Herbst appliance treatment: what we have learned

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Does Class II malocclusion deserve “Early treatment”?

Class II vs. Early treatment

Dentoskeletal effects

“Early treatment should not be thought of as an effective and efficient way to treat most Class II children.”

“The decision for Class II early treatment should be based on special indications for each child.”

Psychosocial effects

Special indications for Class II Early treatment

“Early orthodontic treatment for Class II/1 malocclusion results in higher self-concept scores and fewer negative social experiences.”

O’Brien et al., 2003

Special indications for Class II Early treatment

Risk of traumatic injury

Pre-treatment

Post-treatment with Headgear
Class II vs. Early treatment
Risk of traumatic injury

“Providing early orthodontic treatment for children with prominent upper front teeth is more effective in reducing the incidence of incisal trauma than providing one course of orthodontic treatment when the child is in the early adolescence.”
Thiruvenkatachari et al., 2014

Class II vs. Early treatment
Risk of traumatic injury

• Overjet ≥5mm

But, when would be the ideal timing to treat skeletal Class II ????

Conclusions
Taking into account the limited quality and heterogeneity of the included studies, functional treatment by removable appliances may be effective in treating Class II malocclusion with clinically relevant skeletal effects if performed during the pubertal growth phase.

Conclusions: Fixed functional treatment is effective in treating Class II malocclusion with skeletal effects when performed during the pubertal growth phase.
Class II dentofacial orthopedics
Ideal timing

Class II vs. Early treatment
Summary

Class II vs. Early treatment
Summary

One-phase Class II treatment associated with fixed appliance

One-phase Class II treatment associated with fixed appliance

Advantages
1. Effectiveness: >2 mm mandibular growth
2. Efficiency: Shorter total duration
3. Stability: Ideal intercuspation
How to treat effectively skeletal Class II malocclusion??

- Facial convexity is not bad
- No psychosocial problems
- Risk of trauma is not too big
- Extensive growth potential forecast

What if the facial convexity is TOO big, the compliance is TOO small, or the residual growth phase is NOT too long??
Emil Herbst’s original appliance (1910)

The Herbst appliance is the most frequently used mandibular advancement device in the USA

Retrusion of the mandible is the most commonly occurring factor contributing to skeletal Class II malocclusion

Skeletal Class II malocclusion
Mandibular deficiency

Herbst appliance

Class II malocclusion
Herbst appliance

von Bremen, Pancherz, Ruf, 2007
Silva et al, 2015

McNamara Jr., 1981
Buschang & Martins, 1998
Pancherz & Ruf, 2008

Renfroe, 1948
McNamara Jr., 1981
Buichong & Martins, 1998
Pancherz & Ruf, 2008

Emil Herbst’s original appliance (1910)
Herbst appliance
Immediate benefits

Benefits of Herbst appliance

• Expedite improvement of the **self-esteem**
• Reduce the **risk of incisor trauma**
• Less reliance on **patient compliance**
• Shorter **treatment duration**

Herbst appliance treatment effects
3D assessment study

Patients & Methods

Skeletal Class II patients (n=50)
Pubertal stage (CS3 – CS4)
Ethics approval from IRB

Patients & Methods

Sampling design

Herbst group

Patients & Methods

Herbst group

One-step full activation
Patients & Methods
Comparison group

Previous alignment and leveling

Patients & Methods
Comparison group

Marsupialization of cysts

Patients & Methods
Comparison group

Maxillary impacted canines

Patients & Methods
Herbst appliance design

What we have learned

Image analysis
3D virtual models
What we have learned about

a) Mandibular displacement
b) Condylar growth
c) Condylar displacement
d) Glenoid fossa remodeling
e) Dentoalveolar changes
f) Maxillary adaptations

Mandibular displacement

Facial balance improvement

Pre-treatment
Herbst insertion
2 months
6 months
Herbst removal
8 months of tx.

Pre-treatment
Herbst insertion
Herbst removal
**Mandibular forward displacement vs. Facial improvement**

T0  
T2

8 mos. Herbst appliance

**Diego – 16 y**

**Diego’s CBCT scans superimposition**

*Relative to the cranial base*

T0  
T1  
T2

10mm initial advancement after Herbst insertion

Mandible moved back 6mm during Herbst treatment

4mm effective mandibular advancement

T0 – Pre-treatment
T1 – Immediately after Herbst insertion
T2 – After 8 mos. Herbst treatment

**Mandibular displacement**

*Superimposition at the cranial base*

Herbst group

Comparison group

**Take home message**

- Mean 63% of rebound during Herbst treatment (range 47% - 75%).
- 1.7 mm of effective mandibular forward displacement (5 mm of Herbst advancement).
- Herbst appliance treatment improved the patient’s profile (short-term evaluation).
**Condylar growth**

**Regional Mandibular Superimposition**

**Herbst group**
- 1.9 mm - backward
- 2.5 mm - upward

**Comparison group**
- 0.7 mm - backward
- 1.6 mm - upward

**Herbst vs. Comparison**
- + 1.2 mm (2x more) - backward
- + 0.9 mm (0.5x more) - upward

**Take home message**
- Effective backward condylar growth (1.2 mm).
- Change in the direction of condylar growth.
Where is condyle positioned after Herbst treatment?!

3D superimposition at the glenoid fossa

\[ X (RL) = 0.01 \text{ mm} \]
\[ Y (AP) = 0.06 \text{ mm} \]
\[ Z (IS) = 0.11 \text{ mm} \]
\[ 3D = 0.07 \text{ mm} \]

Condylar displacement
Condyle–Glenoid fossa relationship after Herbst removal

Regardless how much the condyle is moved forward and downward, it returned to its original relationship with the glenoid fossa.

Glenoid fossa remodeling

Herbst vs. Comparison groups

Pre-treatment | Immediately after Herbst insertion | 8 months after Herbst insertion

Comparison group

Baseline | 10 months after
Bone remodeling developed at the articulating surface of the glenoid fossa of Herbst patients. At this point it is not possible to determine that 8 months of Herbst treatment is sufficient to produce a stable new bone in the glenoid fossa.

Dentoalveolar changes

- Significant lower incisor proclination: Mean 7.3 degrees (up to 21 degrees)
- Variable, but mostly small, upper incisor uprighting
- Maxillary molar: 1.4 mm backward, 0.4 mm upward (but maxilla moved 0.9 downward)
- Mandibular molar: 1.1 mm forward, 0.6 mm upward

Maxillary changes

- No significant skeletal SAGITAL and VERTICAL changes were observed.
- Essentially dentoalveolar movements (Headgear effect).