European Scholar Journal (ESJ)
Available Online at: https://www.scholarzest.com
Vol. 4 No.04, April 2023
ISSN: 2660-5562

EFFECTIVENESS OF THE METHOD OF UPPER JAW DEFECTS USING INDIVIDUAL TITANIUM CONSTRUCTIONS IN CONGENITAL CLEFT OF THE UPPER LIP AND PALATE

Tozhiev F.I.
Azimov A.M.
Muqimov I.I.
Musayev Sh. Sh.
Ismoilhuzhaeva K.G.
Tashkent State Dental Institute

Article history:

Received: 22th February 2023
Accepted: 22th March 2023
Published: 26th March 2023

Abstract:

Congenital cleft lip and palate (CHL) being one of the most frequent malformations of the maxillofacial region since the birth of the child is accompanied not only by the cosmetic defect but also by severe functional disturbances. The high frequency of congenital cleft lip and palate, severe anatomical and functional disorders, the difficulty of social adaptation of such children indicate the particular relevance of this problem. According to the World Health Organization (2009), among all congenital malformations, congenital cleft lip and palate occupies the 2-3rd place, and by the severity of anatomical and functional disorders - the leading place.

Keywords: maxillary defect, individual implants, congenital cleft lip and palate

INTRODUCTION: In the Republic of Uzbekistan, the improvement of the health care system has allowed not only to improve public health, but also to achieve some success in the prevention of the formation of malformations, including congenital cleft lip and palate. Certain successes have been achieved in diagnostics, treatment methods have been improved, and programs for the rehabilitation and rehabilitation of these children have been developed.

It should be noted that congenital cleft lip and palate is not only a medical but also a social problem worldwide. The alveolar process plasty seems to be a difficult task, which has not yet found its solution. Good results are observed when autografts are used to restore the integrity of the maxilla, the alveolar process, the shape of the upper lip and the nose. When using the allograft, a number of issues related to harvesting, preservation and storage need to be solved, which requires significant material costs. These difficulties determine the relevance of alveolar process defect plasty, necessitating the development of new methods for the treatment of congenital cleft lip and palate, including alveolar process plasty with autografts using membranes. Early diagnosis of congenital malformations, the use of modern surgical methods of treatment, improvement of rehabilitation and prevention methods aimed at preventing childhood disability is the current topic of many scientific studies.

It is known that in order to provide qualified care for this category of patients, complex surgeries involving a group of specialists are required: orthopedists-dentists, maxillofacial surgeons, engineers, etc., for subsequent rehabilitation, which determines the relevance of the topic.

THE AIM OF THE STUDY: is to substantiate the effectiveness of preoperative preparation for surgical repair of the maxillary defect in congenital cleft lip and palate using stereolithographic models, to improve the accuracy of surgery and reduce the time of surgical intervention.

MATERIALS AND METHODS OF RESEARCH. The work is based on the results of examination of 44 patients with the defects of the jaw at the congenital cleft lip and palate who were hospitalized in the department of children's maxillofacial surgery of TGSI clinic during the period from 2019 to 2023, in order to compare the results of surgical treatment and determine the optimal method of surgical treatment.

In order to systematize the clinical material, we used the classification of congenital cleft lip and palate by L.E. Frolova (1974) and the classification of midface deformities after elimination of congenital cleft lip and palate by B.N. Davydov (2007). Classification of bone formation in the area of the alveolar process by O. Belgrad (1986).

Surgical intervention in patients to eliminate residual and secondary deformities of the upper jaw was performed in the form of secondary and tertiary bone plasty of the alveolar process (group 1), implantation with individual implants (group 2).

We note the predominance of patients with right-sided defects and deformities of the upper jaw - 21 patients, which is 47.7% of the total number of patients studied. Some patients underwent surgical intervention in several stages. The upper jaw defects ranged in size from 1 to 2 cm. In 5 (11.3%) patients the maxillary defects were 1 to 1.5 cm in length; in 8 (18.2%)- 0.8 to 2.0 cm; in 18 (40.9%) - 0.5 to 1.5 cm; in 12 (27.3%) - 0.6 to 1.8 cm and in 1 (2.3%) - 1.5 to 2.5 cm. Thus, significant upper jaw defects were observed in a larger number of patients from 1.0 to 2.0 cm.

The predominant number of upper jaw defects in GERD by localization is on the left side (39%), less often on the right side (48%) and least often on the bilateral side (13%).

With an upper jaw defect, a facial deformity due to the recession of soft tissues into the nasal margins is observed.

From the functional disorders we noted a violation of biting function and speech. All this was accompanied by profuse salivation. As a result of soft tissue changes, soft tissue retraction into the nasal margins was determined and facial asymmetry was noticeable. These factors had a negative impact on the patient's psyche.

All patients underwent the surgical intervention for the upper jaw defect - bone grafting.

The most difficult and important moments of the bone plasty were: preparation of the graft bed, fixation of the upper jaw fragments, selection of the graft and its fixation in the bone wound.

Peculiarities of the bone bed preparation: with strict aseptic observance we removed foreign bodies, carefully stopped bleeding, and in case of rupture of the oral mucosa we applied vicryl and polypropylene sutures to the wound, sometimes double-row sutures. Scar tissue between the ends and around the upper jaw fragments was excised, the scarred fragments were repaired. Often the altered oral mucosa was dissected and then a defect was formed. The method proposed by Professor M.V. Kostylev (1963) was used to close such defects. The comparative assessment of the results of treatment was based on clinical and radiological examination data and analysis of bed-days. Analysis of the distribution of patients by age showed that the age group of 18 and older accounted for the largest number of patients, which was 52.27%. There is a slight predominance of women - 47.7% of the total number of patients.

Clinical examination of patients was performed using the traditional method of alveoloplasty to replace the defect of the alveolar process. The description of the course of the operation, patient management in the postoperative period, general and local status of the patient before and after discharge were studied in case histories. The examination of the patients began with the collection of anamnesis. We found out the etiological factor, the age of the process, the presence of concomitant diseases, whether and how much medical care had been previously provided.

During clinical examination we evaluated the symmetry of the face, the presence of functional disorders (severity of the upper face defect, etc.), took impressions and made diagnostic models with their subsequent evaluation. We studied the long-term results of surgical treatment of patients with upper jaw defects in congenital cleft lip and palate during follow-up examinations for one to two years.

In the preoperative period we also conducted laboratory studies: general blood and urine analysis, biochemical blood analysis, blood sugar. Analysis of blood parameters in the studied case histories showed the absence of significant dynamics of their changes depending on the use of this or that treatment tactics.

Electrocardiogram and chest X-ray data were studied. We carried out sanation of chronic foci of infection and treatment of concomitant diseases. All patients were examined by a therapist and anesthesiologist before the operation and other specialists (ENT doctor, neurologist, traumatologist and other specialists) if necessary. The above examinations were performed on an outpatient basis.

To evaluate the surgical treatment, patients were also photographed before and after surgery. All patients were photographed under the same conditions before and after surgery in two projections (facial and profile images).

Radiological examinations were performed before and after surgery. Depending on the clinical situation, these were: orthopantomogram, facial and profile radiographs of the upper jaw, semiaxial projection, and computer tomography. X-rays were of identical projection and stacking before and after surgery. The radiographs were evaluated according to the following features: the presence of resorption or displacement of biosynthetic autografts, especially in the places of their connection with the patient's bone tissue, the condition of wire sutures, changes in the transparency of paranasal sinuses, etc.

Indications for reconstructive surgery on the upper jaw were intraoperative defects of varying length, as well as defects of the jaw and postoperative deformities of the upper face in congenital cleft lip and palate.

Operations to eliminate the defect of the upper jaw at GERD were subdivided into primary ones - with the help of autologous bone graft and with the help of an individual implant.

Primary elimination of the defect by means of autologous bone transplant was carried out in case of alveolar defects of II, III, V types when there was enough soft tissues and mucosa for free closure of the transplant. At the defects of the alveolar process of I, IV types when there was a big distance between the fragments and when there was space for orthopedic treatment the restoration of the defect of the alveolar process with the endoprosthesis with a dental implant was performed.

The criteria for choosing a graft or a custom-made implant were the type of the alveolar process defect according to Xinlei Yu, Yiping Huang and Weiran Li.

Preoperative preparation of the patient for surgery to restore maxillary defects using individual implants in patients with congenital cleft lip and palate, as well as for secondary surgical intervention for a defect or deformity of the upper jaw, has undergone significant changes in recent years.

Patient preparation for surgical intervention includes:

1.Gathering the anamnesis, determining the age of the disease.

2.Identification of concomitant diseases.

3. general clinical examination: general blood count with gemsindrom, blood group and Rh factor, biochemical blood count, general urinalysis, ECG.

4. Complete radiological examination: X-ray of the upper jaw in three projections, orthopantomography, computer tomography. Orthopantomography was conducted on the apparatus: Panoramik PM 2002 SS orthopantomograph, as well as X-ray Siemens Somatrom CR tomography was used for the work. Depending on the complexity of the object, the scanning was performed in high resolution mode with a slice thickness of 2 or 4 mm. 3-D scanning of facial skeleton bones was performed.

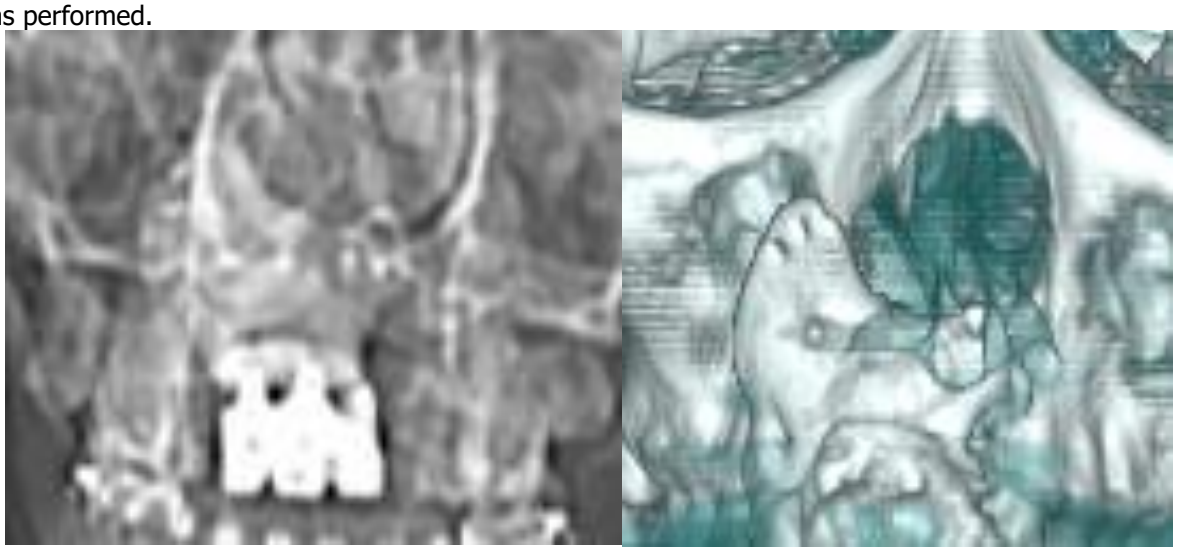

Fig.1 MSCT: titanium implant with dental implants and crowns placed on the right side.

Planning of the upcoming surgical intervention, with determination of the exact volume of the planned alveolar process, or the size of the defect. The mandible was placed in the optimal position, taking into account the bite and cosmetic indicators. Next, the defect was eliminated with a model of an endoprosthesis made of wax by sculpting. The endoprosthesis model was fitted to the place of its future attachment on the upper jaw. A titanium endoprosthesis was fabricated on the basis of the wax template. In this way, the defect was repaired with the wax model, which then served as a template for fabricating the endoprosthesis.

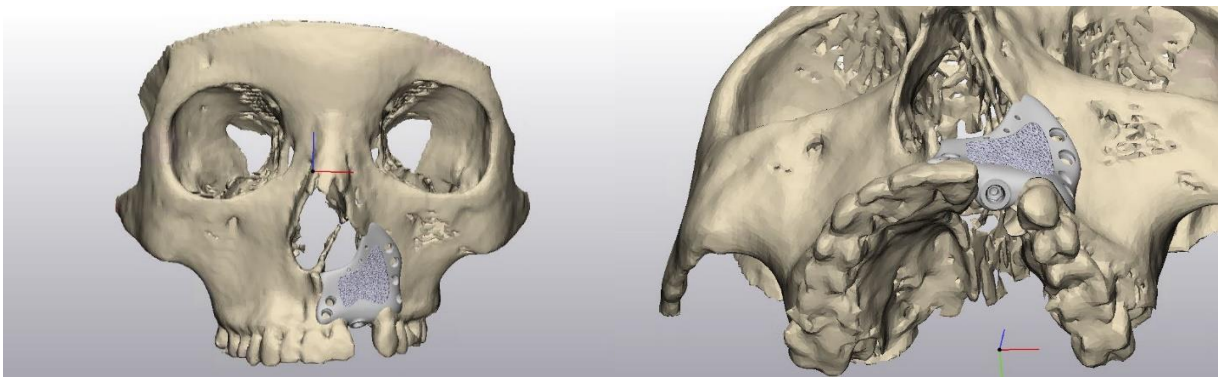

Fig.2 A wax template of an endoprosthesis that accurately corrects the defect is simulated.

6. If an upper jaw defect was planned to be corrected with a titanium endoprosthesis, a simulated upper jaw resection surgery was performed on the model. The resulting defect was repaired with an aluminum template. The height of the branch was also calculated on the model in order to select a titanium joint of the appropriate size. An individual titanium endoprosthesis was fabricated using the available template, which was a titanium plate that had individual curves to adapt it to the specific patient.

Titanium plates and TMJ prostheses made in the conditions of the specialized production with the observance of the corresponding technology from titanium grade BT-1-0 (OST-1 90173-75) were used in the work, also there was used a set of titanium plates for reconstructive operations on the upper jaw of the firm "Martin" (Germany).

8. If it was planned to eliminate the defect with a vascularized autograft of fibula, the linear dimensions of the resected area of the upper jaw were calculated on the X-ray and the angles of osteotomy of the graft were planned taking into account the anatomical curves.

9. Orthodontic examination and treatment included making plaster models of the jaws, making a bimaxillary splint to fix the bite in the postoperative period and to place the jaws in the correct orthognathic position during resection, fitting and fixation of the endoprosthesis, or graft.

10. Before surgery, children were photographed in the following positions: front, profile right, left, open mouth, bite, and front with head tilted back. In the preoperative period, the method of fixation of the endoprosthesis or graft

in the bone wound was determined. Fixation was performed using titanium plates, titanium self-tapping screws, and bone suture method. Individual fixation titanium plates were made to exactly follow all the curves and irregularities of the jaw fragment.

RESULTS OF THE STUDY: In order to compare the informativeness of the methods of examination, we proposed a protocol for assessing the informativeness of each examination (examination, palpation, jaw models, orthopantomography, facial skeleton radiography in standard projections - facial and profile), taking into account the possibility of determining the data that are required for reconstructive-restoration operations on the upper jaw. The evaluation was performed according to the unified summary table 1**.**

Table 1.

Assessment of the informativity of examination methods for planning restorative and reconstructive operations on the upper jaw

	The presence of the defect	Location and degree of bone displacement отломков	Jaw alignment	Localization and severity of the deformity	Location of the defects and its size	Obtaining the 3 d projection	Dense. bones. in haunce.
Examination	+	–	+	+	+	–	–
Palpation	+	–	–	+	+	–	–
Jaw models	–	–	+	+	+	+	–
Orthopantomography	+	–	–	+	+	+	–
X-ray of the maxillary sinus in standard projections	+	–	–	+	+	+	–
(facial, profile)	+	–	–	+	+	+	+

The examination techniques are listed on the side of the table, the parameters necessary for surgical treatment are indicated in the center, "+" means objective data acquisition, "-" means impossibility to acquire data, and "+?" combination. - the acquisition of inaccurate, approximate data.

Analysis of the diagnostic value of MSCT examination confirmed its undoubted value in the examination and treatment of patients with upper jaw defects and deformities in comparison with standard methods of radiological diagnosis (orthopantomography, radiography in standard projections), as well as with objective and additional methods of examination (examination, palpation, jaw models). We recommend mandatory MSCT-diagnostics in this category of patients before surgical intervention.

Based on the data obtained during the MSCT examination of the patient, we have developed a computer program for calculating the exact shape and size of the implants, taking into account the percentage of shrinkage given by the material used for its manufacture ("Calculation program for individually made implants, compensating defects and deformations of the maxillofacial area"). The above-mentioned object is registered in the Register of Intellectual Property Agency of the Republic of Uzbekistan № 3128. The computer program is based on the data obtained during MSCT examination of the patients: thickness, height, length, depth, the defect, which can be determined on the MSCT - slices using a special function available in the MSCT program (Fig. 3). This function allows to connect any given points with a line with the definition of dimensions.

Fig. 3 Determination of implant size on MSCT slices

The MSCT slices were used to determine the size and shape of the defect according to three parameters: width, height, depth, which should be taken from several places of the defect. Thus, there are nine parameters, which are entered into the corresponding cells on the data entry sheet. The following data are entered into the program: the patient's last name, first name, patronymic, medical history number, age, sex, diagnosis, the area of the defect or deformation, the estimated percentage of implant shrinkage, the name of the planned surgery and the defect dimensions obtained on the MSCT sections (height, depth, width), which allows you to calculate the dimensions of the future implant in three dimensions. After entering the necessary data, press the "Calculate" button. The program starts calculating the true dimensions of the implant, taking into account the percentage of material shrinkage in the three projections. These data appear in the windows next to the entered defect size parameters.

Then you need to press the "Print" button. After that, the final result is printed and displayed on a separate sheet with the necessary information about the patient, localization and area of the defect, type of surgery, the material from which the implant will be made, percentage of its shrinkage. Next, the table shows the true implant dimensions (9 parameters) and the figure shows the expected appearance of the implant with the defect area highlighted. The sheet with the final design can be transferred to the technical laboratory for implant fabrication. This program will significantly reduce the number of technical errors and, consequently, reduce the number of complications associated with the manufacturing of the implant (the size of the defect is not taken into account, improper manufacturing of the implant, in which there is a change in the physical and chemical properties of the material). In the preoperative period, the choice of the optimal method of treatment for this pathology should be based on the results of a thorough preoperative examination of the patient.

To identify and analyze the volumetric characteristics of the bone skeleton defect, most maxillofacial surgeons still in daily practice use only methods based on obtaining photographs of the patient in several projections, plaster masks, and X-ray images of the facial skeleton bones in standard stacks. However, the data obtained as a result of these methods are tentative, which leads to errors in surgery planning and complications.

According to the foreign literature, the best imaging method at present is the multispiral computed tomography technique. The use of multispiral computed tomography with 3D reconstruction allows the most complete presentation of the boundaries, size and volume of the defect, accurate assessment of the localization and degree of displacement of bone fragments, the condition of bone structures of the alveolar process.

To confirm the effectiveness of MSCT examination in patients with maxillary defects, 44 patients were examined on a TOSHIBA Aquilion 128 multispiral computer tomograph in axial, coronal and frontal views, for whom complex reconstructive-restorative surgery on the upper jaw bones in congenital cleft of the lip and palate had been planned. As a result of the obtained additional information, the treatment tactics in each case was determined. The conducted research helped to determine the optimal method of surgical intervention, which, in turn, reduced the time of surgical intervention and increased the level of anatomical and functional rehabilitation of patients. Application of the proposed improvement in the protocol of patients' examination and in the technique of reconstructive surgeries allows to optimize treatment, avoid a large number of complications and reduce the period of treatment and, especially, the patient's examination.

Thus, according to the computerized three-dimensional models of the upper jaw bones obtained as a result of the studies, it was possible to accurately assess the boundaries of the defects, the degree of bone displacement and localization, the degree of deformation of the bone structures.

Obtained results of observation for four years with the control of the level of anatomical and functional rehabilitation, showed that the custom-made titanium implants allow to avoid the complications arising during implant fitting, due to the possibility of height and position regulation. Besides, in comparison with autografts, the patient doesn't suffer from additional trauma, due to which surgical aggression and risk of complications development is reduced.

CONCLUSION. Multispiral computed tomography is a universal diagnostic apparatus of a new generation with the potential of use in the maxillofacial surgery. In the scheme of preoperative examination of patients with upper jaw defects in congenital cleft lip and palate it is necessary to include multispiral tomography for more accurate assessment of bone tissue pathology. MSCT data allow modeling three-dimensional implants with their true size and shape, which allows for error-free and accurate manufacturing of its model.

LIST OF REFERENCES:

1. Amanullayev RA, Kurbanhodzhaev SN, Shuyusupova MT, Akbarov AA The effect of congenital cleft lip and palate on the overall development of the child. // Bulletin of the Tashkent Medical Academy. - 2013.- № 4.- C. 46-48.
2. Andreeva O. V. Phased rehabilitation of children with congenital cleft upper lip and palate // Bulletin of Chuvash University. - 2012.- № 3.- C. 269-275.
3. Dyakova S.V. Dentistry of children. Surgery. Moscow: Medicine, -2009 -379 p.
4. Inoyatov A.Sh., Mukimov I.I., Gafarova S.U. Clinical characteristics of children with congenital malformations of the maxillofacial region // Bulletin of the Council of Young Scientists and Specialists of Chelyabinsk region. - 2016. - T. 1. - №. 2 (13). - C. 11-14.
5. Buchanan EP, Monson LA, Lee DY, et al. Secondary deformities of the cleft lip, palate, and nose. In: Neligan PC, ed. PlasticSurgery. Vol. 3. 4th ed. Philadelphia: Elsevier; 2017:637–659.
6. Inoyatov Amrillo, Khaydarov Nodirjon, Kamalova Malika. Etiology, diagnosis and modern treatment of odontogenic pain.Journal of Biomedicine and Practice. 2022, vol. 7, issue 5, pp.320-327
7. Greives MR, Camison L, Losee JE. Evidence-based medicine: Unilateral cleft lip and nose repair. PlastReconstr Surg.2014; 134:1372–1380.
8. Harila V, Ylikontiola LP, Palola R, Sándor GK. Maxillary archdimensions in cleft infants in Northern Finland. ActaOdontolScand. 2013; 71:930–936.
9. Henry C, Samson T, Mackay D. Evidence-based medicine: The cleft lip nasal deformity. PlastReconstr Surg.2014; 133:1276–1288.
10. Shomurodov, K., Khaidarov, N., & Kamalova, M. (2021). The formation and eruption of baby teeth in children. Збгрник наукових праць SCIENTIA.
11. Shomurodov Kakhramon Erkinovich, Kamalova, Malika Ilkhomovna. Proper feeding and precautions during and after feeding of children with congenital cleft palate and lip. Journal of Biomedicine and Practice. 2021, vol. 6, issue 4, pp.16 – 20
12. Shokirov S. T., Mukimov I. I., Sharopov S. G. Characteristics of Anthropometric Indicators of the Face in Patients with Congenital Cliffs of the Upper LIP and Palate after the Main Stages of the Operation //Central Asian Journal of Medical and Natural Science. – 2023. – T. 4. – №. 1. – C. 38-42.
13. Tse RW, Mercan E, Fisher DM, Hopper RA, Birgfeld CB, Gruss JS. Unilateral cleft lip nasal deformity: Foundation-based approach to primary rhinoplasty. PlastReconstr Surg.2019; 144:1138-1149.
14. Weinberg SM, Raffensperger ZD, Kesterke MJ, et al. The 3D facial norms database: Part 1. A Web-based craniofacial anthropometric and image repository for theclinical and research community. Cleft Palate Craniofac J.2016;53: e185–e197.