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Eruption Guidance Appliance: a review

ABSTRACT

Aim *Eruption guidance appliance (Occlus-o-Guide) is recommended for early orthodontic treatment or prevention of malocclusions. The aim of this work is to review the literature about the use of eruption guidance appliance and to evaluate its effects during the treatment of Class II division I malocclusion, increased overbite, increased overjet, and anterior crowding. The aims of the eruption guidance appliance are to increase mandibular length and to increase anterior facial height without affecting maxillary growth. The effects of Occlus-O-Guide are mainly dentoalveolar such as mesial shift of lower molars, extrusion of posterior teeth, lingual tipping and retrusion of upper incisors, protrusion of lower incisors.*

Conclusion *All the analysed works showed great results in the treatment of anterior crowding, increase of the overbite and overjet, both in small deviations of the median line and in minor TMJ problems.*

Keywords *Crowding; Eruption guidance appliance; Interceptive orthodontics; Occlus-o-Guide; OVB.*

Introduction

Early orthodontic treatment allows interception of malocclusions during either the primary or mixed dentition, which lead to better and more stable results than those achieved by a delayed treatment [Kluemper et al., 2000]. In a recent survey of the 159 Diplomates of the American Board of Orthodontics, participants were asked what they perceived to be the benefits of early treatment [Bishara et al., 1998]. The most common responses were as follows:

- greater ability to modify skeletal growth;
- improved patient self-esteem and parental satisfaction;
- better and more stable result;
- less extensive therapy required later;
- reduced potential for iatrogenic tooth damage such as trauma, root resorption and decalcification.

The goal of many clinicians who provide early treatment is to reduce time and complexity of fixed appliance therapy.

Bergesen [1975] developed a prefabricated elastomeric appliance for early orthodontic treatment or prevention of malocclusions, the eruption guidance appliance (Occlus-o-Guide) [Reukers and Bartzela, 2008]. Its main benefit is to combine the effects of a functional appliance with the effects of a positioner. The features shared with functional appliances are mandibular advancement, in order to correct Class II sagittal discrepancies, combined with vertical opening in the anterior region to provide a greater vertical development of the posterior teeth [Janson et al., 2000]. Positioners usually achieve minor tooth movement after orthodontic treatment as a result of the elastomeric material. Occlus-o-Guide basically consists of a single elastic device with intercuspation for the upper and lower teeth in normal occlusions [Janson et al., 1997; Pourramini, 1982]; it is a preformed appliance available in various sizes, from 1G to 7G, and even in half-sizes, depending on the arches length. Full sizes increase by 3 mm, from distal side of canine to distal side of canine; half sizes increase by 1.5 mm, from distal side of lateral incisor to distal side of lateral incisor. There are also appliances for extractive cases, X series for serial extractions and U series for the extractions of two upper bicuspids, and the H series for treatment finalisation, with all permanent teeth [Bergesen, 1981; Bergesen, 1987; Bergesen,1988a].

Patient have to use the appliance only while sleeping and for four hours during the day time. Each one-hour period the patient has to bite into the appliance heavily for one minute and gently for the following minute for the first half hour, with closed lips. During the second half hour, the patient has to bite gently into the appliance, always keeping the lips closed.

Bergesen [1988a; 1981] suggested the use of Occlus-O-Guide in the treatment of Class II division 1 malocclusion during growth in the early mixed dentition: if treatment starts before the collagenous fiber formation, results are more stable, especially in the correction of rotations and crowding [Kleinerman et al., 2011]. Finally it is possible to resolve malocclusions using only a single appliance.

This appliance has many indications and has been found to be effective in the treatment of many malocclusions including crowding, deep bite, excessive overjet, and distal bite. Interceptive treatment performed by means of the Eruption Guidance Appliance permits the achievement of optimal intercuspation, guiding eruption and keeping each permanent tooth in the correct position, until the end of exfoliation [Condò

et al., 2010]. Once the Occlus-O-Guide expressed all the therapeutic effects it becomes passive and can be used as retainer. Clinical experience indicates good and stable results [Keski-Nisula et al., 2008a].

The contraindications for the use of eruption guidance appliance are Class III, maxillary retrusion, mandibular prognathism and severe crowding (up to 8 mm) [Bergesen, 1985; Bergesen,1988b].

The objective of this work was to review the studies about the use of eruption guidance and to compare the effects of this kind of appliance during the treatment of Class II, division 1 malocclusion, overbite, overjet, and anterior crowding.

Discussion

Class II division 1 malocclusion

The effects of Occlus-o-Guide were analysed cephalometrically in the following areas of the craniodentofacial complex: maxillary skeletal component; mandibular skeletal component; maxillo-mandibular skeletal component; maxillomandibular skeletal relationship; vertical component.

Bergesen [1985] showed that Class II was easily corrected with the eruption guidance, but teeth might be bilaterally asymmetrical in a range of 3 mm.

Janson et al. [2000] evaluated cephalometrically the effects of the eruption guidance appliance in 30 patients, 27 with Class II division 1 malocclusion and 3 with Class I malocclusion, analysing lateral cephalometric radiographs in habitual occlusion before and after 26 months of treatment. Patients were instructed on the correct use of the eruption guidance appliance, while sleeping and for 4 hours during the daytime. In the maxillary component there were no significant changes in SNA, SN, ANS, A-Nperp and Co-A. Other studies showed similar results both with the eruption guidance appliance [Janson et al., 1997; Pourrahimi P, 1982] and with other functional appliances [Calvert, 1982; Whieslander and Lagerström, 1979].

Calvert [1982] analysed the cephalometric radiographs of 29 patients with Class II division 1 malocclusion, treated with the Andresen appliance, and compared the results with 19 untreated Class II division 1 cases. He found that the Andresen appliance does not affect neither the maxillary nor the mandibular skeletal growth.

Falk and Fränkel [1987] reported that functional appliances like Fränkel's, did not cause a significant inhibition of maxillary growth, probably because the mandible is advanced at only small steps of 2 mm, therefore the retractor muscles, which might affect maxillary growth, were only slightly stretched. The mandibular cephalometric analysis showed a statistically significant increase of the mandibular length (Co-Gn) after 26 months of treatment. In a similar study Katri Keski-Nisula [2008] analysed pre- and post-treatment cephalometric radioghraphs of 115 children treated with eruption guidance appliance, during a period of treatment of 3.3 years, and he found similar effects on the mandibular length (11.1 mm in the treatment group and 7.2 mm in the control group) .

Other clinical studies using different activator appliances reported growth increases in the mandible. McNamara et al. [1985] compared the skeletal and dental values of 100 patients treated for about 24 months with the functional regulator of Fränkel with a control group of untreated Class II division 1 subjects. He found an advancement of the mandible along the direction of the facial axis, which resulted in increased vertical facial dimension and mandibular length. A consequence of mandible growth was a larger increase in the variable Pog-Nperp, due to mandibular protrusion. The value was significant because most Class II malocclusions are retrognatic [McNamara Jr, 1981], so the advancement of the horizontal position of Pogonion improved the facial appearance. Moreover, according to Bishara and Ziaja [1989], skeletal Class II malocclusion could be cleared up with a forward positioning of Pogonion and not with an increase in the anterior facial height.

According to other outhors [Janson et al., 1997; Janson et al., 2000; Pourrahimi, 1982] the changes in the maxillo-mandibular skeletal relationship were not as statistically significant as in the vertical component. Eruption guidance appliance did not significantly alter the anterior mandibular height, like other functional appliances [Hamilton et al., 1987; Vargevik and Harvold, 1985]. The upper anterior face height was not statistically increased by using this kind of appliance. To estimate the effects of eruption guidance appliance in Class II division 1 malocclusions, it is necessary to analyse the changes in the upper and lower dentoalveolar components.

Janson et al. [2004; 2006] in his studies found that the eruption guidance appliance presented a similar effect to other functional appliances, causing lingual tipping, linear retrusion and inhibition of the vertical development of the upper incisors, because the Occlus-o-Guide is thicker in the anterior region and inhibits the extrusion of the incisors, but it does not establish a contact with posterior upper teeth, so promotes the vertical development of superior molars. The amount of molar relationship improvement is the same that can be obtained with the activator-headgear combination treatment in Class II malocclusion patients.

Regarding the mandibular component, Janson et al. [2000] found that the eruption guidance appliance caused a forward linear movement of the lower incisors, induced by the protrusion of the mandible. A recent study about untreated Class II subjects indicated that the effect of mandibular growth, that potentially could bring the lower dentition forward, seems to be lost because of intercuspal closing and subsequent adaptive movements of the dentoalveolar complex [You et al., 2001]. The forward linear movement of the

lower incisors was observed also with the use of other functional appliances.

Hamilton et al. [1987] evaluated the skeletal and dentoalveolar changes in patients using the FR-2 appliance. He found a significant maxillary incisor retraction and mandibular incisor proclination.

Janson et al. [2007] found a significant mesial movement of the lower first molars in the experimental group with the use of eruption guide appliance, in relation to the control group, probably caused by the resultant medial force that protruded the lower incisors, allowing for increased mesial molar movement.

Keski-Nisula et al. [2008b] showed that eruption guidance appliance induced a change in the dentoalveolar component without significantly affecting the position of the basal skeletal components.

Overbite, overjet and crowding

Many studies investigated the dental effects of treatment with the eruption guidance appliance.

Bergesen [1988c] wrote that the increase of anterior overbite could be corrected from the age of eight. In his work he stated that overbite treatment should start immediately after the deciduous canines exfoliate, prior to the eruption of permanent canines and bicuspids. By the time their eruption was complete, the overbite was usually corrected. Overjet was more easily corrected than overbite with the use of the Occlus-O-Guide, when worn 2 to 4 hours actively during the day.

According to Bergesen [1988c], with eruption guidance appliance moderate OVJ (6-9 mm) can be corrected between 10½ to 14½ years of age in males and between 8 to 11½ years of age in females. OVJ over 10 mm should be corrected ideally prior to 9½ years of age in the male and 7 years of age in the female.

In another work, Bergesen [1988] wrote that the use of the eruption guidance appliance could correct crowding up to 4 mm in the mixed dentition and 1 to 2 mm in the adult age. Moreover it was possible also to correct spacing (up to 3 mm in the upper and lower anterior dentition) and rotations, provided that there was adequate space to within 1 to 2 mm. According to this study the timing for the correction of this kind of malocclusions was no longer than 2 months for rotations, while for crowding and spacing was about 0.75 mm per month. Finally, Bergesen observed that midline discrepancies of 1 mm could be corrected in 72% of cases, and minor TMJ problems could be cleared up.

Keski-Nisula et al. [2008a] recorded the occlusal changes in 167 treated children in the mixed-dentition stage, with crowding, overjet of ≥ 3 mm and lack of tooth-to-tooth contact between the incisors, overbite of ≥ 3 mm and lack of tooth-to-tooth contact between the incisors, after treatment with Occlus-o-Guide. Treatment began when the first primary incisors exfoliated and ended when all permanent incisors and first molars were fully erupted. He found that overjet decreased from 3.1 to 1.9 mm and overbite from 3.2 mm to 2.1 mm. Moreover a good alignment of the incisors was observed in 98% of the treated children. This alignment was possible because eruption guidance appliance was designed to solve crowding by expanding the dental arches [Bergesen, 1984].

Methenitou et al. [1990] investigated the possibility of limiting the development of an excessive vertical overbite and overjet in 43 young children, with the passive use of Occlus-O-Guide during the night for 13 months. He found that overjet decreased from 3.0 mm to 1.4 mm, and overbite from 3.4 mm to 1.4 mm.

Also Janson et al. [2007] in his work evaluated the correction of overjet, overbite and crowding, and studied the stability of these corrections. He found that overjet correction was stable throughout the post-treatment evaluation period in the analysed subgroups. Moreover, he compared the overjet in patients using eruption guidance appliance with normal changes, and he found a statistically significant increase in this variable, because overjet decreases slightly with growth changes in untreated subjects. He confirmed that correction of the overbite was less stable than that of the overjet. Lastly he used the Little's irregularity index, and demonstrated a statistically significant relapse of crowding in the post-retention stage.

Conclusion

Eruption guidance appliance can be effectively used in the early mixed dentition during growth for the corection of Class II division 1, because it produces a statistically significant increase in mandibular length, which induces changes in the dentoalveolar component: forward linear movement of the lower incisors, lingual tipping, linear retrusion and inhibition of the vertical development of the upper incisors, without significantly affecting the position of the basal skeletal components, like others functional appliances do.

Many studies confirm that Occlus-O-Guide can be used for the correction of overbite and overjet in the mixed-dentition. The correction of OVJ is more stable than the correction of overbite, but if the treatment starts before the eruption of canines and finishes when the eruption of cuspids and bicuspids is complete, the results is stable pver time. Moreover the eruption guidance appliance can solve other malocclusions, like crowding, rotations, little midline discrepancies and minor TMJ problems.

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