
Soft Tissue Effects of Twin Block and Herbst Functional Appliances: A Systematic Review

Peer review status:

No

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Article ID: WMC005577

Article Type: Systematic Review

Submitted on: 12-Jun-2019, 12:52:01 PM GMT **Published on:** 27-Jun-2019, 12:04:13 PM GMT

Article URL: http://www.webmedcentral.com/article_view/5577

Subject Categories: ORTHODONTICS

Keywords: Twin Block, Herbst, Class II Malocclusion, Orthodontic Functional Appliances, Soft Tissue, Facial Changes.

How to cite the article: Germanò F, Vompi C, Carreri C, Da Mommio L, Filetici M, Grenga C. Soft Tissue Effects of Twin Block and Herbst Functional Appliances: A Systematic Review. WebmedCentral ORTHODONTICS 2019;10(6):WMC005577

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Source(s) of Funding:

None

Competing Interests:

There are no competing interests

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ABSTRACT

In growing patients, it is possible to correct a Class II malocclusion due to skeletal mandibular retrognathia with fixed and removable functional orthodontic appliances. The aim of this study is to evaluate facial soft tissue changes after the use of Twin Block (TB) and Herbst appliance in Class II division 1 malocclusion cases and compare them using a systematic review of the literature. A computerized research of international literature has been conducted using the principal medical electronic databases (PubMed, Lilacs and Scopus) with the keywords: *Twin Block, Herbst, Class II Malocclusion, Orthodontic Functional Appliances, Soft Tissue and Facial Changes*. 5 articles respected the inclusion criteria and were included in the systematic review, 1 is a case control group study that compared soft tissues effects of Twin Block and Herbst appliances, the ressystemaic reviews about dental, skeletal and soft tissues effects of fixed and removable functional appliances from where the information of Twin Block and Herbst was extracted and compared. Both result to asses an improvement of facial balance and aesthetics. Controversial results were found on retrusion of the upper lip rather than to the protrusion of the lower lip and position of soft tissue menton. The magnitude of the changes may not be perceived as clinically significant due to the method of measurement. Three dimensional quantification of the soft tissue changes is required to overcome current limitations in understanding of the soft tissue changes obtained with the use of TB and Herbst functional appliances.

INTRODUCTION

Class II malocclusion occurs in about one third of the population¹ and it may lead patients to negative feelings of self image and self-esteem due to the increased overjet and unfavourable profile². Thus, the orthodontic treatment of these malocclusions should ideally solve the dentoskeletal disharmony in order to obtain a facial aesthetic improvement^{3,4,5,6,7}. Various factors can contribute to the development of Class II malocclusion and their differential diagnosis can help

in the selection of the most appropriate treatment approach. Among these factors, mandibular retrognathism shows a prevailing frequency^{8,9}. In these cases, a functional appliance therapy is a commonly used treatment protocol for growing Class II patients.

Functional treatment can be carried out either with removable functional appliances (RFAs) or with fixed functional appliances (FFAs). An essential difference between them is that fixed functional appliances do not require patient compliance, which can strongly influence the effectiveness of functional treatment¹⁰. Twin Block (TB) and Herbst appliances are among the most popular functional appliances¹¹. TB is a removable appliance and is the most preferred functional appliance in UK¹², Herbst is a fixed functional appliance and is most commonly used in the USA¹³. There are few studies concerning the soft tissue effects of Herbst appliance in the literature and soft tissue evaluation was performed with only few measurements¹⁴⁻¹⁶. Soft tissue changes after TB appliance treatment were evaluated in greater detail relative to Herbst appliance^{14, 17,18,19,20,21}. Dentoskeletal effects of these appliances were compared in two studies^{17,22} and soft tissue effects were compared in one study²³.

The objective of the present systematic review was to evaluate and compare facial soft tissue changes by using lateral cephalograms after the use of the Twin Block and Herbst appliances in Class II division 1 malocclusion cases.

METHODS

A computerized research of international literature has been conducted using the principal medical electronic databases: PubMed (Medline), Lilacs and Scopus. The following keywords were used and adapted according to the database rules: *Twin Block, Herbst, Class II Malocclusion, Orthodontic Functional Appliances, Soft Tissue and Facial Changes* to identify all articles reporting on the topic till May 2019. No restrictions of time and languages have been fixed. The results have been filtered and valued following our eligibility criteria and then organized following the PRISMA method²⁴. The inclusion criteria were chosen to initially select potential articles from the published abstract results: human clinical trials; facial

soft tissue changes; functional appliances to correct Class II division 1 malocclusions; nonsyndromic or medically compromised patients; no individual case reports or series of cases; no surgical intervention and with groups of patients in active growing stage. Craniofacial growth was considered important to factor out in order to accurately assess the true magnitude of the soft tissue changes. All the article abstracts that appeared to meet these inclusion criteria were selected and finally included in the systematic review.

RESULTS AND DISCUSSION

The updated electronic search of all databases resulted in 127 references. After duplicates were removed, 91 references were left. 78 articles were excluded because the topic was not pertinent or because they were not satisfied the inclusion criteria. The remaining eligible 13 articles were entirely read, and 8 of them were excluded. 5 studies fulfilled the final inclusion criteria and were included in the review. Only 1 article²³ with a case-control groups study, compared the soft tissues effect of Twin Block and Herbst appliances, the others^{20,25,26,27} were systematic reviews about dental, skeletal and soft tissues effects of fixed and removable functional appliances from where the information of Twin Block and Herbst was extracted and compared.

This review of the literature aims to analyze and compare the soft tissue profile changes produced by the TB and Herbst appliances in patients with Class II division 1 malocclusions.

Despite the extensive number of published studies regarding the skeletal and dental effects produced, only a few studies evaluated the soft tissue profile changes^{10,17,18,28}.

In patients with this malocclusions, the lower lip is distorted behind or under the upper incisors and it results in deep labiomental sulcus and acute mentolabial angle.

When the overjet was reduced with functional appliance treatment, physical obstruction of upper incisors is removed and the distortion of lower lip could be prevented. If the patient is instructed to maintain lip seal while wearing the appliance, lip strain is increased and this results in change in the posture and tonicity of perioral muscles. As a result, the lower lip distortion is eliminated; lower lip thickness, lower lip length, and mentolabial angle increased²³.

Baysal et al.²³ evaluated the soft tissue effects of Twin Block and Herbst appliance in patients with class II

division 1 malocclusion with mandibular retrognathia. The patients were divided into three groups. Forty patients were randomly allocated to one of two functional appliance treatment groups. The first group comprised 11 girls and 9 boys (mean age 12.74 years) treated with the Herbst appliance. The second group comprised 10 girls and 10 boys (mean age 13.0 years) who received treatment with Twin Block appliance. The untreated control group included 9 girls and 11 boys with a mean age of 12.17 years. They used the pre treatment and post-treatment cephalograms to evaluate soft tissue changes without any fixed concomitant orthodontic appliance therapy.

It was observed statistically significant soft tissue changes after TB and Herbst appliance therapy, compared to untreated control sample and that the effects of Herbst and TB treatment on the soft tissue profile were similar; they both significantly changed and improve the soft tissue profile. Especially greater advancement of soft tissue pogonion and lower lip were observed in TB group. This study²³ was in agreement with others authors that reported a decrease in soft tissue convexity after Herbst^{14,15,16} and TB^{17,28} therapies.

In reverse, most of the authors report the improvement of the profile to be mainly due to the retrusion of the upper lip, rather than to the protrusion of the lower lip. However, all the studies assessing this outcome reported controversial results based on the low quality primary studies; hence, this evidence has to be considered insufficient^{20,29,30}.

Flores Mir et al.²⁵ in a systematic review on the soft tissue changes with fixed functional appliances in class II division 1 malocclusion stated that the statistical changes and improvement in the soft tissue profile were not the product of a more forward position of the lower lip and soft tissue menton but more likely a retrusion of the upper lip. Unfortunately the magnitude of the changes may not be perceived as clinically significant due to the method of measurement.

One of the biggest differences between Herbst and TB appliances is the *headgear effect* in superior arch of the Herbst. In fact it leads to the opening of nasolabial angle due to the important effect of dental and partly skeletal distalization on superior arch³¹.

In patients with a nasolabial angle already opened and where you want to get only a mandibular advancement without a retraction of the upper arch of the use of Twin block meets better your needs³².

Soft tissue effects of Twin Block therapy were studied in detail with different analyses and imaging systems.

Anterior and inferior movement of chin, forward

movement of lower lip, and reduction in lower lip curvature were reported¹⁷. Singh¹⁸, using geometric morphometrics, showed antero-inferior displacement of mandibular soft tissues. Singh and Clark¹⁹ using finite element scaling analysis, found a reduction in the prominence of lower lip sulcus. According to literature, Baysal et al²³ find that in the TB group, lower lip, lower lip sulcus, and soft tissue pogonion moved anteriorly. Similar changes were found after TB therapy by Varlik et al.³³. Based on these findings, it may be stated that TB therapy results in forward movement of lower third of the face's soft tissues. Flores-Mir et al.^{20, 25} affirm that the current conventional orthodontic frontal and lateral cephalometric analysis are not capable of producing a real 3 dimensional image of the subject's face and results in subjective visual changes rather than actual volumetric changes. Some of the study present in literature have to be considered carefully because they used reference structures that could potentially change as a result of the treatment. For example, the esthetic plane is not a good reference plane to quantify changes in the lips because simultaneous changes in the soft tissue pogonion or pronasale could create the impression of lip changes that are really nonexistent.

A detailed esthetic judgment of the face should evaluate the patient's frontal face view during conversation, facial expressions, and smiling³⁴.

A very limited number of studies evaluating 3 dimensional soft tissue changes after functional treatment have been published^{17,35,36}.

Future studies using similar technology should also consider quantification of the volumetric changes.

CONCLUSIONS

According to these results, statistically significant soft tissue changes were observed after fixed (Herbst) and removable (TB) appliance therapy, resulting in improvement of facial balance and aesthetics.

The functional devices regardless of their type successfully reduced the overjet to within normal limits with similar proportional correction in terms of skeletal and dental effects in the sagittal plane.

The difference is in the operator's ability to diagnose the most challenging matters in the individual case report and adopt the device that best meets aesthetic and functional needs of the patient in question.

Changes produced by the TB appliance in the upper lip seem to be controversial but most of the studies didn't find any change in the anteroposterior position

of the lower lip and soft tissue menton.

On the other side, improvement produced by fixed functional appliances seem to restrict the forward movement of the upper lips. No change in the anteroposterior position of the lower lip and soft tissue menton was found.

Next studies should evaluate the effects of the functional appliances, in isolation, minimizing the effects of confounding concurrent use of fixed appliances by undertaking analysis at baseline, at completion of the functional phase and at the completion of straight wire treatment.

Moreover, a detailed esthetic judgment of the face should be carried out using the patient's frontal face view during conversation, with their facial expressions and smiling. Due to the superimposition of the hard tissues, conventional cephalometric analyses are considered not adequately capable to detect the soft tissue structure, so the results regarding the soft tissues effects might have been underestimated. In light of this, where possible, a future clinical trials should use stereophotogrammetry or laser surface scanner that may likely overcome these limitations and which is considered a reliable, non-invasive and free of radiation technique for assessing facial form.

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