

# Herbst and Extractions of Two Lower Premolars to Correct a Second Class Patient with Thin Gingival Biotype

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## Abstract

Herbst appliance is considered one of the most efficient devices for class II correction, but in cases of patients with thin gingival biotype biomechanics that avoid adverse effects on periodontal health are required. This case shows the use of Herbst combined with extractions of two lower premolars, obtaining mandibular advancement, aesthetic improvement of the profile and reducing the risk of developing gingival recession.

## Introduction

Class II malocclusions represent 20% to 30% of all the orthodontic problems and have always been a challenge for the orthodontist. This type of malocclusion can have skeletal or dental origin or can be produced by both of these conditions, even though Class II is mainly associated with mandibular retrusion [1,2]. The goal of the orthodontic treatment for these patients is to obtain the reduction of mandibular retrusion in order to achieve a correct relationship between mandibular and maxillary bone and teeth and the consequent modification of soft tissues [1,3]. Class II correction can be obtained by the use of both devices producing pulling inter-arch forces, such as inter-maxillary elastics, and devices producing pushing inter-arch forces, such as bite-jumping devices [4]. Among these devices, functional appliances are widely used: they have the purpose of stimulating the growth of the jaws in a favorable direction and correct or decrease the discrepancies [5,6]. The Herbst appliance is one of the oldest devices producing pushing inter-arch forces and it is efficient in determining a significant and stable mandibular advancement [3,5,7-13]. The success of this appliance is due to the fact that patient compliance is not required as it is fixed: this appliance works continuously, as well as having short treatment time (6-8 months) [14-16]. Literature describes it as a reliable fixed functional appliance with a high level of acceptance and its skeletal effects are desired in order to achieve a full functional and aesthetic therapeutic goal [6,17-19]. The main reported enhancements are mandibular sagittal growth, anterior displacement of the mandibular arch, reduction of maxillary sagittal growth, posterior displacement of maxillary arch and temporomandibular joint remodeling [15,20,21]. However, the Herbst appliance may be associated to some undesired dental effects due to anchorage loss, such as the flaring of lower incisors or the palatal inclination of the upper incisors. As a result, part of the overjet would be occupied by dental inclination and the potential for mandibular advancement would partly remain unexploited [22,23]. Several modifications of Herbst have been proposed in order to improve the anchorage, including the metal or acrylic splinted version: the purpose is to contrast the proclination of the lower incisors [15,24,25].

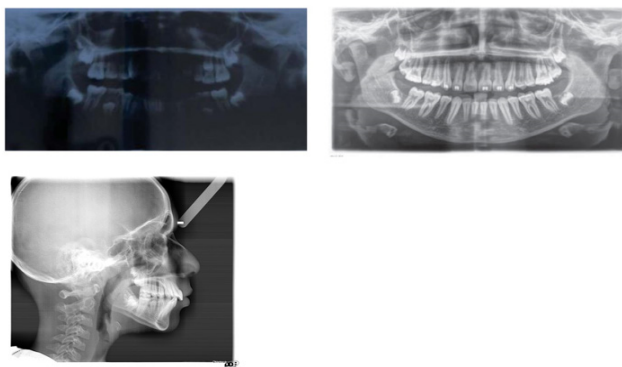
The use of Herbst requires particular attention in some specific cases: in case of lower crowding and thin gingival biotype, the proclination of lower incisors consequent to the anchorage loss could produce gingival recessions. Furthermore, in cases of reduced overjet it is undesirable to procline lower incisors: this would reduce the overjet, lower incisors would contact with the upper ones and the mandibular advancement would be reduced or blocked. In these cases, an unconventional approach is to carry out extractions of lower premolars in order to solve the anterior crowding, avoid the recessions in case of thin gingival biotype and create sagittal space between the upper and lower incisors: this space will be occupied by the mandibular advancement and that will correct the Class II [26]. The request for the orthodontic treatment is not only related to improving the dental and bone relationship but it is also increasingly focused on enhancing the profile aesthetics [27,28]. Herbst is also used in patients who need aesthetics improvement of the profile: skeletal class II patients usually have a rather convex profile due to excessive mandibular retrusion. Mandibular advancement and correction of Class II favors the reduction of facial convexity. The present case represents this unusual concept for Class II correction by means of two extractions in the lower arch, combined with the Herbst appliance in an adolescent patient.

## Diagnosis

A 10.5-year-old Caucasian male was referred for orthodontic correction. Clinical examination showed a convex profile, with the naso-labial angle within the normal limits, thin gingival biotype and there were no mandibular asymmetries. The dental relationship was molar Class I and canine Class II bilaterally. The maxillary arch showed some irregularity in the anterior segment; the lower arch had mild anterior crowding. Cephalometric analysis revealed a skeletal Class II malocclusion with retruded mandible, regular facial height and a slightly protruded inclination of maxillary and mandibular incisors. Over-jet was moderately increased while over-bite was within normal limits. The panoramic radiograph showed the presence of all the permanent teeth with regular interdental bone levels (Figure 1 & 2).



**Figure 1:** 10.5 year-old male patient with convex profile; retrusive mandible; mild anterior crowding; thin gingival biotype and canine Class II malocclusion before treatment.



**Figure 2:** Panoramic radiograph and teleroadiography taken before treatment and after debonding.

### Treatment Plan and Treatment Options

The treatment goals were to improve facial aesthetics, and to reduce the profile convexity, while converting the Class II canine relationship to a Class I canine position. The patient's retruded mandibular position and normal maxillary position influenced the treatment design to incorporate mechanics that would favor mandibular advancement. Class II camouflage through the extraction of upper premolars and maxillary dental compensation was avoided because the patient growth potential still allowed to achieve mandibular advancement, his naso-labial angle was within the normal limits and he exhibited minimal maxillary crowding. Instead, the treatment plan focused on improving maxillary and mandibular arch forms and enhancing mandibular advancement. Since the small preexisting overjet prevented adequate anterior repositioning of the mandible and all Class II mechanics could cause incisors proclination, lower first premolar extraction was planned to increase the overjet and allow greater anterior repositioning. Furthermore, it was necessary to avoid an excessive proclination of lower incisors and the risk of creating gingival recession due to the fact that the patient presented a thin gingival biotype. Bite-jumping appliances were taken into consideration to favor mandibular advancement, but they were avoided because they may be bulky, uncomfortable and they require collaboration. It was clear that facing teen age it would be preferred a non-compliant alternative.

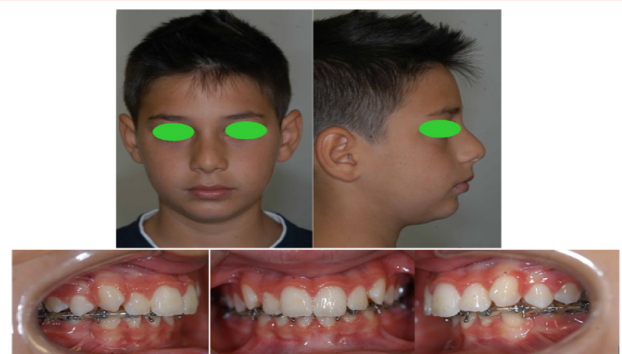
### Treatment Progress

Treatment initiated with rapid maxillary expansion by means of a Hyrax (Leone, Sesto Fiorentino, Italy; [www.leone.it](http://www.leone.it)) anchored on first molars and

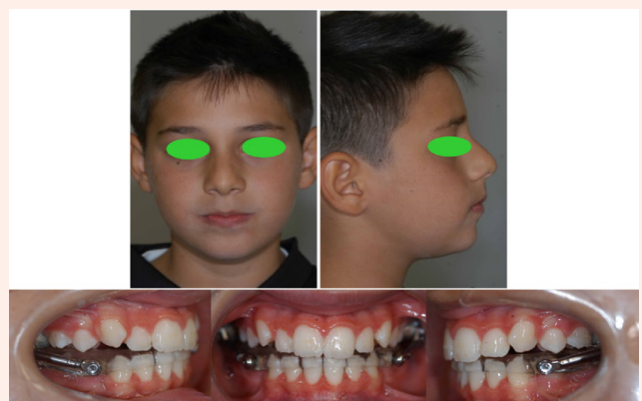
bonded on cuspid palatal surfaces. At the same time, straight-wire 0.22 x.028 brackets (Butterfly System, Trademark of American Orthodontics, Sheboygan, WI; [www.americanortho.com](http://www.americanortho.com)) were bonded in the lower arch (Figures 3-6). One month after maxillary expansion, the mandibular first bicusps were extracted. Eight months a complete cuspid Class II and a OJ increase was achieved, the blocked expansion appliance was removed, the lower arch, where space closure was accomplished, was debonded and Herbst appliance was fixed. The appliance was activated every two months (Figures 4 and 5). Eight months later the Herbst appliance was removed and an intermediate teleroadiograph was taken (Figure 6). Straight-wire brackets were bonded in both arches (Butterfly System, Trademark of American Orthodontics, Sheboygan, WI; [www.americanortho.com](http://www.americanortho.com)). Leveling and alignment was achieved by means of an initial 0.014 NiTi wire coupled with Class II elastics (2.5 ounces - 7.9 size mm 22 hours per day) progressing to rectangular stainless steel wires coupled with 6.5 ounces, 6.4 mm elastics (Figure 7). Elastics to improve intercuspation (6.5oz, 3.2mm) were used in the later phases of treatment 16 months later the arches were debonded. Once the treatment was completed, removable wraparound retainer in the upper arch and Hawley in the lower arch were delivered to stabilize the results.



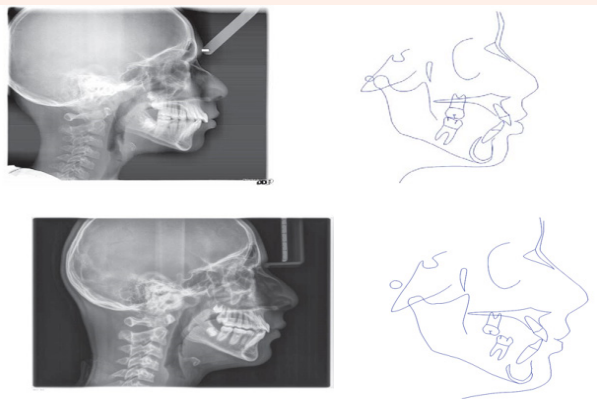
**Figure 3:** Rapid maxillary expansion by means of a Hyrax (Leone, Sesto Fiorentino, Italy; [www.leone.it](http://www.leone.it)) appliance and straight-wire 0.22 x.028 brackets (Butterfly System, Trademark of American Orthodontics, Sheboygan, WI; [www.americanortho.com](http://www.americanortho.com)) in the lower arch.



**Figure 4:** Hyrax appliance was removed.



**Figure 5:** Fixed Herbst appliance.



**Figure 6:** Intermediate telerradiograph after Herbst remotion.



**Figure 7:** Leveling and alignment with Straight-wire brackets and Class II elastics.

## Treatment Results

The active treatment time was 32 months (2 months for alignment and maxillary expansion, 6 months to close the extractive spaces, 8 months for Herbst appliance, 16 months to complete the therapy). The results obtained at the end of treatment were: balanced profile with a good harmony between upper and lower lips; aesthetic and pleasing smile; lip competence; Class I canine and a Class III molar relationship bilaterally. No muscle or joint problems developed. The cephalometric analysis showed the improvement of the sagittal jaw relationship. The facial height remained stable. There was a mild increase of the inclination of lower incisors due to low compliance in wearing Class II elastics, yet the value was still acceptable for the dental anterior limit and gingival biotype. The over-jet was corrected (**Table 1**). A panoramic radiograph taken before debonding showed acceptable root angulations, no evidence of root resorption and stable bone levels (**Figure 2**). The patient was satisfied with the overall aesthetics and treatment outcomes. One year after the end of treatment, the patient was recalled for follow up check and his facial appearance remained stable (**Figures 8-11**). No significative occlusal modification had occurred, and the archforms and alignment were maintained.

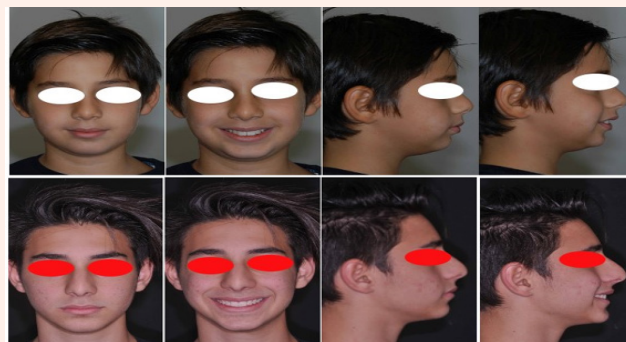


**Figure 8:** Patient after 33 months of treatment.



**Figure 9:** Patient one year after treatment.

**Figure 10:** Teleradiographs and cephalometric tracings before and after treatment.



**Figure 11:** Extraoral photos before and after the treatment.

**Table 1:** Cephalometric analysis.

	Male patient	
	T0	T1
SNA	81,0°	81,5°
SNB	76,0°	78,0°
ANB	5,0°	3,5°
Wits	4	-1
Overjet	4,6	2,0
U1/PP	113	112°
L1/MP	99°	105°

SN'GoGn	37°	35°
Ms-OLp	46	49
Mi-OLp	47,5	58
A-OLp	70	72
Pg-OLp	68,5	73
Co-OLp	3	3
Is-OLp	78	78
Ii-OLp	72	75

## Discussion

Class II camouflage through the extraction of upper premolars and maxillary dental compensation is a strategy often recalled when Class II are addressed, especially in adult patients, but it is not the first choice when a growth potential can be still exploited. However, it is often difficult to achieve a mandibular advancement with a fixed appliance without worsening lower incisors inclination. This case represents an original approach to class II correction overpassing the common perception of the inter-arch discrepancy. The malocclusion was addressed through two extractions in the lower arch, which allowed to control the dental inclination and maintained the OJ for mandibular advancement [28]. Class II dental compensation is manifested by the proclination of lower incisors: this condition reduces the dental discrepancy compared to the skeletal one, limits the activation of the appliances for mandibular advancement and does not allow the correction of the skeletal discrepancy [27]. In the present case a mandibular advancement of 4.5 mm was achieved. However, because of the lower incisors initial protrusion, the patient had 4.6 mm of anterior overjet and, in order to obtain a normal 2 mm anterior overjet it was possible to advance the mandible only 2.6 mm. considering that the functional appliance itself can worsen incisors proclination, the patients could benefit only from a marginal advancement. To address this problem, a control of lower incisor protrusion is mandatory in order to fully treat the skeletal discrepancy. In order to obtain a lingual uprighiting of the lower incisors it is necessary in some cases to perform extractions of lower premolars, especially when the patient presents thin gingival biotype: an increased overjet would be created which would promote the mandibular advancement [27]. Some authors doubted that extraction treatment could be clinically possible prior to class II treatment and they suggested to perform lower incisor uprighiting after the mandibular advancement treatment, just keeping a sufficient skeletal advancement of the mandible during the fixed appliance treatment [27]. In the present case, advancement and lower incisor uprighiting were achieved in one phase and the price for a better control on lower incisors proclination was worth the achieved pogonion advancement. Taking as a reference point the line perpendicular to the floor and passing through the apex of the nasolabial angle, a reduction of the distance between this line and the pogonion occurred with respect to the initial conditions: the reduction of facial convexity and aesthetics improvement of the profile was obtained at the end of the treatment (Figure 13).

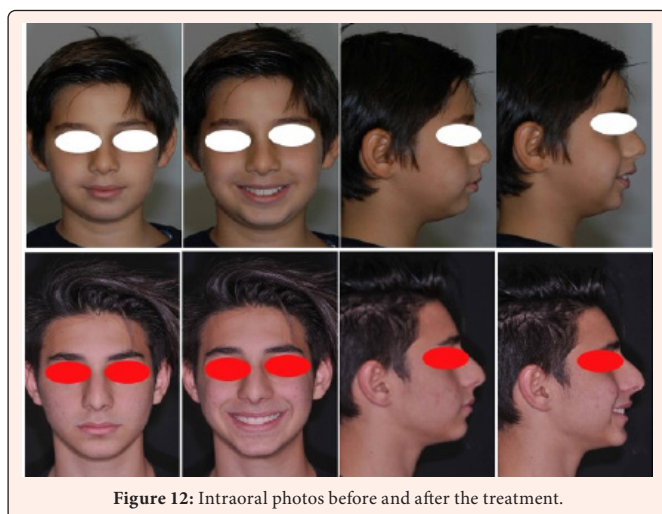


Figure 12: Intraoral photos before and after the treatment.



Figure 13: Profile before and after treatment: it is evident the pogonion advancement and the improvement of facial convexity with respect to the line perpendicular to the floor and passing through the apex of nasolabial angle.

## Conclusion

In cases of growing patients presenting skeletal class II, reduced overjet, thin gingival biotype and convex profile, a valid treatment option is the use of Herbst appliance and extractions of lower first premolars. This system allows pogonion and mandibular advancement and promotes aesthetic improvement of the profile. It also avoids the excessive proclination of lower incisors and reduces the risk of recessions.

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