616.315/.317-007.254-089-039.76

SURGICAL REHABILITATION OF CLEFT LIP AND PALATE PATIENTS USING DISTRACTION OSTEOGENESIS AND ORTOGNATHIC SURGERY. CRITERIA OF OPTIONAL METHODS OF SURGICAL TREATMENT

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Background

Congenital cleft lip and palate (CCLP) is a severe defect of maxilla development featuring by structural and functional disorders. The urgency of problem is to work out and improve surgical procedure for patients with maxillary hypoplasia and it has been defined with a large number of patients with facial skeleton malformation after removing lip and palatine cleft [1, 2, 4, 8]. Orthodontic treatment of secondary deformation of maxilla developing after primary lip and palate surgery in grown up children (73-89%) has not had a positive result [3, 7, 9]. To eliminate these deformations bimaxillary surgical treatment is required. However, according to data of many foreign scientists as well as our own studies up to 25-35% patients with cleft lip and palate could have postoperative relapses after maxilla hypoplasia surgical treatment owing to postoperative scars, instability of maxillary fragments after operation, imperfection of methodology of bone fragment fixation etc. [4-7].

The aim of our work was to study surgical treatment outcomes of the use distraction osteogenesis and bimaxillary orthognathic surgery in the treatment of severe maxillary hypoplasia in cleft and palate patients and identify optional criteria of surgical procedure for patients with CLP.

Material and Methods

47 patients with cleft lip and palate aged between 14 and 26 years were examined and undergone maxilla hypoplasia surgeries over 2003 - 2010 yy., 31 of them were with unilateral and 16-with bilateral cleft. Preoperative preparation included conduction of bone plasty of cleft alveolar process and orthodontic treatment. All patients underwent X-ray and clinical examination and they were made diagnostical models, photo documenting. Lateral cephalometric roentgenography showed the treatment outcomes which could be compared and evaluated not only in one patient but in all groups of patients. Cephalometric measurements were carried out before, and immediately after surgery, dynamically in 12 and 24 months, as well. In first group, on 30 patients subjected to bimaxillary surgery were performed Le Fort I osteotomy and osteotomy of mandible with intraoral access. In 3 patients was used mandible external access with further fixation of bone fragments with titanic miniplates and miniscrews of Medicon (Germany).

In second group, 17 patients subjected to distraction osteogenesis were used intraoral distractors of the same firm (the technique and design of professor K.Wangerin, Stuttgart, Germany) [7, 10].

Distraction Protocol

After a 5-day latency period transantral distraction was performed at a rate of 1 mm per day for 14 to 22 days, according to the patients degree of deformity. The distraction vector was controlled forward and slightly downward. The amount of distraction was measured at the osteotomy line on the basis of preoperative and postoperative cephalograms. After a 6 to 8-month consolidation period, the distraction devices were removed.

Selection criteria for surgical treatment mode

Most of orthognathic surgeons think that 10 mm is the last distance in one-stage maxillary advancement by Le Fort I in patients of III class by Angle. Exceeding of this limit results in the occurrence of high risk of postoperative instability of maxilla fragments and high frequency of relapses [2-4]. According to our data, this limit comprises 8 mm or a bit lesser because of the effect on local soft tissue scars and insufficiency of velopharyngeal ring for patients with severe maxilla hypoplasia mixed with cleft lip and palate. 20 patients who were required more than 8 mm maxilla advancement we used distraction of middle facial zone in order to avoid the development of postoperative relapse. In our opinion, the child with maxilla hypoplasia whose correlation between maxilla and mandible will exceed 11 mm up to 12-13 years regardless of mandible position distraction of maxilla should be considered as alternative method of correction. This advancement will be able to pro-

vide with source for nasal soft tissues and middle face, to balance skeleton, to supply more functional occlusion, to improve speech (despite velopharyngeal incompetence and potential need in pharyngeal surgery) and what is more important, to help these children to be in better psychosocial atmosphere. In the process of cleft patient growing we use distraction as staged surgery. This conception could be compared with palatal advancement surgical procedure in which cross skeletal width is attained before movement in order to increase surgical result stability of standard correcting maxillary surgery.

We also used distraction in order to move maxilla by staged way for adult cleft patients with 12 mm defect. This device was applied not only to remove maxillary bone in sagittal direction forward but also to increase soft tissues as well as for maxilla to restrain stability. At the same time the final occlusion is possible in distractor removing with surgical procedure on mandible.

Achieved results

Anthropometric and cephalometric measurements showed that in patients with CLP in relationships with dentition by Angle III class after primary operations on lip and palate normalization of maxilla and mandible ratio only owing to orthodontic treatment is impossible. Surgical correction is necessary for these deformations. All 47 patients with cleft lip and palate after cheilo- and uranoplasty had deformities of maxilla of this or other degree of severity in the form of dimension of maxilla sizes, retroposition of upper jaw, disturbance of bite in sagittal, vertical and transversal planes, discrepancy of dentition.

In first group of patients, there revealed changes of all angular and liner parameters on lateral teleroentgenograms. SNA corner before maxilla osteotomy conduction by Le Fort I was 75,1±3,4 degrees that indicates on the presence of maxilla retroposition. Interrelation of apical bases of jaws is determined by ANB angle. In patients examined were noted shift of ANB angle on negative side -3,2±0,7 degrees that corresponds to ratio of dentition by Angle III class. Maxilla hypoplasia in children with CLP after cheilo- and uranoplasty was featured by dentition correlation by Angle III class, crowded teeth position, especially in the field of frontal maxilla, fangs and premolars.

During maxilla surgery was advanced at maximum on 8 mm. But advancement (which was from 3 to 8 mm) osteotomy maxillary complex results in movement and redistribution of soft tissue complex of middle face which causes the change of angular values. Thus, in postoperative period frontonasal angle decreases mean 3,45 degrees, profile angle increases mean, in 2,27 degrees and nasolabial diminishes mean, in 3,3 degrees. Improvement of profile facial characteristics in postoperative period in all patients has been visually confirmed by photos and measurements of angular values.

After osteotomy by Le Fort I SNA angle was 82,5±2,6 degrees, ANB angle– 2,2±0,5 degrees, and after mandible retrodisplacement SNA angle was 80,3±2,2 degrees. Control cephalometric measurements made in 12 and 24 months showed stable position of maxilla and mandible. In all patients maxilla extension on the average was equal to 8 mm (diapason was from 3 to 8 mm). Mandible retrodisplacement in sagittal plane on 2-3 mm and 1-3 degrees was observed only in 4 of 33 patients operated in a year. Having analyzed the causes of relapse in these patients we concluded that in surgical treatment on fixation with titanic miniplates it was necessary to carry out bone plasty by block from iliac crest into pitch between displaced fragments of maxilla for better postoperative stabilization. It was these patients that one-stage maxilla advancement in sagittal direction comprises 8 mm. For this purpose, in 11 patients with severe deformities of middle facial zone who were subjected to bimaxillary surgery in maxillary advancement more than on 4 mm to stabilize its position and closure median cleft between displaced fragments there used bone block from iliac crest.

SNA angle in patients of second group before conduction of maxilla distraction was 73,8±3,2 degrees, that also testify the presence of retrognaty of maxilla. ANB angle advancement in negative side -4.3±0,9 degrees responds to dentition correlation by Angle III class. Maxilla hypoplasia in children with CLP after cheilo- and uranoplasty was characterized by dentition correlation by Angle III class, crowded teeth position, especially marked in the field of frontal maxilla, fangs and premolars.

In second group, in 14 of 17 patients after 6-8 monthly adhesion periods after distraction device removing a good new bone was found that was formed in distraction pitch between lines of osteotomy. The surface of a new bone was a little lower than the surface of surrounding normal bones but had rigid structure. In 5 patients at the time of maxilla distraction was distracted not only forward but also down. After completion of distraction bilateral open bite was further observed; upper frontal teeth were open so that they could not be opened in relaxed state. After 5 months adhesion period during distraction device removing these patients were performed secondary Le Fort I osteotomy in order to elevate maxilla in normal position. For maxilla stabilization, they were performed fragment bone plasty by bone block from iliac crest followed with fixation titanic miniplates.

Table I.

Cephalometric values before, after operation, and at 1- and 2-year follow-up

	norm	first group (n=30)				second group (n=17)			
		Preoperatively	Immediately after operation	1 years after	2 years after	Preoperatively	Immediately after distraction	1 years after distraction	2 years after distraction
SNA	82°±3.0°	75,1°±3,4°	82,5°±2,1°	81,5°±2,1°	80,6°±2,1°	73.8°±3.2°	83.1°±3.1°	82.0±3.3 °	81.8±3.1°
SNB	80°±3.0°	78,3°±3,2°	80,3°±2,2°	80,1°±2,1°	80,0°±2,3°	78,1°±3,2°	78,1°±3,2°	78,1°±3,2°	79,2°±3,0°
ANB	2,0°±2.0°	-3,2°±0,7°	2,2°±0,5°	1,4°±0,7°	0,6°±0,2°	-4.3±0,9°	5,0±1,1 °	3,9±0.5°	2.6±0.3°

After surgery performance SNA angle comprised 83.1°±3.1°degrees. ANB angle was equal to -4.3±0,9°degree, later 3,9±0.5°degrees. Control cephalometric measurements performed in 12 and 24 months showed stable position of maxilla. In second group, in all patients maxilla advancement was mean, 12,8 mm (diapason from 5 to 20 mm). Table I.

After distraction of median facial zone, occlusion and profile of soft tissues were considerably improved. To obtain good occlusion after completion of distraction procedure all patients received orthodontic treatment. In 24 months maxilla position and occlusion became stable in all patients, no apparent relapse followed.

Conclusion

Analysis of results of clinical examination and surgical treatment for patients with maxilla deformities after primary operations on upper lip and palate allows drawing the following conclusions:

- leading role in elimination of facial skeleton deformities belongs to orthognathic surgery that should be an integral part of treatment protocol of patients with congenital cleft lip and palate and makes possible to rehabilitate them functionally and anatomically in the whole;

- distraction osteogenesis is a principally new method of correction of secondary maxilla deformities. Its use for patients with severe secondary deformities of jaws permits to gradual maxilla advancement in necessary position owing to osteo- and histodistraction of tissues;

- distraction osteogenesis prolongs bones and soft tissues, as well as diminishes the limits of soft tissues round distraction segments and reduces the risk of relapse. Unlike traditional orthognathic procedure using distraction osteogenesis maxilla can exceed 10 millimeter limit(restriction). It is very important for patients with congenital cleft of lip and palate because after getting normal appearance they need in maxilla advancement more than on 10 mm;

- issue under solution of maxilla distraction use for patients with CLP it should be considered the following: on what distance maxilla should be advanced in sagittal and vertical directions, condition of scars on lip and palate, condition of velopharyngeal ring, patient's age, vector of distraction, correlation between maxilla and mandible;

- maxilla advancement with distraction osteogenesis comprises mean, 12.8 мм (diapason was from 5 to 20 mm);

- spongy- cortical autotransplant (bone block) could be applied for maxilla stabilization after its advancement in bimaxillary surgery conduction or maxilla distraction;

- the use of titanic miniplates and miniscrews provides a reliable fixation and stabilization of jaw fragments after surgery after surgical procedure conduction.

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