

Speech Outcome Evaluation After Two-Flap Palatoplasty In Plastic Surgery Division Cipto Mangunkusumo Hospital: A Retrospective study

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Backgrounds: One of the primary goal of cleft palate repair is to provide an intact mechanism for normal speech production. The purpose of this study is to evaluate the two-flap mucoperiosteal palatoplasty procedure on speech outcomes in patients undergoing surgical repair before the age of 2 years.

Methods: A retrospective analysis study was done on 22 children with complete unilateral cleft palate (with or without cleft lip) who underwent two-flap palatoplasty between year 2002 to 2006 at Cipto Mangunkusumo Hospital. Evaluation was performed by a speech pathologist for pattern of articulation, hypernasality, intelligibility, and velopharyngeal competence.

Results: Palatoplasty were performed after 2 year-old in 11 patients and before 2 year-old in 11 patients. Speech of the 22 children postpalatoplasty was evaluated perceptually from standardised tape recordings. Velopharyngeal competence in patients who underwent palatoplasty before 2 year-old compared to after 2 year-old were 72.7% good, 18.2% fair and 9.1% poor versus 54,5% good, 9,1% fair and 36,4% poor respectively.

Conclusion: Two-flaps mucoperiosteal palatoplasty performed before the age of 2 years old shows better speech outcome in all parameters, although the numbers are not statistically significant. Further prospective study with larger sample is needed.

Keyword: cleft palate, palatoplasty, speech outcome

Latar Belakang: Salah satu tujuan utama operasi sumbing palatum adalah untuk memperbaiki mekanisme artikulasi agar proses pembentukan suara dapat berjalan normal. Studi ini bertujuan mengevaluasi hasil kemampuan bicara pada pasien dengan sumbing palatum yang menjalani operasi two-flap palatoplasti sebelum usia 2 tahun.

Metode: Studi restrospektif dilakukan terhadap 22 anak dengan sumbing palatum unilateral komplit (dengan atau tanpa sumbing bibir) yang menjalani two-flap palatoplasti antara tahun 2002 hingga 2006 di Rumah Sakit Cipto Mangunkusumo. Penilaian dilakukan oleh seorang ahli terapi wicara, yang mencakup pola artikulasi, hipernasalitas, inteligibilitas, dan kompetensi velofaring.

Hasil: Sebelas pasien menjalanni palatoplasti sebelum usia 2 tahun, dan 11 lainnya setelah usia 2 tahun. Kemampuan bicara ke-22 pasien pascapalatoplasti dinilai secara perseptif dari rekaman suara yang distandarisasi. Kompetensi velofaring pada pasien yang menjalani palatoplasti sebelum dan sesudah usia 2 tahun dibandingkan, dengan hasil 72.7% baik, 18.2% cukup, dan 9.1% buruk, versus 54.5% baik, 9.1% cukup baik, dan 36.4% buruk secara restrospektif.

Kesimpulan: Melakukan two-flap mukoperiosteal palatoplasti pada anak dengan sumbing palatum sebelum usia 2 tahun menunjukkan hasil kemampuan bicara yang lebih baik, meskipun makna statistik belum signifikan. Studi prospektif lanjut dengan jumlah sampel lebih besar diperlukan untuk mendukung hasil studi ini.

Kata kunci: cleft palate, palatoplasty, speech outcome

Cleft lip and palate are the most common congenital craniofacial anomalies encountered by plastic surgeons¹. The incidence of cleft lip and palate is 46%, followed by isolated cleft palate at 33%, and isolated cleft lip at

21%. Unilateral clefts are nine times more common than bilateral clefts¹. Individuals born with cleft lip and or palate require care from multiple specialties to optimize treatment outcome¹⁻³.

The techniques of palatoplasty have changed considerably from the ancient times to date^{2,4,5}. The 19th century witnessed a great evolution in palatoplasties, allowing higher success

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of cleft palate closure and more optimal outcomes⁴. Refinements in the basic principles of repair and greater attention to the anatomic and functional details marked the beginning of a modern cleft palate treatment. Treatment objective in palatoplasty has not only been the simple anatomic closure of the palate but also to create an adequately functioning velopharyngeal mechanism for normal speech production, and avoidance of abnormal maxillofacial growth after repair^{2,4-6}. Speech quality remains the most important output by which to assess the surgical success³. The most effective technique for the surgical repair of palatal clefts continues to provoke controversy^{2,4}.

One of the factors that has been identified to influence speech outcome for children with cleft palate is the timing of primary palatal surgery. The majority of studies suggested that earlier surgery was associated with better speech, better articulation, and production of a more normal resonance to minimize the development of compensatory articulations⁶. It is generally thought that speech are improved by early cleft palate repair (before 24 months of age) and that delayed closure (after 4 years) is associated with less retardation of midfacial growth^{5,7}.

The Division of Plastic Surgery in Cipto Mangunkusumo Hospital utilizes the two-flap mucoperiosteal palatoplasty technique with muscle realignment to treat a unilateral or bilateral complete cleft palate. Primary cleft palate surgical repair is recommended between 18 months-old up to ≤ 2 years old⁸. This study evaluates how primary palatal surgery timing affect speech outcome and how it can be used as a guideline for the ideal time in treating complete cleft palate in our division.

METHODS

This retrospective analytic study was performed at the Division of Plastic Surgery and Medical Rehabilitation Department, Faculty of medicine University of Indonesia Cipto Ma-ngunkusumo Hospital Jakarta during June-July 2010. Patients with complete cleft palate with or without cleft lip, who underwent palatoplasty at the Division Plastic Surgery Cipto Mangun-kusumo hospital between 2002

and 2006 are included. All patients underwent two-flap mu-coperiosteal palatoplasty repair for soft and hard palate with repositioning of the muscle (intravelar veloplasty), regardless of the cleft severity and operator. All patients already had prior cleft lip repair. Patients with associated syndromic malformation, oronasal fistulas, mental disorder, redo palatoplasty, the need for secondary velopharyngeal surgery, and loss of follow up were excluded from this study.

Patients were divided into two groups based upon timing of palatoplasty: those repaired between ≤ 2 years old and > 2 years old. Eleven patients were included in each group for analysis. A perceptual analysis will be performed from audio recordings of the patients. The recordings are done by one resident of plastic surgery using a high quality digital recorder in a noise-free room. The microphone will be placed 15 cm away from the mouth of the patient with the articulation samples will stored in a separate audio cassette tape for each patient.

Each child articulates 13 sentences in Bahasa Indonesia, including words predominantly consisted of nasal and oral consonant, with phonation emphasis of the vowels "a", "i", and "u". The words are listed in Table 1. Patients also count numbers from 1 to 10 in Bahasa. Speech samples of the patients will be blindly analyzed by a speech pathologist who is experienced in the assessment of cleft palate speech, using headphones in a noise-free room. Perceptual analysis of intelligibility, articulation, and resonance are analyzed following the Murthy rating criteria for speech parameters¹⁶. Based on the scoring obtained from these parameters, the velopharyngeal competence level is divided into either good, fair, or poor. Good result would refer to definite and probable adequate velopharyngeal competency. Fair result means marginal velopharyngeal competency, whilst poor score means a probable or definite inadequate velopharyngeal competency. The data is statistically analyzed using SPSS 16.0 for window.

RESULTS

Twenty-two patients with unilateral complete cleft lip and palate who underwent the

Table 1. Words in Bahasa Indonesia used to assess patient articulation.

	/a/	/i/	/u/
/b/	balon	bibir	buku
/c/	cacing	cicak	cuci
/d/	daun	mandi	duduk
/g/	gajah	gigi	dagu
/h/	paha	hijau	hujan
/j/	jambu	jinjit	keju
/k/	kaca	kaki	kuda
/l/	lalat	tali	palu
/m/	mandi	minum	mulut
/n/	nanas	anisa	banu
/r/	kerang	lari	rumah
/s/	sapi	dasi	susu

Table 2. Demography of Patients

No.	Age at time of evaluation (yo)	Sex	Age at time of palate repair (mo)	Speech therapy
1.	8	M	96	No
2.	8	M	18	No
3.	11	M	48	No
4.	8	F	18	No
5.	8	M	24	No
6.	3,5	M	12	No
7.	9	M	30	No
8.	5	M	30	No
9.	7	F	20	No
10.	9	M	36	No
11.	8	M	30	No
12.	10	F	20	No
13.	7	F	18	No
14.	11	F	24	No
15.	6	F	18	No
16.	13	M	36	No
17.	6	M	30	1x
18.	6	F	12	No
19.	8	M	30	No
20.	11	M	36	No
21.	10	M	36	2x
22.	8	M	18	No

intravelar veloplasty are included in the study. Informed consents are obtained from the parents to participate in this study. Patients ranged between 3.5 to 13 year-old (mean 8.2 year) at time of speech evaluation. Palate repair were done between 1 to 8 year-old (mean 29.1 months). 15 patients are male, 7 female. Based on Saphiro-Wilk normality test, this data has normal distribution ($p=0.716$). Eleven patients underwent palatoplasty at ≤ 2 years old (aged 12 to 24 months, mean 18.4 months), and eleven

others at >2 years old (aged 30 to 96 months, mean 39.8 months). Only two of the 22 patients received speech therapy, one and two sessions each. Patient demography is listed in Table 2.

An overall assessment of articulation, resonance, and intelligibility, as well as velopharyngeal competence post palatoplasty in all patients shows that 68.2% of patient has normal phonemes production, 63.6% has normal nasality, 77.3% has intelligible speech, and 63.6% of them has good velopharyngeal competence.

Table 3. Perceptual Assessments and Velopharyngeal Competence Results

Characteristics		(n = 22)	%
Articulation rating	Normal production of majority of phonemes	15	68,2
	Predominantly distortion of phonemes	2	9,1
	Distortion and substitution of phonemes	1	4,5
	Phonemes are substituted and omitted	4	18,2
Hypernasality rating	Normal	14	63,6
	Mild hypernasality	3	13,6
	Moderate hypernasality	1	4,5
	Severe hypernasality	4	18,2
Speech intelligibility rating	Normal, all speech is understood	17	77,3
	Listener's attention needed	5	22,7
Velopharyngeal competence	Good	14	63,6
	Fair	3	13,6
	Poor	5	22,7

Table 4. Correlation of the Palatoplasty Timing with Articulation, Hypernasality and Speech Intelligibility Outcomes.

Age of operation	Articulation		Hypernasality Rating		Speech Intelligibility Rating	
	Normal	Abnormal	Normal	Abnormal	Normal	Attention needed
≤ 2 yo	10 (90.9%)	1 (9.1%)	10 (90.9%)	1 (9.1%)	10 (90,9%)	1 (9,1%)
> 2 yo	7 (63.6%)	4 (36.4%)	6 (63.6%)	5 (36.4%)	7 (63,6%)	4 (36,4%)

Table 5. Correlation of the Palatoplasty Timing with Velopharyngeal Competence

Age of operation	Velopharyngeal Competence			P value
	Good	Fair	Poor	
≤ 2 yo	8 (72,7%)	2 (18,2%)	1 (9,1%)	0,808
> 2 yo	6 (54,5%)	1 (9,1%)	4 (36,4%)	

Other distributions of abnormal phonemes, hypernasality and speech untelligibility is summarized in Table 3.

Speech outcomes are then assessed based on the timing of primary palatal surgery in regards to articulation, hypernasality, and speech intelligibility. Articulation and hypernasality criteria in Table 3 are further grouped to either normal or abnormal. Intelligibility are either normal or requiring listener's attention, and velopharyngeal competence are either good, fair, or poor. In all accounts, the group of patient who underwent primary palate repair before the age of two shows a higher proportion of having normal articulation, normal nasality, and inteligible speech as shown in Table 4. Velopharyngeal competence of the early versus later-repair group shows a

tendency of those repaired before the age 2 years to have fewer poor competence (9.1% versus 36.4%) shown in Table 5. However, these figures are not found to be statistically significant.

DISCUSSION

The ideal surgical technique for the repair of unilateral palatal cleft is an ongoing debate. However, the primary goals of palatal repair remain to provide a functional velopharyngeal mechanism for the development of normal speech and to minimize any detrimental effects on maxillofacial growth by achieving a tension-free multilayer closure of the palatal defect with minimal dissection and a succesful reconstruction of the levator muscle sling^{2-5,17}. Although the two-flap palatoplasty was first

popularized more than 25 years ago in world, there are several modification to the original technique. In this study, all samples underwent two flap mucoperiosteal palatoplasty modified by di-ssection of the abnormal attachments of the velar muscles and suturing them without tension, as intravelar veloplasty. All subjects have had their lips repaired.

Dynamically, speech is characterized by ordered maintenance and release of intra oral pressure, producing phonemes (high pressure consonants and vowels) controlled at the level of the lips, tongue, palate, and larynx¹⁸. Children under 4 years of age have generally not yet reached the level of maturity required to cooperate enough to allow for the appropriate perceptual test to accurately assess articulation, resonance and velopharyngeal competence¹⁹. This perceptual assessment is conducted between the age of 3.5 and 13 years. The age of one of our samples is 3.5 years, but the patient cooperate enough to follow the test and the sample sound can be assessed well by speech pathologist. Males predominance is found in the cleft lip and palate population. In this study, male is twice as many as the female sample¹.

The timing of palatal closure is critical, and the best time to achieve this is before the development of palate-related sounds, or the phonemic stage of development. Early palatal repair and its beneficial effects on speech have been reported by several authors¹³. Meanwhile, in our study, 50% of our samples had palate repair at the age of more than 2 years old. This may be due to the lack of knowledge or economic difficulties to get appropriate treatment. McWilliams et al.²¹, performed Furlow palatoplasty in 63 patient, and non Furlow (Von Langenback, four flap Wardill) in 20 patients. Furlow patients had better speech outcome than non Furlow, with normal nasal resonance for Furlow patients around 79%, moderate hypernasality was 4.76%, and 98% of Furlow patients showed normal articulation. Susam park et al²⁰ had 56 patients with unilateral cleft lip and palate repaired using the push-back technique, 80.1% had normal and good velopharyngeal competence. The Salyer et al¹⁹ study performed modified two flap palatoplasty at younger age patients, regardless the type of

cleft, 91% shows normal and mildly impaired hypernasality, 63.2 normal to mildly impaired articulation. In our study, all patients who underwent two flap palatoplasty and intravelar veloplasty by several surgeons, shows 77.3% to have a normal to mildly impaired articulation, 77.3% has normal to mild hypernasality, 77.3% has normal intelligibility, and 63.6% good velopharyngeal competence.

Current developmental research has shown that speech develops between 18 to 24 months of age. Dorf and Curtin¹³ used 12 months of age as an arbitrary dividing point between early and late palatal repair and found better speech, specifically, with fewer compensatory articulations, in those who had early palatal repair. Salyer et al operated at approximately 8 months of age, which is the ideal time to perform the two-flap palatoplasty. In this study, the cut-off point of the early and late palatoplasty is 2 years old. All of the samples are divided into two groups. The group who had early palatoplasty has 90.9% normal articulation and only 63.6% of the sample who performed late palatoplasty has normal articulation. The group who had early palatoplasty has 90.9% normal and mildly nasal resonance, 90.9% normal intelligibility and 72.7% good velopharyngeal competence, compare with 63.6%, 63.6% and 54.5% in group who had late palatoplasty. In our study, there is a patient who had palatoplasty at age 8 years old and gives good velopharyngeal competence. However, this difference was not statistically significant by Fischer test. Although we are unable to show statistically that the palatoplasty before 2 years old is superior to the palatoplasty more than 2 years, a trend toward this conclusion has been demonstrated.

CONCLUSION

According to this study, the management of cleft palate that has been implemented in our center: by two flap mucoperiosteal technique and surgery timed around 2 years of age is still applicable because the rate of good speech outcome is acceptable (72.7%). In the future, we propose to conduct a more thorough research with bigger samples and better design to have a more reliable result.

of cleft palate closure and more optimal outcomes⁴. Refinements in the basic principles of re-pair and greater attention to the anatomic and functional details marked the beginning of a modern cleft palate treatment. Treatment objective in palatoplasty has not only been the simple anatomic closure of the palate but also to create an adequately functioning velopharyngeal mechanism for normal speech production, and avoidance of abnormal maxillofacial growth after repair^{2,4-6}. Speech quality remains the most important output by which to assess the surgical success³. The most effective technique for the surgical repair of palatal clefts continues to provoke controversy^{2,4}.

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