

Treatment of Mandibular Retrognathism with the Herbst Appliance

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Summary

The Herbst appliance was first applied almost 100 years ago. Though very efficient, it has not been well accepted due to certain prejudice. The goal of this research work is to describe this appliance and present how it works. There is also a description of therapy of a young adult patient treated for mandibular retrognathism. To conclude, it should be noted that the Herbst appliance has proved to be an efficient therapeutic instrument, as the patient has shown not only dentoalveolar, but also skeletal changes, although his growth and development had already finished. The estimate of results of the treatment of the above mentioned case has been in accordance with the data from the recent research papers describing the cases when the appliance had been applied to adult patients, proving itself to be a valid alternative to the orthognathic surgery.

Key words: *Herbst appliance, Class II/1, distal bite.*

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Introduction

The first attempt at stimulating growth of the mandible in therapy of distal bite Class II/1 was initiated by Kingsley in 1877. The method described as "jumping the bite" is still applied today according to the principle of functional bimaxillary appliances such as for example activator, bionator, function regulator (1-3) and others, whereby the mandible is brought into the anterior position by constructive bite, inciting remodelling in the area of the jaw joints.

In the literature the possibility of stimulating growth of the mandible by means of functional devices has been controversially discussed. While some studies (4-9) show skeletal changes, others attribute the causes of the occlusal changes to dentoalveolar remodelling (10-13). The results of experi-

ments with functional devices on animals confirm the possibility of stimulating condylar growth (8, 14-16). With the application of the Herbst appliance in the treatment of distal bite the possibility of changing intermaxillary relations has been confirmed (17, 18) which has also been demonstrated by cephalometric radiography (19, 20), during which remodelling in the jaw joint occurs, i.e. remodelling of the joint socket and satisfactory growth of the joint capsule.

Herbst appliance

The Herbst appliance is a fixed, bimaxillary "jumping" apparatus for therapy of distal bite. Emil Herbst first demonstrated his appliance in 1909. However after his death the appliance was forgot-

ten. During the 1970s Hans Pancherz again introduced the appliance in the treatment of mandibular retrognathism. During application of this appliance the lower jaw is continuously held in the protruded position, independently of the patient's cooperation, by means of articulated-telescopic mechanisms fixed on both sides to the teeth. Each telescope consists of a fine tube and a small metal glides through it. Both ends of the telescope are connected to the teeth by the articular mechanism which enables movement of the lower jaw; the fine tube for the first upper molar and the small metal rod for the first lower premolar. It is possible to accurately determine the value of the mesial position of the mandible by means of the length of the tube. This mechanism enables vertical, lateral and minimal anterior movement of the lower jaw, without disturbing basic function.

Case presentation

A 21-year-old student, W.P., (Figure 1) came to the practice with a diagnosis of distal bite, for a consultative examination in February 2001. From the case history it was learnt that he had previously been unsuccessfully treated for two years with a fixed appliance and had finally been advised to undergo operative correction, which he had refused. A clinical examination confirmed the diagnosis and distal bite of the width of the premolar was registered and horizontal incisal step of 12.5 mm. All four first molars had been extracted in the former treatment plan. Following the diagnostic procedure, which involved analysis of plaster casts, static and dynamic occlusion, orthopantomogram, craniogram, condition of the TM joints and photograph of the facial profile, treatment with a Herbst appliance was proposed, with the aim of achieving acceptable intermaxillary relations, improved occlusion and aesthetic profile. After removal of the Herbst appliance it was planned to finish treatment by application of the fixed technique, with which occlusion would be defined. In the first phase of the procedure the old fixed appliance was partially removed and Herbst appliance inserted (Figure 2). Although it is the usual practice to place the appliance in the edge-on bite position of the incisor, this was not done in the case presented because of marked incisal step (Figure 3).

During the first days of the procedure, because of extension effect of the appliance reactive capsulitis occurred, which was determined by the sensitivity of the jaw joints. During the treatment the patient was checked once a month, when the appliance was released on the mandible in order to control the course of the treatment by assessing intermaxillary relations and the condition of the joints. At that time the appliance could be activated when necessary. After ten months the appliance was removed and a fixed appliance again inserted, which completed the treatment. The treatment lasted for 23 months. One year after the end of treatment the results were evaluated by analysis of occlusion (Figures 4, 5), cephalometric analysis (Figures 6, 7) and judgement of the photograph of the facial profile.

Discussion

Because of its advantages (independence of patient cooperation, 24-hour effect, short-term treatment, good conditions for maintaining hygiene) the Herbst appliance is more frequently applied in the therapy of mandibular retrognathism. Optimal term for the commencement of treatment is the age of permanent dentition after maximal puberty growth (MP3 cap-stage). Application of the appliance prior to that age is inappropriate because of the problem of anchors and leads to frequent recurrences (23, 24).

The Herbst appliance is not only successful in the treatment of adolescents but also post-adolescents and young adult patients. Recent studies on the application of magnetic resonance (21, 22, 25) have shown that it can induce condylar growth, i.e. remodelling in the jaw joint (16, 26) even after the end of growth and development. This method of treatment is described as an alternative to the classical surgical method of treatment of mandibular retrognathism in adult patients.

Because of the rigid appearance of the appliance the question is often asked of its eventual harmful effect on the structure of the jaw joints or masticatory muscles. Investigations of the results of treatment (27-30) with the application of history and clinical methods and magnetic resonance, failed to detect undesired changes. Apart from initial and tempo-

rary capsulitis, caused by anterior repositioning of the condyle, there were no other complications. On the contrary, satisfactory effect of the appliance has been observed in cases of mild and moderate anterior dislocation of the disk (27).

In the case presented analysis of the joints before and after, and one year after the application of the appliance was carried out. Analysis consisted of a history questionnaire and clinical diagnostic procedure with the application of manual functional analysis according to Bumann (31, 32). No pathological findings were found. The most significant change after therapy with the Herbst appliance was the more anterior position of the lower jaw compared to the beginning of treatment. When the appliance is inserted because of constructive bite, the mandible is in a protracted position (usually edge-on position of the incisor), and the condyles are positioned on the top of the joint capsules. Finally, the condyles are again positioned in the middle of the joint socket. This is the result of dental and skeletal changes: posterior movement of the teeth of the upper jaw, anterior movement of mandibular dentition (33) and changes in the joint itself with regard to satisfactory direction of condylar growth (34, 35) and remodelling of fovea articularis (35). In the case presented the movement of the mandible towards the front amounted to 6 mm.

Cephalometric radiographic analysis showed anterior movement of the mandible with the changed angles of the facial profile, which was increased, SNB angle which was also increased and ANB difference, which was decreased. Additional analy-

sis by Wits-calculation significantly confirmed the finding of decreased AO:BO relation of 9 mm on the first radiograph to 3 mm on the final radiograph.

The superposition of the line of the radiograph before and after treatment confirms the finding of metric analysis. Retrusion of the upper and protrusion of the lower incisors was registered, which contributed to a reduction of the incisal step. In conclusion, skeletal and dentoalveolar changes were registered. Due to the loss of anchors during treatment with the Herbst appliance protrusion of the lower (around 10-15°) and retrusion of the upper, frontal teeth regularly occurs, which was also registered in the case presented. Although at the end of therapy overjet value was 0 mm, after one year, due to a mild recurrence, the value amounted to 2 mm.

Conclusion

Because of its characteristics the Herbst appliance is the method of choice in the treatment of Class II/1, where the cooperation of the patient is questionable or the optimal period has passed for application of mobile functional appliances. Evaluation of the results of treatment in the case presented is in agreement with data from the recent literature in cases when the appliance is applied for adult patients. The method of treatment with the Herbst appliance is an alternative to orthognathic surgery. However, for a final conclusion on the efficacy of the method further investigations are necessary.