

INTERCEPTIVE ORTHODONTICS IN PRIMARY AND MIXED DENTITION: THE IMPORTANCE OF EARLY DIAGNOSIS

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Abstract

The main objectives of interceptive treatment are to reduce to a minimum the impact of malocclusion development in permanent dentition. A systematic detection of potential orthodontic problems during primary and mixed dentition is more effective than doing nothing to improve the existing situation and ending up by requiring more complex treatment.

In a high number of cases, a second phase of the treatment may be necessary, but interceptive procedures may produce acceptable clinical situation reducing the severity of malocclusion. The proper results will be reached at a much younger age and the child's acceptance in the social environment and also the psychological well-being will be improved before reaching the years of adolescence. A very persuasive attention regarding the eruption and development of the primary and permanent dentitions is an integral part of the care of paediatric patients. This guidance should contribute to the development of a permanent dentition that is in a harmonious, functional and aesthetically acceptable occlusion.

This paper presents the most common orthodontic problems that can be present in the childhood and also some interceptive possibilities in primary and mixed dentition.

Keywords: primary dentition, mixed dentition, interceptive orthodontics

Introduction

In 1982 Richardson defined interceptive orthodontics as the prompt intervention addressing the unfavourable features of a developing occlusion that may make the difference between achieving a satisfactory result by simple intervention, reducing the overall treatment time and providing better stability, functional and aesthetic results [1].

Interceptive orthodontics includes procedures to restore a normal occlusion from a malocclusion that has begun to develop. This intervention can be defined as a treatment that

eliminates or reduces the severity of malformations and may decrease the need or simplify the subsequent treatment.

The function of the primary dentition is to maintain the arch length, so that the permanent dentition, which replaces have sufficient space to erupt. The main objectives of interceptive treatment are to minimize the degree of malocclusion development by maintaining the median line, avoiding crowding, preventing the development of class II and III malocclusion. Early orthodontic intervention has as primary objectives enhancing skeletal, dentoalveolar and muscular development before complete eruption of the permanent dentition. In addition, interceptive procedures can be perceived as useful ways to improve the patient's self-image, eliminating destructive habits, facilitating normal teeth eruption and improving growth models [2,3]. Although in most of the clinical situations, interceptive orthodontics does not produce final orthodontic results without a second phase of treatment in permanent dentition, several studies suggested that applying interceptive measures in primary and mixed dentition could contribute to a significant reduction in the need for treatment after the age of 12.

Anterior open bite treatment brings significant dentoalveolar changes in the anterior region, correcting the open bite by incisor extrusion and up righting. In posterior crossbite cases, results are maintained years after expansion [4].

The percentage of children that could benefit from interceptive orthodontics varies from 14% to 49% [5-7]. Systematic program of orthodontic interceptive treatment during mixed dentition is more effective than doing nothing to improve malocclusions [8]. Studies indicated the presence of long term results after implementing orthodontic interceptive treatment in early mixed dentition, justifying the burden of treatment as compared to single-phase treatment during permanent dentition [9,10]. The aim of this article is to review the most common orthodontic problems that should be treated in primary and mixed dentition and to present the most common management approaches in light of the existing evidence.

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Common problems during primary and mixed dentition

Early loss of primary teeth

Before the age of 7, early loss of the primary first molars leads to a temporary lack of space, which can be regained, on the eruption of the first premolar. When the loss of a second molar happens before this age, often the result is the drifting of the permanent first molars as a consequence of the loss space. In this situation space maintainer is required as a passive fixed appliance that can prevent this space loss; Up to 3 mm per quadrant of space could be obtained. This appliance is not indicated for severe crowding that will require extraction later [11].

Local factors

Primary teeth present on the arch longer time are related to mispositioned permanent teeth. The immediate consequence is the delayed eruption of permanent teeth. The primary teeth should be extracted to allow spontaneous alignment. Interceptive orthodontics for the normal development of the mixed dentition is needed.

In case of the presence of supernumerary teeth extraction will be needed to allow spontaneous eruption. Severe ectopic eruption may require a fixed appliance. Delaying treatment of ectopic eruption of permanent maxillary first molars may be an option when the outcome is unclear. Increased magnitude of impaction was the most reliable predictor associated with irreversible outcome [12].

Crowding

If there is no spacing in the primary dentition there is 70% chance of crowding of the permanent teeth, if there is less than 3mm spacing there is 50% chance of crowding [7].

Ectopic eruption of maxillary canine

When the patient is 10-13 years old in Class I non-crowded for the situations where the permanent canine is impacted or accidentally is erupting buccal or palatal, the treatment is the extraction of the primary canines. Studies have shown that interceptive extraction of the primary canine completely resolves permanent canine impaction in 62% of cases; another 17% show some improvement in terms of more favorable canine positioning [13]. Ectopic eruption of maxillary canines can be associated with root resorption of adjacent teeth [14].

The success of early interceptive treatment for impacted maxillary canines is influenced by the degree of impaction and age at diagnosis [15].

Midline diastema

This stage is generally called “ugly duckling” and it corrects along with the with the complete eruption of lateral incisors and canines [16]. The other causes of midline diastema are low frenal attachment, presence of a supernumerary teeth or cyst in the midline of the upper arch, different angulation of the central incisors or the microdontia of upper central incisors. There also might be present oral habits, muscular imbalances, physical

obstructions, abnormal maxillary arch structure and various dental anomalies [17].

The pathological cause should be identified and removed early. The midline diastema can be closed with a removable appliance in the early years of mixed dentition.

Cross bite

Malocclusions on the transverse plane of the maxilla are called crossbites. If these are localized in the posterior area are defined as alterations of the correct alignment of the palatal cusps of the upper molars and premolars with the pits of the lower molars and pre-molars. Most common causes are: skeletal or dentoalveolar constriction.

Anterior crossbite is defined as an abnormal reversed relationship of a tooth or teeth to the opposing teeth in the buccolingual or labiolingual direction, and it is also known as reverse overjet. The development of anterior crossbite, can be categorised into skeletal, dental, and functional entities. Skeletal anterior crossbite arises due to either genetic or hereditary influence or discrepancy in the size of the maxilla and mandible. In the anterior crossbite of dental origin, one or two teeth are often involved, and the affected tooth/teeth are either upright or mispositioned without any significant maxilla-mandible discrepancy. In the functional-type crossbite, a premature contact between the opposing tooth/teeth could result in the deflection of the mandible to the sides or anteriorly, and this leads to the development of pseudoclass-III.

When is localized in the anterior site it must be treated at an early stage because the upper incisors may be abraded by the lower incisors and as a result of occlusal trauma the periodontal support of the incisors may be affected. If it remains untreated mandibular shift could be the result; growth pattern is rapidly changing, dental compensation leading to a true prognathic aspect and/or asymmetry at a later time. One of the consequences can be the appearance of modified functional patterns [18].

According to different studies the frequency of crossbites seen in dental clinics varies between 1% and 23%. The most frequent is single-tooth crossbite, at around 6-7%, followed by unilateral crossbites, around 4-5%, and lastly, bilateral crossbites, which make up 1.5% - 3.5% [19]. The frequency of crossbites is not influenced by either age or sex.

Vicious oral habits

The presence of vicious oral habits like finger-sucking, abnormal tongue position, tongue thrust (it refers to a swallowing pattern in which the tongue is placed in the front of the mouth to begin the swallow) are the most common factors influencing dental development and potentially facial growth in childhood. The relationship between oral habits and unfavourable dental and facial development is considered to be associational [20,21]. In order to be linked with dentoalveolar or skeletal deformations such as reduced overbite, increased overjet, anterior, posterior crossbite, increased facial height, vicious oral habits must be present in sufficient duration, frequency and intensity, duration being more important than force

magnitude; the pressure coming from the lips, cheeks, and tongue has the greatest impact on tooth position, as these forces are present most of the time [22,23]. In infants and young children non-nutritive sucking behaviours are considered normal. Prolonged non-nutritive sucking habits, have been associated with decreased maxillary arch width, increased overjet, decreased overbite, anterior open bite, and posterior crossbite [24]. Studies indicated that there are significant differences in dental arch and occlusal relationships in pacifier users at 24 and 36 months compared with those that had stopped sucking by 12 months [25]. Moreover, by age 2 to 5 years, a significant increase in overjet (>4 mm), open bite, and posterior crossbite in pacifier users was observed [26].

As a result of digit or pacifier sucking habits some changes in the dental arch perimeters and occlusal characteristics persist well beyond the cessation of the pacifier or digit habit. Parafunctional habits are influencing negatively the occlusion so they have to be corrected as early as possible, so less complex orthodontic treatment may be required later.

Treatment approaches in primary dentition

Anterior crossbite in the primary dentition must be corrected when identified to allow normal dental development and skeletal growth. A simple method such as tongue blade can be used in the early stages of anterior crossbite development as the tooth/teeth are erupting [27].

In order to intercept class III malocclusions cephalometric radiographs are needed to make the distinction between dental and skeletal problems. Removable acrylic appliances with inclined planes are a good alternative for the correction of dental anterior crossbite.

Most of the unilateral posterior crossbite in primary dentition result from a constricted maxillary arch (bilaterally) with a functional shift. Unilateral posterior crossbite could be diagnosed by observing midline discrepancy in centric occlusion. Therapeutic approach consists of selective grinding. Studies have shown that complete correction of posterior crossbite using selective grinding could only be achieved in less than 30% of children [28]. Fixed appliance (W-arch, quad-helix) or a removable appliance with an expansion screw are good alternative treatment.

For Class II malocclusions treatment is initiated in mixed and early permanent dentition. The long-term clinical effectiveness of treatment addressed to correct anterior open bite and deep bite in young children are less documented.

Several abnormal habits in primary dentition are more common: like sucking behaviors (introducing between arches different objects), mouth breathing and bruxism [29].

The most important attitude is to try to correct this behaviours as early as possible. The consequences of digit sucking could interfere with the development of maxillary growth [30].

Untreated caries in primary dentition will be followed by premature loss that could modify the arch length if space maintainers were not applied.

The deficiency in arch length can interfere with occlusion relationships generating rotations, ectopic eruption, crowding, anterior and posterior crossbite, excessive overjet or overbite and class II and III reports between canines and molars.

Therapeutic approaches in mixed dentition

In mixed dentition both dental and skeletal problems can occur (figure 1).

Most common dental problem are related to Class II and Class III malocclusions correction and tooth size-arch length correction. Skeletal problems include maxillomandibular discrepancies associated with Class II and Class III malocclusions.

In the space management it is important to start the treatment just at the end of the mixed dentition stage and to maintain leeway space. This is the gold standard treatment period [31]. It was also found that management of leeway space alone may resolve the crowding problems in more than 80% of orthodontic patients (32). As a treatment alternative: lip bumpers can be used to maintain leeway space. If the permanent first molar position is maintained during the transition to the permanent dentition an average gain of 2.5 mm of space per side in the mandibular arch and about 2 mm per side in the maxillary arch will be obtained.

Transpalatal arch can also be used, either as a passive appliance to maintain the position of the upper molars or as an active appliance that improves the molar position.

Mild-to-moderate crowding (3-4 mm) can be effectively treated with maxillary expansion (quad-helix expander, W-arch, removable appliance with expansion screw) (figure 2).

In extremely severe crowding, serial extraction can represent a treatment option, but it has to be applied with maximum care [33].

For the class II malocclusion headgear, pre-orthodontic trainer or functional appliances can be used. Headgear (GAC International Inc., Central Islip, New York, USA) produce distal force on the maxillary teeth and maxilla. The scope is to shift an end-to-end molar relationship to Class I by moving the upper molars distally (figure 3). The pre-orthodontic trainer is a functional device addressing children with aged between 4 to 10. It has the advantage direct fitting in the patient's mouth. The prefabricated appliances were claimed to be effective for class II division I management.

The appliance can also correct functional problems like interposition of the lips between dental arches or the presence of atypical swallowing pattern; it also discourages oral respiration and bruxism [34,35].

Functional appliances utilize, eliminate, or guide the forces of muscle function, tooth eruption, and growth to correct a malocclusion. They help to correct Class II malocclusion.

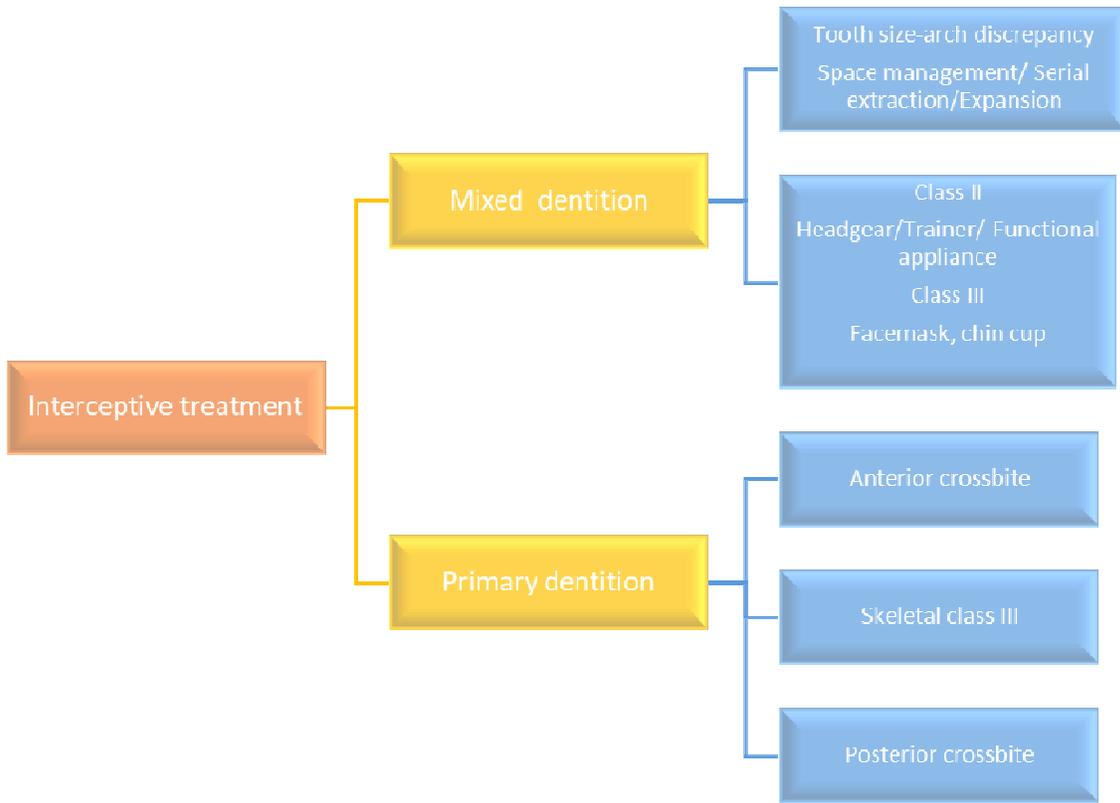


Figure 1. Interceptive approaches.

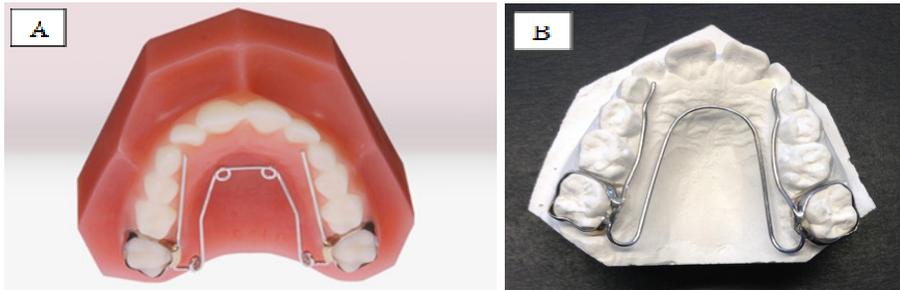


Figure 2. A. Quad-helix expander B. W-arch.



Figure 3. A. Headgear. B. Functional appliances.

Class III malocclusions are associated with maxillary retrognathia, mandibular prognathia, or a combination of both. The multifactorial aetiology is the result of interaction between genetics and environmental factors. There are also often accompanied by vertical or transversal malocclusion.

Intervention at an early stage it is highly recommended. The treatment of Class III malocclusion by means of rapid palatal expansion with facemask protraction creates favourable growth corrections both in maxilla and in the mandible [36]. In a controlled long-term study, after the

follow-up of 7 years it has been found that patients who have been treated before the pubertal growth phase showed a stable increase in the maxillary skeletal width, maxillary intermolar width, and lateral nasal width, while patients treated after the pubertal growth phase showed only dentoalveolar effects [37]. One of the most commonly used interceptive appliances to intercept developing skeletal Class III malocclusion is the protraction facemask also referred to as reverse headgear (figure 4) [38].



Figure 4. Reverse headgear.

The appliance is composed of two components: an extraoral framework (facemask) that fits on the forehead and chin, and an intraoral attachment to the maxillary dentition. The chin and forehead part of the extraoral framework are connected by a middle bar for the connection of the elastics to the intraoral attachment to the maxillary dentition.

Conclusion

Interceptive orthodontics has its benefits in the recognition and elimination of potential irregularities and

malposition in the developing dentofacial complex. The timing of interceptive treatment is critical. The early assessment of the child, followed by regular check-ups and treatment at the appropriate time will reduce malocclusion. The key to be able to apply prevention is awareness of the craniofacial growth and development. The positive aspect with interceptive management is that the treatment outcomes will have been achieved at a younger age and the child's social and psychological wellbeing will be enhanced before adolescence.

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