Int. J. Oral Maxillofac. Surg. 2019; 48: 1313–1316
https://doi.org/10.1016/j.ijom.2019.02.021, available online at https://www.sciencedirect.com

International Journal of Oral & Maxillofacial Surgery

Clinical Paper
Cleft Lip and Palate

The effect of a small triangular skin flap on vermillion height after cleft lip repair: a photogrammetry study

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Ling Siew Wong, Ting Chen Lu, Philip Kuo-Ting Chen: The effect of a small triangular skin flap on vermillion height after cleft lip repair: a photogrammetry study. Int. J. Oral Maxillofac. Surg. 2019; 48: 1313–1316.

Abstract. During primary cleft lip repair, a small triangular flap of about 2 mm is sometimes required to achieve better symmetry of Cupid's bow. The aim of this study was to evaluate the symmetry of Cupid's bow, with and without the use of a small triangular skin flap (STSF). Forty-five children who underwent the repair of unilateral cleft lip between January 1999 and December 2000 were recruited. Twenty children had a STSF included in the repair (STSF group) an d 25 children underwent the same repair without the STSF (NSTSF group). Vermillion height was measured on the cleft and non-cleft sides using reference points. The *t*-test was used to compare the vermillion height ratio between the two groups. The mean age at surgery was 4 ± 1.3 months in the STSF group and 4.3 ± 0.6 years in the NSTSF group. There was no significant difference in vermillion height ratio at 5 years of age between the patients in the two groups. Thus, there is no difference in vermillion height ratio with or without a STSF in cleft lip repair. The use of a small triangular skin flap needs to be assessed carefully, as it will create an unsightly scar over the philtrum area.

Key words: triangular flap; cleft lip; vermillion height.

Accepted for publication 28 February 2019
Available online 18 March 2019

The objectives of cleft lip repair surgery are to recreate an anatomically accurate philtral appearance, re-establish the orbicularis oris, and improve the nasal deformity. Evaluating the long-term outcomes of the primary cleft lip repair is important in order to study surgical outcomes and also predict the evolution of the scar over time[1].

Over the decades, various techniques have been proposed in the pursuit of aesthetic primary correction of unilateral cleft lip[2–8]. Each technique has its own theory supporting the procedure. Despite the numerous eponymous techniques, all are derived from three basic 'methods' for unilateral cleft lip repair: the straight-line technique, the triangular flap technique, and the rotation-advancement technique[9]. Each has its advantages and limitations.

Inadequate rotation of the medial segment is often encountered during the ordinary rotation-advancement technique of lip repair. Hence the surgeon cannot achieve a symmetrical Cupid's bow. To achieve better symmetry, a small triangular flap of about 2 mm is created on the

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lateral lip above the white skin roll. The flap is inserted into a cut in the medial lip for further downward rotation of the medial lip. The purpose of this triangular flap is to solve the short lip height on the medial segment and further reduce the possibility of scar contracture by breaking the curvilinear suture line after lip repair. However, the drawback of this triangular flap is that it creates an unnatural scar that crosses the philtrum.

Studies evaluating the effectiveness of the small triangular skin flap on lip aesthetics are scarce, especially those on the symmetry of Cupid's bow. The aim of this study was to evaluate the symmetry of Cupid's bow, with and without the use of a small triangular skin flap during primary lip surgery.

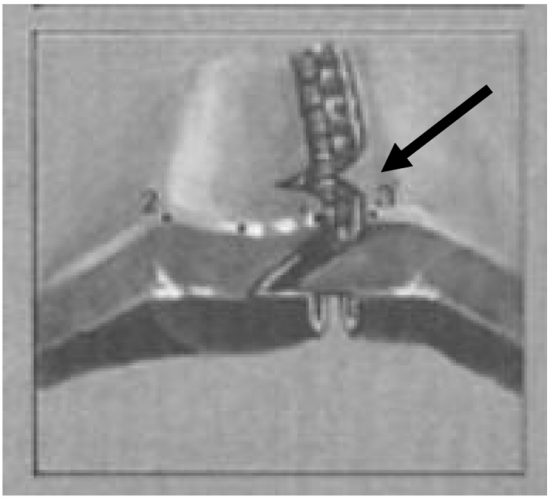

Fig. 1. Arrow indicating the small triangular skin flap used in the Noordhoff technique[10].

Materials and methods

The study was approved by the Institutional Review Board of Chang Gung Memorial Hospital. All patients who underwent the repair of a unilateral cleft lip performed by a single surgeon between January 1999 and December 2000 were recruited. The Noordhoff surgical lip repair technique was used[10] (Fig. 1); the small triangular skin flap was primarily reserved for situations in which the surgeon could not achieve a symmetrical Cupid's bow after muscle repair. Data were collected from all patients when they were 5 years old. Photographs and demographic details were collected. All families had given consent at the time the photographs were taken. Exclusion criteria included syndromic patients, those with incomplete data, and patients who had undergone secondary lip revision at the time of data collection. The patients were categorized into two groups: non-small triangular skin flap (NSTSF) group and small triangular skin flap (STSF) group.

Each patient's photograph was traced from the patient registry system. The photographs were taken with the patient's head in neutral position. They were instructed to have the teeth occluded and the lips relaxed. Images of the facial profile – frontal view and right and left side views – were obtained for each patient. The images were then transferred to ImageJ software program (National Institutes of Health, Bethesda, MD, USA) for the measurement process.

Surgical technique

The Noordhoff surgical technique with small triangular skin flap was used (Fig. 1). After careful muscle approximation, if the lip height was at an unequal level, a short transverse incision was made above the white skin roll to release Cupid's bow into its proper position. An appropriately sized small triangular skin flap, 1–2 mm in width, was incised from the lateral lip and filled into the defect above the white skin roll. The small triangular skin flap did not include the muscle on either the lateral or medial lip. If a symmetrical lip was achieved after the rotation and advancement of the lip, the small triangular skin flap was not used[10].

Measurement

The cleft lip component symmetry index (CLCSI) is a parameter that can be used to objectively compare the various components of the lip and nose[11]. The CLCSI (ratio) for vermillion height = (vermillion height on the cleft side)/(vermillion height on the non-cleft side). A value of 1 indicates perfect symmetry of vermillion height, and a value either less or more than 1 indicates a degree of asymmetry[11].

Landmarks

The landmarks used to assess vermillion height were CPHR (lateral high point of Cupid's bow on the right), CPHL (lateral high point of Cupid's bow on the left), Ch (cheilion; point at the lateral labial commissure), H (vermillion height on the non-cleft side), and H′ (vermillion height on the cleft side). An example of the measurements is shown in Fig. 2 (unilateral left cleft lip). The CLCSI (ratio) for vermillion height = H′/H.

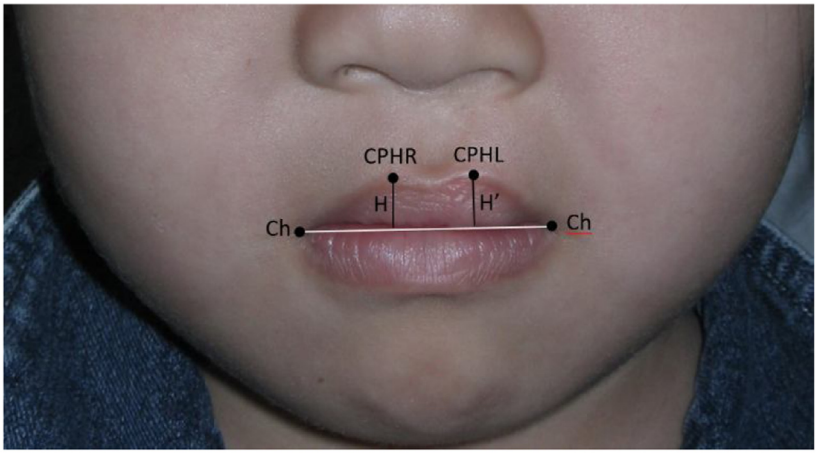

Fig. 2. Landmarks used to assess the symmetry index (ratio) for vermillion height: CPHR: lateral high point of Cupid's bow on the right; CPHL: lateral high point of Cupid's bow on the left; Ch: cheilion (point at the lateral labial commissure); H: vermillion height on the non-cleft side; H′: vermillion height on the cleft side.

Statistical analysis

Descriptive data, such as the distributions of demographic data among the patients, were recorded in tabular form. For the data analysis, the *t*-test was used to compare the vermillion height ratio between the two groups. A *P*-value of <0.05 at the 95% confidence level was considered significant.

Method error

The lip height measurement was done by a single observer (LSW) who was not involved in the surgery in order to reduce the measurement bias. Intra-rater reliability was assessed via repeat analysis of 50% of the lip height measurements on selected photographs. The sample was re-assessed by the same examiner 1 month after obtaining the initial results. Systematic error was calculated by dependent *t*-test for paired samples. The statistical analysis revealed no systematic errors.

Results

Forty-five children with complete cleft lips were included. Twenty children (nine male, 11 female) had a small triangular skin flap included in the repair, and 25 children (19 male, six female) underwent the same repair without the small triangular skin flap. The mean age at surgery was 4 ± 1.3 months in the STSF group and 4.3 ± 0.6 years in the NSTSF group (Table 1). There was no significant difference in vermillion height ratio between the patients in the STSF group and patients in the NSTSF group ($P = 0.462$) (Table 2).

Discussion

Lip appearance is one of the important measures of success in the treatment of patients with cleft lip. The most common cleft lip repair technique is the Millard rotational advancement method[2], which employs rotation-advancement principles to guide cleft lip repair. In those patients with a more severe discrepancy of lip height, a back-cut in the rotation-advancement design is required. However, this design can cause asymmetry of the philtral ridges. It can also worsen the linear scar contracture resulting in an elevation of the Cupid's bow peak.

Noordhoff's modified rotation-advancement technique was introduced to address these concerns[10]. Noordhoff utilized a lower small triangular skin flap above the white skin roll to overcome the problem of unequal lip height. This manoeuvre is primarily reserved for patients with unequal lip height after proper orbicularis muscle approximation. Despite the effect of tissue lengthening, the small triangular skin flap offers the advantage of reducing wound contracture at Cupid's bow. Although the small triangular skin flap is a good technique for resolving lip height discrepancy, the shortcoming of this technique is an unnatural scar that crosses the philtrum. Fisher introduced a technique in which a cutaneous triangle above the white roll is used to directly adjust the height of the medial labial element[6], which is similar to the Noordhoff technique.

This study was designed to analyze the influence of the small triangular skin flap on vermillion height after unilateral cleft lip repair. The data demonstrated that a small triangular skin flap did not improve symmetrical vermillion height compared to the standard rotation-advancement technique. The mean vermillion height ratio of the cleft side to the non-cleft side was 1.1 for both groups. A possible explanation for this result is that the patients requiring a small triangular skin flap had a more severe lip height discrepancy in the first place than those who did not require this flap. Therefore, tissue relapse may have been more severe in the STSF group and the compensation of scar contraction by non-linear scar created by the small triangular skin flap may not be significant.

The results of this study are in contrast to those reported by Russell et al.[12], who concluded that when a pennant or small triangular skin flap was utilized, a better philtral height symmetry could be achieved. However, the study by Russell et al. involved four surgical techniques and three surgeons in the analysis to determine the effectiveness of the small triangular skin flap. In their study, they concluded that lip height asymmetry was affected by the surgeon's technique and skill. In the design of the present study, a single surgeon and a single surgical technique were utilized. Hence, the study results may be more consistent.

Data in the current literature on the objective measurement of the effect of a small triangular skin flap on vermillion height are scarce, which makes comparison of the study results with those of previous studies difficult.

In conclusion, this study found no difference in vermillion height ratio with or without a small triangular skin flap in cleft lip repair. The use of a small triangular skin flap had no role in improving the symmetry of Cupid's bow. Hence, the use of this flap should be assessed carefully, as it will create an unsightly scar over the philtrum area.

Table 1. Patient characteristics at baseline.

Characteristics	STSF group ($n = 20$)	NSTSF group ($n = 25$)
Sex, *n*		
Male	9	19
Female	11	6
Age at surgery, mean ± SD	4 ± 1.3 months (range 2.9–10.2 months)	4.3 ± 0.6 years (range 3.5–5.1 years)
Diagnosis		
Right cleft lip	6	12
Left cleft lip	14	13

STSF, small triangular skin flap; NSTSF, non-small triangular skin flap.

Table 2. Comparison of the vermillion height ratio at age 5 years.

Variable	STSF group ($n = 20$)		NSTSF group ($n = 25$)		*Z* statistic	*P*-value
	Median (IQR)	Mean ± SD	Median (IQR)	Mean ± SD		
H′	1.089 (0.15)	1.137 ± 0.45	1.083 (0.15)	1.123 ± 0.02	−0.735	0.462

STSF, small triangular skin flap; NSTSF, non-small triangular skin flap; IQR, interquartile range; SD, standard deviation.

Funding

Authors' own work; none of the authors received any financial support throughout the research.

Ethical approval

The study was approved by the Institutional Review Board of Chang Gung Memorial Hospital (IRB 201800823B0).

Patient consent

Not required.

Competing interests

There is no conflict of interest regarding the publication of this article.

Acknowledgments. We thank the Director General of Health Malaysia for his permission to publish this paper. This project was assisted by the Craniofacial Research Centre Chang Gung Memorial Hospital (CRRPG5C0071, CRRPG5C0072).

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