Bilateral Cleft Lip Repair: Refinement of the Final Appearance

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Background/ Purpose: Refinement of cleft lip repair will continue to be an everlasting aim of cleft surgeons. The complexity of the deformity and the delicate interrelation between muscular arrangement and external lip features needs a comprehensive approach for proper management. The Mulliken’s principals for cleft repair were a corner stone in cleft management. Yet, many modifications and refinements are published ever since. This study describes technical refinements in then skin design and modifications in the muscle repair in bilateral cleft lip.

Materials & Methods: Eighteen patients were operated upon using modifications in Mulliken’s technique for bilateral cleft lip repair regarding skin tailoring, lateral flap size and muscle repair, with a mean follow up period of one year and two months.

Results: The overall results were extremely satisfactor regarding function and appearance without major complications. Based on the ten parameter for assessment and scoring: five patients (27.8%) had excellent results (mean 26 points), six patients (33.3%) had very good results (mean 22 points), four patients (22.2%) had good results (mean 17 points), and three (16.7%) patients had fair results (mean 12 points).

Conclusion: This method of comprehensive primary muscle, soft tissue and skin reconstruction in bilateral cleft lip address the major sites of distortion in the lip, sulcus and nasal floor producing a full central segment, prominent philtral ridges, adequate white roll, thick vermillion with a seam like median tubercle in addition to a deep gingivo-labial sulcus and alar base symmetry.

Index Word: Bilateral cleft lip repair, Mulliken’s technique, Basket weave muscle repair

INTRODUCTION

Incising a cleft lip is like cutting a diamond; the first cut determines the final result. A diamond lasts forever; the repaired lip affects a lifetime. So minute problems might be everlasting if it is not dealt with properly primarily. Every effort should be made to accomplish excellent results with the first operation. The success of the primary repair to achieve a more natural appearance, the better the prognosis of the patient, the better integration in the society and the better job he gets.

The anatomic stigmata of bilateral cleft lip is the result of bilateral failed fusion and merging between the median nasal process and maxillary processes consequently, there is insufficient mesodermal penetration of the lateral lip ectodermal envelope furthermore; there is total absence of muscle in the prolabial segment, resulting in abortive formation of the philtral dimple, columns, white roll and median tubercle. In addition to these preexisting anatomic stigmata, the iatrogenic consequences of surgical repair may complicate the condition.
Mulliken 1985 has made a detailed analysis of the residual soft tissue deformities seen after bilateral cleft lip repair and stated five principles to eliminate these stigmata. These are maintenance of symmetry, establishment of primary and secure muscle continuity, adjustment of proper prolabial size and configuration and formation of the median tubercle and prolabial white roll from the lateral lip elements.

Although the Mulliken approach to the bilateral cleft lip deformity by his principles and technique significantly reduced secondary sequelae and the consequent need for secondary surgical correction, the perfection is still difficult to achieve due to the multiplicity and complexity of the inherent deformities.

Analyzing the anatomical abnormalities of bilateral cleft lip and reviewing the different types of repair and their results, reveals that the results depend to a great extent on the delicate relation between the muscle and skin.

The upper lip musculature gives it a dynamic function that makes symmetry in both repose and movement important in surgical reconstruction of cleft lip. Fibers of the normal orbicularis criss-cross beneath the philtrum, giving the lip its characteristic dynamism with puckering, whistling, or speech. A cleft, by interrupting and redirecting the orbicularis fibers on each side of the cleft, destroys this dynamism creating the orbicularis muscle bulge laterally.

In 1974 Randall et al 4 pointed out that the orbicularis muscle bulge would be difficult to eliminate unless the orbicularis segments were reoriented, and described bringing the upper ends down and across the cleft into a vermilion pocket on each side. Since then, others have presented a variety of techniques designed to create a better orbicularis junction and philtral anatomy.

Dado (5) described wide undermining of the lip skin with exposure of the orbicularis muscle and horizontal splitting of the lateral muscle flap. The two muscle portions were then advanced medially and sutured to the nasal spine and the inferior portion of the lip. Zimman et al 6 reviewed muscle repair and advanced the muscles toward the cleft, where they were sutured medial to the skin closure. Park and Ha7 dissected the superficial and deep portions of the orbicularis and sutured them end to end independently. Anderl 8 described imbrications of the lateral orbicularis muscle flap into a pocket dissected into the medial muscle border. Splitting and interlacing the orbicularis muscle in a basket weave manner was used in unilateral cleft lip and showed improved aesthetic and functions of the repaired lip. 9

As there is no universal technique for bilateral cleft repair, new techniques and refinements still emerge aiming to reach perfection.

In this work we followed the Mulliken's principles for bilateral cleft lip repair with modifications in skin tailoring, lateral flaps size and muscle reconstruction. We made the prolabium slightly wider, moving the points that determine the upper edge of the lateral vermilion flaps up and adapted the basket weave for muscle repair aiming at improving the long term function and appearance.

**PATIENTS AND METHODS**

From March 2004 till February 2007, 18 patients with bilateral cleft lip were operated upon. The cleft varieties were: bilateral complete clefts (n = 10), bilateral incomplete clefts (n = 5) and bilateral asymmetric clefts (n = 3). The patients' age at the time of repair ranged from 3 months to 20 years with a mean of 2 years and 2 months. Patients with severely protruded premaxilla were offered external tapping for a short time preoperatively. The postoperative assessment was done by three cleft surgeons in our department using ten parameters: creation of philtral columns, creation of philtral furrow or dimple, creation of central white roll, presence of peaks of cupid's bow, creation of median tubercle, absence of length discrepancy between the central and lateral lip elements, alar base symmetry, absence of muscle bulge during lip animation, quality of scar and creation of gingival–buccal sulcus. The results were considered excellent with the score >25, very good with score >20 good with score >15, fair with score> 10 and poor with score < 10. This subjective assessment was done 3-6 months after repair.

**Operative Design:**

We employed technical modifications and refinements to the Mulliken method. The philtral flap was made wider to minimize the tension on the closure. We neither separate the alar base from the lip nor remove a crescent from the upper part of the lateral lip element. The orbicularis oris muscle was divided into four slips. The uppermost slips were...
sutured to the periosteum at the anterior nasal spine, the middle two slips were repaired in basket-weave pattern and the lowermost slips were overlapped to each other to add more augmentation of the midline tubercle. Splitting of the muscle and its repair in this fashion gives two benefits, increasing the vertical length in the midline and increasing the thickness of the muscle layer in the para-median line at the site of the proposed philtral columns. In the vermilion flap, we added 1mm of the skin above the white roll to become a vermilion-white roll-cutaneous flap. This minimizes the excess length in the lateral lip segments to be added to the central one.

**Surgical technique:**

The following points are marked while the skin is slightly stretched during marking (fig: 1). The base of columella, A A’. The point of insertion of alar bases to the nostril sill, B B’. The point of attenuated white roll on the lateral segment, C C’. Point D D’, one mm above point C. Point E E’, is 3 mm lateral to point D and 1 mm from the white roll. Point F, at the center of the prolabium just above its rudimentary white roll. Point G G’, 3 mm lateral to point F on the mucocutaneous junction. Point H H’, is at the vermilion border on the red line in direct continuity with the line DC. Line BD and line AG are slightly concave laterally. These measurements are for infants, for elder patients, the prolabial flap is made wider, so points A, A’, E, E’, G and G’ are made 1mm more lateral.

Critical anatomic points are tattooed: The base of the columella, A A’, the three points at the tip of the prolabial flap, GFG’, Cupid’s bow peak, E E’ and the lateral vermilion flaps, HCDE and H’C’D’E’.

The labial tissue, alveolar edges and nasal walls are infiltrated with adrenaline 1/200,000. The prolabial skin is incised connecting point AG, A’G’ and GFG’. The incisions AG and A’G’ are concave laterally. The prolabial flap is elevated with all subcutaneous fat on its underside and dissected up to the anterior nasal spine level. The excess skin of the prolabium is kept attached to the bone at the periphery and reflected under the repaired lip to assist in alveolar closure and prolabial sulcus deepening.

In the lateral lip segments, skin is incised connecting points BDE as well as the line DCH. During deepening of the line BD all the muscle fibers medial to this line are included in the lateral segment. The mucosa between points B and D is cut a little pit medially at the level where the muscle ends and the cut is extended directly to point H. The rest of the incisions, DC and CDH are cut deep through the skin and the muscle at the same level. The lateral vermilion flap EDCH is now created.

The excess mucosa that is left at the cleft edge is kept attached to the muco-periosteum at the cleft margin to aid in alveolar cleft closure. The mucosa is released laterally at the buccal sulcus on both sides exposing the deep surface of the muscle that is widely dissected laterally. It is freed from its abnormal insertion: from around the pyriform aperture and alar base up to the level of the infra-orbital foramen by blunt dissection in supra-periosteal plane.

The muscle is extensively freed laterally from the skin and mucosa until the muscle bulge is eliminated and it is freely mobile to reach for the central line. The muscle between the points B and E is divided into two slips, a narrow upper slip, to mimic the nasal bundle at the alar base, and a wider lower slip to mimic the naso-labial bundle. This lower slip is further divided into two equal slips (fig. 2). The muscular tissue in the lateral vermilion flap EDCH represents the deep (vermillion) part of the muscle.

In complete clefts, muco-pericondrial flaps are elevated on either side of the nasal septum and vomer extending backwards to the vomerine suture. They are sutured to muco-periosteal flaps elevated from the lateral nasal wall extending posteriorly from the edge of the cleft using vicryl® 5/0. The flaps are made long enough for nasal floor closure by making their horizontal incisions as low as possible.

In cases with cleft alveolus, its lingual side is repaired by two muco-periosteal alveolar flaps that are dissected from the edges of the cleft and are pushed posteriorly, each based on its posterior attachment, and are sutured together. The buccal side is covered by the remaining excess mucosal flaps medial to points BCH and lateral to points AG that were left attached to the edges of the cleft.

The prolabial vermilion is sutured to the premaxillary periosteum to form the posterior layer of the premaxillary gingivo-labial sulcus.

The lateral labial elements are transposed medially. The mucosa of the lateral lip elements are sutured together to form the anterior layer of the premaxillary gingivo-labial sulcus. The bundles of the orbicularis oris muscle are repaired in a basket-weave pattern. The uppermost slips are secured to the periosteum at the anterior nasal spine. The divided middle slips are
inter-digitated to each other and are overlapped so each one is sutured beneath the contra-lateral philtral ridge using vicryl® 4/0. The lowermost slips are overlapped on each other to add more augmentation of the midline tubercle (fig: 3). Skin is closed in two layers using PDS® 5/0 and prolene® 6/0, and the mucosa is sutured in the mid line using vicryl® 5/0. Lip is tapped for 24 hours and exposed thereafter. Sutures are removed on the sixth postoperative day.

Fig 1. Diagrammatic illustration of the technique showing the important points and landmarks. The base of columella, A A'. The point of insertion of alar bases to the nostril sill, B B'. The point of attenuated white roll on the lateral segment, C C'. Point D D', one mm above point C. Point E E', is 3 mm lateral to point D and 1 mm from the white roll. Point F, at the center of the prolabium just above its rudimentary whit roll. Point G G', 3 mm lateral to point F on the muco-cutaneous junction. Point H H', is at the vermilion border on the red line in direct continuity with the line DC.

Fig 2. Splitting of the orbicularis oris muscle into four slips.

Fig 3. The Basket-weave repair of the muscle.

Fig 4. The final shape of the lip after completing the repair.
Fig 5. A five month male child with bilateral complete cleft lip.  
A: Preoperative, B: Postoperative after 2 years and 4 months.

Fig 6. A three month male child with bilateral asymmetric cleft lip.  
A: Preoperative, B: One month postoperative.

Fig 7. A nine month female child with bilateral complete cleft lip.  
A: Preoperative, B: 1.5 months postoperative.
RESULTS

Eighteen patients suffering from bilateral cleft lip were operated upon using this technique. The over all results were extremely satisfactory (fig: 4). The mean follow up period was one year and two months (3 months to 3 years). There were no major complications as disruption, infection or significant lip asymmetry. Broad scar was encountered in two cases, hypertrophic scar in one case, alar base asymmetry in one case, shallow buccal sulcus in one case, and misalignment of whit roll in one case. Based on the ten parameter for assessment and scoring done by three different cleft surgeons: five patients (27.8%) had excellent results (mean 26 points), six patients (33.3%) had very good results (mean 22 points), four patients (22.2%) had good results (mean 17 points), and three (16.7%) patients had fair results (mean 12 points). Figures: 5, 6 and 7 are representative cases.

DISCUSSION

The aim of bilateral cleft lip repair is the precise restoration of the anatomic landmarks and functional units in the upper lip. Surgical procedures should be planned to maximize the preservation of appearance and function and to minimize any distortion during growth.

Many problems faced earlier repairs; broad ugly prolabium, wide scars, unequal lip segments, shallow philtral ridges, shallow sulcus, empty central segment, segmented vermilion, short central segment and tight lip. These problems can be well addressed if the delicate balance between the skin tailoring, prolabium and vermilion, and the complex anatomical configuration of the orbicularis oris muscle with its dynamic relation to the other muscles of facial expression attached to it, could be restored in a near normal fashion.

The white roll-vermilion segment was the most controversial. Techniques that preserve the original central vermilion resulted in a dry, fissured, discolored mucosa and wrinkled tubercle with a double notch at the lateral margins. Although, Talmant preserved central mucosa at the time of primary repair to avoid putting a scar in the philtrum, he needed a second stage to reconstruct the central mucosal deficiency with bilateral island vermilion flaps.

The normal lip often exhibits a vertical seam like ridge centered on the median tubercle. This tubercular raphe is best formed with lateral lip vermilion mucosal flaps. The overlapping of the lower most slips of orbicularis oris muscle adds more augmentation and gives a near natural tubercular raphe. In this regards, the results of the Mulliken technique proved to be superior to earlier techniques.

With the core of his principles remains, we added some modifications and refinements in the skin design regarding length adjustment between the lateral lip elements and the prolabium. But, in contrast to Mulliken, we do not separate the alar base from the upper lip, so the normal relationship between the alar base and upper lip is not violated with no scar in the naso-labial crease.

The added 1mm to the lateral vermilion flaps brought the suture line to the skin segment inside the lip but it proved to be aesthetically convenient and did not affect the smoothness of the skin. It even added to the white roll definition in the mid line and further sharpened the boundaries of the Cupid's bow and the inter-philtral region.

The muscles anatomy of the normal upper lip has been studied in detail. These studies reports that the orbicularis oris exists in two layers, a deep layer that is continuous across the midline and a superficial layer that interdigitates in the midline beneath the philtrum and gains insertion into the dermis lateral to each contra lateral philtral ridge. This arrangement of the superficial layer explains the prominence of philtral columns and the philtral dimple during pursing of the upper lip. A cleft blocks this normal orientation of the orbicularis muscle. Fara described the position and course of the orbicularis muscle from dissections of still born infants with clefts. He identified the abnormal redirection of the muscle fibers by the cleft upward to end under the alar base laterally and the columellar base medially. Nicolau reported that the deep portion of the orbicularis oris muscle was interrupted at the cleft margin but was not otherwise distorted by the cleft. The superficial portion of the muscle was distorted by the cleft and diverted under the alar base. In their dissection, park and Ha confirmed that the superficial portion on the lateral side runs along the cleft margin and inserts into the alar base and periosteum of the pyriform aperture. Awareness of the orbicularis distortion by the cleft aroused interest in reconstructing the muscle as a part of cleft repair.

Basket-weave reconstruction of the orbicularis oris can eliminate the muscle bulge and produce lip
contour symmetry. Splitting and interlacing the orbicularis muscle bundles can mimic its normal structure. This basket-weave reconstruction has been used in unilateral cleft lip and improved aesthetic and functional results both in repose and in function. They have also used basket-weave reconstruction in secondary cases of bilateral cleft lip and few primary cases when tension permits and reported good functional results.

With the basket-weave reconstruction we obtained good functional and aesthetic results. The muscle bulge is eliminated, both philtral columns become prominent with a philtral furrow in between. It also added to the vertical length that is strongly needed in the prolabial segment.

The overall results were gratifying as it was excellent in 5 cases, very good in 6 cases, good in 4 cases and fair in 3 cases with no poor results.

In conclusion a method of comprehensive muscle, soft tissue and skin reconstruction in bilateral cleft lip patients is presented where major sites of distortion in the lip, sulcus and nasal floor are addressed at the primary surgery.

At a mean of one year and two months follow-up, we obtained full central segment with prominent philtral ridges, adequate white roll in the central segment and thick vermilion with a seam like median tubercle. This method also provides deep gingivo-labial sulcus and alar base symmetry.

REFERENCES


