Management of the Herbst splint appliance in Class II malocclusion with different growth pattern

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Introduction

The Herbst appliance has proved to be effective in the treatment of Class II malocclusions. Different methods of stabilization of the telescope mechanism have been described by different authors. The first design proposed by Pancherz in 1979 proved to be difficult both in terms of construction and clinical management because of frequent breakage.

One of the easiest systems of stabilization was proposed by McNamara and it consisted of upper and lower acrylic splints. The use of full occlusal coverage Herbst appliances allow a permanent condylar displacement with stimulation of viscoelastic tissue, mini-

Class II malocclusion treatment can be successfully performed with the Herbst appliance stabilized with acrylic splints. Using this kind of stabilization a posterior open bite is always present when the appliance is removed.

Two case reports are presented to illustrate how it is possible to manage the post-Herbst phase in different types of growth pattern in order to obtain the best aesthetical and functional results.
mizing condylar compression typically found in a more traditional design of the Herbst appliance.

The therapeutic mechanism, present in almost all the functional appliances, is most effective in the Herbst appliance because it is worn 24 h/day and independent from patient compliance. It can induce developmental modulation at the condylar cartilage, epigenetic remodeling of the ramus and corpus and osteogenic deposition that...

Il trattamento delle malocclusioni di II Classe può essere effettuato con successo mediante l’apparecchio di Herbst stabilizzato con splints acrilici. Usando questo tipo di stabilizzazione è sempre presente un morso aperto posteriore quando l’apparecchio viene rimosso. Vengono presentati due casi per illustrare come sia possibile gestire la fase di trattamento post-Herbst in pazienti con differenti pattern di crescita al fine di ottenere i migliori risultati funzionali ed estetici.

Key words: Herbst appliance, Class II malocclusion, Vertical growth pattern.
1. Obtain a symmetrical Class I occlusion without extractions;
2. Improve facial appearance by stimulating mandibular growth;
3. Avoid any extrusion of the posterior teeth of the mandible and reposi-
can result in an increase in the ramus height.
Moreover the flat splints (sometimes in conjunction with a rapid palatal expander) reduce occlusal interferences and disable the inherent proprioceptive coupling of the maxillary and mandibular dentition.
From a clinical perspective this design of the Herbst appliance induces a posterior open bite due both to the bite-block effect of the splints on the posterior dentition and to the vertical changes of the condyle and of the ramus. This open bite can be successfully used inducing its closure differently in relation to different goals that the clinician want to achieve in different growth patterns.
Two case reports are presented to illustrate how it is possible to manage the post-Herbst phase in different types of growth pattern in order to obtain the best aesthetical and functional results.

Case reports

Case 1
Diagnosis and treatment plan
A 12-years old female presented with the chief complaint of protrusive upper incisors and difficulty in closing her lips. Clinical examination revealed a convex, retrognathic profile, lip incompetence at rest and protrusion of the upper lip.
The patient had a Class II, division 1 malocclusion with an overjet of 11 mm and an overbite of 3 mm. She was in the permanent dentition with an accentuated curve of Spee and a narrow upper arch (Figs. 2 a-f).
Cephalometric analysis (Fig. 3) revealed retrusion of the mandible (SNPg 70,5°) with a skeletal Class II (ANPg 5,1°).
Vertical parameters showed a hyperdivergent pattern of growth (SN/Go-Gn 38,9°, Ans-Pns/Go-Gn 29,3°).
The upper and lower incisors were mildly protruded (1/Ans-Pns 117,7°, 1/Go-Gn 101,7°).
Treatment objectives were to:

1. Obtain a symmetrical Class I occlusion without extractions;
2. Improve facial appearance by stimulating mandibular growth;
3. Avoid any extrusion of the posterior teeth of the mandible and reposi-

Le traitement des malocclusions de la classe II peut être réalisé avec succès par l’appareil de Herbst stabilisé avec splints acryliques. Utilisant ce genre de stabilisation un overbite postérieur est toujours présente quand on enlève l’appareil. Deux cas cliniques ont été présentés pour illustrer comment il est possible de manager la phase suivante à l’Herbst dans différents types de croissance afin d’obtenir les meilleurs résultats esthétiques et fonctionnels.

Traduit par Maria Giacinta Paolone
Treatment progress

The first phase of treatment (9 months) involved the use of an acrylic splint Herbst appliance. The splints were not cemented due to the possibility of maintaining good oral hygiene and to perfect retention of the appliance due to the permanent dentition. Moreover, the appliance was well tolerated during meals and was never found any compliance problem. The appliance was removed only for oral hygiene. The construction bite was made with the lower jaw protruded until the incisors were edge to edge and then lowered to obtain a molar clearance of 4-5 mm. The acrylic splints were designed and built for even distribution of occlusal contacts (Figs 4 a-c). After nine months the sagittal correction was achieved and the patient presented with a posterior open bite of 3-4 mm (Figs 5 a-c). The anchorage of the Herbst appliance inhibits the dental eruption and spontaneous interocclusal setting that would normally occur. Therefore, a posterior open bite is usually present when the acrylic splints are removed. The Herbst appliance was removed and upper arch was fully bonded (.022 slot MBT prescription) and a .016 NiTi archwire was applied. The patient was instructed to wear the lower splint full time included during the meals in order to avoid the posterior shifting of the lower jaw reaching the maximum intercuspation (Figs 6 a-c). Archwire sequence of the upper arch was .016 NiTi - .019 x .025 NiTi - .019 x .025 SS. After six months the posterior open bite was closed by counterclockwise rotation of the lower jaw and the lo-

El tratamiento de la maloclusión Clase II, puede ser realizado con éxito con el aparato de Herbst estabilizado con férrulas de acrílico. El uso de este tipo de estabilización crea una mordida abierta posterior, aun cuando se retira el aparato.
Se muestran dos casos donde se ilustra cómo es posible gestionar la etapa posterior a la fase de Herbst en diferentes tipos de patrón de crecimiento, con el fin de obtener los mejores resultados estéticos y funcionales.

Traducido por Santiago Isaza Penco
The Herbst splint was discontinued (Figs 7 a-c). At this time the lower arch was fully bonded for final alignment and coordination with the upper arch. After 22 months of treatment the patient was debonded. Two essix full coverage retainers were fitted to be worn nighttime.

Treatment results
The patient’s facial appearance improved even though lip incompetence at rest was still present. Patient and her parents were totally satisfied with the result. A full Class I cuspid and molar relationship were achieved (Figs 8 a-f).

Cephalometric analysis (Fig. 9) revealed a normalization of the sagittal discrepancy (ANPg 2.8°) with control of clockwise mandibular rotation (SN/Go-Gn 38.9°, Ans-Pns/Go-Gn 26.4°). The inclination of the palatal plane increased (SN/Ans-Pns from 9.6°...
Lower incisors were mildly proclined (1/Go-Gn from 101.7° to 109.5°) as expected in all the kinds of Herbst stabilization.\textsuperscript{11,51,52}

Case 2
Diagnosis and treatment plan
A 12 years old female presented with the chief complaint of crowding of upper front teeth with upper malocclusion with an overjet of 6.3 mm and an overbite of 4.6 mm. She was in permanent dentition with no crowding in the lower arch and an accentuated curve of Spee due to the infraocclusion of the posterior teeth of the lower arch (Figs 10 a-f). Cephalometric analysis (Fig. 11) revealed a dental Class II malocclusion with no skeletal discrepancies in the sagittal plane (SNA to 12.5°) probably due to the intrusion forces produced by the telescope mechanism on the posterior segment of the upper dentition. The ramus height also increased (from 39.1 mm to 40.2 mm) in agreement with the theories of condylar displacement and growth.

left cuspid out of the arch. Clinical examination revealed a convex, mild retrognathic profile with a well pronounced labiomental fold. The angle between submandibular plane and prethyroid plane (cervical angle) was accentuated. The patient had a Class II, division 1
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Vertical parameters showed a brachyfacial pattern of growth (SN/Go-Gn 26°, Ans-Pns/Go-Gn 17°). Lower incisors were mildly proclined (1/Go-Gn 110°). Treatment objectives were to:
1. Obtain a symmetrical Class I occlusion without extractions;
2. Improve facial appearance unrolling lower lip and creating a more pleasant cervical angle;
3. Allow the extrusion of the posterior lower teeth to correct the curve of Spee and to improve the overbite increasing the posterior vertical dimension.

Treatment progress
The first phase of treatment involved the use of an acrylic Herbst appliance similar to case one both for the construction and the clinical management (Figs 12 a-c). After nine months the sagittal correction was achieved and the patient showed a posterior open bite of 3-4 mm. The Herbst appliance was removed and upper arch was fully bonded (.022 slot MBT prescription) and a .016 Ni-Ti archwire was applied (Figs 13 a-c). Contacts were present between left and right second molars, so in the next appointment it was possible bond all the lower arch to enhance the eruption of the lower posterior teeth increasing posterior vertical dimension (Figs 14 a-c). Archwire sequence of the upper and lower arches was .016 NiTi -.019 x .025 NiTi -.019 x .025 SS. The final phase of treatment involved the use of upper and lower SS .016 archwires and intermaxillary elastics from upper second bicuspid to lower second molar to obtain optimal intercuspation between upper second bicuspid and the embrasure between lower second bicuspid and lower first molar (Figs 15 a-c). Total treatment time was 24 months. Two essix full coverage retainer was applied to be worn nighttime.

Treatment result
The patient’s facial appearance improved not only for the normalization of the labio-mental fold but also for the reduction of the cervical angle. A full Class I cuspid and molar relationship was achieved (Figs 16 a-f). Cephalometric analysis (Fig. 17) revealed no significant variations in the sagittal parameters. Also in this case the palatal plane tilted backward and upward (SN/Pns-Ans from 9,1° to 10,8°) and the ramus height increased from 43,3 mm to 46 mm.

Figs 12 a-c  Splint Herbst appliance at the day of insertion.

Figs 13 a-c  The posterior open bite present when the Herbst appliance was removed. The upper arch was fully bonded.

Figs 14 a-c  Upper and lower arches bonded.
Lower incisors were proclined from $110^\circ$ to $116^\circ$.

Discussion

The Herbst appliance, stabilized with acrylic splints according to the McNamara design, is easy to construct, not expensive and well tolerated by the patients. The frequency of complications and the breakages of this kind of appliance are very rare when not absolutely absent. Laboratory and chair time are reduced. For all these reasons in an orthodontic practice the management of this kind of appliance is never critical.

Moreover if the appliance is not cemented the oral hygiene is well maintained. At this stage an important key point is to induce in the patient a strong motivation to wear the appliance 24 hours per day meals included. The patient can remove the appliance only for oral hygiene. If the clinician is not sure of the patient cooperation, the appliance must be cemented. The use of the Herbst appliance stabilized with acrylic splints in different growth pattern Class II pa-
tients, induce always the same occlusal aspect at the end of Herbst phase: a posterior open bite.

The next phase of treatment (posterior open bite management) can be modulated by the clinician in order to obtain better aesthetic and clinical results.

In the hyperdivergent growth pattern the main goals are to reduce or better to control the vertical dimension and to induce a counterclockwise rotation of the mandible with an increase in the projection of the chin on the sagittal plane. In these cases the proclination of the upper incisors and/or the intrusion of the lower incisors confirm that the clinician can manage to obtain optimal results in patients with different types of growth.

Unfortunately it appears to be impossible to avoid the proclination of the lower incisors confirming the difficulty to manage the incisors inclination with all types of Herbst stabilization.\(^{1,11,51,52}\)

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