



The versatility of the 2X4 appliance

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Abstract

Early diagnosis and treatment are fundamental in order to reduce the severity of a malocclusion.

In three of most common conditions (anterior crossbite, posterior crossbite and impacted/ectopic incisors) a 2X4 fixed appliance can be very useful with some advantages compared to removable appliances.

Introduction

Interceptive treatment is fundamental to reduce the severity of a developing malocclusion.

Three of the most common conditions that are referred to an orthodontist for early treatment are the anterior crossbite, the posterior crossbite and the delayed eruption of a central incisor due either to impaction or ectopic position and alignment of the incisors for the correction of rotations, diastemas and incorrect teeth inclinations and angulations in the mixed dentition stage.¹⁻⁸

Timing of orthodontic treatment is linked to:

- clinical effectiveness;^{2,3}
- psychological benefits;⁴
- influences on the duration and outcome of treatment;^{5,6}
- cost-effectiveness ratio.⁷

The 2X4 is a fixed appliance which is made of bands on the first permanent molars, brackets bonded to the erupted maxillary incisors and continuous archwires to provide/maintain good arch form, as well as control of anterior teeth.

Some limits of removable appliances in children are often lack of collaboration from the patient, lack of retention and improper activation. Instead, fixed appliances in mixed dentition don't need collaboration.

Methods

The 2X4 is a very useful and versatile fixed appliance which is used in mixed dentition. The aim of this study is to analyze some clinical applications of this appliance. A systematic review was performed on Pub Med and Scopus. From literature 19 articles were

selected.

Review

White et al.⁹ stated that anterior crossbites require early treatment.⁹ Anterior crossbite with functional shift also called pseudo Class III malocclusion.

In this condition, there is an anterior bite inversion with anterior mandibular sliding in habitual occlusion principally caused by upper incisors that are posteriorly positioned. Dawson's clinical maneuver helps to make this diagnosis.

Turpin¹⁰ and Di Malta¹¹ proposed some classifications to differentiate different types of Class III malocclusions, principally the true malocclusion with basal discrepancy and familiar history¹²⁻¹³ (this condition, once diagnosed, require timely orthopedic treatment compatible with the collaboration of the small patient) and pseudo Class III malocclusions with functional origin.

For the diagnosis of pseudo Class III malocclusions, the Dawson's maneuver can be very useful⁴. To perform this diagnostic maneuver, we have to bring the jaw to centric relationship to see the discrepancy between habitual occlusion and centric relationship with the possibility of reaching the head-head match of the incisors in mandibular forced retraction with a modification of the profile when passing from habitual occlusion to centric relationship. It is also important to underline the lack of familiarity in pseudo Class III malocclusions.

Fixed and removable appliances were generally well accepted by the patients and both methods of treatment can be recommended.¹⁵

The 2x4 has the advantages of fixed appliances like minimal discomfort, reduced need of patient cooperation, increased control of teeth movements, possibility of movements in all three planes of the space.

A good correction of an anterior crossbite can be achieved with a removable appliance like removable mandibular retractor if a purely tipping movement is required. However, if a translational movement is required, the control afforded with a simple fixed appliance such as the 2X4 appliance is preferred. Also, in presence of rotated teeth, where a removable appliance would be of very limited benefit, fixed

appliances allow the labial segment to be fully aligned.

Caution must be taken when, because of the incisors uprighting, there could be damage due to the proximity of their roots with the crown of the developing permanent canine. An important factor determining whether early correction of an anterior crossbite will be stable is the achievement of an adequate overbite. If this can be attained, then the result should require no further retention. A bonded retainer may be placed on the palatal surface of upper incisors if the relapse potential is significant as this maintains the incisors in their corrected position until the occlusion becomes more established. It needs to be borne in mind that this 2X4 treatment is not necessarily a definitive course of orthodontic treatment and the patient should always be warned of this.^{1,8,15}

Another indication of 2X4 fixed appliance is the posterior crossbite in combination, for example, with a quad helix.^{8,15}

Posterior crossbite develops when vestibular cusps of upper posterior teeth are in a more palatal position compared with corresponding inferior cusps.¹⁶

Prevalence of this malocclusion varies from 1% and 16%, depending from the examined population, with a greater prevalence in Caucasian ethnicities.¹⁷

Malocclusions on transversal plane can be of skeletal, dental or mixed origin.

In differential diagnosis between malocclusions of dental origin and malocclusions of skeletal origin it's very important to evaluate the trend of Wilson curve:

- an inverted Wilson curve (inferior concavity) is caused by accentuated palatoversion of upper molar suggesting a dental posterior crossbite:
- a normal or accentuated Wilson curve indicates the maintenance of a correct inclination of molars axes and is, therefore, an expression of a crossbite caused by a maxillary contraction or an excessive mandibular transverse dimension.

If the crossbite affects one or a few dental elements it is more likely to be related to the dental component alone, differentiating it from skeletal posterior crossbite.

Clinically, the presence of a monolateral crossbite with non-coincident interincisal median lines is frequently detected.

Also in this condition the Dawson maneuver is fundamental. It, bringing the jaw in a centric relationship, allow us to detect pre-contacts and reveals a re-centering of median lines with a bilateral maxillary contraction, even of smaller magnitude.

The clinician should ask yourself following questions:

- Does the magnitude of the crossbite involve a single tooth or an entire segment?
- Is there a displacement associated with the crossbite?
- How significant is the skeletal component?
- Is it possible to compensate this discrepancy with only teeth movements?

If the expansion is indicated at an early stage, then this can be carried out easily and simultaneously by adding a quad helix to the 2X4 appliance.^{1,8,15}

Another use is for the correction of impacted/ectopic incisors. The incidence of unerupted maxillary incisors is not exactly known, although the prevalence has been reported as 0.13% in the 5-12 year-old age group.¹⁸ In another population, this has been estimated as 2.6%.¹⁹ Causes of failure of the eruption include: previous history of trauma, early extraction of deciduous teeth allowing closure of eruption space or formation of fibrous gingival tissue, retained deciduous teeth, supernumerary teeth, odontomes. Once the cause has been identified and dealt with, it may be that space needs to be created to allow traction to be applied to the affected tooth in order to bring it into the line of the arch. The major advantages in carrying out this treatment with a 2X4 appliance are the easiness with which space opening can be controlled using a fixed appliance and also the possibility to control the force magnitude and vector with much more precision than with a removable appliance.^{1,8,15}

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Conclusions

The 2X4 fixed appliance is an easy and versatile orthodontic device that can be effectively and efficiently used, alone or in combination with other appliances such as the quad helix, in mixed dentition.

Being a fixed appliance, it overcomes some disadvantages of removable appliances such as the fact that it is rarely full time worn, possibility of appliance damage/lost, difficulty in speech/eating, gagging, gingivitis/palatal hyperplasia/fungine infections, need of correct activation, possibility of only tip the teeth.

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