International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2022): 7.942

Herbst Appliance: A Non-compliant Skeletal Class II Corrector

Kareena Reynold[1], Binnoy Kurian[2], Vidya S L[3]

Post Graduate, Department of Orthodontics and Dentofacial Orthopaedics, St Gregorios Dental College, Kothamangalam, 686681, India
Email Address: *kareena.kafeel[at]gmail.com*

Affiliation- Professor and Head of Department, Department of Orthodontics and Dentofacial Orthopaedics, St Gregorios Dental College, Kothamangalam, 686681, India
Email Address: *drbinnoy[at]gmail.com*

Affiliation- Post Graduate, Department of Orthodontics and Dentofacial Orthopaedics, St Gregorios Dental College, Kothamangalam, 686681, India
Email Address: *vidyasl1996[at]gmail.com*

Abstract: ***The most frequently reported sagittal malocclusion is skeletal Class II with retrusive mandible. Improving the patient's profile and correcting the occlusion by positioning the mandible forward is the treatment main objective. Functional orthopedic treatment seeks to correct malocclusions and oro-facial function. One main disadvantage of removable functional appliance is patient compliance. Thus evolved the "noncompliant functional appliances". Herbst is a fixed functional appliance which does not require patient cooperation and does not interfere in speech or mastication. This article reviews about the Herbst appliance design, duration of treatment, effects, modification, advantages and disadvantages of appliance.***

Keywords: Herbst appliance, class II malocclusion, sagittal malocclusion, fixed functional appliance

1. Introduction

A number of orthodontic appliances, both fixed and removable, have been advocated for the correction of sagittal discrepancies between the dental arches and/or their bony bases. The most frequently reported is skeletal Class II malocclusion with retrusive mandible, for which a wide variety of treatment modalities have been developed[1]. Improving a patient's facial profile and correcting the occlusion by positioning the mandible forward is the main objective in correction of a growing skeletal class II malocclusion. Harmonizing the shape of the dental arch and oro-facial function is generally corrected with the help of a functional orthopedic treatment. One main disadvantage of removable functional appliance is patient compliance. They are generally bulky, causes discomfort, have unstable fixation, lacks tactile sensibility, exerts mucous pressure (encouraging gingivitis), space for the tongue gets reduced, deglutition and speech difficulties and often affects esthetics. The acceptance and adaption of these appliances becomes very difficult due to these adverse effects. Thus evolved the "noncompliant functional appliances".

These non-complaint appliances have the following advantages[2].

1) Beneficial effects in patients who have passed the maximal pubertal growth and have limited growth potential.
2) Treatment can be completed within 6 to 8 months using residual growth.
3) It is useful in treating uncooperative patients and in mouth breathers with nasal airway obstruction.
4) Indicated in patients whose optimal threshold for adaptive growth changes is not reached with a part time wear of removable functional appliances.

Fixed functional appliances are designed to be used 24 hours a day, which means that there is a continuous stimulus for mandibular growth. The advantage of being smaller in size permits better adaptation to several functions such as a swallowing, mastication, breathing and speech.

2. Literature Survey

Orthopedic effect according to Duterloo is defined as change in the position of bones in the skull in relation to each other induced by therapy. According to Issacson, orthopedic appliances provide a new muscular and functional environment for the facial bones that encourages growth changes in either the mandible or maxilla. Theories on bone plasticity may be traced to Wolff and Roux who believed that form and function were intimately related. Roux in 1883 reported the results of studies he performed on the tail fins of Dolphins. He described the characteristics of functional stimuli as they build, mold, remold and preserve tissue. Changes in the functional stress produced changes in the internal bone architecture and external shape.

In 1880, Kingsley introduced the term and concept of Jumping the Bite for patients with mandibular retrusion. He inserted a vulcanite palatal plate consisting of an anterior incline that guided the mandible to a forward position when the patient closed on it. Hotz modified the Kingsley plate and called it Vorbissplatte.

Herbst appliance was originally introduced by "Emil Herbst" at the International Dental Congress in Berlin in 1905. In 1934, Herbst presented a series of articles in the ZAHNAZTUCHE RUNDSCHAU on his experience with the appliance[3]. In fact, the appliance was originally recommended for disorders of TMJ (Herbst 1934). Moreover, at that time Herbst did not have any age limit for the appliance. After 1934, very little was published on the subject of the treatment was forgotten.

The honor of having reintroduced the Herbst appliance goes to Hans Pancherz of Malmo, Sweden (1979). He called attention to the possibilities of stimulating mandibular growth by means of Herbst appliance. Using Herbst appliance, Pancherz (1979)[4] showed that class II malocclusions could be treated successfully in 6 months and that sagittal mandibular growth was increased by treatment. He also said that increased muscle activity is seen in Class II division 1 malocclusion patients treated with Herbst appliance.

Stainless steel crowns were recommended by Norris M. Langford (1982)[5] which are superior to banding, due to being resistant to breakage and becoming loose. Raymond P. Howe (1982)[6] suggested the use of bonded appliances which, can be used in younger patients where premolars have not yet erupted. Lennart Wieslander (1984)[7,8] introduced the use of headgear with the Herbst appliance in severe Class II malocclusions with maxillary protrusion and mandibular retrusion during the mixed dentition period of effective treatment.

Development of the Herbst Appliance

Originally, the telescoping parts of the Herbst appliance were curved conforming to the Curve of Spee. The later designs were, however, straight as they are today. Until 1934, telescopes of German silver were made by Herbst but in cases where the appliance had to be worn for a longer period of time, i.e., (more than 6 months), he had recommended the use of gold material. Bands or crowns/caps were used on the abutment teeth. The material was German silver or gold.

Basic design of the Herbst Appliance

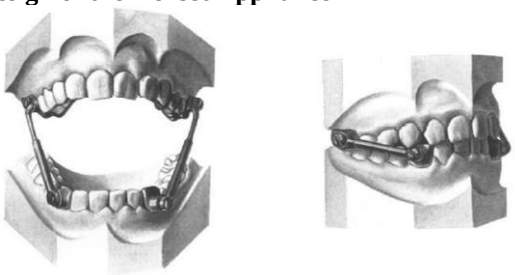

Figure 1: Herbst appliance

It can be compared with an artificial joint working between the maxilla and mandible. A bilateral telescope mechanism keeps the mandible in an anterior forced position during all mandibular functions such as speech, chewing, biting, and swallowing. The telescopic mechanism (tube and plunger) is an attachment to the orthodontic bands, splints or crowns. The plunger is positioned in the mandibular first premolar region and the tube is positioned in the maxillary first molar region. The telescopes when constructed properly allows lateral jaw movements and also mandibular opening and closing movements.

Many designs of the Herbst appliance have been developed over the last 20 years (Type I, II and IV). The original device is a banded Herbst design.

Type I- is characterized by a system in which screws are used to fix the crowns or bands which is the most common form. The axles will have to be welded to the bands or crowns and then fix the plungers and tubes with the screws.

Type II- has a fixing system in which with the help of screws, it fits directly on to the arch wires. This method of application can cause constant fractures in the arch wire though, which is a disadvantage. The difficulty in lateral movements together with lack of flexibility and the stress placed on the arch wires through activation can cause fractures, especially in the lower arch.

Type IV- has a fixation system that allows greater flexibility and freedom of mandibular movement due to the ball attachment. A disadvantage in comparison to other similar appliances is that brakes are required to stabilize the joint which are small and sometime difficult to fit. When a brake is lost or a fracture occurs, the appliance becomes loose.

Banded Herbst Design

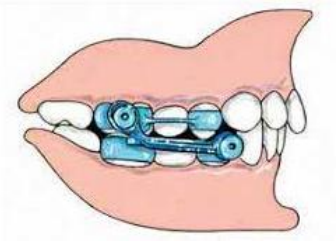

Figure 2: Banded Herbst appliance

Pancherz[4] modified the original Herbst design by using thick orthodontic bands (at least 0.15 mm) on the maxillary and mandibular first premolars and first molars. A lingual bar extended from the first premolar band to the first molar band on each side of the maxillary arch. In the mandible, a lingual archwire interconnected the first premolars. Axles or pivots were soldered to the buccal surface of maxillary first molar bands, so that screws could secure the tubes in place. The plungers were secured to the buccal surface of the mandibular first premolars in a similar fashion.

In 1981, the maxillary teeth were included in the appliance by placing brackets on these teeth. A labial archwire connected these brackets to the brackets on the upper first premolar bands. In the mandible, the lingual archwire was extended posteriorly to the molars, which also were banded. In 1983, the lower anteriors were included into anchorage by

bracketing them. A labial archwire was attached to the brackets and to tubes above the axels on the premolar bands.

The current banded version of the appliance incorporates additional anchorage units from the original design of Pancherz. When used in the permanent dentition, bands are placed on all first premolars and all first molars, and both buccal and lingual wires connect the premolar and molar bands.

Manufacturers recently have introduced thicker (.010") preformed bands, which add to the strength of the banded Herbst. These blank bands can be adapted and fitted in the laboratory directly on the working model. The advantage to the orthodontist is the elimination of an appointment to fit bands.

Stainless steel crown herbst design

Figure 3: Stainless steel crown Herbst appliance

A number of clinicians, including Langford,[5] Dischinger, have advocated the use of stainless-steel crowns as anchor units. The original design incorporated stainless steel crowns on the upper first molars to which were soldered the pivots that were used to secure the maxillary tubes of the Herbst bite-jumping mechanism. In the lower arch, one of two designs can be used. Both designs involving the placement of stainless-steel crowns on the lower first premolars. The Type II design incorporates bands on the lower first molars that are connected to the stainless-steel crowns and to each other by means of an .045" stainless steel lingual wire. Another type of stainless-steel crown Herbst, recommended by Dischinger[9], has been termed the cantilever Herbst, because of the mandibular extension arms that are anchored to stainless steel crowns on the lower first molars. As the crowns are only on the permanent molars, this type of appliance design has been advocated for use in patients in both the mixed and early permanent dentitions. Dischinger also advocates this appliance design because it minimizes the anterior vector of force transferred to the mandibular incisors by moving the force vector from the mandibular premolars to the first molars.

Cantilever Herbst Appliance

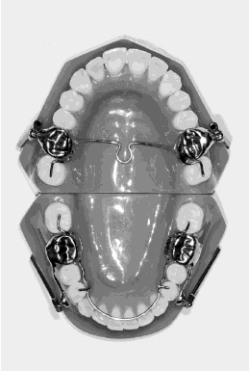

Figure 4: Cantilever Herbst appliance

The cantilever Herbst design incorporates stainless steel crowns on all upper and lower permanent first molars. The lower part of the appliance features heavy metal extension arms that are cantilevered off the lower first molars. These arms extend anteriorly lateral to the dentition and terminate in the first premolar region. The Herbst axle is soldered to the cantilever arm adjacent to the buccal surface of the lower first premolar. In addition, support wires in the shape of occlusal rests to the lower second deciduous molars or permanent second molars may be added for additional stabilization of the appliance.

ACRYLIC SPLINT HERBST APPLIANCE

Figure 5: Acrylic Splint Herbst appliance

Developed in the early 1980s by Howe[6], McNamara, and co-workers. As an alternative Herbst design for Class II correction, the acrylic splint Herbst is very effective, especially when combined with an upper expansion screw. The acrylic splint design also has been used as a removable appliance in the treatment of temporomandibular disorders and sleep disorders.

The acrylic splint Herbst appliance is composed of a wire framework, over which has been adapted 2.5-3.0 mm thick splint acrylic. In lateral view, the acrylic splints cover all of the lower teeth, except for the second molars. The design of the upper splint varies according to whether the splint is bonded or removable. If the splint is removable, the posterior teeth are covered from the canines through the first molars; if the maxillary splint is bonded, the labial surfaces of the canines are not covered with acrylic. The axles of the Herbst bite-jumping mechanism are soldered adjacent to the lower first premolars and the upper first molars.

The lower splint, which always is removable, is trimmed so that one third to one half of the labial surfaces of the lower

incisors are covered by the splint. This type of lower incisor coverage aids in the retention of the lower splint during treatment.

The lower splint has full occlusal coverage that extends from lower first molar to lower first molar. If second molars are present, occlusal rests are provided as well. The axles that connect the Herbst bite jumping mechanism to the splint are soldered to the base archwire at the mesial aspect of the lower first premolar before acrylic is added.

The Flip-Lock Herbst Appliance

Figure 6: Flip-Lock Herbst appliance

A new design, the Flip-Lock Herbst appliance[10], reduces the number of moving parts that can lead to breakage or failure. It has a ball-joint connector instead of a screw attachment, and it does not need retaining springs. The first-generation Flip-Lock Herbst was made from a dense polysulfone plastic, but this material did not prove strong or durable enough to withstand the forces generated within the ball-joint attachment. In the second generation, the metal had replaced plastic. However, fracture problems persisted. The third generation had used a horse-shoe ball joint. In terms of both application as well as its resistance to fracture, this system proved to be more efficient than the previous models. A strong, heat-tempered stainless steel that resists brittle fracture is now used. The diameter of the soldered ball and the length of the stem have been designed with CAD/CAM computer technology.

To place the appliance, the maxillary sleeve attachments are fastened in a lock-and-key manner after the crowns have been cemented. The rods must be long enough so they do not come out of the sleeves on maximum opening. They have forked ends that are crimped onto the mandibular balls. It can be removed at the chair with a loop-forming plier. It is reactivated every six to eight weeks using 1-3mm split bushings that are crimped onto the rods as needed.

Molar tubes can be soldered at bracket level to combine edgewise appliances with Herbst therapy. The Flip-Lock Herbst can be combined with a jackscrew appliance if desired.

The Flip-Lock Herbst appliance has many advantages when compared to the conventional Herbst designs:

1) Improved patient comfort and acceptance.
2) Fewer clinical problems in comparison to screw or pin attachments.
3) Less chair time for reactivation.
4) Less frequent emergency appointments.

Mandibular Advancement Locking Unit (MALU)

Figure 7: Mandibular Advancement Locking Unit (MALU)

The Mandibular Advancement Locking Unit (MALU)[11] is a recently developed attachment device for the Herbst. The MALU consists of two tubes, two plungers, two upper "Mobee" hinges with ball pins, and two lower key hinges with brass pins.

Only the first molars are banded in the upper arch of the edgewise-Herbst MALU appliance, with .051" headgear tubes. In cases of overexpansion a palatal arch can be used. In the lower arch, the anterior segment is bonded from cuspid to cuspid with .022" brackets and also the first molars are banded. In order to help in settling the occlusion and locking in the mandible, the bicuspids may be left unbracketed. An .021"X .025" stainless steel archwire with slight labial root torque in the anterior segment is bent back tightly at the distal ends. Tip back bends mesial to the lower first molars are helpful in controlling the incisors. It is at the end of the MALU tube where each upper Mobee hinge is inserted into the hole and secured the first molar headgear tube with the ball pin and it is at the end of the plunger that each lower key hinge is inserted into the hole and locked to the base arch, distal to the cuspid, with the brass pin. The amount of mandibular protrusion needed is the determining factor for the length of the tube-plunger assembly adjustment.1-5mm spacers can be progressively advance the mandible.

MALU Herbst appliance has several advantages over other Herbst appliances.

1) Due to the fact that no laboratory construction is required, the cost can be considerably lower.
2) Its simplicity makes it useful even for non-growing patients in whom only dental movement and mandibular repositioning are required-typically cases with distal condylar displacement.
3) Where patients are non-co-operative with removable appliances or headgear, this can be used as an alternative.

Ideal period for Herbst Therapy

With respect to maximum mandibular growth stimulation and long-term stability of treatment, the ideal period for the Herbst appliance is in the permanent dentition at or just after the pubertal peak of growth corresponding to the skeletal maturity stages FG to H of the middle phalanx of the third finger (implying the precapping to preunion stages of the epiphysis and metaphysis). Because mandibular growth stimulation using the Herbst appliance is also possible in postadolescent

young adult subjects, Herbst appliance is used as an alternative to orthognathic surgery in older class II subjects[12].

The Ideal Patient

Skeletal morphology

- Retrognathic mandible.
- Small mandibular plane angle indicating an anterior growth direction of the mandible.
- Normal or reduced lower facial height.

Dental morphology

- Class II dental arch relationships with increased overjet and normal or increased overbite.
- The maxillary and mandibular teeth well aligned and the two dental arches fitting each other in normal sagittal position. Minor crowding in the maxillary anterior segment (especially in the canine region) is usually no problem.

Treatment of Class II Division 1 Malocclusion

Step 1: Orthopedic Phase- The sagittal jaw base has a normalized relationship and the Class II malocclusion is transferred to a Class I malocclusion with the help of the Herbst appliance.

Step 2: Orthodontic Phase- A multibracket appliance is used to treat tooth irregularities and arch discrepancy problems (with or without extractions of teeth).

Treatment of Class II Division 2 MALOCCLUSION

Step 1: **Orthodontic Phase-** Anterior maxillary teeth alignment with the help of a multibracket orthodontic appliance.

Step 2: **Orthopedic Phase**- Normalization of sagittal jaw base relationships and transformation of the Class II malocclusion into a Class I malocclusion by means of the Herbst appliance.

Step 3: **Orthodontic Phase-** Arch-discrepancy problems and tooth irregularities are treated with a multibracket appliance (with or without extractions of teeth).

Preparation of the dentition before Herbst Treatment

Proclined lower incisors should be retracted. Upper incisors that are tipped lingually should be proclined with fixed appliance. Extruded upper incisors should be intruded.

Bite registration:

Pancherz and Clark, have advocated an incisal edge-to-edge bite registration and have reported excellent treatment results. On the other hand, Frankel has advocated a "step-by step" method of advancement where the bite is brought forward in 2-3 mm increments. Both methods are accommodated easily with this technique.

Patients with an overjet of 7 mm or less, the bite registration should be taken in an incisal end-to-end position. In those patients with overbites greater than 7 mm, the bite should be taken half way between centric relation and an incisal end-to-end position, with a subsequent advancement of the mandible to an edge-to-edge relationship 2-4 months later. Bite registration is sent to the laboratory along with the work models with instructions.

Treatment Effects of Herbst Appliance

1) Effects on the Maxilla

Many studies [4,13] have shown that patients treated with the Herbst appliance over a period of six months or more undergo a slight reduction in the SNA angle. McNamara and co-workers[13] compared the treatment effects of the acrylic-splint Herbst appliance to Class II untreated controls over a period of 12 months. Although a significant difference in SNA angle was not noted when the Herbst appliance was compared to untreated controls, a slight inhibition of midfacial length was detected. The 0.5 mm reduction in growth does not have a clinically meaningful effect on the growth and development of the maxillary complex.

During the first twelve months after the Herbst appliance removal, the modest maxillary changes produced during treatment generally rebound. Pancherz observed that the influence of bite jumping on maxillary growth appeared to be reversible or "temporary." Maxillary prognathism (SNA angle) was reduced slightly during treatment (81.0° to 80.3°), but during a follow-up period of 12 months, maxillary growth increased, and the SNA angle rebounded to near pretreatment values (80.8°).[14]

2) Effects on the Maxillary Dentition

The telescoping mechanism of the Herbst appliance places an upward and backward vector of force on the maxillary first molars. Subsequent molar distalization and intrusion have been shown with Herbst appliance therapy[7]. Following seven months of Herbst appliance therapy, Pancherz and Anehus-Pancherz found that the upper first molars were distalized in 96% of the subjects, with the average first molar distalization of 2.1 mm (maximum 4.5 mm).

Intrusion of the maxillary first molars also was observed in 69% of the subjects, resulting in an average intrusion of 0.7 mm during treatment (maximum 3.5 mm). A short-term evaluation of the post treatment period by Hansen and Pancherz found distal molar movement was maintained following treatment. Six months following the cessation of Herbst treatment, molars were positioned distally by 1.2 mm when compared to their pre-treatment positions. The maxillary molars in the untreated group moved mesially 0.6 mm during the same period, resulting in an overall 1.8 mm short-term treatment effect. In a long-term study, Hansen and Pancherz also found slight rebound in horizontal molar position six years following their first observation period. Throughout the post treatment observation period, the maxillary first molars moved mesially only 0.2 mm more in the treated patients than in the untreated controls (1.4 mm compared to 1.2 mm).[15]

Most studies have found that the position of the maxillary incisors remains unchanged following Herbst therapy.[4] McNamara and co-workers[16] reported that upper incisor moved lingually 1.4 mm and extruded 0.8 mm relative to the

untreated controls. Change in maxillary incisor position following Herbst treatment is similar to that seen to occur during normal growth.[15]

3) Effects on the Mandible

Clinical studies have found that the mandibles of Herbst patients increase in length two to three millimeters more than do the mandibles of untreated controls. The SNB angle in treated patients is found to be one to two degrees greater than in untreated controls. Pancherz found a decreased rate in mandibular growth in the six months immediately following Herbst treatment. These results imply that the Herbst appliance does not produce a long-term increase in mandibular growth.[15]

4) Effects of Herbst Appliance on Temporomandibular Joint

Bite jumping using the Herbst appliance does not seem to have a deleterious effect on TMJ and masticatory function and does not seem to induce TMD on a short or lion term basis. On the contrary, the Herbst appliance improves TMJ function in some class II TMD subjects.[11]

5) Effects on the Mandibular Dentition

Analysis of sagittal dentoalveolar changes has revealed that the lower first molars of treated subjects undergo increased mesial movement, usually one to two millimeters, as compared to untreated controls.[15] Studies by McNamara and co-workers[16] indicate that occlusal coverage of the acrylic-splint Herbst inhibits the vertical movement of the mandibular molars in comparison to the banded design of the appliance.

Pancherz and Hansen reported the majority of posterior movement of the mandibular molars occurred in the first six months following Herbst treatment. In the subsequent six months, the mandibular molars remained in a stable anteroposterior position relative to the mandible. Pancherz found that the incisal edges of the mandibular incisors of patients treated with the Herbst appliance were intruded 1.8 mm relative to untreated controls.[16] Pancherz [4,7] has noted that part of the vertical incisor changes are due to tooth proclination as a result of the mesially directed force vector of the appliance acting on the lower teeth.

6) Effects on the Vertical Dimension

Maxillary first molars are intruded and mandibular molars erupt freely. Lower anterior facial height increases during treatment, although changes in the mandibular plane angle are not observed, due to concomitant increases in posterior face height. Although closing of the nasal plane angle and the mandibular plane angle have been observed following Herbst treatment, long-term increases in posterior and anterior face heights relative to untreated controls have been reported.[15]

7) Treatment Effects on The Masticatory System

At the start of treatment, when the appliance was inserted, the EMG activity from both the temporal and masseter muscles was reduced. After 3 months of treatment the EMG activity from the two muscles had increased to almost pretreatment values. After 6 months of treatment, when the appliance was removed, the EMG activity from the temporal and masseter muscles exceeded pretreatment values. The patients experience chewing difficulties during the first 7 to 10 days of treatment, although chewing ability is reduced during a much longer period

8) Effect on Functional disorders

Formation of a dual bite: The dual bite was probably due to an inadequate treatment period. Six months of treatment is too short for a complete skeletal and neuromuscular adaptation to the new mandibular position created by therapy. On retreatment with the Herbst appliance, the dual bite was eliminated. TMJ sounds: Clicking noticed disappeared during treatment. As clicking may be related to an anterior dislocation of the articular disc, it is possible that the jumped position of the condyle during treatment promoted reposition of a displaced disc. TMJ and muscle tenderness: The number of patients exhibiting tenderness to palpation of the TMJ and of one or more masticatory muscles was doubled during the first 3 months of treatment with the Herbst appliance. After removal of the appliance, most of the joint and muscle symptoms noted during treatment had disappeared.

Class II Relapse Following Herbst Treatment

Pancherz [17] suggested that the main cause of the class II relapse in patients treated with the Herbst appliance were persisting lip and tongue function and an unstable cuspal interdigitation.

Retention after Treatment

As treatment usually is performed in the mixed dentition, retention will thus be necessary until permanent teeth have erupted and the occlusion is stabilized. The Andresen activator is a most suitable retention device after Herbst treatment. The appliance holds the teeth in the desired position.

Advantages of the Herbst Appliance

1) Continuous action - The Herbst appliance acts 24 hours a day maintaining the mandible in a protruded position.
2) Treatment duration is short. Normally 6-8 months of treatment with the Herbst appliance is required to achieve a class I molar and skeletal relation.
3) Can be used in uncooperative patients.
4) It can also be used successfully in post - adolescent patients in whom very little growth is remaining to work with.
5) Advantageous in mouth breathers who are unable to adapt to removable appliances.
6) Does not interfere in speech or mastication.

Disadvantages of the Herbst Appliance

1) Risk of development of dual bite with attendant risk of TMJ dysfunction if treated inadequately.
2) High incidence of breakage and loosening of the appliance.
3) Rapid intrusion of the mandibular first premolars and maxillary molar occurs. This partially deactivates the appliances.

4) It increases the difficulty of oral hygiene procedures.
5) Because of its rigidity mandibular lateral movements are restricted.
6) Bonded Herbst causes increased risk of plaque accumulation and decalcification.

3. Discussion

Class II malocclusions are frequently encountered in orthodontic practice. It is also a known fact that mandibular retrusion contributes to a majority of these Class II malocclusions. Among the choices available to an orthodontist, usage of removable functional appliances (or orthopedic traction, for controlling excess maxillary growth) in early growing years was the modality of choice followed by a phase of fixed appliances for final detailing; this was termed as two-phase treatment. Pancherz and co-workers have demonstrated the potential of condylar and glenoid fossa remodeling beyond the pubertal growth spurt using the Herbst appliance.[18] Studies comparing the effectiveness of one-phase versus two phase treatment have demonstrated that a two-phase regimen does not confer any special advantage when compared to a single-phase treatment in which a fixed appliance is combined with a growth modulation appliance (treatment is usually started in the early permanent dentition).

The main advantages of combining Fixed functional treatment along with fixed appliance therapy is termed as "Telescoping treatment". This refers to the combination of two treatment modalities to maximize the benefits whilst minimizing their individual drawbacks. To be more specific, the fixed appliance is aimed at targeting the dentition and providing the following dental corrections: a) facilitating mandibular advancement by eliminating dental interferences and b) consolidating the arches in order to minimize the adverse dental side-effects. This is in conjunction with the fixed functional appliance providing the impetus for anterior mandibular repositioning and optimizing growth.

The first fixed functional appliance namely, the Herbst appliance, was very rigid, suffered from breakages and could allow for only limited lateral movements. Their main indication is Class II skeletal cases, where to stimulate growth and harmonize skeletal defects, the advancement of the mandible is necessary. Dental movement with the appliance is always achievable. If in some cases an advantage can be taken of this benefit, in others more common dental movements can be impeded, especially in movements related to the labial version of the lower incisors. With a view towards avoiding unwanted dental movements, for many years now various methods have been suggested in order to increase anchorage. Some examples of them are the introduction of torque in the arch wires and the use of lower incisor brackets with lingual torque, lingual arches, the thickness of the arch wires, etc.

It is foreseen that for the next century, the evolution of support systems is a backward step in the technological and scientific progress. Initially the bands were supported by appliances. Then came the use of rigid bands, connections that were welded to the bands, the introduction of crowns on the upper molars and then on the crowns on all molars and sometimes even on the lower pre-molars. The introduction of the cantilever increased further still the thickness of the wires that were being used as means of support.[19]

4. Conclusion

The need for patient compliance in achieving class II correction is often the most limiting factor in determining the duration of treatment and the quality of results achieved. Fixed functional appliances aim to remove some of these patients determined variable factors. Fixed functional appliances designed for class II correction exert a protrusive force on the mandible. Rigid fixed functional appliances have been shown to have more extensive skeletal effects, mostly because of the stimulation of adaptive osseous remodeling in the Temporomandibular Joint. The most important advantage of fixed functional appliances over removable appliances is that it is worn full time, regardless of patient cooperation.

Herbst appliance is one of the rigid fixed functional appliances, which have skeletal as well as dental effects. It helps in the downward and forward growth of mandible

References

[1] Jasper J and McNamara. Correction of interarch malocclusions with fixed force module. Am. J. Orthod. & Dentofacial Orthop.1995; 108:641 - 650.
[2] Rothenberg J., Campbell E.S & Nanda R. Class II correction with the Twin Force Bite Corrector. JCO 2004;38:232-240.
[3] Herbst E. Atlas und Grundriss der Zahrztlichen orthopedie. Munich, Germany, J.F.Lehmann Verlog, 1910.
[4] Pancherz H. Treatment of class II malocclusion by jumping the bite with the Herbst appliance. A cephalometric investigation. Am. J. Orthod.1979;76:423-442.
[5] Norris M. Langford. Updating fabrication of the Herbst appliance. JCO1982:173-174.
[6] Raymond P. Howe. The bonded Herbst appliance. JCO1982;16:663-667.
[7] Pancherz H. The mechanism of class II correction in Herbst appliance treatment. A cephalometric investigation. Am. J. Orthod. & Dentofacial Orthop.1982;82(2):104-113.
[8] Lennart Wieslander. Intensive treatment of severe class II malocclusions with a headgear-Herbst appliance in the early mixed dentition. Am. J. Orthod. & Dentofacial Orthop.1984;86:1-13.
[9] Dischinger TG. Edgewise Herbst appliance. JCO1995;29:738-742.
[10] Robert A Miller. The Flip-Lock Herbst appliance. JCO1996;30(10):552-558.

[11] Sabine Ruf. Short and long term effects of the Herbst appliance on temporomandibular joint function. Semin.Orthod2003; 9: 74-86.
[12] Sabine Ruf and Pancherz H. When is the ideal period for Herbst therapy- Early or Late? Semin. Orthod.2003; 9:47-56.
[13] Pancherz H. The Herbst appliance- Its biological effects and clinical use. Am. J. Orthod. & Dentofacial Orthop.1985; 87: 1-20.
[14] Vogt W. A new fixed interarch device for class II correction. JCO2003; 37(1):36-41.
[15] Sabine Ruf & Pancherz H. TMJ remodeling in adolescents and young adults during Herbst treatment. A prospective longitudinal MRI and cephalometric investigation. Am. J. Orthod. & Dentofacial Orthop.1999;115:607-618.
[16] James A. McNamara, Raymond P. Howe & Treey G. Dischinger. A comparison of the Herbst and Frankel appliance in the treatment of class II malocclusion. Am. J. Orthod. & Dentofacial Orthop.1990;98(2):134-144.
[17] Pancherz H. The nature of class II relapse after Herbst appliance treatment: A cephalometric long term investigation. Am. J. Orthod. & Dentofacial Orthop.1991;100:220-233.
[18] Selim Arici. Effects of fixed functional appliance treatment on the temporomandibular joint Am J Orthod Dentofacial Orthop 2008;133:809-14.
[19] Dischinger TG. Edgewise Herbst appliance. JCO1995;29:738-742.