

Primary Palatoplasty: A Comparison of Results by Various Techniques - A Retrospective Study

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Abstract

Introduction: To identify a better method for primary cleft palate (CP) repairs with respect to velopharyngeal function. **Materials and Methods:** A retrospective, longitudinal review of medical charts of patients with congenital CP who underwent four different techniques of palatoplasty, performed by three different surgeons in the Department of Maxillofacial Surgery of the National Center for Maternal and Child Health. Nasopharyngoscopy (NPS) was used for velopharyngeal function evaluation. CP was classified according to the Veau system and the “Golding-Kushner” scale for NPS results was used for assessing the patient’s velopharyngeal function and its association with cleft types and the primary palatoplasty techniques. Pearson’s Chi-square analysis and binary logistic regression were used for statistical analysis. **Results:** A total of 335 patients were included in the study. The mean age at primary palate repair was 22.9 ± 13.6 months. There were 56, 42, 177, and 60 patients with Veau-I, Veau-II, Veau-III, and Veau-IV types, respectively, whereas for primary palatoplasty 65 patients underwent Furlow, 148 patients – Mongolian, 108 patients – two flap, 34 patients – von Langenbeck technique. NPS assessment of adequate velopharyngeal function was followed by Furlow’s technique in 89.4% of cases, Mongolian technique in 62.2% of cases but by “two flap” only in 48.1% and von Langenbeck in 47.1% of cases. **Discussion:** The Furlow and Mongolian techniques were superior for maintaining velopharyngeal function after primary palatoplasty.

Keywords: Cleft palate, nasopharyngoscopy, primary palatoplasty, velopharyngeal insufficiency

INTRODUCTION

Cleft lip and palate (CL/P) are the most common congenital malformations affecting the head-and-neck region. There are many studies on the incidence of CL/P, approximately 1.5:1000 newborns worldwide.^[1] The prevalence rate in Mongolia is 1:1072 live births (2012).^[2]

In Mongolia, a total of 3172 newborns were born with congenital malformations between 2014 and 2018. Among all newborns with congenital malformation, nonsyndromic CL/P was 479, syndromic CL/P was 68, a total of 547 (17.2%) CL/P cases have been reported.^[3]

The main purpose of palatoplasty is to build normal oral competence, normal velopharyngeal function, normal hearing, and feeding with the lowest retardation of maxillary growth as well.^[4]

Early palatoplasty (before 24 months old) has a good outcome for speech and hearing development, yet late

palatoplasty (after 4 years old) has a low effect on impairing mid-facial growth.^[5]

In recent years, the most commonly used surgical techniques can be divided into three main groups cleft closure by involving oral mucosa, surrounding tissues, the difference of surgical procedures on the palatal soft tissue, and the timing of intervention;

1. Two-flap palatoplasty
2. Furlow double opposing Z plasty
3. Two-stage palatoplasty.

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These techniques have their pros and cons and studying these techniques in all aspects.^[6]

Mongolian technique is similar in principle to Bardach’s technique, the deviation in this technique being in the posterior aspect of the repair. The modification involves a bilateral triangular dissection of the nasal mucosa at the base of the uvula and the soft palate.^[7]

Primary cleft palate (CP) repair can also be performed in one or two stages. Most cleft surgeons prefer one-stage palate repair.^[8,9]

Over the last 30 years, European, British, and North American researchers studied surgical techniques for CP, the optimal age for surgical treatment, assessing surgical outcomes, complications and tried to create a “Gold Standard management,” but still evidence regarding the optimal surgical technique and timing of CP surgery is lacking. Thus, surgical results mainly depend on the cleft surgeon’s knowledge, experience, and skills.^[10] Every surgeon should be fully aware of all the techniques of CP surgery so that there is no doubt in the choice of which method to use for what type of clefts.

The three most documented complications of palatoplasty are velopharyngeal insufficiency (VPI), fistula formation, and the retardation of maxillary growth. These complications lead to poor speech intelligibility, articulation errors, and a nasal escape. Food may enter the nasal cavity while eating, there may be midfacial growth impairment, mandibular prognathism, and abnormal facial appearance, all leading to subsequent surgical corrections. Speech pathologists assess postoperative velopharyngeal function and noted among complications, VPI causes in 5%–86% after primary CP repair.^[11-13]

Therefore, it is essential to choose an adequate primary surgical method for each particular type of CP. This study aimed to compare the results of instrumental evaluations of patients with CL/P repaired by different palatoplasty techniques.

Aims

The objectives of this study were to identify better methods for primary CP repair in relation to velopharyngeal function.

MATERIALS AND METHODS

Ethical considerations

The study was approved by the Research Ethics Monitoring Committee of the Mongolian National University of Medical Sciences (approval number 2020/3-01, Ethics Sub-Committee of the NCMCH) (approval number 46).

A retrospective, longitudinal review of medical charts of patients with congenital CP underwent four different techniques of palatoplasty, performed by three different surgeons in the Department of Maxillofacial Surgery of the National Center for Maternal and Child Health (NCMCH) and who had velopharyngeal function assessment was made. Ethics approval was obtained from the Mongolian National University

of Medical Science and NCMCH to perform a retrospective assessment of all cases of nonsyndromic CP. Patient consent was waived due to the retrospective nature of the study.

Inclusion criteria were as follows:

1. Nonsyndromic CP
2. Based on velopharyngeal function evaluation with nasopharyngoscopy (NPS) after primary palatoplasty.

Patients were excluded as follows:

1. Syndromic CL/P
2. Oronasal fistula formation after primary palatoplasty
3. Chronic hypertrophic tonsillitis and adenitis
4. Hearing impairment
5. Patients with neurological or psychological disease.

We used Veau classification in our study.

1. Veau I: Cleft of the soft palate only
2. Veau II: Cleft involving the hard and soft palate
3. Veau III: Cleft involving complete unilateral of soft, hard palate, lip, and alveolar ridge
4. Veau IV: Cleft involving complete bilateral of soft, hard palate, lip, and alveolar ridge.

The flexible fiberoptic NPS (Germany, Scholly) 3.4 mm in diameter was used for the evaluation. The “Golding-Kushner”^[14] scale is the method for assessing the results of our speech therapist’s NPS examination in our center. This rating system was used to assess the patient’s velopharyngeal function to associate with cleft types and the primary palatoplasty techniques.

The “Golding-Kushner” scale is used to evaluate the velopharyngeal closure rate and it rated 0.1–1.0 points. 1.0 point displays that when a patient is swallowing there is complete separation of the oropharyngeal and nasopharyngeal cavity with complete velopharyngeal closure and allows air travel from lungs to oral cavity without any air leakage. If closure was incomplete or cannot be closed, it will be rated 0.95 and below and diagnosed with VPI [Figure 1].

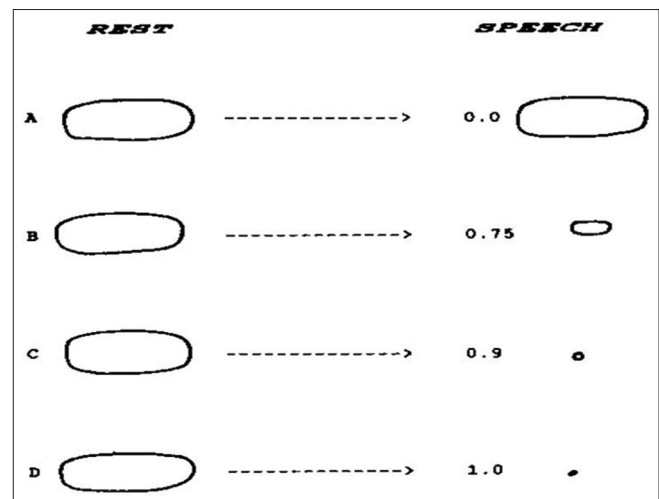


Figure 1: Golding-Kushner scale of NPS.^[14] NPS: Nasopharyngoscopy

Statistical analyses of the data were performed with Statistical analyses of the data were performed with SPSS software (IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp). Pearson’s Chi-squared analysis and binary logistic regression were used for statistical analysis. A $P < 0.05$ was considered statistically significant in all instances.

RESULTS

There were 335 patients who underwent primary palatoplasty repair with Mongolian technique, two-flap palatoplasty, Furlow double opposing Z-plasty, and Langenbeck repair in the Department of Maxillofacial Surgery of the NCMCH between 2014 and 2018.

The mean age at the time of surgery was 23 ± 14 months [Table 1].

According to the Veau system, there were Veau-I 56, Veau-II 42, Veau-III 177, and Veau-IV 60 patients. For primary palatoplasty, Furlow double opposing Z plasty was used in 47 patients, the Mongolian technique was used in 148 patients, and Langenbeck palatoplasty was used in 34 patients [Table 1].

There was no evidence of statistical significance between different surgical techniques and age at surgery [Table 2].

About 89.4% ($n = 42$) of the patients who underwent Furlow Z plasty and 62.2% ($n = 92$) of the patients who underwent the Mongolian technique developed sufficient velopharyngeal function. About 52% of the patients who underwent two-flap palatoplasty and 53% of the patients who underwent Langenbeck palatoplasty developed VPI [Table 3].

Comparing the Mongolian technique and other palatoplasty techniques, Furlow Z-plasty outcome had 20% better velopharyngeal function ($P = 0.001$), yet after two-flap palatoplasty developed 77% more VPI ($P = 0.027$) [Table 4]. The decision of assessment for the velopharyngeal function

was based on the instrumental evaluation of an experienced speech therapist. The decisions were made together with the cleft surgeons of the cleft team.

DISCUSSION

In 1766, Le Monnier, a French dentist, successfully repaired a cleft velum. Since then, surgeons developed different surgical techniques; hence, cleft repair has been enriched with many techniques. At first, the main purpose of CP repair was only to close the CP and separate the oral and nasal cavity. However, nowadays cleft repair is not only for creating the mechanically complete palate but also to create as close as possible to the functionally normal palate which promotes normal mid-facial growth and normal speech.^[15] However, the search for a “Gold standard” that meets all of these requirements is still controversial among researchers and surgeons.^[16] There is still much controversy surrounding the optimal timing of palate repair, surgical sequence, and technique for surgical closure.^[17-19]

In our country, all CPs are repaired with one-stage palatoplasty. We use two-flap palatoplasty, Furlow Z-plasty, and the modification of the two-flap palatoplasty Mongolian technique^[7] which was developed by our surgeons in 2000. There are some publications about the result of the “Mongolian” technique. Ayanga,^[2,7] reported a lower risk of postoperative complications of wound dehiscence and oronasal fistula formation, and the author’s previous study showed VPI rate was low (33.4%–38.1%) for Veau-III and IV types of cleft.^[20]

Furlow double opposing Z plasty is one of the most common surgical techniques among cleft surgeons.^[8,21,22] Some disadvantages of this procedure are as follows: (1) it is difficult to perform in patients with wide clefts; (2) it requires high skill from the surgeon; (3) it requires the use of elongated incisions; and (4) it entails the risk of flap necrosis.^[23]

Complete velopharyngeal closure is one of the best criteria for primary palatoplasty.^[21] Yu *et al.*,^[24] reported that Furlow’s palatoplasty showed sufficient velopharyngeal closure. The occurrence of complete velopharyngeal closure was better than for the von Langanbeck procedure.

In recent years, cleft surgeons have been working to improve the effectiveness of CP surgery by introducing their own methods and validating the results. Wang *et al.*^[25] introduced a new modification to lengthen the soft palate by making a multiple zigzag incision in the nasal mucosa which is named zigzag plasty. Their study showed a good lengthening of the soft palate than compared to other methods.

In addition, this is ultimately a matter of quality of life for patients with CL/P. Every surgeon should try to reduce the number of secondary surgeries by improving the quality of primary surgery, especially for patients with high risk.^[26]

Two-stage palate repair is still widely used in everyday practice. It is complicated to compare clinical outcomes

Table 1: General characteristics of all patients

Characteristics	Quantity	Percentage
Sex		
Male	183	54.6
Female	152	45.4
Area		
Ulaanbaatar	153	45.7
Countryside	182	54.3
Cleft type		
Veau I	56	16.7
Veau II	42	12.5
Veau III	177	52.8
Veau IV	60	17.9
Surgical technique		
Furlow Z-plasty	47	14.0
Mongolian	148	44.2
Two flap	106	31.6
Langenbeck	34	10.2
Total	335	100

Table 2: Comparison between age at surgery and different surgical techniques

Parameters	Surgical techniques				P
	Furlow Z-plasty, n (%)	Mongolian technique, n (%)	Two flap, n (%)	Langenbeck, n (%)	
Age at surgery (months)					
<18	22 (46.8)	81 (54.7)	60 (56.6)	24 (70.6)	0.204
>18	25 (53.2)	67 (45.3)	46 (43.3)	10 (29.4)	
Cleft type					
Veau I	37 (78.7)	0	0	19 (55.9)	<0.0001
Veau II	9 (19.1)	17 (11.5)	1 (0.9)	15 (44.1)	
Veau III	1 (2.1)	98 (66.2)	78 (73.6)	0	
Veau IV	0	33 (22.3)	27 (25.5)	0	

Table 3: Comparison different surgical techniques in velopharyngeal function

	Surgical techniques				P	Total
	Furlow Z-plasty, n (%)	Mongolian technique, n (%)	Two flap palatoplasty, n (%)	Langenbeck palatoplasty, n (%)		
Nasopharyngoscopy						
Mild	4 (8.5)	33 (22.3)	32 (30.2)	16 (47.1)	<0.0001	85 (25.4)
Moderate	1 (2.1)	12 (8.1)	11 (10.4)	2 (5.9)		26 (7.8)
Normal	42 (89.4)	92 (62.2)	51 (48.1)	16 (47.1)		201 (60.0)
Severe	0	11 (7.4)	12 (11.3)	0		23 (6.9)
Hypernasality						
Mild	5 (10.6)	33 (22.3)	31 (29.2)	15 (44.1)	<0.0001	84 (25.1)
Moderate	1 (2.1)	12 (8.1)	11 (10.4)	3 (8.8)		27 (8.1)
Normal	41 (87.2)	92 (62.2)	52 (49.1)	16 (47.1)		201 (60.0)
Severe	0	11 (7.4)	12 (11.3)	0		23 (6.9)
Nasal air emission						
Nonaudible	32 (68.1)	74 (50.0)	32 (30.2)	13 (38.2)	<0.0001	151 (45.1)
Audible	15 (31.9)	74 (50.0)	74 (69.8)	21 (61.8)		184 (54.9)
Velopharyngeal closure						
Complete	42 (89.4)	92 (62.2)	51 (48.1)	16 (47.1)	<0.0001	201 (60.0)
Incomplete	5 (10.6)	56 (37.8)	55 (51.9)	18 (52.9)		134 (40.0)
Total	47 (100)	148 (100)	106 (100)	34 (100)		335 (100)

Table 4: Comparison of surgical techniques

Surgical techniques	B	95% CI		P
		Lower limit	Upper limit	
Mongolian technique	1.0			
Two flap palatoplasty	1.77	1.07	2.94	0.027
Furlow Z-plasty	0.20	0.07	0.52	0.001
Von langenbeck palatoplasty	1.85	0.87	3.92	0.109

B: Comparative ratio, CI: Confidence interval

of one-stage surgery, it is related to a lack of studies that report long-term outcomes, small groups of patients, lack of prospective studies, and study models that lead to different outcomes.^[27]

McCrary *et al.*,^[28] found that the risk of developing a VPI after primary two-stage palate surgery was 1.8 times higher than in one-stage surgery. This study was a large cohort study with a total of 1047 CP patients; 59.6% had a two-stage repair, 40.4%

had one-stage CP repair. They found that 32% of patients with two-stage CP repair developed VPI, one stage CP repaired patients were 22%.

In 2019, Stein *et al.* reported that one-stage repair is associated with less risk of palatal fistula formation and VPI than two-stage palate repairs in their big meta-analysis study.^[22]

Many researchers^[5,10,29,30,31,32,33,34,35] have published their views on the evaluation of primary palatoplasty outcomes. They pointed out we should consider surgical technique as well as age at the time of surgery to evaluate the surgical result. There was evidence either early or late palatoplasty had advantages and disadvantages. Early palatoplasty provides normal speech development^[5,10,29] though delayed palatoplasty has minimal impairment of maxillary growth with a negative effect on speech development.^[30] Salgado *et al.*^[36] discussed in their study that the optimal timing for CP repair surgery still requires more reliable scientific evidence. Controlled studies are still lacking, as well as primary studies focused on limiting confounding factors in assessing effects on maxillary growth.^[36]

For children at the age of 2 years, speech has already started to develop. If the patient did not receive palatoplasty surgery before the age of 2 years, it will significantly decrease the possibility of normal speech development.^[31]

Thus, speech pathologists recommend early palatoplasty to establish normal velopharyngeal function and increase the chances of normal speech development.^[29]

Bruneel *et al.*^[37] found that speech discomfort negatively affected the quality of life in patients with VPI. Quality of life has been found to improve after speech correcting surgery in that cases.^[38] Kaplan^[32] suggested 6–9 months for the optimal age for palatoplasty. Because postoperative swelling lasts 3–6 months on the palate, swollen tissue limits soft palate movement.^[32]

Some researchers have compared the results of early and delayed palatoplasty and found no differences between them. For example, a recent study comparison between a total of 181 patients who underwent Furlow's palatoplasty at The Children's Hospital of Philadelphia, USA, before 6 months and up to 24 months old. The study did not find a significant difference in velopharyngeal function.^[33]

Kirschner *et al.*^[34] performed speech evaluation on 90 patients who underwent complete unilateral CL/P repair either between 3 and 7 months of age or later than 7 months of age. There were no differences between the groups for resonance, nasal air emission, and articulation. However, 10% of patients who underwent early palatoplasty required pharyngoplasty to correct postoperative velopharyngeal function, and only 6% of delayed surgery required subsequent correction.

The results of this study show that early surgery is not optimal, besides it can result in perioperative complications associated with too young age.

Besides, delayed palatoplasty has the disadvantage of widening the cleft gap, which can lead to postoperative complications such as wound dehiscence and formation of oronasal fistula.

Shaffer *et al.*^[35] reported that patients who had late palatoplasty may be related to short- and long-term lag in speech/language development.

Pet *et al.*^[39] concluded in their study that the increases in moderate, severe VPI, and rates of speech correcting surgeries related to later palatoplasty.

The national treatment protocol for this abnormality recommends that primary CP repair should be performed between the ages of 12 and 18 months. However, due to the characteristic geographical location, the population density of Mongolia, health education among the population, and the current state of the health system, there are still many cases receiving surgical treatment at a delayed age. In terms of performing two-stage CP repair, it is available in treatment centers in countries with highly developed cleft care systems. However, depending on the developing country and the

population density of some countries, a one-stage palate surgery may be appropriate.

In 2012, Ayanga reported the patient's mean age of case reviewed in their study was 6 years, and 87% of all patients were operated at an age later than 18 months.^[2] In 2017, Erdenetsogt reported the patient's mean age of case reviewed in their study was 24 months, and 62% of all reviewed patients were delayed.^[20] However, in this study, the majority of patients (54.5%) underwent surgery before 18 months, which is a result of the improved diagnostic, treatment, and monitoring system in our country.

CONCLUSIONS

The Furlow and Mongolian techniques were superior for maintaining velopharyngeal function after primary palatoplasty.

The velopharyngeal function was better when using Furlow Z-plasty technique in Veau I and II type of clefts, and the "Mongolian" technique in Veau III and IV type of clefts.

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Conflicts of interest

There are no conflicts of interest.

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