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## ORTHODONTIC TREATMENT OF A PATIENT WITH SEVERE CLASS II MALOCCLUSION, BONY FIBROUS DYSPLASIA, ROOT RESORPTIONS, AND MISSING FOUR PREMOLARS

### LECZENIE ORTODONTYCZNE PACJENTA Z CIĘŻKIM TYŁOZGRYZEM, DYSPLAZJĄ WŁÓKNISTĄ KOŚCI, RESORPCJAMI KORZENI I BRAKIEM CZTERECH PRZEDTRZONOWCÓW

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#### Streszczenie

*Wstęp:* Celem pracy było przedstawienie pacjenta z tyłozgryzem, resorpcjami korzeni zębów i brakami zębów przedtrzonowych, leczonego aparatem Herbsta w końcowym okresie wzrostu oraz ocena możliwości leczenia ortodontycznego w niepostępującej dysplazji włóknistej kości.

*Material i metody:* Materiał badawczy obejmował wywiad oraz zewnątrz- i wewnątrzustne badanie kliniczne, modele, pantomogram, rentgenogram nadgarstka i telerentgenogram 14-letniego pacjenta z ciężkim tyłozgryzem, resorpcją korzeni spowodowaną wcześniejszym leczeniem ortodontycznym, dysplazją włóknistą kości oraz brakiem czterech przedtrzonowców. Dalsze, skuteczne leczenie przeprowadzono za pomocą aparatu Herbsta i aparatów stałych cienkołukowych.

*Wyniki:* Pierścienie założono na górne pierwsze trzonowce i dolne drugie trzonowce oraz osadzono aparat Herbsta, który wysuwał zuchwę. Po 3 miesiącach leczenia pacjent nie był w stanie cofnąć zuchwy. Uzyskano I klasę Angle i kłową. Nagryz poziomy i pionowy zmniejszono do 2 mm. Skrócono dolny odcinek twarzy i cofnięto wargę dolną, uzyskując wydolność warg oraz poprawę profilu pacjenta. Po zakończeniu niwelacji i szeregowania zębów zdjęto aparaty stałe i wykonano górną płytę retencyjną oraz przyklejono dolny stały retainer. Okres aktywnego dalszego leczenia wyniósł 15 miesięcy. Nie zaobserwowano nadmiernej ruchomości żadnego zęba po leczeniu. Chirurg szczękowo-twarzowy również nie

stwierdził progresji ani transformacji nowotworowej dysplazji włóknistej po zakończeniu aktywnego leczenia ortodontycznego.

*Wnioski:* 1. Leczenie tyłozgryzu pod koniec wzrostu za pomocą aparatu Herbsta jest możliwe. 2. Resorpcje korzeni nie są wskazaniem do rezygnacji z dalszego leczenia, jeśli możliwe korzyści przewyższają podejmowane ryzyko. 3. Ortodontyczne przesuwanie zębów w obrębie niepostępującej dysplazji włóknistej kości jest możliwe i wydaje się bezpieczne.

**H a s ł a:** tyłozgryz – resorpcje korzeni – dysplazja włóknista kości – leczenie ortodontyczne.

#### Summary

*Introduction:* A case of distal occlusion is presented with root resorptions and missing premolars, treated at the end of the growth period with Herbst appliance. Orthodontic treatment in non-progressive fibrous dysplasia is assessed.

*Material and methods:* Anamnesis, results of extraoral and intraoral examinations, typodonts, panoramic view, hand-wrist radiogram, and cephalogram were obtained in a 14-year-old boy with severe distal occlusion, root resorptions resulting from previous orthodontic treatment, fibrous dysplasia of bone, and missing four premolars. Successful treatment was achieved with Herbst appliance followed by fixed appliances.

**Results:** Bands were placed on upper second molars and lower first premolars and the Herbst appliance was positioned forcing the mandible forward. After three months the patient was unable to position the mandible backwards. Canine and Angle Class I were achieved, overjet and overbite were reduced to 2 mm. Lower face height was reduced and the upper lip was retracted, producing lip competence. At this point the fixed appliances were removed, an upper removable retention plate was made, and a lower flexible spiral wire retainer was bonded. Active retreatment lasted 15 months. No hypermobility of any teeth nor progression or neoplastic transformation of fibrous dysplasia were noted at the end of orthodontic treatment.

**Conclusions:** 1. It is possible to treat distal occlusion with Herbst appliance at the end of the growth period. 2. Root resorptions are not a contra-indication to treatment if potential benefits outweigh risks. 3. Orthodontic tooth movement appears possible and safe in patients with non-progressive fibrous dysplasia.

**Key words:** distal occlusion – root resorptions – bony fibrous dysplasia – orthodontic treatment.

## Introduction

Class II malocclusion is a common problem in orthodontics. Functional correction of distal occlusion requires continued body growth with mesial movement of mandibular teeth, distal movement of maxillary teeth, and orthopedic changes in apical bases of the jaws. After cessation of growth, treatment is usually compensatory and includes retruding upper incisors and achieving canine Class I after extractions in the upper dental arch, leading to Angle Class II. In severe cases, orthognathic mandibular advancement is the treatment of choice since it is the only way to improve substantially the facial profile.

The Herbst appliance introduced by *Herbst* [1] is based on a bite-jumping telescope mechanism. Telescopic tube-and-rod assemblies of this fixed functional appliance extend from the maxillary first molars to the mandibular premolars and keep the mandible in a protruded position during occlusion and jaw closure [2]. The telescope mechanism is positioned in the mouth on stainless steel crowns, cast [3], acrylic splints [4, 5] or bands [6, 7].

The Herbst appliance is especially useful with early permanent dentition at or just after the pubertal growth peak [2]. Six to eight months of treatment are enough to achieve Class II correction through inhibition of growth of maxilla, enhanced growth of mandible, posterior movement of maxillary teeth, and anterior movement of mandibular teeth [2]. In the long term, Class I is maintained by stable intercuspation, but sagittal jaw relationship substantially relapses [2]. Root resorption is a complication which occurs in many patients who undergo orthodontic treatment. It is usually not severe enough to create clinical problems, though

[8]. *Remington et al.* [9] examined 100 patients 14 years on the average after treatment and found no tooth loss, with hypermobility in only two cases. *Sameshima* and *Sinclair* [10] studied 868 patients who completed fixed appliance treatment and observed that first premolar extraction was associated with more root resorption than non-extraction or extraction of upper first premolars only. This fact seems to be due to maxillary central incisor root approximation to the palatal cortical plate during orthodontic treatment [11]. Other factors significantly associated with root resorption include duration of treatment, abnormally shaped apices, and patient's age (adults are more susceptible) [10].

Fibrous dysplasia is a developmental bone disease of unknown etiology in which normal bone is replaced by fibroosseous tissue [12, 13]. It may affect one (monostotic form) or more bones (polyostotic form). Craniofacial bones are involved in 10% of patients with monostotic disease and in 50% with the polyostotic form [14]. Fibrous dysplasia is a benign condition but occasional malignant transformation is observed [15, 16]. Radiation therapy is considered to contribute to malignant transformation of the lesion [15]. Total excision and reconstruction of the lesion with an autogenous bone graft prevents recurrence and malignant transformation [17, 18] on the one hand but may cause greater functional loss than the disease itself on the other hand. Sometimes, total excision of the lesion is not possible [19]. For these reasons and because the lesions cease to progress in early adult life, follow-up is the management of choice in many cases [20, 21, 22].

We decided to present a case of distal occlusion with root resorptions and missing teeth treated at the end of growth period with Herbst appliance and to assess the effects of orthodontic treatment in non-progressive fibrous dysplasia.

## Material and methods

Our subject was a 14-year-old boy referred to the Department of Orthodontics for further treatment of distal occlusion with root resorptions, fibrous dysplasia, and missing four premolars. Previous treatment for three years consisted of a fixed appliance on the upper dental arch only, without headgear, with extractions of upper second premolars and lower right first and left second premolars. Extraoral and intraoral examinations were done, alginate impressions were taken, study casts were poured and analyzed. Panoramic view, hand-wrist radiogram, and cephalogram were obtained as well.

## Results

The patient had severe Class II malocclusion, with Angle and canine Class II, protrusion of upper incisors, 10 mm overjet, and 2.5 mm overbite (fig. 1). Supraposition of lower incisors in relation to the occlusal plane was visible. Upper

and lower midlines were coinciding. Mesiodistal widths of upper and lower anterior teeth were matching, the anterior Bolton ratio was normal (77.4%). The overall Bolton ratio could not be calculated due to missing four premolars. Oral hygiene was poor (fig. 2), gingivitis was apparent, and



Fig. 1. Occlusion before retreatment: a) anterior view; b) intercuspaton of right posterior teeth; c) intercuspaton of left posterior teeth

Ryc. 1. Zwarcie przed dalszym leczeniem: a) widok z przodu; b) zaguzkowanie zębów bocznych strony prawej; c) zaguzkowanie zębów bocznych strony lewej



Fig. 2. Stained dental plaque  
Ryc. 2. Wybarwiona płytka nazębna

numerous white spot lesions were found. The incisal edge of the upper right lateral incisor was abraded. The upper lip was protruded, the labiomental fold deepened, and the lower lip retruded. Lower face height was increased and lip incompetence with hyperactivity of the mental muscle during lip contact was visible (fig. 3). Unimpaired nasal breathing was confirmed. The patient was able to protrude the mandible to the point of contact of incisal edges of upper and lower incisors. The alveolar bone over the upper right lateral teeth was hypertrophic due to fibrous dysplasia which was histopathologically verified (fig. 4) and referred to a maxillofacial surgeon for follow-up.

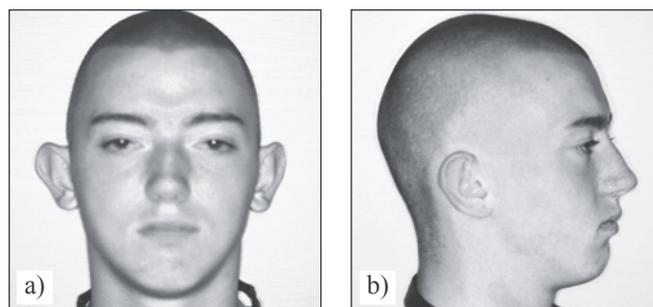


Fig. 3. Face appearance before retreatment: a) en face; b) profile  
Ryc. 3. Wygląd twarzy przed dalszym leczeniem: a) en face; b) profil

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Rozpoznanie histopatologiczne:	Data: 29 stycznia 2006
Obraz mikroskopowy odpowiada wcześniej rozpoznaniem: Dysplazja fibrosa.	
Asystent: lek. med. O. Oszurek	Konsultant: dr med. C. Glaz

Fig. 4. Histopathology of the dysplastic bone tissue  
Ryc. 4. Wynik badania histopatologicznego dysplastycznej tkanki kostnej



Fig. 5. Panoramic view  
Ryc. 5. Zdjęcie pantomograficzne

Panoramic view revealed root resorptions of upper incisors, first premolars, and first molars. The lower left third molar was retained (fig. 5). Cephalometric analysis revealed a retrognathic face type, skeletal Class I, neutral sagittal jaw relation with ANB angle equal to  $1.4^\circ$ , N1 high-angle vertical relation, ML-NL angle equal to  $35.6^\circ$  and index of 74.9%, posterior rotation of the mandible with ML-NSL angle of  $40.5^\circ$  and mandibular angle of  $136.7^\circ$ . Upper incisors were proclined (1 : NA was  $44.4^\circ$ ; fig. 6). The hand-wrist radiogram revealed almost full growth cessation (fig. 7).

Indications for further orthodontic treatment were as follows: impairment of lip function due to protrusion of upper incisors, compromised biting and chewing function resulting from excessive overjet, and risk of traumatic injury to protruded upper incisors. The potential risk of continued orthodontic treatment included progression of caries and gingivitis, further shortening of roots, and potential influence of tooth movement on altered tissue in the region of upper right posterior teeth involved in fibrous dysplasia,

together with possible difficulties in moving teeth in the area involved.

Orthodontic objectives were to distalize the upper and procline the lower dental arch, and to intrude the upper molars in order to allow forward rotation of the mandible. The retained lower left third molar was removed after consultation with an oral surgeon. The treatment plan also aimed at improved oral hygiene by staining the dental plaque and repeated instructions, as well as at remineralization of white spot lesions by application of fluoride.

Brackets from upper premolars and upper first molar bands were removed. The upper first premolars and second molars, as well as lower premolars were banded and Herbst appliance was placed forcing the mandible forward (fig. 8). After two months, the lower right premolar band broke and the appliance had to be repaired. After three months of treatment the patient was unable to move his mandible backwards. The anchor teeth were intruded by biting force causing an open bite in the premolar and canine region. The appliance was removed and teeth 14, 16, 24, and 26

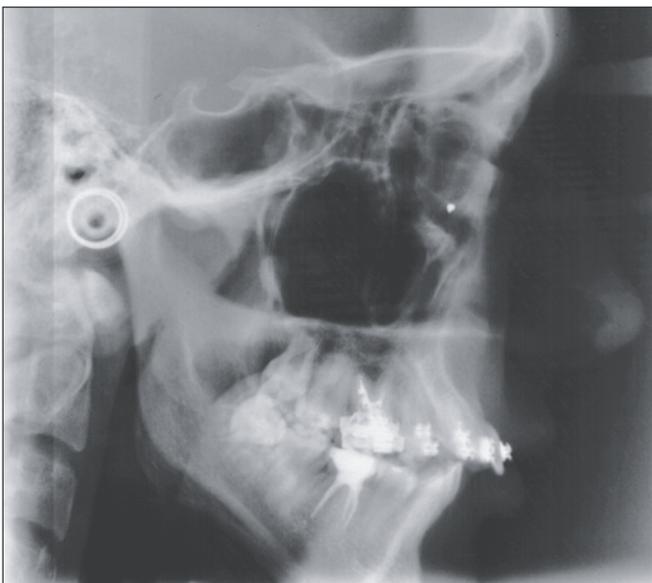


Fig. 6. Cephalogram

Ryc. 6. Zdjęcie teleradiologiczne



Fig. 7. Hand-wrist radiogram

Ryc. 7. Radiogram nadgarstka

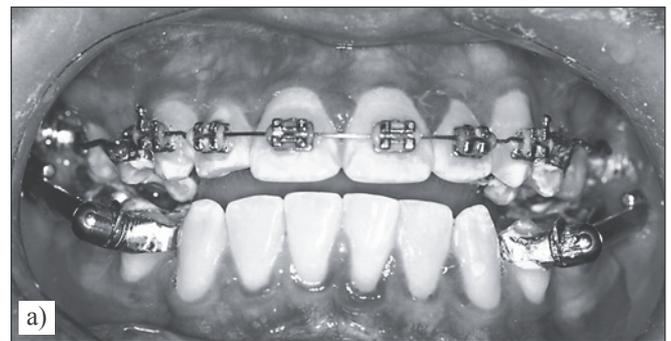


Fig. 8. Occlusion with Herbst appliance in place: a) anterior view; b) right side; c) left side

Ryc. 8. Zwarcie po osadzeniu aparatu Herbst: a) widok z przodu; b) strona prawa; c) strona lewa

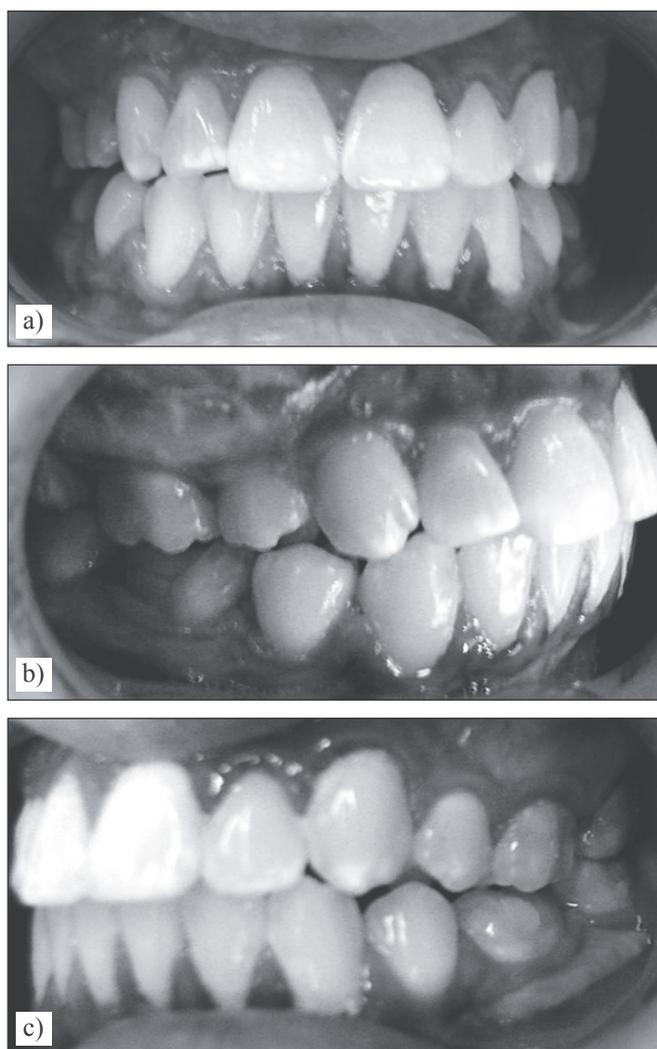


Fig. 9. Occlusion after treatment: a) anterior view; b) intercuspal view of right posterior teeth; c) intercuspal view of left posterior teeth

Ryc. 9. Zwarcie po zakończeniu leczenia: a) widok z przodu; b) zaguzkowanie zębów bocznych strony prawej; c) zaguzkowanie zębów bocznych strony lewej

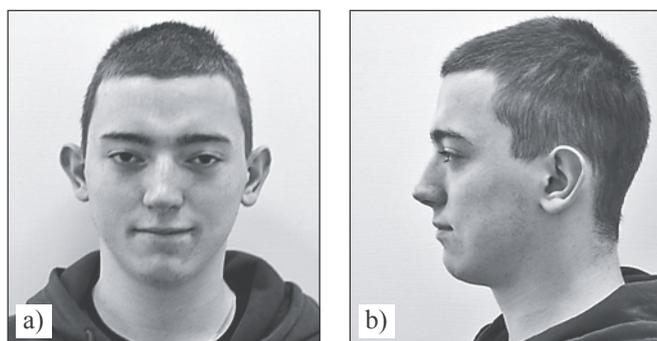


Fig. 10. Face appearance after treatment: a) en face; b) profile

Ryc. 10. Wygląd twarzy po leczeniu: a) en face; b) profil

were bonded. The lower dental arch was bonded but the archwire had to be segmented in order to avoid intrusion of the lower incisors which would otherwise create an anterior open bite. The posterior open bite was closed with vertical elastics and a continuous archwire was placed. Canine and molar Class I was achieved, overjet and overbite were

reduced to 2 mm (fig. 9). Lower face height was reduced and the upper lip was retracted. The lips became competent improving the appearance of the face (fig. 10).

After completion of leveling and alignment, the appliances were removed and an upper removable retention plate, as well as a lower bonded flexible spiral wire retainer were placed. The whole active retreatment lasted 15 months. No hypermobility of any teeth was noted after treatment. Neither significant progression nor malignant transformation of fibrous dysplasia were found by the maxillofacial surgeon after completion of active orthodontic treatment.

## Discussion

Distal occlusion is usually due to mandibular alveolar or skeletal retrognathism. In our patient, malocclusion was mainly dentoalveolar, but complicated by posterior rotation of the mandible. In order to protrude the mandible, it was beneficial to allow its forward rotation by intruding upper molars. The high-pull headgear effect of the Herbst appliance [2] was utilized. The alternative could be to use a high-pull headgear which would, however, require continued skeletal growth, as well as good patient cooperation. Given the patient's age, both factors were almost absent. Previous removal of four premolars followed by space closure with a complete loss of anchorage in the upper dental arch excluded compensatory treatment by retraction of upper front teeth after removal of two teeth in the upper dental arch.

The anchor teeth for the Herbst appliance were chosen differently due to previous extractions. Susceptibility of the Herbst appliance to failure was its main disadvantage. The weak point were the bands used to carry the telescope mechanism. Alternatively, a cast or acrylic splints could be used.

In the study of *Sameshima* and *Sinclair* [10], the greatest root resorption was 1.67 mm and appeared in incisors moved horizontally between 3.0 and 4.5 mm. In our patient, the amount of root resorption was apparently greater, resulting in dull-ended roots of lengths equal to those of crowns. Root resorption of more than 3 mm was reported to occur in 10% to 20% of cases [23, 24]. The potential risk factors of root resorption in our patient included extraction [10, 25], treatment duration [10], incisor retraction [10], and individual susceptibility [8]. The shape of root apices before treatment could be a risk factor of minor importance for root shortening [8]. The stage of root development is important as well, since incomplete root formation is considered to be a protective factor [26]. Different susceptibilities of various groups of teeth with particular weakness of upper central incisors has been noted as well [27, 28] and may explain substantial amount of root resorption of the upper centrals and laterals, but not first molars.

Orthodontic treatment in our patient proceeded normally and no difficulties were noted. *Crawford* [29] treated ortho-

dontically a patient with Class II malocclusion and fibrous dysplasia of the maxillary sinus and reported extreme difficulty in correcting midline discrepancy and Class II molar relationship on the affected side although the patient wore the headgear for 12 to 14 hours a day and elastics almost 24 hours a day for 22 months of a 24-month treatment period. This finding suggests that the lesion resists distalization of the maxillary posterior dental segment thus impeding correction.

## Conclusions

1. It is possible to treat distal occlusion with Herbst appliance at the end of the growth period.
2. Root resorptions are not a contra-indication to treatment if potential benefits outweigh risks.
3. Orthodontic tooth movement appears possible and safe in patients with non-progressive fibrous dysplasia.

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