Stages of correction and rehabilitation of patients with dental-maxillofacial defects and deformities

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Abstract.

Objects: To increase the efficiency of combined surgical and orthodontic treatment and rehabilitation of maxillofacial deformities. **Materials and methods:** We observed 352 patients (213 women and 139 men) aged 16 to 45 years, who were divided into 2 main groups with dentoalveolar defects and deformities. **Results:** Using our innovative techniques of treatment: installation of a cortical

plate in the base of the nose, using of the chin implant, chin osteotomy, and other methods, increased the wanted results of treatment. **Conclusion:** Thus, in order to achieve the desired result it should always be combined with surgical, orthodontic, psychological treatment with postoperative rehabilitation.

Keywords: Dental maxillofacial deformities, surgical and orthodontic treatment.

Introduction

Correction of dental-maxillofacial deformity [1] is a complex medical problem that carried out using the methods of anthropometric and computer modeling of the patient's facial reconstruction [2], to achieve optimal functional and desired aesthetic results based on the use of modern methods of osteotomy [3], of the facial section of the skull and the choice of rational methods of fixing the resulting bone fragments, ensuring their fusion and excluding the likelihood of relapse, TMJ dysfunction and other complications.

The significance of this problem is the prevalence of dental-maxillofacial and skeletal deformities of maxillofacial region, reaching among the population, according to various authors, 27-41% of their total number [4-6]. According to the studies of many authors and our observation, the mental deviations that have developed in this regard are reversible, and psychological rehabilitation of this group of patients invariably occurs when the anomaly is corrected. Another important task is to achieve optimal functional results, i.e. correction of dental arches, restoration of occlusion, and prevention of the development of complications such as dysfunctions, impaired innervation, and circulatory disorders of tissues in the area ofsurgery are necessary. Patients themselves carry out assessment of the achieved aesthetic results prior to operation (**Fig. 1 a, b**). If they are satisfied with their appearance after the operation, the result can be considered good [7-10].

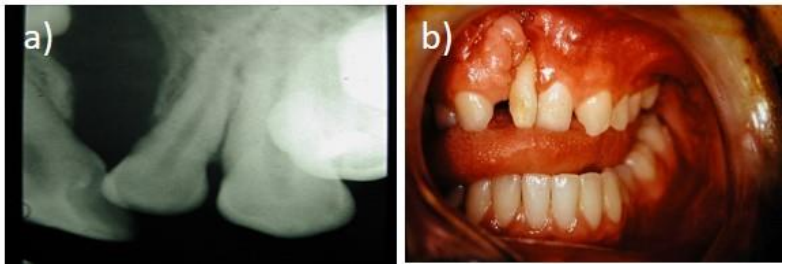

Figure 1. a) Dental X-ray showing alveolar process bone defect of the upper jaw before operation; b) The patient's bite before the operation.

Purpose of the study – to increase the efficiency of treatment in patients with defects and deformities of the jaws through the use of innovative methods of planning orthodontic and surgical treatment, as well as rehabilitation, ensuring the achievement of aesthetic and functional results.

Materials and methods

For the period from 2014 to 2020 years we observed 352 patients (213 women and 139 men) aged from 6 to 45 years. In this work, patients classified according to the nature of diagnosed dentoalveolar defect and deformity. All patients divided into 4 groups, depending on the diagnosis and method of treatment. In reconstructive operations of dentoalveolar anomalies and deformities, preoperative orthodontic treatment contributes to the achievement of the treatment effect. According to the literature data, the need for orthodontic treatment varies within 85% of people with dentoalveolar anomalies and deformities. Of all patients, only 21 (5.6%) did not require preliminary correction of dental arches and underwent reconstruction of the lower jaw in the chin area for aesthetic reasons. In 331 patients examined by us (94.4%), preoperative orthodontic preparation was required, depending on the diagnosis. In the first group of patients with a congenital cleft of the alveolar process of the upper jaw, 90 people. Auto-bone grafting was carried out according to our technique. After orthodontic preparation, we performed auto-bone grafting using an improved method. Operation course: At the first stage, donor material was taken from the anterior 1/3 of the iliac crest. The second stage of surgical treatment began with the reconstruction of the bottom of the nasal cavity, preparation of the recipient bed for the bone graft (**Fig. 2a, b**). A mucoperiosteal flap was cut out to cover the graft from the

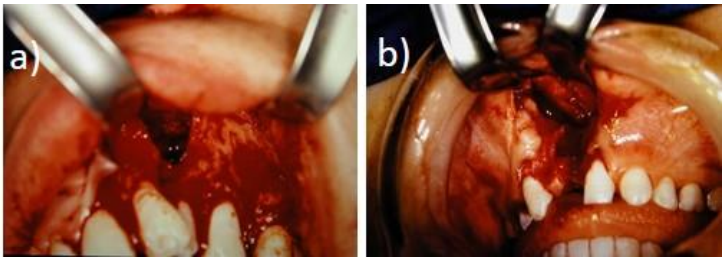

Figure 2. a) After detachment of the mucoperiosteal flap; b) After formation of back wall.

vestibular side. This flap included a keratinized mucous membrane, which moved to the apex of the formed alveolar ridge. After the reconstruction of the nasal fundus, an insulating plate was made from the cortical layer of the taken bone, which was installed on the base of the nose, **(Fig.** 4) to isolate the nasal cavity and the anterior 1/3 of the hard palate, they proceeded to place the taken free bone fragment directly into the alveolar defect (**Fig. 3a, b**).

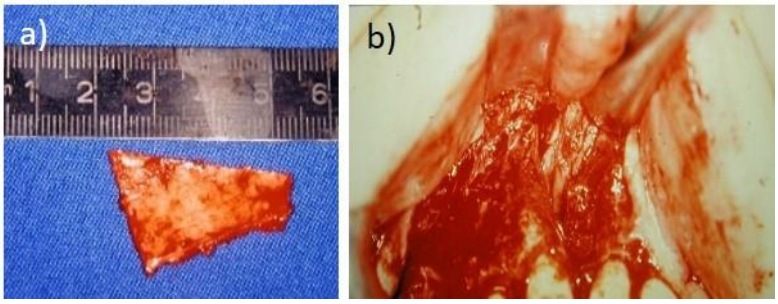

Figure 3. a) An autograft taken from the iliac crest (isolation plate); b) Isolating plate after defect detection.

The bone autograft was softened using special instruments and adjusted to the shape and size of the defect in such a way that it would enter it with some effort fixed inside defect; after which the final stage of operation started where the graft was covered with a vestibular mucoperiosteal flap and the wound was sutured (**Fig. 4a, b**). Bone regeneration in patient teeth after surgery and complete bone formation with no cavity observed in space between teeth (**Fig. 5 a, b**).

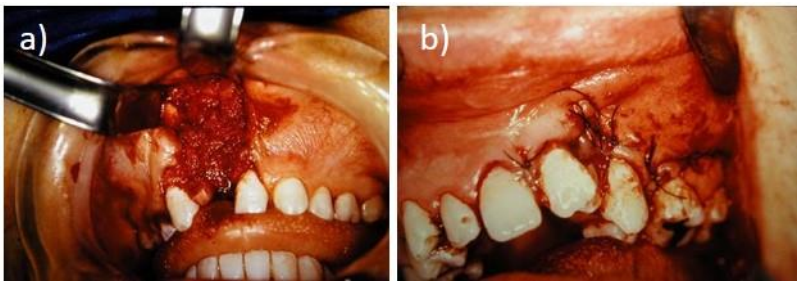

Figure 4. a) After fixing the spongy bone layer; b) After suturing the mucoperiosteal flap.

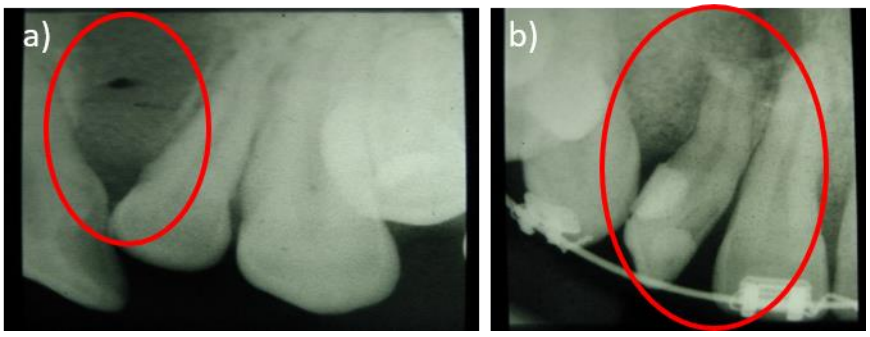

Figure 5. a) Bone regeneration in the same patients teeth after surgery 3 months later shown in red oval, X-ray photograph; b) Complete bone formation with no cavity observed in space between teeth shown in red oval, X-ray photograph taken after surgery 6 months later.

In group II patients with inferior prognosis were 75 people, 55 of which received treatment according to our method. The method is carried out as follows, after the appropriate treatment of the oral cavity, infiltration and conduction anesthesia is performed, an incision is made along the transitional fold from tooth 33 to tooth 43, we peel off the mucoperiosteal flap, we expose the chin section of the lower jaw, we install a chin implant with fixation with 4 screws. Then the mucoperiosteal flap is put in place and interrupted sutures are applied. After suturing, the hook of the chin implant protrudes above the mucous membrane in 2 places in the mental area. One end of the rubber rods fixed on hooks, the other end of the rubber rods is fixed on the previously installed hook of 6 teeth of the upper jaw (**Fig 6a-c**). Clinical and additional research methods were carried out: production of diagnostic models of the jaws, X-ray, cephalometric analysis, 3D computed tomography, echo osteometry, anthropometric measurements, and photographic research methods.

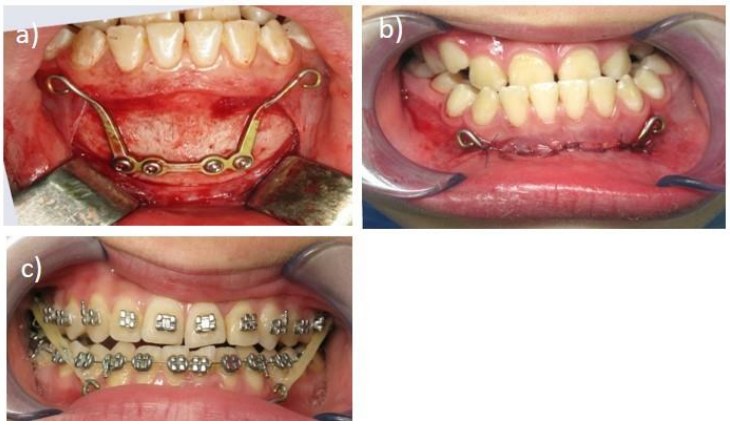

Figure 6. a) Chin implant placed on the lower jaw; b) Apparatus in the oral cavity after suturing the mucoperiosteal flap; c) Installed chin implant in action.

Results and discussion

In the 1st group of patients were 90 people with a congenital cleft of the alveolar process of the upper jaw, who had auto-bone grafting surgeries were carried out according to our technique (Patent KR No. 2062) [11]. According to the results of our research, we can say that in the defects of the alveolar ridge, the use of our modified method improves the outcome of the surgical treatment, due to the installed cortical plate in the base of the nose and preventing microflora from entering the nasal cavity. The effectiveness of the treatment is also confirmed by the results of clinical, radiological, and densimetric studies, and when using the modified method, the defects were restored 1.5 times faster than the traditional method. Mixing the collapan gel with a bone transplant made it possible to improve the resistance to opportunistic flora because of its antibacterial action.

In the 2nd group of patients (75 people) with lower prognathous, 55 of them were treated by our method (Patent KR No. 2180**) [**12]. We have treated 75 patients with mesial occlusion (Angle class III anomaly), including 49 women and 26 men, where the numbers of female patients were 1.8 times more than male. The

results of the study show that already on the 3rd month of treatment, the effect of the use of the chin implant affects the changes in cephalometric parameters. On average, over 3 months of treatment, the main sagittal angles of cephalometry changed by ± 0.430. In patients in the age groups of 12-15 years old and 16-18 years old, the indices of impaired occlusion are more pronounced, compared with the age group 19-21 years old. It has been proven that the use of both a chin implant and a chin sling is more effective during the period of skeletal growth. During this period, the growth of the lower jaw was more easily delayed compared to older patients. Consequently, if the patient is in the higher age, the less effective treatment methods of III class occlusion according to Angle. According to the results of the cephalometric analysis for 3 months of treatment of patients of the main group, depending on age, it can be seen that the average value of the SNA angle increased to 79.5 ± 3.30, while significant changes were in the age categories of 12-15 years and 16-18 years. In the age group 19-21 years old, no particularly significant changes were observed. Thus, according to the results of the 3rd month of treatment, the protraction of the upper jaw in patients aged 19-21 years in the main group is significantly less than in patients in the age group of 12-15 years old and slightly lower than in the age group of 16-18 years old.

In the sagittal plane of the main group with the use of a chin implant and the comparative group with the use of a chain sling, there was a change in the SNA, SNB angles to the normal values (**Table 1**). Along with this, the delay in the vertical growth of the lower jaw in the main group had a significant difference in comparison with the patients in the other group. In the main group, AR-GO-ME, N-GO-ME indicators significantly decreased concerning the compared group, which indicated a delay in the growth of the lower jaw and transformation of the type of growth. Therefore, tendency for growth of the lower jaw is significantly lower in patients with a chin implant than in patients wearing a chin sling. The molar ratio in the main group improved on average by 1.4 mm, a significant difference in proclining of the lower incisors up to 2.4° compared to the patients of the compared group.

Table 1. Distribution of the main indicators characterizing bites depending on the age.

Age / **Indicators**	**12-15 y.o**	**16-18 y.o**	**19-21 y.o**
SNA	80.5 ± 3.3^0	78.9 ± 3.3^0	77.0 ± 3.3^0

SNB	82.3 ± 3.3^0	83.2 ± 3.3^0	80.2 ± 3.3^0
ANB	9.4 ± 3.8^0	8.3 ± 3.8^0	7.2 ± 3.8^0
Ar-Go-Me	135.9 ± 6.3^0	133.5 ± 6.3^0	133.2 ± 6.3^0

In the issue, in the subsequent 6 and 9 months of follow-up examination and analysis of cephalometric parameters, diagnostic models, the changes proceeded with the same stable intensity, and in patients aged 12-15 years, the changes were much faster. This fact, in turn, proves that the use of orthodontic methods for treating anomalies of the dentition at the age of an early permanent dentition is more effective in comparison.

A mandatory point in the study was the complexity of the use of devices for the rapid expansion of the upper jaw in conjunction with the chin implant and the sling, due to this, in patients with underdevelopment of the upper jaw, where the devices for the rapid expansion of the upper jaw were additionally used, the protraction of the upper jaw in the late period of the mixed bite was much higher. Then in patients with permanent occlusion. The average difference in the protraction of the upper jaw in the 3rd month of treatment in the main group was 1.2-2.4 mm, and the indicators of the number of VITS in the main group were 0.5-1.2 mm more. Thus, according to the results of this study, there is a reliable efficacy of the use of a chin implant in comparison with a sling, which often patients simply refused to wear due to aesthetic discomfort.

In group III, 83 patients (48 women, 35 men) with distal occlusion and dystopia of the anterior teeth, grade II according to angle, did not require surgical intervention on the lower jaw. The upper jaw was expanded using the RPE apparatus (which is attached directly to the bone of the upper jaw with pins (mini-implants) on both sides), then, after the necessary expansion, the dentition was leveled with braces. In goup IV were 104 patients, depending on the area in which the surgical intervention performed, using various osteotomy methods. 42 patients aged 17 to 31 years had a surgical correction of the lower prognathous with intervention on both branches of the mandible. All patients underwent retromolar sagittal osteotomy of the branches of the lower jaw with complete detachment of muscles around the branch. Analyzing the results of the surgical treatment of the group of patients under discussion, it can be concluded that the achievement of optimal functional and aesthetic results in patients with lower progression as well as the underdevelopment of the lower jaw can be achieved if the following indications are observed: if the sagittal gap does not exceed 1.0 cm and there is no displacement of the central incisal line, then it is necessary to carry out a retromolar sagittal osteotomy with complete detachment of the muscles around the ramus of the lower jaw, while good results are achieved.

Number of patients with upper prognathous were 21 (12 women, 9 men) aged from 17 to 31 years, had a surgical treatment according to the sagittal gap between the dentition, operation of which was carried out in the amount of fragmentary osteotomy in the anterior part of the upper jaw and high horizontal osteotomy of the upper jaw. The given clinical observation fully reflects the general results of using the technique developed by us: fragmentary osteotomy of the upper jaw and high horizontal osteotomy of the upper jaw, which, subject to the indications, ensures restoration of the bite of patients while maintaining their appearance. In all examined patients, we did not observe the development of any complications in the postoperative period or recurrence of the corrected deformity.

The surgery of lower prognathous with simultaneous osteotomy in the chin area was performed in 30 patients for aesthetic reasons. Therefore, our clinical examples show that the intervention in the chin area to correct the lower prognathous, the restoration of occlusion in the group of patients under discussion occurs according to the methods of retromolar sagittal osteotomy of the mandibular branches and horizontal osteotomy of the chin area are due only to aesthetic indications.

Finally, treatment of the lower prognathous in the amount of osteotomy of the mandibular branch normalizes the bite but does not provide the desired aesthetic effect. This goal, following the wishes of the patient, was achieved by "additional" intervention in the chin of the lower jaw. To achieve a successful result of the intervention, it is crucial to consolidate the results of orthodontic treatment in the preoperative period. The determination of the optimal time for starting orthodontic treatment in the postoperative period is equally important. Determining the optimal timing of the start of orthodontic treatment in the postoperative period reduces the risk of complications, especially relapse.

The division into groups according to the nature of defects and deformities of the jaws and the individual approach of each patient allowed us to normalize the bite after the operation and obtain an appearance that satisfied the patient.

In the postoperative period, children with a congenital defect and deformity of the jaws need carefully organized care and long-term rehabilitation, as well as step-by-step treatment with the participation of a maxillofacial surgeon, orthodontist, otorhinolaryngologist, speech therapist, a methodologist in therapeutic gymnastics, and also a psychologist.

Based on maxillofacial surgery, a rehabilitation center for children with congenital defects and deformities of the maxillofacial region has been created. Patients are registered in the special software ONYX CEPH3 from 01/01/2015 to the present, where we enter detailed information about patients with the above pathology (name, date of birth, place of residence, contact numbers, diagnoses and

treatment plans, photo of phases and profile, oral cavity before and after surgery). The purpose of this process is to closely monitor the general condition of patients, clinical examination, and rehabilitation.

Conclusion

Postoperative rehabilitation of patients is an important link in the context of ongoing treatment and largely determines the outcome of surgical correction of the dentoalveolar deformity. The postoperative period consists of three main stages: intermaxillary immobilization, functional load on the dental-jaw apparatus, during this period electro-vibration massage (Patent KR 134) [13] used according to our method, as well as orthodontic and orthopedic treatment. The continuity and consistency of the implementation of these stages determine the degree of likelihood of a complication, the possibility of a relapse, and, ultimately, the achievement of the optimal result of a planned and performed surgical intervention with the restoration of the anatomical and functional state and aesthetic appearance of the patient.

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