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Therapeutic management of patients with class III skeletal malocclusion. Mandibular prognathism, maxillary retrognathism – a case report

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Abstract

Mandibular prognathism (progenism, underbite) is a type of malocclusion characterised by an abnormally anterior position of the mandible or the underdevelopment of the maxilla. The profile of an individual with the pathology is significantly prolonged in the sagittal plane, which distorts facial aesthetics. Underbite also negatively affects the entire masticatory function and may cause numerous ailments. Patients with prognathism struggle not only with

aesthetic problems, but with functional issues as well. What is more, it can lead to difficulties in the psychosocial area of life by causing lower self-esteem and distorted self-image. Mandibular prognathism is treated with the use of orthodontic camouflage or combined orthodontic-surgical treatment, the latter method, despite its invasiveness, being the more popular one. An important element in the process of patient rehabilitation during treatment is the physiotherapist, who selects the right rehabilitation procedures aiming at the stomatognathic system. Even before the surgery itself, proper therapy begins whose task is preparing the craniofacial area for surgical invasion. After surgery, on the other hand, the physiotherapeutic procedures aim at the reduction of swelling, activating temporomandibular joints (TMJ), myofascial therapy, and special exercises (myokinesthetic therapy) which are aimed at supporting the adaptation of the body to a new morphological structure.

This dissertation presents the case of a 19-year-old female patient with mandibular prognathism who underwent combined orthodontic-surgical treatment. The treatment consisted of Le Fort I osteotomy and bilateral sagittal split osteotomy (BSSO). The overall results of treatment were evaluated as very good.

Keywords: prognathism, mandibular diseases, craniofacial abnormalities, malocclusion, Angle class III.

Introduction

Mandibular prognathism (*positio mandibulae anterior morphologica*), also called prognathism or underbite, is a type of malocclusion assessed on the basis of the Frankfort horizontal plane. Individuals with mandibular prognathism have an overdeveloped body or rami of the mandible [1,2], or an underdeveloped maxilla [3], which leads to changes in facial features, such as extended chin or an anterior position of mandibular teeth in relation to maxillary teeth (mesial occlusion) [4]. There are other defects that are often connected with prognathism, such as an open bite (anterior or complete), and crossbite (unilateral or bilateral) [5]. The aetiology of mandibular prognathism distinguishes: genetic predispositions, general and local factors. A higher incidence of prognathism can be observed in individuals whose relatives suffer from it as well [7]. In terms of functional disorders, prognathism is characterised by the

dominance of mandible-protracting muscles over the ones that retract it – the movement of retraction is practically impossible (the result of the mandibular retraction test is negative). According to Angle's classification, it is class III skeletal malocclusion [1,8]. Apart from distorted facial aesthetics caused by improper proportions, patients also experience speech impediments, problems with masticatory function and the functioning of temporomandibular joints (TMJ) [4]. Another aspect of significance is the quality of psychosocial relationships and self-acceptance, which have been observed to improve greatly after treatment. Self-esteem has also been observed to rise [6]. Research shows that as many as 75% patients with prognathism expects to gain better facial aesthetics from treatment [4].

Mandibular prognathism is a relatively rare type of malocclusion: it constitutes only 9% of all cases of malocclusion [1]. Little literature is available on the incidence of mandibular prognathism. Research conducted on a group of children aged 10-12 in Lublin, Poland found class III malocclusion in 3.3% of subjects [7]. The greatest incidence of prognathism is found in Asia, while in Europe it is estimated to amount to 4.88% [8].

There are two methods of mandibular prognathism (in the case of permanent teeth) – orthodontic camouflage, and a surgery combined with orthodontic therapy. The party responsible for the choice of treatment and assessment of indications for surgery are a team of an orthodontist and a maxillofacial surgeon [10]. Factors taken into account during the decision-making process are: radiology examination, the analysis of facial features and plaster casts, clinical tests, and the WITS appraisal. The most common surgery if the defect only affects the mandible is BSSO (bilateral sagittal split osteotomy), or VRO (vertical ramus osteotomy) [7, 8, 11]. If, however, the maxilla is underdeveloped as well, Le Fort I osteotomy is also conducted, which enables the relocation of the maxilla to a proper position [9].

Case report – a history of a patient's treatment

A 16-year old female patient, J.S., visited an orthodontist for consultation due to her dissatisfaction with the appearance of her face (excessively protruding mandible, long facial features, diastema) and the functioning of the masticatory apparatus (frequent accidental cheek biting, hypersalivation caused by incorrect positioning of the lips, speech problems).

Based on family history, it was established that prognathism occurs among relatives on the father's side, which increased the probability of the occurrence of the defect in patient J.S. as well.



Figure 1. Extraoral pictures taken before treatment (source: own resources).

Diagnosis

The orthodontic diagnostic process consisted of physical examination and the patient's medical history. Extraorally, the asymmetry of the facial skeleton was visible. The analysis of facial features demonstrated that the patient had a flattened mentolabial sulcus, a straight profile slanting towards the front and a positive lip step.

The defect was analysed in terms of teeth, occlusion and the skeleton: intraoral examination revealed bilateral Angle class III and bilateral canine class III. During the assessment of the mutual positioning of incisors it was established that the overjet is -0.5 mm, while the overbite is reverse with the value of 0.5 mm.

Initial therapy plans assumed combined orthodontic and surgical treatment. However, it was delayed and the patient was recommended to visit the orthodontist again when bone development was complete and occlusion reached its final shape.



Figure 2. Extraoral pictures at an early stage of treatment (source: own resources).

At the age of 19, the patient visited a doctor again. This time, apart from medical history and physical reexamination, impressions were taken for diagnostic models which revealed the McNamara measurement of 36 mm and Tonn's index of 74%.



Figure 3. Cephalometric image taken at an early stage of treatment (source: own resources).



Figure 4. Pantomograph taken at an early stage of treatment (source: own resources).

Treatment plan

Considering the degree of the defect, combined orthodontic and surgical treatment was planned as follows:

1. Extraction of third molars in order to achieve permanent retention after treatment has been completed.

2. Orthodontic preparation of teeth in arches to a surgery with the use of dental brackets, that is malocclusion decompression (improving teeth arrangement, dental arch harmonisation).
3. Double jaw surgery aimed at eliminating the defect.
4. The maintenance of proper oral hygiene.
5. The use of elastics for a period of 6 weeks for the purpose of achieving proper dental arch intercuspation.
6. Further orthodontic treatment with the use of brackets.
7. Retention of achieved treatment results and physical therapy for the purpose of full restoration of proper masticatory function.



Figure 5. Intraoral pictures at an early stage of treatment (source: own resources).

Treatment procedures

The preoperative orthodontic preparation lasted about 14 months. Patient J.S. was then hospitalised released after 3 days in a good condition. The removal of brackets took place 4 months later; that was also when permanent retainers were installed on both mandibular and maxillary dental arches.

1. Orthodontic procedures

After a treatment plan was formed, fixed-in archwire MBT .022 brackets were installed on the mandible and the maxilla. In February 2017, the patient was qualified by a surgeon for a double jaw surgery, and instructions were issued for the orthodontist regarding the upper incisor to FHP angle (100-100° to bone surface) and the vertical positioning of lower incisors in the tooth sockets (angle of about 90°). During further orthodontic treatment, the regular

arches of the brackets were replaced with steel arches. Several days before surgery, intraoperative plates were made and hooks installed on bracket arches.



Figure 6. Intraoral picture after the installation of permanent brackets (source: own resources).

2. Surgical procedures

In December 2017, patient J.S. arrived at the Craniofacial Surgery Clinic of the Independent Public Clinical Hospital no.1 of the Pomeranian Medical University in Szczecin. A diagnosis was presented: maxillary retrognathism, mandibular prognathism.



Figure 7. Cephalometric image taken before surgery (source: own resources).



Figure 8. Pantomograph taken before surgery (source: own resources).

Preparation for surgery consisted of manual muscle relaxation in the surgical field and instructions to do Gerry's muscle exercises in order to stretch adduction and abduction muscles of the mandible. On the next day, in general anaesthesia, with endotracheal intubation, the surgery was conducted: Le Fort I osteotomy from an incision in the vestibular fornix Regio 14 - 24. The maxillary advancement and impaction proceeded according to plan. Positioning was conducted with the use of the first intraoperative splint. Miniplate osteosynthesis was conducted with the use of the system KLS Martin 1.5 – 4 L-shaped plates in the areas of the pyriform aperture and crista zygomaticoalveolaris. Cinch stitches were applied. In the following stage of surgery, from bilateral incisions in the bottom of the vestibule from second premolars towards the back to the front edges of the ramus, bilateral sagittal split osteotomy (BSSO) was conducted and the mandible was relocated to form proper occlusion. Positioning was conducted with the use of the second intraoperative splint. Subsequently, miniplate osteosynthesis was conducted with the use of the system KLS Martin 2.0 – 2 plates 2-0-2 and Cinch stitches. The surgery ended with kinesio taping (swelling prevention). On the second day after the surgery, rubber elastics were used for a period of 6 weeks (changed weekly), after which the patient was released from hospital in a good general and local condition.

3. Further orthodontic procedures

4 months after the surgery, brackets were removed and permanent retainers for both mandibular and maxillary arches were installed for a period of 5 years. A retention plate was made; the patient was instructed to wear it for 1 year.



Figure 9. Intraoral pictures taken after completed treatment and installation of a permanent retainer on mandibular and maxillary arches (source: own resources).

4. Physical therapy procedures

Rehabilitation began on the second day after the surgery. For the purpose of swelling reduction, Hilotherm was used, which is a device with a cooling mask on the surgical field. Initially, physical therapy procedures consisted of gentle techniques aiming at reducing swelling and activating muscles in the face and neck area. With time, more intensive techniques were introduced enhancing muscle strength and TMJ mobility. Rehabilitation lasted 12 months.

Rehabilitation after the orthognathic surgery	
Days 0-2 after the surgery	<ul style="list-style-type: none"> • hiloterapy (low temperature treatment).
Day 3 – week 3 after the surgery	<ul style="list-style-type: none"> • lymphatic drainage in the craniofacial area, • isometric exercises of the face and neck, • facial exercises, • active exercises of the shoulder girdle and cervical spine, • kinesio taping.
Weeks 3-6 after the surgery	<ul style="list-style-type: none"> • isometric exercises of the face and neck, • facial exercises.
Weeks 6-10 after the surgery	<ul style="list-style-type: none"> • active TMJ exercises.
Week 10 and afterwards	<ul style="list-style-type: none"> • manual therapy within the joint system, that is: passive and active mobilisation of TMJ, fascial therapy, TMJ distraction, TMJ rotation and translation enhancement, • neuromobilisation, • Rocabado exercises within the joint system and cervical spine, • therapy of post-surgical scars (intraoral treatment), • autotherapy (myokinesesthetic therapy).

Table 1. Physical therapy outline

Treatment results



Figure 10. Extraoral pictures after treatment (source: own resources).

The final effect of treatment was assessed as positive despite sensory disturbances around the right corner of the mouth and the chin. Dental arches were properly spaced with good occlusion and intercuspation. Diastema was eliminated and normal overjet and overbite were achieved. Extraorally, a significant improvement in the harmony of facial features was observed, which had a positive effect on the patient's overall craniofacial appearance.

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