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# Secondary Cleft Lip Reconstruction and the Use of Pedicled, Deepithelialized Scar Tissue

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**Background:** The optimal time to create symmetry in a cleft lip is during primary repair; a secondary effort later is more difficult due to potential scarring and possible tissue deficiency of the repaired cleft lip. A plethora of methods for secondary correction have been described that have the goal of constructing the philtral column, ameliorating bad scar results, and augmenting lip volume, for example. Nevertheless, there is no single procedure that yields completely satisfactory results. In addition, the appropriate timing for secondary surgical corrections of the cleft lip is still under debate.

**Methods:** We present a new technique for secondary lip reconstruction of unilateral and bilateral cleft patients using pedicled, de-epithelialized cleft scar tissue as an autologous graft to obtain sustainable lip volume. Our results were evaluated by physicians and patient-parent satisfaction surveys.

**Results:** The esthetic outcomes of 29 patients were assessed using a patient satisfaction questionnaire and a physician survey based on the preoperative and postoperative clinical images. The success of the procedure was evaluated using a 5-point scale. The total scores of both the physician and patient assessments were high, although no correlation was found between the scores.

**Conclusions:** Cleft lip reconstruction using pedicled, deepithelialized scar tissue leads to excellent physician and patient satisfaction scores; this technique can be executed at any patient age and as a secondary repair for any given primary type of cleft disorder. *(Plast Reconstr Surg Glob Open 2016;4:e1061; doi: 10.1097/GOX.0000000000001061; Published online 25 October 2016.)*

The philtrum and Cupid's bow are important esthetics of a normal appearance. In case of a cleft lip disorder, a pronounced malformation is observed. The optimal time to create symmetry in a cleft lip is during the primary repair. However, secondary deformities are not uncommon, and these deformities can leave a cleft stigma in the patient's face.[1] Secondary deformity can include whistle deformity, a poorly defined philtrum, notching of the upper lip, bulging on the lateral lip segment, and volume deficiency at the upper vermilion. For functional, esthetical, and psychological reasons, a secondary correction is often requested. However, this secondary reconstruction is even more difficult due to scarring and tissue deficiency of the repaired cleft lip.[2,3] The lips, a paramount structure of the face, have various functional and esthetic significances and play an important role in speaking, eating, emotions, phonation, beauty, and charm. The use of surgical techniques to correct white hypertrophic scars and tight lips must result in patient satisfaction, reduced scarring, and an improvement in upper lip morphology.

Many methods for secondary cleft lip correction have been described,[4–8] but a standard treatment has remained elusive up until now. The purpose of these techniques is to reconstruct a new philtral column, augment lip volume, and ameliorate bad scar results from previous surgeries when necessary. Despite these developments, no single

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procedure has yielded completely satisfactory results. In addition, the appropriate timing for the secondary surgical correction of the cleft lip is still being debated.[9]

Here, we present an anatomical approach to the secondary cleft lip reconstruction, a new concomitant technique in which scar pedicled flaps are used, after deepithelialization, to improve volume, symmetry, and overall lip appearance for both unilateral and bilateral cleft patients over a wide range of ages.

## PATIENTS AND METHODS

### Patient Selection

We searched our institute's records for patients who received a secondary repair using deepithelized scar tissue as a concomitant technique from 2004 to 2014. In all these cases, volume deficiency was observed as a part of the surgical challenge. We included patients in the study when the primary repair was done at another hospital. After obtaining informed consent from the patient or the patient's parents, we obtained clinical photographs to create the physicians' satisfaction survey. The patient-parent satisfaction questionnaire was filled out during a phone call consultation. The type of cleft, the patient's sex, and age at the time of surgery and postoperative follow-up information were documented.

### Surgical Technique

All patients were treated under general anesthesia by the first author, and their skin was prepared with Hibidil (Hibi Antiseptics, CPS Cito Pharma Services, Uster, Switzerland). Next, the patient was draped in the usual manner and chlorhexidine digluconate (Corsodyl, GlaxoSmithKline, Brentford, UK) was used to rinse intraorally. No epinephrine was administered to avoid distortion of the actual shape and volume of the lip tissue.

The anatomy of the lip and nose was studied carefully to identify the borders of the esthetic units and anatomical landmarks. The future borders of the esthetic units were marked using a Medline fine-tip marking pen (Corporate Headquarters Medline Industries, Mundelein, Ill.). Next, anatomical landmarks such as the upper and lower border of the white roll and the merging points on the wet line of the lateral and medial vermilion segments were marked with methylene blue using a sharp needle.

The surgical technique consisted of sharp incisions through the skin and underlying soft tissue without perforating the oral mucosa, made by a carbon steel surgical scalpel blade no. 11 (Swann-Morton, Sheffield, England), on the marked anatomic boarders. The orbicularis muscle was identified and released for about 1 mm from the upper lying skin. An adequate release from the underlying mucosa was performed. The residual cleft scar was then deepithelized and rotated as a pedicled subdermal or submucosal flap in the volume defect to obtain satisfactory morphological results and competent lip volume.

To achieve those goals, the cleft scar was partially excised (Fig. 1) and carefully deepithelialized preserving a vital inferior pedicle (Fig. 2). The graft site was prepared via blunt tunneling (Fig. 3). To keep the auto-graft in the correct position, we placed a braided resorbable suture 5/0 (Vicryl, Ethicon, Somerville, N.J.) on the distal end of the graft (Fig. 4). The resorbable suture comes out transcutaneously at the border of the volume defect and was fixed using a Suture Strip (Dermasciences, Maidenhaid, United Kingdom). Then, the orbicularis oris muscle was reoriented and sutured with Surgipro 4/0 or 5/0 (Syneture, Norwalk, Conn.). In this way, the anatomical units were reapproximated such that the suture lines became the future borders of these units. In bilateral cases where there was no muscle approximation under the philtrum, the edges of the orbicularis oris muscle of the lateral lip segments were identified, dissected, and reapproximated in the midline under the new philtrum. The skin and mucosa margins were then trimmed and reapproximated (Fig. 5).

### Satisfaction Score and Statistics

Five maxillofacial cleft surgeons assessed the esthetic outcome based on the preoperative and postoperative clinical images obtained from frontal and lateral views. The improvements in lip symmetry, philtrum shape, scar visibility, symmetric dry/wet line, and lip fullness and overall improvement were evaluated using a 5-point scale: 0 represented no improvement, 1 corresponded

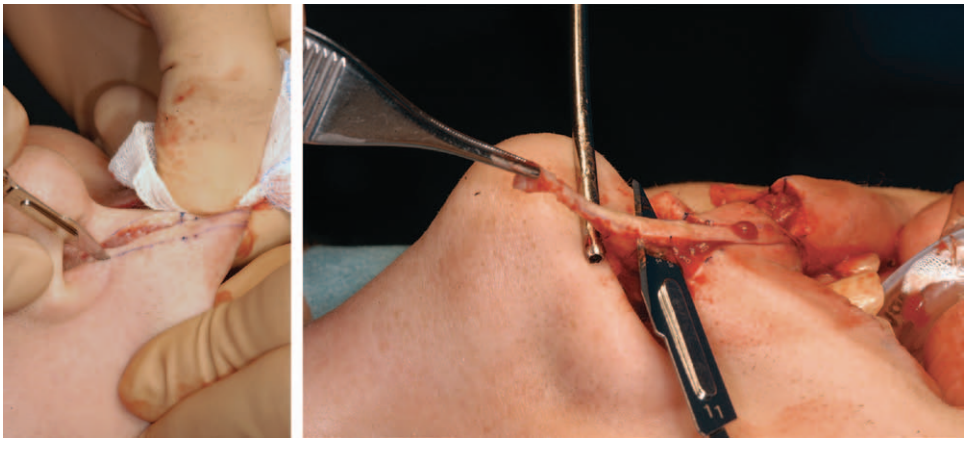


**Fig. 1.** Excising partially the cleft scar.

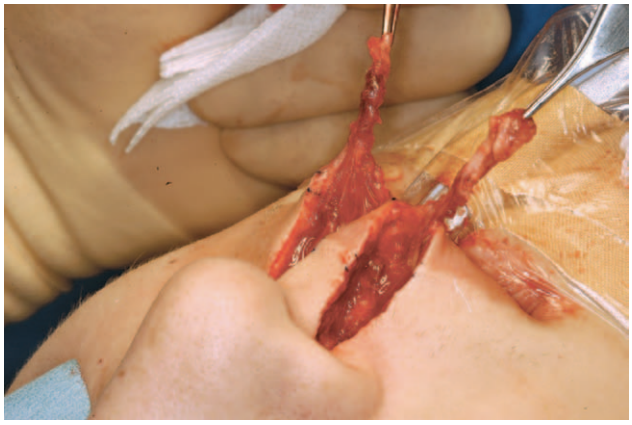

**Fig. 2.** Careful deepithelialization of the cleft scar with preservation of a vital inferior pedicle.

**Fig. 3.** The graft site is prepared by blunt tunneling.

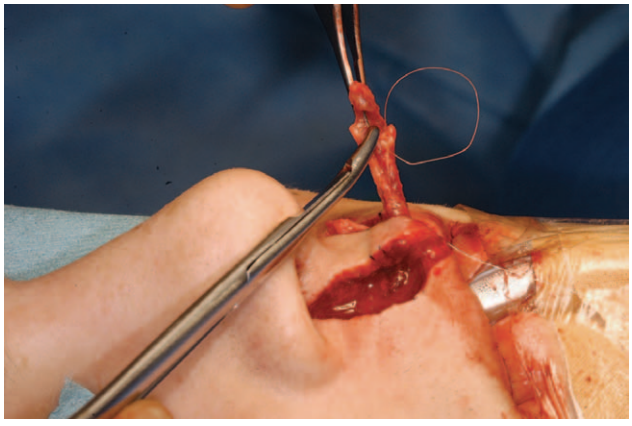

**Fig. 4.** A braided resorbable suture is placed on the distal end of the graft to keep the correct position.

to 25% improvement, 2 corresponded to 50% improvement, 3 corresponded to 75% improvement, and 4 corresponded to 100% improvement. Even more important was the patient's opinion of the outcome. The success of the procedure was accordingly also evaluated by a patient satisfaction questionnaire using a 5-point scale (0 = dissatisfied; 1 = only partially satisfied; 2 = half satisfied; 3 = mostly satisfied; 4 = totally satisfied) addressing lip fullness, symmetry, and overall appearance.

The analysis of the satisfaction scores was expressed using a percent agreement, which corresponded to the percentage of respondents indicating an outcome among the top 2 values (3 or 4). Because the percent agreement is a measure of the central tendency and does not take into account the variability of the respondents, we calculated the coefficient of variation by dividing the SD by the mean. Higher coefficient of variation values indicates more variability.

The statistical differences between the patient satisfaction scores over the different diagnosis groups, age, and sex were analyzed using the Real Statistics Resource Pack software (Release 4.3).[10] The nonparametric Kruskal–Wallis test was applied to test whether samples originate from the same distribution. For 2 groups, the Mann–Whitney test was performed. The $\alpha$ level for statistical significance was set at 0.05.

## RESULTS

A total of 46 patients were enlisted of which 29 patients finally completed the patient satisfaction survey (response rate of 63%) and were included in this study (9 females and 20 males; Table 1). The mean age at time of surgery was 18±12 years, with an interquartile range of 12 to 20. The patient satisfaction survey was conducted an average of 3.33 years after surgery (range: 0.33–9.75 years). The clinical pictures, used in the physician survey assessing the esthetic outcome, were taken an average of 8 months after surgery (range: 5 days to 6 years). At primary diagnosis, 38% of patients had a bilateral cleft lip and palate, 35% of patients had a unilateral cleft lip and palate, 17% of patients had a unilateral cleft lip, and 10% of patients had unilateral cleft lip and alveolus.

During the standard follow-up consultations, there were no significant hematomas, infections, or debilitative partial or total loss of the flaps reported. Furthermore, no patients underwent any subsequent surgical revision during the follow-up period (**See Supplemental Digital Content 1**, which displays examples of the preoperative and postoperative photographs showing an improved symmetry and reduction of the secondary deformities, ***http://links.lww.com/PRSGO/A266***).

In Table 2, we present the results of the patient and physicians surveys. The parent-patient satisfaction scores were characterized by a median value of 3.0 for all aspects on a 5-point scale ranging from 0 to 4. Lip fullness had a mean value of 3.2, symmetry had a mean value of 3.1, and overall appearance had a mean value of 3.3. The satisfaction level given by the percent agreement was in total 97% with a confidence interval of 4%. The lowest satisfaction was reported for the symmetry assessment, and we note that the variability in the responses was also the largest for this value. In Figure 6, we show the distribution of the patients' ages, treatments, and sex. The satisfaction scores are provided for the respective groups. There were no statistically significant differences found for the different groups, and all patients reported a high satisfaction score independent of their age, treatment, or sex. All *P* values were >0.30.

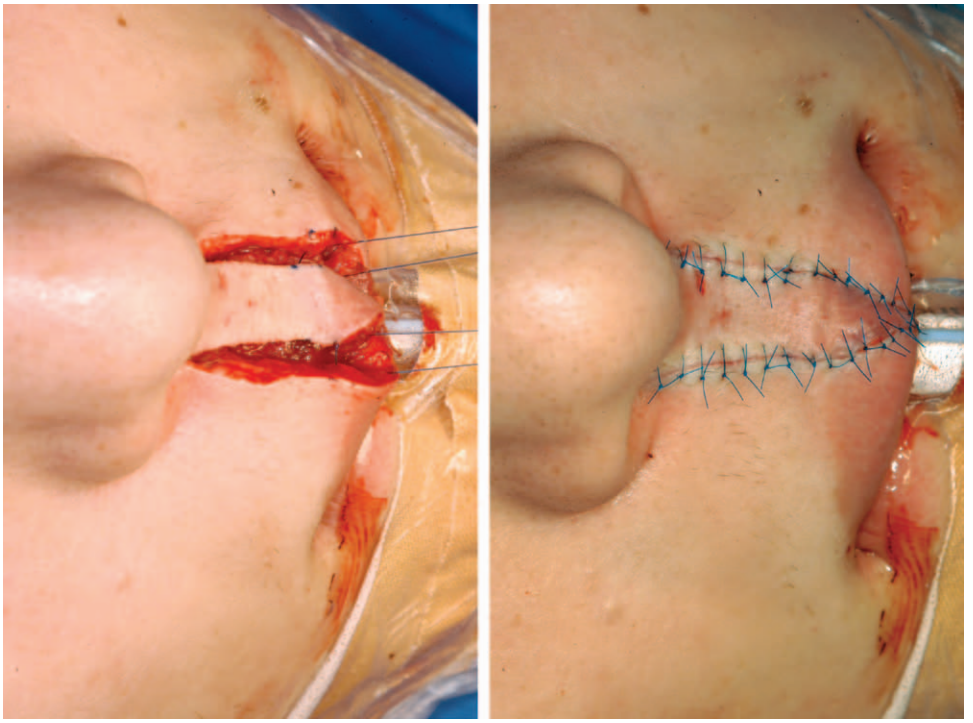

**Fig. 5.** The skin and mucosa margins are trimmed and reapproximated such that the suture lines will become the future boarders of the philtrum.

**Table 1. Information on the Studied Patient Group**

| | Total No. Patients = 29 | | | | | Primary Types | |
|---|---|---|---|---|---|---|---|
| | Surgery | Patient Survey | | Physician Survey | | UCLA | 3 (10%) |
| | Age (y) | Age (y) | FU Time (y) | Age (y) | FU Time (y) | UCLP | 10 (35%) |
| Mean ± SD | 18±12 | 22±11 | 3.15±2.26 | 21±12 | 1.37±1.76 | BCLP | 11 (38%) |
| Median | 15 | 19 | 2.50 | 17 | 0.68 | UCL | 5 (17%) |
| Range | 6–56 | 10– 57 | 0.27–9.73 | 8–57 | 0.01–6.13 | Sex | |
| IQR | 12–20 | 16–21 | 1.64–4.97 | 15–21 | 0.28–1.30 | F, 9 (31%) | M, 20 (69%) |

BCLP, bilateral cleft lip and palate; FU, follow-up; IQR, interquartile range; UCL, unilateral cleft lip; UCLA, unilateral cleft lip and alveolus; UCLP, unilateral cleft lip and palate.

**Table 2. Results of the Patients' Satisfaction and Physicians' Survey**

| | Patients' Survey | | | Physicians' Survey | | |
|---|---|---|---|---|---|---|
| | Agreement (%) | CV (%) | Mean/Median | Agreement (%) | CV (%) | Mean/Median |
| Overall | 97 | 13 | 3.3/3.0 | 92 | 14 | 3.3/3.0 |
| Symmetry | 79 | 20 | 3.1/3.0 | 92 | 14 | 3.3/3.0 |
| Lip fullness | 93 | 16 | 3.2/3.0 | 89 | 15 | 3.2/3.0 |
| Philtrum shape | | | | 92 | 14 | 3.3/3.0 |
| Scar visibility | | | | 85 | 16 | 3.1/3.0 |
| Symmetric dry/wet line | | | | 92 | 15 | 3.4/3.5 |
| Total | 97 | 14 | 3.3/3.2 | 96 | 11 | 3.3/3.3 |

The results of the patients' satisfaction and physicians survey using a five-point scale ranging from 0 to 4 are represented by the percent agreement, the coefficient of variation (CV) and mean/median values.

The physicians' survey evaluating the improvements also yielded high mean and median values (≥3.0). The percent agreement rating the level of improvement was in total 96%. The lowest agreement, which was still 85%, was found for scar visibility; the respondents exhibited a higher variability (16%) for this variable.

## DISCUSSION

To reduce cleft stigmata, cleft lip patients of various ages can request surgical improvements. Surgical planning for those patients require not only that the anatomy of the lip and its functions be maintained but that the esthetic design, proportion, and form be preserved as well.

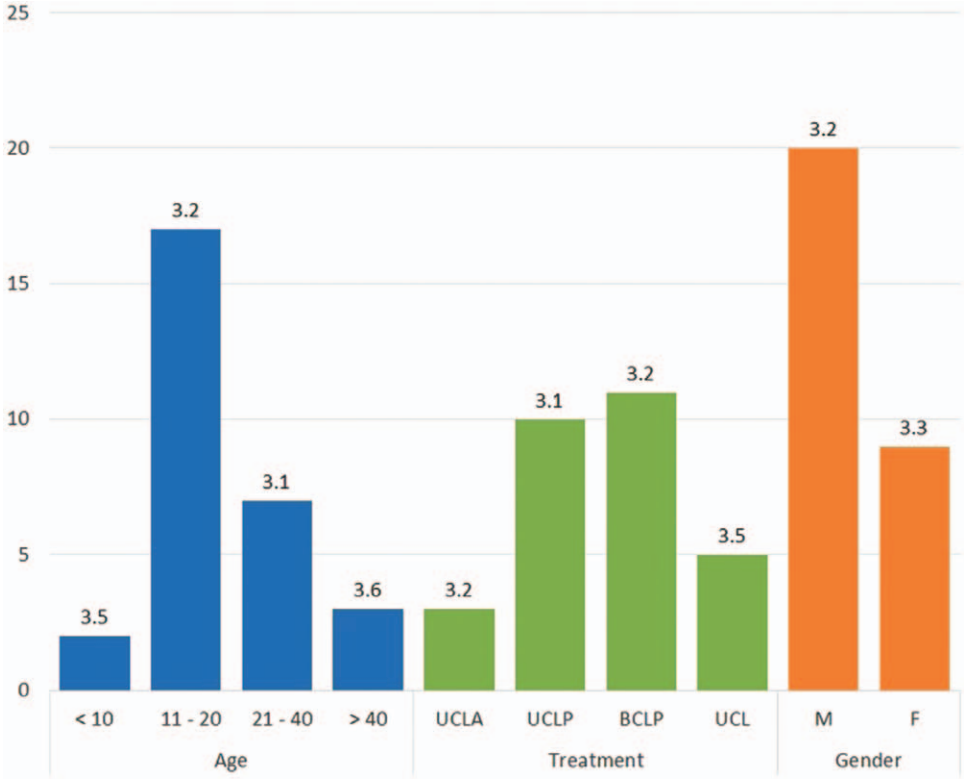


**Fig. 6.** Age, treatment, and sex distribution from the studied patient population together with the total satisfaction scores per group.

Because the lips are a dominant structure of the face, both functionally and esthetically, there is an obvious psychological relevance for the social impact on verbal and emotional communication.

According to Mulliken et al,[11] the principles of bilateral cleft lip repair include symmetry, primary muscular continuity, proper philtral size and shape, and formation of the median tubercle. Changing the design of the mouth has consequences for both the patient and the people interacting with him or her. Secondary deformities such as a tight upper lip, the absence of the Cupid's bow, a whistle deformity, a lack of upper lip bulk and vermilion tubercle, the absence of the philtral complex, and increased visibility of the incisors behind the upper lip are all perceived as abnormal and unattractive.[12, 13] The goal of surgery is therefore to restore both the function and appearance of the lip, which can typically be achieved using local flaps or, if necessary, grafts and/or orthognathic surgery.

Several techniques for secondary cleft lip repair have been described in literature. A safe technique with a small risk of necrosis is Abbe flap reconstruction in which a full-thickness flap of tissue from the lower lip is transferred to the upper lip with an intermediate stage in which the lips are stitched together. After several days, the flap is divided and the lips are released. It has been reported that some patients required additional operations to improve their lips. Another disadvantage is the deformity created at the donor site on the lower lip and a mismatch in texture and color of the upper lip.[13] Matsuo et al[14] presented a simple method of transposing bilateral lateral vermilion border flaps into the midposterior line of the prolabium to correct the "whistling lip" deformity. This method decreases upper lip tension, deepens the labiogingival sulcus, and reconstructs a peaked tubercle. One disadvantage is the slight difference in color between the dry and wet mucosa and the fact that the technique results in additional scars in the vermilion. Another simple and easy technique to correct the whistle deformity in cleft lip patients was described by Patel and Hall.[15] In this method, a dermis fat graft is used to augment the free border of the lip to correct for the vermillion notch deficiency. The results, however, are less reliable due to the difficulty predicting the degree of absorption. Furthermore, there is an increased risk of developing an infection with the technique. Grewal et al[16] presented a modification of Kapetansky's axial-based pendulum flap[17] to correct central lip deficiencies in both unilateral and bilateral cleft lip patients; this procedure, which was called "the whistle flap procedure," re-establishes continuity of the orbicularis oris muscle and creates a more natural tubercle and central lip element. The whistle flap technique is effective at correcting many residual deformities of the vermilion after primary cleft lip repair and has been shown to yield long-lasting improvements with minimal scarring. In 2011, Yin et al[18] described the "curved-line method" to surgically revise secondary bilateral cleft lip deformities. The technique's name refers to the incisions that are made along curved lines. The depth of the incisions is limited to the orbicularis oris muscle without opening it. A sharp dissection is performed through these incisions on both sides between the

orbicularis muscles and the skin or oral mucosa glands until the flaps can be adequately mobilized. In contrast with the technique described in this article, Yin et al did not note any muscle reapproximation beneath the philtrum.

The technique presented in this article uses pedicled, deepithelialized scar tissue beside a complete anatomical approach to the various deformities caused by a poor primary lip repair. In this correction, the skin scars are excised, the esthetic units of the lip are reconstructed as perfectly as possible, and orbicularis muscle is reoriented and reconstructed, maintaining symmetry, reforming philtrum and Cupid's bow, and restoring vermilion volume deficiency. Our aim was to solve most of the known complications and mismatches described in literature by combination of the mentioned methods. The presented technique is a one-stage surgery procedure that does not require a donor site, which results in a lower biological cost for the patient and fewer possible complications (e.g., infections and necrosis) than have been reported in standard grafts. Another advantage of the present technique is the inclusion of the scar tissue in the deepithelialized flap, which prevents additional scars. Our results demonstrated a well-defined lip volume, an adequate Cupid's bow, and symmetry valorization with complete vermilion and acceptable restoration. There was no decrease in lip volume reported during the follow-up period (Table 1). Five expert cleft surgeons evaluated the esthetic outcome and reported a high improvement score. Even more importantly, the parent-patient satisfaction scores were high and were independent of age, treatment, or sex.

## CONCLUSIONS

Based on the patient-parent satisfaction survey and on the thorough evaluation performed by expert cleft surgeons, we can conclude that the proposed technique leads to an excellent esthetic result that can be executed at any patient age and as a secondary repair for any primary type of cleft lip disorder. The augmentation of the lip volume remained stable with this technique during the follow-up period.

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