Many techniques for cleft lip repair have been introduced to improve the aesthetic and functional outcomes. Noordhoff\(^1\) reported that a vermilion triangle flap improved vermilion height in primary repair. Although the technique and its modification have been widely accepted in recent years, red lip deformity was usually treated in secondary repair because it is still not focused on the labial tubercle in primary repair. We herein describe a modified technique for vermilion repair focused on the formation of the labial tubercle.

### SURGICAL TECHNIQUE

**Markings**

The operative markings of a muco-vermilion quadrangular flap are shown in Figure 1A.

**Medial Lip**

Point 2, which represents the deepest point, and points 1 and 3, which represent the highest points of Cupid’s bow, are marked at the vermilion-cutaneous junction.

Points 4, 5, and 6 are marked just above the vermilion-cutaneous junction below points 1, 2, and 3, respectively. Points 2, 5, and 7 are marked at a midline of the labial tubercle. The lengths of lines 5–7 and 7–8 are decided by a lateral quadrangular flap, as described later. Triangular area 5-6-7, which includes the entire border of the muco-vermilion junction, is expected to be discarded.

**Lateral Lip**

Point 9, where the vermilion is highest, as described by Noordhoff\(^1\), is marked at the vermilion–cutaneous junction. Point 10 is marked at the line perpendicular to the vermilion–cutaneous junction such that length of line 9-10 is equal to that of line 3–6. Then a quadrangular flap 10-11-12-13 is designed, such that point 11 is just above the muco-vermilion junction and that the length of line 10-11 is equal to that of line 6-5. Angles 10-11-12 and 11-12-13 are approximately 90 degrees. The length of line 11-12 is long enough to place point 13 within the mucosa and is equal to the length of line 5-7; the length of line 12-13 is slightly shorter than line 10-11.

**White Lip**

A modified small triangular flap is used for the white lip, and a columella base flap is used for the medial crural footplate, similar to the technique described by Fisher.\(^2\)

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Maneuvers

Incisions were made with a scalpel and were completed with scissors. The columella and the alar base were corrected by muscle reconstruction. The cleft side peak of Cupid’s bow was rotated downward and positioned to the correct position. After closure of the underlying mucosa and muscle suture, the muco-vermilion quadrangular flap was adjusted to the cleft side of the labial tubercle. The flap was thinned, especially around its pedicle. Triangular area 5–6–7, including the border of the muco-vermilion junction, was discarded, and the area was widened enough to insert the quadrangular flap. Before suturing the flap, the marginal portions of the orbicularis oris muscle were sufficiently attached to each other. The quadrangular flap was softly sutured using absorbable sutures. The final suture lines of vermilion repair are shown in Figure 1B.

RESULTS

Since January 2011, this type of technique has been used in 53 consecutive unilateral cleft lip repairs, including 25 incomplete unilateral cleft lip repairs and 28 complete unilateral cleft lip repairs. At the time of the operation, the patients were between 3 and 5 months of age. In all cases, pictures were taken at more than 1 year after surgery for evaluation. In all cases, the height of the vermilion on the medial side of the cleft was adequate. In most cases, the amount of the labial tubercle was appropriate and the curvature of free margin was preferable; however, in several early cases, tubercle was slightly deviated to the cleft side because the mucosa and subcutaneous tissue were excessively preserved. Representative cases are shown in Figures 2 and 3.

DISCUSSION

In unilateral cleft lip repair, a vermilion triangular flap is accepted by many cleft surgeons, as it makes up for the insufficient vermilion height on the cleft side.1–5 A vermilion triangular flap can improve the texture of the vermilion and reduce the exposure of the mucosa; however, it frequently causes other deformities, such as bulking of the red lip free margin or the unification of the labial tubercle and lateral segment. A triangle flap has a great deal of volume at the base below the peak of Cupid’s bow and less volume at the apex at the midline of the tubercle. Thus, the tubercle tends to be attracted by contraction toward the basal portion. The ideal contour of the free border of the lip is thick at the midline of the labial tubercle and somewhat thin below the peak of Cupid’s bow. It is difficult to allow a sufficient amount of tissue on the tip of a
In conclusion, the quadrangular flap can be considered an ideal flap for the construction of the vermilion.

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