INTRODUCTION

A cleft lip is a gap in the upper lip due to failure of organogenesis during embryological development. This disorder can be accompanied by a gap in the palate, namely a gap in the palate of the mouth so that there is a direct connection between the nose and mouth. The most common congenital defect in children and the most common congenital malformation of the head is cleft lip and palate. The prevalence of cleft lip in the world is estimated at 0.5–1.6 per 1000 live births, with a male-female ratio of 2:1. The national prevalence of cleft lip in Indonesia is known to be 0.2%.

Cleft conditions can vary in appearance and severity, ranging from small, incomplete clefts to extensive bilateral clefts. Cleft lips can be classified into microform, incomplete, complete, and unilateral or bilateral. A unilateral cleft lip occurs when the medial nasal process and maxillary process fail to fuse on one side. This condition can occur due to hypoplastic processes and tissue loss in the orofacial region. The problems caused by cleft lip and palate are aesthetic and functional. Functionally, a cleft lip causes difficulty eating and speaking. Aesthetically, a cleft lip condition causes complaints in terms of an unattractive appearance, resulting in a psychosocial impact on the patient.

The aesthetic factor is an important initial step in supporting the patient’s social function. Therefore, various surgical techniques have been used to produce the best aesthetic outcome in cleft lip surgery. Several cleft lip surgery techniques, such as the Millard, Fisher, Randall-Tennison, Skoog, and Trauner techniques, have been developed. The surgical technique chosen is adjusted to the type of cleft lip experienced by the patient, but the two techniques most often used are the Millard and Fisher techniques.

The Millard technique is a cleft lip surgery technique that uses rotational and advancement flap techniques developed by Dr. D. Ralph Millard, Jr., in Korea in 1958. This technique is performed by making an incision and flap on two sides: a rotational flap on the medial lip and an advancement flap on the lateral lip. Meanwhile, the Fisher technique uses the principle of anatomical subunit approximation, in which the measurement of the boundaries and extent of the surgical procedure is very accurate, resulting in a more anatomical position of the scar tissue. Regarding surgical scars, nose symmetry, vermilion, Cupid’s bow and nasal, and Steffensen grading, better aesthetic results were found in Fisher’s technique compared to Millard’s.

Aesthetic outcome comparison between Millard and Fisher technique for cleft lip surgery: a literature review

Ni Kadek Parswa Diah Pradnyandari*

ABSTRACT

Background: Cleft lip is the most common congenital defect found in children, with a prevalence of 0.5 to 1.6 per 1000 live births. Besides causing functional problems, a cleft lip greatly affects the patient’s aesthetic appearance. Therefore, several surgical techniques have been developed to produce a good clinical appearance to support the patient’s social functioning. The Millard and Fisher technique is the most widely used cleft lip surgery (cheiloplasty) technique. This literature review aims to compare the aesthetic outcomes between the Millard and Fisher techniques in cleft lip surgery.

Methods: This literature review was carried out by searching studies in online databases in the form of PubMed, the Cochrane Library, and Google Scholar using the keywords “cleft lip surgery,” “Millard,” “Fisher,” “aesthetic outcome,” and “comparison.” Appropriate studies were then carried out through a narrative synthesis analysis.

Discussion: The Millard technique uses the principle of rotational and advancement flaps, performed by making incisions and flaps on two sides, namely a rotational flap on the medial lip and an advancement flap on the lateral lip. Meanwhile, the Fisher technique uses the principle of anatomical subunit approximation, in which the measurement of the boundaries and extent of the surgical procedure is very accurate, resulting in a more anatomical position of the scar tissue. Regarding surgical scars, nose symmetry, vermilion, Cupid’s bow and nasal, and Steffensen grading, better aesthetic results were found in Fisher’s technique compared to Millard’s.

Conclusion: Fisher’s technique provides superior aesthetic results compared to Millard’s technique in cleft lip surgery.

Keywords: Cheiloplasty, Cleft Lip Surgery, Fisher and Millard technique.

is very accurate, resulting in a more anatomical position of the scar tissue and a better aesthetic outcome.\textsuperscript{10} Based on this background, this literature review will compare the aesthetic outcomes between the Millard and Fisher techniques in cleft lip surgery.

**METHODS**

The literature review uses studies published online on three electronic data sources, namely PubMed, Cochrane Library, and Google Scholar, using the keywords “cleft lip surgery,” “Millard,” “Fisher,” “aesthetic outcome,” and “comparison.” A study search was carried out using the following PICO criteria:

- **P (Population)** = unilateral cleft lip patients
- **I (Intervention)** = Millard’s cleft lip surgery technique
- **C (Comparison/Control)** = Fisher’s cleft lip surgery technique
- **O (Result)** = post-operative aesthetic outcome.

The results of the studies that match the search criteria are then analyzed using a narrative synthesis to produce a literature review.

**RESULTS**

**Embryology and clinical anatomy of cleft lip**

At four to seven weeks of gestation, there is a fusion between the medial nasal portions of the frontonasal process to form the intermaxillary segment consisting of the premaxilla and prolabium. At the seventh gestational week, apoptosis occurred in the epithelium of the medial nasal and maxillary ridges that form the upper lip, as shown in Figure 1A. Failure of fusion between the medial nasal prominence and the ipsilateral maxillary prominence will result in a unilateral cleft lip. If it occurs on both sides, it will result in a bilateral cleft lip. The ratio of left, right, and bilateral unilateral cleft lip occurrences is 6:3:1. The orbicularis oris is a complex muscle that helps us eat, speak, and maintain oral tone. This muscle consists of four quadrants, the upper, lower, left, and right, each consisting of the smaller pars marginalis and the larger peripheral pars.\textsuperscript{2,5}

In normal lips, the center of the philtrum is flanked by a symmetrical

![Figure 1](image1.png)

**Figure 1.** (A) Embryology of the primary palate. Failure of fusion of the medial nasal prominence with the ipsilateral maxillary prominence will result in a unilateral cleft lip. (B) Anatomy of the outer lip. (C) Infants with an incomplete unilateral cleft lip. (D) Infants with a complete unilateral cleft lip.\textsuperscript{2,5}

![Figure 2](image2.png)

**Figure 2.** Millard’s surgical technique on the unilateral cleft lip (A) Surgical signs, (B) flap technique performed, and (C) post-operative view.\textsuperscript{1}
the columella. The cleft and the healthy, placing the scar parallel to the philtrum, restoring function and orientation of the orbicularis oris muscle, restoring the labial buccal sulcus, balancing and repositioning of the ala nasi base, raising the lower lateral cartilage that is depressed at the nostrils, and leveling the maxillary segments that are usually hypoplastic. The surgical scar must be positioned on the natural line of the lips and the nasolabial complex. The nasal boundaries should be made with a balanced curve, and the alar bases should be symmetrical when viewed from the front.5,6

**Millard technique**

The Millard technique was first introduced by Dr. D. Ralph Millard, Jr., in Korea in 1958 with the rotational and advancement flaps principle. In this surgical technique, rotation-advancement is performed to produce a balanced lip vertical length and an equal Cupid's bow on the left and right without disturbing the continuity of the philtrum. This technique is carried out with two stages of flap: rotational flap and advancement.5,6,11 The rotational flap is made using a curvilinear incision directed along the medial element of the lip, such that it reflects the non-cleft palate on its lower side. Then a curved incision is made in the philtrum area, allowing caudal rotation of the apex of Cupid's bow on the cleft side. A triangular flap advancement from the lateral side of the lip is then used to cover the resulting defect. The triangular section of skin on the lateral side of the rotational flap forms the columella base flap, or C-flap, which is then rotated cranially to reconstruct the cleft nostril. Millard stated that the rotation on Cupid's bow was often inadequate, causing a defect in the form of a back cut. The resulting rectangular defect can be filled by caudal rotation of the C-flap.6,11

The main appeal of this technique is its "cut-as-you-go" approach and the good preservation of Cupid's bow and philtrum. On the lower lip, the scar reflects the philtrum on the non-cleft side. However, the scar on the upper lip fails to develop a normal philtrum shape. In addition, this technique can also form excessive scars at the base of the nose. And if the C-flap fails to cover the defect, nostril stenosis

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**Cleft lip surgery**

Cleft lip surgery (cheiloplasty) is an operative procedure to close gaps in the lips. Definitive cheiloplasty can be carried out using the principles of a child’s age of at least three months or 10 weeks, a minimum weight of 5 kilograms or 10 pounds, and a minimum hemoglobin level of 10 grams/dL, known as the “rule of ten.”6 Operations on the cleft lip or cheiloplasty in children were performed under general anesthesia using an endotracheal tube positioned inferiorly outside the operating area. Surgery can be performed under local anesthesia in cooperative adult patients. During surgery, the patient is slightly tilted upwards so that the area to be operated on is perpendicular to the operator’s line of sight. There are several surgical techniques, including the Rose-Thompson technique, the quadrangular flap technique, the triangular flap technique, the Millard technique, and the Fisher technique. However, the most widely used technique is the Millard technique, which uses the rotational and advancement flaps principle.7,10

Although several surgical techniques can be performed, the principle and purpose of the operation remain the same, namely balancing Cupid’s bow, equalizing the vertical height of the lip between the cleft and healthy parts, equalizing the height of the vermilion on other repaired parts, maintaining the philtrum and dimples, and equalizing the length of the philtrum that arises from Cupid’s bow and curves toward the base of the columella. Whereas in cases of unilateral cleft lip, Cupid’s bow remains on the medial part of the lip. The height of the lip, as measured from the cleft side to the base of the columella, is usually less, resulting in a slanted Cupid’s bow. There is also a vermilion difference in cleft lip height. The height of the lateral portion of the lip, as measured from the subalar to Noordhoff’s point, will also differ greatly between the cleft and non-cleft sides. The transverse length on the lateral side is always shorter than on the non-cleft side. The lateral part of the lip is also hypoplastic, as shown in Figures 1C and 1D.2,5

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**Figure 3.** Fisher’s surgical technique on the unilateral cleft lip (A) Surgical signs, (B) flap technique performed, and (C) post-operative view.1
Table 1. Study evaluating the aesthetic outcome of the Millard and Fisher technique in cleft lip surgery

<table>
<thead>
<tr>
<th>Study</th>
<th>Study design and sample</th>
<th>Comparison parameters</th>
<th>Millard technique</th>
<th>Fisher technique</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elmghraby MF et al., 2021, Egypt¹⁵</td>
<td>A prospective cohort study of 40 unilateral cleft lip patients.</td>
<td>Lip height and width, vermilion height, alar base between normal and cleft sides, and scar appearance according to Steffensen criteria.</td>
<td>• Scar appearance is otherwise good in 65% of cases.</td>
<td>• Scar appearance is otherwise good in 90% of cases.</td>
</tr>
<tr>
<td>Elprince NH et al., 2010, Libya⁴</td>
<td>A randomized clinical trial, unilateral cleft lip patients aged 1–24 months.</td>
<td>Lip dimensions (width, height lateral, medial, and central), nasolabial appearance and nasal symmetry.</td>
<td>• There is an increase in all lip dimensions, especially the lateral, and an improved nasolabial appearance with reduced nasal dimensions.</td>
<td>• There is an improvement in the nasolabial appearance and increased lip dimensions compared to before surgery.</td>
</tr>
<tr>
<td>Hoffmann D et al., 2011, USA¹³</td>
<td>A prospective study of 20 unilateral cleft lip patients</td>
<td>The symmetry of Cupid's bow, nose, vermilion border, presence of hypertrophy or discolored scars, and suture marks.</td>
<td>• The appearance of the nose is better than before surgery.</td>
<td>• Fisher's technique gives a better overall appearance than Millard's.</td>
</tr>
<tr>
<td>Patel TA et al., 2019, USA¹⁴</td>
<td>A prospective cohort study of 22 cleft lip patients was conducted, with 12 patients using the Millard technique and 10 using the Fisher technique.</td>
<td>Lip height and width, vermilion height, alar base width, and according to Steffensen criteria.</td>
<td>• Significant differences in lip height, vermilion height, and alar base length between the Millard and Fisher techniques were found to be higher in the Millard technique.</td>
<td>• Millard has a better vermilion edge. Better nose shape than Millard.</td>
</tr>
<tr>
<td>Suchyta M et al., 2020, USA¹⁵</td>
<td>Twenty-nine patients with cleft lips were subjectively assessed by 254 participants.</td>
<td>Assessment of scars, satisfaction with the result of surgery using a Likert scale, scar severity, and nasal symmetry.</td>
<td>• Scars were seen in patients treated with the Millard surgical technique, according to 92.0 1.5% of respondents.</td>
<td>• As many as 70.3±8.6% of respondents stated that scars were seen in patients with the Fisher operation technique.</td>
</tr>
</tbody>
</table>

can result. Because an aggressive incision at the alar base of the cleft can result in significant forgetting, it should be avoided. The length of the lateral lip incision should be made of sufficient length to match the total length of the rotational incision. The surgical wound should be covered with sutures to prevent adhesions and moist gauze for one day. This serves to absorb the seepage of blood or serum. One day after surgery, the wound can be treated with antibiotic ointment.¹⁵ Several surgical complications that can arise are wound dehiscence and wound expansion due to excessive tension in the operating area, premaxillary malposition, and vermilion deficiency due to retraction along the lip correction line, as well as thickness-related lip asymmetry, which can be avoided by precise intraoperative measurement of the precise anatomic distance of the lip arches. Postoperative infection is rare because the facial area is well vascularized.⁶ ⁸ ¹¹

**Fisher technique**

Fisher's technique, introduced by Dr. David M. Fisher in 2005 in Canada, used the principle of anatomical subunit approximation.¹ This technique aims to produce scars on the ideal surgical line to produce a better aesthetic appearance. In this technique, the philtrum column on the medial side of the lip is extended through a small incision in the white roll, which is then closed by a triangular flap on the lateral side of the lip. The suture line runs from the vermilion border to the advancement of the triangular flap to the columellar base, curving to the nasal base. Fisher's technique allows the correct scar to be located on the anatomical subunit. Therefore, the incision on the medial side
No scars formed along the columella, the floor of the nose, or ala nasi. In addition, the incision line is simple and continuous without the T-point. Fisher's technique uses a triangular cutaneous incision over a white roll to directly adjust the medial lip's height. In this technique, the traditional rotational advancement is not performed and only supports the superior rotational technique to increase the vertical height of the lips. Fisher's technique can balance the vertical length of the lips and Cupid's bow. This technique also maintains the integrity of the lip-columella fold, does not cause scars on the columella, ala Nasi, and allows the operator to determine the ideal position of the Noordhoff point. The operator must carefully calculate the dimensions of the operating area in the inferior triangle so as not to make the incision longer than necessary.

Aesthetic outcome comparison between Millard and Fisher technique

Several studies have compared the aesthetic outcomes of the Millard and Fisher techniques in unilateral cleft lip surgery. From the results of a literature search, five studies were found that compared the aesthetic results of the Millard and Fisher techniques in unilateral cleft lip surgery. Of the five studies, one randomized clinical trial, three prospective cohort studies, and one cross-sectional study evaluated the aesthetic results between the two cleft lip surgery techniques, as shown in Table 1 below.

Of the five studies that compared the Millard and Fisher techniques, overall, it was stated that both the Millard and Fisher techniques resulted in improved aesthetic appearance for cleft lip patients. However, Fisher's technique produces a better overall appearance than Millard's. As in the clinical trial by Elprince NH et al., which involved 12 pediatric patients aged 1 to 24 months with unilateral cleft lip. Patients were divided into two groups; six underwent cleft lip surgery using the Millard or Fisher techniques. The post-operative aesthetic outcome comparison was carried out based on quantitative and qualitative assessments between the cleft and normal sides. This study found
that the nasal symmetry in both groups improved postoperatively, but better results were found in the group using Fisher's technique. Medial lip height increased in both groups but was not statistically significant. A statistically significant difference was found in the lateral lip height. The study stated that the nasolabial appearance in both groups was quite good. Lip dimensions have also improved since before surgery. Lateral lip height was found to be better with the Millard technique. However, in terms of nasal symmetry, better results were found in the Fisher group.8

There are two studies, namely the study by Elmaghraby MF et al. and the study by Patel TA et al., which conducted aesthetic outcome assessments using the Steffensen criteria.12,14 The Steffensen criterion is a criterion for assessing the quality of the post-operative cleft lip using 8 parameters, namely cutaneous line symmetry, vermilion symmetry, scarring, Cupid's bow, lip length, nostril symmetry, alar dome, and alar base shape. The normal and cleft sides that had surgery were categorized into good, average, and bad, as shown in Table 2. Elmaghraby MF et al. found a higher percentage of good grades in the Fisher group than in Millard's (90% vs. 65%), and the quality of surgery with average or poor grades was lower in the Fisher group compared to Millard.12 The study by Patel TA et al. also found similar results, namely, that in the group of patients with the Millard technique, more asymmetrical results were found in terms of lip height, vermilion, and alar bases when compared to the Fisher technique group. The study also concluded that the Fisher technique produced a better aesthetic outcome and was independent of the severity of the cleft.14

### DISCUSSION

This prospective cohort study by Hoffmann D et al. followed up on the patients for 2.5 years. It evaluated the esthetic outcome with the following criteria: Cupid's bow symmetry, nose, vermilion margins, hypertrophy or discolored scars, and suture marks. The study found minimal differences in velum edges for the two groups, but Fisher's technique provided a better overall appearance. The study also concluded that Fisher's technique is superior to Millard's technique.13

The last study by Suchyta D et al. involved 29 patients with cleft lips and was subjectively assessed by 254 participants. The assessment was carried out by evaluating the scar, satisfaction with the result of surgery, the scar's severity, and the nose's symmetry. The assessment results showed that the percentage of surgical scars was more clearly visible in the Millard group than in the Fisher group (92.0 ±1.5% vs. 70.3±8.6%). In addition, the scar severity score was also higher in the Millard group than in the Fisher group (2.64± 0.30 vs. 1.88±0.31). Meanwhile, no significant difference was found between the two techniques in terms of nasal symmetry.15

Surgery for cleft lip is fundamental to improving physiological function, aesthetic appearance, and social and psychological health in children with cleft lips. Multidisciplinary management is needed to produce good therapeutic and clinical outcomes. The Millard technique, the rotational advancement technique, is the most commonly performed cleft lip surgery technique.1.5,16 This technique is straightforward, with minimal use of markers and operating area measurements. The Millard technique is called a technique that can be modified easily by the operator (cut-as-you-go) in that it removes less tissue, improves nasal access, and allows preservation of the philtrum and Cupid's bow.1,6 Meanwhile, Fisher's technique is a more recently developed technique that applies the anatomical subunit approximation technique. There are several advantages and disadvantages to both techniques.1.10 The Millard technique aims to preserve the patient's original congenital philtrum and Cupid's bow locations, where only rotation is performed to return them to their original position. This technique is more flexible for the operator, allowing for modification and manipulation while maintaining the operation's main objective, resulting...
in minimal tissue wastage and making secondary corrections easier.5,7

Whereas Fisher’s technique divides the cleft into two distinct anatomical units, namely the nasal (consisting of the nasal base and alar rim) and the lip (the white roll, vermillion, and philtrum concavity), with very precise measurements and several equivalent dimensions possible on the anatomical subunit before and after surgery.17,19 Therefore, the clinical outcome of Fisher’s technique is more predictable in most cases. This technique produces scar tissue at the anatomical location from the top of Cupid’s bow to the base of the nose. In addition, the scar is also covered by the columella base and inside the white roll. However, compared to the Millard technique, it is more complex and requires as many as 25 operational markers in its implementation.20,21

CONCLUSION

Based on the literature review results, it can be concluded that the Millard and Fisher techniques both improve the aesthetic appearance of cleft lip patients, especially those with unilateral cleft lips. However, most of the better aesthetic results were found in the Fisher technique in terms of minimal surgical scars, nose symmetry, vermilion, Cupid’s bow, more nasality, and better Steffensen grading than the Millard technique.

CONFLICT OF INTEREST

The author declares no conflict of interest in writing this literature review.

ETHICAL CONSIDERATIONS

None.

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AUTHOR CONTRIBUTIONS

All authors have the same contribution, from preparing ideas and searching the literature to writing a literature review.

REFERENCES