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MAXILLARY GROWTH RATES AFTER PALATOPLASTY DEPENDING ON THE MATERIAL FOR APPLICATION ON LATERAL DEFECTS

Shaeva R.G.
Department of Maxillofacial Surgery, Tashkent State Dental Institute, Uzbekistan

Abstract
Numerous studies have proven the influence of palate plastic surgery on the development of the upper jaw - a restriction of growth in the transversal direction has been noted. In this regard, issues of improving surgical treatment protocols do not lose their relevance and require an interdisciplinary approach. The work carried out a comparative analysis of the effect on the parameters of the upper jaw of various materials for covering the surface of lateral palate defects formed during surgery to eliminate a congenital cleft palate (CCP). During digital processing of plaster models of the upper jaw 6 months after uranoplasty, a positive effect of covering the lateral areas of the palate in the area of the Ernst-Langebeck incisions with buccal fat pad (BFA) was discovered.

Keywords Congenital cleft palate, uranoplasty, iodoform, PRF, collagen sponge, buccal fat pad, plaster models.

INTRODUCTION

Patients with congenital cleft lip and palate (CCLP) undergo reconstructive surgery already at the first stage of their life, among which the most common interventions are cheiloplasty and uranoplasty. Currently, there are many surgical protocols used to treat patients with CCP; however, the question of the "gold standard" regarding surgical technique and timing of its implementation still remains open. Despite this, similar requirements are set for each plastic method, such as guaranteeing the best functional (speech, swallowing, breathing, etc.) and aesthetic results with minimal damage to the growth of bones in the maxillofacial area [1, 3, 4].

Palatoplasty can have different effects on the development of the anterior maxilla, depending on the parameters and type of cleft; Studies have proven that the severity of the cleft is directly proportional to the degree of growth retardation in a given area. Elimination of the cleft leads to a slowdown in the growth of the upper jaw in the transversal direction. Previously performed cheiloplasty may also be a limiting factor [2, 5, 6, 8]. According to Russell-Perry et al. limitation of the growth of the upper jaw is associated with the formation of a scar in the area of the relaxing incision in the lateral areas of the palate, and not only with the area of the exposed bone of the hard palate [12, 14]. It should be noted that in cases of large clefts, primary closure alone is often insufficient, given the increased tension in the defect area and insufficient coverage of local tissues, especially in the lateral palate along the

Ernst-Langenbeck incision lines, which requires the use of various materials or grafts to close the resulting lateral defects in order to reduce tension in tissues in the surgical area [7, 9, 10].

Thus, studying the influence of materials used to cover the surface of lateral defects on the nature of growth and development of the maxillary bone is an urgent task, and conducting clinical studies in this direction helps to increase the effectiveness of complex rehabilitation of patients with CCLP [11, 13].

The purpose of the study: to conduct a comparative analysis of the parameters of the upper jaw after uranoplasty depending on the material covering the surface of the lateral defects of the palate.

METHODS

The study included 103 children (64 (62.1%) boys and 39 (37.9%) girls) aged from one to 7 years with congenital cleft lip and palate (CCLP), registered at the dispensary in the scientific and practical Center of Dentistry and Maxillofacial Surgery of the Tashkent State Dental Institute. 32 (31.1%) had unilateral end-to-end cleft palate, 36 (34.9%) had bilateral through cleft of the upper lip and palate, and 35 (34%) had isolated cleft palate. In 37 (35.9%) patients, palatoplasty was performed using the method by Frolova L.E., 35 (34%) – according to the method by Azimov M.I. and 31 (30.1%) – according to Bardach J. Depending on the method of coating (material) of the wound surface in the area of lateral defects, each group of subjects was divided into groups by random distribution: group I – iodoform (n=25), group II – PRF (obtained by centrifugation of 30 ml of venous blood in dry glass vacuum tubes at 3000 rpm for 10 minutes) (n=27), group III – collagen sponge ("Belkozin", Russia) (n=25), group IV – buccal fat pad (n=26).

To study the dynamics of growth and development of the upper jaw after palatoplasty, 24 children of the same age group (age 1.5-2 years at the time of surgery) with unilateral and bilateral CCLP and isolated CCP were selected. Parameters were also studied in 10 healthy children for the purpose of comparative data analysis. The analysis was carried out both taking into account the method of palatoplasty and the material covering the surface of the lateral defects. Early orthodontic treatment, which also affects the processes of growth and development of the upper jaw, was taken into account when processing anthropometric indicators.

6 months after palatoplasty, a visual assessment of the shape of the palate and dental arch was carried out, and plaster models were cast from the resulting casts, which were then scanned using a Helios 500 scanner (Eighteeth, Jiangsu, China) and the resulting digital models were processed using software provision.

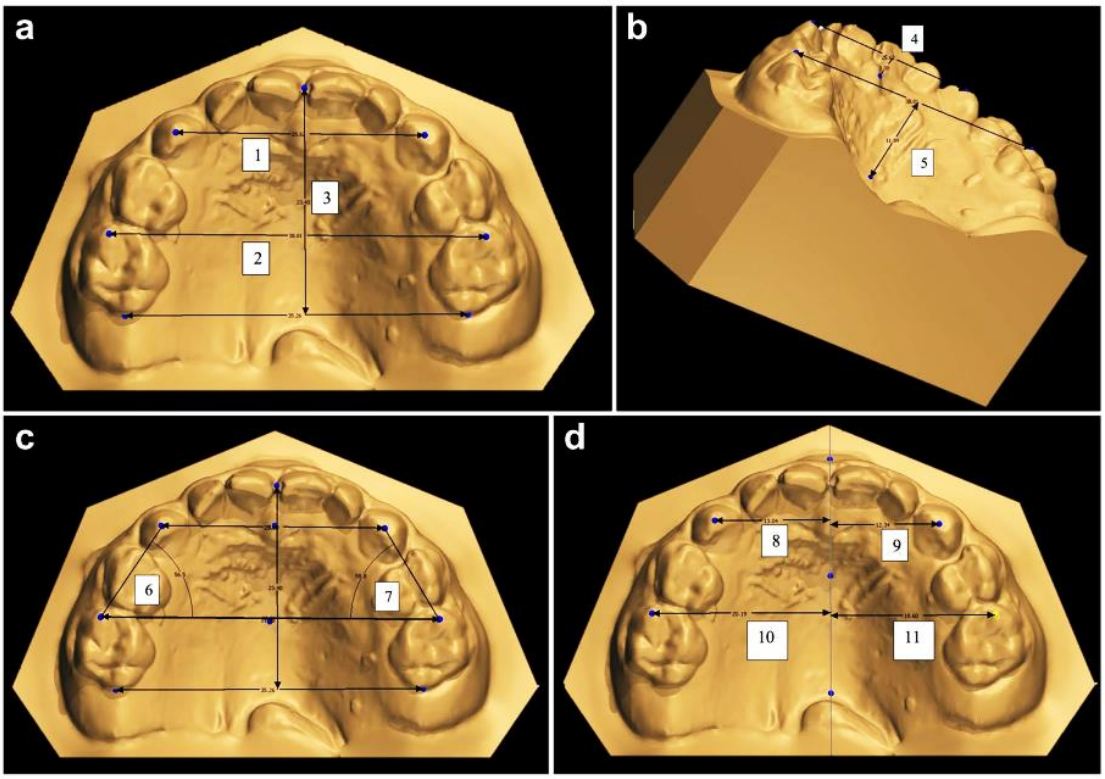

Fig. 1. Maxilla parameters on models after palatoplasty

(Molyneaux C., 2022)

The following parameters were studied according to Molyneaux C. (2022) after palatoplasty (Fig. 1) for a comparative assessment of the results with normal indicators: 1 – distance between the canines – Inter-canine width (ICW) – distance between the tips of the mesiobuccal tubercles of the canines; 2 – distance between molars – Intermolar width (IMW) – distance between the tips of the mesiobuccal cusps of the second molar; 3 – arc length – Arch length (AL) – midline from the point between the incisors to the posterior edge of the upper jaw; 4 – depth of the anterior part of the palate – Anterior palatal depth (APD); 5 – depth of the posterior palate – Posterior palatal depth (PPD). Analysis of the symmetry of the dental arch: 6 – right lateral angle – Right side angle (RSA); 7 – left side angle – Left side angle (LSA); 8 – distance from the right canine to the midline – Right canine distance to midline (rCDM); 9 – distance from the left canine to the midline – Left canine distance to midline (lCDM); 10 – distance from the right molar to the midline – Right molar distance to midline (rMDM); 11 – distance from the left molar to the midline – Left molar distance to midline (lMDM) [10].

Data analysis was performed using SPSS Statistics for Windows (IBM, Armonk, NY). Stratification was performed based on the incidence of postoperative complications using the X-square test, and p less than 0.05 was considered statistically significant.

RESULTS AND DISCUSSION

When visually assessing the images of the upper jaw, the majority of patients in group I were found to have a narrowing of the anterior part of the hard palate, a decrease in the height of the vault of the palate and a reduction in the distance between the primary canines; the shape of the palate was closer to conical (Fig. 2).

Fig. 1. Visual assessment of the growth and development of maxilla 6 months after palatoplasty

The above visual signs were also reflected in the studied parameters during digital processing of plaster models - there was a significant discrepancy from the values of the control group (Table 1).

The indicators of children who received early orthodontic treatment with a preforming plate before surgery were closest to normal. In the subjects with unilateral CCLP/CCP who did not receive early orthodontic treatment, preservation of the primary deformation of the alveolar process of the upper jaw was observed: lateral displacement of a large fragment of the upper jaw and mesial displacement of a small fragment.

Table 1.

Parameters of the upper jaw 6 months after uranoplasty - analysis depending on the material covering the lateral defects, (M± m)

Parametres	GROUPS				Control
	I	II	III	IV	
ICW, мм	26,9±0,32	27,2±0,26	28,0±0,14	28,5 ±0,28	29,0±0,36
IMW, мм	40,0±0,19	41,7±0,22	41,0±0,18	42,7±0,52	43,2 ±0,69
AL, мм	23,4± 1,08	24,1±0,84	24,8 ±0,58	26,2±0,82	26,8 ±0,58
APD, мм	3,77±0,78	4,71±0,74	4,12±0,82	4,45± 1,04	4,58± 1,82
PPD, мм	10,7± 1,18	11,1± 1,14	11,0±0,88	12,8±0,92	13,2± 1,24
rSA, °	48,2± 0,25	51,8± 0,42	52,2± 0,22	60,8± 0,56	62,1± 0,34

lSA, °	50,6 ± 1,06	52,1± 1,31	56,7±0,85	58,2±0,72	59,6 ± 1,22
rCDM, мм	13,2 ± 0,15	13,8± 0,15	14,2 ± 0,12	14,2 ± 0,25	14,9± 0,25
lCDM, мм	12,5 ± 0,08	12,7 ± 0,14	13,2± 0,07	14,8± 0,18	15,1 ± 0,18
rMDM, мм	20,2 ± 0,42	20,9± 0,17	21,2 ± 0,24	21,4± 0,14	21,6 ± 0,37
lMDM, мм	20,6 ± 0,22	20,7± 0,14	20,8± 0,18	21,7 ± 0,35	22,1 ± 0,34

Analysis of the parameters of the upper jaw revealed a growth retardation in the sagittal and transverse directions in group I (iodoform). The length of the arch (the midline from the point between the incisors to the posterior edge of the upper jaw) in this group was on average 12.7% less than normal, in group II (PRF) – by 10.8%, in group III (collagen sponge) – by 7.5%. On average, jaw width indicators differed from the norm in the anterior section by 7.2%, in the distal section - by 7.2%. In group II (PRF) the values were lower by 6.2% in the frontal area and by 3.5% in the distal, in group III (collagen sponge) - by 3.4% and 5.1%, respectively. The indicators in the majority of those studied in group IV (CHP) were closest to the values obtained during the examination of healthy children, which indicated a normal process of growth and development of the upper jaw (Table 1).

After plastic surgery of the hard palate using the method of Frolova L.E. and BardachJ. growth retardation was noted on the side of the cleft at the level of all teeth. In children with CCLP on the side of the cleft, the length of the upper jaw was achieved using the method of L.E. Frolova. up to 22.5 ± 0.49 mm, according to M.I. Azimov's method. – 28.5 ± 0.42 mm, and according to the BardachJ method. – 24.5 ± 0.54 mm. But even less, the small fragment was shorter than the large one. After uranoplasty in children with isolated CCP, fragments in length on both sides similarly increase, in contrast to the initial parameters after plastic surgery of the anterior part of the hard palate (Table 2).

Table 2.

Parameters of the maxilla 6 months after palatoplasty - analysis depending on the method of plastic surgery, (M± m)

Options	**Palate plastic surgery methods**			**Control**
	by Frolova L.E.	by Bardach J.	by Azimov M.I.	
ICW, мм	26,0 ± 0,82	26,2±0,62	28,5±0,42	29,0±0,36
IMW, мм	39,5±0,22	40,8±0,27	41,5±0,68	43,2 ±0,69
AL, мм	22,8±0,58	24,5±0,54	25,2±0,24	26,8 ±0,58
APD, мм	3,54±0,34	4,71±0,74	4,42±1,08	4,58± 1,82

PPD, мм	11,2± 1,02	11,6± 1,02	12,5±0,78	13,2± 1,24
rSA, °	45,5± 0,52	51,8± 0,42	52,2± 0,22	62,1± 0,34
lSA, °	52,3± 1,05	55,2± 1,34	58,2±0,88	59,6 ± 1,22
rCDM, мм	13,5± 0,21	13,8± 0,15	14,7± 0,12	14,9± 0,25
lCDM, мм	13,9± 0,12	14,2± 0,18	14,9± 0,22	15,1 ± 0,18
rMDM, мм	19,8± 0,14	20,5± 0,21	21,4± 0,24	21,6 ± 0,37
lMDM, мм	19,5± 0,12	20,7± 0,14	21,9± 0,28	22,1 ± 0,34

The transverse dimensions of the upper jaw in children with CCP 6 months after uranoplasty, depending on the method of palate plastic surgery, the following results were obtained: after plastic surgery according to the method of Frolova L.E. the narrowing at the level of III|III teeth in children with CCLP was 30.6 ± 1.0 mm and in children with isolated CCP – 30.5 ± 1.0 mm; at level IV|IV of teeth with CCLP – 38.0 ± 0.7 mm, with isolated CCLP – 37.5 ± 0.7 mm; at the level of V|V teeth in children with CCLP, the width reached 36.1 ± 1.0 mm and in children with isolated CCP – 37.1 ± 0.9 mm ($p < 0.05$).

After palatoplasty by BardachJ the transversal size at the level of V|V teeth with a through cleft was 37.1 ± 1.0 mm, and with an isolated CCP – 37.2 ± 0.9 mm ($p<0.05$).

After palatoplasty using the method of Azimov M.I. The transverse dimensions of the upper jaw at the level of all teeth along the isometric line did not differ significantly from normal values and at the level of the second primary molars reached 35.9 ± 1.0 mm with a through cleft, and 36.5 ± 1.0 mm with an isolated cleft ($p<0.05$). It should be noted that in patients whose lateral defects were covered with thyroid gland, normal rates of growth and development of the upper jaw were noted. The most significant discrepancy between anthropometric parameters and normal values was observed in children who underwent uranoplasty using the method of L.E. Frolova. and the lateral defects were covered with an iodoform bandage. When analyzing the data, there was a clear connection between retarded growth of the upper jaw in the transversal direction with rough scarring and tension of the edges of the surgical wound in areas of defects in the lateral parts of the palate.

CONCLUSIONS

Thus, the most positive effect of the use of BFP to cover the surface of lateral defects of the palate on the growth and development of the upper jaw, both in the sagittal and transversal directions, was determined in comparison with other materials (iodoform bandage, PRF, collagen sponge). The high efficiency of the use of BFP is due to faster epithelization and prevention of tension of the edges of the surgical wound, severe scarring, as well as inflammatory complications. Therefore, in combination with the correctly selected palatoplasty method, the use of BFP promotes normal growth and development of the upper jaw.

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