Original Article
Aesthetic reconstruction of philtrum using de-epidermized scar flap in secondary unilateral cleft lip

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Abstract: Background: The presence of philtrum in the middle area of the upper lip is a pre-eminent feature of facial aesthetics. However, the philtrum is invariably damaged in cleft lips, and the damage persists even after primary surgery. We attempted to use de-epidermized scar tissue flaps, to raise the philtral ridge and dimple, in secondary unilateral cleft lip deformities. Methods: A prospective study was planned to determine the effectiveness of this novel procedure in 11 patients with secondary unilateral cleft lip deformities, from 2011 to 2013. Pre- and post-operative photographs were taken and postoperative evaluation was performed between 6 and 23 months. Eminence of the philtral ridge was scored on a 5 point grading scale; the dimple was scored on a 3 point grading scale as well as the scars. Scores were recorded both preoperatively and postoperatively. Results: The results demonstrated a significant improvement in both, the philtral ridge and dimple, as indicated by the preoperative and postoperative scores (2.27 vs. 3.91, 1.36 vs. 2.03, respectively, all P<0.05). Five patients had a significant improvement in the appearance of scar, while appearance of the scar was acceptable to the remaining patients. Conclusions: The use of de-epidermized scar tissue is an effective and simple method to construct the philtrum, in cases of secondary cleft lip.

Keywords: Secondary unilateral cleft lip, philtrum, de-epidermized scar tissues flap, reconstruction

Introduction
The philtrum plays an important aesthetic role in determining the shape and form of the upper lip and creates individual identity [1]. Unfortunately, this aesthetic feature is often lacking in cleft lips or deformities caused by repaired cleft lip [2]. The philtral ridge(s) can develop thickening or indentation, and the dimple can become distorted after cleft lip surgery, in some cases [3]. Thus, reconstruction of philtrum becomes necessary in cases of secondary unilateral cleft lip. However, the complex shape of the upper lip makes it technically challenging in cases, which have undergone cleft lip repair surgery. Although a variety of methods with the employment of muscle flaps, cartilage grafts, fascial graft, and tendon grafts for constructing the philtrum have been described [4-7], there has been a low focus on the scar tissues caused by the primary surgery. We present here, a novel method of philtrum reconstruction using a flap of de-epidermized scar tissues, in cases of secondary unilateral cleft lip deformity. This is a simple procedure, which is easy to learn, with good aesthetic outcomes at both singularizing philtral ridge and deepening philtral dimple.

Patients and methods

Patients
The study was approved by the Ethics Committee of Shaoxing People’s Hospital. Philtrum reconstruction was performed in 11 patients with secondary unilateral cleft lip deformities, from June 2011 to March 2013 at our hospital. There were 6 male and 5 female patients in this study group, and the median age was 18.2 years (range: 9-35 years), at the time of reconstruction. Six deformities were on the left unilateral cleft lip, while 5 were on the right. The technique used for primary cleft lip repair was
Using de-epidermized scar flap to reconstruct philtrum


The baseline data of each patient is presented in Table 1. Patient satisfaction scores and occurrence of complications were documented. This research was conducted in strict accordance with the principles outlined in the Declaration of Helsinki and written informed consent was obtained from all patients or guardians.

Operative procedures

Plan for the type of skin incision was based on the height of lips bilaterally, before surgery. If the difference was large (more than 2 mm), the surgical incision was designed as per Millard method. If the difference was less than 2 mm the surgical incision was only designed for simple upper lip scar reduction (Figure 1A). The surgery was performed under general anesthesia (in 3 pediatric patients) or local anesthesia (1% lignocaine with 1/200,000 adrenaline) in adults. During the general anesthesia, 0.5% lignocaine with 1/200,000 adrenaline was injected into the skin to reduce bleeding.

Based on the preoperative design, the upper lip skin was incised to full-thickness, and the epidermis of the scar area was carefully removed. The scar flap was then isolated and cut off on the nasal side, and the pedicle near the vermillion was carefully preserved (Figure 1B). The superficial orbicularis oris muscle was then dissected and sutured to the corresponding components. Deep orbicularis oris muscle was also reconstructed if necessary. Thereafter, the scar flap was rotated to the correct position, where the philtral ridge of affected side could achieve a symmetry with the contralateral side, and fixed with the 3-0 silk suture (Figure 1C). Remnant of the flap was cut off at the edge of alar base, and scar tissue with poor blood supply was removed. Skin on both sides of the incision was then dissected appropriately. Subsequently, the skin was sutured in layers according to the Millard method or simple scar reduction, depending on the preoperative design. An iodine cotton ball was placed on the philtral dimple and sutured in place at the end of the surgery. Based on methods described previously, a different kind of deformation, construction of vermillion and open rhinoplasty (such as alar collapse) was also repaired during the process [8, 9], if necessary. The upper lip was dressed postoperatively and the sutures were removed 7 to 10 days later.

Assessment

The aesthetic outcome was evaluated after at least 6 months of follow up, by comparing with digital images of the patients acquired before surgery. For assessing the results of reconstruction of philtrum, a method previously introduced was followed [3]. Philtrum and scar appearance based on a grading system (Table 2) was evaluated by 3 plastic surgeons blinded to the design. The surgical outcome was scored as follows: satisfactory from 9 to 11, acceptable from 6 to 8, poor from 3 to 5.

Statistics

Statistical analyses were performed using SPSS 20.0 software (SPSS Inc., Chicago, IL, USA). Differences between the preoperative and postoperative scores were evaluated by paired student's t-test. Values of \( P < 0.05 \) were considered statistically significant.

Results

There was no hematoma or inflammation after the surgery in any patient and all were followed up at the outpatient clinic for a period of 6 to 23 months. As illustrated in Table 3, the scores for convexity of the philtral ridge before and after surgery were 2.27 and 3.91, respectively. The scores for the philtral dimple increased from 1.36 to 2.03 after the surgery. The differences

<table>
<thead>
<tr>
<th>Patient</th>
<th>Gender</th>
<th>Age (years)</th>
<th>Side</th>
<th>Follow-up (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Male</td>
<td>21</td>
<td>Right</td>
<td>12</td>
</tr>
<tr>
<td>2</td>
<td>Female</td>
<td>25</td>
<td>Left</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>Female</td>
<td>15</td>
<td>Right</td>
<td>15</td>
</tr>
<tr>
<td>4</td>
<td>Male</td>
<td>9</td>
<td>Left</td>
<td>8</td>
</tr>
<tr>
<td>5</td>
<td>Male</td>
<td>17</td>
<td>Left</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>Male</td>
<td>20</td>
<td>Right</td>
<td>15</td>
</tr>
<tr>
<td>7</td>
<td>Female</td>
<td>35</td>
<td>Right</td>
<td>23</td>
</tr>
<tr>
<td>8</td>
<td>Female</td>
<td>13</td>
<td>Left</td>
<td>9</td>
</tr>
<tr>
<td>9</td>
<td>Male</td>
<td>15</td>
<td>Right</td>
<td>18</td>
</tr>
<tr>
<td>10</td>
<td>Female</td>
<td>13</td>
<td>Left</td>
<td>6</td>
</tr>
<tr>
<td>11</td>
<td>Male</td>
<td>17</td>
<td>Left</td>
<td>7</td>
</tr>
</tbody>
</table>

Table 1. Baseline data of each patient
Using de-epidermized scar flap to reconstruct philtrum

were statistically insignificant (P=0.001 and 0.013, respectively). Moreover, 5 of the 11 patients had a significant improvement in appearance of the scar (Figure 2), while appearance of the scar was acceptable to the remaining subjects. All patients were satisfied with their long-term results, and none required further surgery.

Discussion

In most forms of unilateral cleft lip, the philtral ridge is damaged on the affected side and the philtral dimple is shallow [10]. Although the optimal time to create the philtrum is during primary repair, it is challenging due to increased skin tension caused by an inherent tissue deficiency or a deformed philtrum [11]. The anatomy of the philtrum has been extensively studied and is well described, and during corrective surgery, special attention should be paid to orbicularis oris muscle reconstruction. For instance, eversion of the orbicularis oris muscle with vertical mattress sutures described by Mulliken [12]; transmucosal repair of the orbicularis oris muscle or overlapping the orbicularis oris muscle under the reconstructed philtral ridge as described by Cho [13] and Li [11], respectively; interdigitating muscular flaps for secondary unilateral cleft lip were proposed by Cho and Baik [14]. However, no singular procedure can be adopted for all patients, due to the variable deformities caused by cleft lip induced aberrant dissection. The rotation advancement technique and the interdigitating of flaps might not achieve adequate vertical lip length, and thus fail to create a symmetric philtrum.

Tissue transfer such as tongue flaps, palatal mucosal grafts, island flaps from the lower lip, palmaris longus grafts, temporoparietal fascial grafts or even artificial material have been used to overcome the challenge of inadequate tissue in secondary cleft lip deformities [10, 15]. However, lower to upper lip transfer of tissue comprises two stages and leads to lower lip scarring; fascial and dermis-fat grafts can cause concomitant donor-site morbidity; other complications such as absorption, inflammation, and infection might also develop. These disadvantages made these procedures undesirable.

It has been thought that the scar tissue is a pathological tissue, which forms due to inadequate initial repair. It is usually abandoned during the surgery because of its inadequate blood supply and unpleasant appearance. However, anatomical studies of secondary cleft lip deformities, reveal that the upper lip scar flap has a rich blood supply from the mouth and nose, besides many communicating branches [16]. Its blood supply originates from the nasal alar basal artery, the nasal septum branch of the upper lip artery and anterior ethmoidal artery. Until now, few studies focused on this discarded tissue. Early in 1984, Stal et al. described the method for philtral augmentation using de-epithelialized scar tissue [17]. Suzuki et al. folded the orbicularis oris muscle flap to construct the philtral ridge, along with depithelization of scar tissue to augment the philtral ridge further [18]. However, there is little evidence of its long-term outcomes. In our study, we carefully evaluated the appearance and blood supply of the scar tissue. Distal bleeding of the upper lip scar flap was observed intraoperatively, and adequate blood supply was seen on histology. The upper lip scar flap is not an axial flap, but its aspect ratio can be achieved to 5-8:1, still with sufficient blood supply [16]. We excised

Figure 1. Representative images showing the surgical procedure. A: Skin incision was accurately mapped before the surgery. If the difference between heights of lips bilaterally was more than 2 mm, the Millard method was used for surgical incision. On the contrary, the surgical incision was only designed for simple upper lip scar reduction. B: Isolation of the de-epidermized scar tissue flap. The upper lip skin was incised and epidermis of the scar area was carefully removed; the scar flap was then isolated and cut off on the nasal side, and the pedicle near the vermilion was carefully preserved. C: Fixation of the de-epidermized scar flap. After the reconstruction of orbicularis oris muscle, the scar flap was rotated to the correct position according to the contralateral side, and fixed with the 3-0 silk suture. Construction of vermilion and open rhinoplasty (such as alar collapse) was also performed.
Using de-epidermized scar flap to reconstruct philtrum

**Table 2. Evaluation of the philtrum with height of the philtral ridge, prominence of the philtral dimple and appearance of scar**

<table>
<thead>
<tr>
<th>Eminence of Philtral Ridge</th>
<th>Philtral Dimple</th>
<th>Scar</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 Same as normal philtral ridge</td>
<td>3 Prominent dimple</td>
<td>3 Better than preoperative status</td>
</tr>
<tr>
<td>4 Less prominent than normal side</td>
<td>2 Slight dimple</td>
<td>2 No significant changes</td>
</tr>
<tr>
<td>3 Flat</td>
<td>1 No dimple</td>
<td>1 Widened scar</td>
</tr>
<tr>
<td>2 Slight groove</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Prominent groove</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 3. Preoperative and postoperative scores of the philtrum and scars**

<table>
<thead>
<tr>
<th></th>
<th>Preoperative</th>
<th>Postoperative</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Philtral ridge</td>
<td>2.27</td>
<td>3.91</td>
<td>0.001</td>
</tr>
<tr>
<td>Philtral dimple</td>
<td>1.36</td>
<td>2.03</td>
<td>0.013</td>
</tr>
<tr>
<td>Scars</td>
<td>1.36</td>
<td>2.39</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 2.** One year after the surgery. The projection of philtral ridge improved and the incision scars were not visible.

the flap selectively during the surgery. The scar tissue flap might develop its own blood supply independently, which is consistent with its long axis, and will extend and strengthen with time. We also sutured an iodine cotton ball in place, to augment the philtral dimple, as well as philtral ridge.

In our study, 11 patients who had a deficient philtral dimple or ridge even after primary unilateral cleft lip surgery underwent reconstruction with scar tissue flap. All patients were followed up from 6 to 23 months; 10 patients had satisfactory results with acceptable appearance of the scar. However, photographic documentation is not an objective measurement and its long-term data efficacy is relatively low. An appropriate postoperative evaluation model needs to be developed. Quantitative parameters like 3-dimensional imaging [19] or laser Doppler imager [20] are necessary to assess the efficacy of this method.

From our clinical experience, the preoperative incision should include the evident scar flap, but not the entire scar tissue. Else, it can lead to undesirable tissue defect and hypertrophic scar. Additionally, the scar flap with poor blood supply should be excised. Furthermore, the issue of tissue displacement can only be resolved by complete release of the ectopic attachment of soft tissue, and suturing them to the corresponding components. Finally, iodine cotton should be fixed between the ridges with deep muscle tissue firmly, in order to boost the dimple and philtral ridge.

**Conclusions**

This technique is particularly suitable for patients with inadequate soft tissue for secondary revision, as the scar tissue is redundant. It is really a merit that the scar tissue was used for reconstruction of philtral ridge rather than repair of nasal floor or nasal sill. Moreover, it is simple, with a short operating time, and can be performed even by surgeons with less experience. Our indication for this technique is for reconstruction of the philtrum during secondary cleft lip repair with evident scar on the diseased side of the lip.

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**Disclosure of conflict of interest**

None.
Using de-epidermized scar flap to reconstruct philtrum

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