

Conventional Palatoplasty Versus Physiological Palatoplasty

Sandhya Pandey*, **Ravi Kumar Chittoria****, **Mohapatra Devi Prasad*****, **Friji M.T.*****,
Dinesh Kumar Sivakumar***, **Bibilash Babu Suseela***

*Senior Resident, **Head, ***Associate Professor, Department of Plastic Surgery, Jawaharlal Institute of Postgraduate Medical Education and Research (JIPMER) Pondicherry, India-605006.

Abstract

Cleft lip and palate are variations of a type of congenital deformity caused by abnormal facial development during gestation. The main organs affected are mouth, nose and ear. Hence treatment of the condition is aimed to provide optimum function of all these organs. Apart from correction of oral competence and ear pathology, speech correction is always a challenging aspect of the management in patients of cleft palate. Various methods of palatoplasty have been described ranging from anatomical closure to the functional closure of the defect. Both methods have their own advantage, disadvantages and outcomes. We present a case series to compare these two methods with special reference to speech outcome.

Keywords: Cleft Palate; Palatoplasty; Intravelar Veloplasty.

Introduction

Cleft palate (palatoschisis) which can occur with or without cleft lip are variations of a type of congenital deformity caused by abnormal facial development during gestation. Cleft palate is a condition in which two palatal shelves, that forms roof of the mouth fail to fuse partially (usually soft palate) or completely (both soft and hard palate).

Among the cleft lip and palate population, most common presentation is cleft lip and palate- 46%,

followed by isolated cleft palate- 33%, isolated cleft lip- 21%. Majority of bilateral cleft lips (86%) and unilateral cleft lips (68%) are associated with cleft palate. Unilateral clefts are more common than bilateral clefts and occur more frequently on left side than on right [1]. Etiology of cleft palate is Multifactorial. Genetic, environmental teratogens, folic acid deficiency during pregnancy, smoking, alcohol, maternal obesity, poor nutrition and certain drugs during pregnancy are some of the etiological factors known for cleft palate. Intrauterine exposure to anticonvulsant phenytoin is associated with 10-fold increase in cleft lip. Clefts may be syndromic or non syndromic. More than 40% of isolated cleft palates are part of malformation syndromes [1].

Various classifications have been described for cleft lip and palate. Davis and Ritchie presented first classification for cleft lip and palate, followed by Veau's classification, Kernahan and Stark classification, Modified Kernahan's classification, Kriens classification etc. Balakrishnan presented Indian classification in 1975. This still remains a popular system for classification of cleft lip and palate. He divided cleft lip and palate in to three groups, Group 1- cleft lip alone, Group 2- cleft palate alone, Group 3-combination of cleft lip, palate and alveolus. He used abbreviations R-right, L-left, M- midline, A-alveolus, P-partial, S-submucosal, micro- microform [2]. This is popularly known as Nagpur classification [2,3].

Normally levator muscles forms a transverse sling across the posterior half of soft palate, which on contraction causes the soft palate to move superiorly and posteriorly, contracting the posterior pharyngeal wall for velar closure. In addition to being discontinuous across the cleft, the levator muscle runs more or less longitudinally across the cleft margin before it inserts aberrantly in to the posterior border of hard palate, this results in inability to close

Corresponding Author: **Ravi Kumar Chittoria**, Head, Department of Plastic Surgery, Jawaharlal Institute of Postgraduate Medical Education and Research (JIPMER) Pondicherry, India-605006.

E-mail: drchittoria@yahoo.com

the palate against the posterior pharyngeal wall and air escapes through the nose during speech producing hypernasal quality. In addition to levator positioning abnormal fusion of tensor veli palatini muscle impairs function of Eustachian tube and contributes to cleft otopathology [4].

Various goals of palatoplasty are to separate oral and nasal cavities to provide better speech outcome and Eustachian tube function, and to minimize any detrimental effect on dento-maxillofacial growth [5].

Methodology

The present study is a Prospective clinical study, preliminary result of ongoing thesis, conducted in department of Plastic Surgery JIPMER, Pondicherry from November 2014 to November 2015.

Inclusion Criteria

Patients with cleft lip and palate group 2 and 3 (Nagpur classification) [3]

Between 9 month to 7 years of age

Full term born children.

Exclusion Criteria

Preterm born children

Children with history of developmental delay

All patients with cleft palate or cleft palate with cleft lip were diagnosed clinically. Eighteen patients were included in the study. Patients were operated as per hospital protocol. They were divided into 2 groups. Group A- patients who were operated by palatoplasty without radical intravelar veloplasty (two layer closure or anatomical closure) (Figure 1a, 1b, and



Fig. 1a: Pre operative



Fig. 1b: Nasal mucosa repaired



Fig. 1c: Palatal mucosa repaired



Fig. 2a: Pre op



Fig. 2 b: Levator Muscle dissection and repair



Fig. 2c: Post op

1c). Group B - patients operated by palatoplasty with radical intravelar veloplasty (three layer closure or functional closure) (Figure2a, 2b and 2c).

Both pre operative and post operative Speech

assessment was done in all patients in a blinded manner and final comparison was done in both the groups. Following parameters were used for speech outcome, middle ear function and post operative outcome.

Parameters for Speech outcome

According to universal variables for reporting speech outcome in patients with cleft palate [6] -

1. Nasal emission (0= absent, 1= mild, 2= moderate, 3=Severe)
2. Nasal turbulence (0= absent, 1= mild, 2= moderate,3=Severe)
3. Hyper nasality will be graded on 4 point scale (0= absent, 1= mild, 2= moderate, 3= Severe)
4. Speech intelligibility will be graded on a 5 point scale (0= none, 1= poor, 2= moderate, 3= good,

Grading	Definition
1	Normal speech, no nasal emission
1/2	Intermittent nasal emission, good intelligibility
2b	Continuous nasal emission, intelligible speech
2m	Continuous nasal emission, unintelligible speech
3	Presence of compensatory articulation

4= very good)

5. Velo pharyngeal insufficiency will be measured using Borel- Maisonne scale [7].

Further additional evaluation of velo pharyngeal insufficiency was done by naso-endoscopy in children who were more than three years of age and were co-operative.

Parameters for Middle Ear Function

Tympanometry was done for all patients before and after surgery. Graphical record of tympanometry will be compared in all patients before and after surgery.

Parameters for Post- Operative Complications

Immediate post-operative complications (within 48 hours) i.e. bleeding, airway difficulties.

Early post-operative complications (after 48 hours within 7 days)- oro-pharyngeal infection, wound dehiscence, palatal flap necrosis.

Late post-operative complications (after 7 days) oro-nasal fistula formation.

Result

Eighteen patients over one year duration with cleft palate were studied prospectively (Table 1).

Age Distribution

7 patients were between 1-3 years of age group, 4

Age Distribution

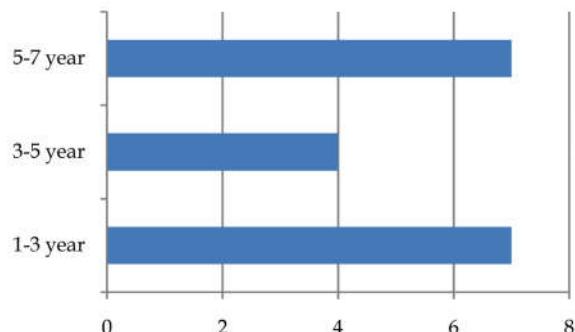


Fig. 3:

patients were between 3-5 years of age group and 7 patients were between 5-7 years of age group. The mean age was 4.13 year (Figure3).

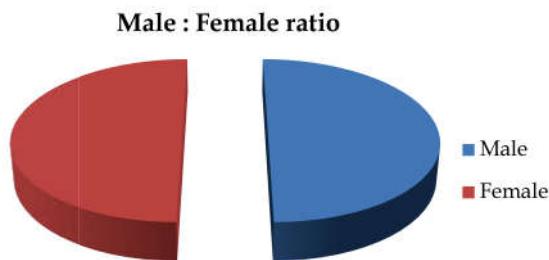


Fig. 4:

Sex Distribution

9 patients (50%) were male and 9 patients (50%) were female (Figure 4).

Nasal Emission

In group A - Pre operative nasal emission was mild in 3(33%), moderate in 6(66%) and post operative nasal emission was absent in 1(11.11%), mild in 3(33%), moderate in 5(55%) patients. Overall improvement in nasal emission was seen in 2(22%) patients (Figure 5a).

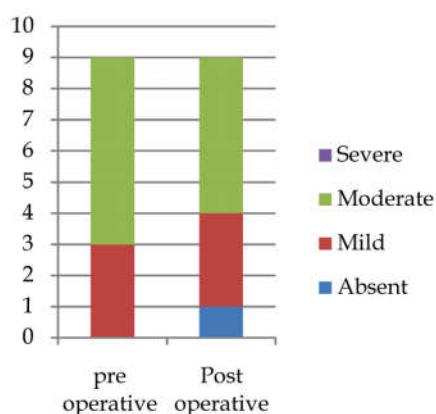


Fig. 5a: Group A

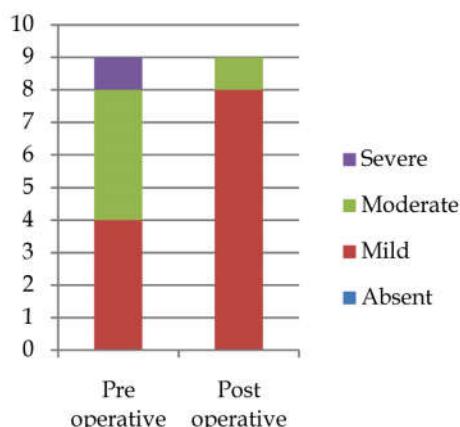


Fig. 5b: Group B

In group B- Pre operative nasal emission was mild in 4(44%), moderate in 4(44%), and severe in 1(11.11%) patients and post operative nasal emission was mild in 8(88%) and moderate in 1(11.11%) patients. Overall improvement in nasal emission was seen in 5 (55.55%) cases (Figure 5b).

Nasal Turbulence

In Group A- Pre operative nasal turbulence was mild in 3(33.33%), moderate in 6(66.67%), Post operative nasal turbulence was absent in 1(11%), mild in 3(33.33%), moderate in 5(55.55%). Overall improvement was noticed in 2(22.22%) cases (Figure 6a).

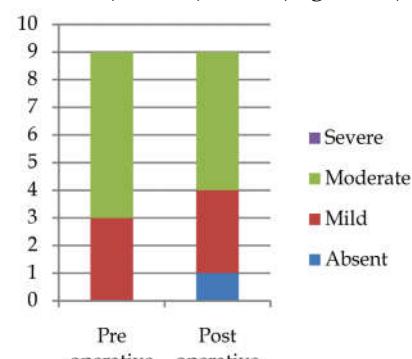


Fig. 6a: Group A

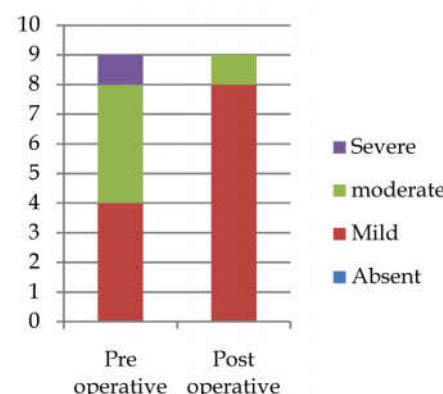


Fig. 6b: Group B

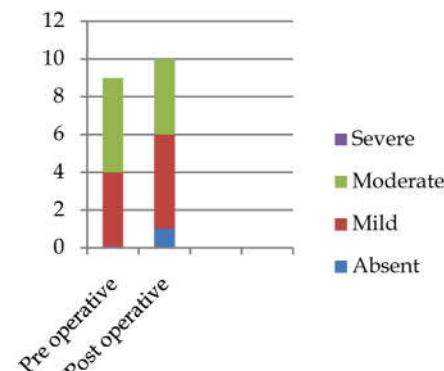


Fig. 7a: Group A

In group B- Pre operative nasal turbulence in was mild in 4(44.4%), moderate in 4(44.44%) and severe in 1 (11.11%). Post operative nasal turbulence was mild in 8(88.88%)% and moderate in 1(11.11%). Overall improvement was noticed in 5(55.55)% cases (Figure 6b).

Hyper Nasality

In Group A- Pre operative hyper nasality in was mild in 4(44.44%), moderate in 5(55.55%). Post operative hyper nasality was absent in 1 (11.11%), mild in 5(55.55%), moderate in 3(33.33%). Overall improvement was noticed in 3(33.33%) cases (Figure

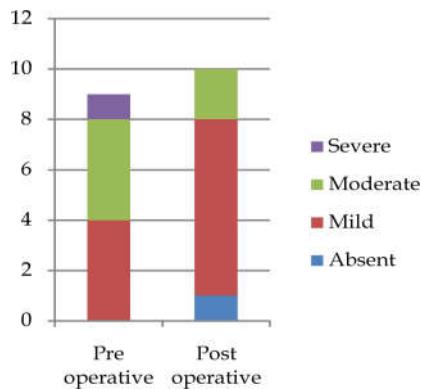


Fig. 7b: Group B

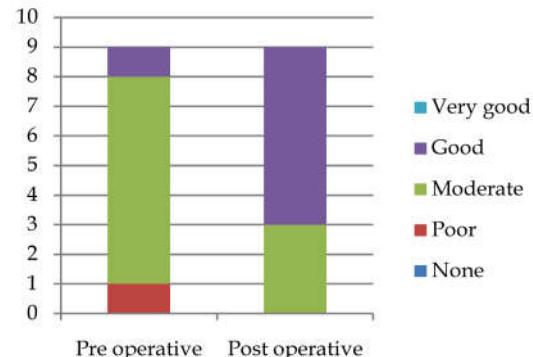


Fig. 8b: Group B

In Group B- Pre operative speech intelligibility in group B was poor in 1(11.11%), moderate in 7(77.77%), good in 1(11.11%). Post operative speech intelligibility in group B was moderate in 3 (33.33%) and good in 6 (66.66%). Overall improvement in speech intelligibility was notice in 6 (66.66%) patients (Figure 8a).

VPI (Velopharyngeal Insufficiency)

In Group A- Pre operative VPI was grade ½ in 2 (22.22%), grade 2b in 4 (44.44%), grade 2m in 3 (33.33%). Post operatively VPI was grade 1 in 1(11.11%), grade ½ in 1(11.11%), grade 2b in 4(44.44%),

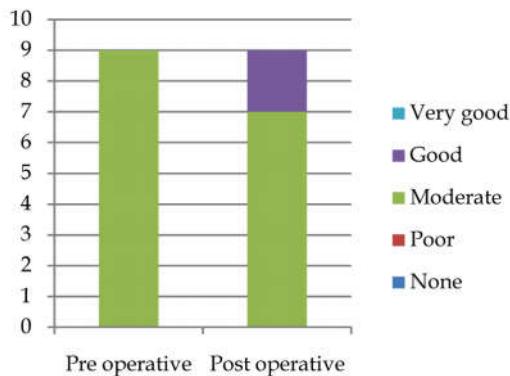


Fig. 8a: Group A

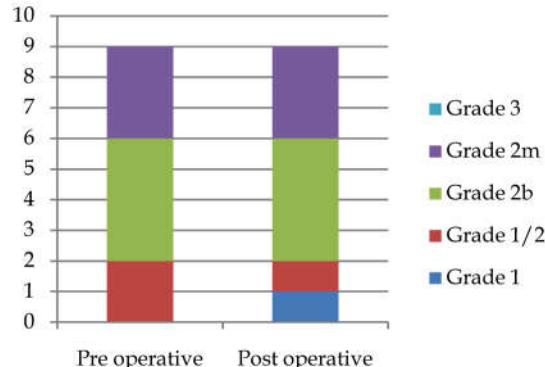


Fig. 9a: Group A

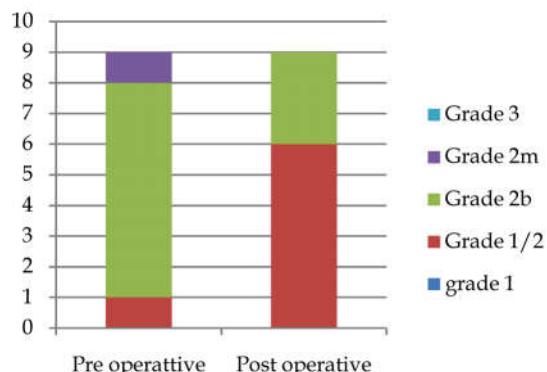


Fig. 9b: Group B

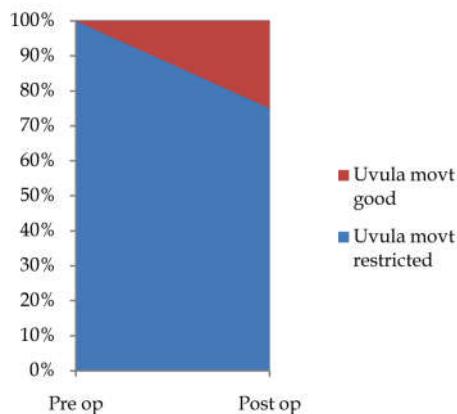


Fig. 10a: Group A

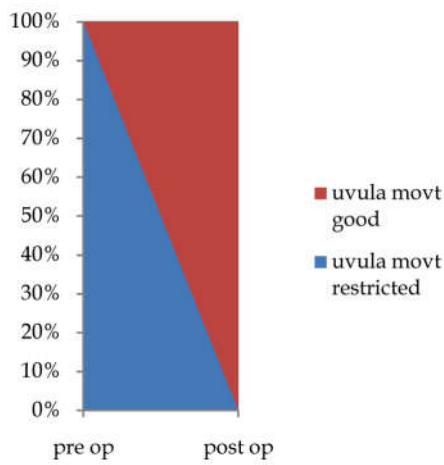


Fig. 10b: Group B

grade 2m in 3(33.33%). Overall improvement in VPI was noticed in 1(11.11%) patient (Figure 9a).

In Group B- Pre operative VPI was grade ½ in 1 (11.11%), grade 2b in 7(77.77%), grade 2m in 1 (11.11%). Post operatively VPI was grade ½ in 6(66.66%), grade 2b in 3(33.33%). Overall improvement in VPI was noticed in 7 (77.77%) patient (Figure 9b).

Nasoendoscopy

In Group A- Nasoendoscopy was performed in total 4 patients. Pre uvula movement was found to be restricted in all 4(100%) patients. Post operatively In 1(11.11%) patient uvula movement was found to be good, while in 3(33.33%) patients it was restricted. Overall improvement was seen in 1 (11.11%) patient (Figure 10a). In Group B- Nasoendoscopy was performed in total 4 patients. Pre operative uvula movement was found to be restricted in all 4(100%) patients. Post operatively uvula movement was found to be good in all 4(100%) patients. Overall improvement was seen in 4(100%) patient (Figure 10b).

Tympanometry

In Group A, all 9 patients had pre operative tympanograph of type B, post operative tympanograph was also recorded as type B in all patients.

In Group B, all 9 patients had pre operative tympanograph of type B, post operative tympanograph was recorded as type B in 8 patients and type A in 1 patients. Only one patient (11.11%) showed improvement in middle ear function.

Post operative Complications

All patients recovered well and no any significant complication was seen in patients of both groups.

Discussion

Various goals of palatoplasty have been described. The goals of successful palatoplasty are to separate oral and nasal cavities without any fistula, to achieve sufficient velar length to provide better speech outcome and Eustachian tube function, and to minimize any detrimental effect on dento-maxillofacial growth. Levator veli palatini muscle is primarily responsible for palatal elevation and production of sound [4]. After palatal repair speech should be evaluated by an objective assessment following a standardized protocol [5].

Various methods of cleft palate repair are described by various surgeons. Von Langenbeck palatoplasty uses two parallel incisions along the cleft side, two parallel incision along the alveolus and then two layer closure of the defect. Veau-Wardill-Kilner V-Y push back palatoplasty is a modification of Von Langenbeck technique to release the palatal length for improved function. Furlow's palatoplasty is also known as double reversing Z-plasty for soft palate to increase length of soft palate. Bardach Two-Flap Palatoplasty is a modification of Von Langenbeck technique in which incisions are made along cleft margin and alveolar margin, these are joined anteriorly to free the muco-periosteal flaps, soft plate is repaired in straight line, Levator veli palatine muscle dissection and reconstruction is performed and hard palate is closed. Two staged Palatoplasty, in which soft palate and lip is repaired early and hard palate is repaired later. Hole in one repair is the procedure in which both palate and are repaired together [8].

Victor Veau first advocated re-approximation of levator palatini muscle in midline during palatal repair. Krien O.B. introduced modification of Wardill-kilner V-Y push back technique, in which submucosal

Table 1

S No.	Type of surgery	Nasal Emmission	Nasal Tubulence	Hypernasality	Speech intelligibility	grade of VPI	Nasoendoscopy	Tympanometry	Post op Complications immediate
		Pre op	Post op	Pre op	Post op	Pre op	Post op	Pre op	Post op
1	7 yr/F with IVW	mild	mild	mild	mild	mild	moderate good	2b	1/2 Restricted
2	5.5 yr/F without IVW	mild	absent	mild	absent	mild	moderate good	1/2	1 Restricted
3	5 yr/F without IVW	mild	mild	mild	mild	mild	moderate good	1/2	1/2 Restricted
4	4 yr/F with IVW	severe	mod	severe	moderate	severe	moderate poor	2b	N/A
5	4 yr/F without IVW	moderate	moderate	moderate	moderate	moderate	moderate moderate	2m	N/A
6	5 yr/F without IVW	moderate	moderate	moderate	moderate	moderate	moderate moderate	2m	N/A
7	6 yr/F without IVW	moderate	moderate	moderate	moderate	moderate	moderate moderate	2m	N/A
8	2 yr/M with IVW	mild	mild	mild	mild	mild	good	1/2	1/2 N/A
9	2 yr/M with IVW	mild	mild	mild	mild	mild	moderate good	2b	1/2 N/A
10	2.5 yr/F with IVW	mild	mild	mild	mild	mild	moderate moderate	2b	N/A
11	2 yr/M without IVW	moderate	moderate	moderate	moderate	mild	moderate moderate	2b	N/A
12	6 yr/F without IVW	moderate	moderate	moderate	moderate	moderate	moderate moderate	2b	2b
13	7 yr/F with IVW	moderate	moderate	moderate	moderate	moderate	moderate good	2b	1/2 Restricted
14	3 yr/M without IVW	moderate	moderate	moderate	moderate	moderate	moderate moderate	2b	N/A
15	2 yr/M without IVW	mild	mild	mild	mild	mild	moderate moderate	2b	N/A
16	2.5 yr/F with IVW	moderate	moderate	moderate	moderate	moderate	moderate moderate	2b	N/A
17	7 yr/M with IVW	moderate	moderate	moderate	moderate	moderate	moderate good	2b	1/2 Restricted
18	6 yr/M with IVW	moderate	moderate	moderate	moderate	moderate	moderate good	2b	1/2 Restricted

dissection of the muscles on the nasal side is done and then reconstruction of palatal muscles in midline and three layer closure is done [5].

A retrospective study was one done on 58 patients of submucous cleft palate to compare speech outcomes among three procedures, two-flap palatoplasty with muscle retropositioning, double opposing Z-plasty and pharyngeal flap [7]. Speech outcome and need for secondary procedures were main outcome measures of the study. There were significant difference in success among procedures ($p=0.018$). Normal or borderline function was achieved in 6/20 (30%) patients who underwent two flap palatoplasty, in 10/15 (67%) patients who underwent double-opposing z-plasty and in 11/12 (92%) patients who underwent pharyngeal flap. Conclusion of the study was that double-opposing z-plasty is more effective than two-flap palatoplasty with muscular retropositioning and in children older than 4 years, primary pharyngeal flap was found to be more effective [9].

Sommerlad B C 2003 conducted a study on various methods of palatoplasty. This prospective study was done for 442 palatal repair between 1978 to 1992. Comparison was done between two methods of palatoplasty. Evidence from independent assessment suggests that more radical muscle dissection improves velar function, but speech improvement was not significant enough to perform intravelar veloplasty routinely [10].

A retrospective, time series and cohort analysis on 213 patients and described the importance of radical intravelar veloplasty during two flap

palatoplasty [10]. Comparison of outcomes was done before and after introduction of intravelar veloplasty between two study groups, with special emphasis on immediate post operative complications, oronasal fistula rate and speech outcome . Conclusion of the study was that there were no differences in post-operative complications between two groups. Perceptual speech evaluation demonstrated significantly better speech outcome and significantly lower rate for secondary palate surgery for velopharyngeal insufficiency in intravelar veloplasty group. They concluded that most important predictor for speech outcome was the addition of intra velar veloplasty (odds ratio, 0.175 ;95 percent confidence interval, 0.039 to 0.785). Muscle repair during cleft palate repair is important for adequate functional outcome [11].

A prospective cohort study on effect of palatal muscle reconstruction on functional outcome of cleft palate surgery was conducted on 70 patients. Included patients were Veau class 1 and Veau class 2 cleft patients. Patients were divided in two groups, group A (Veau class 2) included 32 patients and group B (Veau class 1) included 38 patients. In each group two-layer palatoplasty without intravelar veloplasty was compared with three-layer palatoplasty with intra velar veloplasty. They found that palatal muscle repair results in better speech outcome and greater resolution of secretory otitis media in early post operative period. Incidence of postoperative velopharyngeal incompetence was greater in two-layer palatoplasty group and incidence of palatal fistula rate was greater in three- layer palatoplasty group [11,12].

A retrospective study on speech outcome of palatal repair with and without intravelar veloplasty was conducted on 40 children with complete unilateral cleft lip and palate. Patients were treated according to two different protocols: Malek protocol (lip and soft palate repair without intravelar veloplasty at 3 month and hard palate repair at 6 month) and Talmant protocol(lip and soft palate repair with intravelar veloplasty at 6 month and hard palate repair at 16 month). Main outcome measures evaluated were speech intelligibility, velopharyngeal insufficiency and incidence of complications. They found that speech intelligibility and velopharyngeal incompetence was better in children who were operated by intravelar veloplasty. There was no significant increase in post operative complications [13].

Conclusion

Palatal repair with intravelar veloplasty is effective in outcome of speech outcome as compared with two

layered palatal closure without intravelar veloplasty. Significant improvement is noticed in nasal emission, nasal turbulence, hyper nasality, speech intelligibility and velopharyngeal insufficiency. Other parameters like middle ear function, incidence of post operative complications do not show significant difference in both procedures. However a study with large sample size is required for better analysis.

References

1. Hopper R. A, Cutting C, Grayson B. Cleft Lip and Palate In: Wolters Kluwer (ed). Grabb and Smith's Plastic Surgery. Sixth ed. Lippincott Williams &Wilkins: 2007. P201-225.
2. Agrawal K. Classification of Cleft lip and Palate: An Indian Perspective. Journal of Cleft Lip Palate and Craniofacial anomalies. 2014 July-Dec; 1(2): 78-83.
3. Kale SM. History of Nagpur plastic, reconstructive and maxillofacial surgery unit : first plastic surgery department of India. IJPS. 2003; 36(2): 134-137.
4. Wiliam Y. Hoffman. Cleft Palate : Eduardo D. Roriguer (ed). Peter C. Neligan's Plastic Surgery. Third edition. vol 3. Elsevier: 2013; p 569-583.
5. Hooper R A, Tse R, Smartt J, Swanson J, Kinter S. Cleft Palate repair and velopharyngeal dysfunction. Plast Reconstr Surg. 2014 Jun; 133(6): 852-864.
6. A Henningsson G, Kuehn D. P, Sell D, et al. Universal parameter for reporting speech outcomes in individuals with cleft palate. Cleft Palate Craniofac J. 2008; 45: 1-17.
7. Borel- Maisonne S. Velopharyngeal insufficiency viewed by the speech pathologist. Reeducation Orthophonique. 1975; 13: 61-81.
8. Agarwal K. Cleft palate repair and variations. Indian J Plast Surg. 2009 oct; 42: 102-109.
9. Sullivan S R, Vasudevan S, Marrinan E M, Mullikan J B. submucous Cleft Palate and Velopharyngeal Insufficiency: comparison of Speech Outcomes Using Three Operative Techniques by One Surgeon. Cleft Palate-Craniofacial Journal. 2011 sep; 48(5): 561-570.
10. Sommerald, B. C. A technique for palatal repair. Plast Reconstr Surg. 2003 nov; 112(6): 1542-1548.
11. Andrades P, Espinosa- de-los-Monterosa A, Sheel D H, Thurston T E, Fowler J S, Xavier S T, Ray P D, Grant JH. The importance of radical intravelar veloplasty during two-flap palatoplasty. Plast Reconstr surgery. 2008 Oct; 122(4): 1121-30.
12. Mohamed E. Hassan, Sherif Askar. Does Palatal Muscle Reconstruction Affect the Functional Outcome of Cleft Palate Surgery?. Plast Reconstr Surg. 2007; 119: 1859.
13. J. C. Doucet, C. Herlin, G. Capteir, H. Baylon, M. Verdeil , M. Bigorre. Speech outcome of early palatal repair with or without intravelarveloplasty in children with complete unilateral cleft lip and palate. British J. Oral and Maxillofacial Surg. 2013; (51): 845-850.