Original Article

Comparative Study between Modified Millard and White Roll Vermilion Flap Techniques in Unilateral Lip Repair: A Randomised Controlled Study

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Abstract

Background: Cleft lip and palate, which affects 0.5–1.6 out of every 1000 live births, is the most prevalent congenital defect of the head and neck. Several approaches, including quadrangular flaps, triangular flaps and rotation-advancement procedures, White Roll Vermilion Turn Down Flap (WRV flap) from the lateral lip element were employed by Mishra to modify Millard's technique to create the vermilion and white roll on the medial lip segment. This study aimed to use the anthropometric measurements taken pre- and post-operation to evaluate quantitative assessment of modified Millard technique compared with WRV flap technique in unilateral cleft lip (UCL) repair. **Materials and Methods:** Prospective, randomised controlled study recruited infants scheduled for UCL repair. Infants aged 3–6 months, either complete or incomplete deformity. A total of 42 patients were randomized in 1:1 ratio to undergo either WRV flap technique (group A) or modified Millard technique (group B) and another control included 21 age-matched healthy children. We compared WRV flap procedure to Modified Millard's procedure in terms of both qualitative (another surgeon's opinion) and quantitative (anthropometric) evaluation. **Results:** Vertical lip length and philtral lip height significantly longer in Millard group (B) than WRV flap group (A) in immediate postoperative assessment and nasal width was significantly wider in WRV flap group (A) than Millard group (B) in 3-month post-operative assessment. The lip shape, the vermilion shape was better in Millard technique than WRV flap technique; however, this was statistically insignificant. However, no major difference in the overall results between the WRV flap and Millard rotation-advancement repairs. **Conclusion:** Anthropometric measurement of surgical outcome evaluates the surgical technique used and helps to compare between cleft and non-cleft side showing the degree of deformity and we used subjective assessment to analyse facial aesthetics. Overall results demonstrate no significant differences between modified Millard technique and WRV flap technique.

Keywords: Millard technique, unilateral cleft lip, white roll vermilion turn down flap technique

Introduction

Cleft lip and palate, which affects 0.5–1.6 out of every 1000 live births, is the most prevalent congenital defect of the head and neck.[1] When the palatal shelves and the medial nasal process fail to fuse together between the 4th and 8th week of development, unilateral cleft lip (UCL) and palate results.[2] Lip muscles are disrupted and abnormally inserted to the columellar base on the non-cleft side and from the alar base on the cleft side. The nasal floor and alveolus on the cleft side may be deficient or absent.[2] Making a symmetrical lip with a small scar and restoring the face's natural appearance and functional structure are the objectives of cleft lip repair.[3]

Over the past century, numerous surgical repair approaches have been developed.[4] The first known cleft-lip repair was a straight-line suture and a simple cut along the cleft borders, followed by a curved incision to lengthen the lip.[5] The drawbacks of straight-line restorations included vertical scar contracture and lip notching.[5] Several approaches, including quadrangular flaps, triangular flaps, and rotation-advancement procedures, were established in the middle of the twentieth

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century.[2] Tennison-triangular Randall's approach, which relies on mathematical calculations and lessens vertical lip contraction, is the most popular triangular technique; however, the scar violates the philtrum.[6] The Millard rotation-advancement approach was created to align the scar with the naturally occurring philtral column. The initial rotation-advancement technique underwent various variations.[7,8] Vermilion notching and a scar along the philtral line can be noticed in Millard's repair. The Cupid's bow is distorted and the white roll up is pulled up by scar contracture.[9]

White Roll Vermilion Turn Down Flap (WRV flap) from the lateral lip element was employed by Mishra to modify Millard's technique to create the vermilion and white roll on the medial lip segment.[9] If there is medial hypoplastic vermilion or partial medial vermilion loss, the WRV flap procedure is also used.[9]

Anthropometric evaluation of surgical technique with comparison of cleft and non-cleft sides is a method of measuring surgical outcome.[3,6] Farkas *et al.* provided normative measurements of the lip and nose.[10] Qualitative assessment is subjective assessment and can analyse facial aesthetics and appearance impairment using scales, indices, scoring systems and rankings.[11] Both direct and indirect techniques can be used to perform anthropometric measurements and qualitative assessments. The most accurate anthropometric method is direct anthropometry, which is the gold standard but requires general anaesthesia in young kids. Two dimensional (2D) images can be used for indirect anthropometry; however, calibration and image distance standardisation are needed for linear measurements.[12]

In our study, we compared the modified Millard technique to the WRV flap procedure in terms of both qualitative (another surgeon's opinion) and quantitative (anthropometric) evaluation.

The goal of cleft lip repair is making a symmetrical lip with minimal scar restoring the normal appearance of the face and functional anatomy.

Our objectives in this study was to present a new unpopular technique in UCL repair (Mishra technique) and compare it with the popular technique that most surgeons used (Modified Millard) and to see the differences in the outcome between them and which was better and which simulated the normal anatomy of the lip by using two assessment techniques, qualitative and quantitative evaluation.

Moreover, we tried to demonstrate different assessment techniques for any similar studies in the future and making it standard.

Materials and Methods

The present manuscript was prepared in concordance with the recommendations of strengthening the reporting of observational studies in epidemiology.[10] The study's protocol was approved and registered by the local ethics committee of Cairo University Teaching hospitals (Ref N100-2018). Parents of eligible patients signed written informed consents before study enrolment. Informed consent from parents of all patients was taken before starting our study.

Study design and patients

This was a prospective, randomised controlled study. Forty-two patients with UCL who presented to outpatient clinics of Cairo University Specialized Paediatric Hospital between March 2020 and September 2022 were included in the study. Patients were randomized into two groups by using card choice; Group A repaired by WRV flap technique and Group B repaired by Modified Millard technique. A control group included 21 age-matched healthy children from 'growth follow up clinics'.

Infants were included if they aged between three to 6 months and had UCL deformity, either complete or incomplete. Infants with or without associated cleft palate were included. We excluded infants aged <3 months or more than 6 months, infants with recurrent UCL, median cleft lip, facial cleft cases, BCL and/or patients with major congenital anomalies or syndromic cases.

Methods

All the patients were subjected to preoperative clinical assessment including history taking and clinical evaluation. Pre-operative examination of the deformity included with Millard modification on Kernhan and stark cleft lip and palate modification [Figure 1].[13]

Pre-operative investigations included routine pre-operative blood investigations including haemoglobin estimation and coagulation profile.

Photography standards

Preoperative photos were taken in frontal and basal positions. Each frontal position photograph was taken using the camera positioned 50 cm from the subject, the subjects were positioned so that the lens of the camera is perpendicular to the interpupillary line and 50 cm from subject in frontal position, and 45 degrees in submental (basal) position, where a ruler and the endotracheal tube in the background were used for calibration [Figure 2]. Photograph of subjects has been taken with a digital camera (Canon EOS Rebel T5 Digital SLR Camera with 18 Megapixels and 18–55 mm Zoom Lens). The photograph was then imported into Adobe photoshop_ CC_2020 for analysis, and also some mobile applications were helpful like: image meter and prime ruler with accurate measurements [Figure 3].

Perioperative details

All patients received general anaesthesia with midline oral endotracheal intubation. Ointment eye protection and oropharyngeal packing were always checked. Patients were placed in the supine position with neck slightly extended using small shoulder roll and with supporting the head using ring cushion. The operating table was tilted into reverse Trendelenburg position. Face was prepared and draped.

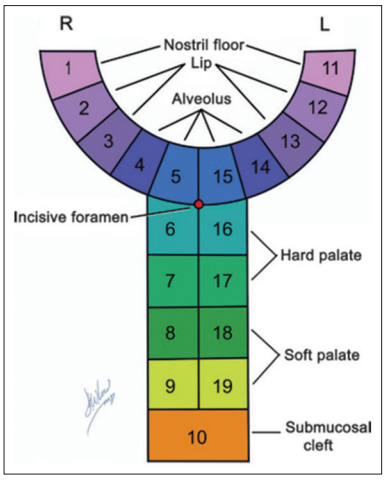


Figure 1: Kernahan "striped Y" diagram[13]



Figure 2: Image meter application for measurement



Figure 3: Frontal view (left), nasal view (right) and the endotracheal tube and ruler calibration

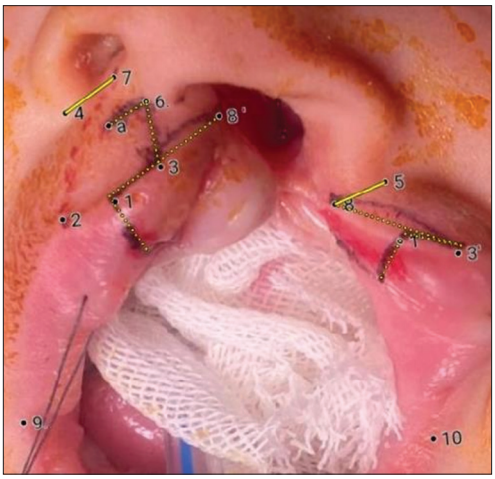


Figure 4: Nasal and vermilion border points

Operative details of two surgical techniques

One of the surgeons exclusively performed WRV flap technique, while the other exclusively performed Modified Millard's rotation-advancement technique.

WRV flap, WRV flap technique:

Landmarks

Nasal and vermilion border points

Point 1: lowest point of Cupid's bow (non-cleft side). Point 2: 1st peak of Cupid's bow (non-cleft side). Point 3: 2nd peak of Cupid's bow (non-cleft side). Point 4: alar base (non-cleft side). Point 5: alar base (cleft side). Point 6: midpoint of the columella. Point 7: atop of philtral column. Point 8: atop of philtral column. Point 9: oral commissure (non-cleft side). Point 10: oral commissure (cleft side). Point 3': corresponding peak of Cupid's bow (cleft side). Point 8': corresponding atop of philtral column. Point a: Back cut in non-cleft side [Figure 4].

Lines

At non-cleft side

Curvy linear line starting at 1 mm above point 3 to point 6 with back cut to a, not reaching the non-cleft side philtrum was drawn.

A line was drawn 1 mm above point 1–3.

Mucosal line

Line from point 1 perpendicular to the vermilion border to the gingivolabial sulcus was drawn.

At cleft side

A line was drawn starting 1 mm above points 1' to 3' (same distance 1–3 of non-cleft side).

A straight line was drawn from point 3' to point 8.

A line from point 8 to point 5 was drawn which was the same length of the non-cleft nostril point 4–7.

Mucosal line

Line from point 1' perpendicular to the vermilion border and then with mucosal crease to the vestibule [Figure 5].

Incision

Incision of the cutaneous and mucosal tissues [Figure 6]:

We used both the 11 blades with 15 blades. We did not make incision deeper than the sub mucosal or subcutaneous layer. After cutting during this stage and removing the discarded tissue: equilateral triangle c flap and releasing incision are created.

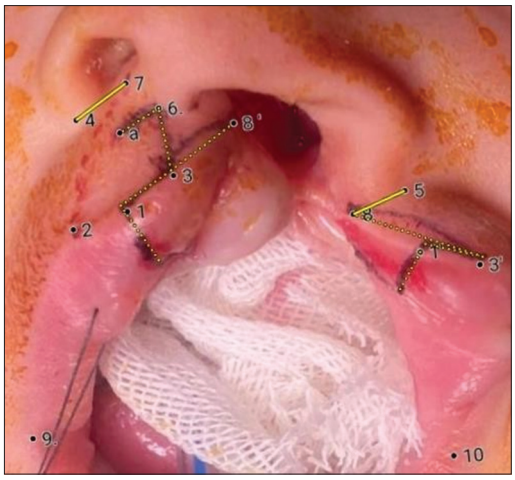


Figure 5: Lines of WRV flap Technique (Skin triangle flap lines and Mucosal lines)

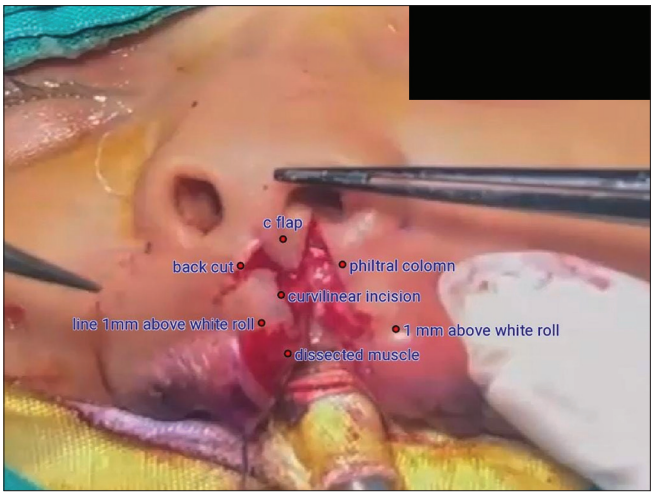


Figure 6: Incision of the cutaneous, mucosal and muscle tissues



Figure 7: Suturing of WRV flap Technique



Figure 8: Nasal and vermilion border points of Modified Millard's technique

Dissection of the muscle

We dissected the orbicular muscle from the skin and the mucosa over a distance by one cutting movement, fixing the lip firmly between thumb and index finger and taking special attention to free the muscle completely from abnormal insertion from the columellar base on the non-cleft side and from the alar base on the cleft side.

Suturing

Nasal floor suturing

We found that if we took a stay at corresponding points of the nostril and then took every corresponding point posterior to it using 5.0 vicryl^{R} that nose was more symmetrical.

Alar base suturing

By position the alar base using a stay suture of 4.0 vicryl^{R}. This suture was important for two reasons. It levelled both nostrils on the same height, and it determined the width of the nostril.

Muscle layer suturing

The suturing of the muscle was carried out using 4.0 vicryl^{R} in an inverted interrupted fashion every corresponding point together starting from white roll level upwards. The upper most suture was also fixed to the periosteum.

Cutaneous and mucosal suturing

Repair was completed by suturing these points together Point 8 with point 8', point 3 with point 3' and point 1 with point 1' and tip of c flap with point a. mucosal repair in midline with vertical mattress sutures The suturing was carried out using 6.0 prolene^{R} [Figure 7].

The suturing of mucosal lip was carried out using 6.0 prolene^{R}.

Modified Millard technique

Landmarks

Nasal and vermilion border points

Point 1: lowest point of Cupid's bow (non-cleft side). Point 2: 1st peak of Cupid's bow (non-cleft side). Point 3: 2nd peak of Cupid's bow (non-cleft side). Point 4: alar base (non-cleft side). Point 5: alar base (cleft side). Point 6: midpoint of the columella. Point 7: atop of philtral column. Point 8: atop of philtral column cleft side. Point 9: oral commissure (non-cleft side). Point 10: oral commissure (cleft side) [Figure 8].



Figure 9: Line of Modified Millard's Technique (rotational, advancement flap lines and mucosal lines)



Figure 10: Suturing of Modified Millard Technique



Figure 11: Preoperative anthropometry reference points



Figure 12: Post-operative anthropometry reference points

Lines

At non-cleft side

Rotational flap

A curvilinear line is designed from point 3 to point 6 and then back cut at point 3 to a Columellar flap (c-flap): it is an area bounded by two lines: a curvilinear line of rotational flap and a line from point 3 to nasal sill along white roll to 8'.

Mucosal line

It is a line from point 3 perpendicular to the vermilion border to the vestibule with back cut between wet and dry junction of mucosal layer.

At cleft side

Advancement flap: It is a curved line from point b to point 8 along white roll then a line from point 8 to point 5 along alar base, with small triangle at point 3 and b apex at c.

Mucosal line

It is a line from point 3 perpendicular to the vermilion border and then with mucosal crease to the vestibule with triangle between wet and dry junction of the mucosal layer [Figure 9].

Incision

Incision of the cutaneous and mucosal tissues

For the cutting procedure, we used number 11 blade and number 15 blade. We did not make incisions deeper than the sub mucosal or subcutaneous layer. After cutting during this stage and removing the discarded tissue, three flaps are created: advancement flap, rotational flap and c flap.

Dissection of the muscle

We dissected the orbicular muscle from the skin and the mucosa over a distance. We did this in one cutting movement, fixing the lip firmly between thumb and index finger or by using hooks and with taking special attention to free the muscle completely from abnormal insertion from the columellar based on the non-cleft side and from the alar base on the cleft side. Also we kept some dermis on it.

Suturing

Nasal floor suturing

We found that if we took a stay at corresponding points of nostril and then took every corresponding point posterior to it using a Vicryl 5-0 that nose become more symmetrical.

Alar base suturing

We positioned the alar base using a stay suture of 4.0 vicryl^{R}. This suture was important for two reasons. It levelled both

nostrils on the same height and it determined the width of the nostril.

Muscle layer suturing

The sutures of the muscle were carried out using 4.0 Vicryl[R] in an inverted interrupted fashion every corresponding point together starting from white roll level upwards. The upper most suture was also fixed to the periosteum.

Cutaneous and mucosal suturing

Repair was completed by suturing these points together:

- Point 8 with point 6
- Point c with point a
- Point 3 with point 3' and
- Tip of c flap with point 5.

Mucosal triangle in cleft side with back cut in mucosa of non-cleft side. The suturing was carried out using 6.0 Vicryl[R].

The suturing of mucosal lip was carried out using 6.0 Vicryl[R] [Figure 10].

For qualitative assessment, we used other surgeon preference (Blind without knowing the used technique) and give it score

- Lip shape score (0–10): 0 bad, 10 perfect shape
- Scar appearance score (0–10): 0 very bad scar, 10 no evident scar
- Vermillion thickness score (0–10): 0 very bad, 10 perfect thickness.

Complications

- Thin vermilion thickness
- Thick vermilion thickness
- Double white roll
- hypertrophic scar
- Lip notching.

Quantitative assessment

Anthropometric measurements were done.

Pre-operative

Comparison of preoperative measurements of the cleft side versus the non-cleft side and the control group to know the impact of cleft deformity immediate and 3 months post-operative.

Comparison of post-operative measurements of the cleft side versus the non-cleft side and the control group to assess surgical outcome immediately post-operative and after follow-up.

Anthropometric analysis

The following anthropometric measurements were taken.

Pre-operative

We compared the vertical lip height (VLH), horizontal lip length (HLL), nasal width (NW) and vermilion width (VW) between the groups.

Pre-operative anthropometry reference points:

Pre-operative lip assessment

1. VLH on non-cleft side: measured from the ala base to the peak of Cupid's bow on the same side (point 2–5)
2. VLH on cleft side: measured from the ala base on the cleft side to a point where the white roll begins to disappear (point 1–4)
3. HLL on non-cleft side: measured from peak of Cupid's bow on the non-cleft side to the ipsilateral commissure of the mouth (point 5–7)
4. HLL on cleft side: measured from where the white roll starts to fade out to the ipsilateral commissure (point 4–6)
5. NW: measured from ala base to the midpoint of the columella for cleft side (point 2–3) and non-cleft side (point 1–3)
6. Total NW: measured from the ala base on the cleft side to the ala base on the non-cleft side (point 1–2)
7. Vermilion height: measured from the peak of Cupid's bow to the oral mucosa on the cleft side (point 4–8) and non-cleft side (point 5–9) [Figure 11].

Post-operative

Post-operative lip assessment

1. VLH: measured from the ala base to the peak of Cupid's bow, for both the cleft (point 1–4) and non-cleft sides (point 2–5)
2. HLL: measured from the peak of Cupid's bow to the commissure for both the cleft (point 4–6) and non-cleft sides (point 5–7)
3. NW: measured from the ala base to the midpoint of the columella for both the cleft (point 1–3) and non-cleft sides (point 2–3)
4. Total NW: measured from the ala base on the cleft side to the ala base on the non-cleft side (point 1–2)
5. Philtral height (PH): measured from the peak of Cupid's bow to the midpoint of the columella for both the cleft (point 3–4) and non-cleft sides (point 3–5)
6. Vermilion height: measured from the peak of Cupid's bow to the oral mucosa on the cleft side (point 4–9) and non-cleft side (point 5–10) [Figure 12].

Statistical analysis

Statistical package for social sciences (SPSS) version 24 for windows was used for the analysis. Numerical data were expressed as mean and standard deviation (SD) if normally distributed. The Chi-square test was used to test the association between categorical variables. Fischer exact test was used in the case of violation of assumptions. Independent sample *t*-test and Pearson correlation were used for testing the parametric numerical variables difference between two groups. Repeated-measures ANOVA was used to test the association between paired parametric numerical data of the two groups. $P < 0.05$ was considered statistically significant.

Results

Characteristics of patients

We included and 42 patients randomised equally in the WRV flap and Millard groups, and 21 healthy controls. The age ranged from 3 to 6 months with the highest percentage of patients (47.6%) aged 3 months. Males represented 71.4% and 61.9% for the WRV flap and Millard groups, respectively.

The left incomplete cleft lip type accounted for 54.8% of the pathologies in our groups. The detailed characteristics are shown in Table 1.

Preoperative anthropometric measurements

The VLH was significantly shorter in the side of the cleft for both the WRV flap (7.72 ± 0.83) and Millard (8.52 ± 1.01) groups compared to the non-cleft side (WRV flap = 8.19 ± 1.18, Millard = 8.88 ± 1.16) and to the controls (9.51 ± 1.36).

VLH was also significantly shorter in the WRV flap (8.19 ± 1.18) group when compared to the Millard group (8.88 ± 1.16). HLL was significantly shorter in the cleft side of both the WRV flap (11.11 ± 1.84) and Millard (10.61 ± 1.8) groups when compared to non-cleft side and to the controls (14.75 ± 2.75). However, no significant difference in HLL between the Millard and WRV flap groups. Furthermore, the VW was significantly thinner in the cleft side for WRV flap (4.69 ± 1.07) and Millard (4.8 ± 1.14) groups in comparison to the non-cleft side (WRV flap = 5.2 ± 1.27, Millard = 5.14 ± 1.11). Moreover, VW was significantly thinner in the WRV flap group in comparison to the controls. The details of preoperative measurements are shown in Table 2.

Immediate post-operative anthropometric measurements

We compared the groups regarding the VLH, HLL, NW, PH and VW. The VLH was significantly shorter in the WRV flap group in the cleft side comparing to the non-cleft side and to the controls. Furthermore, the WRV flap group had shorter VLH than the Millard group in the cleft side with non-significant *P* value.

Regarding the NW, WRV flap group was wider in comparison to the Millard group. The PH in the Millard group was longer in the cleft side compared to the non-cleft side, WRV flap group and controls. No significant difference was found between the groups in the HLL and VW. The results of the post-operative anthropometric measurements are shown in Table 3.

Furthermore, in our study, we found that vertical lip length, HLL and vermillion width were significantly greater in cleft side than pre-operative measurement of cleft side in both groups. Furthermore, NW was found to be narrower on the cleft side than pre-operative measurement of cleft side in both groups.

Three months post-operative anthropometric measurements

We compared the groups regarding the VLH, HLL, NW, PH and VW.

The VLH was significantly shorter in the cleft side of the WRV flap and Millard groups in comparison the non-cleft sides.

HLL was significantly shorter in the cleft side of the Millard group compared to the non-cleft side and to controls.

The NW in the WRV flap group was significantly wider in the cleft side compared to the non-cleft and controls, but only wider in comparison to the controls in the Millard group.

PH was significantly longer and VW was significantly thicker in the cleft sides of Millard and WRV flap groups in comparison to the non-cleft sides. The results of the 3 months anthropometric measurements are shown in Table 4.

This may be attributed to the severity of WRV flap group cases was more severe than Millard group.

Anthropometric measurements over 3 months follow-up

The overall changes in the anthropometric measurements were a significant increase in the VLH, HLL and VW in both groups. The NW showed significant decrease overtime in both groups. The results are summarized in Table 5.

Table 1: Characteristics of the patients

	n (%)	WRV flap group, *n* (%)	Millard group, *n* (%)	*P*
Age (months)				
3	20 (47.6)	10 (47.6)	10 (47.6)	0.381
4	9 (21.4)	3 (14.3)	6 (28.6)	
5	5 (11.9)	2 (9.5)	3 (14.3)	
6	8 (19)	6 (28.6)	2 (9.5)	
Gender				
Male	28 (66.7)	15 (71.4)	13 (61.9)	0.744
Female	14 (33.3)	6 (28.6)	8 (38.1)	
Cleft lip type				
Right complete	2 (4.8)	0	2 (4.8)	0.293
Right incomplete	7 (16.7)	5 (23.8)	2 (9.5)	
Left complete	10 (23.8)	6 (28.6)	4 (19)	
Left incomplete	23 (54.8)	10 (47.6)	13 (61.9)	

WRV: White roll vermilion

Table 2: Pre-operative anthropometric measurements

Parameter	Control group, mean±SD	WRV flap group, mean±SD		*P* value for WRV flap versus control	Millard group, mean±SD		*P* value for Millard versus control	*P* value for WRV flap versus Millard	
		Cleft	Non-cleft		Cleft	Non-cleft		Cleft	Non-cleft
Vertical lip height (mm)	9.51±1.36	7.72±0.83	8.19±1.18	<0.001	8.52±1.01	8.88±1.16	0.011	0.008	0.063
P		0.018		<0.001					
Horizontal lip length (mm)	14.75±2.75	11.11±1.84	12.5±1.92	<0.001	10.61±1.8	12.59±2.13	<0.001	0.378	0.880
P		0.001		0.003					
Vermilion width (mm)	5.08±1.32	4.69±1.07	5.2±1.27	0.298	4.8±1.14	5.14±1.11	0.464	0.749	0.878
P		<0.001			<0.001				

WRV: White roll vermilion, SD: Standard deviation

Table 3: Immediate post-operative anthropometric measurements

Parameter	Control group, mean±SD	WRV flap group, mean±SD		P value for WRV flap versus control	Millard group, mean±SD		P value for Millard versus control	P value for WRV flap versus Millard	
		Cleft	Non-cleft		Cleft	Non-cleft		Cleft	Non-cleft
Vertical lip height (mm)	9.51±1.36	7.83±0.81	8.62±1.48	<0.001	9.09±1.21	9.39±0.95	0.710	0.002	0.168
P		<0.001		0.501					
Nasal width (mm)	7.49±0.87	7.55±1.15	6.45±1.16	0.845	6.78±0.95	7.42±1.42	0.016	0.046	0.053
P		0.375		0.872					
Philtral height	9.13±2.03	8.81±1.41	7.64±1.19	0.557	10.05±1.34	9.25±1.42	0.091	0.049	0.005
P		<0.001		<0.001					

WRV: White roll vermilion, SD: Standard deviation

Table 4: 3 months post-operative anthropometric measurements

Parameter	Control group, mean±SD	WRV flap group, mean±SD		*P* value for WRV flap versus	Millard group, mean±SD		*P* value for Millard versus	*P* value for WRV flap versus Millard	
		Cleft	Non-cleft	control	Cleft	Non-cleft	control	Cleft	Non-cleft
Vertical lip height (mm)	9.51±1.36	9.73±1.38	10.83±1.92	0.6	9.75±1.14	10.2±1.14	0.542	1	0.545
P		<0.001		<0.001					
Horizontal lip length (mm)	14.75±2.75	14.47±2.44	15.25±2.67	0.732	13.56±1.87	14.81±2.14	0.110	0.110	1
P		0.058		<0.001					
Nasal width (mm)	7.49±0.87	11.8±2.27	8.27±1.17	<0.001	8.6±1.14	8.49±1.48	0.001	<0.001	1
P		0.009		0.341					
Philtral height (mm)	9.13±2.03	11.5±2	9.54±2.19	<0.001	10.08±1.63	9.12±1.35	0.101	0.055	1
P		<0.001		0.041					
Vermilion width (mm)	5.08±1.32	5.42±0.99	4.86±1.16	0.347	5.68±1.25	5.16±0.83	0.600	1	1
P		<0.001		0.034					

WRV: White roll vermillion, SD: Standard deviation

Qualitative assessment

The opinion of surgeons was scored regarding the lip shape, vermilion shape, scar shape and complications. Millard group had an overall better lip shape and a better vermilion thickness (near normal) compared to the WRV flap group. However, this was statistically insignificant for both the lip shape ($P = 0.207$) and vermilion shape ($P = 0.695$). The WRV flap group had a better scar shape relative to the Millard group but statistically insignificant ($P = 0.739$).

The most common complication in our study was hypertrophic scar. This occurred in six patients (28.6%) in the WRV flap group and in seven patients (33.3%) in the Millard group. Nearly half of our patients (47.6%) in both groups did not show any complication.

As regards the scar shape: WRV flap group was better healed and less evident than Millard technique. However, this was also statistically insignificant.

Table 5: Anthropometric measurements over 3 months follow-up

Group	WRV flap	*P*	Millard	*P*
VLH pre-operative	7.72 (0.83)	<0.001	8.52 (1.01)	<0.001
VLH post-operative	7.83 (0.81)		9.09 (1.21)	
VLH after 3 months	9.73 (1.38)		9.75 (1.14)	
HLL pre-operative	11.11 (1.84)	<0.001	10.61 (1.79)	<0.001
HLL post-operative	13.02 (2.23)		12.34 (2.11)	
HLL after 3 months	14.47 (2.44)		13.56 (1.87)	
NW pre-operative	12.52 (2.69)	<0.001	12.09 (3.18)	<0.001
NW post-operative	7.55 (1.15)		6.78 (0.95)	
NW after 3 months	11.08 (2.27)		8.6 (1.14)	
VW pre-operative	4.69 (1.07)	<0.001	4.8 (1.14)	<0.002
VW post-operative	5.6 (1.02)		5.17 (1.45)	
VW after 3 months	5.42 (0.99)		5.68 (1.25)	

WRV: White roll vermillion, VLH: Vertical lip height, HLL: Horizontal lip length, NW: Nasal width, VW: Vermilion width

Discussion

The goal of cleft lip repair is making a symmetrical lip with minimal scar restoring the normal appearance of the face and functional anatomy.[3] Several modifications applied to the original rotation-advancement technique.[7,8] Mishra modified Millard's technique and used WRV flap from the lateral lip element to form the vermilion and white roll on the medial lip.[9]

Farkas and colleagues provided anthropometric measurements of the lip and nose.[3] Anthropometric measurements can be

done by direct or indirect methods. Direct anthropometry is the gold standard; this is the most accurate anthropometric method. Indirect anthropometry can be done by 2D photos but requires image distance standardisation and calibration for linear measurements.[12]

In this study, we compared WRV flap and modified Millard techniques in repair of UCL cases. Our study included 42 patients, Group A (21 patients) repaired by WRV flap technique and the other Group B (21 Patients) repaired by Modified Millard technique and Control group included 21 healthy children.

In our study, we evaluated cleft repair outcomes immediate and 3 months postoperatively for each group and compared them with pre-operative measurements and with each other and with the control group. Age ranged between 3 and 6 months with no significant differences between the study groups.

When comparing between both groups, we found that:

Quantitative assessment

In our study, we made four anthropometry comparisons between two groups as following:

The comparison of pre-operative measurements of (the cleft side versus the non-cleft side) and (the control) to know the impact of cleft deformity.

As regarding the first comparison, in our study, we found our results showed that HLL and VLH were shorter and NW was wider on the cleft sides than on the non-cleft sides and the control. These comparisons indicate statistically significant differences.

In the study done by Adetayo *et al*.,[6] HLL and VLH on the cleft side were lower than those of the non-cleft side and the controls and NW on cleft side wider than those of the non-cleft side and the controls.

In the study done by Boorer *et al*.,[14] in 75 patients, the height of the lateral lip was less than that of the non-cleft side. In 86 patients, the lateral lip transverse length was less than on the non-cleft side.

Comparison of pre-operative, immediate post-operative measurements and 3 months post-operative of (the cleft side) was performed to know the effect of surgery on the cleft deformity correction immediately post-operative and short-term follow-up.

In our study we found that vertical lip length, HLL and vermillion width were significantly greater in cleft side than preoperative measurement of cleft side in both groups. Also, NW was found to be narrower on the cleft side than pre-operative measurement of cleft side in both groups.

In the study done by Datusanantyo *et al*.,[15] NW and PH ratios decreased significantly reaching symmetry immediately after surgery, the HLL, and VLH ratios remained unchanged.

In the study done by Adetayo *et al*.,[6] postoperatively, there was a significant increase in HLL and VLH, as well as a significant decrease in NW in both surgical groups when compared with the pre-operative measurements.

The comparison of immediate post-operative and 3-month post-operative measurements of (the cleft side versus the non-cleft side) and (the control), to assess surgical outcome and change after 3 months follow up.

In our study, we found that vertical lip length significantly shorter in cleft side than non-cleft side and control in WRV flap technique; this may make the aesthetic outcomes of Millard group better than the WRV flap group.

Furthermore, HLL significantly shorter in cleft side than control in both groups, PH was significantly longer on the cleft side than non-cleft side in both groups.

NW was significantly narrower in the cleft side than control in Millard group in immediately post-operative assessment, this was intended according to the steps of Millard technique (Cinch Suture). Moreover, significantly wider in the cleft side than non-cleft side and control in WRV flap group in 3 month post-operative assessment.

Vermillion width was significantly thicker in the cleft side than non-cleft side in both groups. In the study done by Datusanantyo *et al*.,[15] a year after surgery, the NW and HLL ratios increased significantly, while PH and VLH ratios remained unchanged. There was no difference in the ratios based on the initial size and completeness of the cleft.

In the study done by Adetayo *et al*.,[6] in Millard group reported improvements after repair in the HLL, VLH, NW and PH on the cleft side and compared these to the non-cleft side and the control group.

A study done by Hakim *et al*.[16] performed post-operative digital anthropometry on 18 patients who received UCL repairs with rotation-advancement and they compared these to normal controls.

They found that there were improvements in the lip and nasal measurements.[16]

A study done by Bilwatsch *et al*.[17] reported improvements after repair with the Tennison-Randall technique.

In the study done by Zaleckas *et al*.,[18] performed post-operative anthropometry on 66 patients who received UCL repairs with (C. Tennison, R. Millard) different techniques and they compared these to normal controls. They found that there were improvements.

The comparison of the immediate post-operative and 3-month post-operative surgical outcomes was from the WRV flap and modified Millard.

In our study, we discovered that NW was significantly wider in the WRV flap group than the Millard group at 3 months after surgery and that the vertical lip length and philtral lip height in the Millard group were significantly longer than those in the WRV flap group at immediately post-operative assessment.

In the study done by Adetayo *et al*.,[6] the Millard group had longer HLL and VLH and a greater reduction in NW and total NW than the Tennison group.

Meanwhile, the Tennison group had longer PH and Cupid's-bow width. However, only post-operative horizontal and VLH s were significantly different between the two groups ($P = 0.037$ and $P = 0.026$).

In the study done by Li *et al*.,[19] Mohler technique was more symmetric results than tennison Randall and can be applied to any degree of severity, Tennison was longer lip height in cleft side and alar base was more lateral and downwards.

Qualitative assessment

We found that qualitative assessment is as important as anthropometry analysis as its aesthetic operation that eye can notice any slight asymmetrical shape in the repaired lip. Hence we used the opinion of expert surgeon in cleft lip repair.

The lip shape, the vermilion shape was better in Millard technique than Mishra technique. However, this was statistically insignificant, The scar shape was less evident in Mishra technique than Millard technique, this may be attributed to the suture material used in each group VicrylR for Millard group and ProleneR for Mishra group and WRV flap technique is novel technique and needs more practice and that we master the Millard technique well. However, this was also statistically insignificant.

In the study done by Musanzayi *et al*.,[20] a total of 101 participants were enrolled in the research, according to the Asher-McDade Aesthetic Index. Overall, nasal symmetry, the shape of the nose and Vermilion were rated 'very good', 'good' and 'average'.

In the study done by Jan *et al*.,[21] the satisfaction score (dissatisfied, satisfied and happy) was done which was not statistically significant.

Conclusion

Mishra's technique is novel technique and needs more practice and that we masters the Millard technique well, Anthropometric measurement of surgical outcome evaluates the surgical technique used and help to compare between cleft and non-cleft side showing the degree of deformity and we used subjective assessment to analyse facial aesthetics and appearance impairment as the harmony of a person's face is as important as measurements, so they should be used together.

However, no major difference in the overall results between the Mishra and Millard rotation-advancement repairs. Thus, either technique could be used for unilateral clefts, as the goal of cleft lip repair is making a symmetrical lip with minimal scar restoring the normal appearance of the face and functional anatomy.

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Conflicts of interest

There are no conflicts of interest.

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