



Effects and long-term stability of functional treatment with removable appliance for Class II Malocclusion

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Corresponding Author:

Dr. Debora Lori,
DDS, Sapienza University of Rome - Department of Oral and MaxilloFacial Sciences - Italy

Submitting Author:

Dr. Debora Lori,
DDS, Sapienza University of Rome - Department of Oral and MaxilloFacial Sciences - Italy

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Author(s): Loli D

Abstract

Class II malocclusion is not a single entity but results from numerous combinations of both skeletal and dental alveolar components. Treatment of Class II malocclusions may involve functional appliance therapy. Ideally this therapy should be started in the late mixed dentition followed by Phase II therapy to align permanent dentition. The two basic types of functional appliances commonly used today are tooth-borne and tissue-borne appliances. The only tissue-borne appliance is the functional regulator or Fränkel II. Instead, for example, Twin Block and Bionator are considered tooth borne. In tooth-borne appliance, there are more dentoalveolar effects than with tissue-borne appliance. In addition, functional treatment brings improvement in soft tissue profile with an increase in self-concept and a reduction of negative social experiences. When initiated at the appropriate patient developmental growth stage has been shown to be stable also in long term study and to result in the correction of Class II malocclusion.

Introduction

Class II malocclusion is not a single entity but results from numerous combinations of both skeletal and dental alveolar components. The earliest description was provided by Edward Angle when he defined a Class II malocclusion as characterized by the lower molar in distal position relative to the upper molar. He further subdivided class II malocclusions into Class II division 1 with anterior maxillary teeth protrusive and Class II division 2, with retroclined maxillary central incisors.

According to Mc Namara ¹, 75% of Class II skeletal discrepancies are the result of mandibular retrognathia.

Class II malocclusion is the result of multiple factors that influence growth and development and not from one specific factor. The development of Class II malocclusion, however, may be related to some specific causes, genetic influences, and environmental factors. Such specific causes as the effect of

teratogens on mandibular growth, mandibular deficient syndromes (Pierre-Robin and Treacher-Collins), childhood fractures of the jaw may all contribute to the development of a Class II skeletal pattern. Local and environmental factors may also be an issue in the development of Class II malocclusions because of their alteration of the normal physiologic pressures and forces associated with craniofacial growth. These pressures and forces may be disrupted or imbalanced by the effects of abnormal function of soft tissues. Disruption of normal lip balance such as that associated with lip incompetency may lead to flaring of the upper incisors from an imbalance of labial and lingual musculature. The lip-tongue contact needed for an oral seal during swallowing can cause the lip to retrocline lower incisors and the protruding tongue to flare upper incisors, thus increasing overjet. It has also been speculated that mouth-breathing can cause the opening muscles to place a distal force on the mandible, retarding its growth and rotating the mandible clockwise. In addition, it is thought that finger-sucking habits can produce a Class II division 1 incisal relationship within a Class II or Class I skeletal pattern.²

Treatment of Class II malocclusions may involve functional appliance therapy. The action of functional appliance is the bite wax in *advancement of mandibular, which stimulate cells of prechondroblasts of condylar cartilage to divide, differentiate and proliferate on the base of functional stimulating.*³

The ideal patient for functional therapy is a growth patient with retrognathic mandibular and slight maxillary protrusion, lower incisors with normal positioning, upper incisors proclined and without teeth-basal discrepancy.^{2,4}

Ideally this therapy should be started in the late mixed dentition followed by Phase II therapy to align permanent dentition. In the absence of severe dentoskeletal compensations, functional appliance therapy should be initiated at the beginning of cervical vertebrae maturation stage CS3 (peak in mandibular growth) to maximize the treatment effects and reduce the need for posttreatment retention⁵. In addition, the study of mandibular morphology with the angle Co-Go-Me can determine best responders to the

functional therapy.

Methods

Aim of this systematic review is to analyze effects and effectiveness of some functional appliance also in a long term. Keyword use were: Class II malocclusions, effects of functional therapy, long term study, stability. Scopus and PubMed were used as sources of this review. 16 articles were selected.

Review

The two basic types of functional appliances commonly used today are tooth-borne and tissue-borne appliances. The only tissue-borne appliance is the functional regulator or Fränkel II. Instead for example Twin Block, Bionator are considered tooth borne.

The Fränkel II appliance is considered a tissue-borne appliance because it uses the buccal vestibule as the main support of the appliance. The Fränkel II vestibular shields and lower labial pads are used to restrain the buccal and labial musculatures that apply pressure and restrict dental and skeletal development. The mandibular musculature is stimulated to reposition the mandible to a functionally anterior position by feedback stimulus from the lingual pad, which is lingual to the lower incisors. Since the appliance is tissue-borne greater flaring of the incisors may be noted. The buccal shields provide spontaneous lateral expansion of the maxillary and mandibular arches caused by pressure elimination from the buccal musculature, thus allowing the tongue to help in arch development. In addition, the vestibular shields stimulate additional growth laterally by causing tension on the alveolar periosteum.

The second basic type of functional appliance is the tooth-borne appliance, which uses the dentition as the primary anchor. In this type of appliance, there are more dentoalveolar effects than with the tissue-borne appliance.

LR Toth⁶ suggest that compared with the untreated subjects, the treated groups with Twin Block and FR-2 appliance of Fränkel show a statistically significant increase in mandibular length. The Twin-block patients achieved an additional 3.0 mm of mandibular length, whereas the Fränkel group increased 1.9 mm more than did the controls. A significant increase in lower anterior facial height was evident in both treatment groups. Vertical increase in

the Twin-block patients was significantly greater than in the FR-2 group. In general, more extensive dentoalveolar adaptation was observed with the tooth-borne Twin-block appliance than with the more tissue-borne FR-2 of Fränkel. The Twin-block and FR-2 samples both showed significant retroclination and extrusion (eruption) of the maxillary incisors. The Twin-block patients also exhibited distal movement of the upper molars; however, there was no extrusion. Slight lower incisor proclination was noted in both treatment groups, and lower molar extrusion was found to be significantly greater in the Twin-block group compared with the other 2 samples. No horizontal differences were detected in the lower molars among groups. The present study suggests, therefore, that Class II correction with the Twin-block appliance is achieved through normal growth in addition to mandibular skeletal and dentoalveolar changes. Class II correction with the FR-2 is more skeletal in nature, with less dentoalveolar changes noted.

K. O'Brien^{7,8} et al suggested that there are minimal benefits of early functional or growth modifying treatment in the transitional dentition. Treatment starting at this age simply increased the duration and the cost of treatment and resulted in poorer final occlusion. Results showed that early treatment with Twin-block appliances resulted in reduction of overjet, correction of molar relationships, and reduction in severity of malocclusion. Most of this correction was due to dentoalveolar change, but some was due to favorable skeletal change. In particular, overjet correction was dental for 73% and skeletal only 27%.

There are changes in soft tissue profile using functional appliances in the treatment of skeletal class II malocclusion with an increase in self-concept and a reduction of negative social experiences. The subjects also reported treatment benefits that could be related to improved self-esteem.^{9,10,11}

Another study on Bionator suggested that the Bionator appliance produced labial tipping of the lower incisors and lingual inclination of the upper incisors, as well as a significant increase in mandibular posterior dentoalveolar height. The major effects of the Bionator appliance were dentoalveolar, with a smaller significant skeletal effect. The results indicate that the correction of a Class II division 1 malocclusion with the Bionator appliance is achieved not only by a combination of mandibular skeletal effects, but also by significant dentoalveolar changes¹².

About the stability over the long term, Gultan¹³ found that functional appliance treatment results were stable

and even improved during retention.

Berger and Pangrazio-Kulbersh¹⁴ reported that patients treated with functional appliance continued to grow in a favorable direction and in addition the functional results showed stability over time.

Kochel J¹⁵ suggested that a significant skeletal effect (even in long-time stability) through a bionator treatment could be confirmed of a Class II, Divisions 1 and 2 patients.

Freeman DC¹⁶ indicated that correction of a Class II malocclusion with the FR-2 appliance maintains favorable results over the long term with both skeletal and dentoalveolar changes.

Conclusions

Therapy with functional appliances can improve soft tissue profile with positive psychosocial effects. Using tooth-borne appliance there are more dentoalveolar effects than with the tissue-borne appliance. When initiated at the appropriate patient's developmental growth stage, it has been shown to be stable also in long term study and with very good results in the correction of Class II malocclusions.

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