



Bionator di Balters and Frankel in the treatment of class II malocclusions: a literature review

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Abstract

Functional devices in class II malocclusions can optimize mandibular growth in order to obtain a first-class skeletal relationship, normalising neuromuscular activity and achieving harmonious anatomical relations. The aim of this review is to compare the dentoalveolar and skeletal effects produced by the Frankel II (FR-2) and Bionator appliances in patients with Class II malocclusion. A research was conducted online on the following databases: Pubmed, Google scholar and Scopus until 2019. A combination of key words like *frankel II*, *bionator II*, *functional appliance*, *dentoskeletal effects* was used. According to inclusion and exclusion criteria, 18 articles have been selected. As results, the major effects of the bionator and the FR-2 appliances were dentoalveolar as labial tipping, linear protrusion of the lower incisors and a lingual inclination, retrusion of the upper incisors, increase in mandibular posterior dentoalveolar height. Smaller, but significant, skeletal effect as significant increases in mandibular growth and in the degree of mandibular protrusion can be also observed.

Background

Some studies have shown that the class II malocclusion can be categorized into 4 main groups: anterior position of the maxilla, anterior position of the maxillary dentition, mandibular skeletal retrusion in absolute size or relative position and excessive or deficient vertical development (1,2). McNamarastated that most Class II patients present a deficiency in the anteroposterior position of the jaw (3). This type of malocclusion can be treated in growing patients with the use of functional appliances. Frankel and Bionator are two functional devices used in the treatment of malocclusion from mandibular deficit. Functional jaw orthopedics (FJO) at the pubertal spurt followed by fixed appliances is a viable therapeutic option in patients with Class II malocclusion associated with mandibular retrusion (4). Several functional devices have been designed to treat second class malocclusion by mandibular deficit. The goal of these functional appliances is to optimize mandibular growth

in order to obtain a first-class skeletal relationship. Such modification also aims at dentoalveolar change of the maxillary and mandibular anterior teeth, normalising neuromuscular activity, and achieving harmonious anatomical relations. The aim of this review is to compare the dentoalveolar and skeletal effects produced by the Frankel II (FR-2) and Bionator appliances in patients with Class II malocclusion.

Bionator

Bionator appliance, which was developed by Balter in 1964 [Graber and Neumann, 1984], is a passive appliance. The acrylic components consist of a lower horse shoe shaped acrylic lingual plate from distal of last erupted molar of one side to other side; an upper arch with a lingual extension that cover molar and premolar region. A vestibular arch that extends with handles buccinatoris and a palatal bar orients the tongue and mandible anteriorly by stimulating its dorsal surface. The buccinator bends moves cheeks laterally in order to favour expansion and transverse development of dentition (5-7).

Frankel

The frankel 2 regulator (Fr2), conceived by Rolf Frankel in 1956, is a passive activator that is the only tissue retention device and has the function of keeping the jaw in an active protruded position by a nociceptive stimulus on the mucosa, as opposed to the traditional activators in which the passive protrusion is bound by the presence of planes to slide in contact with the teeth. consists of acrylic components and wire components. Acrylic components are composed by buccal shield or premolar and tuberosity shield, extended well into the sulcus; lower lip pads in the labial sulcus of the anterior region; lingual shield extended towards premolar region. Wire components are upper labial bow, lower lip pad support wire, lower lingual support wire, maxillary lingual stabilizing bow, palatal bow, lower lingual springs, canin loops, canine extension, occlusal rest. The fr2 allows minor and projected 2mm mandibular movements, the bite of the construction should be taken in a protruded position of two mm unlike other functional appliances where the construction bite is head to head (8-12).

Materials and Methods

A research was conducted online on the following databases: Pubmed, Google scholar and Scopus until 2019. A combination of key words like *frankel II*, *bionator II*, *functional appliance*, *dentoskeletal effects* was used. A manual research is also conducted. Original articles, reviews, case report studies, randomized studies, case-control studies were included. Studies that involved syndromic patients were excluded.

Review

According to inclusion and exclusion criteria, 18 articles have been selected.

Skeletal maxillary effects

Both Frankel and Bionator appliances seem to not produce maxillary effects, in terms of restriction of maxillary growth. This result agrees with other studies of activator and bionator appliances that also showed no significant restriction of maxillary growth (13-17). In contrast, other investigators noted some restrictive effect, particularly when the SNA angle was used (18-21).

Skeletal mandibular effects

A statistically significant increase in mandibular protrusion and length was observed in both experimental groups. particularly patients treated with the bionator. This finding, of increased mandibular growth after functional appliance treatment, agrees with the results of a number of investigations involving the bionator or Frankel appliance (22,23). The increase in effective mandibular length should be discriminated considering ramus height and corpus length. Numerically larger changes, but without statistical significance, occurred in the ramus height (Ar-Go) of both experimental groups. Mandibular body length, however, particularly in the bionator group, seemed to contribute more to the effective mandibular length, consistent with the results of other investigators.

Effects on the maxillomandibular relationship

Marked improvement in the maxillomandibular relationship as small changes in maxillary anterior growth and by the anterior positioning of the mandible in both the bionator and the FR-2 has been shown, with no significant difference between the two treatments. Similar results were found with bionator or activator therapy by some authors (24-26)

and also for the FR-2 (27).

Effects on vertical component

Some authors (28) reported that functional appliances do not change the craniofacial growth pattern. The result is probably related to the posterior bite opening that occurs when the mandible was brought forward.

Dentoalveolar effects

Both the bionator and the FR-2 produced a lingual tipping of the upper incisors (29). It depends on the labial wire that may come in contact with the incisors during sleeping hours, causing them to retract. Proclination of the lower incisors was produced by both appliances, probably consequently to the resultant mesial force on the lower incisors induced by the protrusion of the mandible. The vertical eruption of the lower first molars, is greater with the FR-2 appliance (30) and the bionator or activator appliance (31). The FR-2's advancement of the mandible contributes to opening the bite in the posterior region and it allows a greater vertical increase of the lower posterior teeth and helps to correct the overbite, the Class II molar relationship, and the deep curve of Spee.

Conclusions

In conclusion, the major effects of the bionator and the FR-2 appliances were dentoalveolar, with a smaller, but significant, skeletal effect. Both appliances provided no significant restriction of maxillary growth, but significant increases in mandibular growth and in the degree of mandibular protrusion, especially with the bionator appliance. Similar significant improvement of the anteroposterior relationship between the maxilla and the mandible. No statistically significant differences in craniofacial growth patterns have been underlined. The bionator group showed a greater increase in posterior facial height. A similar labial tipping, linear protrusion of the lower incisors and a lingual inclination, retrusion of the upper incisors, can be observed. Finally, a significant increase in mandibular posterior dentoalveolar height and no extrusion of the upper molars resulted in either treatment group.

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