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QUANTITATIVE MEASUREMENT OF BILATERAL CHEILORRHAPHY: A RETROSPECTIVE STUDY

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ABSTRACT

Introduction: Bilateral cheilorraphy has higher complexity compared to unilateral cheilorraphy. Anthropometric measurements provide nasolabial identification of the surgery result objectively. This study aims to assess the outcome of bilateral cheilorrhaphy with the *Djohansjah* technique at Surabaya CLP Center.
Methods: 26 patients underwent bilateral cheilorrhaphy from January 1 to December 31, 2018, at the Surabaya CLP Center. Anthropometric measurementswere performed on control photos one-year post-surgery with the GIMP application(GNU Image Manipulation Software) version 2.10.12 to measure the cupid's bow width ratio, hemilabial length ratio, nasal width ratio,and philtrum ridge length ratio. A statistical analysis was performed using Independent Sample t-Tes and *Mann-Whitney* Test.
Results: An anthropometric size difference test based on preoperative condition was performed. No significant difference of the cupid's bow width ratio, hemilabial length ratio, nasal width ratio, and philtrum ridge length ratio between the group of identical cleft lip and unidentical cleft lip with $p > 0.05$ was found. Likewise, there was no difference between the identical cleft alveolar and unidentical cleft alveolar, as well as the group with or without cleft palate.
Conclusions: Symmetry of lips, nose, and philtrum was achieved with bilateral cheilorrhaphy with the *Djohansjah* technique at the Surabaya CLP Center and there was no significant difference in cupid's bow width ratio, hemilabial length ratio, nasal width ratio, and philtrum ridge length ratio on preoperative cleft condition.

Highlights:

1. There were no significant differences in anthropometric measurements across various groups indicating consistent results in these facial parameters.
2. Bilateral cheilorrhaphy using the Djohansjah technique at the Surabaya CLP Center achieved satisfactory symmetry of the lips, nose, and philtrum, with consistent anthropometric measurements in preoperative cleft conditions.

INTRODUCTION

Cleft lip and palate are congenital disorders where a defect or cleft is present on the lip with or without cleft alveolar and cleft palate due to impaired prominence fusion in the face embryo during the intrauterine growth period. The incidenceof cleft lip disorders is 1 in 700 births worldwide. The highest prevalence is in Asian and native American populations, namely 1:500 births. Among the cleft lip and palate population,the most common diagnosis is palate

(33%) and isolated cleft lip (21%). The majority of bilateral (86%) and unilateral (68%) cleft lip were associated with cleft palate[1].

Bilateral cheilorraphy has higher complexity compared to unilateral cheilorraphy. The most obvious feature of bilateral cleft lip is the protruding premaxilla. Uncontrolled growth of the premaxillary suture results in excess projection of the premaxilla, with or without segmen trotation and angulation[1]. Moreover, there is no normal side that becomes a guideline for bilateral cheilorrhaphy. The presence of nasal shape deformity in conjunction with the bilateral cleft lip makes a reconstruction more challenging. Postoperative conditions also play a role in defining the prognosis for further treatment[2]. Previous techniques, which involved several phases, resulted in an abnormal appearance of the lips and nose marked by a scar at the intersection of the lips and columella, a wide nasal tip, an unstable premaxilla and often a large nasolabial fistula . There are a number of bilateral cheilorrhaphytechniques to reconstruct bilateral cleft lip such as the Mulliken, Millard modification, Veau-III, Schultz, Browne, Glover, McComb, and Djohansjah[4,5,6]. At the Plastic Reconstructive and Aesthetic Surgery of Faculty of Medicine of Universitas Airlangga/ RSUD Dr. Soetomo, Surabaya, the bilateral cheilorrhaphyis performed using the *Djohansjah* technique (Figure 1).

In general, Marzoeki et al. (2002) outlined that during the determination of the surgery design, the prolabium is projected to be the philtrum. Point A is determined at the middle of the lower philtrum corresponding tothe midpoint at the base of the columella (point D). Point B and point C are determined at 2-3 mm to the right and left of point A. Then,point E and F are 1-2 mm to the right and left margins of the base of the columella. Point G and J are where the vermilion thinning starts. Point H and I each are 2-3 laterally from PointG and J. Point K and L are where the nostril indentation and vermilion meet. All these points are connected as line AB, AC, CE, and BF.The CE and BF lines are passed into the nose about 1 cm to form the nasal floor. The KG andHG points are connected at the margin of the white line. So are with LJ and JI. From the K andL points, the line is passed into the nose to form the vestibulum nasi[5].

Figure 1. The *Djohansjah* Bilateral Cheilorrhaphy Technique Design[5]

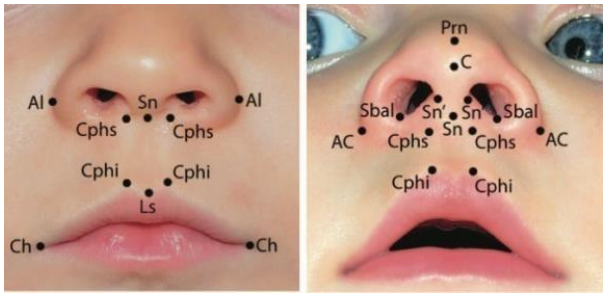
Figure 2. Final Result of Bilateral Cheilorrhaphy[5]

The prolabial skin under the CAB line is dissected and left as a flap which originates at the base of the columella and released from the periosteum. All lateral segments of the muscle and subcutaneous tissue are liberated from the periosteum so that the lateral segments and the

ala nasi can easily move medially. Once the tissues are easily movable, suturing can be performed (Figure 2)[5].

Djohansjah stated that this technique was designed by him in 1980, but it has never been popularized both at domestically and abroad. To date, the *Djohansjah* technique is still widely used for bilateral cheilorrhaphy procedure.

Anthropometric measurements are measurements of the length between two anthropometric points[8]. One of the anthropometric measurements uses the points proposed by Farkas dkk. (1992)[12]. Anthropometric measurements are carried out at several points that describe the anthropometry of the lips, nose, and philtrum, according to the anthropometric points as in Figure 3. This study aims to assess the results of bilateral cheilorrhaphy that uses the *Djohansjah* technique.



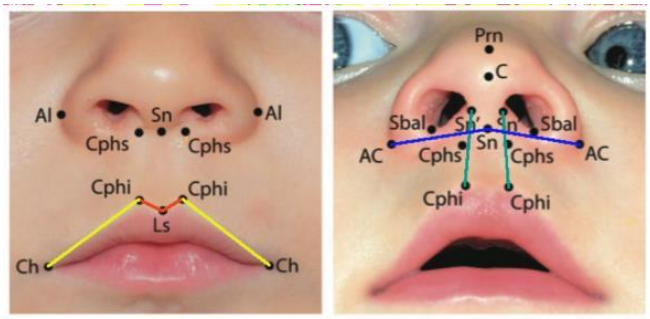
*Note: Ch:The lateralmost point at the labial commissure;Cphi: The highest point on the edge of the upper vermilion (cupid's bow); Ls: The midpoint on the edge of the upper vermilion; Sn: The midpoint at the nasolabial angle (the base of the columella); Sn:The point on the inner nostrils where the columella meets the columellar crest; AC: The lateralmost point at the facial-alar line[11]

Figure 3. Nasolabial Anthropometric Points

METHODS

This was a descriptive analytic study with longitudinal retrospective design. 68 patients underwent bilateral cheilorrhaphy procedure since January 1, 2018 to December 31, 2018 at the Surabaya CLP Center. 42 patients were excluded because they did not provide post op photos for a year, submitted blurry post op photos that ssmake the determination of anthropometric points difficult, had post op complications, showed bilateral cheilorrhaphy history in other place, and the bilateral cheilorrhaphy was performed by Plastic Surgery Resident through a guidance operation.

We compared the results of anthropometric measurements between post-op photos at one year and preoperative conditions based on the ratio, namely the results of the distribution of anthropometric measurements on the right and left sides. There are four ratios being evaluated as described in Figure 4.



*Note: Red line(width of the cupid's bow): distance from the cristaphiltra inferior (Cphi) to the labiale superius (Ls). Yellow line (hemilabial length): distance from the chelion (Ch) to the crista philtra inferior (Cphi). Blue line (nasal width): distance from the alar curvature to the subnasale (Sn). Green line (length of philtrum ridge): distance from the crista philtra inferior (Cphi) to the subnasale (Sn)

Figure 4. Anthropometric measurements

We used a ratio value that compared the size of the right and left sides of each variable. The ratio did not cause a bias value because measurements were made in the same plane. We performed anthropometric measurements with GIMP (GNU Image Manipulation Software) version 2.10.12 (www.gimp.org) to calculate the ratio of cupid's bow width, hemilabial length, nose width, and philtrum ridge length. Then, the data obtained were processed using spreadsheet software Microsoft Excel® for Mac version 14.6.9 (Microsoft Corporation).

Statistical analyses were performed using the Independent Sample t-Test and the *Mann-Whitney* test by GNU PSPP (available at https://www.gnu.org/software/pspp/) version

1.2.0, free software under the terms of the GNU public license general (Free Software Foundation, Inc.). We used 95% confidence intervals for all statistical analysis purposes.

RESULTS

In the anthropometric measurements performed on patients control photos at one-year post op, it was found that the four ratio results were close to one, which meant it was close to symmetry (Table 1). We obtained a mean value of cupid's bow width ratio of 1.000, hemilabial length ratio of 0.978, nasal width ratio of 0.991, and philtrum ridge lengthratio of 1.004.

Table 1. Anthropometric Measurement at One Year Post-Op

Ratio	Mean	Standard Deviation
Cupid's bow widthratio	1.000	0.344
Hemilabial lengthratio	0.978	0.063
Nasal width ratio	0.991	0.586
Philtrum ridgelength ratio	1.004	0.389

Then, the anthropometric size difference test was also carried out based on the conditions before the operation. There were three pre-operative conditions, namely: (1) whether or not the right and left cleft lip were identical according to the completeness of the cleft, (2) whether or not the cleft alveolar was identical according to the completeness of the cleft, and (3) whether or not there was a cleft palate. There was no significant difference in cupid's bow width ratio (p= 0.327), hemilabial length ratio (p=0.148), nasal width ratio (p=0.729), and philtrum ridge length ratio (p=1.000) between identical and unidentical cleft lip groups. There was no significant difference in cupid's bow width ratio (p = 0.965), hemilabial length ratio (p=0.398), nasal width ratio (p=0.603), and philtrum ridge length ratio (p=0.604) between identical and unidentical cleftalveolar groups. At the same time, there was no significant difference in cupid's bow width ratio (p=0.102), hemilabial length ratio (p=0.386), nasal width ratio (p=0.248), and philtrum ridge length ratio (p=0.829) between groups with or without cleft palate (Table 2).

DISCUSSION

Studies on bilateral cheilorrhaphy procedure outcomes in various scientific publication are not uncommon, both qualitatively quantitatively. There are many assessment systems used to assess cleft lip reconstruction procedure outcomes. There has been a standard for functional outcome assessment, while for aesthetic outcome assessment, the approach is divided into quantitative and qualitative analysis. Qualitative analysis is based on the appearance evaluation overall from patient photos or more relevant evaluations by directviewing. While quantitative analysis involves anthropometric measurements that areexpressed in numerical data[9].

Table 2. Anthropometric difference test on cupid's bow width ratio, hemilabial length ratio, nasal width ratio, and philtrum ridge length ratio on the condition of cleft lip, cleft alveolar, and cleft palate before surgery

	Cleft Lip				Alveolar Cleft				Palatal Cleft			
	Type	N	Mean	p	Type	N	Mean	p	Type	N	Mean	p
Cupid's bow width ratio	Unidentical	7	1.01	0.327	Unidentical	5	1.00	0.965	With cleft	24	1.00	0.102
	Identical	19	1.00		Identical	21	1.00		Without cleft	2	1.04	
Hemilabial length ratio	Unidentical	7	17.07	0.148	Unidentical	5	16.10	0.398	With cleft	24	13.88	0.386
	Identical	19	12.18		Identical	21	12.88		Without cleft	2	9.00	
Nasal width ratio	Unidentical	7	14.36	0.729	Unidentical	5	15.10	0.603	With cleft	24	14.00	0.248
	Identical	19	13.18		Identical	21	13.12		Without cleft	2	7.50	
Philtrum ridge length ratio	Unidentical	7	1.00	1.000	Unidentical	5	1.01	0.604	With cleft	24	1.00	0.829
	Identical	19	1.00		Identical	21	1.00		Without cleft	2	1.01	

Anastasso and Chipkov (2003) investigated a qualitative analysis of nasal and labial deformities of cleft lip, alveolar, and palate before and after surgery according to the American Cleft Palate Association's visual classification scale[13] . Bermudez dkk (2009) evaluated the surgery outcomes in an humanitarian organization objectively by independents evaluator by comparing preoperative conditions, right after surgery and post op photos at one week,six months, and one year[14]. Richardson and Khrisna (2017), evaluated the aesthetic results of bilateral cheilorrhaphy using the *Mulliken* technique. The assessment used a simple scale that was evaluated by both medical and non- medical people. The areas assessed were the lips, nose and general facial features in standard photographs[9]. Likewise, Lun et al. (2002) evaluated bilateral cheilorrhaphy outcomes using the *Noordhoff* technique with reunification of muscles and dissection of blunt nose, differences in nose appearance assessment, which were assessed by surgeons and lay people[15].

Matsumoto et al. (2013) analyzed bilateral cheilorrhaphy outcomes by selecting one- or two-stage procedure at Kagoshima University Hospital. The photos taken were before surgery, one-year post surgery, and at 3 years old for lip and nose shape analysis, then compared with healthy Japanese children according to age and gender. Prior to measuring the shape of the lips and nose, all pictures were standardized with a personal computer (PC) so that the distance between the two bilateral medial eye angles was 100.0 mm, using 3D Rugle V software (Medic Engineering Co., Kyoto, Japan)[10].

This study was not significantly different from that of Matsumoto's et al., where the measurements were performed on ratio values. Using these ratios, we could observe all the labial, nasal and philtrum aspects, where symmetry was the end result desired by the patient and his family. Comparison of cupid's bow width, hemilabial length, nose width, and philtrum ridge length could be an alternative method of anthropometric measurements to assess bilateral cheilorrhaphy outcomes.

Anthropometric measurements during the follow up period (one-year post op) provide objective overview on what happened during the growth of the child and identify adverse procedure outcomes. In the anthropometric size difference test based on preoperative conditions, there was no significant difference in the cupid's bow width ratio, hemilabial length ratio, nasal width ratio, and philtrum ridge length ratio to cleft lip, alveolar, and palate conditions. These preoperative conditions could be defined as whether or not the cleft between the left and right sides are identical. Thus, it could be said that unidentical cleft lip and alveolar on the left and right, and the presence or absence of cleft palate did not affect the symmetry of the lips, nose and philtrum as an outcome of bilateral cheilorrhaphy surgery.

However, the results of one-year post surgery needed further observation. According to Matsumoto et al. (2013), surgeons should take into account changes that might happen during the growth and development of the patient after the surgery. It would take a long time to prove whether the level of symmetries produced during the postoperative year is the same as that of the adolescent age[10] . In a journal written by Thomas et al., (2012), it was mentioned that Farkas et al. found that at one year old, the width of nose and the height of the upper lip reached about 80 percent of its each potential growth, with nasal tip protrusion only reaching 50 percent of its maximum growth. This observation gave rise to a belief in the importance of measurements during the first

year of life when the growth of nose and lips isoccurring rapidly, because this is the best timeto perform a nasolabial revision[11].

Changes in the nasolabial dimensions occur as the child grows. All nasolabial dimensions grow rapidly, except for the columellar length and nasal tip protrusion. Children with repaired cleft lip and palate do not grow normally, and the closure of cleft would cause the rapidly growing dimension tobe too long or too wide (nasal length, interalar distance, and prolabial dimension, especially the distance between the peaks of cupid's bow), and the slowly growing dimension to lag behind (the columellar length and nasal tipprotrusion). In 1992, Farkas examined changes in nasolabial growth. He took six age-related measurements, namely three types of nose (nose height, nose width, nasal tip protrusion); and three other types of upper lip (upper lip skin height, upper lip vermilion height, and upper lip total height). In the study,different maturation levels of each dimension were obtained. The height of the upper lip skin showed the fastest maturation at the age of three years, while the dimension that had the slowest maturation was the nasal tip protrusion, which occurred at the age of 16 years[12] .

The major strength of this study was its objectivity on the bilateral cheilorrhaphy procedure outcomes at the Surabaya CLP Center. The measurements used indices so that the results could be compared. Another advantage was the use of software to calculatethe post op results, enabling this type of study to be conducted in a retrospective observational manner.

However, this study was not without shortcomings. The first weakness was the incomplete photo data of research subjects at one-year post surgery. This incompleteness decreased the number of subjects that could be included as research subjects. The second weakness was that in anthropometric measurements, two-dimensional measurements were carried out which of course had different characteristics from three-dimensional measurements on direct subjects or on three-dimensional images. The third shortcoming was the fact that the subject was toddlers, with which cooperation was difficult to achieve when taking pictures. Lastly, these measurements were performed by only one researcher, leading to high level of subjectivity.

CONCLUSION

Bilateral cheilorrhaphy with the *Djohansjah* technique at the Surabaya CLP Center produces good lip, nose and philtrum symmetry. There was no difference in the results of bilateral cheilorrhaphy surgery withthe *Djohansjah* technique at the Surabaya CLP Center on the symmetry of the lips, nose, and philtrum based on the preoperative cleft conditions.

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CONFLICT OF INTEREST

None.

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None.

AUTHORS CONTRIBUTION

All authors contributed to wrote this study.

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