

## Secondary palatoplasty in velopharyngeal insufficiency closure using double opposing Z-plasty technique

Palatoplasti sekunder pada penutupan insufisien velofaring menggunakan teknik *double opposing Z-plasty*

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### ABSTRACT

**Objective:** The surgical management of cleft palate or velopharyngeal insufficiency is anatomical reconstruction of an intact structure for improvement of speech outcome while minimizing the incidence of oronasal fistula. **Case:** A 20 years old male came to the outpatient clinic in Hasanuddin University Dental Hospital with a chief complaint of speech problem. He have had lip dan palate surgery previously. **Management:** Secondary palatoplasty was performed using double opposing z-plasty technique. **Discussion:** There was an optimal soft palate lengthening after surgery and speech outcome will evaluate regularly. **Conclusion:** The treatment of secondary cleft palate using double opposing z-plasty provide adequate lengthening of soft palate in the patient.

**Keywords:** cleft palate, velopharyngeal insufficiency, palatoplasty, furrow, double opposing z-plasty.

### ABSTRAK

**Tujuan:** Manajemen bedah celah palatum atau insufisien velofaring adalah rekonstruksi anatomi struktur utuh untuk perbaikan hasil bicara sambil meminimalkan insiden fistula oronasal. **Case:** Seorang laki-laki berusia 20 tahun datang ke klinik rawat jalan di Rumah Sakit Gigi Mulut Universitas Hasanuddin dengan keluhan utama kualitas bicara. Pasien telah menjalani operasi bibir dan palatum sebelumnya. **Penatalaksanaan:** dilakukan palatoplasti sekunder menggunakan *double opposing z-plasty technique*.

**Pembahasan:** Ada pemanjangan palatum lunak yang optimal setelah operasi dan hasil bicara akan dievaluasi secara teratur. **Sim-pulan:** Perawatan celah palatum sekunder menggunakan *double opposing z-plasty technique* memberikan pemanjangan palatum lunak yang memadai pada pasien.

**Kata kunci:** celah palatum, insufficiency velopharyngeal, palatoplasti, furrow, double opposing z-plasty.

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### INTRODUCTION

Cleft lip and palate is the most common congenital defect in the craniofacial region, with the prevalence was one per 750 live births. The incidence of velopharyngeal insufficiency (VPI) after primary palatoplasty requiring secondary surgery ranges 5-45%. Velopharyngeal competence is the inability of velopharyngeal sphincter to close perfectly that required for production of nasal consonant (sound of 'm', 'n', and 'ng').<sup>1</sup> VPI is an anatomical defect of the velum; there in an inadequate condition to close completely the nasopharyngeal space that produce air leakage through the nose during speech resulting hypernasality and decreasing speech quality of the patients. This condition can severely hinder speech intelligibility.<sup>2-4</sup> The surgical purpose of primary cleft palate repair or secondary VPI treatment is to reconstruct the normal anatomic of the palate to provide a mechanism that allows the adequate function and increases the speech quality, improve swallowing, and hearing, prevent regurgitation of foods and fluids into the nasal cavity, and preservation of maxillary growth while minimizing fistula formation. However, wide CP can require significant undermining of the palatal tissue to achieve good closure in the midline, which can result

in thin palatal flaps under tension. VPI can occur following the primary repair of cleft palate. The incidence of secondary procedures for VPI following primary palatoplasty ranges 4.9-27%. Several techniques are used for CP including von Langenback palatoplasty, Veau-Wardill-Kilner pushback palatoplasty, two-flap palatoplasty, and Furlow double opposing z-plasty.<sup>5-7</sup>

The optimal timing of surgery and the appropriate operative technique remain controversial. The velopharyngeal sphincter is the anatomic basis of velopharyngeal competence and normal speech. The sphincter is located between the oral and nasal cavities and allows the speaker to separate the nasal cavity from the oral cavity. Velopharyngeal closure is achieved by tension in the velum and its elevation toward the pharyngeal walls that move toward the rising velum and reduce the lumen of the velopharynx. In CP and secondary VPI patients, the velopharynx has partial or totally abnormal in morphology and in muscular structure and function.<sup>8-10</sup> The double-opposing z-plasty or furrow technique was introduced by Leonard Furlow in 1986. This technique conceptually and procedurally was challenging but have acceptance by many surgeons as the preferred tech-

nique in the treatment of submucous CP repair with VPI.<sup>11</sup>

### Advantages and disadvantages

The advantages of double opposing z-plasty technique include appropriate reorientation of the soft palate muscles into horizontal, slightly posterior sling, and lengthening the soft palate, improved speech results. Some cleft centers have been reported lower fistula rates after the procedure of palatoplasty. This is believed to be a result of flaps that lie across incision lines (ie, the oral and nasal layer incisions do not align with each other), through providing an intact tissue layer above or below one layer's incision. The furrow double opposing z-plasty also does not attach the maxilla to the posterior pharyngeal wall, and therefore has a diminish risk of complications associated with pharyngeal flap surgery in the CP patient such as hyponasal speech, snoring, obstructive sleep apnea and mouth breathing. The other advantages of the technique is the lengthening of the soft palate, restoring the natural transverse configuration of the muscle sling and rehabilitating normal velar anatomy and function, it can improve the speech. Like other CP technique, the furrow double opposing z-plasty developed for several modifications. On the other hand, disadvantages of this technique are related to its procedure because it involves more geometric configuration in planning and more time spent in creating and transposing the flaps for closure, therefore increased the surgery duration. The z-flaps have different angles according to the width of the palatal defect and available soft palate tissue.<sup>11,12</sup>

This article is aimed to report management of secondary palatoplasty in velopharyngeal insufficiency closure using double opposing Z-plasty technique.



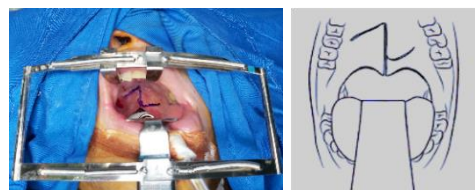
**Figure 1** View of VPI in 20 years old patient.

### CASE

A 20-years-old male came to the outpatient clinic in Dental Hospital of Hasanuddin University with a chief complaint of speech problem. He was born with cleft lip and palate. Surgical lip repair had been performed at an early age (four months). However, residual right unilateral alveolar clefts and associated oronasal fistulae were present (Fig 1).

### Surgical technique with Furlow Double-Opposing Z-Plasty

Secondary palatoplasty was performed under general anesthesia with oral endotracheal intubation, that is secured in the midline to the chin. First, the anteriorly based mucosal flap is designed on the right side of the palate with an angle of 70-80 degrees. This allows less contraction of the tip of the mucosal flap and makes surgery technically easier to perform. After infiltration with epinephrine solution (1:100,000), the cleft edge is incised with No 11 knife between the nasal and oral mucosa in the soft palate extending to the uvula. The hard palate and lateral incisions are incised using a No.15 knife. The mucoperiosteal flap is elevated. The muscle attachment to the posterior margin of the palatal bone is released using blunt scissors. Exploration of the greater palatine neurovascular bundle is performed, and the ligamentous fibers lateral and posterior to the pedicle and foramen are released, allowing mobility of the flap. The hook of the hamulus is cut at the base, preserving the integrity of the tensor veli palatini muscle. The mucoperiosteal flap is further mobilized to easily align without tension in the midline. In the soft palate, the nasal mucosal flap is dissected on the patient's right side, leaving the palatal mucosa intact as a single layer. On the left side, the nasal layer is dissected as a single mucosal layer, leaving the muscular component attached to the palatal layer for later dissection as a musculomucosal flap. The wrong insertion of the levator muscle to the cleft edge and bony shelf is mobilized bilaterally by cutting and pushing with the blunt scissor. It is recommended that a thin muscle layer be left in the left nasal mucosa flap to ensure flap integrity. After flap dissection, the nasal layer repair is started beginning with the z-plasty in the soft palate. After muscle dissection, the right posterior-based flap is incised at 60 degrees in the middle of the soft palate to achieve a 5-mm limb for the



**Figure 2** Design and marked of double opposing z-plasty incision (Source Furlow LT Jr. Cleft palate repair by double opposing Z-plasty. *Plast Reconstr Surg* 1986;78:724-38)



**Figure 3** The oral flaps elevated using a dingman mouth retractor and clinical photograph of oral mucosal flap using double opposing z-plasty after sutured.



**Figure 4** Postoperative intraoral image (day 7<sup>th</sup>, 14<sup>th</sup>, 21<sup>st</sup>), there is lengthening of the soft palate.

z-plasty. The left anterior based nasal mucosal flap is incised at 60 degrees to achieve a reciprocal 5-mm limb. The flaps are aligned as a z-plasty with the central limb straight to the midline and sutured with 4-0 Vicryl.

## DISCUSSION

*Perkins et al* and *Chen et al* reported that the Furlow double opposing z-plasty is excellent technique for treatment of VPI and submucous CP. The most beneficial advantage of this technique is its ability to improve quality of speech with lengthening of the soft palate and restoring transverse anatomy of the levator sling.<sup>13</sup> There is a limited amount of literature looking at CP repair in the adult population and the functional benefits. Severe complications in patient who underwent CP repair are infrequent condition, some severe defects are extended tissues deficiency and presented as severe fistulas.<sup>14</sup> VPI is a common complication after CP repair. Secondary palatoplasty using furlow technique or double opposing z-plasty was successfully applied for the improvement of VPI following primary CP repair.<sup>14</sup> The procedure was fairly considered for mild or marginal VPI because of its lower complication rate and optimal result. Compared with the pharyngeal flap, the double opposing z-plasty establishes a more physiological upper airway, soft palate or velar lengthening, and levator muscle reconstruction. However, the choice of surgical technique depends on the size of the gap and the closure pattern of the sphincter, but it is the surgeon's preference that ultimately decides the technique that can produce the best result.<sup>5</sup>

The fundamental aspect of the furlow technique include oral and nasal-based mucosal and muscle flaps that are designed as z-plasty flaps on one side and then reversed in configuration on the underlying side. As is generally accepted in flap design, a z-plasty produces lengthening of a tissue limb and prevent tension when interdigitated with a corresponding z-plasty flap. Two z-plasties allow transposition of the flaps thus that an incision line does not lie on another during closure, resulting in a reconstructed soft palate that is resistant to dehiscence and disruption of flaps, especially in broad clefts. The surgeon must understand and recognized precisely CP anatomy before performed palatoplasty. The primary objective of palatoplasty is to dissect and organize palatal musculature appropriately, specifi-

cally the tensor levator aponeurosis, and to reposition the muscles correctly, such that function is optimally restored to the velar mechanism. Also, it is important to minimize tissue trauma to the hard palate during surgery to reduce scarring and following growth perturbations of the maxilla. There are many technical modifications of the furlow technique. Mostly, surgeons create a transverse overlapping levator muscle sling that is perfectly positioned near the posterior pharyngeal wall without the formation of a midline scar. The velum is lengthened by recruiting lateral palatal tissues.<sup>9</sup> Before performed the CP repair, the surgeon should make initial assessment consisting of evaluation of nasal emission, resonance, phonation, sleep oxygen saturation levels and articulation as a preoperative evaluation as a comparative measurement with postoperative evaluation. The most advanced technology for assessment of velopharyngeal function during speech include video nasopharyngoscopy (VNP) and multiplanar videofluoroscopy (MPVF).<sup>15</sup> Postoperative evaluation for a successful VPI includes complete closure of the oral and nasal layers without fistula formation, velopharyngeal competence with good speech and feeding outcome. Severe complication after VPI closure are rare but significant problem which characterized by extended deficiency of tissues, this condition permits a flow of foods and fluids into the nasal cavity.<sup>16-18</sup> The limitations in our management of this cases was not performed comprehensive preoperative assessment like auditory perceptual assessment (APA), nasometric assessment, flexible nasopharyngoscopy. There are some controversies about speech function after CP repair, especially in adult patient. *William et al* reported that 82% of patients who underwent Furlow procedure and 71% of patients operated on using the von Langenback technique got adequate velopharyngeal and speech function after 4 years of age. The evaluation of speech outcome from the furlow technique is parallel with several clinical trials. It is important to continue evaluation of speech function of the patients.<sup>6</sup> The other indicator to evaluated the result of the surgery, including the need of surgery for fistula closure or VPI. A study in Taiwan reported the prevalence of adequate velopharyngeal function was 86.6% and 5.5% required surgical correction for VPI. The study conducted by Chorney, et al reported that 5.1% of their patients required a secondary

palatoplasty following the use of the modified Furlow palatoplasty.<sup>2</sup>

The double opposing z-plasty technique has produced a palate of adequate length, decreased of the gap between the velum and pharynx. It was consistent with result of surgery in our patient, this case got 5 mm anatomic lengthening of soft palate. However there is just a minimal improvement of speech quality in our patient, especially the pronunciation of numbers. The patient had developed compensatory mechanisms and misarticulations needed more time and speech therapy. This patient will be followed up on the anatomical structure and speech outcome regularly as a long term postoperative evaluation. Furlow technique have superior ve-

lopharyngeal function and speech outcome compared with the von Langenback palatoplasty and two flaps palatoplasty but it has a higher rate of fistula formation.<sup>2</sup> The development of fistula after primary CP repair may occur as a result of infection, wound tension, the presence of dead space or wound dehiscence, and single-layer repair.<sup>5</sup>

It was concluded that palatoplasty of soft palate or VPI after primary palatoplasty by using Furlow double opposing z-plasty technique in our patient got optimal result, especially in lengthening of soft palate, but speech outcome needed time to be evaluated. With good preoperative evaluation and excellent surgical technique, there was no severe complication.

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