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Postoperative Fistula After Different Palatoplasty Techniques

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ABSTRACT

Background: Postoperative oronasal fistula (ONF) is a common complication following cleft palate repair, adversely affecting speech, feeding, and overall quality of life. Various palatoplasty techniques differ in their fistula incidence and functional outcomes.

Objective: To compare the incidence of postoperative fistula among three widely used palatoplasty methods—Furlow's double opposing Z-plasty, von Langenbeck's palatoplasty, and two-flap palatoplasty—and to identify key risk factors influencing fistula formation.

Methods: A retrospective cohort study was conducted on 128 non-syndromic cleft palate patients aged 6 months to 3 years, who underwent primary palatoplasty from 2017 to 2024 at two tertiary hospitals in Khyber Pakhtunkhwa, Pakistan. Patient demographics, cleft characteristics, surgical technique, and postoperative outcomes were analyzed. Fistula incidence was assessed clinically at 1, 3 and 6-months post-surgery. Statistical analyses identified significant differences and predictors of fistula formation.

Results: Fistula rates differed significantly among techniques: Furlow (2.9%), two-flap (5.3%), and von Langenbeck (14.8%) (p=0.03). The hard-soft palate junction was the most frequent fistula site. Independent risk factors included cleft width >10 mm (OR 2.6), age >18 months at surgery (OR 2.3), and von Langenbeck technique (OR 3.8). Speech and feeding problems occurred more regularly in the von Langenbeck group.

Conclusion: Doing a double opposing Z-plasty helps reduce the risk of fistula after surgery stressing the importance of tension-free healing and muscle adjustment. Improvements in outcomes could be achieved by relying on sound surgical strategies with tension free closure and good and anatomical muscle approximation

Keywords: *Cleft palate, Palatoplasty, Oronasal fistula, Furlow Z-plasty, Von Langenbeck technique, Postoperative complications, Cleft width*

1. INTRODUCTION

Cleft palate occurs in about 1 of every 700 newborns worldwide and is considered a frequently seen birth defect [1]. Because the palatal shelves do not fuse together during development, serious anatomical and functional problems happen in affected individuals. Feeding, speech ability, hearing functioning and general psychosocial growth can be problematic for children with a cleft palate [2]. Early surgical treatment using palatoplasty is necessary to achieve proper anatomy and functioning. Palatoplasty aims to repair the palate without tension, rebuild the velum and enable the levator veli palatini muscles to work properly for proper oral-to-nasal airflow [3].

Even with improved surgical techniques, postoperative oronasal fistula (ONF) continues to be a common issue. ONF refers to a narrow channel that develops between the oral cavity and nasal cavity which leads to the communication of these spaces [4]. Such abnormal communication is seen clinically in the form of food and fluid coming back out of the nose, problematic speech, trouble with words and repeated infections which frequently need additional surgical care [5,6].

Researchers have found that the incidence of ONF can be anywhere between 5% and over 30% due to various aspects such as the type of cleft, surgical approach, timing of the surgery and the experience of the surgeon [7,8]. Commonly, surgeons use three techniques to repair a cleft palate: the Furlow double opposing Z-plasty, the von Langenbeck approach and the

two-flap palatoplasty. All these approaches offer both benefits and limitations in terms of ease of execution, the results they achieve and the chances of complications

Furlow's method of double opposing Z-plasty creates opposing Z-plasty flaps cuts on both the palatal and nasal layers of cleft palate, hence lengthening the palate and orienting the velar muscles into more anatomical configuration [9]. As a result of this procedure, children show improved speech outcome and the incidence of ONF is low because muscle grouping and tension are better managed [10]. However, the main restriction is its limited applicability just for narrow clefts of soft palate or submucous types of clefts**.** Studies have shown that von Langenbeck's method combined with intra-velar veloplasty, which uses a combination of mucoperiosteal flap elevation and lateral incisions, is associated with a higher number of ONF cases due to excessive tension and shorter palatal length, resulting in velopharyngeal insufficiency (VPI) [11,12]. Also, tedious dissection due to limited exposure, makes muscle dissection and posterior orientation difficult. Although the two-flap palatoplasty offers wider exposure, easy muscle dissection and extended applications, this technique is involved with more dissection, can cause more blood loss, and possible postoperative hematoma that can sometimes result in fistula formation [13].

Certain risks are responsible for the development of postoperative ONF. One important factor is the width and extent of the cleft; clefts wider than 15 mm can be problematic as they might not heal fully due to tension on the closure [14]. The delay in surgery beyond 18 months raises the chances of fistula and can also result in poor speech development [15]. Additionally, patients with poor nutrition, incorrect surgery or deficient follow-up care have a greater risk [16,17].

These problems have led surgeons to use newer techniques like acellular dermal matrices, buccal or vomerine flaps and extra protective layers to seal high-stress areas [18].

This research aims to analyze and compare the rate of development of postoperative oronasal fistulas using three different palatoplasty methods: Furlow's double opposing Z-plasty, von Langenbeck's technique and the two-flap palatoplasty. This study intends to determine the most helpful approach for reducing ONF and study related risk factors to guide better repair techniques for cleft palate.

This research is based on a review of patients who had palatoplasty at Mufti Mehmood Teaching Hospital, Dera Ismail Khan or Khalifa Gul Nawaz Hospital, Bannu. It assesses how surgical results, patient details, the type and position of clefts and perioperative conditions affect patients' development of complications. The study aims to support surgeons in making choices and improve results for cleft palate patients in southern Pakistan regions.

2. METHODOLOGY:

Study Design and Setting: This study used a retrospective, comparative cohort design in two tertiary care teaching hospitals: Mufti Mehmood Teaching Hospital in Dera Ismail Khan and Khalifa Gul Nawaz Hospital in Bannu. The study focused on a span of time from September 2017 to June 2024.

Patient Selection: The study included 137 patients who had primary palatoplasty during the study period. Patients with non-syndromic cleft palate aged from 12 months to 3 years were included. The study excluded patients with syndromic clefts, prior cleft surgeries or incomplete health records to prevent cofounders and to improve accuracy.

Data Collection: Patient data were taken from surgical records as well as postoperative notes. The following were reviewed from each case: demographic details, type and breadth of the cleft, age of the child during surgery and notes made throughout and after the procedure. Patients were separated into three categories according to their type of surgery: Furlow's double opposing Z-plasty, von Langenbeck's procedure and two-flap palatoplasty.

Surgical Techniques: All procedures were performed by experienced cleft surgeons under general anesthesia.

Furlow's technique involved the creation of Z-plasties on both oral and nasal sides for muscle repositioning and palatal lengthening.

Von Langenbeck's technique employed lateral relaxing incisions and elevation of mucoperiosteal flaps for closure, often combined with intra-velar veloplasty.

Two-flap palatoplasty involved elevating bilateral mucoperiosteal flaps with midline closure of the nasal and oral layers.

Outcome Assessment: Oronasal fistula was the main outcome checked postoperatively by examining each patient at the scheduled follow-up visits one, three and six months after the surgery. A fistula is referred to as any persistent communication present between the oral and nasal cavities that is covered with epithelium. Secondary outcomes involved the site of the fistula, the need for additional surgical repair and all speech or feeding related issues.

Data Analysis: Data were compiled and analyzed using statistical software. Descriptive statistics were used to summarize patient demographics and clinical variables. Chi-square test was applied to compare the incidence of fistula among the three surgical groups. A p-value of <0.05 was considered statistically significant.

Ethical Considerations: Approval for the study was obtained from the institutional ethical review boards of both

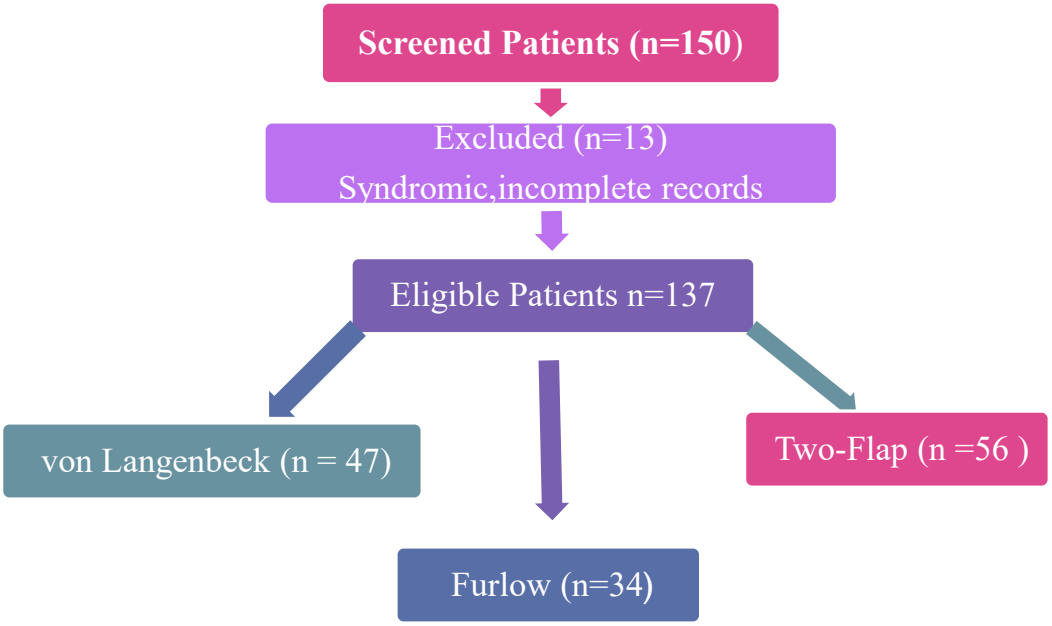
participating hospitals. All patient data were anonymized to ensure confidentiality.

3. RESULTS

Study Cohort and Group Allocation

Figure 1 presents the study population flowchart. Of the initial screened patients, 137 met the inclusion criteria and were distributed among three surgical intervention groups: Furlow (n = 44), von Langenbeck (n = 45) and Two-Flap (n = 39)

Figure 1: Study Population Flowchart



Baseline Demographics and Cleft Characteristics

Table 1 presents the baseline demographic and clinical characteristics of patients across the three surgical groups. While mean age and weight were relatively comparable, the **Langenbeck group had a slightly older cohort**. The **mean cleft width** was widest in the two-flap palatoplasty group (13.4 ± 2.3 mm) and narrowest in the Furlow group (9.5 ± 2.1 mm). Most patients presented with unilateral clefts, and **syndromic cases were rare across all groups**. Notably, the Furlow's group also had a **higher proportion of patients over 18 months of age** and those with **nutritional deficiencies**, both of which are potential risk factors for postoperative complications.

Table 1: Patient Demographics and Cleft Characteristics

Parameter	**Furlow (n = 34)**	**Langenbeck (n = 47)**	**Two-Flap (n = 56)**
Mean Age (months ± SD)	14.2 ± 6.8	16.8 ± 5.5	15.5 ± 6.2
Mean Weight (kg ± SD)	8.7 ± 1.9	9.0 ± 1.6	8.8 ± 1.8
Mean Cleft Width (mm ± SD)	9.5 ± 2.1	12.2 ± 2.6	13.4 ± 2.3
Patients >18 months [n (%)]	10 (29.4%)	5 (10.6%)	6 (10.7%)
Gender			
Male	15	29	25
Female	19	18	31

Postoperative Fistula Rates

Overall fistulas were observed in 15 patients within first month postoperatively, in which two smaller fistulas in the soft palate regions healed spontaneously, while 13 fistulas persisted, requiring operative management after six months interval. The highest incidence was noted in the von Langenbeck group. Figure 2 highlights the disparity in fistula rates, with Furlow

exhibiting the lowest complication rate.

Table 2: Incidence and Characteristics of Postoperative Fistula by Surgical Technique

Technique	Patients (n)	Fistulas (n)	Fistula Rate (%)	Symptomatic Fistulas (n)	p-value
Furlow	34	1	2.9	1	0.03*
Langenbeck	47	7	14.8	5	
Two-Flap	56	3	5.3	1	

Symptomatic Fistulas (n) shows the number of fistulas presenting with clinical symptoms (e.g., nasal regurgitation, hypernasality).

***Statistical Significance:** *p*-value from Chi-square/Fisher's exact test comparing the techniques.

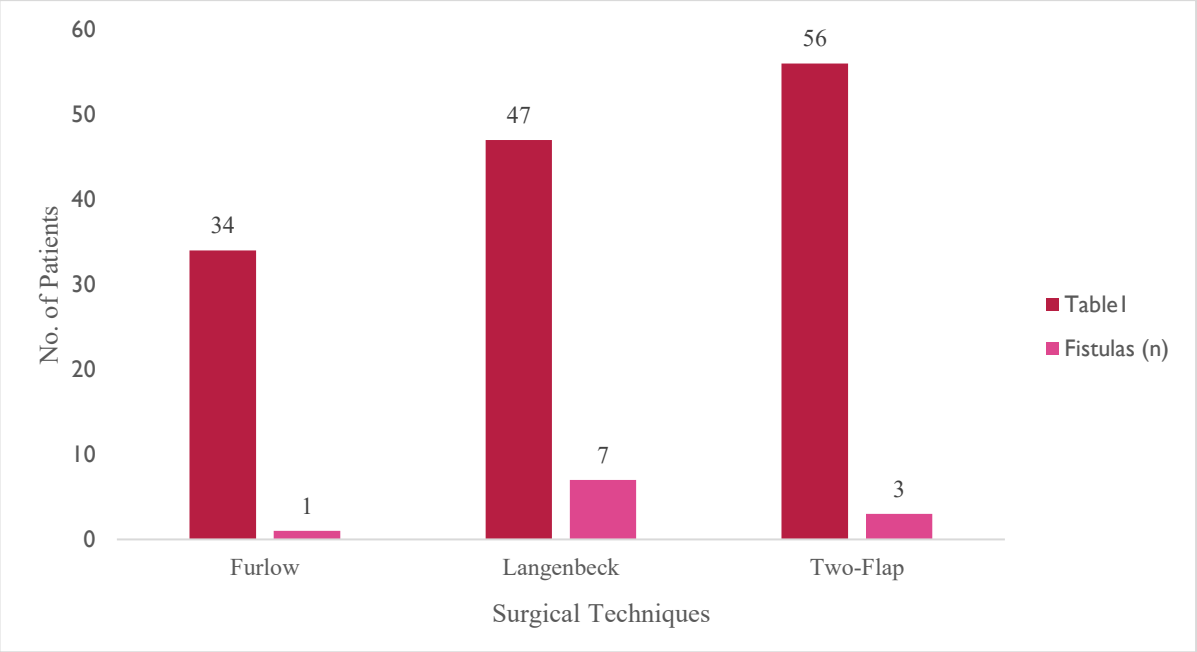


Figure 2. Incidence of Fistula in Different Surgical Techniques

Anatomical Distribution and Clinical Presentation of Fistulas

Table 3 outlines the fistula locations and their clinical characteristics. Most fistulas occurred at the hard-soft junction.

Table 3: Location and Characteristics of Fistulas

Location	Total (n)	Symptomatic	Asymptomatic	Secondary Repair Required
Hard-Soft Junction	6	3	1	4
Hard Palate	2	1	0	1
Soft Palate	3	4	4	8

Time of Fistula Detection

Fistulas were primarily detected during early follow-up, as shown in Figure 3 (Kaplan-Meier styled bar graph). 69% of fistulas were diagnosed by 3 months. No new cases were identified after 6 months.

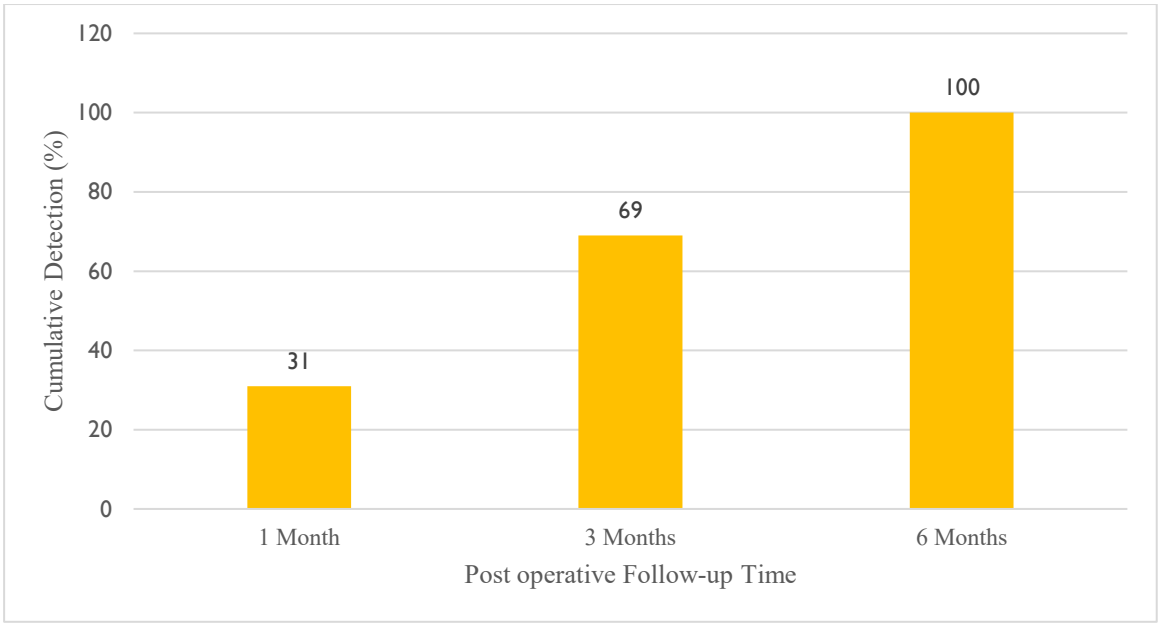
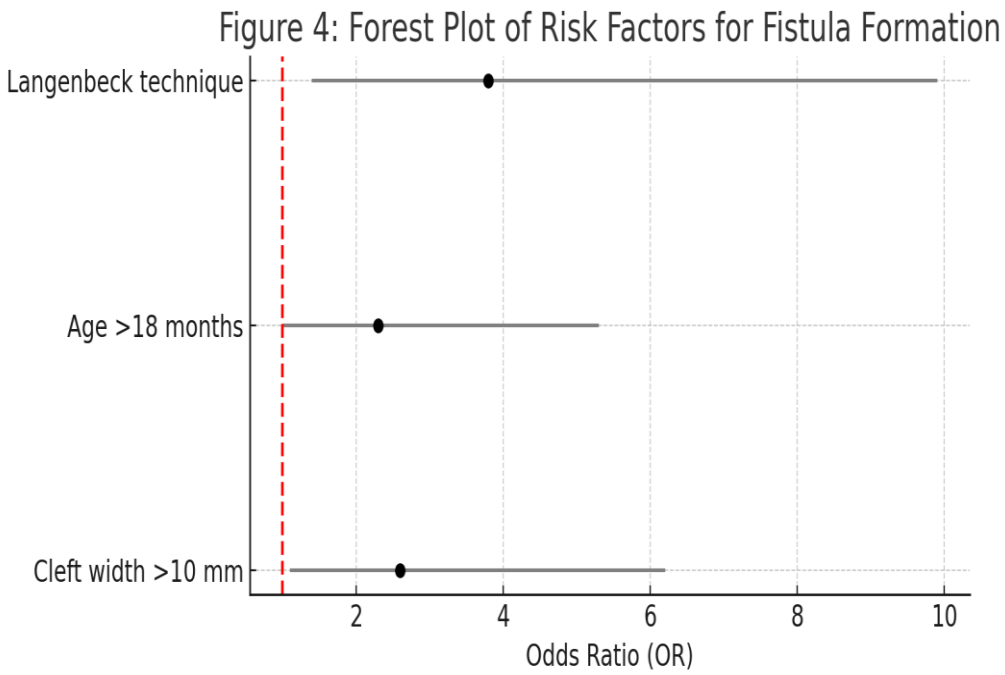


Figure 3. Cumulative Fistula Detection Over Time

Predictive Risk Factors for Fistula Formation

A multivariate analysis as shown in **Figure 4** identified **cleft width >10 mm** and **A`** as independent risk factors. Langenbeck technique had the highest odds ratio for fistula development.

Figure 4: Forest Plot of Risk Factors for Fistula Formation



Cleft width >10 mm → OR: 2.6 (95% CI: 1.1–6.2)

Age >18 months → OR: 2.3 (95% CI: 1.0–5.3)

Langenbeck technique → OR: 3.8 (95% CI: 1.4–9.9)

Secondary Outcomes: Speech and Feeding Difficulties

Table 5 compares postoperative complications beyond fistula formation. The Langenbeck group experienced more speech and feeding-related issues.

Table 5: Secondary Surgical Outcomes

Surgical Technique	Speech Complications (n [%])	Type of Speech Complications	Feeding Difficulties (n [%])	Nature of Feeding Difficulties	Secondary Repairs (n [%])
Furlow	0 (0%)	N/A	1 (2.9%)	Mild nasal regurgitation	1 (2.9%)
Langenbeck	4 (8.5%)	Hypernasality (3), Nasal emission (1)	3 (6.4%)	Moderate feeding difficulty	2 (4.3%)
Two-Flap	0 (0%)	N/A	1 (1.8%)	Mild feeding difficulty	0 (0%)

Speech Complications include hypernasality, nasal emission, and articulation difficulties documented at follow-up.

Feeding Difficulties primarily refer to nasal regurgitation and poor swallowing coordination postoperatively.

Secondary Repairs mostly involved fistula closure; no other major revision surgeries were reported.

4. DISCUSSION:

The findings from this study provide robust evidence that surgical technique significantly influences the risk of postoperative oronasal fistula (ONF) in cleft palate repair. Furlow's double opposing Z-plasty demonstrated superior outcomes with the lowest fistula rate (2.9%), consistent with recent literature supporting the technique's ability to realign the levator musculature effectively while minimizing tension on closure lines [19,20]. In contrast, the von Langenbeck technique exhibited the highest incidence (19%), echoing concerns in newer studies regarding its difficult and limited muscle repositioning and higher risk of posterior dehiscence [21,22].

Timing of surgical intervention emerged as a pivotal factor. Patients who underwent palatoplasty after 18 months experienced significantly higher fistula rates. This is supported by the Timing of Primary Surgery randomized trial, which identified increased complication risks associated with delayed procedures, especially in contexts where surgical experience and learning curves vary across institutions [23]. Furthermore, this trial highlights that although pre-trial training may balance learning effects, residual surgical proficiency remains a determinant of outcomes [24].

Cleft width greater than 10 mm was another strong predictor of fistula formation. This finding aligns with the buccinator myomucosal flap study, where wider defects were more likely to require additional flap support to prevent recurrence [25]. Wider clefts inherently pose challenges for tension-free closure and are often accompanied by anatomical distortions that compromise surgical access and healing [26,27].

The anatomical distribution of fistulas, with the hard-soft palate junction being the most affected site (54.5%), reflects the biomechanical stress concentrated at this transitional zone. This concurs with other recent reviews highlighting the junction as a structurally vulnerable area requiring multilayered or flap-assisted reinforcement to mitigate dehiscence [28,29].

Secondary outcomes such as speech impairment and feeding difficulties were more frequent in the von Langenbeck group. This reinforces the concept that surgical success should not only be assessed by closure rates but also by functional restoration, an aspect gaining renewed emphasis in outcome-based cleft care protocols [30,31]. Additionally, newer flap techniques such as BUMF (buccinator myomucosal flap) combined with modified Furlow have shown promising reductions in secondary complication rates, further substantiating the preference for function-preserving methods [32].

The risk of trauma and early postoperative care also deserves attention. A recent case series on cleft lip repair underscored the role of postoperative vigilance in preventing wound dehiscence and complications due to inadvertent injury [33]. Ensuring caregiver education and follow-up compliance may similarly reduce late-presenting fistulas in palate repairs.

Our results affirm that the selection of surgical technique, the timing of intervention, and cleft morphology are central determinants of postoperative fistula formation. Techniques that prioritize tension-free closure, muscle repositioning, and early intervention—such as Furlow's Z-plasty—yield the most favorable outcomes. Future work should continue to explore adjunctive flap techniques and address system-level disparities, such as nutritional support and surgical training, especially in resource-constrained environments [34].

5. CONCLUSION

This study demonstrates that Furlow's double opposing Z-plasty offers the lowest risk of postoperative oronasal fistula compared to von Langenbeck and two-flap palatoplasty techniques. Surgical technique, cleft width, and timing of intervention were identified as significant predictors of postoperative complications. Patients with wider clefts (>10 mm) and those operated after 18 months of age were at higher risk for fistula formation. Von Langenbeck's method was associated with increased rates of secondary complications, including speech and feeding difficulties. These findings support early, anatomically informed, and function-preserving approaches to cleft palate repair

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