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## Skeletal and dental effects of Herbst appliance in II class malocclusions: a systematic review

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# Skeletal and dental effects of Herbst appliance in II class malocclusions: a systematic review

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**Abstract:** the aim of this review is to evaluate the effectiveness of using Herbst Appliance in II class malocclusions caused by a backward mandibular position.

**Materials and method:** for this review scientific articles found in data base like PubMed, EMBASE, web of Science have been taken into account and the research has been done with the following keywords: II class, Herbst, effects, fixed functional appliance.

**Discussion:** Interesting result have been obtained by analyzing several studies. A significant decrease has been measured in SNA and ANB, and an increase of SNB, Â Go-Gn, SNA-Gn as skeletal effects and a decrease of overjet as the result of dento-alveolar effects.

**Conclusions:** Herbst appliance is an efficient system to treat II class, both of skeletal and dental effects.

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IntroductionÂ

There are different type of II class: caused by a protrusion of the maxilla, a retrusion of the mandible, Â or both. In the Caucasian population the 85% of II class are caused by a mandibular retrusion. Functional appliances are very used in the treatment of this type of II class and Herbst appliance represents a fixed functional one. Because of its fixed structure it is the only functional appliance that doesnâ€™t need a collaboration, so its effects are more predictable. This is the reason of its high success rate.

By the cephalometric analysis SNA, SNB, ANB angles and Witts index indicates a II class caused by a mandibular retrusion.

Herbst appliance was developed by Emily Herbst in the early 1900s and it was reintroduced by Pancherz in the late 1970 (1).

Usually the Herbst appliance is attached to bands Â on upper molars and lower premolars or molars (banded Herbst design) or cast splints (cast splint Herbst design). The appliance can also be attached to stainless steel crowns (stainless steel crown Herbst design) and to acrylic splints (acrylic splint Herbst design) which, in addition to the banded and cast splint designs, form the four basic designs of the Herbst appliance . Other Herbst variation include space-closing Herbst designs, cantilevered Herbst designs, and expansion designs.

In all this structure the appliance has bilateral telescope anchored to lower and upper arch and so it keeps mandible in protrusion 24h/die.

Each telescopic mechanism consist of a tube and a plunger which fit together, two pivots, and two locking screws.

The appliance allow the mandible to perform not only opening movements but also small lateral movements, mainly because of the loose fit of the tube and plunger at their sites of attachment.

At the beginning of 2000s a new type of bands (Rollo bands) were introduced into the market (2), similar to a preformed crown with a hole in the chewing part that permits the correct cure of the cement so to reduce the countless fractures of the structure. In fact the main problem of the Herbst is this one. Moreover it could lead to soft tissue injuries, pivot breakage, lower splint breakage, band or component debonding, demineralization (acrylic splint Herbst design) and proinclination of lower incisors.

On the other hand these complications are surmountable: the possible fracture with the use of Rollo band and vetroionomeric cement, decubitus of soft tissue with a reduction of lateral movements and composite on the pivots, the hypomineralization with an accurate hygiene and fluoride sessions, the proinclination of the lower incisors with the use of mini screw that can increase skeletal anchorage and reduce dental effects.

There are three types of telescopic Herbst:

1. Herbst Miniscope

2. Herbst HTH
3. Herbst MTH

Herbst miniscope guarantees 6 degrees of lateral movement, Herbst HTH 20 degrees, and Herbst MTH 12 degrees. Herbst MTH was created to reduce the problem of decubitus ulcers and fractures of the structure that could occur with the other two models with their laterality.

It was created by Antonio Manni and it is characterized by Rollo band and acrylic lower splint (3).

Because of its dental support, Herbst appliance caused not only skeletal effects but also dental effects.

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#### Materials and method

For this review scientific articles found in data base like PubMed, EMBASE, web of Science have been taken into account and the research has been done with the following keywords: II class, Herbst, effects, fixed functional appliance.

Several studies have been published about the use of Herbst appliance; in this review are not considered case report concerning the standard Herbst structure but only the modified one (with miniscrew). As the result of this analysis only 20 full articles have been selected from 50.

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#### Review

Many studies demonstrate the effectiveness of the Herbst device (4,5,6,7).

According to Pancherz et al. (8,9) it determines dental effects like the distalization and intrusion of the upper molar, the retroinclination and extrusion of the upper incisor, the mesialization and extrusion of lower molars, proinclination and intrusion of the lower incisors.

The skeletal effects are the reduction of the maxillary growth (headgear effect), increasing in growth of mandible, the renew of the articular fossa, a clockwise rotation of the occlusal plane, a bit increase in ante-inferior vertical growth, that is reduced in the acrylic splint Herbst than in the bands one.

According to Xin Yang et al. (10) there is a decrease of 0.56 of SNA angle and 1.08 of ANB, an increase of 1.06 for SNB. The decrease of the overjet is about 4.8 mm, and for the overbite 1.69.

The increase of Co-Go is 1.76 mm, Co-Gn 1.74 mm, the II class molar relationship decreases of 5.70 mm, Apoint-OLp of 0.52 mm and Pg-OLp increase of 1.45.

The upper incisor's retroinclination changes from

3.2° to 8.2° at the end of the treatment; the lower incisor's proinclination changes from 5° to 10.8° (11).

This great proinclination isn't connected with any lower incisors recessions and can be reduced thanks to miniscrew.

According C. Luzi et al. (12,13), two miniscrew (6 mm long, 1.5 mm in diameter) inserted between lower first and second premolars on each side can increase skeletal anchorage and reduce lower incisors proinclination.

The TADs were tied tightly to the customized hooks on the Herbst appliance with 0.12 stainless steel ligatures. This rigid connection provided indirect skeletal anchorage to the mandibular basal bone, with the aim of avoiding any dentoalveolar compensations in the lower dentition during the bite-jumping period.

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#### Conclusion

Compared to other removable functional appliances (14,15,16), the Herbst appliance is fixed to the teeth and thereby is able to work 24 hours a day. In addition, the duration of treatment is relatively short (7-9 months), while the removable functional appliances usually require 2-4 years, thus making the Herbst appliance suitable for postpuberal patients and young adults. The main advantages of the Herbst appliance include the short and standardized treatment duration, the lack of reliance on patient compliance to attain the desired treatment effects, the easy acceptance, and patient tolerance. In addition, the distalizing effects of the maxillary first molars contributes to the avoidance of extractions in class II malocclusions with maxillary crowding or maxillary surgery in patients at the end of their growth. Other advantages include the improvement in the patient's profile immediately after placement, the absence of removable parts, the maintenance of good oral hygiene, the simultaneous use of fixed appliances, and the ability of modify the appliance for various clinical applications.

So with an appropriate use and indications and in right patients it is considered a valid appliance in the treatment of II class.

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