
The effectiveness of Herbst appliance in II class malocclusion

Peer review status:

No

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Article ID: WMC005368

Article Type: Systematic Review

Submitted on: 07-Nov-2017, 05:41:43 PM GMT **Published on:** 08-Nov-2017, 05:44:03 AM GMT

Article URL: http://www.webmedcentral.com/article_view/5368

Subject Categories: ORTHODONTICS

Keywords: Herbst, class II malocclusion, fixed appliance, functional appliance

How to cite the article: Favale M, Di Luzio C, Caputo M, Bellisario A, Squillace F. The effectiveness of Herbst appliance in II class malocclusion. WebmedCentral ORTHODONTICS 2017;8(11):WMC005368

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Source(s) of Funding:

No funds has been taken

Competing Interests:

None

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Abstract

The aim of this review is to evaluate the effectiveness of using Herbst Appliance in II class malocclusion caused by a backward mandibular position. Herbst has an high clinical success rate, indeed it is one of the most used devices.

Materials and method: For this review scientific articles found in data base like PubMed, EMBASE, Cochrane Library and web of Science have been taken into account.

Discussion: Interesting results have been obtained by analyzing several studies. A significant decrease has been measured in SNA and ANB, due to an increase of SNB. It is induced by Herbst device which pushed forward and cause the growth of the jaw.

Furthermore Co-Gn have been increased following Herbst treatments, indicative of anteriorly positioned mandibular base and increased mandibular length. This may suggest that the sagittal changes of mandibular are brought about changes in both condylar positions and mandibular lengths.

Conclusions: Herbst appliance is an efficacious system to treat II class, thanks to the induced skeletal and dento-alveolar modifications.

Introduction

Second class malocclusion is one of the most common skeletal alterations, that affects the Caucasian population in a percentage from 12% up to 32% [1]. The diagnosis of II class is possible by performing the cephalometric analysis of x-ray in lateral view and by a clinical aesthetic examination. Taking into account the lateral radiograph, analyzing the SNA and SNB is important to assess if the second class is caused by the mandibular reduction in length or maxillary excess, or a mix of both; If the value of ANB is greater than 4 degrees, a II class is detected. The Wits index is another parameter useful to value the typology of class and the divergency: it consist of a linear measurement of the Ao - Bo segment, where Ao and Bo represent respectively the projection of point A and point B on the occlusal plane.

Furthermore, it is important to consider the inclination of the incisors and the divergence of patient.

We could classify II class malocclusion in three different types: skeletal, dento-alveolar and the pure dental type. These alterations require dental or skeletal approaches depending of malocclusion nature [3]. If the type of II class is skeletal type, It could be treated with functional or mechanical orthopedic appliances.

Herbst appliance is one of many functional devices used to treat II class malocclusion. It was developed by Emil Herbst in the early 1900s and it was reintroduced by Pancherz in the late 1970 [2].

One of major advantages of Herbst is that it does not require the patient to cooperate and this the reason of it high success rate. Therefore it results to be one of the most used appliance for II class treatment [7].

Herbst appliance has bilateral telescope anchored to lower and upper arch and so it keeps mandible in protrusion 24h/die. This allows the aesthetic profile to improve immediately.

On the other hand, many complications are related to the device during the treatment period: lower splint breakage, band or component fracture or debonding, screw loosening, rod distortion, pivot breakage, and soft tissue injuries [6].

The mucous injury rate is about 12% [8], this is a moderate-low incidence with respect to other functional appliances, but it is an important aspect of Herbst complications.

Elevate incidence of appliance fracture has lead to develop different type of design.

Pancherz used a Herbst device made of an outer cylinder and an inner tube that ended with two eyelets. The tube was anchored to the upper first molar band and to the band of the lower first premolar using two screws for eyelets and screwed into two nuts welded to the respective bands.

Other types of older design were the Herbst appliance with stainless steel crowns on the maxillary first molars and removable mandibular acrylic splint or the Herbst appliance with four stainless steel crowns on the first upper and lower molars.

At the beginning of the 2000s, a new Herbst was introduced into the market, consisting of a new type of

band (Rollo band) and a telescopic Herbst. The Rollo band is similar to a preformed crown. It has a hole in the chewing part that permits the correct cure of the cement and facilitates removal. The Rollo band is thicker than a traditional band (the metal thickness is .007 mm) to increase load resistance and sand blasting improves retention.

There are three types of telescopic Herbst:

I. Herbst Miniscope

II. Herbst HTH

III. Herbst MTH

They have common design, consisting of two cylinders and one piston running inside. Both the inner cylinder and the piston have a stop on the distal terminal used to avoid disassembly. The use of the Rollo bands and these types of telescopic systems have reduced the frequency of decay and fracture of the device.

Herbst miniscope guarantees 6 degrees of lateral movements, while the Herbst HTH allow 20 degrees of movements and the Herbst MTH makes side movements possible up to about 13 degrees. The Herbst MTH is the type that has lower amount of appliance fractures due to lateral movement. The facilitation of clinical management by the orthodontists has been accompanied by a decrease in comfort for the patient. In fact using Herbst Miniscope and Herbst HTH an increase in the number of decubitus ulcers has been obtained. Herbst MTH was created to overcome the problem of decubitus ulcers that could occur with the other two models. The ulcers are caused by excessive latency: when the jaw moves on one side, the outer cylinder of the hinge protrudes excessively into the interior of the vestibule on the outer side of the vestibule and this causes an excessive pressure on genital mucosa. The problem occurs mainly at night in patients who tends to sleeping on side.

The Herbst determines dental effects like the distalisation (up to 2.8mm) and upper molar intrusion, the retro-inclination (up to 3.5mm) and upper incisor extrusion, the mesialization (up to 1.8mm) and extrusion lower molars, buccal (up to 10.5mm) and intrusion of the lower incisors [11].

The skeletal effects are the reduction of the maxillary growth (headgear effect), increasing in growth of mandible, the renew of the articular fossa [12], a slight clockwise rotation of the occlusal plane. The inferior jaw can also growth till 4 mm, but is necessary a rotation of Pogonion for an anterior positioning in a sagittal view is necessary.

Materials and method

Several articles have been published about the use of the Herbst device in the second classes. For this work it is been taken in account articles in literature published in data-base such as PubMed, EMBASE, Cochrane Library and Web of Science.

The keywords used were: *Herbst, Class II Malocclusion and Orthodontic Functional Appliances.*

No restrictions of languages have been fixed; articles until February 2017 have been taken into account, items that were not considered eligible were analyzed and then removed. As results of these analysis only 20 full articles have been selected.

Review

Many studies demonstrate the effectiveness of the Herbst device. It is indeed, one of the most used devices to treat second class due to mandibular backward position.

The speed and effectiveness of the treatment may lead the clinician to prefer it to other mobile functional devices, anyway it is very important to select the patient.

The fixed equipment requires a low collaboration, which is in contrast with the high collaboration that the patient regarding oral hygiene requires. Indeed fixed device could easily lead to an increase of the risk of plaque level and consequently to an increase of the risk of demineralization; for this reason it is important to instruct the patient to cure his/her oral hygiene.

Treatment time using Herbst appliance is about of 9 months [13-14]. The variables depends only to the individual response to the treatment: skeletal age (further away from the growth spurt and greater the dento-alveolar effects and minor skeletal ones) and the genetic pattern of the patient mandibular growth [15-5]. In adults the treatment lasts longer than 12 months, because the patient has an adult bone structure and a dental alveolar already structured.

According to Panchez et al [16] changes occurring in second-class patients after therapy with Herbst are the following ones: correction of occlusal ratio in class I with an average molar advancement of 6.1 mm (due to 37% to a skeletal response), overjet correction of about 8.4 millimeters due to skeletal modification in 27% of cases and upper and lower anterior teeth inclined.

Class II patients treated with the Herbst appliance show changes of TMJ with anterior displacement of the condyles and remodeling glenoid fossae [18]; this is one reason of moving forward of the jaw.

Furthermore Pancherz noticed in the long-term studies that Herbst's device often led to the recurrence in the immediate post-treatment. For this reason, he recommend to use it in premature permanent dentition to limit changes only to the mandibular protrusion [21].

It is possible to use the Herbst device in association with the temporary anchorage devices (TADs)[22] to increase the anchorage, contain dental effects (in order to reduce undesirable proclination of lower incisors) and enhance the skeletal response.

Discussion

Thanks to the new types of Herbs this device fits strongly the second class therapy. Its effects are similar to the ones generated by the Twin Block functional device.

Xin Yang, in a meta-analysis [19], analyzes SNA, SNB, ANB, mandibular plane angle, Co-Go, Co-Gn, overjet, overbite and molar relationship modification. He found a significant decrease in SNA and ANB due to an increase of SNB that Herbst appliance has induced with the forward position and growth of mandible. Furthermore, Co-Gn have been increased following Herbst treatments, indicative of anteriorly positioned mandibular base and increased mandibular length; this may suggest that the sagittal changes of mandibular are brought about by changes in both condylar positions and mandibular lengths.

Several studies show that Herbst appliance reduce dental overjet, dental overbite and molar discrepancies. As mentioned above, this appliance could forward mandibles, and this is a contribute to the improvement of dental discrepancies.

The recurrence is more pronounced for dental effects than skeletal [20], the ideal age of treatment is close to pubertal growth spurt, in early permanent dentition.

However, also adult patients are affected by dental effects and the slight remodeling of the glenoid fossae with an anterior displacement of condyle, although the treatment is a bit longer and less effective compared to patient in growth. Anyway, in adult and young patients it is recommended to avoid recurrences.

Conclusion

Several studies selected showed the effectiveness of use Herbst appliance in II class.

Among the major effects we could find:

- an increased anteroposterior length of the mandible;
- increased vertical height of the ramus;
- increase in lower facial height;
- mandibular incisors proclination;
- mesial movement of lower molars;
- distal movement of upper molars.

There are also effects in the TMJ like a remodeling of glenoid fossae and anterior displacement of condyle.

The fracture of the device and the mucous membrane decubitus remain among the major side effects of this device. Indesiderable dento-alveolar effect could be contained by the use of mini screw.

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