ISSN: 2581-5989
PubMed - National Library of Medicine - ID: 101738774

*International Journal of Dental Science and Innovative Research (IJDSIR)*
*IJDSIR : Dental Publication Service*
*Available Online at:www.ijdsir.com*
*Volume – 4, Issue – 5, September - 2021, Page No. : 375 - 382*

# Effects of the Flip Lock Herbst Appliance on Facial Profile - A Soft Tissue Cephalometric Analysis.

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**Citation of this Article:** Dr. Sushmitha R. Iyer, Dr. Sridhar Premkumar, "Effects of the Flip Lock Herbst Appliance on Facial Profile - A Soft Tissue Cephalometric Analysis", IJDSIR- September - 2021, Vol. – 4, Issue - 5, P. No. 375 – 382.



**Type of Publication:** Case Report

**Conflicts of Interest:** Nil

## Abstract

**Introduction:** The objective of this preliminary study is to compare the pre and post treatment effects on soft tissue profile in class II patients after treatment with the Flip lock Herbst appliance.

**Materials and methods:** The study included 8 patients in their active growth period with class II division 1 malocclusion due to a retrognathic mandible treated with the Flip Lock Herbst appliance (single-step advancement protocol). Standardized lateral cephalograms were analyzed through a set of soft tissue cephalometric variables. Paired sample t-test was used to assess statistical significance. Statistical significance was set at $p < 0.05$.

**Results:** Statistical analysis revealed significant upper lip retrusion and an increase in upper and lower lip's thickness. Significant increase was also observed in the soft tissue vertical parameters. Additionally, straightening of the profile was also observed. Few remaining variables revealed no significant differences.

**Conclusions:** Significant soft tissue changes were noted after treatment with the Flip lock Herbst appliance.

**Keywords:** Flip lock Herbst appliance, Class II malocclusion, Soft tissue.

## Introduction

Orthodontic patients and parents are primarily motivated towards betterment of facial esthetics[1-3]. As predicted by Ackerman the 21st century has seen more emphasis placed on soft tissue function and esthetics[4]. The soft tissue drape is variable between different facial patterns[5] and it can mask or compensate the underlying skeletal problem[6].

Class II malocclusion due to retrognathic mandible is associated with convex profile and perioral soft tissue problems like lip incompetence . Functional appliances aim at correcting this imbalance and provide an optimum environment for enhancement of mandibular

growth.Correction of such dentofacial problems is routinely analysed with evidence of cephalometric skeletal variables. But, the relationship between hard tissue and soft tissue is too complex[7]. As a result many studies have shifted the focus on the soft tissue effects of functional appliances[8-11].

The Flip-Lock Herbst appliance(TP Orthodontics Inc.) is a fixed functional appliance, a variant of the Herbst appliance[12]. It has better patient tolerance with increased freedom for the mandible's lateral movements[12]. Several studies on the Herbst appliance have shown its effectiveness in correction of class II malocclusion[13-15]. There have been no studies on the effects of the flip lock Herbst on soft tissues. Therefore this study was undertaken to assess the effects of the Flip-Lock Herbst appliance on soft tissues.

**Materials and methods**

Lateral cephalograms from a previous project were utilised for this study[16]. Eight patients with class II division 1 malocclusion, who reported to one governmental dental college and hospital, were treated with the Flip-Lock Herbst appliance after obtaining ethical clearance from the Institutional Ethics Committee. The age of the subjects ranged from 12 to 15.8 years, with a mean of 13 years. All the patients were in active growing period as confirmed by Hand wrist radiographic examination.

**Appliance design and bite jumping**

The Flip-Lock Herbst appliance (TP Orthodontics Inc.) consists of two ball connectors, a tube, and a plunger on each side (Figure 1). Partial anchorage design in the upper arch and total anchorage in the lower arch had been followed on all patients.(Figure 2)

The functional treatment lasted for 6.1 to 10.3 months (7.9 months on average). The details of the patients are summarized in Table 1.

**Inclusion criteria**

1. Permanent dentition with class II division 1 malocclusion.
2. Overjet of 7–9 mm.
3. Patients in active growth period
4. Retrognathic mandible (SNB: 74–77°; Nasion perpendicular to Pogonion; Co-Gn).
5. Orthognathic maxilla (SNA: 82±2°; Point A to Nasion perpendicular; Co-A).
6. Average growth pattern.

**Exclusion criteria**

1. Proclined lower incisors (IMPA: >110°)
2. Prognathic maxilla
3. Upper and lower incisor crowding
4. Previous history of orthodontic treatment
5. Previous history of trauma
6. Systemic diseases
7. Periodontal disorders

**Records**

Lateral cephalograms of all patients were available at T1 (before the start of treatment) and T2 (after completion of functional therapy):

Table 1: Summary of details of patients treated for the study

| S.no | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Duration of treatment | 8 months | 8 months | 9 months | 7 months | 9 months | 7 months | 7 months | 8 months |
| Age | 12 years 4 months | 12 years 3 months | 15 years 1 month | 13 years 5 months | 13 years 9 months | 13 years 2 months | 12 years | 12 years 10 months |
| Sex | Female | Female | Male | Female | Male | Male | Female | Male |
| Hand wrist stage | Stage 4 | Stage 5 | Stage 5 | Stage 5 | Stage 4 | Stage 4 | Stage 4 | Stage 4 |

**Cephalometric analysis**

The lateral cephalograms were analyzed accordingto the method described by Kinzinger et al[17] by asingle blinded examiner. The analysis included a set oflinear (horizontal and vertical) and angular soft tissueand selected angular dentoalveolar measurements

(Table 1). Figure 3 shows a graphical representation ofthe measurements.

**Definition of the cephalometric landmarks and measurements**

Reference planes: FH - Frankfort horizontal, PP- Palatal plane , E-Line Esthetic line, and MP -mandibular plane

Soft tissue landmarks:

(Ls) most anterior point of the upper

(Li) lip most anterior point of the lower lip

(Sn) subnasale

(A') deepest concavity at the junction of

(B') soft tissue pogonion

(Me') soft tissue menton

(N') soft tissue nasion ,

(Pn) nose tip ,

(Pog') soft tissue pogonion

(Cm) columella ,

Dental landmarks

(U1) longitudinal axis of the upper central incisor

(L1) longitudinal axis of the lower central incisor

**Statistical analysis**

The results of normality tests Kolmogorov-Smirnov and Shapiro-Wilks revealed that the variables followed a normal distribution. Therefore, to analyze the data, parametric methods were applied. To compare the mean values between pre-treatment and post-treatment periods, a paired-samples t-test was applied. To analyze the data, SPSS (IBM SPSS Statistics for Windows, version 22.0, Armonk, NY: IBM Corp. Released 2013) was used. The significance level was fixed at 5% ($\alpha = 0.05$).

Table 2 : Statistical analysis of soft tissue cephalometric variables

| Variables | T1 | | T2 | | P- Value |
|---|---|---|---|---|---|
| Soft tissue | Meaan | Sd | Mean | Sd | |
| Horizontal (mm) | | | | | |
| Pog'-sn on fh | 15.1 | 2.1909 | 11.388 | 2.6968 | 0.001 |
| Ls-e-line | 2.812 | 1.6686 | -0.863 | 2.2916 | 0.012 |

| | | | | | |
|---|---|---|---|---|---|
| Ls-sn on fh | 3.037 | 1.1376 | 2.02 | 0.9004 | 0.028 |
| Li-e-line | -1.1 | 2.801 | 0.663 | 1.4491 | 0.068 |
| Li-sn on fh | 4.637 | 1.6026 | 1.375 | 0.9347 | 0.012 |
| A-a' on pp | 16.638 | 2.1639 | 17.95 | 2.4024 | 0.005 |
| B-b' on mp | 11.1 | 1.7897 | 12.45 | 2.3367 | 0.003 |
| Pog-pog' on mp | 11.75 | 3.4189 | 12.425 | 2.4371 | 0.39 |
| Vertical (mm) | | | | | |
| Me'-fh | 88.962 | 11.955 | 92.463 | 11.6839 | 0.006 |
| Sn-fh | 24.563 | 5.2563 | 26.35 | 3.8053 | 0.007 |
| Ls-fh | 36.363 | 8.197 | 38.2 | 7.6364 | 0.013 |
| Li-fh | 53.25 | 8.4451 | 57.225 | 6.3283 | 0.049 |
| Ls-mp | 54.8 | 6.1015 | 57.563 | 5.7904 | 0.026 |
| Li-mp | 39.275 | 6.0265 | 42.762 | 5.589 | 0.003 |
| Sn-mp | 64.488 | 7.9451 | 67.413 | 7.6378 | 0.001 |
| Angular (°) | | | | | |
| N'-pn-pog' | 127.713 | 3.4048 | 133.0 | 4.7606 | 0.001 |
| N'-sn-pog' | 154.175 | 6.4276 | 159.913 | 6.0324 | 0.001 |
| Cm-sn-ls | 112.688 | 9.9679 | 120.088 | 5.3322 | 0.062 |
| Ii. Dentoalveolar | | | | | |
| U1/pp | 119.813 | 4.6178 | 112.775 | 3.3725 | 0.004 |
| L1/mp | 100.238 | 4.7229 | 104.875 | 6.6579 | 0.003 |

**Results**

The pre T1 and post treatment T2 results are tabulated in table 2. Statistically significant changes were observed for the Dento alveolar variables, p=0.004 for U1/PP and p=0.003 for L1/PP . Among the soft tissue measurements, all the vertical parameters showed significant increase after treatment reflecting the increase in lower anterior facial height.

Facial convexity was decreased as reflected by the angular values (N'-Pn-Pog') &(N'-Sn-Pog') ($p<0.001$). However there was a mild increase in Nasolabial angle Cm-Sn-Ls (p=0.062).

Among the horizontal measurements all values showed significant difference except soft tissue chin thickness (Pog-Pog' on MP) and lower lip position (Li-E-Line).

**Discussion**

Soft tissues vary considerably in thickness and are a major factor in determining a patient's final facial profile. Additionally there are differences in facial structures among various ethnicities[18-19]. Hence this study was carried out to evaluate the soft tissue changes occuring in south Indian patients with class II malocclusion treated with a functional appliance, the Flip lock Herbst.

The Herbst appliance is a fixed functional appliance with 24 hr action. Favourable results have been been documented with the Herbst appliance as reduction in facial convexity and upper lip retrusion[14]. The flip lock Herbst variant has demonstrated successful skeletal and dental correction in 60:40 ratio[16].The present study aimed to evaluate its effects on the soft tissues.

Overall favourable changes were noted. There was a 7° reduction in the upper incisor inclination (U1/PP). Lower incisors proclined by 4°. These changes are inevitable with functional appliances but kept to a minimum. Measurements of perioral soft tissue thickness of skeletal Class II Division 1 patients are affected by dental variables[5].The minimal dentoalveolar changes observed in the present study are presumed to contribute to improvement in facial soft tissues[20].

As a consequence to the upper anterior retroclination, the nasolabial angle also increased by 7°. Secondary to these changes, the Sn point also moved inferiorly (Sn-FH) backwards (Ls-Sn on FH). There was significant retrusion in upper lip position similar to other studies [8,9]. This is in accordance to the change in upper anterior inclination with treatment. There was also a concomitant increase in upper lip thickness by mm indicative of soft tissue changes occurring at the adolescent period[21].

Slight increase in soft tissue thicknesses at point A,B and Pog' were noted. This was observed in both sexes because the sample was based on developmental age and not chronological age.

Both lips moved backwards with respect to the estheticplane. As the E line shifts with chin point advancement the relative position of the lips change due. Hence the use of E line is controversial. However other measurements showed upper lip retrusion (Ls-Sn on FH). (Li-Sn on FH) values reduced due to a combination of backward movement of Sn and forward mandibular advancement carrying the Li point anteriorly. The results in lower lip are similar to morris et al [22]who showed advancement and lengthening of lower lip.

Soft tissue pogoniondisplacedanteriorly with respect to subnasale by 4mm . Soft tissue growth at pogonionwas 0.6mm and that leaves pog' displacement in the sagittal plane by 3.4mm.

Facial profiles of untreated class II subjects maintain their original configuration compared to profiles of treated patients that show a tendency for improvement[23] It has been documented that functional appliances decrease facial convexity[24]. The soft tissue profile changes was analysed by changes in the N'-Pn-Pog' and N'-Sn-Pog'values. There was a significant decrease in soft tissue convexity from 127° to 133°. Similar degree of change was also seen in a previous study[14], on facial profile change of adolescents and young adults.

The quality and quantity of soft tissue changes seen are directly related to patient co-operation[22]. The Flip lock with its fixed mode of delivery is not dependant on patient co operation. However there was inter individual variation and more pronounced effects seen in the mandibular measurements similar to a previous study[20].

Functional therapy typically increases the lower anterior facial dimensions[25,26]. In the present study the soft tissue menton moved vertically by 3.5 mm. Upto 6.1 mm increase in LAFH has been demonstrated[25]. Other

studies have also demonstrated increase in vertical values with functional treatment [22].

The soft tissue variables showed inter individual variation despite strict inclusion criteria. The present study included only patients with orthognathic maxilla, retrognathic mandible and average growth pattern. According to Lee et al, perioral soft tissue characteristics of skeletal Class II Division 1 subjects show significant differences in accordance to sagittal and vertical skeletal patterns and are influenced by sagittal positions and inclination of the incisors along with facial depth and facial length[5]. These variations were similar to the findings in an other study[20] and can be explained due to differential nature of class II correction in each individual.

**Limitations:**

Sample size is small being a preliminary study. Not enough sample to distinguish sexual dimorphism. However all subjects were in similar stage of chronolgical development and individual data showed interindividual differences in nature of skeletal and soft tissue correction.

**Conclusion**

Functional treatment with the Flip lock Herbst appliance in growing adolescents demonstrated significant soft tissue cephalometric changes with more significant changes in the vertical dimension.

**References**


1. Dimberg L, Arnrup K, Bondemark L. The impact of malocclusion on the quality of life among children and adolescents: a systematic review of quantitative studies. Eur J Orthod. 2015;37(3):238-4
2. McComb JL, Wright JL, Fox NA, O'Brien KD. Perceptions of the risks and benefits of orthodontic treatment. Community Dent health. 1996;13(3):133-8
3. Vig KW, Weyant R, O'Brien K, Bennett E. Developing outcome measuresin orthodontics that reflect patient and provider values. Semin Orthod. 1999;2(5):85-95
4. Ackerman JL, Proffit WR, Sarver DM. The emerging soft tissue paradigm in orthodontic diagnosis and treatment planning. Clin. orthod. Res. 1999;2(2):49-52
5. Lee YJ, Park JT, Cha JY. Perioral soft tissue evaluation of skeletal Class II Division 1: A lateral cephalometric study. Am J Orthod Dentofacial Orthop. 2015;148(3):405-13
6. Ghafari JG, Macari AT. Component analysis of Class II, Division 1 discloses limitations for transfer to Class I phenotype.. Semin Orthod. 2014;4(20):253-27
7. Battagel JM. The relationship between hard and soft tissue changes following treatment of Class II division 1 malocclusions using Edgewise and Fränkel appliance techniques.Eur J Orthod. 1990;12(2):154-65
8. Baysal A, Uysal T. Soft tissue effects of Twin Block and Herbst appliances in patients with Class II division 1 mandibular retrognathy.Eur J Orthod. 2013;35(1):71-81
9. Quintão C, Helena I, Brunharo VP, Menezes RC, Almeida MA. Soft tissue facial profile changes following functional appliance therapy.Eur J Orthod. 2006;28(1):35-41.
10. Varlık SK, Gültan A, Tümer N. Comparison of the effects of Twin Block and activator treatment on the soft tissue profile. Eur J Orthod. 2008;30(2):128-34.
11. Hourfar J, Lisson JA, Gross U, Frye L, Kinzinger GS. Soft tissue profile changes after Functional Mandibular Advancer or Herbst appliance treatment

in class II patients. Clin Oral Investig.2018 ;22(2):971-80.

12. Miller RA. The flip-lock Herbst appliance. J Clin Orthod: JCO. 1996;30(10):552-8
13. do Rego MV, Martinez EF, Coelho RM, Leal LM, Thiesen G. Perception of changes in soft-tissue profile after Herbst appliance treatment of Class II Division 1 malocclusion.Am J Orthod Dentofacial Orthop.2017;151(3):559-64.
14. Pancherz H, Anehus-Pancherz M. Facial profile changes during and after Herbst appliance treatment. Eur J Orthod. 1994;16(4):275-86
15. Ruf S, Pancherz H. Dentoskeletal effects and facial profile changes in young adults treated with the Herbst appliance. Angle Orthod. 1999 ;69(3):239-46.
16. Iyer SR, Premkumar S, Muruganandam M. Skeletal and dental changes induced by the Flip-Lock Herbst appliance in the treatment of Angle's class II division 1 malocclusion during active growth period: A preliminary study. J. Dent. Res. Dent. Clin. Dent. Prospects. 2021;15(1):59
17. Kinzinger G, Frye L, Diedrich P. Class II treatment in adults: comparing camouflage orthodontics, dentofacial orthopedics and orthognathic surgery–a cephalometric study to evaluate various therapeutic effects. J Orofac Orthop. 2009;70(1):63-91
18. Fonseca RJ, Klein WD. A cephalometric evaluation of American Negro women. Am J Orthod. 1978;73(2):152-60.
19. Kalha AS, Latif A, Govardhan SN. Soft-tissue cephalometric norms in a South Indian ethnic population. Am J Orthod Dentofacial Orthop. 2008 Jun 1;133(6):876-81.
20. Martina S, Di Stefano ML, Paduano FP, Aiello D, Valletta R, Paduano S. Evaluation of profile changes in class II individuals treated by means of herbst miniscope appliance. Dentistry journal. 2020;8(1):27
21. Genecov JS, Sinclair PM, Dechow PC. Development of the nose and soft tissue profile. Angle Orthod. 1990;60(3):191-8
22. Morris DO, Illing HM, Lee RT. A prospective evaluation of Bass, Bionator and Twin Block appliances. Eur J Orthod. 1998;20(6):663-84
23. Moore AW. Orthodontic treatment factors in Class II malocclusion. Am J Orthod.1959;45(5):323-52.
24. Idris G, Hajeer MY, Al-Jundi A. Soft-and hard-tissue changes following treatment of Class II division 1 malocclusion with Activator versus Trainer: a randomized controlled trial. Eur J Orthod. 2019;41(1):21-8
25. Lee RT, Barnes E, DiBiase A, Govender R, Qureshi U. An extended period of functional appliance therapy: a controlled clinical trial comparing the Twin Block and Dynamax appliances.Eur J Orthod. 2014;36(5):512-21
26. Yıldırım E, Karaçay Ş, Tekin D. Three-Dimensional Evaluation of Soft Tissue Changes after Functional Therapy. Scanning. 2021;2021

**Figures and legends**

Figure 1: The Flip-Lock Herbst appliance (TP Orthodontics Inc.) consists of two ball connectors, a tube, and a plunger on each side

Figure A

Figure B

Figure 2: Partial anchorage design in the upper arch and total anchorage in the lower arch.

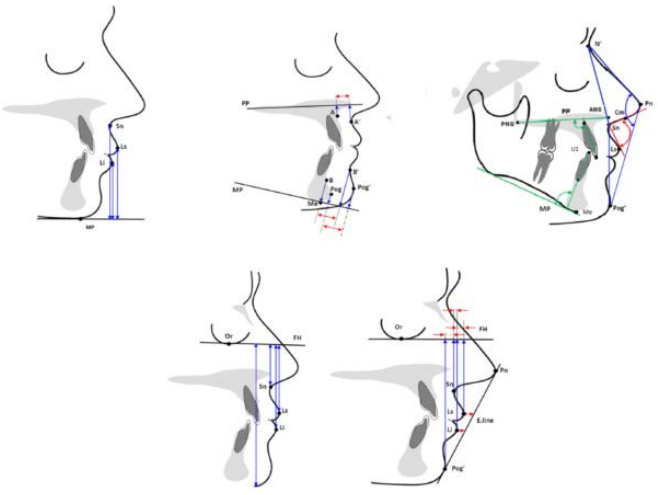

Figure 3: Linear (horizontal and vertical) and angular soft tissue and selected angular dentoalveolar measurements. Graphical representation of the measurements as described by Kinzinger et al [17].