

CLINICAL CASE

Dent. Med. Probl. 2009, 46, 3, 359–364
ISSN 1644-387X

© Copyright by Wrocław Medical University
and Polish Stomatological Association

PATRYCJA DOWNAROWICZ¹, MARTA SZUMIELEWICZ¹, WOJCIECH PAWLAK²,
BARBARA WARYCH²

Orthodonto-Surgical Treatment of Skeletal Open Bite – Case Report

Leczenie ortodontyczno-chirurgiczne szkieletowego zgryzu otwartego – opis przypadku

¹ Department of Dentofacial Orthopedics and Orthodontics, Wrocław Medical University, Poland

² Department of Maxillofacial Surgery, Wrocław Medical University, Poland

Abstract

This is a case report of an adult patient with a skeletal open bite who was interdisciplinarily orthodonto-surgically treated. In the treatment of these malformations it had been shown that the team approach is very important to achieve a high-quality functional and aesthetic results. Most cases of dentofacial deformities require orthodontic preparation in order to align dental arches and decompensate anterior teeth. This permits optimal positioning between dental arches after bimaxillary movement. In the first stage of treatment orthodontic therapy was used to prepare the patient to the operation, in the second – the surgery on the maxilla and the mandible was performed. The diagnosis, the orthodontic therapy, the surgical treatment and the post-surgical rehabilitation were described in this work (**Dent. Med. Probl. 2009, 46, 3, 359–364**).

Key words: skeletal open bite, interdisciplinary treatment, orthognathic surgery.

Streszczenie

Praca przedstawia opis przypadku dorosłej pacjentki ze zdiagnozowanym szkieletowym zgryzem otwartym leczonej zespołowo ortodontyczno-chirurgicznie. W leczeniu tych wad wykazano, że tylko ścisła współpraca chirurga szczękowego i ortodonta może zapewnić trwałą poprawę estetyki i funkcji. Większość przypadków wad gnatycznych wymaga uprzedniego przygotowania ortodontycznego polegającego na wyrównaniu łuków zębowych i dekompensacji zębów przednich. Pozwala to na takie przesunięcia odłamów kostnych szczęki i żuchwy, aby uzyskać optymalne warunki zgryzowe. Na pierwszym etapie leczenia zastosowano więc przygotowanie ortodontyczne do zabiegu, na drugim etapie zaś – zabieg na szczęcie i żuchwie. W pracy opisano diagnostykę, terapię ortodontyczną, leczenie chirurgiczne i rehabilitację pozabiegową (**Dent. Med. Probl. 2009, 46, 3, 359–364**).

Słowa kluczowe: szkieletowy zgryz otwarty, leczenie zespołowe, chirurgia ortognatyczna.

An open bite is a dental disorder in which the relationship between the upper and lower dental arches is incorrect in vertical dimension. It results from abnormal growth in height of the facial part of cranium. Researchers define it as the presence of an opening in the occlusion (infraocclusal opening) of various intensity, in the anterior or/and lateral segments of dental arches [1, 2]. An important element in the etiology of open bite is genetic factor, most often manifested in the enlargement of mandibular angle as well as in the relationship between the maxillary and mandibular base and the

surface of the anterior cranial fossa; hence this disorder is considered more difficult for treatment [3]. Researchers also emphasise great importance of tongue dysfunction in case of an open bite [4]. Etiology of open bite skeletal deformities include respiratory disturbances connected with the impairment in the upper respiratory [5]. An open bite can be characterised by the following deviations from the morphological norm: enlargement of mandibular angle, mandibular posterior rotation, maxillary anteinclination, mesioinclination of lateral teeth and exaggerated curve of Spee in the lo-

wer arch. In facial features the maxillary segment is visibly elongated [2, 3, 6]. Depending on the background of defect and its clinical manifestation various methods of treatment are recommended. Disorders of lower intensity, without adverse changes in the facial profile, can be treated only orthodontically, with or without extraction. Such treatment uses a number of mechanisms the task of which is to contain the vertical growth of the maxilla and the intrusion of upper and lower lateral teeth (headgear, orthodontic implants), elongation of anterior teeth (vertical elastic extension), control of the position of the tongue (fixed or moveable tongue blocks, muscular exercise). In patients with a severe open bite skeletal discrepancies, connected with significant exceeding of normative values of angles defining the location of the mandible and its morphology as well as complicated by the adverse aesthetics of a patient's face, qualify for orthodonto-surgical treatment – uni- or bimaxillary [3, 4, 6, 7]. The treatment of skeletal open bite constitutes a great challenge for an orthodontist not only because of its difficult mechanics, interdisciplinary co-operation with a surgeon, speech therapist and other specialists, but also because of the possibility of disorder recurrence, especially after isolated orthodontic treatment [6].

The aim of this work was to present a case of a skeletal open bite under interdisciplinary orthodonto-surgical treatment.

Case Report

Patient J. B., aged 20, with skeletal open bite, reported to the Department of Orthodontics of Medical University in order to undergo orthodontic treatment. The patient had not been orthodontically treated before. The main complaint of the patient was difficulty in biting off and chewing food, clearly noticeable gingival smile, elongated maxillary segment and difficulty in bringing the upper and lower lip together. Within the scope of orthodontic diagnostics the patient underwent clinical examination (subject examination – interview and examination). Also, model analysis and radiological examination (evaluation of a pantomogram and of a lateral cefalogram of the head) were performed. In the extra-buccal examination an imbalance in facial proportions was observed: the maxillary segment constituted 60% of morphological face (Fig. 1). The patient had a convex facial profile with a backward-located chin, downwardly folded lower lip and enlarged nasal-labial angle. The height of maxillary segment was enlarged (Fig. 2). A speech impediment was also noticed. In the intra-buccal examination and during the model ana-



Fig. 1. Presurgical face frontal view photograph

Ryc. 1. Fotografia twarzy *en face* przed leczeniem chirurgicznym



Fig. 2. Presurgical face lateral view photograph

Ryc. 2. Fotografia boczna twarzy przed leczeniem chirurgicznym

lysis it was diagnosed that the patient had a complete open bite with retained contact on the second premolars and molars (Figs. 3, 4). A gummy smile, which is a characteristic symptom of a skeletal open bite, was also observed (Fig. 5). The horizontal overlap measured 2 mm, and the vertical overlap – 1 mm. In the area of first molars Angle Class I was diagnosed, and in the area of canines also Angle Class I was reported on both sides. The disorder was accompanied by maxillary stenosis with the lateral crossbite on the left side. The analysis of pantomographic picture showed the presence of lower third molars, which were extracted during orthodontic treatment. The extraction was performed because the line of surgical cut was planned to cross the area of those teeth. It was also reported that the patient did not have any of four first premolars. Other structures did not depart from the norm. The analysis of telereöntogram performed that Segner-Hasund method revealed the following deviations in the angular and linear



Fig. 3. Presurgical occlusal frontal view photograph
Ryc. 3. Fotografia zgryzu *en face* przed leczeniem chirurgicznym



Fig. 4. Presurgical occlusal lateral view photograph
Ryc. 4. Boczna fotografia zgryzu przed leczeniem chirurgicznym

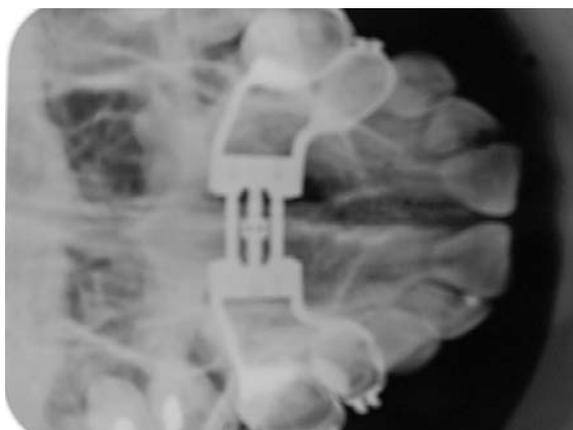


Fig. 5. Photograph of palatine raphe after cracking
Ryc. 5. Zdjęcie na płytkę zgryzową po rozerwaniu szwu podniebiennego

measurements: SNA angle was 75° (the norm $82 \pm 3.0^\circ$), SNB was 76.6° (the norm $80 \pm 3.0^\circ$), ANB -1.7° (the norm $2.0 \pm 2.0^\circ$). The values of vertical

measurements indicated high-angle relationship ($ML-NSL = 30.5^\circ$). The index value significantly exceeded the norm (Index = 68.1%). The enlarged mandibular angle, the proportion of the posterior and anterior face height ($SGo/NMe = 64.7\%$) and other measurements indicated posterior rotation of the mandible and were characteristic of an open bite. The lower incisors were properly aligned in relation to the APg line ($1-:APg = 2.4 \text{ mm}$), but slightly inclined in relation to the mandibular base ($1-:ML = 99.8^\circ$). The upper incisors were inclined in relation to the NPg line ($1+:NPg = 3.1 \text{ mm}$), but properly aligned in relation to the maxillary base ($1+:SN = 106^\circ$). The analysis showed the shortening of maxillary length. The length of the mandibular body and ramus was at the lower limit of the norm (Table 1).

In the functional examination respiratory dysfunction was observed. Speech impediment was also reported, concerning sounds s, z, c, sz and cz. No deviations were observed in the function of the temporomandibular joints.

On the basis of a complete examination a skeletal open bite and maxillary stenosis were diagnosed.

The treatment plan included: widening of the maxilla, tooth decompensation – alignment of the upper incisors, bimaxillary surgery: with the use of Obwegeser-Dal Pont method in the mandible and of Le Fort I method in the maxilla.

The plan included thus orthodonto-surgical treatment.

In the first stage, an appliance with the hyrax screw to break the palatal suture was implanted in the maxilla. The patient was instructed to turn the screw of the appliance twice a day for the period of one month. After this period the patient was directed to make a picture for the occlusal plane in the maxilla. On the basis of the picture it was observed that the palatal suture was broken (Fig. 6). The appliance was left in the oral cavity as retention for 3 more months. The second stage of treatment was carried out with the use of thin-arched fixed braces, Roth system locks with 0.018 slot. After the removal of the appliance with the hyrax screw, a palatal bridge was put in its place to stabilise the width of the upper arch. To perform levelling, elastic arches were used first. The aim of the treatment was to level the widths of the dental arches and align the teeth in the lateral and anterior segment. The pre-surgical orthodontic treatment lasted 20 months. Then the patient was referred to the Department of Maxillo-Facial Surgery at the Wrocław Medical University. The first part of surgery performed there was the sagittal osteotomy of the mandible with the use of Dal Pont method; the second one – the Le Fort I type surgery on the ma-

Table 1. Selected cephalometric measurements according to Segner and Hasund analysis before and after surgery**Tabela 1.** Wybrane przed- i pooperacyjne pomiary cefalometryczne wg analizy Segnera i Hasunda

Measurements (Pomiary)	Norm (Norma)	Before the surgery (Przed zabiegiem)	After the surgery (Po zabiegu)
SNA	82 ± 3.0°	74.9°	81.0°
SNB	80 ± 3.0°	76.6°	80.0°
ANB	2.0 ± 2.0°	-1.7°	1.0°
NL-NSL	8.0 ± 4.0°	5.3°	7.5°
ML-NSL	28 ± 5.0°	30.5°	29.5°
Index	80.0 ± 7.0°	68.1°	77.5°
1+SN	104.0 ± 6°	106°	100°
1-ML	94.0 ± 7°	99.8°	90°
Length of the maxilla (Długość szczęki)	–	31.9 mm	34.0 mm
Length of the mandibular body (Długość trzonu żuchwy)	–	51.6 mm	54.0 mm
Length of the mandibular ramus (Długość gałęzi żuchwy)	–	34.7 mm	38.0 mm

**Fig. 6.** Gummy smile**Ryc. 6.** Uśmiech dziąsłowy**Fig. 7.** Occlusal frontal view photograph after orthognathic treatment**Ryc. 7.** Fotografia zgryzu *en face* po leczeniu chirurgicznym

xilla. After the proper positioning of the mandible and maxilla, they were stabilised with bicortical screws. The rigid intermaxillary immobilisation was used in the first stage after the surgery, and in the following 6 weeks vertical elastic extensions were used to stabilise the occlusion (Figs. 7, 8). After the surgery the patient reported for a post-surgical check once a week during the first 6 weeks, and after that period – once a month. In the extra-buccal examination conducted after the surgery it was observed that the gingival smile was substantially reduced, the lower facial segment was shortened, but the maxillary segment was still longer in comparison with the middle facial segment (Figs. 9, 10). The analysis of telereöntogram after the surgery revealed the normalisation of angular and linear measurements: SNA angle was 81°, SNB 80°, ANB 1°, ML-NSL 29.5°, 1-:ML 90°, 1+:SN 100°. The whole orthodontosurgical treatment lasted 32 months. In the reten-

**Fig. 8.** Occlusal lateral view photograph after orthognathic treatment**Ryc. 8.** Boczna fotografia zgryzu po leczeniu chirurgicznym



Fig. 9. Face frontal view photograph after orthognathic treatment

Ryc. 9. Fotografia twarzy *en face* po leczeniu chirurgicznym



Fig. 10. Profile view photograph after orthognathic treatment

Ryc. 10. Fotografia boczna twarzy po leczeniu chirurgicznym

tion therapy a fixed retainer made of a flat woven steel wire was applied for teeth 33–43, and in the upper arch Hawley's plate was used. In the intra-buccal examination Angle Class I and canine Class I were observed.

Discussion

In the case described above it was decided that interdisciplinary orthodonto-surgical treatment should be used. Patients do not often decide to undergo orthognathic surgery despite the benefits it can bring because of the risk of complications such as lip paralysis, paresthesia, hematoma or infections [3]. Patients who agree to such treatment are characterised by firm determination resulting from certain psychological aspects, the willingness to improve their facial aesthetics, correct tooth imperfections or make it easier for them to bite off and chew food [8, 9].

The majority of researchers recommend Le Fort I surgery, considering it the most stable osteotomy in the treatment of such group of gnathic defects [10–12]. There are very few reports claiming the instability of this kind of treatment [13]. The method that is not recommended for treatment is the isolated surgery type BSSO on the mandible, because in most cases the defect recurs after the surgery. It is used very rarely and only in few cases.

In the case described above, some speech impediment was also observed. In the foreign and polish literature there are numerous reports stating that people with gnathic defects have problems with proper articulation. The most common undesirable feature of articulation is interdentality. It is caused by the incorrect positioning of the tongue, which results from the fact that the space for the tongue is enlarged in vertical dimension. In such a situation raising the tongue to the inner surface of the upper incisors during the articulation of phonemes is more difficult than putting it between the teeth [1]. In the literature available on the subject no criteria of cephalometric analysis have been found that would clearly indicate when to use the surgical and non-surgical treatment of an open bite. Therefore a decision concerning the treatment – orthodontic or orthodonto-surgical – should be made by doctors after a detailed analysis of the case, in which they would take into consideration facial aesthetics, intensification of the skeletal disorder, the patient's age, the height pattern, dysfunction and parafunction.

However, the application of such interdisciplinary treatment as the authors have described in this work undoubtedly brings a favourable aesthetic and functional effect.

References

- [1] KONOPSKA L., BIELAWSKA H., GÓRNIAK D., RUCIŃSKA-GRYGIEL B.: Wady wymowy u osób ze zgryzem otwartym. *Czas. Stomatol.* 2003, 54, 115–124.
- [2] MASZTALERZ A.: Norma morfologiczna w rozpatrywaniu wad zgryzu. *Czas. Stomatol.* 1995, 48, 738–745.
- [3] KIM Y.H., HAN U.K., LIM D.D., SERRAON M.L.P.: Stability of anterior open bite with multiloop edgewise arch wire therapy: A cephalometric follow-up study. *Am. J. Orthod. Dentofac. Orthop.* 2000, 118, 43–54.
- [4] KONDO E., AOBA T.J.: Nonsurgical and nonextraction treatment of skeletal Class III open bite: Its long-term stability. *Am J. Orthod. Dentofac. Orthop.* 2000, 117, 267–287
- [5] KUSTRZYCKA K., JAWORSKA M.: Wpływ schorzeń górnych dróg oddechowych na wady zgryzu. *Czas. Stomatol.* 1997, 50, 47–51.
- [6] SAITO I., YAMAKI M., HANADA K.: Nonsurgical treatment of adult open bite using edgewise appliance combined with high-pull headgear and Class III elastics. *Angle Orthod.* 2005, 75, 273–279.
- [7] PARK H.S., KWON T.G., KWON O.W.: Treatment of open bite with microscrew implant anchorage. *Am. J. Orthod. Dentofac. Orthop.* 2004, 126, 627–636.
- [8] JUGGINS K.J., NIXON F., CUNNINGHAM S.J.: Patient – and clinician – perceived need for orthognathic surgery. *Am. J. Orthod. Dentofac. Orthop.* 2005, 128, 697–702.
- [9] LAZARIDOU-TERZOUDI T., ASUMAN KIYAK H., MOORE R., ATHANASIOU A.E., MELSEN B.: Long-term assessment of psychologic outcomes of orthognathic surgery. *J. Oral Maxillofac. Surg.* 2003, 61, 545–552.
- [10] PROFIT W.R., BAILEY T.J., PHILLIPS C., TURVEY T.A.: Long-term stability of surgical open-bite correction by Le Fort I osteotomy. *Angle Orthod.* 1999, 70, 112–117.
- [11] SWINNEN K., POLITIS C., WILLEMS G., DE BRUYNE I., FIEUWS S., HEIDBUCHEL K., ERUM R., VERDONCK A., CARELS C.: Skeletal and dento-alveolar stability after surgical-orthodontic treatment of anterior open bite: a retrospective study. *Eur. J. Orthodont.* 2001, 23, 547–557.
- [12] IANNETTI G., FADDA M.T., MARIANETTI T.M., TERENCE V., CASSONI A.: Long-term skeletal stability after surgical correction in class III open-bite patients: a retrospective study on 40 patients treated with mono- or bimaxillary surgery (Clinical Notes). *J. Craniofac. Surg.* 2007, 18, 350–354.
- [13] DENISON T.F., KOKICH V.G., SHAPIRO P.A.: Stability of maxillary surgery in open bite versus non-openbite malocclusions. *Angle Orthod.* 1989, 59, 5–10.

Address for correspondence:

Patrycja Downarowicz
Department of Dentofacial Orthopedics and Orthodontics
Wroclaw Medical University
Krakowska 26
50-425 Wrocław
Poland
Tel.: +48 71 784 02 99
E-mail: p.downarowicz@wp.pl

Received: 24.04.2009

Revised: 22.05.2009

Accepted: 8.06.2009

Praca wpłynęła do Redakcji: 24.04.2009 r.

Po recenzji: 22.05.2009 r.

Zaakceptowano do druku: 8.06.2009 r.