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PROSTHETIC REHABILITATION OF PATIENTS WITH UNILATERAL COMPLETE CLEFT OF THE PRIMARY AND SECONDARY PALATE

REHABILITACJA PROTETYCZNA PACJENTÓW Z JEDNOSTRONNYM CAŁKOWITYM ROZSZCZPEM PODNIEBIENIA PIERWOTNEGO I WTÓRNEGO

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Abstract

The goal of this paper was to present the orthodontic treatment of a patient with unilateral lip, alveolar and hard palate cleft (UCLP) and the agenesis of permanent teeth and prosthetic rehabilitation of two cases differing from each other in the extent of tissue deficiency.

Both patients underwent a long, multi-specialist surgico-orthodontic treatment including derotation of the maxilla's smaller segment and restoration of space for the missing teeth. In the first case presented, cross-bite on the front teeth and the canine was eliminated during a late phase of orthodontic treatment in order to prepare for final prosthetic rehabilitation. Two prosthetic restorations in patients with similar dental anomalies (hypodontia of the right upper incisors) were presented and discussed in detail. Prosthetic rehabilitation with cemented restoration was carried out after the end of growth.

Satisfactory function of the orthognathic system and face appearance were accomplished. In both cases cemented prosthetic restorations preserve the treatment outcome and bite stability. The results were excellent and satisfying for the patients. The patient who presented more extensive tissue distortion has retained correct bite and prosthetic restorations for 20 years. The patient whose correction of the malocclusion and the cemented prosthetic restoration was completed is also predicted to maintain long-standing oral health and good functioning of the masticatory system.

Key words: cleft lip, cleft palate, orthodontic treatment, prosthetic rehabilitation

Streszczenie

Celem pracy było przedstawienie przebiegu leczenia protetycznego po wcześniejszym leczeniu ortodontycznym aparatem stałym, pacjentek z jednostronnym rozszczepem wargi, wyrostka zębodołowego i podniebienia twardego (UCLP), agenezją stałych zębów w dwóch przypadkach różniących się rozległością deficytu tkanek.

Obie pacjentki przeszły długotrwałą wielozespołową terapię chirurgiczno-ortodontyczną, w tym obejmującą odrotowanie mniejszego segmentu szczęki i wytworzenie miejsca dla brakujących zębów. Pierwszy prezentowany przypadek obejmuje korektę zgryzu krzyżowego w zakresie zębów przednich i kła w późnym etapie leczenia ortodontycznego, w celu przygotowania do ostatecznej rehabilitacji protetycznej. Zaprezentowano i omówiono szczegółowo dwa uzupełnienia protetyczne dla pacjentek o podobnym zębodołowym deficycie – brak prawych górnych stałych zębów siecznych. Rehabilitacja protetyczna stałym uzupełnieniem została wykonana po ukończeniu wzrostu.

U pacjentek uzyskano satysfakcjonującą funkcję układu stomatognatycznego i wygląd twarzy. W obu przypadkach stałe wypełnienia protetyczne zabezpieczają wieloletnie wyniki leczenia ortodontycznego w okresie od dzieciństwa do 18 roku życia i stabilność zgryzu. Wyniki były wysokiej jakości i przyniosły zadowolenie pacjentek. Pacjentka o wyższym stopniu wrodzonej destrukcji tkanek zachowała bardzo dobry stan zgryzu i uzupełnienia protetyczne przez 20 lat. Pacjentka, u której zakończono korektę wady zgryzu i przygotowano stałe uzupełnienie protetyczne również rokuje na wieloletnie utrzymanie dobrego zdrowia jamy ustnej i funkcji narządu żucia.

Słowa kluczowe: rozszczep wargi, rozszczep podniebienia, leczenie ortodontyczne, rehabilitacja protetyczna

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INTRODUCTION

One of the most commonly occurring congenital disorders in the craniofacial area is the complete cleft of the primary and secondary palate. This defect is characterized by the interruption of anatomical continuity, as well as the malformation and displacement of tissues affected by the cleft. It is inseparably associated with impairment of the respiratory, speech, hearing and food intake functions during the perinatal period, followed by postoperative malformations, dental anomalies and usually severe malocclusion, as well as the disruption of facial aesthetics, which is typically a source of complexes of varying intensity, self-acceptance issues and psychosocial development disorders.

Treating cleft defects is a long-term and complex process and it poses a great challenge to the whole team of specialists such as: a plastic surgeon, oral and maxillofacial surgeon, orthodontist, phoniatriest, speech therapist, and also more and more often a psychologist.

Despite having standards of dealing with patients afflicted with a complete primary and secondary cleft palate which has been elaborated over years and despite the existence of government refund programs for orthodontic care of these patients, at times we still come across a patient who for various reasons was unable or unwilling to accept the aid offered, or when they did so, the treatment did not follow established standards.

THE FIRST CASE

The authors present the case of a female patient who reported to an orthodontic office at the age of 25 in order to continue treatment which she had abandoned for a few years prior. The cause for this abandonment was complete discouragement and a lack of motivation after a never-ending, prolonged treatment with removable appliances, which did not yield the kind of results that the patient expected. She also admitted to not having cooperated well enough on her side. The patient was not provided with any psychological support.

Her motivation for resuming treatment was having obtained an attractive job which required direct verbal

contact with people, and which she really wanted, while the present occlusion rendered proper pronunciation impossible and interfered with her facial appearance.

The patient was born with a left unilateral complete cleft of the primary and secondary palate. For 21 years since her birth she was under orthodontic and overall medical supervision of the Multi-Specialization Medical Centre, where she underwent two stages of primary surgery, and 6 secondary plastic surgeries, mostly involving nose correction. The autologous bone graft surgery from the wing of ilium was done as late as when she was 21 years old. Afterwards, she continued orthodontic treatment in a private office. During this treatment the patient utilized removable appliances and one upper fixed palatal appliance. At the age of 23 she interrupted her treatment to resume it only at the age of 25. During the 2-year break in orthodontic treatment she did not use any appliance.

Extraoral examination indicates: significantly impaired facial deformity and asymmetry, distinct atrophic scar contracting upper lip, concave profile, retrusion of the upper lip, reduced thickness of the red part of the upper lip, prominent lower lip and positive lip step, all noted in profile. Intraoral examination indicates: pseudo-mesio-occlusion, teeth 21 and 22 missing, deviation of upper dental arch symmetry, correct lower dental arch symmetry, inconsistency of center lines due to displacement of upper teeth in the direction of the fissure of the cleft, canine almost class I on the right side, left upper canine remained in a cross-bite leaning towards the fissure of the cleft, cross-bite of upper right central and lateral incisors and canine 23 (fig. 1). It was impossible to determine the Angle classes due to teeth 46 and 26 missing.

In accordance to the Goslon Index ((1, 2)) measuring defect intensity, the patient was evaluated as Goslon 3 grade.

Cephalometric analysis indicates: slightly intensified skeletal class III (ANB -3.5, Wits -1.8), increased 1:1 interincisal angle (136.9°), retruded lower incisors (86.9°) angle between axis of tooth and lower margin of mandible, greatly decreased distance: 1+:NPg (mm) (-0.7 mm).

The treatment plan included the application of fixed metal braces on the upper and lower jaw and aimed to:

eliminate cross-bite on teeth 12, 11 and 23, alignment of the teeth in the upper and lower dental arches, restoration of sufficient space for the missing teeth 21 and 22, obtaining canine class I bilaterally, mesialization of teeth 27 and 47 into the place of the previously removed teeth 26 and 46 and achieving Angle class I, obtaining correct overjet and overbite.

The upper fixed appliance with a 0.022 slot in the MBT system was applied in July 2012, the lower one 3 months later. Treatment was carried out in the following archwire sequence: 0.14, 0.16, 0.18 NiTi, 17x25 TMA and 18x25 posted SS for the upper arch, and for the lower one: 0.14, 0.16, 0.18 NiTi, 17x25 TMA, 19x25 TMA.

In order to recreate space for the missing central and lateral left incisors, an open NiTi spring was used while working on a stainless steel rectangular archwire. Dental-alveolar correction was achieved by retroinclination of the lower incisors and protrusion of the upper ones. Once enough space for the missing incisors was recreated, composite artificial teeth were attached into the arch in these places by applying braces on them and fastening them with the use of metal and elastic ligatures (fig. 2). This significantly improved the patient's aesthetics and well-being.

Presently, the patient is passing through the final stage of orthodontic preprosthetic treatment. She was

presented prosthetic solutions regarding the replacement of her missing teeth and tissues. The patient did not approve any insertion of dental implants. Her usage of a removable retainer and attending follow up visits have also become an uncertainty. Consequently, we have planned a bridge with metal elements meant to stabilize the obtained tooth positions, initially including only proximal surfaces of directly adjacent teeth (fig. 3). However, after having rediscussed the matter, we extended the retention elements to the palatal surfaces of adjacent teeth (fig. 4), as abutment teeth were positioned in a cross-bite prior to the treatment. Palatal extensions of retention elements may be cut off once the retention time expires. Such a plan has brought forward in the need for enhancing the labial inclination of the adjacent teeth (torque of tooth 12 and 24 enlarged) in order to make room for retention elements derived from the bridge. Mesiodistal diameters of teeth 11 and 12 have been measured (in contact points) in order to adjust the distance between teeth 11 and 23, so as to obtain precise measurements for prosthetic replacements of teeth 21 and 22. Along with complementing the missing teeth, the planned prosthetic rehabilitation aims to mask the deficiency of the alveolar process tissue in the cleft's area – including the level of the attached gingiva being positioned too high – in order to properly adjust the length

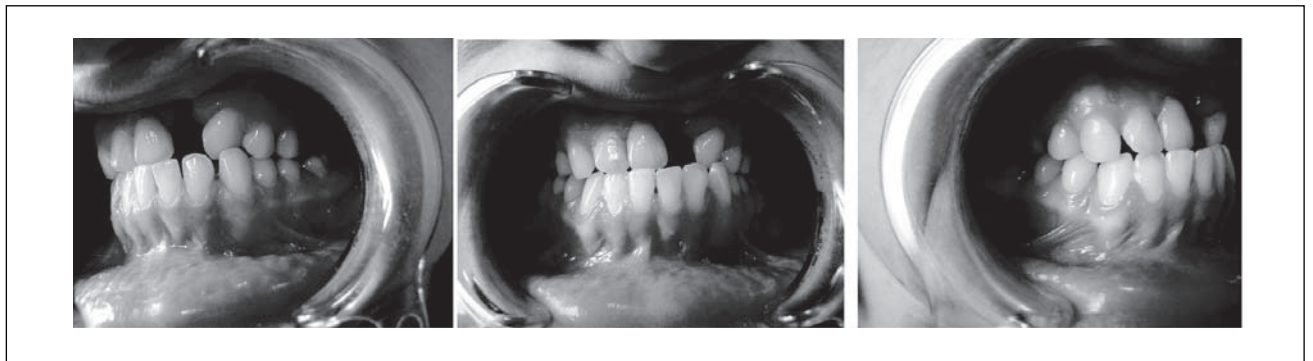


Fig. 1. Patient's intraoral photographs of occlusal conditions before orthodontic treatment with a *thin arch fixed appliance*.

Ryc. 1. Fotografie śródustne pacjentki przedstawiające warunki zwarciowe przed leczeniem ortodontycznym aparatem stałym cienko-łukowym.

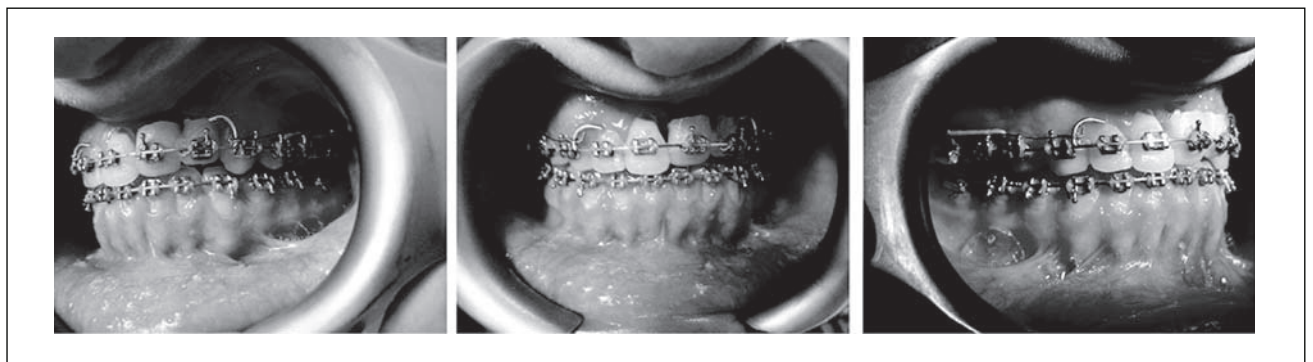


Fig. 2. The final status after the active phase of orthodontic treatment. The patient is prepared for prosthetic rehabilitation.

Ryc. 2. Stan po zakończeniu aktywnej fazy leczenia ortodontycznego. Pacjentka przygotowana do zaopatrzenia protetycznego.

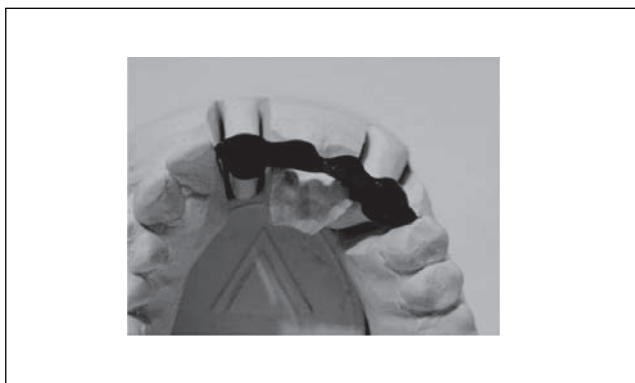


Fig. 3. A wax-up of the metal framework with retention elements adhering to the mesial surfaces of the adjacent teeth.

Ryc. 3. Wax-up metalowego rusztowania z elementami retencyjnymi przylegającymi do powierzchni stykających sąsiednich zębów.

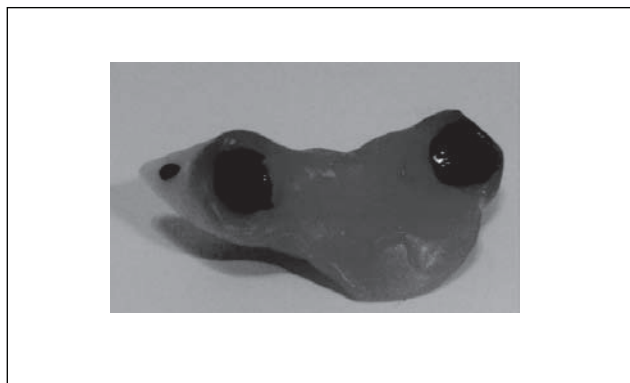


Fig. 5. Prosthetic camouflage covers large surface neighbouring soft tissues (rose wax surface).

Ryc. 5. Protetyczny kamuflaż zawiera (pokrywa) dużą powierzchnię sąsiadującą z tkankami miękkimi (różowa woskowa powierzchnia).

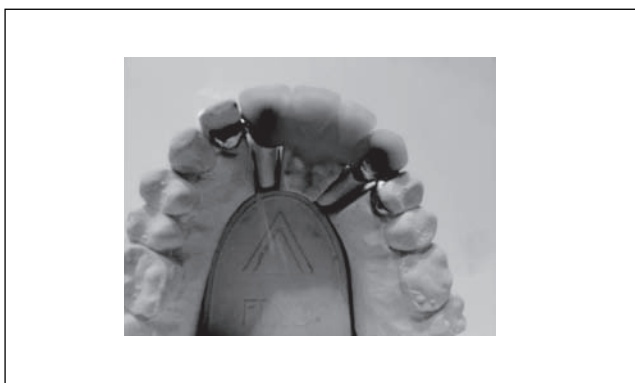


Fig. 4. A prosthetic replacement prototype with metal framework and retention elements on palatal surfaces of teeth contiguous with abutment teeth. The eventual bridge will be of a similar form and veneered with gingiva-colored porcelain which mimics soft tissue.

Ryc. 4. Prototyp uzupełnienia protetycznego na metalowym rusztowaniu z elementami retencyjnymi na powierzchniach podniebiennych zębów sąsiadujących z filarami. Ostatecznie wykonany most będzie podobnego kształtu most wykonany z różową porcelaną imitującą tkanki miękkie.

of the installed tooth crowns. The ultimately completed prosthetic camouflage is presented in figure 5.

We had a similar case (missing teeth 21 and 22 with a concomitant cleft of the alveolar process) 20 years ago. Despite the improper shape of the dental arch, the 37-year old refused the suggestion she should undergo orthodontic treatment with braces, recalling years of unsuccessfully using removable appliances and by then having used acrylic prostheses for fifteen years. The patient was given a similar cemented bridge as the one in case 1, however the alveolar cleft was more extensive and continued into a partially open palatal cleft. The wider range of the cleft's fissure caused difficulty in food intake and inarticulate rhinolalia. In this case, the unclosed cleft fissure extorted the construction of a complex palatal obturator veneered with gingiva-colored porcelain mimicking soft tissue (fig. 6). On the labial side, however, missing hard and soft tissue was complemented with a type of acrylic device relined

with silicone elastomer Molloplast B (Detax GmbH & Co). The soft, elastic form of the silicone enabled stable and secure fastening of the labial part of the prosthetic complementation on a spherical cast-iron rack mounted on a short jib raised from the bridge (fig. 7).

RESULTS

The treatment of the first patient with removable appliances eventuated in a correct bite in lateral segments, with the exception of the canine on the left side. The presented thin arch fixed appliance treatment, designed to correct the cross-bite in the range of teeth 12, 11, 23 and restore sufficient space for missing teeth 21 and 22 led to enhancing the vermilion of the upper lip to a slight but stable degree and widening the smile. As a result of the above, the lower margin of the upper lip was subject to a forward placement, which caused the facial features to improve. The curve corresponding to the upper margin of the lower lip transformed almost into an arc of concordance with the line connecting the incisive edges of the upper incisors, greatly improving the smile aesthetics. Orthodontic treatment reduced the disproportion between the mandible and maxilla that is characteristic of this type of defect, and laid the foundation for prosthetic reconstruction, of which the goals are: improvement of face aesthetics, speech advantage, and comfort of food intake. Due to the large width of the cleft fissure and the lack of two teeth, it was impossible to close the gap by orthodontic means, which is nowadays recommended whenever favourable conditions occur. Fixed prosthodontics is planned for the patient in place of the missing 21 and 22 incisors, in the form of a porcelain bridge. Prosthetic supplies are currently at the stage of being designed. Because the proportions for the height, shape and outline of the gum are completely distorted (or rather, non-existent), technicians must endeavour to recreate them most closely. Overall, the central incisor has the greatest gum height, the lateral incisor 1.5 mm less, and the canine the same as the central incisor (3). The patient's alveolar process is collapsed and shortened in the cleft area, so there is



Fig. 6. An obturator on the palate based on a metal framework veneered with gingiva-colored porcelain.

Ryc. 6. Obturator na podniebieniu na podbudowie metalowej licowany różową porcelaną.

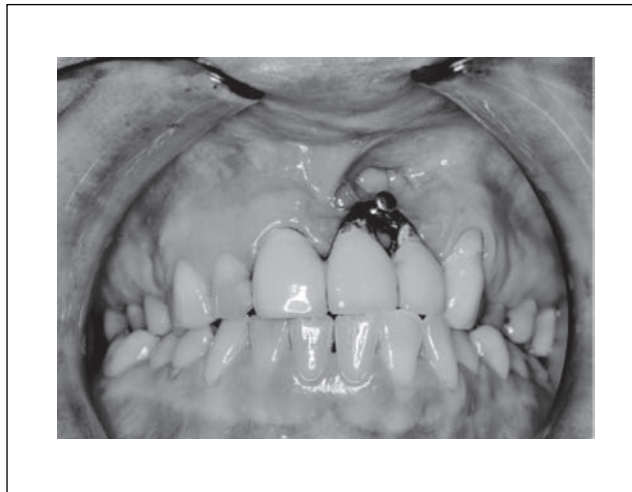


Fig. 7. A metal rack raised from the bridge for fixing of the labial obturator.

Ryc. 7. Metalowy uchwyt lany mostu do umocowania obturatora wargowego.

a plan to use veneered, gingiva-colored porcelain which would mimic the soft tissue, with the aforementioned proportions retained, along with reducing the fissure over the bridge as much as possible and recreating the smile symmetry. There is no open connection between the patient's oral and nasal cavity, so it is inexpedient to perform an obturation.

After taking off the braces, a removable Hawley retainer is planned for the lower dental arch, and for the upper arch initially an upper Schwarz plate with the missing teeth installed.

Similar aesthetic changes were observed in the second patient's case with presented prosthetic restoration *in situ*; the extensive tissue distortion, however, imposed the need to create more complex prosthetic appliances. In spite of the removable element of restoration (an obturator

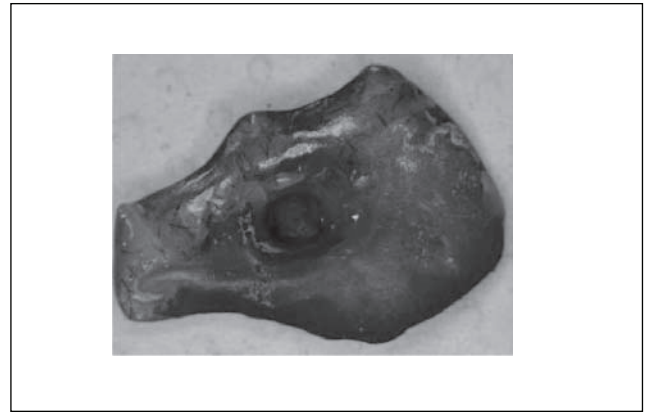


Fig. 8. A removable labial obturator – an acrylic appliance relined with silicone elastomer after 20 years of using, still in good condition to fix on the bridge rack.

Ryc. 8. Zdejmowany obturator wargowy – forma wykonana z akrylu wyścielona elastomerem silikonowym po 20 latach użytkowania nadal w dobrej kondycji do mocowania na uchwycie mostu.

installed under lip – fig. 7), it was deeply satisfying to the patient, including closing the cleft fissure on the palate and highlighting the lip. The patient accepted a two-part prosthetic restoration, appreciating the advantage in maintaining proper hygiene over the alternative of the heavy construction of a bridge (fig. 8).

DISCUSSION

The presented cases are examples of a treatment model of the late 1980s. Although alveolar bone grafting in the area of the cleft's fissure was introduced to the world in 1977 (4), in this patient's case such a protocol was not applied, even though she was being treated around the years 1995-1997. In both cases such a lack of treatment results in a significant collapse of the upper lip on the cleft's side, due to the lack of proper bone support. Orthodontic treatment that was carried out from the youngest years involved numerous, frequently changed removable orthodontic appliances. The patient does not recall any interruptions in her orthodontic treatment, other than the one she made herself as an adult person.

The result of the work of the Eurocleft project, which operated during the years 1996-2000, was not only creating a record of medical specialist centers in Europe that dealt with the treatment of patients with cleft defects, but also compiling clinical protocols, including orthodontics. According to these standards:

- orthodontic treatment should be divided into stages, as limited in time as possible, and initiated only when it would bring long-term benefit to the patient;
- patients with a lip or alveolar cleft and a cleft palate can be treated by so-called "local orthodontists";
- the number of appliances should be kept to a necessary minimum;
- alveolar bone grafting should be performed at the age of 8-11, so as to allow the eruption of permanent lateral incisor teeth (if they exist) or canines through already grafted bone;

- fixed retainers should be bonded on 2 teeth at once on both sides of the cleft, or semi-soft Essix retainers should be worn day and night for 4 months, then afterwards at night only;
- fixed retainers should be bonded on 2 teeth on both sides of the cleft at once, and semi-soft Essix retainers should be worn day and night for 4 months, then afterwards at night only.

In the range of prosthetic restorations, crowns and implant supported bridges are preferred (5, 6). Implants require bone augmentation but it is a long and expensive procedure. Our patients unambiguously chose prosthetic bridges. In the adhesion era there is a discussion of choice between Maryland bridges, which save enamel and traditional overdenture restoration. However, clinicians have noted failure in the retention of overdenture restoration and in cleft patients. Besides the psychological aspect, there is also a problem with skeletal stability. We chose the most reliable type of bridge with added cast-iron components preventing the collapse of maxilla bone, especially by the concentration of tension within the edentulous alveolar bone (5, 6, 7).

Bridges in patients with clefts of the alveolar process or/and palate are challenging for cleft patients in terms of hygiene, because of their expanded surfaces of pontic, contiguous with the mucosa of the gingival tissue. Fixed, closely adhering prosthetic restoration, even if thoroughly veneered with porcelain, may lead to the accumulation of food and bacteria plaque and subsequently a disease of the mucosa and periodontium. Prevention from caries undermining Abutment teeth should be given careful attention, so as to prevent the development of caries.

In the second case presented, it is important to introduce an elastic joint of a separate under-labial obturator and the possibility to expose the surface of the soft tissues covering the cleft fissure where there is the least saliva flow. Moreover, the soft material of the appliance forms a cushioning element for lip muscles, which together with masticatory forces could escalate bone atrophy by generating pressure on stiff bridge elements. The latest studies indicated the osteogenic effect of the elements of elastic prostheses (8). According to our experience, silicone relining does not become stiff with age and the mechanical properties of the prosthesis that allow stable connection with the bridge during mastication, speech, and daily activities are retained. Cast-iron elements extending onto the surrounding teeth fulfill a function of fixed retention holding teeth on both sides of the cleft.

CONCLUSION

Multi-specialized medical care is a basic condition for achieving the desired treatment results of patients afflicted with a lip and palatal cleft. This treatment is multistage and long-term. A decisive influence on the future end result is played by the quality of the surgery performed, as well as the right timing and also the quality of secondary surgery. Final orthodontic and prosthetic treatment is an integral component of the therapy and

requires close cooperation of dental specialists. Such treatment should have clearly defined goals, with appliance selection matched to the type of dentition and its time shortened to a possible minimum.

REFERENCES

1. Dogan S., Olmez S., Semb G.: Comparative assessment of dental arch relationships using goslon yardstick in patients with unilateral complete cleft lip and palate using dental casts, two-dimensional photos, and three-dimensional images. *Cleft Palate Craniofac. J.* 2012, 3, 347-351.
2. Mars M., Plint D.A., Houston W.J.B., Bergland O., Semb G.: The Goslon Yardstick: A New System of Assessing Dental Arch Relationships in Children with Unilateral Clefts of the Lip and Palate. *Cleft Palate Journal.* 1987, 4, 314-322.
3. Zachrisson B.U.: Planning esthetic treatment after avulsion of maxillary incisors. *J. Am. Dent. Assoc.* 2008, 11, 1484-1490.
4. Wiggman K., Larson M., Larson O., Semb G., Brattström V.: The influence of the initial width of the cleft in patients with unilateral cleft lip and palate related to final treatment outcome in the maxilla at 17 years of age. *Eur. J. Orthod.* 2013, 35, 3, 335-340.
5. Wasiluk G., Chomik E., Bereznowski Z.: Telescopic overdenture supported on teeth and dental implant. A case report. *Prosthodontics.* 2013, 63, 4, 272-280. (in Polish).
6. Kawakami S., Yokozeki M., Horiuchi S., Moriyama K.: Oral rehabilitation of an orthodontic patient with cleft lip and palate and hypodontia using secondary bone grafting, osseo-integrated implants, and prosthetic treatment. *Cleft Palate Craniofac. J.* 2004, 3, 279-284.
7. Marcusson A., Paulin G.: Changes in occlusion and maxillary dental arch dimensions in adults with treated unilateral complete cleft lip and palate: a follow-up study. *Eur. J. Orthod.* 2004, 4, 385-390.
8. Sereno N., Jarman-Smith M.: www.google.com/patents/WO2013076493A1?cl=en

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