

## Furlow Palatoplasty: A Preliminary Study

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### ABSTRACT

Double opposing Z plasty palatoplasty has been introduced by Furlow in the 1980s for repair of cleft palate. The procedure depends on the geometrical properties of the Z plasty in achieving both palatal lengthening and restoration of a muscular sling. This study was performed on 20 patients with cleft palate in an attempt to assess the technical aspects of this procedure. The study was conducted at Cairo University Children Hospital during the period from September 1<sup>st</sup>, 2003 till August 31<sup>st</sup>, 2004. The overall success rate was 80%. Gain in length ranged from 2 mm to 6 mm with an average gain of 3.85 mm. Average operative time was 2 hours and 31 minutes. No medical or surgical complications were encountered. The average follow up period was 6.1 months. Flexible nasopharyngoscopy showed the results of velopharyngeal competence after surgery to be above average. In conclusion, the double opposing Z plasty (Furlow) palatoplasty, is a technically challenging procedure, however, can attain excellent results as the learning curve rises. Endoscopic assessment of the velopharyngeal valve might be an indicator of adequate function, however, the final functional outcome can only be assessed by speech analysis. Speech analysis of patients included in this study will be done once their ages allow. This study is considered to be a preliminary step in assessment of Furlow palatoplasty (technical aspect) before recommending it as the standard of care in cleft palate repair.

### INTRODUCTION

There is little disagreement that the primary objective for surgical repair of palatal clefts is the subsequent development of normal speech. Thus, speech remains the single most important standard by which techniques of palatoplasty are judged [1].

Velopharyngeal competence is the cornerstone in speech production. To achieve a competent valve, the length of the soft palate as well as the integrity of its muscular sling are crucial. Palatal pushback techniques evolved to add length to the palate. Muscle reconstruction in a separate layer was also advocated. The remaining problem is linear scarring that contributes to contracture and shortening of the repaired palate [2].

In 1978, Dr. Leonard Furlow [3] described an elegant new technique of repairing palatal clefts

using opposing mirror image Z-plasties of the oral and nasal mucosa. Palatal muscles included in the posterior flaps of both Z-plasties, are retroposed and overlapped to form a palatal muscle sling. There are three main advantages for this technique over the former palatal pushback techniques. First, palatal lengthening is the geometrical resultant of the Z-plasties. Second, it avoids linear scarring and subsequent contracture. Last, but definitely not least, is the restoration of a muscle sling.

At the Children Hospital, Cairo University, the standard surgical procedure performed for cleft palate repair remains to be the Von Langenbeck procedure. Furlow palatoplasty was performed on a very limited scale and in individual occasions. This study is planned to assess this procedure regarding its surgical technique and complications, as a preliminary step before standing on its functional results.

### MATERIAL AND METHODS

Twenty patients with non-syndromic cleft palate were included in this study. All patients had no previous attempts of repair. Surgeries were done at Cairo University Children's hospital during the period from September 1<sup>st</sup>, 2003 till August 31<sup>st</sup>, 2004. The patients ranged from 16-30 months in age, with an average of 21 months. Eleven patients were females while nine were males.

Preoperative assessment included history and physical examination. History included consanguinity, paternal ages, exposure to risks during pregnancy (medications, trauma, radiation) and similar conditions among siblings or family members. Classification of the cleft type was done according to Veau Classification (Table 1).

All surgeries were performed by the authors under general anesthesia. Two measurements were obtained prior to surgery: the length and width of the cleft using a paper ruler. The length of the

repaired palate was repeated immediately after termination of the procedure and the gain was calculated.

The technique of double opposing Z-plasty after Furlow was used in all patients. Since the authors are right-handed, the right side of the plate was approached first with the oral mucosal flap dissected anteriorly. Four flaps were dissected in the following order: an anteriorly based right-sided oral mucosal flap, a posteriorly based right-sided muscle/nasal mucosal flap, a posteriorly based left-sided oral/muscle flap and finally an anteriorly based left-sided nasal mucosal flap (Figs. 1-4).

Follow-up visits were conducted in the outpatient clinic on weekly basis for the first month, then bi-weekly for the second month and monthly thereafter.

One month after surgery, nasopharyngoscopy was performed to visualize the velopharyngeal (VP) valve. Patients were given a score according to the VP valve competence (3 for complete closure, 2 for mild gapping and 1 for wide gapping).

## RESULTS

Results of surgery are expressed in Table (2). Operative time ranged from 1 hour 45 minutes to 3 hours and 10 minutes. Average operative time was 2 hours and 31 minutes.

Lateral relaxation incisions were performed to obtain a tension-free closure in two patients. Otherwise, no relaxation incisions were needed.

Adequate seal was obtained in 16 patients. Four patients had post operative oro-nasal fistula. The overall success rate was 80%. Gain in length ranged from 2mm to 6mm with an average gain of 3.85mm.

No medical complications were encountered during surgery. There were no surgical complications, such as hemorrhage or wound infection. In one patient, buttonholing of the oral mucosal flap occurred during dissection and the surgeon elected to suture the buttonhole and convert the procedure to two-flap repair to avoid flap compromise. No postoperative complications as obstructive apnea or bleeding were encountered.

Follow-up ranged from 3 to 11 months, with an average follow-up period of 6.1 months.

Postoperative endoscopic assessment of the velopharyngeal valve showed high scores (3) in 7 patients, average score (2) in 9 patients and low scores (1) in 3 patients. One case was excluded

from post operative assessment, in whom one flap was torn and the procedure was converted to two-flap closure.

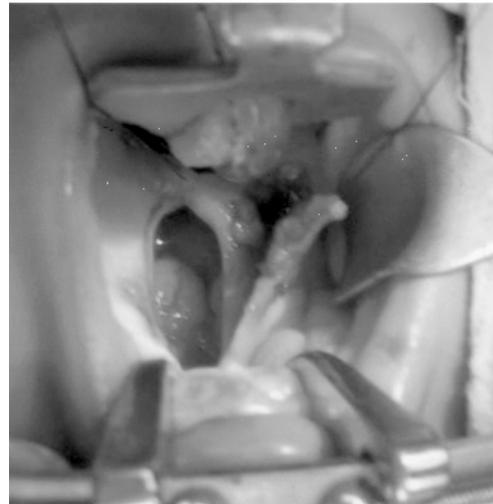


Fig. (1): The right-side anteriorly-based oral mucosal flap shown raised. Note the muscle is preserved attached to the nasal mucosa.

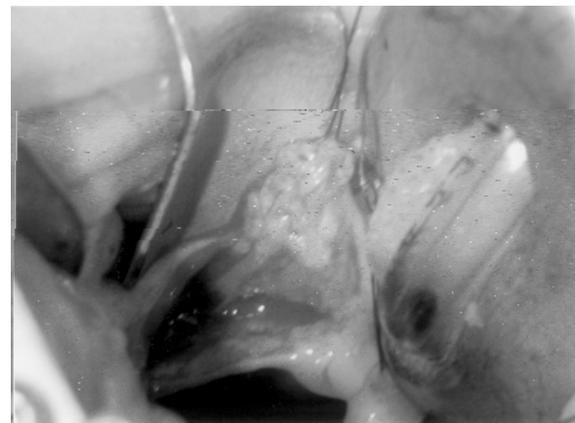


Fig. (2): The left-side posteriorly-based oral/muscle flap shown raised. Note the thickness of the muscle on the undersurface of the flap.

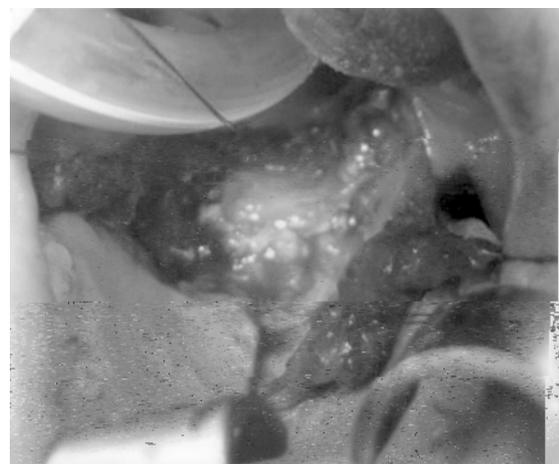


Fig. (3): The deep layer (first Z plasty) closed. Note the orientation of the muscle on the right side is in a horizontal direction.

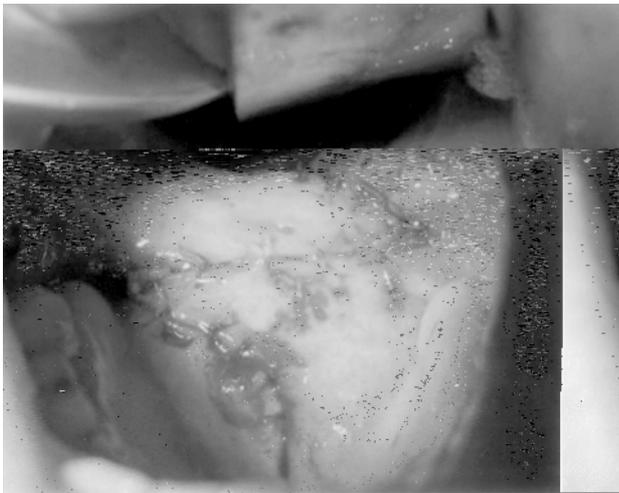


Fig. (4): The superficial layer (second opposing Z plasty) closed.

Table (1): Preoperative assessment of the patients

No.	Age (months)	Sex	Risk F	Classification (Veau)
1	18	F	Consanguinity	I
2	16	F		I
3	17	M		II
4	20	F		II
5	23	M	Family	I
6	18	M	Consanguinity	III
7	19	F		II
8	21	F		II
9	24	F	Consanguinity	I
10	23	F		II
11	23	M		I
12	24	M	Sibling	II
13	30	M		II
14	26	F		II
15	23	M		III
16	27	F		II
17	17	M	Consanguinity	I
18	18	F		III
19	28	F	Sibling	II
20	20	M		I

Table (2): Results

No.	Classification	Width (mm)	Length gain (mm)	Op time	Relax incisions	Success	Endoscopy	F/U (m)
1	1	7	2	3.1		Success	1	11
2	1	8	2	2.45		Fistula	2	10
3	2	14	4	2.5	Yes	Success	3	8
4	2	16	0	2.35		Tear	n/a	8
5	1	7	4	1.45		Success	2	8
6	3	14	5	3.1	Yes	Success	3	7
7	2	14	4	2.15		Success	2	7
8	2	15	3	2.5		Fistula	1	7
9	1	8	4	2.4		Success	3	6
10	2	15	5	2.35		Success	3	6
11	1	13	4	2.45		Success	2	6
12	2	11	5	2.15		Success	2	5
13	2	7	3	2		Success	2	5
14	2	14	3	2.55		Fistula	1	5
15	3	13	3	3		Success	2	5
16	2	7	5	2.2		Success	2	4
17	1	5	6	1.45		Success	3	4
18	3	12	7	2.5		Success	2	4
19	2	6	5	1.55		Success	3	3
20	1	7	6	2		Success	3	3

## DISCUSSION

Most cleft surgeons agree on the fact that Furlow Palatoplasty is a more complicated surgical procedure than other techniques. It is hard to visualize by trainees and requires meticulous technique and adequate understanding of the anatomy of the palate as well as the concept of the Z-plasty. Models have been advocated in some training programs to help in illustrating the key points and make it easier for surgeons to adopt the technique [4].

In his original article [3], Furlow recommended closure of the hard palate without lateral relaxation incisions, making use of the palatal arch. By bringing the dissected muco-periosteal flaps to a horizontal position, the gap can be crossed in most cases. This has the advantage of avoiding raw surfaces on the bony palate with the risk of impairment of facial growth [5].

However, he mentioned the problem of short mucoperiosteal flaps in wide clefts. This can be overcome by the use of lateral relaxing incisions [1,3]. In this study, the authors used vomerine flaps in all Veau type II and III clefts (n=10 & 3 respectively) to close the nasal mucosa. Lateral relaxation incisions were used only twice in this series, with cleft widths of 14 mm.

Regarding soft palate closure, the key point is to obtain intact, healthy and mobile flaps. In this series, the most difficult steps were dissection and mobilization of the two anteriorly based mucosal flaps (the right oral mucosal flap and the left nasal mucosal flap). The thinness of the flap as well as its relatively limited arc of rotation attributed to this difficulty. Back cuts were used to facilitate closure in all cases. In one case, button holing of the oral mucosal flap on the right side was done during dissection and the procedure was converted to two-flap closure.

The success rate of Furlow Palatoplasty approaches 100% in most of the institutions that adopted this technique [1,3,6,7]. Formerly, it has been only used in small defects, however, currently with its promising results, have been used in all types of clefts. In this series, the overall success rate was 80% (n=16). In three patients a fistula occurred at the junction of the hard and soft palates. In a fourth patient, the procedure was terminated and converted to two-flap closure.

The average gain in length obtained in this series is 3.85 mm. Better results of up to 6 mm were obtained later in the study as the technique was gradually mastered. Schubert, Bartel and

Hemprich [6] presented their 10-year experience with Furlow palatoplasty performed on 114 patients at Wittenberg, Germany. An average increase in length of 1cm was achieved in their series. Bae et al. [8] reported more length gain by Furlow's technique than push back procedures, as measured by a paper ruler at the end of surgery (the same method is used in this study). Similar results have been reported by measurements obtained by standard cephalograms [9].

The main advantage of Furlow Palatoplasty is the restoration of a functional muscle sling capable of obtaining a competent velopharyngeal valve. Speech is the final outcome, by which a procedure can be judged. In modern literature, functional results after Furlow palatoplasty appear to be superior to other techniques including the von Langenbeck [10] and intravelar veloplasty [11].

In this study, concern was on the technical feasibility of the procedure as a preliminary step. In the second phase of the study, children will be examined by speech pathologists to assess the functional outcome of the procedure. However, nasopharyngeal endoscopy was used one month after the procedure to assess the competence of the velopharyngeal valve. This is considered to be a simple indicator of the functional outcome. According to a simple scoring system, the average results were above average. Although promising, final results can only be obtained after speech analysis.

In conclusion, Furlow palatoplasty represents an efficient step in cleft palate repair. In a preliminary study focusing on the technical aspect of the procedure, the overall results appeared promising. These included success rates in obtaining an adequate seal as well as obtaining a considerable length gain. Results will improve as the procedure is practiced, as evident by the better results obtained in the last group of patients (n=6) in this study. The second phase of this study will be conducted once the age of the patients allows for speech assessment. Once functional results are obtained, a clear view of the procedure regarding both its technical and functional aspects will be available before it can be recommended to be the "standard of care" in cleft palate surgery.

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