

# Comparison of Twin Block and Herbst Appliances in Treatment of Class II Malocclusion: a Systematic Review

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# Comparison of Twin Block and Herbst Appliances in Treatment of Class II Malocclusion: a Systematic Review

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## Abstract

In growing patients, it is possible to correct a second class skeletal mandibular retrusion with functional orthodontic appliances. We have viewed 1982-2016 PubMed articles to compare, in terms of compliance, timing, dental effects, and skeletal profilometric changes Twin block and Herbst appliances. The dental and skeletal effects are the same, but the Herbst unlike the Twin Block presents a retraction of the upper arch effect, a greater retraction of the upper first molar, a greater torque loss of the upper front area and a greater flaring of the lower incisors (on average 5 ° and 11 °, respectively in the Twin Block and in the Herbst). The Herbst treatment time (average of 9 months) is less than the Twin Block (average 12 months). The most important difference is patient compliance as the Herbst is a fixed device in cui the efficiency and effectiveness is dependent operator while the Twin block is a removable device dependent compliance. Choosing the most effective orthodontic coverage depends on the treatment goals you want to Achieve but Surely patient compliance and the effect headgear Herbst are among the most important factors to consider in choosing orthodontic coverage blackberries in tune with our objectives treatment.

## Introduction

The feed devices described in the literature more and more efficient and effective are the Twin Block and Herbst. In fact, in growing patients we can stimulate mandibular growth to reach a first skeletal class. The most suitable timing for the action of these two devices is the beginning of the peak regrowth in this way are obtained the major skeletal effects in the shortest possible time. Moving away from the growth spurt dental effects will be greater than the effects scheletrici.<sup>1-2</sup>

The diagnosis of skeletal II Class Malocclusion is performed by the cephalometric skull radiograph on latero-lateral projection. ANB and AO-BO are the two

most used cephalometric indexes for detection of skeletal class. Also in lateral cephalometric radiogram is important to evaluate SNA and SNB (to assess whether the second class is due to the mandibular reduction in length, maxillary excess or a mix of both), the flaring of the incisors and the divergence of patient. The flaring of the lower incisors is very important, because patients in second skeletal class have an important compensation usually IMPA of 95 ° -100 ° and then check this flaring is essential to prevent periodontal problems because both units cause a flaring of the lower incisors. The forwarding of mandible creates a posterior open bite that can be closed with the extrusion of the posterior teeth when the patient hypodivergent or earlier if the patient hyperdivergent.<sup>3-4</sup>

Clinically assessing whether there are cross-cutting issues by bringing the lower jaw to the desired position and if there is the need overjet mandibular advancement. The Nasolabial Angle is very important to assess because the therapy with Herbst if we do not control the upper arch distalization with mini screws (headgear Herbst) effect is an increase of this angle in patients with narrow angle is advantageous while in patients with an already open angle worsen the patient's profile.<sup>4,5</sup>

### Herbst

The Herbst "hinge" is a fixed functional appliance presented by Dr. Emil Herbst at the Berlin Conference of 1906. It's a fixed functional device, cemented on the dentition that determines an advancement of the mandible; Thus link to it structure the effects are both dental a skeletal. The mandible is forced to remain in protruded position 24 hours a day. In literature have been described various designs. Pancher used a Herbst constituted by an outer cylinder and an inner tube that ended with two eyelets and is anchored to the upper first molar band to the band of the lower first premolar through two screws for eyelets and screwed into two nuts welded to the respective bands. To manage the anchor, the two upper and lower bands were respectively solidarized together by a palatal arch and a lingual arch.<sup>6,7</sup> This Herbst broke often at the level of the bands for the minimum laterality which was permitted to the patient.

Among the modern designs include L Herbst MTH described by Dr. Manni and collaborators who is a telescopic Herbst. The MTH is a telescopic Herbst. The appliance proposed have the same design of the first hinge, composed of two cylinders, there are an inner and an external cylinder, and a piston that slide inside as a "fishing rod". Both the inner cylinder and the piston have a stop in the distal end which prevents disassembly. The upper distal of the outer cylinder is shortened and bevelled chamfer, in the inferior extremity there is a joint composed by a cavity in which is inserted the spherical head of the screw. The eyelet with traditional screw on the upper part limits the transverse movement of the hinge and prevents the contralateral terminal part of the cylinder to protrude excessively into the vestibule in way to not compress cheek's mucosa during laterality movements. The consequence is a decrease in ulceration of the buccal mucosa.

It also makes possible lateral movements up to 13 ° around and protects the unit from the possibility of fractures (because it grants wide laterality) and at the same time the possibility of ulcers or folds decubitus (because the laterality is not excessive). The Herbst MTH can be applied on the arch lower than a cantilever bar or on a splint in the resin that covers the lower arch. The splint, associated with this telescopic hinge loses the primary function of reducing fractures, but retains the ability to control the clockwise rotation of the occlusal plane, and the reduction of intra-articular pressure, preventing any idiopathic condylar resorption. We also replacing traditional bands the Rollo band, this are preformed bands that have a hole in the masticatory that allows proper cement polymerisation (using glass ionomer cement) and facilitates the removal, and is thicker than a traditional band (the metal thickness is .007 mm to increase the resistance to loads). The internal surface sandblasted improves retention.

The Herbst is a device fixed functional dental support that determines the skeletal and dental effects. The dental effects are: the distalization (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.<sup>9</sup> The skeletal effects are: the reduction of the maxillary growth (headgear effect)<sup>10</sup>; increasing in growth of mandible; the renew of the articular fossa<sup>11</sup>; a slight clockwise rotation of the occlusal plane. More clockwise rotation is due with a lesser manifestation of the other three effects. The inferior jaw can also growth till 4 mm, but if it isn't a rotation of Pogonion, it

doesn't place anteriorly in a sagittal view.

### **Twin Block**

The device presented by William J. Clark in 1982, is functional apparatus suitable for the therapy of Class II both hyperdivergent and hypo divergent one. It can be removable or fixed. Given the extensive literature about we focus on the Twin removable block.<sup>19</sup> It is composed of a double plates anchored with the hooks or cemented, which presents the vertical occlusal increases (bite-blocks) that come into contact through the ramps present in the second premolars level. The meeting of the ramps is responsible of mandibular advancement.<sup>20,21</sup>

The goal of orthodontic treatment according to Dr. Clark uses the Twin Block: double plate with two seats inclined planes on the occlusal Bite Blocks which is very comfortable for the patient. The two inclined planes of the upper and lower bite blocks are in contact with an angle of 70° in closing, resulting in a comfortable posture of the mandible till a crown to crown incisor relationship.

The occlusal inclined plane is fundamental functional mechanism in the dentition, the planes of the cusps are decisive for the occlusal relationships of the posterior teeth and therefore may represent a block for the growth and development of the jaw which, remaining in a distal position, also represents a block for the development of the maxilla.

The objective of the Twin Block is to cancel the action of unfavourable cusp contacts, both of the back teeth than those of upper canines through the release of the occlusion, this is made possible thanks to resin thickness (Bite Blocks) that stimulate proprioceptive contacts favourable of inclined planes which allow to the jaw a forward movement.<sup>19-22</sup> According to Clark, if the mandible occludes in a distal relationship with respect to the upper jaw, the occlusal forces which act on the lower teeth during function have a distal component of force that is not good for a normal mandibular development. Thus Twin-block, changing the occlusal plane using acrylic inclined planes placed on the occlusal bite blocks, reposition the mandible forward, and use the occlusal forces to correct the skeletal malocclusion Class II. The unfavourable cusp contacts the distal occlusion are replaced, then, by proprioceptive a favourable contacts the inclined planes of the Twin-block, which goes to free his jaw locked in its functional position distale.<sup>23</sup>

The cut off of posterior-superior bite-blocks allows selective extrusion of lower molars followed by an opening of the bite and the resolution of the hypo divergent condition. In cases of hyperdivergent molars

should be in contact with bite-blocks counteracting the eruptive process. In this case at the end of therapy there would be a posterior bite that will be closed with the intrusion of upper teeth in case of gummy smile or lower if there is no gummy smile (that way we'll have an anterior rotation of mandible).<sup>24,25</sup>

The effects of the Twin Block are both dental and skeletal. The unit is composed by various component. A central screw for transversely expanding higher or lower arch when is necessary increases occlusal angled at 75 ° to the occlusal plane, that occlude each other and come into contact in the distal region of the lower premolars or the first molars, resulting in a mandibular advancement. The essence of the two plates that constitute the T.B. It is enclosed in these resin occlusal thicknesses which allow to realize the inclined planes are able to advance the mandible. On average are achieved with an angle of 70° with respect to the occlusal plane but, where there is a difficulty of the patient to stay in this new position, this angle may be reduced.

Initially, the author realized the first appliance with a 90° angle, in this way the patient must make a considerable effort to occlude in progress and resulted impossible in some cases, so to eliminate the ' inconvenience an angle of 45 ° was made, but this angle promotes the growth forward and downward. After careful analysis it was concluded that the ideal angle is 70° +/- 5 upon the tolerability of patient and the ability to determine a more horizontally directed force.<sup>19</sup>

The peculiarity of T.B. is the presence of Delta Hooks on the first upper molars and the first lower premolars. It is one of the peculiarities of T.B. This hook was invented by the author and is very similar to the Adams hook, the difference lies in the retention shape which initially were triangular (Delta name) but may also be circular. This type of closed-loop, compared to the handles open "U" of Adams, makes this new hook less exposed to risks of deformation and break and does not require adjustments, also ensures excellent retention for both molars that for premolari.<sup>5,6</sup> For the construction, which is extremely simple, it is an Angle gripper framework round nose pliers and wire 0.7 mm Leowire. The vestibular arc continues with a loop that forms a slight curve apical to the gingival margin of the maxillary canine. The canine loop after its curvature virtualizes itself again to go into the space between the canine and the first upper premolar or deciduous molar.

At first in the Clark's drawing the superior plate is anchored to the jawbone by ball hooks, placed distal to the canines. The action that this plate exercised in

the upper teeth caused an overcorrection angle of the same, this can be a lock for the programmed mandibular advancement. The use of T.B. throughout the day determines a good lip seal, then lips are the same in function as vestibular arch, working in a natural way on the verticality of the incisor.<sup>25</sup> These considerations have led Clark to eliminate the vestibular arc, except for the cases of excessive flaring of the incisors. It is evident that this makes the device more aesthetic.

## Materials and Methods

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During the years, several dentistry works have been published on international literature about the incidence of Class II Malocclusion and its treatment planning. Many appliances have been performed to treat this anomaly and, in particular, a great use has been done of Herbst and Twin Block appliances. So a detached research of international literature on the use of these orthodontic devices and on all the differences between them has been performed using the principal medical databases: PubMed (Medline), Lilacs and Scopus. The keywords used were: *Twin Block*, *Herbst*, *Class II Malocclusion* and *Orthodontic Functional Appliances*; to identify all articles reporting on the topic till October 2016. 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 method. The search identified 13,450 abstracts, which were reviewed manually and each article of interest was marked for further review. The full text of the marked studies was retrieved and studies that satisfied our eligibility criteria were included in this review. At the end only 68 full articles have been selected.

## Review

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### Patient's cooperation

Herbst is a fixed unit, therefore the kind of collaboration requires is a correct oral hygiene and the rubber bands in the post Herbst finalization. It is an efficient and effective instrument because in an average of 9 months' time, you will get the treatment goals with minimal cooperation of patient.<sup>21,22</sup>

The single problem links with the collaboration of patient is the oral hygiene because with fixed appliance hygiene it is more difficult to control. Therefore, the norm when we start any type of orthodontic therapy, at first clinician should give instruction to control oral hygiene, especially when the

treatment plan is based on fixed appliance. The twin block is a removable orthodontic coverage. The skeletal and dental effects can be obtained with a full cooperation of the patient that had to be able to stay with this appliance 24 hour/day.<sup>21,22</sup> At first before to start a treatment is very important to have an interview with parents and with the patients. During this the clinician must be able to recognize if there will be a collaboration of the family to follow the patient to respect your line guides and to value if the guy is responsible and receptive to your instructions. The average treatment is for patients between 11 and 15 years of age and that's why the interview with parents is of great importance to tell if a guy is followed or not and if it is a responsible guy and receptive to your doctor's instructions or parents. A test that can be done is oral hygiene control. The majority of patients have poor oral hygiene. So see improvements over time after various instructions and motivation to oral hygiene can be a valuable test in order to understand the degree of cooperation that the patient can offer us.

#### **Average treatment time**

Herbst therapy lasts an average of nine months. The variables are related only to the individual response to treatment, skeletal age (further away from the peak of growth and greater the dento-alveolar effects and minor skeletal ones) and the genetic pattern of the patient<sup>1,2</sup> mandibular growth. In adults, treatment is longer than 12 months, because the patient has an adult bone structure and dental alveolar already structured. For this reason, it's harder get the treatment goals required. The treatment with Twin Block usually had a during about 14 months.<sup>24</sup> The variables are mainly related to the patient's ability to cooperate because in younger patients is difficult to have a sufficient degree of cooperation. The failures described in the literature from this apparatus are in fact linked to poor patient compliance.

#### **Profilometric patient changes**

One of the biggest differences between these two devices is "headgear effect" in superior arch of the Herbst. In fact, one of the advantages or disadvantages, dependent upon patient characteristics profilometric is the opening of nasolabial angle of Herbst appliance due to important effect of dental and partly skeletal distalization on superior arch.<sup>25</sup>

So in patient where you want to distalize the upper arch to get a raise of the upper arch length in cases of upper crowding and/or protrusion of the maxilla Herbst it is more predictable in the possibility to get the treatment goals compared to Twin block. This headgear arch effect determines an opening angle

upper lip nose.

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 our needs.<sup>26</sup> Alternatively in a no-cooperative patient can use a Herbst with the maxillary arch miniscrews with the scope to limit the typical distalization Herbst effects in the upper arch.

#### **Dental effects**

All II class therapies determine a variable degree of flaring of the lower incisors as a side effect. The use of Herbst without miniscrews take to an inclination of about 11°, the Twin Block of 5° and the average for the II class elastics is around 18°. <sup>26-28</sup> Thus in patients in which you want to limit the flaring of the lower incisors is to increase skeletal effects and / or periodontal problems for the use of the Twin block is more attuned to the goals of therapy compared Herbst without the aid of miniscrews.<sup>28</sup> In reality, the Herbst with miniscrews limits the pro inclination of the lower incisors so there is no difference with the Herbst if using miniscrew.<sup>28-30</sup>

Today, the philosophy is to do a therapy with fixed multibrackets appliances with I molar and canine class relationships, in order to minimize the use and, therefore, the side effects of Class II elastics that would serve in these cases only as a restraint of mandibular position obtained.<sup>31</sup>

#### **Skeletal effects**

A randomized control study of Baykal A et al. of 2014 where the objective was to compare the skeletal effects of Twin Block and Herbst, discusses how Twin Block skeletal results are greater than Herbst.<sup>27</sup> In fact, this study compares Herbst without the use of mini screws with Twin block.<sup>30-31</sup> Other studies instead consider Herbst as a viable alternative to surgery in cases of second classes of mandibular retrusion. In other literature works differences of structural and skeletal effects of Herbst and Twin Block are minimal<sup>27-31</sup>.

## **Conclusion(s)**

Herbst and Twin Block are two effective mandibular advancement devices described in the literature. Their efficiency and effectiveness also is widely documented in the literature. Compliance is certainly the most important variable to consider in this type of removable appliances where could be considered the most important prognostic factor.

Skeletal and structural effects are similar in the two devices while the most significant difference is in the

“headgear effect” of Herbst that can be useful in many clinical cases and is a very important factor to consider because it determines changes in the patient's profile.

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. Very important in both devices is the pre and post management for permits full potential of the orthodontic device and to keep the dental and skeletal effects that we have obtained.

There is no better device but therapeutic choice had to be specific for our treatment goals.

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