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Research Article

**PROTOCOL OF PRESURGICAL ORTHODONTIC  
TREATMENT OF CHILDREN WITH BILATERAL CLEFT LIP  
AND PALATE**

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**Abstract:**

*Bilateral cleft lip and palate is characterized by the displacement of the middle fragment of the upper jaw as well as the decrease of the upper jaw's length on the sagittal plane, hypoplasia of the anterior upper jaw, disjunction of the orbicularis oris muscle, hypoplasia of the central fragment, absence of skin on the nasal septum and varying degrees of protrusion of the incisive bone. Protrusion of the incisive bone causes difficulties during cheiloplasty performed on patients with bilateral cleft lip and palate and has negative influence on the operation's results.*

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**INTRODUCTION:**

Cleft lip and palate (CLP) is one of the most common malformations of the maxillofacial area that has a tendency to increase. Lodging on the 3-4 place within the structure of congenital anomalies, CLP occupies one of the first places with respect to the severity among the anatomical and functional disorders. Among those, the most severe form is the bilateral CLP, which occurs less frequently (15-25%) than other forms.

In recent years many clinics have adopted fixed orthodontic appliances with intramedullary fixation to reposition the intermaxillary bone and to expand of the fragments of the upper jaw in children with CLP (Egorova MI 2010; Katasonova ES 2011; Starikov NV 2006, 2014; Blinder JA 2016). At present time it is becoming increasingly important to perform the primary operation at early stages of child growth. It requires an interdisciplinary approach. Moreover, with the progress of orthodontic techniques, it becomes possible to perform a successful surgery using orthodontic preparation at the early stages of child life.

**The aim** of this study is to increase the efficiency of surgical treatment using pre-orthodontic correction of the intermaxillary bone position in children with bilateral CLP.

**MATERIAL AND METHODS:**

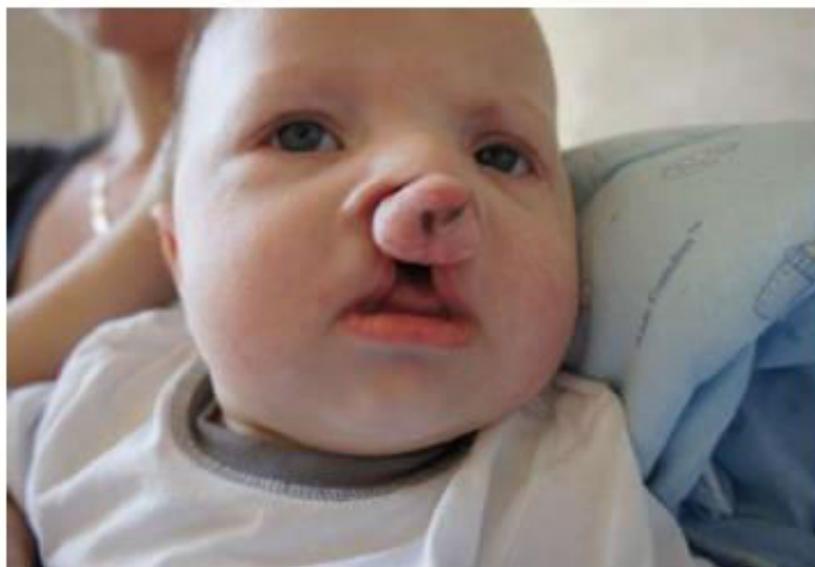
During the period from 2011 to 2016 orthodontist and maxillo oral surgeons working in collaboration have developed an algorithm for treatment of children with bilateral CLP and have treated 24 patients aged from two months to one year.

During two weeks period, they had been perform ingintermaxillary bone traction towards an attached appliance, whilstat the unit itself the movement had beendirectedtowards the side of the upper jaw fragments by unwinding the screw.

After two weeks they had removed the orthodontic appliance and the microimplants from the intermaxillary bone. In this way the whole assembly has been removed. This had been followed by the primary-stage bilateral cheiloplasty.

**RESULTS:****Orthodontic protocol**

The orthodontic protocol includes obtaining of an impression, making a model (a control model is simultaneously made for further investigations and measurements), making an individual orthodontic appliance with expanding screw and a splint with toe loop to attach to the intermaxillary bone. This is shown in Figures 1, 2, 3, 4.



**Fig.1.** Patient K-va, 2 months old, bilateral cleft lip and palate.



**Fig. 2.** Patient K-va, 2 months old, computed tomography in two projections.



**Fig. 3.** Obtaining of an impression and manufacturing of diagnostic and control models.



**Fig. 4.** Making a custom tray and an individual plate shaped orthodontic appliance with expanding screw and splint with toe loop to attach to the intermaxillary bone.

#### **Surgical protocole**

Before the start of the surgical treatment the orthodontic appliance is attached to the side of the upper jaw fragments using mini screws, and micro screws are attached to the both sides of the intermaxillary bone.

The main distinctive feature of this approach is that a partial vomer osteotomy is performed before installing the orthodontic appliance. This makes it

possible to reduce the time of preparation for primary cheiloplasty.

Micro implants are connected to the main structure using spring. Two weeks later, when the intermaxillary bone and the lateral fragments are in the optimal state, the primary cheiloplasty is performed under endotracheal anesthesia (Figures 5, 6, 7).



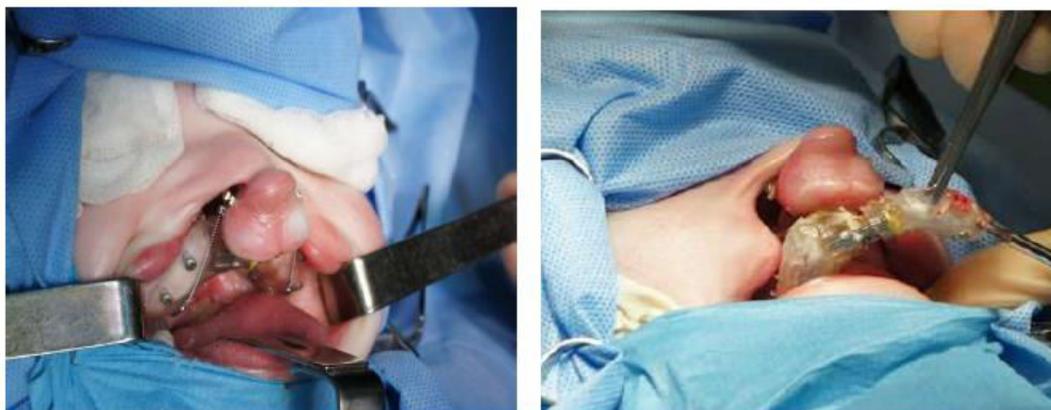
**Fig. 5.** Partial vomerosteotomy, fixing of the orthodontic appliance to the fragments of the upper jaw with micro screws.

In the process, we abandoned the splint with intermaxillary bone toe loop and used micro screws instead. Those were fixed to the both sides of the intermaxillary bone. This proved to be much more effective than the splint with toe loops.

Next, the orthodontic appliance and the mini screws were fixed by using springs.



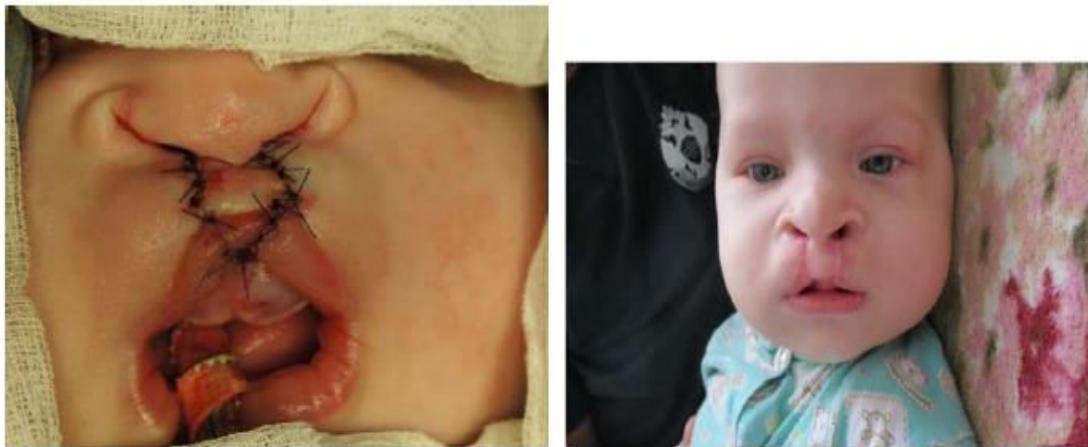
**Fig. 6** Fixation of the micro screws to both sides of the intermaxillary bone.



**Fig. 7.** Fixation of the micro screws and the orthodontic appliance containing springs and removal of the orthodontic appliance after two weeks.



**Fig. 8.** Position of the intermaxillary bone before treatment and before surgery.



**Fig. 9** Results of the primary cheiloplasty immediately after and two weeks after the surgery.

Orthodontic correction with cortical support on micro implants also increases the effectiveness of surgical treatment in older groups of patients.

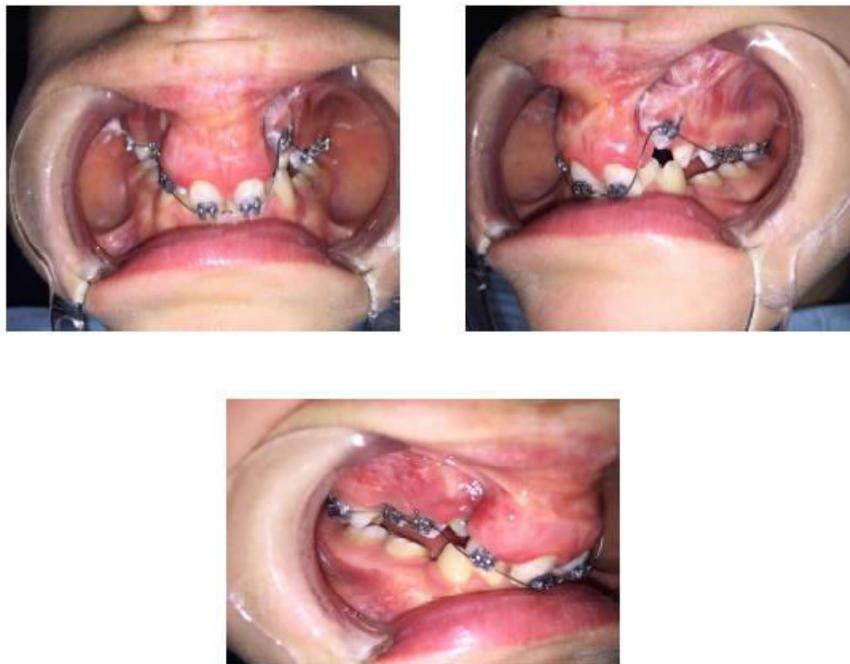
This approach does not require the use of massive orthodontic appliances, which improves the quality of treatment and reduces the time of treatment, improves hygiene and does not prevent speech development.

We also used orthodontic protocol for older patients. This can be seen in a 13 years old patient with a diagnosis of complete bilateral cleft lip and palate. Fig. 10 shows the patient state before orthodontic correction.



**Fig. 10.** Patient 13 years old with bilateral cleft lip and palate.

For orthodontic correction Smart Clip braces were used. (Fig. 11)

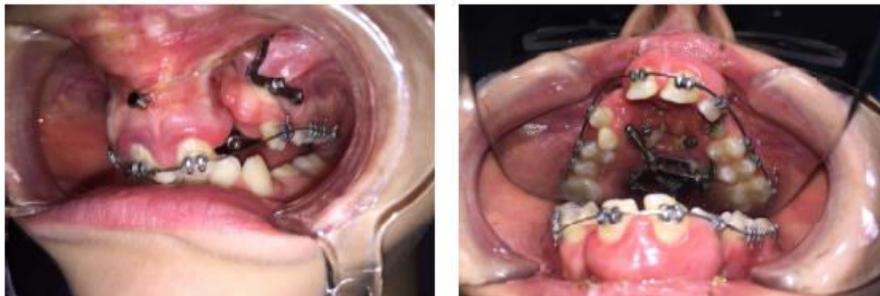


**Fig.11.** Arch wire 0.14 NiTi

After 8 weeks, the arc 14x25 NiTi was replaced. At the stage of leveling, to monitor the position of the posterior teeth, miniplates supported by micro implants were used at the sidefragments of the maxilla and a minisrew was fixed in the intermaxillary bone. From the miniscrew to miniplate we fixed elastic chain from the both sides. This allowed intrusion and rotation of the intermaxillary bone. A distractor was inserted and was used during two weeks. (Fig. 12, 13).



**Fig 12.** Patient K-v, 13 years old, 8 weeks, arc 14x25 NiTi.



**Fig 13.** Patient K-v, 13 years old. A distractor is fixed to the palate fragments.

After 4 month the wire was replaced by TMA 17x25 with compensatory bends for further rotation of the intermaxillary bone. The wire was fixed in the side section to the micro implants to avoid extrusion of teeth in the lateral segments. This is shown in Fig. 14.



**Fig. 14.** The result of orthodontic treatment before and after 6 months.

**CONCLUSION:**

1. Clinical and biometric research was performed on jaw models from 24 children with bilateral CLP both at the preoperative and the postoperative periods. Normalization of the relations between the intermaxillary bone and the lateral fragments was observed in all patients.

2. The use of the modern appliances design with modifications and the use of micro implants allow to reduce the time of the orthodontic preparation to the surgery for infants (under one year). The described approach allow to introduce active elements into the orthodontic appliance, to normalize the position of the intermaxillary bone and the shape of the upper jaw, and to perform subsequent primary cheiloplasty.

3. For a successful early orthodontic preparation it is necessary to ensure a reliable fixation of the orthodontic appliance. This reduces the treatment time, creates favorable conditions for primary cheiloplasty, improves patient condition during postoperative period, prevents the development of secondary deformities of the maxillofacial region, and significantly reduces the time of rehabilitation of patients with bilateral CLP with the good aesthetic results.

4. In older patients, the use of micro implants allows successfully and in a short time to carry out orthodontic correction of anomalies of dental system without the use of additional massive orthodontic appliances, which impair speech and hygiene and bring general discomfort to the patients.

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