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Combined Orthodontic and Surgical Treatment of Skeletal Class III Malocclusion: A Case Report

Zespołowe leczenie ortodontyczno-chirurgiczne szkieletowej klasy III – opis przypadku

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A – research concept and design; **B** – collection and/or assembly of data; **C** – data analysis and interpretation; **D** – writing the article; **E** – critical revision of the article; **F** – final approval of article

Abstract

Skeletal class III malocclusion can be caused by excessive mandibular growth, maxillary hypoplasia, or a combination of both. The aim of this study was to present a multidisciplinary treatment of a 28 year-old female with a skeletal class III malocclusion and bilateral hypodontia of the first and second maxillary premolars. Orthodontic treatment, as a part of the patient's preparation for surgery, included a straight wire appliance using Roth prescription for both dental arches. A transpalatal distractor (TPD) was used to correct the transversal maxillary deficiency. The expansion was later continued using the quad-helix appliance. The second stage of surgical management included the bimaxillary osteotomy (BIMAX) in order to correct the skeletal malocclusion (mandibular prognathism and maxillary hypoplasia). Orthodontic treatment was continued after surgery, until the normal occlusal relationships were restored. The outcomes included a complete functional repair of the patient's stomatognathic system and a significant improvement of the aesthetic appearance of her face. Multidisciplinary management was used involving orthodontic and surgical strategies. The treatment restored normal occlusal relationships, improved the stomathognatic function, the patency of upper airways as well as the aesthetic appearance of the patient's face and smile (**Dent. Med. Probl. 2016, 53, 3, 424–429**).

Key words: orthognathic surgery, severe maxillary hypoplasia, transversal maxillary distraction.

Słowa kluczowe: chirurgia ortognatyczna, rozległa hipoplazja szczęki, poprzeczna dystrakcja szczęki.

Skeletal class III malocclusions can be caused by excessive madibular corpus length, maxillary hypoplasia or a combination of both factors [1–3]. Cephalometry in patients with a class III malocclusion typically reveals: decreased SNA, increased SNB, negative ANB, negative Witts value, as well as a compensatory protrusion of maxillary incisors and a simultaneous retrusion of mandibular incisors. Furthermore, excessive mandibular corpus length and/or decreased maxillary length with a short or long mandibular ramus can be found. Midface hypoplasia is characterized by the retrusion at the subnasal region and the upper lip with a poorly demarcated vermilion zone, flat cheeks, shallow orbits, dark circles under the lower lid, and a decreased nasolabial angle [4]. Skeletal malocclusions can be hereditary or caused by the embryonic developmental defect, trauma and functional impact. Other potential factors implicated in the origin of class III malocclusion include developmental abnormalities (cleft lip/palate, Down syndrome), hormonal disorders (acromegaly), functional disorders (habitual, head tilt downward and forward, tongue protrusion, pre-

mature tooth loss and abnormal occlusal contact) [5–8].

The prevalence of skeletal class III malocclusion varies among different populations. It is the most common among individuals of Asian descent, affecting 16.7% of the Korean population, 3–5% of the Japanese population and 2% of the Chinese population [9, 10]. The prevalence of skeletal class III malocclusion ranges between 1% and 4% [11].

According to the study performed on the Polish teenager population by Grodzka et al. [12], the prevalence of skeletal class III malocclusion was the highest in 15 year-olds (2.5%), and did not exceed 2% in 13 and 14 year-olds.

Unsatisfactory facial aesthetics is one of the main reasons motivating patients to seek orthognathic treatment. Most patients seeking surgical treatment experience a range of psychological difficulties related to the inability to accept their facial appearance and various occlusal problems [13].

The aim of the paper is to present a multidisciplinary treatment of a 28 year-old female with a skeletal class III malocclusion and bilateral hypodontia of the first and second maxillary premolars.

Case Report

The case of a 28 year-old female with a skeletal class III malocclusion is presented. The patient came to the orthodontic practice for treatment of the skeletal malocclusion. She was determined to have it corrected, so as to restore an aesthetic facial appearance.

A complete orthodontic assessment was carried out, including an intraoral and extraoral exam, impressions and study models, lateral teleradiography of the head as well as a panoramic radiograph. Particular attention was paid to facial proportions. Below, the findings of the clinical assessment were listed:

1. Extraoral exam – a retrusion at the subnasal region and an upper lip with poorly demarcated vermilion zone, flat cheeks, shallow orbits, dark circles under the lower lid, and mild facial assymetry due to the left lateromandibulism (Fig. 1a, 1b).

2. Intraoral exam – maxillary hypoplasia (a complete crossbite: anterior and bilateral), compensatory protrusion of maxillary incisors and a simultaneous retrusion of mandibular incisors, bilateral hypodontia of the first and second maxillary premolars and a 2 mm left lateromandibulism (Fig. 2a, 2b). No temporomandibular joint abnormalities were observed. A panoramic radiograph revealed the absence of wisdom teeth. The measurements of the lat-

Fig. 1a. Extraoral examination photographs before treatment

Fig. 1b. Extraoral examination photographs before treatment

Fig. 2a. Bite before treatment

Fig. 2b. Bite before treatment

eral teleradiographs of the head revealed maxillary hypoplasia (SNA = 78˚, reference value 82.0 ± 3.0˚), mild mandibular prognathism (SNB = 82.8˚, reference value 80.0 ± 3.0˚), and a high gonial angle (GntgoAr = 137˚, reference value 122 ± 7.0˚, ML-NSL = 39.4˚, reference value 28.0 ± 5.0˚, ML-NL = 34.8˚, reference value 20.0 ± 7.0˚) indicative of skeletal class III malocclusion with the ANB angle of 0.5˚ (reference value 2.0 ± 2.0˚). The vertical facial dimension exceeded the reference range, which was suggestive of elongated lower face (Index = 69.0˚, reference value 80.0 ± 7.0˚).

Based on diagnostic investigations, a diagnosis was made of maxillary hypoplasia, skeletal open bite, mandibular prognathism, mild left lateromandibulism and a bilateral hypodontia of the first and second maxillary premolars. The proposed treatment plan included:

1. Maxillary expansion using the transpalatal distractor (TPD).
2. Preoperative orthodontic treatment in order to remove arch size discrepancies and achieve dentoalveolar decompensation.
3. Bimaxillary osteotomy: Le Fort I osteotomy (maxillary advancement) and sagittal ramus split osteotomy (slight posterior mandibular repositioning with the simultaneous correction of the left lateromandibulism).
4. A potential postoperative orthodontic correction of a mild dental misalignment in order to improve occlusion and long-term retention after appliance removal.
5. Narrow crown restoration of the maxillary and mandibular incisors in order to improve smile and facial aesthetics.

The first stage of treatment included surgical maxillary expansion by means of transpalatal distraction using the screw-based device (TPD). Due to significant maxillary hypoplasia, it was difficult to choose the appropriate size of the transpalatal distractor. The smallest commercially available device of 14 mm was anchored at an angle to the midpalatal suture. The patient activated the screw twice daily for 10 days achieving an increase of intercanine and intermolar widths (Fig. 3, 4). At the end of this period, the patient reported pain, so screw activation was discontinued, and the remaining expansion was achieved using the quad-helix appliance (Fig. 3, 4), which could not have been used before TPD due to insufficient space. Next, the second stage of the complex management involved orthodontic treatment, as part of preparation for orthognatic surgery. The straight wire appliance using Roth prescription was used for both dental arches. The upper arch was further extended using quad-helix and gradually wider archwires (Fig. 5). The changes in inter-

Fig. 3. Upper arch before TPD treatment

Fig. 4. Upper arch after TPD treatment

Fig. 5. Upper arch after quad-helix expansion

canine and intermolar width after the TPD and using the quad-helix are shown in Table 1. The wire sequence was as follows: 0.014X25" CuNiTi, and 0.017X25" TMA for both the maxillary and mandibular arch. The aim of orthodontic treatment was to achieve dentoalveolar decompensation and better alignment and to create the anteroposterior space so as to enable the surgeon to transpose

Table 1. The width of the upper arch at baseline, after TPD, after TPA and after orthodontic treatment

	Baseline	After TPD	After TPA and orthodontic treatment
Inter-canine width	19 mm	24 mm	30 mm
Inter-molar width	28 mm	33 mm	35 mm

the palatal shelves during the surgery (Fig. 6a, 6b). The preoperative orthodontic treatment lasted for 12 months. Afterwards, up-to-date impressions and plaster diagnostic models were made, as well as a new panoramic radiograph and lateral teleradiographs of the head were taken, which served as a basis for planning the extent of orthognatic surgery. The bimaxillary osteotomy was scheduled – Le Fort I maxillary osteotomy and advancement, as well as sagittal ramus split osteotomy (Obwegeser) and its posterior repositioning. As a result, harmonius facial features and normal occlusal relationships were restored.

The postoperative intraoral radiographs (done in week 4 postoperatively) revealed a significant improvement of facial appearance in both the frontal and lateral view (Fig. 7a, 7b). The outcomes included achieving facial symmetry en face, as well as an improved soft tissue profile, namely, creating a more convex contour of the cheeks and a subnasal region, as well as a reduced prominence of the chin and the lower lip. The postoperative intraoral radiographs revealed a class I canine relationship and bilateral Angle's class I neutroocclusion, with normal overjet and overbite (Fig. 8a, 8b). The values of postoperative cephalometric measurements were within the reference ranges.

The postoperative orthodontic management included improving occlusion by a slight correction of the dental malocclusion and using elastics in order to close the tiny underbite gaps. The fixed appliances were removed 6 months postoperatively. At the same time, the maxillary front teeth were widened as part of aesthetic dentistry treatment (Fig. 9). A retention splint was used on the maxillary arch. Additionally, a retainer was anchored to the lingual surface of the mandibular front teeth (between the mandibular canines).

Fig. 6a. Bite before BIMAX surgery

Fig. 6b. Bite before BIMAX surgery

Discussion

The management of patients with skeletal malocclusion is a complex process starting with a detailed assessment based on dental impressions

Fig. 7a. Extraoral examination photographs after BIMAX surgery

Fig. 7b. Extraoral examination photographs after BIMAX surgery

Fig. 8a. Bite after BIMAX surgery

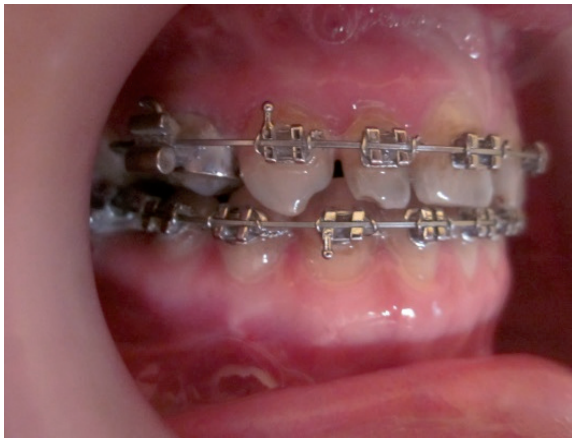

Fig. 8b. Bite after BIMAX surgery

and plaster diagnostic models, panoramic radiograph, lateral radiographs of the head, functional assessment of temporomandibular joints (TMJs)

Fig. 9. Bite after aesthethic dentistry

and a thorough analysis of facial aesthetic features.

In the discussed case, a complex orthodontic and surgical treatment was necessary. Most researchers recommend BIMAX procedures (Le Fort I and BSSO) in patients with a skeletal class III malocclusion as the most stable long-term osteotomy [14].

Despite obvious advantages of the surgical treatment, only few patients opt for it, due to the risk of complications, such as paresthesias, hematomas and infections [15]. Patients strongly determined to improve their facial aesthetics, occlusal relationships and masticatory function make the best candidates for surgery [16, 17].

An experienced, multidisciplinary team of maxillofacial surgeons, orthodontists and dental prosthetists (clinical dental technicians or denturists) is undoubtedly the best team to approach treating skeletal malocclusions [18].

Table 2. Selected cephalometric parametres based on Segner and Hasund's harmony box measured before and after surgery

Measurement	Reference value	Preoperatively	Postoperatively
SNA	82 ± 3.0°	81.3°	84.2°
SNB	80 ± 3.0°	82.8°	81.1°
ANB	2.0 ± 2.0°	0.5°	1.0°
1+SN	104 ± 6°	98.9°	99.1°
1-ML	94 ± 7°	85.6°	86.2°
Wits appraisal	0 ± 2.0 mm	6.9 mm	1.5 mm
Maxillary length (Go-Me)	–	40.6 mm	44.1 mm
Corpus length (Go-Pog)	–	63.8 mm	62.1 mm
Ramus length (Ar-Go)	–	55.4 mm	51.0 mm

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