervention in terms of long-term clinical effectiveness?

The definitions of population, intervention, comparison, and outcome were developed based on the focused question. Each was defined as follows:
Population: inpatients requiring orthodontic intervention from different dentition stages.
Intervention: orthodontic treatment
Comparison: early versus late intervention
Outcomes: factors including treatment duration, social effects, and long-term stability

An electronic search was conducted without time or language restrictions using databases such as PubMed, Google Scholar, and ResearchGate. The reference lists of included studies and relevant reviews were also searched for other potential studies. The following keywords and phrases were used during the search: early orthodontic treatment, late orthodontic treatment, mixed dentition, permanent dentition, class II malocclusion, deep bite, overbite, crossbite, crowding, long-term stability, early versus late orthodontic intervention effects, and early versus late orthodontic long-term effects.

Results/Discussion

The results summarize findings on early versus late orthodontic intervention across various clinical conditions and multiple outcomes, including short-term treatment effects, long-term stability and effects, and treatment duration. Overall, it can be deduced that the choice between early and late treatment is largely a case-by-case decision depending on the type of condition and its severity. However, for certain clinical conditions, clinicians tend to favor either early or late intervention as the more appropriate approach.

Early Treatment

Overjet

A study by Batista et. al. suggested that early treatment can reduce the risk of dental trauma, especially when there is an excessive overjet, such as when the lips do not cover the teeth properly, or the incisors are exposed at rest (Batista et al., 2018). Based on this study and other material, a review by Fleming concluded that approximately 10 to 13 years in females and 11 to 14 years in males appear to be the optimal timing for the most effective growth modification of overjet in Class II malocclusion. However, it was acknowledged that early treatment increases treatment duration due to a reduced rate of mandibular growth observed in pre-adolescents (Fleming, 2017). As a result, early intervention for extreme overjet is suggested.

In comparison, a systematic review and meta-analysis conducted by Almugla and Shekhar across 18 different studies assessing primary outcomes, including overjet (mm) and ANB angle (°, degrees) determined that the general trend observed was that early orthodontic treatment resulted in temporary short-term improvements. However, these improvements frequently decreased or relapsed occurred over time. For example, studies have reported no clinically significant long-term skeletal benefits from early functional appliance intervention compared with later-stage treatment (Almugla & Shekhar, 2025).

Another study by Cobourne et al. acknowledged that an increased overjet is associated with a higher likelihood of experiencing incisor trauma. Their study found that early overjet correction can reduce the prevalence of incisor trauma in children, but there is significant variation, and the existing evidence is not enough to support this fact. Additionally, even though severe overjet is linked with a negative impact on oral health-related quality of life (OHRQL) with the potential that a child may be more susceptible to bullying or teasing, in reality, early treatment was found not to have not impacted OHRQL significantly. Regardless, it is still important to take into account the social impact treatment may have on the child. Therefore, they claim that careful treatment selection is necessary, focusing on children with severe overjet (>10mm). Although early treatment may not provide greater clinical outcomes, taking into consideration other factors, such as risk of dental trauma or if a child is being teased because of their overjet, may lead to the suggestion of the decision to intervene early (Cobourne et al., 2022).

Overall, these findings suggest that early treatment of overjet is not recommended for all patients but should rather be selectively chosen in cases where the severity of the condition or its risks justify intervention. This supports the idea that the timing of orthodontic intervention is not fixed but highly depends on the patient's condition and case. Nonetheless, the evidence

suggests that early treatment is recommended in specific situations where patients with severe overjet are suffering from the risk of dental trauma or a significant psychosocial impact.

Class II Malocclusion

In a study that included 32 articles out of 3,569, when comparing the skeletal and dental outcomes of early versus late treatment for high-angle Class II cases, one observational study reported no additional advantages of early intervention (Hamidaddin, 2024). Similarly, another set of clinical trials chosen, addressed that treatment of Class II malocclusions found no improved effectiveness for early intervention when comparing delaying treatment until adolescence in terms of final orthodontic outcomes (Hamidaddin, 2024).

Additionally, a meta-analysis by Sunnak et al. indicated that short-term interventions for class II correction resulted in significant reductions in ANB and overjet compared with an untreated control group. However, no statistical significance was found in the long-term outcomes when comparing early versus late intervention. There was also no comprehensive systematic appraisal that highlighted the benefits of intervention before the age of 11. It was concluded that while early treatment can more effectively utilize the child's period of growth, fully exploiting this growth requires extended treatment times that can be difficult for the patient to sustain, thus reducing the practical, theoretical benefit. Additionally, the additional cost and burden may offset the potential benefits of early treatment (Sunnak et al., 2015).

In comparison, a study by Fleming found that, for Class II malocclusion, treatment is most effective when performed in the early mixed dentition. Nonetheless, treatment in the late mixed dentition may still yield improvement, though likely to a lesser extent (Fleming, 2017).

In a comparative analysis conducted to evaluate the efficacy of orthodontic intervention early versus late to manage Class II malocclusion, a cohort of 100 patients were diagnosed and divided into two groups: early intervention group (n = 50) and late intervention group (n = 50). The mean age of the early intervention group was 10.5 years (SD = 1.2) and 14.3 years (SD = 1.5) for the late intervention group. The assessment of the treatment outcomes were measured before and after orthodontic treatment and included changes in overjet, molar relationship, and cephalometric measurements. Tables 1 and 2 refer to changes in overjet and molar relationship, and to cephalometric measurements of the early versus late intervention group across different skeletal and dental parameters (see the tables below for specific numbers). Based on the results, in most categories, the early intervention group showed greater improvements in skeletal and dental parameters on cephalometric analysis than the late intervention group. There were less noticeable improvements in overjet reduction and molar relationship, and smaller changes in cephalometric measurements for the late intervention group (Kaje et al., 2024).

Table 1
Changes in overjet and molar relationship in early intervention and late intervention group

Parameter	Early intervention group (n=50)	Late intervention group (n=50)
Pretreatment overjet (mm)	8.2 (SD-1.4)	8.5 (SD-1.2)
Post-treatment overjet (mm)	3.0 (SD=0.8)	5.2 (SD=1.3)
Mean reduction in overjet	5.2 (SD=1.3)	3.3 (SD=1.1)
Pretreatment Molar Class II (%)	100	100
Post-treatment Molar Class II (%)	90	80

Note. Adapted from Kaje et al., 2024

Table 2
Comparison of cephalometric measurements in early intervention and late intervention group

Parameter	Early intervention group (n=50)	Late intervention group (n=50)
SNA angle (°)	82.5 (SD=2.0)	81.8 (SD=1.8)
SNB angle (°)	78.3 (SD=1.6)	78.9 (SD=1.7)
ANB angle (°)	4.2 (SD=1.0)	2.9 (SD=0.8)
Increase in ANB angle (°)	1.3 (SD=0.6)	1.2 (SD=0.7)

Note. Adapted from Kaje et al., 2024

Overall, these studies suggest greater improvements and more favorable outcomes, including overjet reduction, correction of molar relationships, and favorable skeletal changes, with early orthodontic intervention for treating Class II malocclusion. While late treatment can still achieve successful results, it appears that the effectiveness of skeletal modifications is decreased by making use of the developmental period of the patient. As a result, early intervention is determined as the more strategically effective timing for Class II malocclusion.

Crowding
An observational study found that early orthodontic treatment with first premolar extraction is more stable, increases post-treatment stability of mandibular incisors, and yields better overall outcomes compared with late treatment. Early treatment is also believed to have a lower prevalence of relapse (Hamidaddin, 2024).

A systematic review comparing the effects of early and late extraction on the correction of crowding showed that even though both methods had a similar level of effectiveness in the correction, there were more favorable secondary outcomes for early treatment (e.g., less relapse and reduced active treatment time) (Lopes et al., 2015). However, the overall evidence was insufficient to determine a definite conclusion as to which is more superior.

An additional study evaluating patients with severe crowding caused by tooth size arch length deficiency reported that during the pretreatment and post-treatment stages of early versus late intervention, there were no significant differences between these groups. However, in the post-retention stage, the late treatment group exhibited a greater mandibular anterior teeth irregularity and deviated greater from the midline. Regarding treatment duration, it was presented that the active treatment time with fixed appliances was much shorter compared to the late premolar extraction group but the total treatment time was twice longer. Despite likely following a higher cost, the patients would have fixed appliances for a shorter time and earlier esthetic aspects corrected, which resulted in improved social relationships and better cost benefit (Lopes et al., 2015).

Treatment of dental crowding most commonly occurs in the late mixed or permanent dentition. Late stages are the suggested optimum period for the correction of dental crowding, as there is currently limited evidence supporting the benefits of treatment prior 10 years of age, excluding cases where localized malocclusions require targeted interceptions (Fleming, 2017).

In conclusion, even though some studies suggest that there is insufficient evidence to determine when intervention is the most ideal, these findings indicate that when addressing extractions, early treatment is the preferred timing for intervention. Even though the general treatment effectiveness may be similar amongst both groups, when observing secondary factors such as treatment duration and the social factor of having early intervention, early orthodontic intervention is more justified to address extractions.

Late Treatment

Anterior Open Bite
The early treatment of anterior open bite has been attempted using both fixed and removable appliances (Fleming, 2017). The outcomes are highly dependent on the aetiology, associated with various oral habits. Therefore, growth-related or skeletal open bites typically require more complex intervention and are likely to be better treated in the permanent dentition.

Posterior Crossbite
In a study by Fleming, it was found that when treating posterior crossbite, there is limited comparative evidence evaluating the effectiveness or stability of treatment across different age groups. Even though past research suggests that early crossbite correction can be more successful, correction in the later dentition remains the more commonly accepted approach (Fleming, 2017).

Additionally, a study was done comparing the long-term stability of the rapid expansion of the maxilla, the primary treatment used to correct crossbites, between two groups: one during mixed

dentition and the other during permanent dentition. The findings suggest that there was no additional advantage of early expansion for results in retention and stability (Hamidaddin, 2024).

As a result, these findings indicate that even though results comparing early versus late orthodontic intervention are similar when addressing posterior crossbite, the late treatment is more widely accepted as there are no additional benefits or justifications as to why early treatment is more beneficial.

Deep bite

A prospective clinical trial by Baccetti et al. evaluating a sample of 58 patients with deep bite divided the patients into two groups: early treatment during mixed dentition (prepubertal) and late treatment during permanent dentition (pubertal). Reevaluation was done after an average period of 15 months following the completion of treatment. The findings of the trial were that early treatment provided a shorter total treatment time. However, late treatment has a significantly greater overbite correction. After one year, 92% of patients undergoing late treatment had a corrected overbite whereas early treatment patients had a lower correction percentage and had higher relapse tendencies. Therefore, late treatment (during puberty) is considered to be the more effective treatment to produce more stable outcomes for addressing deep bite (Baccetti et al., 2012).

Clinician Opinion

Nguyen et al. reported that an electronic survey was completed by 228 members of the American Association of Orthodontists in 2023, with the aim to investigate early treatment practices and clinician opinions among members of the American Association of Orthodontists. The questionnaire covered areas including clinical experience, preferred timing of intervention for different conditions, and clinicians' perceptions of early interceptive treatment. Table 3 shows respondents' responses for what stage they would initiate treatment for different types of malocclusion. As a result, this demonstrates a clinician perspective which tells us more about which orthodontic conditions would benefit more from early or late intervention, offering insight into clinicians' approaches to treating different conditions.

Table 3

Summary of responses related to timing of early orthodontic treatment

Questions		n (%)
Timing of first orthodontic consultation	Primary dentition (<6 years old)	3 (1.32)
	Early mixed dentition (6–7 years old)	105 (46.05)
	Mid-mixed dentition (8–9 years old)	100 (43.86)
	Late mixed dentition (10–11 years old)	17 (7.46)
	Permanent dentition (≥12 years old)	3 (1.32)

Type of problems treated early in growing children (select all that apply)	Posterior crossbite	218 (95.61)
	Crowded upper or lower arch	127 (55.70)
	Anterior open bite	152 (66.67)
	Excessive overjet	156 (68.42)
	Deep impinging bite	187 (82.02)

Note. Adapted from (Nguyen et al., 2025, 288)

Table 4

The stage of dental development indicated by the respondents to initiate early treatment for various occlusal conditions.

Malocclusion	Primary dentition (<6 years)	Early mixed dentition (6-7 years)	Mid-mixed dentition (8-9 years)	Late mixed dentition (10-11 years)	Permanent dentition (>11 years)
Posterior crossbite	14 (6.14)	81 (35.53)	117 (51.32)	14 (6.14)	2 (0.88)
Crowding	3 (1.32)	42 (18.42)	90 (39.47)	46 (20.18)	47 (20.61)
Anterior open bite	5 (2.19)	68 (29.82)	85 (37.28)	29 (12.72)	41 (17.98)
Increased overjet	1 (0.44)	32 (14.04)	95 (41.67)	48 (21.05)	52 (22.81)
Deep bite	1 (0.44)	26 (11.4)	68 (29.82)	49 (21.49)	84 (36.84)

Values are given as n (%)
Note. Adapted from (Nguyen et al., 2025, 289)

Timing of first orthodontic consultations was either during the early mixed dentition (6–7 years old) or mid-mixed dentition (8–9 years old). Posterior crossbite was the condition most frequently determined for early treatment while deep impinging bite, which is a more severe case of deepbite, had the lowest frequency for early treatment. Malocclusion conditions including posterior crossbite, crowding, anterior open bite, and increased overjet were preferred to be treated during the mix-mixed dentition years. Whereas, deep bite was more commonly treated during the permanent dentition.

Based on the response from the questionnaire, orthondists most commonly addressed posterior crossbite in early treatment. On the other hand, current literature review from the sources from above states that late treatment would be more effective as there are no additional benefits or advantages of early treatment.

In comparison to results from orthodontic survey, literature review of crowding shows that there is a mixed opinion of treating crowding in early or late stages. Ultimately, stronger evidence supports that it is more effective during the early stages of treatment of crowding when considering factors such as the social impacts and benefits to long-term stability. This is contrary to the questionnaire results where most orthodontists preferred to intervene earlier.

According to current research, anterior open bite and increased overjet were found to be more effectively treated during later stages. Similarly, this is what most orthodontists are doing according to the questionnaire, showing a more agreed upon consensus.

Conclusion

Based on my findings, early intervention appears most beneficial and effective for conditions that are growth-dependent or progressive in nature, where well timed intervention can modify skeletal development, help reduce associated risks, as well as address the resulting psychosocial impacts. In contrast, conditions that are less reliant on patient growth would benefit more from effective treatment later on, where for certain conditions, results are more stable and relapse is less frequent. However, the overall conclusion is that the timing of treatment highly depends on the specific condition affecting the patient and a range of other factors, including the severity of the malocclusion, the patient's stage of growth, and potential psychosocial impacts. All of these factors are necessary to consider, as they can influence whether early intervention is necessary to prevent worsening dental misalignment and modify skeletal growth, or whether delaying treatment until a later dentition stage is acceptable. Ultimately, further research needs to be conducted to address a lack of studies covering the long-term consequences each method results in for patients. Additionally, there is a disproportionate focus on certain conditions, particularly class II malocclusion, whereas other orthodontic issues are less extensively studied. This imbalance may be explained by the high prevalence of this condition and the existence of well-established treatment protocols, which make it more suitable for controlled clinical research in comparison to other orthodontic conditions. The wide range of orthodontic conditions and their individual complexities make it difficult to come to a universal conclusion for the ideal timing of intervention, which is why the optimal treatment timing should be determined on a case by case basis.

References

1. Ali, H. (n.d.). *Understanding Relapse in Orthodontic Treatment*. Orthodontia. Retrieved April 17, 2026, from https://www.orthodontia.co.uk/post/understanding-relapse-a-crucial-component-of-aligner-treatment
2. Almugla, Y. M., & Shekhar, M. G. (2025). Does Early Orthodontic Treatment in Mixed Dentition Improve Long-Term Outcomes? A Systematic Review and Meta-Analysis. *Medicina*, *61*(10), 1854. https://doi.org/10.3390/medicina61101854
3. Al-Shayea E. I. (2014). A survey of orthodontists' perspectives on the timing of treatment: A pilot study. *Journal of orthodontic science, 3*(4), 118–124. https://doi.org/10.4103/2278-0203.143232
4. Baccetti, T., Franchi, L., Giuntini, V., Masucci, C., Vangelisti, A., & Defraia, E. (2012, July). Early vs late orthodontic treatment of deepbite: A prospective clinical trial in

growing subjects. *American Journal of Orthodontics and Dentofacial Orthopedics*, *142*(1), 75-82. https://dpl6hyzg28thp.cloudfront.net/media/1-s2.0-S0889540612003599-main.pdf
5. Batista, K. B., Thiruvenkatachari, B., Harrison, J. E., & O'Brien, K. D. (2018). Orthodontic treatment for prominent upper front teeth (Class II malocclusion) in children and adolescents. *The Cochrane database of systematic reviews,* 3(3), CD003452. https://doi.org/10.1002/14651858.CD003452.pub4
6. Brizuela, M., Palla, A., & N., D. K. (2024). *StatPearls*. StatPearls Publishing. https://www.ncbi.nlm.nih.gov/books/NBK499873/
7. *Cephalometry*. (n.d.). ScienceDirect. Retrieved April 20, 2026, from https://www.sciencedirect.com/topics/medicine-and-dentistry/cephalometry
8. *Classification of Occlusion*. (n.d.). James C. West DDS. Retrieved April 24, 2026, from https://www.westhoustonorthopedo.com/classification-of-occlusion
9. Cobourne, M. T., DiBiase, A. T., Seehra, J., & Papageorgiou, S. N. (2022). Should we recommend early overjet reduction to prevent dental trauma?. *British Dental Journal, 233*(5), 387–390. https://doi.org/10.1038/s41415-022-4916-0
10. *Dental Midline*. (n.d.). Burke & Redford Orthodontists. Retrieved April 28, 2026, from https://burkeredfordorthodontists.com/dental-midline/
11. *Does Tongue Thrusting Create Anterior Open Bites?* (n.d.). Jorgensen Orthodontics. Retrieved April 18, 2026, from https://www.jorgensenorthodontics.com/blog/does-tongue-thrusting-create-anterior-open-bites
12. *Do you know what occlusion class you have?* (n.d.). Gentle Care Dentistry. Retrieved April 20, 2026, from https://www.gentlecaredentistry.com.au/single-post/2018/12/21/do-you-know-what-occlusion-class-you-have
13. Fagu, N. (2016, September 25). *Dental Health….CROSSBITE*. Kaieteur News. Retrieved April 19, 2026, from https://kaieteurnewsonline.com/2016/09/25/dental-health-crossbite/
14. Fleming, Padhraig. (2017). Timing orthodontic treatment: early or late?. *Australian Dental Journal, 62,* 11-19. 10.1111/adj.12474.
15. Hamidaddin, M. A. (2024). Optimal Treatment Timing in Orthodontics: A Scoping Review. *European Journal of Dentistry*, *18*(1), 86-96. 10.1055/s-0043-1768974
16. Hsu, J.-Y., Cheng, J. n. H.-C., Feng, S.-W., Lai, P.-C., Yoshida, N., & Chiang, P.-C. (2024, June 24). Strategic treatment planning for anterior open bite: A comprehensive approach. *Journal of Dental Sciences*, *19*(3), 1328-1337. https://www.sciencedirect.com/science/article/pii/S1991790224001168
17. Jamilian, A. (2019, December 6). *Midline discrepancy*. Dr. A. Jamilian Orthodontist. Retrieved April 24, 2026, from https://jamilian.net/en/midline-discrepancy/
18. Kaje, R., Rashme, R., Manimegalan, P., Vundela, R. R., Saidalavi, S. K., & Jadhav, A. V. (2024). Assessing the Efficacy of Early versus Late Orthodontic Intervention in the Management of Class II Malocclusion: A Comparative Analysis. *Journal of Pharmacy & Bioallied Sciences, 16*(Suppl 3), S2691–S2693. https://doi.org/10.4103/jpbs.jpbs_370_24
19. Lopes Filho, H., Maia, L. H., Lau, T. C., de Souza, M. M., & Maia, L. C. (2015). Early vs late orthodontic treatment of tooth crowding by first premolar extraction: A systematic review. *The Angle orthodontist, 85*(3), 510–517. https://doi.org/10.2319/050814-332.1
20. *Malocclusion*. (2024, October 28). Cleveland Clinic. Retrieved April 24, 2026, from https://my.clevelandclinic.org/health/diseases/22010-malocclusion

21. *Management of the Developing Dentition and Occlusion in Pediatric Dentistry*. (2024). AAPD. https://www.aapd.org/globalassets/media/policies_guidelines/bp_developdentition.pdf
22. *Maxilla*. (n.d.). ScienceDirect. Retrieved April 24, 2026, from https://www.sciencedirect.com/topics/medicine-and-dentistry/maxilla#related-terms
23. *Mixed Dentition*. (n.d.). ScienceDirect. Retrieved April 10, 2026, from https://www.sciencedirect.com/topics/medicine-and-dentistry/mixed-dentition
24. Mohammed, H., Morsi, A., Wafaie, K., Daniel, B. K., & Farella, M. (2025). Patients' perspectives of the long-term impact of orthodontic treatment: a qualitative study. *The Angle orthodontist, 95*(2), 205–211. https://doi.org/10.2319/031424-216.1
25. Nguyen, M., Al-Moghrabi, D., Tomlinson, L., Azami, N., Dolce, C., & Arqub, S. A. (2025, September 2). Early orthodontic treatment practices and perceptions: A cross-sectional survey of AAO members. *Journal of Orthodontics*, *52*(3), 285-294. https://doi.org/10.1177/14653125251358832
26. *Orthodontics Beyond Aesthetics: The Health Benefits You Should Know*. (2024, June 13). Rowlett Dental Associates. https://www.rowlettdental.com/orthodontics-beyond-aesthetics-the-health-benefits-you-should-know/
27. *Overbites – Why Do They Need Correction?* (n.d.). Peak Orthodontics. Retrieved April 19, 2026, from https://peakorthodontics.co.nz/overbites-why-do-they-need-correction/
28. *Overjet*. (2024, June 17). Cleveland Clinic. Retrieved April 20, 2026, from https://my.clevelandclinic.org/health/diseases/overjet
29. *Overjet correction*. (n.d.). Reflections. Retrieved April 20, 2026, from https://www.reflectionsortho.com/service/orthodontic-problems/overjet-correction/
30. Sunnak, R., Fleming, P.S., & Johal, A. (2015, February 12). Is orthodontics prior to 11 years of age evidence-based? A systematic review and meta-analysis. *Journal of Dentistry*, *43*(5), 477-486. https://doi.org/10.1016/j.jdent.2015.02.003
31. *Teeth*. (2023, January 26). Cleveland Clinic. Retrieved April 25, 2026, from https://my.clevelandclinic.org/health/body/24655-teeth
32. Thygesen, M. (2025, August 7). *Dentition*. Valby Tand. Retrieved April 20, 2026, from https://www.valbytand.dk/en/dentition/#elementor-toc__heading-anchor-0
33. *Tooth Enamel*. (2025, October 7). Cleveland Clinic. Retrieved April 10, 2026, from https://my.clevelandclinic.org/health/body/24798-tooth-enamel
34. *Tooth Eruption/Development Stages*. (n.d.). Clarinda Clinic. https://clarindaclinic.com/tooth-eruptiondevelopment-stages/
35. Tsuchida, S., & Nakayama, T. (2022, April). *Metabolomics Research in Periodontal Disease by Mass Spectrometry*. ResearchGate. Retrieved 24, April, from https://www.researchgate.net/figure/Periodontal-tissue-and-other-important-factors-Periodontal-tissue-refers-to-the-tissue_fig1_360299415
36. *What Is Dentofacial Orthopedics?* (2024, August 30). Colgate. Retrieved April 20, 2026, from https://www.colgate.com/en-us/oral-health/kids-oral-care/dentofacial-orthopedics