

Accepted Manuscript

Efficacy of Morpho-functional repair in management of different morphological variants of unilateral complete cleft lip

Srinivas Gosla Reddy, MBBS, MDS, PhD, Rishabh Shah, BDS, MDS, Sidra Ansari, BDS, MDS, Rajgopal R. Reddy, MBBS, BDS, Ashish Fanan, BDS, MDS



PII: S1010-5182(19)30445-7

DOI: <https://doi.org/10.1016/j.jcms.2019.07.028>

Reference: YJCMS 3357

To appear in: *Journal of Cranio-Maxillo-Facial Surgery*

Received Date: 20 April 2019

Revised Date: 23 April 2019

Accepted Date: 21 July 2019

Please cite this article as: Reddy SG, Shah R, Ansari S, Reddy RR, Fanan A, Efficacy of Morpho-functional repair in management of different morphological variants of unilateral complete cleft lip, *Journal of Cranio-Maxillofacial Surgery*, <https://doi.org/10.1016/j.jcms.2019.07.028>.

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Manuscript Details

Manuscript number JCMS_2019_406_R1

Title Efficacy of Morpho-functional repair in management of different morphological variants of unilateral complete cleft lip

Article type Original article

Corresponding Author Rishabh Shah

Corresponding Author's Institution

GSR Institute of Cranio Facial Surgery

Order of Authors Srinivas Gosla Reddy, Rishabh Shah, Sidra Ansari, Rajgopal Reddy, Ashish Fanan

Authors list

Srinivas Gosla Reddy, MBBS, MDS, PhD¹; **Rishabh Shah**, BDS, MDS²; Sidra Ansari, BDS, MDS³; Rajgopal R Reddy, MBBS, BDS⁴; Ashish Fanan, BDS, MDS⁵;

1. Srinivas Gosla Reddy, MBBS, MDS, PhD.

GSR Institute of Craniofacial Surgery, Hyderabad, Telangana, India.

2. Rishabh Shah, BDS, MDS.

GSR Institute of Craniofacial Surgery, Hyderabad, Telangana, India.

3. Sidra Ansari, BDS, MDS.

GSR Institute of Craniofacial Surgery, Hyderabad, Telangana, India.

4. Rajgopal R Reddy, MBBS, BDS .

GSR Institute of Craniofacial Surgery, Hyderabad, Telangana, India.

5. Ashish Fanan, BDS, MDS.

GSR Institute of Craniofacial Surgery, Hyderabad, Telangana, India.

CORRESPONDING AUTHOR

Rishabh Shah

GSR Institute of Craniofacial and Facial Plastic Surgery No. 17-1-383/55, Vinay Nagar Colony,

I.S Sadan, Saidabad, Hyderabad-500059, Telangana, INDIA Phone: +91-9427418780, Email:

rishabh20_02@yahoo.co.in

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors

Abstract

Background: To study the surgical outcome in various morphological variants of unilateral complete cleft lip in our high volume centre over a period of 4 years, using Morpho-Functional technique in all cases by indirect two dimensional photographic analysis.

Methods: In this prospective cohort study, 749 patients with Unilateral Cleft Lip with palate were included over a period of 4 years from January 2010 to December 2014. All Subjects underwent surgery before the age of 1 year with the follow-up two dimensional photographs taken at 4 years post-operatively. Eight measurements were performed on the photographs. All parameters were measured on both Cleft & Non cleft sides and the ratio was considered with the normal side as the base line. Shapiro –Wilk and Kolmogrov – Smirnov tests were used to confirm that the data was normally distributed. One way ANOVA was done to find out if there were any significant differences amongst the different groups along various parameters, respectively. Further Tukey post hoc analysis was done to confirm where the differences occurred between groups.

Results: None of the groups showed any statistical differences on any parameters. There were minor variations between the different groups due to the ranging morphology of the defect but overall satisfactory to good results were seen on all measured parameters evaluated.

Conclusion: This shows that the Morphofunctional technique, with its combinations & modifications of various school of thought, is versatile enough to achieve good surgical outcomes despite the wide variations seen in size and type of defects in unilateral cleft lip. This comes about because of the comprehensive nature of the technique & the balance that it creates among the affected structures.

Keywords Unilateral Cleft Lip; Morphofunctional technique; anthropometric measurements

INTRODUCTION

The primary goal of cleft lip repair should be to achieve adequate lip length on the cleft side. Other equally important objectives are an inconspicuous residual scar that does not cross anatomical boundaries; adequate Cupid's bow width, absence of notching of vermilion border and an absence of peaking of the vermilion at the Cupid's bow on cleft side.¹⁻² These treatment outcomes also depend on how wide the cleft is, the amount of nasal septum deviation and variation in abnormal muscle attachment, and any surgical repair should take these into consideration.³

Unilateral cleft lip repair designs can be divided into 3 schools, (1) straight-line closure, (2) geometric, and (3) rotation-advancement techniques. The most common technique used to repair a unilateral cleft lip is the Millard rotation-advancement flap. Along with its various modifications, like the Noordhoff vermilion flap, the Mohler modification and Tennison and Randall technique.³⁻⁴ However, no single technique fulfils all of the above mentioned criteria.

With this in mind, we decided to study the surgical outcome in various morphological variants of unilateral complete cleft lip in our high volume centre over a period of 4 years (January 2010 to December 2014), using a Morpho-Functional Septocheiloplasty technique in all cases.

MATERIAL AND METHODS

In this prospective cohort study, 749 patients were included over a period of 4 years from

January 2010 to December 2014. All patients had unilateral complete cleft lip with palate, without any associated syndromes, and underwent surgery before the age of 1 year (4-5 months) with the follow-up two dimensional photographs taken at 4 years post-operatively. Depending on the presence and absence of Simonart's band, nasal dome deformity and difference in the level of greater and lesser alveolar segment unilateral complete cleft lip can be divided into the following morphological variations (Figure 1 to 6):

Type I a – Presence of Simonart's band (Figure 1.) Type I b – Absence of Simonart's band (Figure 2.) Type II a – Flattening of nasal and ala dome. (Figure 3.) Type II b – Nasal and ala dome not flat (Figure 4.)

Type III a – Difference in prominence of greater vs lesser segment of alveolar ridge as assessed on lateral view photographs. (Figure 5.)

Type III b – No difference in alveolar ridge segments (Figure 6.)

From these variations 8 groups were created based on permutation and combinations seen in patients. To test the reliability and reproducibility of these methods, inter-observer variances were tested. For the inter-observer variance, 2 observers did the identification.

Surgical note on Morpho-Functional Septo-Chelioplasty for repair of unilateral complete cleft lip:

The incision that was used to repair the primary unilateral complete cleft lip was based on combination of the Millard (non-cleft side) and the Pfeifer (cleft side) techniques (Figure-7).² This was followed by muscle dissection on the cleft side, giving prime importance to dissection of ala nasalis muscle. 5mm back cut is given in the vestibule on cleft side, through which wide sub-periosteal dissection was done to raise the entire facial mask from the piriform rim, fronto-nasal area, infra orbital and maxillary buttress region (Figure – 8 and 9). It can be termed facial mask elevation. On the non- cleft side, a minimal dissection is done to relieve the abnormal attachments from the anterior nasal spine and the columella (Figure – 10). On the non cleft side through the same incision, septal cartilage is identified. Perichondrium is completely freed from the septal cartilage on both sides as well as detached from anterior nasal spine, septo-vomer junction and septo-spinal ligaments to achieve straightening of the septum and columellar centralization.⁵ The nasal septum is relieved of all its abnormal attachments and repositioned at its morphological position (Figure – 10). This is followed by perialveoloplasty by suturing the alveolar flap from both sides posteriorly, which later on forms the nasal floor in the anterior region. The alar base is stabilized to match that of the contralateral side by taking a suture through the alar head of the nasalis muscle on the cleft side to the contralateral muscle through the septum. Once this alar cinch suture is placed, the nasal floor is reconstructed (Figure – 11 and 12). Then the septal cartilage is sutured with the perichondrium on non-cleft side in three places superiorly, intermediate and inferiorly to move it to a physiological position (Figure - 13). To decrease the dead space, single quilting suture is placed in the nasal septal region (Figure -13). Then the lip is closed in layers, first the mucosal layer followed by muscle where the orbicularis oris is approximated and repaired to a natural position, followed by tension free skin closure which is made possible by facial mask elevation and suturing of the transverse nasalis muscle

(Figure – 14, 15 and 16). Figure 17 & Figure 18 show a Pre op photograph & 4 year post op photograph of the patient, respectively.

Key steps in Morpho-Functional Septocheiloplasty:

1. Facial mask elevation (wide sub-periosteal dissection)
2. Perialveoloplasty
3. Septoplasty
4. Ala nasalis suturing
5. Cheiloplasty with triangular flaps on the vermillion

Photographic Analysis:

Two different photographic views were used for analysis; frontal view and submental (worm's eye) view (Figure 19 & Figure 20). The criteria that were followed for the frontal view required both ears to be visible to minimize rotation and to have the least possible nostril show to minimize tilt. The submental view was taken such that the nasal tip should be projected between the medial canthi and eyebrows with no head rotation⁶.

Indirect anthropometric measurements were performed on postoperative digital photographs with Adobe Photoshop 7.0 (Adobe Systems, Inc., San Jose, Calif.) and Scion Image Software (National Institutes of Health, Bethesda, Md.). Adobe Photoshop 7.0 was used to identify

predetermined landmarks and reference lines on the postoperative photographs of each patient.⁷⁻⁸ On the frontal view photographs (Figure 19), the first line that was drawn was the bipupillary line (PPL). This line was drawn between the most inferior point of the right and left pupils. The second line was drawn as a tangent to the columella and was parallel to the bipupillary line (CM). After the lines were drawn, four sets of points were marked on either side. The first set of points marked the endocanthion bilaterally (EN_R and EN_L). The second set marked the alar base bilaterally (AB_R and AB_L), the third set marked the highest point on the Cupid's bow bilaterally (CB_R and CB_L), and the fourth set marked the lowest point of the lip mucosa perpendicularly below the third set of points (RM_R and RM_L). After the two lines were drawn, the measurements were taken using the Scion Image Software.⁷⁻⁸ The first set of measurements was the shortest distance between AB_R and AB_L to the PPL (AB-PPL). These measurements were done to quantify the symmetry of the alar height. The second set of measurements was the shortest distance between CB_R and CB_L to CM (CB-CM). The third set of measurements was the distance from RM_L to CB_R , and RM_L to CB_L (CB-RM). The second and third sets of measurements were done to quantify the symmetry of the lip with special attention to the Cupid's bow. The fourth set of measurements that were taken was the distances between AB_R and EN_R and between AB_L and EN_L (AB-EN).⁹

On the worm's-eye view photographs (Figure 20), two sets of points were marked to measure the width of the nose and two sets of points were marked on each nostril to measure the height of the nose. The points to measure the nostril width were marked as NL_R and NL_L for the most lateral point of the inner border of the nostril, and NM_R and NM_L for the most medial point of the inner border of the nostril. The points to measure the nostril height were marked NT_R and NT_L for the most cranial point of the inner border of the nostril, and NB_R and NB_L for the

most basal point on the inner border of the nostril. The first measurement was to determine the nostril gap area (NGA) using the Adobe 7.0 Magic Wand tool.⁷⁻⁸ The second set of measurements was the distance between NL_R and NM_R and NL_L and NM_L (NL-NM). The third set of measurements was the distance between NT_R and NB_R and NT_L and NB_L (NT-NB).⁷⁻⁹

Outcome measures:

To present the results of the measurements, ratios (larger side/smaller side) were calculated using the built-in mathematical tools of Microsoft Excel (Microsoft, Inc., Redmond, Wash.). The AB-PPL and AB-EN ratios were used to assess the symmetrical position of the nose. The CB-CM ratio was used to assess the vertical height of the lip and to assess the symmetry of the Cupid's bow. The CB-RM ratio was used to assess the symmetry and vertical height of the vermillion. The AB-EN ratio was used to assess the nasal width symmetry and the NGA, NL-NM, and NT-NB ratios were used to assess nostril symmetry. Ratios were analyzed using the independent samples *t* test (5 percent level of significance).

RESULTS

All the parameters were measured on both Cleft & Non cleft sides, whereas the normal side was considered as the baseline to evaluate the size ratio of the Cleft side: Non-Cleft Side. (Table 1)

Shapiro –Wilk and Kolmogorov –Smirnov tests were used to confirm that the data was normally distributed. One-way ANOVA was done to find out if there were any significant differences amongst the different groups along various parameters, respectively. Further Tukey post-hoc analysis was done to confirm where the differences occurred between groups.

Mean AB-PPL ratio ranged from 0.94 in Group 2 to 1.02 in group 8 (P- Value - 0.27), which is statistically not significant. Mean AB- EN ratio ranged from 0.93 in Group 2 to 1.05 in group 8 (P value - 0.03), which is statistically not significant. Mean CB-CM ratio ranged from 0.90 to 0.96 amongst all groups (P Value - 0.33), which is non - significant. Mean CB – RM ratio ranged from 1.05 to 1.15 amongst all groups (P value - 0.96), which shows it is non- significant. Mean NL-NM ratio ranged from 1.08 to 1.17 within all groups (P value - 0.70), which is statistically non significant. Mean NT-NB ratio ranged from 0.87 to 0.99 (P value - 0.60), which is statistically non significant. Mean NGA ratio ranged from 0.89 to 1.04 (P value -0.49), which is non significant.

DISCUSSION

There are various accepted methods of cleft lip repair. The techniques used vary widely based on surgeon preference and training.¹⁰ The rotation-advancement technique popularized by Millard remains one of the most commonly used surgical repairs today, along with its various modifications like Noordhoff¹¹, Mohler¹² and Randall-Tennison¹². These modifications attempted to correct the perceived deficiencies of

rotation advancement technique, such as application to wide clefts, limited medial element rotation, inadequate vermilion fullness, and philtral column aesthetics. Other surgeons pioneered their own distinct repairs, including Delaire¹³⁻¹⁴, and Nakajima and Yoshimura¹⁵. In addition, Fisher recently reported his anatomical subunit approximation technique for unilateral cleft lip repair¹⁶. None of these techniques takes into account the morphological variations seen in unilateral complete cleft lip.

Not every unilateral complete cleft lip is same; some have a Simonart's band, some have a huge difference between the greater and lesser segment, and some are associated with remarkable nasal deformity, thus differing in surgical outcome. Therefore, in our study we divided the unilateral complete cleft lip into six main morphological variations and further divided the subjects into 8 groups depending on the combination of these morphological variations commonly seen over a period of 4 years.

We used our surgical technique, viz "Morpho-Functional Septo-Cheiloplasty" for correction of all these variations. This technique uses Afroze incision, which is a combination of Millard incision on the noncleft side and Pfeiffer incision on the cleft side. The advantage of this technique is that there is no tension on the postoperative scar because the incision is essentially horizontal in nature and the contracture of the scar occurs horizontally rather than vertically. There is also no pressure on the Cupid's bow for the same reason². The next key step is wide sub- periosteal dissection on the cleft side, lifting the entire facial mask from the cleft side towards the midline, which is based on Delaire functional philosophy¹³⁻¹⁴. Not correcting the nose during primary cleft lip repair was dogmatic in the past, although it meant severe functional, aesthetic, and psychological

problems for the child. This attitude was defended vehemently, even fanatically, by many surgeons who were afraid that growth impairment might occur²². Theoretical basis of septal repositioning (from anatomical to physiological position) during primary cheiloplasty is that most nasal and deep bundles of orbicularis oris in unilateral cleft lip insert to the mucoperichondrium and anterior nasal septum. Correction of the deviated septum is important because it provides stability and exact positioning of the previously lifted alar crus of the cleft side and nasal tip, allowing the nose to grow in a balanced way with similar muscular force being exerted on both sides. Also it creates a balanced air entry for both inspiration & expiration. Studies have demonstrated the absence of significant negative sequelae after manipulation of the septum in children²³. The next key step is alar cinching to prevent further flaring of the cleft nostril. This is followed by final closure of lip vermilion by a triangular flap on cleft side fitting on to the non-cleft side, thus enhancing the lip fullness and eliminating weaselling deformity. Objective evaluation of aesthetic outcome in cleft lip operations is difficult.¹⁷ To compare aesthetic outcome in cleft lip surgery, different evaluation methods have been described such as direct¹⁸⁻¹⁹ and indirect anthropometric analysis.²⁰ Direct anthropometric analysis is accurate and well accepted by anthropologists, but it is very difficult to reproduce, especially in large numbers of patients because the recall might be ineffective and the patients grow during the periods of recall.⁷⁻⁸

In our study, evaluation has been done by indirect photographic measurements. One disadvantage of this technique is difficulty in standardization. It is difficult to keep the photographic distances and the head position of the child constant. We achieved

standardization by ensuring that the same photographer took the photographs with the same camera at the same focal distance. To eliminate the problems of observation bias and patient variations, ratios between the cleft and non-cleft side were used to evaluate the results rather than direct measurements.

In our study, AB-PPL value ranged from a low of 0.94 in group 2 to 1.02 in group 8. These values were not significantly different in any of the groups and were always within 5 % of the Normal side, showing good symmetry in relation to distance between alar base to bipupillary line. Similarly AB- EN ratios were not significantly different (0.93- 1.05) among all the groups showing satisfactory symmetrical position of the nose & symmetrical nasal width. The mean of CB-CM ranges from a low of 0.90 in Group 3 to 0.96 in Group 1. These values, although they did not reach the ratio of 1, were still within 10% variation from normal in all groups, hence providing a reasonable outcome regarding vertical height of the lip and symmetry of the Cupid's bow. CB – RM ratio ranged from a low of 1.05 in Group 2 to 1.15 in Group 1. These value were more than 1 in all groups & not significantly different in any of the groups, thus pointing toward over correction & increased height of vermillion on cleft side. NL-NM ratio range from a low of 1.08 in Group 4 & Group 6 to 1.17 in Group 1. These values were more than 1 in all groups. NT-NB ratio ranges from a low of 0.87 in Group 4 to 0.99 in Group 5 & Group 6. These values however, did not reach the ratio of 1. NGA ratio ranged from a low of 0.89 in Group 4 to 1.04 in Group 1 & Group 3. These values were not significantly different in any of the groups and were always within 5 % of the Normal side, showing good nostril symmetry.

None of the groups showed any statistical differences on any parameters. These were minor variations between the different groups due to the ranging morphology of the defect,

but overall satisfactory to good results were seen on all measured parameters evaluated.

The main advantage of indirect photographic analysis over direct measurements was the good reproducibility.⁷ However, three-dimensional stereo photogrammetry can be used to achieve the most optimal results to compare such techniques.

Conclusion

This study shows that the Morphofunctional technique, with its combinations & modifications of various school of thought, is versatile enough to achieve good surgical outcomes despite the wide variations seen in size and type of defects in unilateral cleft lip. This comes about because of the comprehensive nature of the technique & the balance that it creates among the affected structures.

References:

1. Lazarus DD, Hudsona, Van Zylje, Repair Of unilateral cleft Lip: A Comparison Of Five Techniques. *Annals of Plastic Surgery* 41:587, 1998.
2. Reddy SG, Reddy RR, Pagaria N, Bronkhorst E, Prasad R, Berge S. Afroze Incision For Primary Cheiloplasty. *Journal of Craniofacial Surgery* 20 (Suppl 2): 1733–1736, 2009
3. Davis JS, Ritchie H.P, Classification of Congenital Clefts of Lip and the Palate. *JAMA*;79(16):1323-1332, 1922.
4. Sitzman TJ, Giroto JA, Marcus JR. Current Surgical Practices in Cleft Care: Unilateral Cleft Lip Repair. *Plast Reconstr Surg*;121(5):261e–70e, 2008.
5. Agarwal R, Chandra R: The septospinal Ligament In Cleft Lip Nose Deformity: Study In Adult Unilateral Clefts. *Plast reconstr surg* 120(6):1633 40, 2007.
6. Ettorre G, Weber M, Schaaf H, Lowry JC, Mommaerts MY, Howaldt HP. Standards for Digital Photography In Craniomaxillo-Facial Surgery: Part I. Basic Views And Guidelines. *J Craniomaxillofac Surg*.34:65–73, 2006.
7. Nagy K, Mommaerts MY. Analysis of The Cleft-Lip Nose In Submental-Vertical View: Part I. Reliability Of A New Measurement Instrument. *J Craniomaxillofac Surg* 35:265–277, 2007.
8. Mommaerts MY, Nagy K. Analysis Of The Cleft Lip-Nose In The Submental-Vertical View: Part II. Panel Study: Which Is The Most Important Deformity? *J*

Craniofacial Surg, 36:315–320, 2008.

9. Krimmel M, Kluba S, Bacher M, Dietz K, Reinert S. Digital Surface Photogrammetry For Anthropometric Analysis Of The Cleft Infant Face. *Cleft Palate Craniofac J*, 43:350–355, 2006.
10. Hetal H.P, Thomas D. Samson, Donald M., Unilateral Cleft Lip Repair. *Operative Techniques In Otolaryngology*. 2015
11. Noordhoff, M. S. Reconstruction Of Vermilion In Unilateral And Bilateral Cleft Lips. *Plast. Reconstr. Surg.* 73: 52, 1984.
12. Mohler, L. R. Unilateral Cleft Lip Repair. *Plast. Reconstr. Surg.*80: 511, 1987.
13. Delaire, J., Precious, D. S., Gordeef, A. The Advantage of Wide Subperiosteal Exposure In Primary Surgical Correction Of Labial Maxillary Clefts. *Scand. J. Plast. Reconstr. Surg. Hand Surg.* 22: 147, 1988.
14. Markus, A. F., Delaire, J. Functional Primary Closure Of Cleft Lip. *Br. J. Oral Maxillofac. Surg.* 31: 281, 1993.
15. Nakajima, T., Yoshimura, Y. Early Repair Of Unilateral Cleft Lip Employing A Small Triangular Flap Method And Primary Nasal Correction. *Br. J. Plast. Surg.* 46: 616, 1993.
16. Fisher, D. M. Unilateral Cleft Lip Repair: An Anatomical Subunit Approximation Technique. *Plast. Reconstr. Surg.* 116: 61,2005.
17. Reddy GS, Reddy RR, Pagaria N, Berge S. Afroze Incision For Functional

Cheiloseptoplasty. *J Craniofac Surg*, 20(Suppl 2):1733–1736, 2009.

18. Farkas LG, Hajnis K, Posnick JC. Anthropometric And Anthroposcopic Findings Of The Nasal And Facial Region In Cleft Patients Before And After Primary Lip And Palate Repair. *Cleft Palate Craniofac J*, ;30:1–12, 1993.
19. Horswell BB, Pospisil OA. Nasal Symmetry After Primary Cleft Lip Repair: Comparison Between Delaire Cheilorhinoplasty And Modified Rotation-Advancement. *J Oral Maxillofac Surg* ;53:1025–1030; Discussion 1031, 1995.
20. Liou EJ, Subramanian M, Chen PK, Huang CS. The Progressive Changes Of Nasal Symmetry And Growth After Nasoalveolar Molding: A Three-Year Follow-Up Study. *Plast Reconstr Surg*;114:858–864, 2004.
21. Van Loon B, Reddy SG, Van Heerbeek N, 3d Stereophotogrammetric Analysis Of Lip And Nasal Symmetry After Primary Cheiloseptoplasty In Complete Unilateral Cleft Lip Repair. *Rhinology*; 49:546–553 2011.
22. Chait L, Kadwa A, Potgieter A, The Ultimate Straight Line Repair For Unilateral Cleft Lips. *J Plast Reconstr Aesthetic Surg* 2007.
23. Hans A, Heribert H, Milomir N, Primary Simultaneous Lip And Nose Repair In The Unilateral Cleft Lip And Palate. *Plast Reconstr Surg* ;121:959, 2008.

Figure 1. Type I a - Without Simonart's band.

Figure 2. Type I b - With Simonart's band.

Figure 3. Type II a - Without complete collapse of nasal dome and ala.

Figure 4. Type II b - With complete collapse of nasal dome and ala.

Figure 5. Type III a - Without difference in level of alveolar ridges.

Figure 6. Type III b - With difference in level of alveolar ridges.

Figure 7. Incision marking.

Figure 8. Muscle dissection on cleft side.

Figure 9. Ala nasalis dissection on cleft side.

Figure 10. Muscle dissection on non-cleft side, septal cartilage repositioning.

Figure 11. Septoplasty, perialveoloplasty and nasal floor reconstruction.

Figure 12. Ala nasalis suture.

Figure 13. Quilting suture.

Figure 14. Mucosal layer suturing.

Figure 15. Orbicularis oris suturing.

Figure 16. Skin suturing.

Figure 17. Pre-op.

Figure 18. 4 year Post op.

Figure 19. FRONTAL VIEW PARAMETERS.

Figure 20. Submental (WORM'S) VIEW PARAMETERS.

ACCEPTED MANUSCRIPT

Parameters	Groups								P – value	Post hoc
	G1 N=12	G2 N=11	G3 N=7	G4 N=23	G5 N=313	G6 N=128	G7 N=149	G8 N=104		
	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD		
AB-PPL	0.98±0.04	0.94±0.21	1.01±0.18	1.00±0.04	0.99±0.04	1.00±0.03	1.00±0.04	1.02±0.24	0.27	NA
AB-EN	0.95±0.93	0.93±0.20	1.01±0.02	1.00±0.03	0.98±0.10	1.00±0.04	1.01±0.04	1.05±0.37	0.03 *	G8>G5
CB-CM	0.97±0.04	0.96±0.08	0.90±0.08	.96±0.08	0.93±0.11	0.93±0.09	0.92±0.09	0.92±0.09	0.33	NA
CB-RM	1.15±0.22	1.05±0.12	1.09±0.12	1.09±0.14	1.08±0.28	1.07±0.32	1.10±0.20	1.07±0.18	0.96	NA
NL-NM	1.17±0.14	1.09±0.12	1.12±0.26	1.08±0.15	1.12±0.26	1.08±0.19	1.12±0.24	1.13±0.22	0.70	NA
NT-NB	0.92±0.17	0.91±0.13	0.97±0.13	0.87±0.18	0.99±0.67	0.99±0.22	0.95±0.23	0.88±0.25	0.60	NA
NGA	1.04±0.18	0.95±0.17	1.04±0.23	0.89±0.17	0.97±0.25	0.96±0.21	1.00±0.27	0.94±0.38	0.49	NA







































