

## Vermillion Notch After Millard Repair of Unilateral Cleft Lip

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### ABSTRACT

*Background / Purpose:* Millard rotation-advancement flap repair of unilateral cleft lip deformity is widely used for its satisfactory results. With all its advantages, the Millard repair may need labial revisions to correct secondary lip deformities. One of the common secondary lip deformities is vermilion notching. The objective of this article is to analyze different factors responsible for vermilion notching after Millard repair and assess the results of labial revisions addressing these factors.

*Material and Methods:* Twenty children with vermilion notching after Millard repair of unilateral cleft lip were included in this study. Age ranged from 2-12 years with a mean of 4.3 years. Six patients were males while 14 were females. They were operated upon for their secondary lip deformity by the authors at the Children's Hospital, Cairo University (Aboul Reesh), during the period from January 2006 till December 2008. Preoperative assessment was performed both clinically and utilizing preoperative standard photography. Intraoperative assessment was also done with emphasis on the muscle bulk at the lower border of the lip. The surgical procedure was tailored to address the pre and intra operative findings.

*Results:* Preoperative assessment revealed short lip with tented Cupid's bow in 15 cases (75%), deficient vermilion in 11 cases (55%), severe notching in 6 cases (30%) and obvious scar in 8 cases (40%). Intra-operative assessment showed deficient muscle fibers at the lower lip border in all 20 cases (100%). Surgical technique included dissection of the muscle bulk and re-approximation at the lower lip border in all cases. In 15 cases (75%), total revision was performed to increase the rotation of the medial lip segment. In 9 cases (45%), lateral displacement of the paring point was done on the lateral lip segment. Seventeen cases (85%) had their scar revised.

*Conclusion:* The underlying cause(s) of vermilion notching included either two or three combined mechanisms. A common factor is inadequate muscle approximation at the lower border of the lip. Other factors include inadequate rotation of the medial segment, medial placement of the paring point on the lateral segment and hypoplastic medial or lateral segments.

### INTRODUCTION

The ideal repair of a unilateral cleft lip would result in a symmetrical upper lip. This implies

symmetrical philtral column length, linear scar not transgressing the philtral column, smooth Cupid's bow without peaking and a full smooth vermilion without notching. This should be obtained in a single operation without the need of multiple revisions.

The concept of rotation advancement flap repair was introduced by Millard and is based on a rotation flap on the non cleft (medial) side coupled with an advancement flap on the cleft (lateral) side. The concept of rotation-advancement flaps seems to fulfill the criteria of an ideal repair. Skin scar runs with the philtral column without interruption and the muscles come closest to their normal alignment of fibers [1].

One of its main advantages is that the technique allows adjustment as the operation proceeds, with further rotation and advancement movements tailored to the individual care. Fulfilling most of the goals of repair, the Millard technique deserved to be the most widely practiced method today [2]. With all its advantages, Millard repair may need labial revisions to correct secondary lip deformities.

One of the common secondary lip deformities is vermilion notching [3].

Mulliken reported his 15-year experience with the Millard technique in correction of unilateral cleft lip. He reported labial revisions in 42% of his patients. The second most frequently seen secondary anomaly was vermilion mismatching. His labial revision in such cases was uni-limb Z-plasty at the vermilion-cutaneous junction to achieve adequate vermilion match [4]. Christophe-des et al., performed a long term subjective and objective assessment of the lip scar in unilateral cleft lip repairs using the Millard technique and reported an incidence of vermilion notching of 45% [5].

The objective of this article is to analyze different factors responsible for vermilion notching and assess the results of labial revisions addressing these factors.

### MATERIAL AND METHODS

Twenty children with vermilion notching after Millard repair of unilateral cleft lip were included in this study. Age of the patients ranged from 2-12 years with a mean of 4.3 years. Six patients were males while 14 were females. They were operated upon for their secondary lip deformity by the authors at the Children's Hospital, Cairo University (Aboul Reesh), during the period from January 2006 till December 2008.

All patients had had their previous lip repair performed using the classic Millard rotation-advancement flap technique. Preoperative assessment was performed clinically together with preoperative standard photography. Assessment included lip length as compared to the non-cleft side (short/equal), integrity of Cupid's bow (smooth/tented), vermilion fullness on either side of the notch (near normal fullness/deficient), the severity of the notch (mild/severe) and the quality of the scar (masked/obvious) (Table 1).

Table (1): Results of preoperative assessment.

Item	Number	Percentage
Short Lip	15	75
Tented Cupid's Bow	15	75
Deficient Vermillion	11	55
Severe Notching	6	30
Obvious Scar	8	40

All corrective procedures were performed under general anesthesia. The technique was tailored according to pre and intra-operative findings. Intra-operative assessment included the bulk of muscle fibers at the lower lip margin. Surgical techniques used included muscle re-approximation, revision of medial segment rotation and modification of the paring point on the lateral lip segment. Scar revision was done in cases with obvious scars.

Patients were followed-up weekly during the first month, then monthly thereafter. Postoperative assessment using both clinical and photographic documentation was performed after a minimal of

3 months of corrective surgery. Follow-up period ranged from 3 to 34 months with a median of 16 months.

### RESULTS

Preoperative assessment revealed short lip with tented Cupid's bow in 15 cases (75%), deficient vermilion in 11 cases (55%), severe notching in 6 cases (30%) and obvious scar in 8 cases (40%) (Table 1). Intra-operative assessment showed deficient muscle fibers at the lower lip border in all 20 cases (100%) (Fig. 1). Patients with deficient vermilion (n=11) included two different groups, those with hypoplastic medial segments (n=2) and those with medially placed paring point on the lateral lip segment (n=9). This latter group retained cleft tissue in their previous repairs that accounted for the hypoplastic appearance of the vermilion at the site of notching.

Surgical technique included dissection of the muscle bulk and re-approximation at the lower lip border in all cases. In 15 cases (75%), total revision was performed to increase the rotation of the medial lip segment. Back cuts were used in these cases to gain enough length. In 9 cases (45%), lateral displacement of the paring point was done on the lateral lip segment with excision of excess cleft tissue available at the lateral aspect of the vermilion notch (Fig. 2). Too medial placement of the paring point was the only case in 5 cases, while 4 cases had both inadequate rotation in addition to lateral paring point displacement. These 4 cases therefore needed total lip revision to improve rotation of the medial segment, in addition to lateral displacement of the paring point on the lateral segment. Although the old scar was obvious only in 8 cases, however, a total of 17 cases (85%) had their scar revised. Those included the 15 total lip revisions in addition to 2 cases with obvious scars that did not need total revision (Table 2).

Table (2): Surgical techniques.

Technique	Number	Percentage
Re-approximation of muscle at the lower lip margin	20	100
Total Lip Revision with adequate rotation of the medial segment	15	75
Lateral Displacement of the paring point on the lateral segment	9	45
Scar revision (including total lip revisions)	17	85

Accordingly, the underlying cause(s) of vermillion notching included either two or three combined mechanisms. Inadequate muscle approximation is a common factor in all cases. The second cause was inadequate rotation of the medial segment (n=9) and medial placement of the paring point on the lateral segment (n=5). Four patients had combined both inadequate rotation and medially placed paring point. Another 2 patients combined inadequate rotation with hypoplastic medial segments (Table 3).

Table (3): Combination of factors in vermillion notching.

Factors	Number	Percentage
Inadequate muscle bulk + Inadequate rotation of the medial segment	9	45
Inadequate muscle bulk + Medially placed paring point on the lateral segment	5	25
Inadequate muscle bulk + Inadequate rotation of the medial segment + Medially placed paring point on the lateral segment	4	20
Inadequate muscle bulk + Inadequate rotation of the medial segment + Hypoplastic medial segment	2	10
Total	20	100

All patients tolerated the procedures well with no significant intra-operative medical or surgical complications. Wound infection was noted only in one case (5%) and was managed conservatively. Postoperative assessment showed satisfactory results in 18 cases (90%) (Fig. 3), while residual notching was noted in 2 cases (10%). Cases with residual notching were those who showed inadequate rotation of the medial segment together with hypoplastic medial segment.

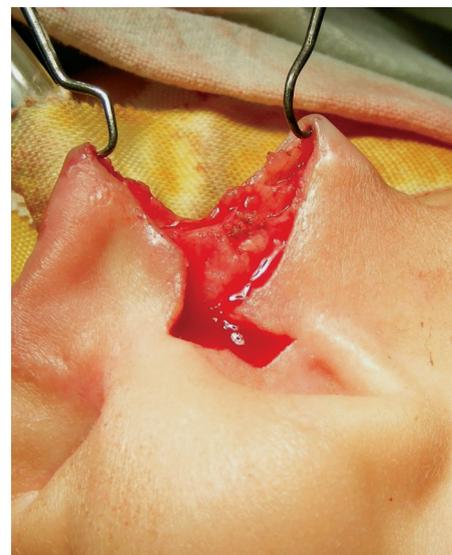


Fig. (1): Intraoperative photograph showing deficient muscle bulk at the lower lip border. Note the edge of the repaired muscle in the upper half of the lip, while the lower half is totally deficient of muscle bulk.



Fig. (2): Using the Millard technique in correction of unilateral cleft lip deformity, the paring point that determines where the lateral lip segment meets with its counterpart on the medial segment is determined by several methods. The dotted line (a) refers to this paring point as the point where the white roll attenuates, which is usually at a distance from the oral commissure equal to its counterpart on the normal side. The dotted line (b) refers to a more favorable point, placed slightly laterally, marked by the level of maximal vermillion fullness.



Fig. (3): Pre operative (left) and post operative (right) photographs of a patient with vermillion notching after Millard Repair of left unilateral cleft lip. The causes of notching in this case included: deficient muscle approximation at the lower lip border, inadequate rotation of the medial flap and medially placed paring point on the lateral flap. Correction was performed by total lip revision, muscle approximation at the lower border, increasing medial segment advancement with a back cut and excision of cleft tissue from the lateral flap with medial placement of the paring point at the point of maximal vermillion fullness.

## DISCUSSION

A smooth balanced vermilion is the resultant of a perfect match between the medial and lateral segments. Vermillion notching represents an element of mismatch between the two segments. The problem of vermilion mismatching may result from indolent factors in the cleft lip, surgical factors related to the technique used or a combination of both [4].

By indolent factors, we mean obvious difference in bulk between the medial and lateral lip segments caused by the mechanism of clefting and in particular the oblique muscle orientation. While some surgeons described a hypoplastic medial lip segment, others stated the opposite. Mulliken reported his 15-year experience with the Millard technique in correction of unilateral cleft lip. He stated that the most common secondary labial problem was fullness of the lateral mucosal border and minor deficiency of the median tubercle. He also mentioned that although this imbalance could be addressed primarily, it is probably best corrected secondarily. This is accomplished by rotation of a de-epithelialized submucosal flap into the tubercle [4]. The same principle of hypoplastic medial segment was described by Noordhoff. However, he advocated the use of a triangular vermilion flap devised from the redundant vermilion on the lateral side to compensate for its deficient counterpart on the medial side [6]. In this study group, only 2 patients had evident hypoplastic medial segments.

On the other hand, Millard stated that many of his patients exhibit the opposite problem. He referred to attenuation of the lateral mucosal free margin. For this deficiency of the lateral mucosa, he recommends secondary correction with a V-Y mucosal roll-down flap [1]. In the same line, Lewis also described the problem as a full medial segment as opposed to an attenuated lateral segment. However, he referred to excessive advancement of the lateral flap as a cause of the imbalance rather than indolent factors [7].

Indolent factors can therefore be responsible for vermilion mismatch. However, surgical factors can be as much influential. Surgical inadequacy can be evident in muscle restoration at the lower part of the lip, in medial flap rotation or in lateral flap advancement. The aberrant, oblique configuration of the orbicularis muscle segments represents one of the most important anatomic abnormalities in the cleft lip. Correct repositioning of the muscle

into a horizontal orientation is critical in repair. Success on the skin level will never compensate for deficiencies in muscles redirection [8].

This is particularly applicable to the lower half of the lip, where the obliquity of the fibers may account for its deficiency. Deficiency of the muscle bulk can cause vermilion notching. It is the muscle bulk on the medial segment that is usually less than its counterpart on the lateral segment. Adequate dissection and reorientation of the muscle fibers is crucial in obtaining a matched vermilion [9]. An overdo in muscle approximation has been proposed by Narayanan, producing a "roll" or "sausage" bulge at the site of muscle repair in order to achieve enough bulk at the vermilion border capable of preventing notching [3]. All cases included in this study were found to have inadequate muscle bulk at the lower border of the lip. Muscle dissection and approximation was a common step in all corrective procedures (Fig. 1).

Regarding the medial flap, Ray stated that one of the more common errors observed in Millard's technique is insufficient rotation. He described several rotation errors that include faults in flap incision design, failure to utilize a back cut and failure to orient the muscle fibers. The effect of under rotation of the medial flap was emphasized by Narayanan as a definite cause of vermilion notching. In this series, 75% of patients had inadequate rotation of the medial segment. Increasing rotation was achieved by total revision of the lip, with back cuts at the columellar base for more length.

Retaining effective rotation also depends on appropriate design and elevation of the advancement flap. A critical determinant is where the advancement flap is pared (Millard point 8). The classic technique in defining this point depends on measuring the non cleft vermilion from commissure to Cupid's bow peak and imposing this measurement on the cleft side [1]. Other surgeons define this point by the point where the white roll attenuates. Both these techniques put the paring point too medial on the vermilion-cutaneous junction of the cleft side, with consequent shortening of the lip height and possible notching [10].

Ray recommended using the volume of the vermilion in determining the paring point. It is the point where the vermilion volume starts to attenuate that would obtain perfect matching. Such lateral placement of the paring point may apparently sacrifice too much vermilion on the

advancement side. However, having enough volume on the advancement flap produces a better volume match and consequently less incidence of notching [10].

Sacrificing too much vermillion may compromise the length of the lip segment. To ensure adequate length, several minor modifications are proposed. These include extending the tip of the advancement flap into the vestibule, convex design of the advancement flap incision and designing a white roll flap on the rotation side to be inserted into the a small incision on the advancement side at the vermillion-cutaneous junction [8]. The design of incisions and placement of points have been proposed by several surgeons as the most influential factor in determining success. This applies more to point 8 on the lateral lip segment. Inclusion of "cleft tissue" in the repair guarantees a secondary deformity [5,7,11,12]. In this series, 45% had medially placed paring point on the lateral flap with inclusion of cleft tissue in the repair and consequent notching. Excision of cleft tissue and lateral displacement of the paring point achieved excellent results (Fig. 2).

#### *Conclusion:*

In conclusion, vermillion notching represents a common secondary lip deformity following Millard repair of unilateral cleft lip. Indolent and surgical factors share in the development of this deformity. Indolent factors in the form of tissue hypoplasia are not preventable and should be augmented by local flaps. Surgical factors, on the other hand, can be prevented. Recommendations during primary repair include adequate muscle alignment in the lower half of the lip, adequate rotation of the medial segment and precise definition of the paring point on the advancement flap.

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