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ORTHODONTIC TREATMENT IN CHILDREN WITH CLEFT LIP AND PALATE REPAIRED USING A TWO-STAGE SURGICAL CORRECTION – AUTHORS' EXPERIENCE

LECZENIE ORTODONTYCZNE DZIECI Z ROZSZCZEPEM WARGI I PODNIEBIENIA OPEROWANYCH DWUETAPOWO – DOŚWIADCZENIA WŁASNE

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Abstract

Aim: *The purpose of this study was to present and evaluate orthodontic rules and methods in the treatment of children and adolescents with complete cleft lip and palate.*

Materials and methods: *The material consists of about 5500 primary clefts treated at the Hospital and Clinic of Plastic Surgery in Polanica-Zdrój in the years 1976-2008. The most common surgical procedure (>99%) consisted of two-stage repair of cleft lip and palate. In the years 1976-2008, surgical treatment was administered to 5,500 children with a cleft lip and palate. The efficiency of orthodontic procedures is discussed in relation to multidisciplinary cooperation, with a particular emphasis on surgery.*

Conclusions: *Apart from cleft morphology and the quality of primary surgery, the patients appearance, midface development and occlusal conditions depend on multidisciplinary cooperation, with special regard given to orthodontic treatment.*

Key words: cleft lip and palate, orthodontic methods, multidisciplinary treatment

Streszczenie

Cel: *Opracowanie i przedstawienie schematu oraz oceny postępowania ortodontycznego u dzieci i młodzieży z całkowitymi rozszczepami wargi i podniebienia.*

Materiał i metody: *Materiał kliniczny stanowiło 5500 pierwotnych rozszczepów leczonych w Szpitalu i Klinice Chirurgii Plastycznej w latach 1976-2008. U ponad 99% pacjentów stosowano dwuetapowe operowanie wargi i podniebienia.*

Wnioski: *Oprócz morfologii i jakości pierwotnego leczenia operacyjnego, wygląd pacjentów, rozwój środkowej części twarzy i warunki zgryzowe zależą od wielospecjalistycznego leczenia, ze szczególnym uwzględnieniem właściwego postępowania ortodontycznego.*

Słowa kluczowe: rozszczep wargi i podniebienia, terapia ortodontyczna, leczenie wielospecjalistyczne

INTRODUCTION

Cleft lip and palate is one of the most frequent congenital deformities of the craniofacial area (1, 2). The extent of morphological changes, the type of cleft as well as the effectiveness of primary surgery significantly affect the treatment outcome (3, 4). One must also not overlook the role of orthodontists, whose cooperation with other specialists, particularly surgeons, helps achieve increasingly better treatment results.

The aim of this paper is to present and evaluate the rules and methods of orthodontic treatment implemented in the Orthodontic Centre at the Plastic Surgery Hospital in Polanica Zdrój.

MATERIAL AND TREATMENT METHODS

During the period between 1976 and 2008 5,500 cases of primary cleft lip and palate were surgically treated at the Plastic Surgery Hospital and Clinic in Polanica Zdrój. Initially, orthodontic treatment was conducted at various orthodontic centres in Poland. From 1996, the majority of the patients who were operated on received treatment at the Orthodontic Centre of the Plastic Surgery Hospital and Clinic in Polanica Zdrój. The remaining patients, from more distant parts of the country, were referred to other accredited centres, located closer to where they lived.

Orthodontic care was applied from the first weeks of a baby's life (5), but proper orthodontic treatment was implemented in children in the period of mixed dentition, that is approximately 7 months before or after secondary alveolar bone grafting. Most advocates of fixed-appliance treatment argue that early orthodontic correction in the period of primary dentition has no influence on the ultimate development of the jaw and that correct occlusal conditions in primary dentition do not affect the occlusion of permanent teeth. Rotation and palatal position of medial incisors adjacent to the cleft is observed in over 90% of patients with cleft lip and palate.

In patients with complete clefts, primary surgery on the lip was usually performed at the age of 6 months, and palatoplasty, depending on surgeons' preferences, either before the age of one or, more frequently, between the ages of two and three. In unilateral clefts, lip operations involved an anatomical anastomosis of the orbicularis oris muscle using Millard's or Randall's methods, with primary correction of nasal deformity. Bilateral cleft operations usually involved two stages. In over 100 cases the so-called early elongation of columella was performed.

Cleft palates were corrected either by using an extended vomer flap or, more frequently, according to the Veau method (6). The purpose of the treatment was not only to separate the oral cavity from the nasal cavity but also to restore anatomical conditions for comprehensive speech development (4, 6-9).

Orthodontic treatment was adjusted to each patient's therapeutic needs in accordance with the guidelines specified by the National Health Fund in the programme of care for children with congenital craniofacial disorders (10). The basic criterion for assessing the severity of malocclusion when planning the treatment and evaluating the results was the GOSLON 5-point score adopted by Eurocleft (11). Conducting team therapy, resulted in achieving optimum occlusion and facial aesthetics (12).

In unilateral clefts of the lip, alveolar process and palate, typical skeletal deformities involve a displacement of segments of the cleft jaw and a deviation of the nasal septum towards the healthy side. Intraorally, palatally rotated lesser segments result in partial anterior and/or lateral cross-bite. Reverse overjet within a single primary tooth can be corrected by grinding the opposing teeth. Orthodontic treatment can be postponed until the time of early mixed dentition, which is consistent with research conducted by other authors (13). In the case of severe malocclusions with features of pseudo underbite, in our opinion it is necessary to conduct active orthodontic treatment at every stage of occlusal development. Eliminating the reverse overjet by means of active and functional appliances stimulates the growth of the maxilla in the anterior-posterior dimension. Correcting the occlusion improves the functions of speech, chewing and breathing, mainly by creating more room for the tongue as well as slightly increasing the anteroposterior dimensions of the nasal cavity. It was demonstrated by our own research as well as that conducted by other authors (14).

In complete bilateral clefts, after lip repair surgery, the restored anatomical structure of the orbicularis oris muscle exerts the desired pressure on the premaxilla, preventing its excessive protrusion. In patients with a considerable protrusion of the premaxilla, increased horizontal overjet >5 mm and deep vertical overbite, the final shaping of the maxillary arch, and a resultant improvement in occlusion, is possible after alveolar osteoplasty with autogenous bone grafts, usually taken from the iliac crest. The procedure is typically performed between the ages of 7 and 9 years.

After cleft palate repair, performed no later than at the age of 3 years old, that is, during the stage of primary dentition, occlusal adjustments in all types of cleft defects are implemented in patients with considerable skeletal discrepancy. An abnormal pattern of oro-facial growth and the resultant necessity to monitor the occlusal conditions justify limiting the duration of orthodontic treatment to the necessary minimum in malocclusions with a GOSLON score of 2 and 3 until skeletal maturity is reached (15).

An additional complication in the treatment of post-cleft deformities are disorders relating to the teeth. These include a lack of permanent tooth buds adjacent to the cleft, delayed development or a lack of second premolars, as well as, much more frequently than in children without cleft defects, impacted first molars. Atypical formation in the crowns of lateral incisors combined with crown and/or root dilaceration in unilateral clefts and with shortened roots in bilateral clefts requires the use of orthodontic forces at a level which helps reach a plateau.

Many authors recommend that prior to alveolar osteoplasty it is necessary to plan and restore optimum

occlusal conditions on the basis of LL radiographs and diagnostic models (16, 19).

In patients with unilateral clefts the preparation of dental arches involves a correction of reverse overjet in the incisors by means of utility arches with coil springs as well as arches with U-loops, saggital expanders and, if necessary, a face mask.

The need for a transverse expansion of the jaw relates to cases where there is a considerable displacement of the lesser segment in relation to the greater segment, as well as cases of patients with protrusion of the premaxilla and incorrectly positioned incisors. The expansion and correct positioning of the maxillary segments is considerably easier when done before corrective surgery than if performed after alveolar bone grafting.

In bilateral clefts, in the opinion of some authors, the lateral cross-bite correction should be done before alveolar bone grafting. According to Tindlund, intercanine widening of maxilla during the deciduous and mixed dentition is noted (17). After alveolar bone grafting, until the bone has healed, a fixed appliance stabilises the premaxilla, thus preventing micro traumas and bone grafts resorption. Already at the end of the 1990s it was proved that stabilising the bone prior to bone transplantation increases the effectiveness of alveolar osteoplasty (18).

In patients who have undergone secondary osteoplasty a fixed appliance has the additional function of a stabiliser for the period of six months after surgery. A radiograph taken after this time (preferably a CT-3D image) helps assess the healing process of the bone graft. A decision to perform further bone grafting is taken by the orthodontist. At the age of about 11 years, a canine tooth should grow into the correctly healed and restructured bone, providing additional stabilisation for the area of the alveolar cleft, a fact which was emphasised by Feichtinger (19).

Subsequent stages of orthodontic treatment according to Semb aim to monitor maxillary and mandibular growth, control the eruption of groups of teeth, as well as correcting overjet and overbite (20). Recreating the line of dental symmetry is possible after restoring the atypical crowns of lateral incisors after they have been orthodontically repositioned. If a lateral incisor is missing, the gap can be closed by repositioning the canine towards the medial incisor, leaving the tooth gently intruded in a slightly palatal position, or replace it with a prosthetic restoration, as reported by Piórkowska (21).

The prosthetic rehabilitation of patients with complete clefts in the event of missing individual teeth is conducted through the use of removable or fixed prostheses. Removable acrylic prostheses are used in patients during the developmental period and they are often equipped with orthodontic screws for changing the transverse dimension of the prosthetic restoration so as not to impede the natural growth of the jaw. Cast metal dentures are used in adult patients when it is impossible to use fixed bridges. These prostheses can replace a greater number of missing teeth in patients with oligodontia, and the metal palatal plate additionally acts as a retainer (22, 23).

When individual teeth are missing, fixed restorations, in the form of bridges, are used. The number of prosthetic abutments depends on their quality and the morphological conditions of the alveolar process. If there is considerable atrophy of the alveolar process, additional abutments are incorporated in the area of the bone graft in order to improve the stability of the planned construction and to relieve the pressure on the principal abutments. The pontic of the bridge ought to be shaped in such a way as to ensure the best possible aesthetic effect as well as permitting proper oral hygiene. This was shown in the works of a number of authors (23, 24).

In the prosthetic rehabilitation of patients with complete clefts, after the reconstruction of the alveolar process it is possible to mesialise the canine towards the bone graft. However, in order to improve the aesthetics of the front section it is necessary to recontour the canine so that its labial surface resembles that of a lateral incisor. Recontouring during the development stage is done using composite materials, with limited preparation of the hard tissues; when growth is completed the shape of the canine can be changed through the use of composite or ceramic veneers, or dental crowns (complete or partial). The choice of appropriate procedure depends on the patient's age, the state of the periodontium, as well as the size of the clinical crown of the canine to be recontoured and the position of the tooth in the alveolar process. Evaluation of the morphological and functional conditions after the surgical and orthodontic treatment has been completed helps select the least invasive method involving limited abutment preparation, and at the same time one that will produce significant improvement in the aesthetic appearance of the anterior section (24).

On the basis of the diagnostic and therapeutic principles presented above, a model for the treatment of children and adolescents with a cleft lip and palate after two-step surgery in the Orthodontic Centre at the Plastic Surgery Hospital and Clinic in Polanica Zdrój has been developed. Thus, orthodontic treatment involves the following steps:

1. Preparing the maxillary arch for secondary alveolar osteoplasty.
2. Controlling the eruption of individual teeth and/or groups of teeth; controlling overjet and overbite.
3. Qualifying cases for maxillary distraction or osteotomy after the completion of skeletal growth in patients with primary maxillary hypoplasia with considerable skeletal discrepancy.
4. Prosthetic care.

Illustrative material for the article was included in fig. 1-7.

CONCLUSIONS

In complete clefts, an acceptable appearance, midface development and occlusal conditions depend not only on morphology and the quality of primary surgery, but are also the result of the work of a number of closely cooperating specialists.

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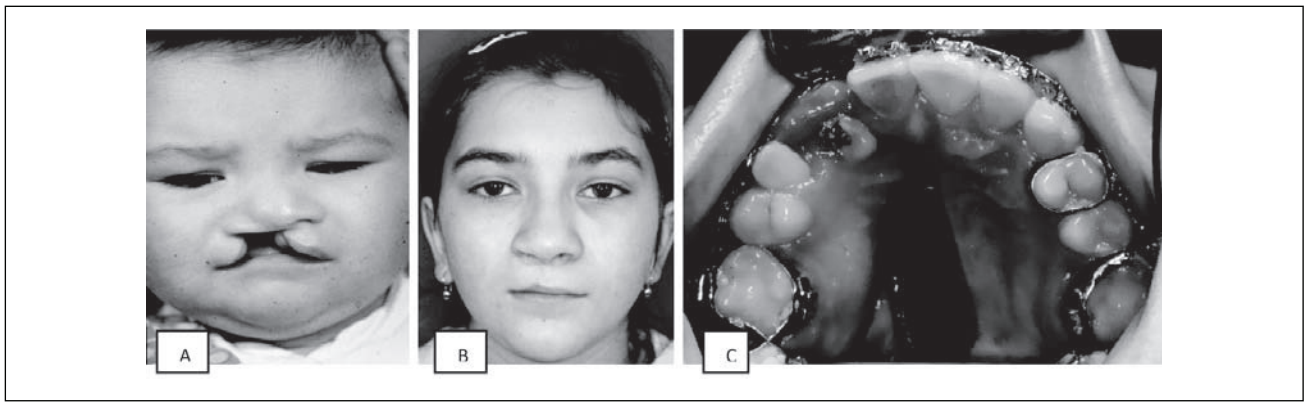

Fig. 1. An example of the treatment of unilateral cleft lip, alveolar process and palate. A – before lip surgery performed using Millard's method and palate surgery using an extended vomer flap; B and C – long-term treatment outcome.

Ryc. 1. Przykład leczenia całkowitego jednostronnego rozszczepu wargi wyrostka zębodołowego i podniebienia. A – przed operacją wargi sposobem Millarda oraz zeszyciem rozszczepu podniebienia z użyciem wydużonego płata z lemiesza, B i C – odległy wynik leczenia.

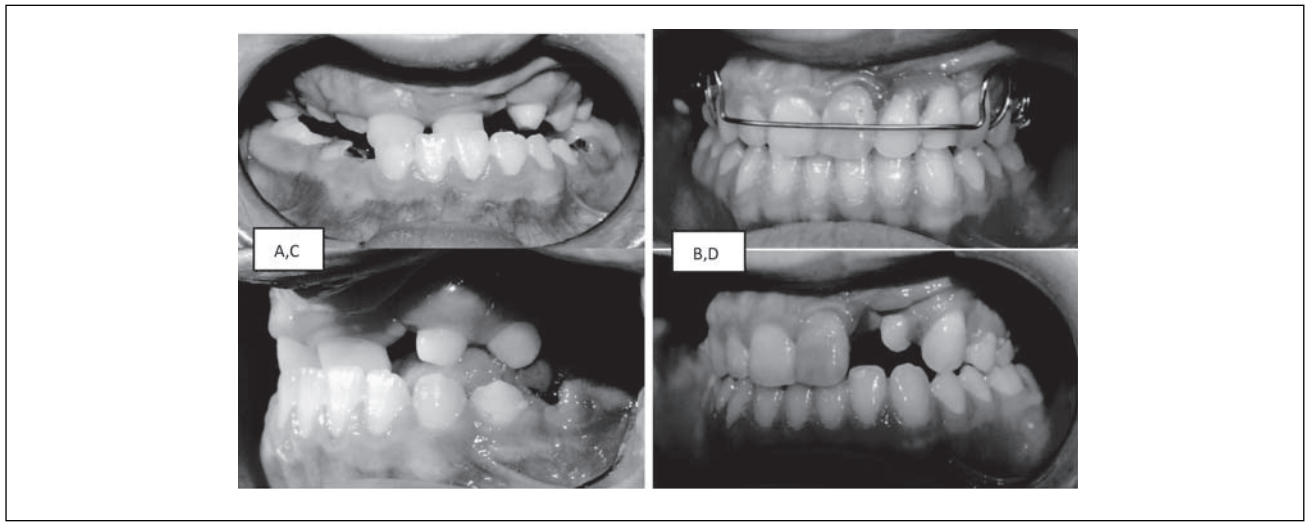

Fig. 2. A, C – occlusion in complete unilateral cleft during the period of mixed dentition; B and D – long-term treatment outcome.

Ryc. 2. A, C – warunki zgryzowe w całkowitym rozszczepie jednostronnym w okresie uzębienia mieszanego; B, D – odległy wynik leczenia.

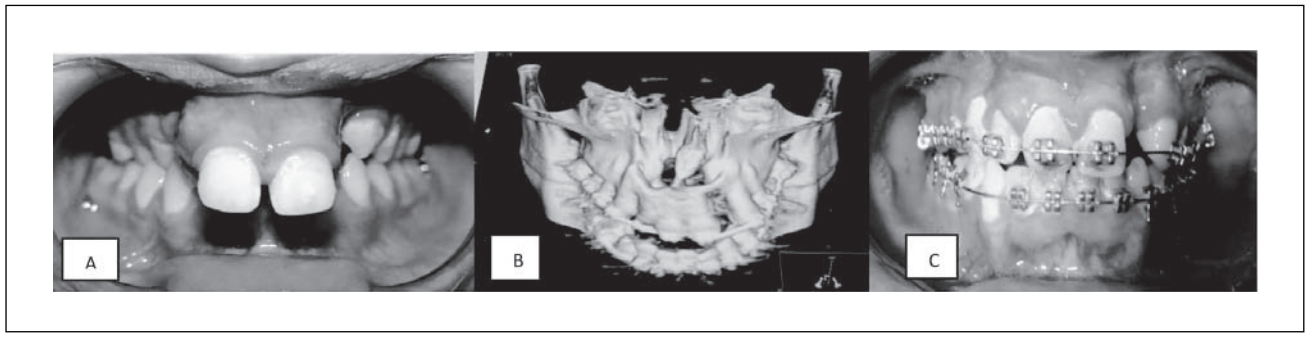

Fig. 3. Complete bilateral cleft lip, alveolar process and palate. A – protrusion of the premaxilla – 9 mm; B – CT-3D after alveolar osteoplasty; C – long-term treatment outcome.

Ryc. 3. Obustronny całkowity rozszczep wargi, wyrostka zębodołowego i podniebienia. A – protruzja kości przysiecznej – 9 mm, B – kontrolne TK-3D po osteoplastyce wyrostka zębodołowego, C – odległy wynik leczenia.

Fig. 4. An example of the treatment of a patient with complete unilateral cleft lip, alveolar process and palate. A – correction of reverse overjet, tooth 21; B – the same patient at the age of 15 after secondary alveolar bone grafting, correct occlusion; C – long-term outcome of surgical, orthodontic and prosthetic treatment.

Ryc. 4. Przykład leczenia pacjenta z jednostronnym całkowitym rozszczepem wargi, wyrostka zębodołowego i podniebienia. A - korekta odwrotnego nagryzu ząb 21, B – ten sam pacjent w wieku 15 lat po operacji wtórnego przeszczepu kości do szczeliny wyrostka zębodołowego, zgryz w granicach normy, C – odległy wynik leczenia chirurgiczno-ortodontyczno-protetycznego.

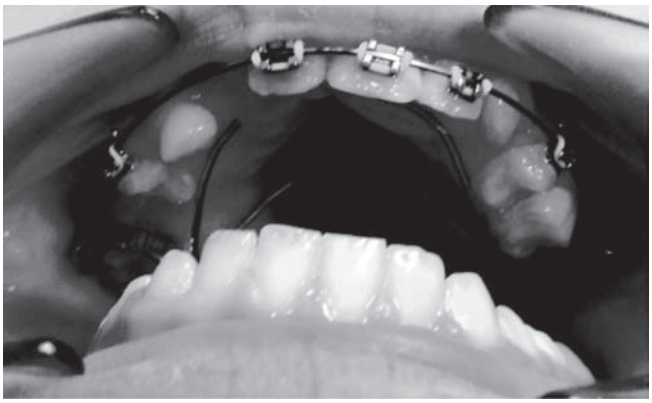

Fig. 5. Intraoral radiograph of a ten-year-old patient with a unilateral cleft being prepared for alveolar osteoplasty. On the palatal side a fixed thick-wire appliance which prevents palatal displacement of the canines and premolars, on the vestibular side an external steel arch stabilising the shape of the maxillary arch.

Ryc. 5. Fotografia wewnątrzustna 10-letniej pacjentki z rozszczepem jednostronnym przygotowanej do operacji osteoplatyki wyrostka zębodołowego. Od strony podniebiennej aparat grubołukowy przeciwdziałający dopodniebiennym przemieszczeniom kłów i przedtrzonowców, od strony przedsionkowej zewnętrzny łuk stalowy stabilizujący kształt łuku szczęki.

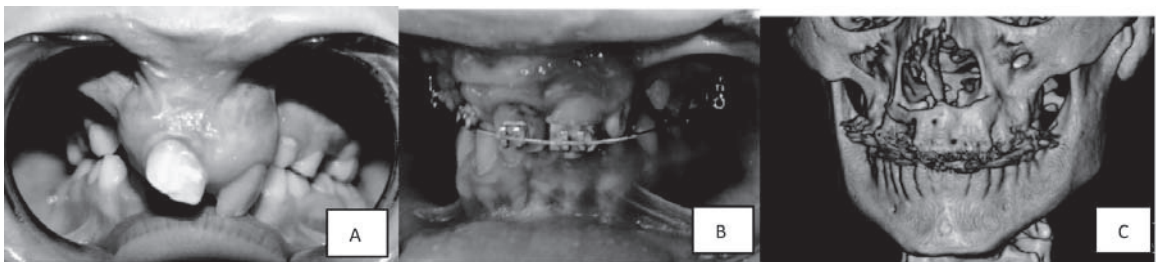

Fig. 6. Complete bilateral cleft lip, alveolar process and palate. A – early mixed dentition; B – occlusion after bone grafting; C – CT-3D 12 months after surgery.

Ryc. 6. Obustronny całkowity rozszczep wargi,wyrostka zębodołowego i podniebienia. A − wczesne uzębienie mieszane, B – warunki zgryzowe po operacji przeszczepu kości, C − kontrolne TK-3D po 12 miesiącach od operacji.

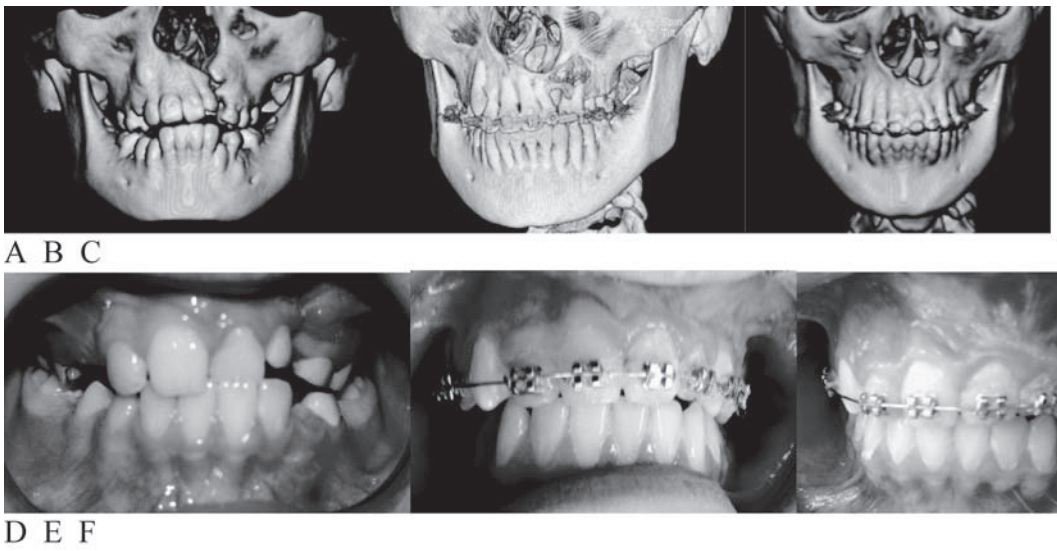

Fig. 7. CT-3D and occlusion in a complete unilateral cleft. A – before bone grafting; D – before orthodontic treatment; E – orthodontic preparation for bone grafting; B – after bone grafting; C and F – 24 months after alveolar bone grafting.

Ryc. 7. TK-3D, oraz warunki zgryzowe w całkowitym jednostronnym rozszczepie. A – przed operacją przeszczepu kości, D – przed leczeniem ortodontycznym, E – przygotowanie ortodontyczne do przeszczepu, B – po przeszczepie kości, C i F – 24 miesiące po operacji przeszczepu kości do wyrostka zębodołowego.

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