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An Evaluation of Surgical Outcome in Bilateral Cleft Lip Using Modified Millard Approach

Khan, Mahabubur Rahman

University of Rajshahi

Ph.D Thesis

AN EVALUATION OF SURGICAL OUTCOME IN BILATERAL CLEFT LIP USING MODIFIED MILLARD APPROACH

MAHABUBUR RAHMAN KHAN

THESIS SUBMITTED FOR THE DEGREE

OF

DOCTOR OF PHILOSOPHY

IN THE
INSTITUTE OF BIOLOGICAL SCIENCES
UNIVERSITY OF RAJSHAHI
BANGLADESH

BY

MAHABUBUR RAHMAN KHAN

JANUARY, 2020

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HUMBLY DEDICATED TO

ALL CLEFT PATIENTS THROUGHOUT THE WORLD, ESPECIALLY MY BROTHER WHO BORN WITH A CLEFT LIP AND PALATE.

DECLARATION

I do, hereby declare that, the thesis entitled **"An Evaluation of Surgical Outcome in Bilateral Cleft Lip Using Modified Millard Approach"** for the degree of Doctor of Philosophy in Medical Science, contains no material, which has been submitted for the award of any other degree or diploma in any university. To the best of my knowledge and belief it contains no material previously published of written by any other person or any other forms except when due reference is made in the text of the thesis.

(**Mahabubur Rahman Khan**)
Signature of the candidate

CERTIFICATE

This is to certify that the thesis entitled **"An Evaluation of Surgical Outcome in Bilateral Cleft Lip Using Modified Millard Approach"** has been prepared by **Mahabubur Rahman Khan** under my guidance and supervision for submission to the Institute of Biological Sciences (IBSc), University of Rajshahi, Bangladesh for the award of the degree of Doctor of Philosophy in Medical Science. It is also certified that the materials included in this thesis are the original works of the researcher and have not been previously submitted for the award of any degree or diploma anywhere.

I have gone thoroughly through the draft of the thesis and found it acceptable for submission.

Supervisor

Dr. Tanzima Yeasmin
Professor
Dept. of Biochemistry & Molecular Biology
University of Rajshahi
Rajshahi-6205.

Co-supervisor

Dr. Al Mamun Ferdousi
Professor & Former Dean
Dept. of Oral & Maxillofacial Surgery
BSMMU,
Dhaka, Bangladesh.

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within Bangladesh, I consider myself fortunate to have assisted the needy around the globe.

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With gratitude,

Mahabubur Rahman Khan.

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ABSTRACT

To handle premaxilla of Bilateral cleft lip cases is the biggest challenge for a surgeon. All the post-operative complication arises only at this area. Like labial fistula, fibrosis, scaring, inadequate development pre-maxilla causing incompetent lip etc.

So, our art, technique and concentration for bilateral cleft lip surgery based on premaxillary work. Here is the modification of modified millard's techniques-

To save 2-3 mm mucous layer of premaxilla, the tissue which is discard by other techniques like Manchester techniques. Handle that tiny tissue; carefully place it in correct position which will give a long term excellent aesthetic surgical outcome.

In Bilateral cleft lip cases always the premaxilla is short. We design and dissect and lengthen 1-2 mm and shape the upper lip with normal length.

Mobilize the mucous layer from both sides, close the opening of cleft alveolus and built up a very good sulcus layer.

This will help the normal development of premaxilla and will prevent the post-operative complication of bilateral labial fistula which is very common complication of bilateral cleft surgery.

Abbreviations

ABG	:	Alveolar bone grafting
ACPA	:	American Cleft Palate-Craniofacial Association
ALFH	:	Anterior lower face height
ATFH	:	Anterior total face height
AUFH	:	Anterior upper face height
CBCLP	:	Complete bilateral cleft lip and palate
CFA	:	Craniofacial anomalies
CLP	:	Cleft lip and palate
CL/P	:	Cleft lip with or without cleft palate
CP	:	Cleft palate
CT	:	Computed tomography
CUCLP	:	Complete unilateral cleft lip and palate
DI	:	Digital image
DICOM	:	Digital imaging and Communication in Medicine
DPI	:	Dots per inch
DMA	:	Dentomaxillary advancement
ICC	:	Intraclass correlation coefficient
IQ	:	Intelligence quotient
IVV	:	Intravelar veloplasty
JPEG	:	Joint Photographic Experts Group
NAM	:	Nasoalveolar molding
PSIO	:	Presurgical infant orthopedics
RCT	:	Randomized control trial
SD	:	Standard deviation
UCLP	:	Unilateral cleft lip and palate
WHO	:	World Health Organization

Chapter-1

INTRODUCTION

1. INTRODUCTION

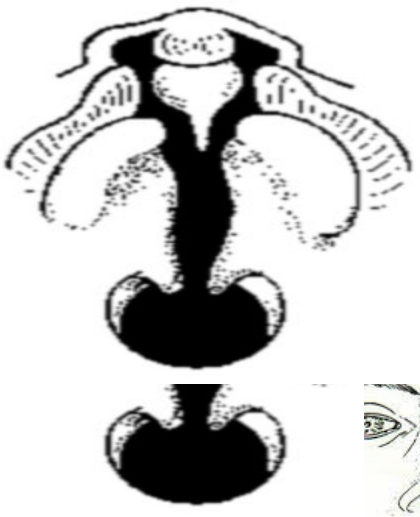
To born as a normal human being is a blessing. A baby is born with congenital facial defect (cleft lip) in this world to face challenges one after another is their whole life. Immediately after birth a new born cleft baby struggle with breathing problem to intake and adjust the extra volume of air breathing every moment with extra wide nasal space which is not normal.

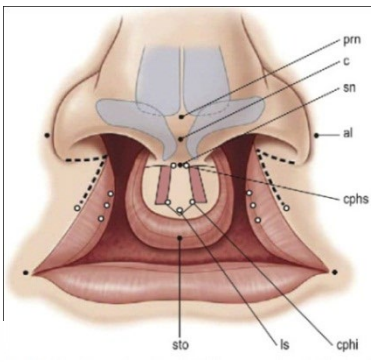
Then come to feeding, A new born failed to suck the breast milk due to lack of natural oral assistance approaches (lip, cheek, and chin support) might assistance with facility of a steady stage for vigorous activities of the tongue, lips, and cheeks for the period of sucking efforts (Clarren *et al*. 1987; Hwang, Lin, Coster, Bigsby, & Vergara. 2010). Due to feeding and breathing problem can be disturbed, the normal growth of cleft baby. CBL (Cleft on the both side of the lip) seems at what time the arrangements of the lip and or palatal shelves failed to fuse among the eight and twelfth weeks of pregnancy (Pearson & Kirschner. 2011).

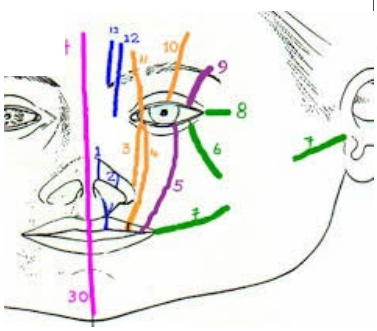
So, CBL are the very common abnormalities and might or might not be present in the perspective of orofacial inherited abnormalities and/or craniofacial disorders (Arvedson & Brodsky. 2002; Cooper-Brown *et al*. 2008; Shprintzen *et al*. 1985). Difficulties with nourishing procedure and management of breathing and swallowing might take place with isolated CBL, but are generally transitory in nature (Masarei *et al.* 2007). In compare, nourishing and swallowing problems could be important in the situation of difficult craniofacial abnormalities secondary to upper airway obstruction, cranial nerve deformities, and neuromotor factors (Arvedson & Brodsky. 2002; Cooper-Brown *et al*. 2008; Kummer. 2013; Perkins, Sie, Milczuk, & Richardson. 1997). Disorganized nourishing might cause in insufficient capacity of oral consumption, poor weight gain, and eventually negotiated nutritious and growing status. In addition, airway obstacle as a effect of the craniofacial abnormality might cause an incapacity to

attain or tolerate airway protection for the period of feeding and swallowing, posing a possible danger to respiratory health (Dinwiddie. 2004). At very early age, cleft patient face another challenge of painful surgery one after another. That painful suffering can be more when post-surgical complications arise. At school age more challenges are also come that is isolation, rudeness, non-cooperation by other childrens and teachers.

In Bangladesh these cleft patient are often called "‡VvuU KvUv/Zvjy KvUv", in India they are called "Lord Ganesha" in Kenya, are called "Mdomo sungura" (Rabbit face), In Somalia, "Faruro", In Rwanda, "Kabali" etc. That is their biggest psychological trauma in their life. As a result these cleft children refuse to go to school, refuse to play with other children. At the age of marriage, there is more painful sufferings from in laws family, insultation, mental and physical torturing, even sometimes separation of life. That's the reality of cleft patients. Cleft is a most-frequent congenital birth. Facial defect affecting 1 in every 500 to 1000 birth world-wide, varies in different races. Like Asian, European and African. One baby is born with cleft every two minute in the world according to WHO study published in 2000. Cleft is a greek word means a space or opening made by cleavage or split. BCL&P is a cleft which involves base of the nose, the upper lip, the alveolar process, hard palate and soft palate.







1.1 CLEFT LIP and PALATE

A **CBL/P** is an initial or split in the upper lip which happens when development of the facial arrangements in an unborn baby don't close by totally. CP might be CSL or CBL. A newborn with a CP may possibly experience a cleft in the roof of the mouth (cleft palate).

CBL, also recognized as orofacial cleft, is a set of disorders which comprises cleft lip (CL), cleft palate (CP), and CBL (cleft on the both side of the lip). (Facts about CBL. 2014; Watkins *et al*. 2014) A CP comprises an inaugural in the upper lip that might spread out into the nose. (Facts about Cleft Lip and Cleft Palate. 2014) The cleft might be one side, both sides, or in the middle (Facts about Cleft Lip and Cleft Palate. 2014). A CP is when the top of the mouth comprises a cleft into the nose (Facts about Cleft Lip and Cleft Palate. 2014). These syndromes may result in breastfeeding difficulties, language difficulties, hearing complications, and repeated ear contaminations (Facts about Cleft Lip and Cleft Palate. 2014). A reduced amount the period that the situation is related with other syndromes (Facts about Cleft Lip and Cleft Palate. 2014)

CSL and CBL are the outcome of tissues of the face not assembly correctly during the growth phase. (Facts about Cleft Lip and Cleft Palate. 2014) Although, it is a kind of genetic deficiency (Facts about Cleft Lip and Cleft Palate. 2014). The cause is unknown in most cases (Facts about Cleft Lip and Cleft Palate. 2014). Threat issues consist of smoking during gestation, diabetes, obesity, an aged mother, and few drugs (example: few used to treat seizures). (Facts about Cleft Lip and Cleft Palate. 2014; Watkins *et al*. 2014) CSL and CBL may frequently make a diagnosis during gestation with an ultrasonography examination (Facts about Cleft Lip and Cleft Palate. 2014).

A CSL and CBL may be effectively treated with surgical treatment (Facts about Cleft Lip and Cleft Palate. 2014). That is frequently completed in the first few months of life for CP and before 1 year and 6 months for CP (Facts about Cleft

Lip and Cleft Palate. 2014). Language therapy and dental carefulness might also be required (Facts about Cleft Lip and Cleft Palate. 2014).With proper management, results is good (Facts about Cleft Lip and Cleft Palate. 2014)

CBL & P occurs in about 1 to 2 per 1000 births in the developed world (Watkins *et al*. 2014). Cleft Lip is around two times as common in males as females, whereas Cleft palate without Cleft Lip is more common in females (Watkins *et al*. 2014). The disorder was previously identified as a "hare-lip" because of its similarity to a hare or rabbit, but that term is currently considered to be unpleasant. (Boklage ,Charles E. 2010).

1.1.1 DEFINITION OF CLEFT LIP AND PALATE (CBL/P).

CBL/P is among the most general genetic situations (Vanderas. 1987; Clinical Standards Advisory Group. 1998; Mosey and Little. 2002). In common terms, cleft lip is the occurrence of a couple of upright opening in the upper lip and alveolus. It might differ since a minor deficiency to a whole cleft spreading up to and concluded the bottom of the nose. Whereas cleft with palate exists in the existence of one upright opening in the palate. CBL/P was supposed to happen while the appearance procedures in an embryo did not entirely fused. The working meaning for CBL/P had been well-defined that arising as a cleft on the either side of the lip and palate or cleft lip with or without cleft palate (CBL/P) or a cleft palate without lip (CP) (ICBDMS. 2001). The main cleft sub-types are isolated cleft lip (CL), cleft lip and alveolus (CLA), cleft palate only (CP), unilateral incomplete cleft lip and palate (IUCLP), unilateral complete cleft lip and palate (UCLP), incomplete bilateral cleft lip and palate (IBCLP) and bilateral complete cleft lip and palate (BCLP). Common improvement of the oral fissure starts around the 4^{th} week of gestation, a absence of combination of the primary palate in the 5^{th} week of gestation displays as cleft of the lip and alveolus whereas absence of union of the secondary palate during the 8^{th} week of gestation outcomes in cleft of the palate (Sperber. 2002).

1.1.2 CAUSES OF CBL/P

The reason of CBL/P is not well assumed but there is a solid hereditary relation, intricate through the relations of a collection of eco-friendly and way of life features for example nutrition or smoking (Murray. 2002). The multifactorial idea of reason and outcome of CBL//P had established by detecting the aetiological heterogeneity in a series of occurrence of CBL/P. Several are initiated by altered genes, others as a outcome of chromosomal irregularities, precise ecological mediators and a decent number is produced by a communication among genetic factor and ecological issues (Mossey. 2009; Botto. 2002; Butali. 2011). CL/P is supposed to be genetic; the legacy trait had showed by researches on relatives and mongoloid twins (Douglas. 1958; Asling *et al*.1960). The chief cleft sub types are isolated cleft lip (CL), cleft lip and alveolus (CLA), cleft palate only (CPO), unilateral incomplete cleft lip and palate (IUCLP), unilateral complete cleft lip and palate (UCLP), incomplete bilateral cleft lip and palate (IBCLP) and bilateral complete cleft lip and palate (BCLP).

Relationship among ecological threat issues and CBL/P for example parental contact to tobacco, liquor, malnutrition, infection, medicinal drugs and teratogens had investigated, with maternal smoking and lack of folic acid being steadily connected with the danger of emerging clefts (Mossey *et al.* 2007).

1.1.3 PREVALENCE OF CBL/P

Cleft lip and palate arises more regularly than sequestered cleft lip and sequestered palate (Calzolari *et al*., 2007, Tolarova and Cervanka. 1998). Normally CL/P occurs men more than women (Niswander *et al*. 1972; Ritter *et al*. 2004). In case of Gender distribution of cleft lip and palate finds that isolated cleft lip was more usual in men while isolated Cleft palate was common in women (Rittler *et al*. 2004)

The universal occurrence of CBL/P was 1:700 live births (WHO. 2002). Greater frequency had described between Asians through an occurrence as high as 2 per 1000 (Gorlin *et al*. 2010). In the Chinese a frequency of 1.12 per 1000 had noted (Cooper *et al*. 2000). These statistics were marginally upper than a cleft occurrence of 1 per 1000 stated in White British (CRANE Project Team. 2009). Minor occurrence 0.3-0.9 per 1000 live deliveries had described amongst the black residents (Butali *et al*. 2009). However it hard to determining accurate occurrence in the black group due to bias in procedure and reporting (Mossey *et al*. 2009). The occurrence of clefts in the diverse cultural group was not identified (Hernandez-Diaz. 2000).

The World Health Organization in its sequence of reports on global joint investigation on craniofacial irregularities described on the occurrence and incidence of clefts (WHO 2002, 2003). In overall, cleft on the both side of the lip with or without palate and sequestered cleft palate had an incidence of about 1 in 700 live births (WHO. 2002). It is similarly explicated that though alterations amongst republics do exist, birth incidence of CP (with or without CP) was about 1:1000 births. Further, in two thirds of patients identified with cleft, the left-hand side was more recurrently affected, and it was more widespread in men than in women (WHO. 2002).

Greater frequency of CL/P had described amongst Asians whereas small frequency had described amongst African residents. In Europe, researchs had discovered that 1.45-1.57 in each 1000 persons were born with cleft lip and/or palate (Derijcke *et al.* 1996). In a research of all Danish offspring with clefts born among the years of 1976 and 1981 the frequency was 1.89 per 1000 live births (Jensen *et al*. 1988). It had problematic in establishing the incidence of CL/P in Nigeria, due to beneath reporting; earlier researchs had described a frequency of among 0.2-0.3 per 1000 (Iregbulem *et al*.1982). A very current research had stated an occurrence of 0.5 per 1000 (Butali *et al*. 2011).

1.2 CLASSIFICATION

Cleft on the both side of the lip and palate (CBL/P) were categorized according to their phenotypes or appearances. Classification of CBL/P based on this phenotypic appearance. Imprecise and unreliable classification remains a problematic nowadays. So, requirement for a classification which is simple, universal, and practical.

Classification of CBL/P is difficult because of their appearances is phenotypically diverse. This thesis discovers the advancement of concepts about CBL/P catagories and includes the patterns termed by Veau (1931), Harkins *et al.* (1962), Fogh-Andersen (1943), Brophy (1923), Spina (1973), Kernahan and Stark (1958), Davis and Ritchie (1922), Broadbent *et al*. (1968).

1.2.1 ANATOMIC AND MORPHOLOGIC PERSPECTIVES

1.2.1.1 J.S Davis, M.D.; H. P. Ritchie (1922)

Davis and Ritchie move on further than simply applauding suspension of the word harelip. Davis and Ritchie were amongst the leading supporter for appropriate classification scheme. They discussed, that, there are no usually recognized normal expressions for analyzing hereditary CBL/P, and, in result, it is frequently hard to recognize the explanations in several of the papers transcribed on that CBL/P. Some researchers may practice a set of expressions to define few of these disorders, whereas other might practice the similar expressions to analyze those disorders which are practically dissimilar. Yet again an investigator might have a set of expressions which, it seems on research, which investigator alone practices and the person who reads might have to rest on on the explanations to discover what is actually expected by the script. In circumstance, the expression is significantly confused. Classification proposed by J.S Davis, M.D.; H. P. Ritchie is very easy and simple. It is consists of 3-group methods that acceptable discrete explanation of the lip, palate and alveolus. Classifications were given below:

Group I: Pre-alveolar cleft lip (lip is affecting by the clefts)

(1) Unilateral (complete/incomplete: right/left)

(2) Bilateral (left: complete/incomplete; right: complete/incomplete)

(3) Median (incomplete /complete)

Group II: Post-alveolar cleft lip (palate is affecting by the clefts)

(1) Hard palate

(2) Soft palate

Group III: Alveolar cleft (alveolar process is involving the cleft)

(1) Unilateral (complete/incomplete: right/left)

(2) Bilateral (left: complete/incomplete; right: complete/incomplete)

(3) Median (incomplete / complete)

As CBL/P phenotypes might include several arrangements, J.S Davis, M.D.; H. P. Ritchie permitted similarity of the classifications. Precisely, they approved that CBL (alveolus intact) is verified as both group I and group II; nonetheless, each and every situation concerning an alveolus cleft (regardless of the integrity of the lip or palate) would be characterized completely as group III. Additional analysis, it is seeming that J.S Davis, M.D.; H. P. Ritchie accepted that for instance a topic of ambiguity (if not weakness) in their grouping system: In the 3rd group, there is frequently an connected cleft of the (alveolar) procedure, lip and palate of several steps structurally; but there must be contained within that situation, of flexible incidence, in which a CBL and cleft procedure are existing with a usual palate, or, if those incidents arise, of a CP and cleft procedure with a usual lip. The suitable grouping of these incidents is a topic for argument. That would be more achievable to record them in the 3rd cluster as there the prospect is specified for the straight explanation of the 3 structures. (J.S Davis, M.D.; H. P. Ritchie, 1922).

Their idea that the alveolus made the foundation of an ‘‘smart arrangement’’ was not globally recognized and was reason for much argument. Nonetheless, J.S Davis, M.D.; H. P. Ritchie’s suggestion was established positively by present-day specialists such as James Thompson of Galveston, Texas, whom went on record to say that ‘‘there is great need of development in arrangement and terminology and that the system [by J.S Davis, M.D.; H. P. Ritchie] is a stage in advance’’ (J.S Davis, M.D.; H. P. Ritchie, 1922).

Vilray Blair of St. Louis was thoughtfully kept in that certification of the new system:
it is thoroughly in kindness with and vigorously accept of the complete thought but it is trying to scheme roughly for worldwide adaptation. Although it is not totally accepted, it is not meaningful; and, to guarantee its acceptance, so, it’s requires the finest strategy. As it is not, someone would exist something a slight superior, distressed the one which have to accepted and went on. (J.S Davis, M.D.; H. P. Ritchie,1922) Blair’s main disapproval of the grouping scheme was its origin on current clinical viewpoints (that was issue to be changed) rather than on anatomy alone (which is immutable):

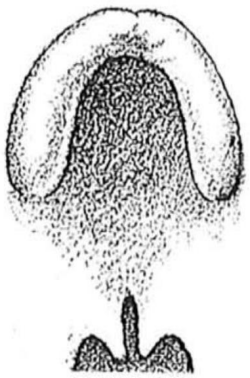
Dr. Ritchie sets onward that the grouping will be alongside clinical outlines, leaving the anatomic outlines. Permitting that, the clinical grouping system had the better application; the anatomic source is much stable. Classification built on a clinical idea that had not hoisted the experiment of time.

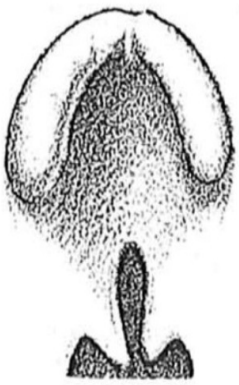
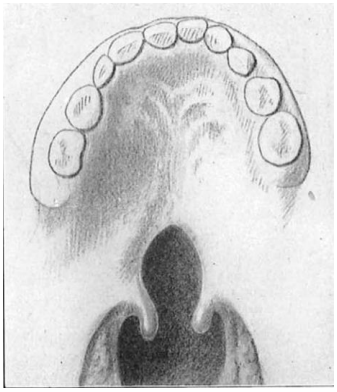
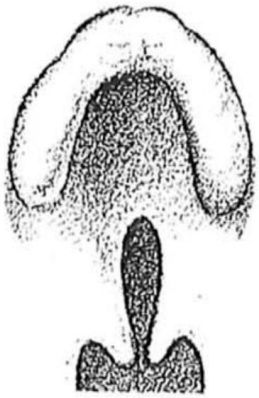
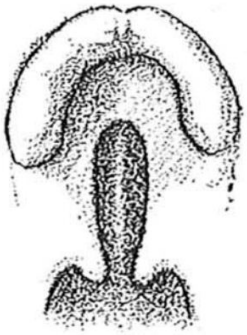
Brophy (1921 to 1923)

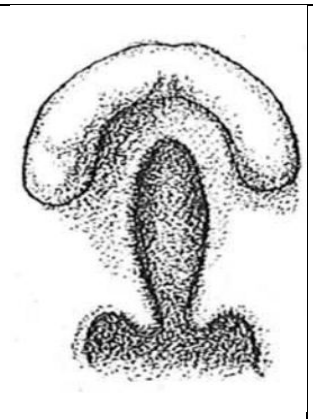
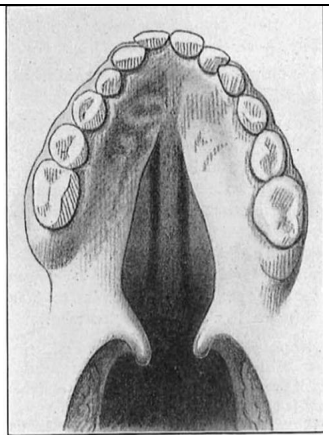
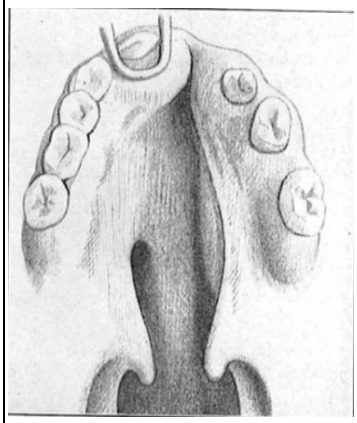
T.W. Brophy (Chicago) resound Blair’s feeling that appropriate classification would be established on appropriate accepting of anatomy; he was relatively verbal in assessing the Davis and Ritchie scheme as it is inadequately meticulous in this respect. In 1921 and 1923, Brophy issued his personal meticulous research of the formulas of CBL/P founded on unbelievable 5076 and 2676 operations to renovation CP (Cleft lip and palate) (Brophy, 1921). The purpose was to justification for ‘‘each muscles and bones intricate in that

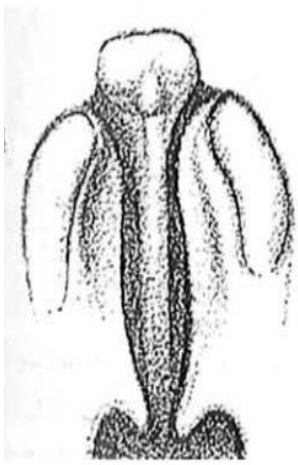
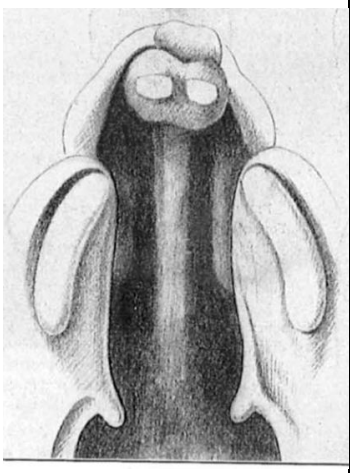
malformations'' (Davis and Ritchie, 1922). Therefore, the grouping comprised 16 separate morphological forms of CP (Cleft lip and palate) with/without (Table 1). Brophy's classification were mentioned by the Annals of Surgery (McWilliams, 1924), but numerous specialists measured the method excessively multifaceted and impractical.

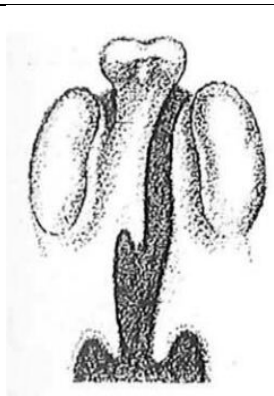
TABLE 1 Morphologic Classification Schemes of Brophy (1923) and Veau (1931)*

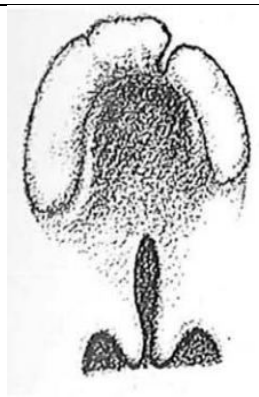
BROPHY			**VEAU**	
1		A very simple system of cleft palate, just a partial cleft of the uvula.	*"Division de la luette"* (division of the uvula)	
2		**A** cleft spreading forward into the fibres of the levator palate and the replicated portions of the tensor palate muscle; which gives the complete anatomic form.		***1°Forme*** " Divisions simples du voile" (simple divisions of the velum)

3		A cleft spreading through the uvula and forward to the posterior border of the horizontal plates of the palate bones.	**I**	
4		A cleft spreading through the complete soft palate, including partial or whole cleft of the horizontal plates of the palate bones		
5				***2° Forme*** ***"Divisions du voile et de la voûte"*** (divisions of the velum and vault)

6			**II**	
7		A complete single cleft of the total soft and hard palate, as well as the alveolar process; the maxilla is separated from the pre-maxilla, usually on the left side, and escorted by single harelip.	**III**	***3° Forme*** ***"Divisions du bec-de-liêvre unilateral total"*** (divisions of the complete unilateral harelip) 

8		A tripartite cleft, spreading through soft and hard palate, separating the pre-maxillae from the maxillae; nearly always complicated with double harelip.	**IV**	***4° Forme*** ***"Divisions du bec-de-liêvre bilateral [total]"*** (divisions of the [complete] bilateral harelip) 
9		A cleft of the entire soft palate, extending through the horizontal plates of the palate bones and into, though not through, the palatal plates of the maxillae. (The pre-maxillae are divided from the maxillae, between which and the anterior part of the cleft, the hard palate is normal; it is usually difficult with double harelip.)		**"*Division du voile dans le bec-de- liêvre bilatéral total"*** (Divisions of the velum in bilateral complete harelip)

10		A cleft only among the maxilla and premaxilla, usually on the left side and escorted by single harelip.	***"Bec-de- liêvre unilatéral total sans division palatine"*** (complete unilateral harelip without palatal division)
11		A cleft entirely splitting the pre-maxillae from the maxillae, with the palate otherwise normal.	***"Bec-de-liévre bilatéral total sans division palatine"*** (bilateral complete harelip without palatal division)
12		A cleft only of the anterior one half or one third of the hard palate, with protruding pre-maxillae which are completely separated from the maxillae.	***" La fusion des lames palatines Ś est arrêtée `a la partie moyenne"*** (fusion of the palatal shelves ceased in the midline)
13		A cleft of the complete soft and hard palate, spreading through the alveolar ridge on one side, with pre-maxillae detached entirely on one side and moderately on the other,	***"Fente unilatéral dans un bec-de- liêvre unilatéral total"*** (unilateral cleft [palate] in a bilateral complete cleft lip)

14		A cleft of the soft palate, incomplete or complete, usual hard palate with cleft in the alveolar border.	***"Bec-de-liévre uilatéral total avec division palatine isolée de la fente du rebord alvéolaire"*** (unilateral complete hare lip limited to a fissure in the alveolar ridge with palatal division)
15		A cleft only of the alveolar process anterior to the maxillae, due to the improvement or absence of the pre-maxillae, usually accompanied by harelip in the median line.	***"Bec-de-liévre bilatéral total sans tubercule médian avec intégrité de la voûte palatine"*** (bilateral complete harelip with absent median tubercle and an intact palatal vault)
16	An exceedingly rare form, a cleft entirely separating in the median line the entire palate and lip.		n/a

* Brophy's (1923) system was very detailed but arguably too complex for practical use. Veau himself commented that Brophy's classification featured a numerous countless ''variétés de la même forme'' (''varieties of the similar type'') and aimed to simplify the classification into one that was more utilitarian and clinically significant. Veau I encompasses Brophy classes 1 to 3, Veau II encompasses Brophy classes 4 to 6, Veau III corresponds with Brophy class 7, and Veau IV corresponds with Brophy class 8 (and arguably 13). Differences among the Brophy classes within these groupings are really matters of severity. Brophy classes 9 to 16 are other combinations of CL+P that are not considered by the Veau classification, which was limited to describing clefts of the palate (CP) only. According to Veau, ''Pour ma part, je m'y refuse absolument . . . ils sont opérés comme des becs-de-liévré ordinaire et non comme des divisions palatines'' (''For my part, I absolutely refuse [to classify them] . . . they are operated upon like ordinary harelips and not like palatal divisions.'') Figures reproduced from Veau V. Division Palatine. Paris: Masson; 1931. Permission granted by Elsevier-Masson press.

Veau (1931)

Victor Veau (1931) issued milestone separation palatine, that is called the method to estimation and managing of CP. Veau was humble of Brophy but willingly serious of the grouping scheme, testifying that it identified a numerous countless ''variétés de la même forme'' (''varieties of the identical type'') that would be assembled together.

Veau's significantly shortened grouping of palatal clefts contained of four morphological systems (Table 1):

I. The velum/ muscular palate

II. The velum/ muscular and hard palate, up to the perceptive foramen

III. The velum/ muscular and hard palate spreading one side of the lip through alveolus

IV. The velum/ muscular and hard palate spreading both side of the lip through alveolus

Despite the fact that Veau argues the most difficult of anatomical outcomes in Separation Palatine, so decisively selected to eliminate ''confounding'' specifics (severity) since the grouping scheme itself, favoring modest classifications. In the following study devoted to cleft lip, Bec-de-Lièvres (Veau and Récamier, 1938), Veau avoids taxonomical classifications completely and in its place supports a perfect and brief explanation of the labial deficiency (containing laterality [one or both side of the lip /median] and level [simple/ total]). The simplicity, morphologic source, and scientific significance of Veau's method to classification through it very good-looking to the current specialists.

EMBRYOLOGICAL PERSPECTIVES

Fogh-Andersen (1942)

Classification given by Davis and Ritchie had one criticism and that was the alveolar procedure as separating mark among the pre-alveolar clefts and post-alveolar clefts were indiscriminate. P. Fogh Andersen was a good doctor who measured the perceptive foramen, rather than alveolar procedure, to be a improved separating link from an embryological perspective.

In the article, Genetically Harelip and Cleft Palate (1942), this suggested an alternate to the Davis and Ritchie classification which was poised of four catagories:

(1) Harelip (single or double)

(2) Harelip with cleft palate

(3) Isolated cleft palate

(4) Rare atypical clefts, e.g., median cleft lip

Similarly J.S Davis, M.D.; H. P. Ritchie, Fogh-Andersen's cluster one clefts (''harelip'') was anterior, but Fogh-Andersen, that intended the cleft were anterior to the perceptive foramen rather than to the alveolar procedure. Prominently, Fogh Andersen illustrious in the huge epidemiologic research that certain notch of labial clefting were consistently witnessed in connotation with separation of the alveolar procedure, advising that cleft lip and alveolus were related and perhaps related to the etiologically. So, Fogh-Andersen's cluster 1 (''harelip'') efficiently contains cleft lip alone and cleft lip with cleft alveolus, and his cluster 2 (''harelip with cleft palate'') incorporated cleft lip and alveolus with cleft palate (e.g., Veau III and Veau IV) although CBL with integral alveolus (e.g., cleft lip with a Veau I or Veau II cleft palate). Fogh-Andersen additional developed the characterization of an inaccessible CP (Cleft lip and palate) (group 3) as a deficiency that is ''constantly average [which] certainly not touches further than the incisor foramen'' (Fogh-Andersen, 1971). That explanation is alike to a Veau I cleft of the soft palate only or a Veau II cleft of the secondary hard and soft palate. Veau III and Veau IV CP were automatically involved in cluster 2 since Fogh-Andersen assumed certain grade of labial clefting to be existent each and every time the alveolar procedure were disturbed.

Lastly, Fogh-Andersen added cluster 4 to seizure the average CBL that was formerly observed only as a occasional deficiency rather than as a classic but distinct type of CBL..

Kernahan, D.A. and Stark, R.B. (1958)

Kernahan D.A. and Stark R.B. (New York) has too reliable supporters for a cleft grouping scheme on developing anatomy. In 1958, they were providing support for Fogh-Andersen's usage of the perceptive foramen as the embryo-logically sound separating line by mentioning indication since the most existing accepting of facial embryogenesis:

Kernahan D.A. and Stark R.B. confronted the usage of morphology alone as a foundation for classification: ''the embryologic actions prominent to the malformation, viz., the distinct nature and time formation of the primary and secondary palates, were well understood''; and thus, ''cleft lip and palate preferably would be categorized on that basis'' (Kernahan D.A.,1991).

Transformers were added to define laterality (unilateral/bilateral/median) and severity (total/subtotal). That nosological outline is closely equal to that of Fogh-Andersen, though the arrangement of the clusters is dissimilar. Kernahan and Stark comprised median CBL in their cluster 1 (anterior clefts) rather depend on a distinct catch-all classification for a typical clefts.[1]

TABLE 2 Conditions for an ''Ideal'' Classification System*

I.	Concise, clear definitions of terms; hence,
	A. Rejection of the meaningless, the ambiguous, and the irrelevant
	B. Preference for simple, descriptive English terms
	C. Retention of established customary terms, where possible, in order to avoid duplication and confusion
	D. Formation of new terms only where necessary
	E. Indication of synonomous [sic] terms, especially those of wide usage such as ones based on Latin or Greek, to facilitate comprehension and use of the system proposed here
II.	Convenience of use through:
	A. Economy of expression
	B. Logical arrangement of classification conformable with
	1. Normal topographic (spatial) relationship of anatomical structures
	2. Normal sequence in embryologic advent and union

C. Standardized methods of measurement

III. Stimulation of scholarly and clinical research by:

A. Standardized procedures for observation and reporting

1. Meaningful in terms of embryologic antecedents

2. Meaningful in describing tissue relationships used to evaluate need and method of therapy

B. Provision for rare conditions

* In its 1962 report, the Nomenclature Committee of the American Association for Cleft Palate Rehabilitation published its principles for a perfect grouping system (Harkins *et al*., 1962). These regulatory ideologies are still very valid.

[1] A current obligation of fetal facial improvement explains that a median pre-maxillary cleft is due to imperfect synthesis of the medial nasal eminences to arrangement the pre-maxillary section, Although the more common lateral cleft lip with/without cleft alveolus arises from abnormal synthesis of the right/left maxillary eminences with the pre-maxillary section. In this light, a method systematized stringently allowing to embryologic ideologies should indeed categorize median labial clefts independently from lateral labial clefts.

Chapter -II

RATIONALE, HYPOTHESIS, AIMS AND OBJECTIVES

2. RATIONALE, AIMS AND OBJECTIVES

2.1. Rationale of the study

A Modified Millard's Technique (without banking of lateral elements) for bilateral cleft lip cheiloplasty is a dependable and adaptable procedure connected with outstanding surgical outcome. The clinical results showed less scar formation, adequate length of the upper lip and reconstituted symmetrical nostrils.

The Millard's repair intricate complete elevation of the prolabium and reconstruction of the orbicularis through the premaxilla. In addition, Millard banked lateral sections of the prolabium as "forked flaps" that were meant to add collumellar height at a later stage.

This technique has more worldwide use and has been adjusted to give more acceptable clinical result, the banking of the lateral module of the prolabium however give unsightly scar especially in the dark-skinned individuals, which are more liable to to unnecessary scar formation.

A modification of this technique is therefore necessary to achieve a more esthetic result especially in this group of patients

2.2. Aims

The general aim of this study was to describe occurrences of cleft lip and evaluate the treatment outcomes in this unique group of patients.

2.3. Objectives

2.3.1. General Objective

The general objectives of this study was to review the surgical outcome of bilateral cleft lip surgery (BCLS) done using modified Millard's (fork flap) system.

2.3.2. Specific Objectives

1. Modified Millard's technique which is complete elevation of the prolabium and reconstitution of the orbicularis across the premaxilla without banking of lateral segments of the prolabium.

2. Evaluate surgical outcome that is Adequate length of the upper lip, symmetrical nostrils, reconstituted philtrum and adequate columella length.

3. To build up the foundation of surgery that is reconstruct the mucous layer by closing the fistula, increase the adequate length of sulcous which give a very good length of lip automatically.

4. To give a very good long form aesthetic view to the subjects/patients which will give him confidence and satisfied life.

Chapter-III

REVIEW OF LITERATURE

3. LITERATURE REVIEW

Cleft lip and cleft palate or both are the most common or facial inherited deformities found amongst live birth the causes of which are not clear but have a trend that includes 2 etiological factors, genetic and environmental (1 Murray. 2002). The purpose of the analysis is to mark the opinion in research knowledge about cleft on the both side of lip and/or palate (Bilateral cleft lip and/or palate). A Literature review of the universal journal/research work have been made to argue about the anatomical features, the epidemiology, etiology, hereditary and environmental factors, diagnosis and treatment of this malformations. The results of the cleft on the both side of the lip and/or palate (CBL/P) decrease within the utmost frequent inherited anomalies of the bones of the skull and face area. At present, lots of experimental and phonotypical structures of this abnormality, which vary allowing to the diverse structural arrangements involved. The etiological, hereditary and environmental situation which were not previously identified. To afford accurate identification and management is essential. A multidisciplinary exercise and involvement is essential for the medical group to explain these malformations. The relation among altered medical surgeons provides an acceptable care for the subjects and their relatives. The clinical management is the most shared action use for these deformities, along with the orthodontic management.

Nonetheless, the best action is hard to invention as of the huge inconsistency of that malformations and the individual response of each subjects to the treatment. Every argumentation has been separated by bearing in mind that the different problems registered above:

3.1 Epidemiology

CBL/P has a global prevalence of 1/700 live births (Pigott 1992). The extreme birth incidence ratio (1/500 birth) is described for the Asian and Amerindian residents. A transitional incidence rates (about 1/1000 birth) was described in

European residents, whereas the African residents has the lowermost occurrence (1/2500 birth) (Beaty *et al.* 2010; Christensen and Mitchell. 1996; Mossey *et al*. 2009). Cleft palate (CP) may possibly the only one pathology affecting the patient, whereas CBL (Cleft on both side of the lip) might be related or not with CP. Around 70% of all the CBL disorder and 50% of CP merely fall inside non-syndromic pathologies. Although syndromes are associated to cardiac, limb, ophthalmological and other. (Del Prete *et al*. 2014)

3.2 Aetiology

CBL might be both a feature in patterns (Table 1) and out-of-the-way ones, termed non-syndromic cleft. Reasons of non-syndromic CBL still keep on imprecise (Mossey *et al*. 2009). Numerous researches had recommended an association among certain parental lifestyles for the period of the first tri-semester of prenatal period besides the progress of a cleft. Near it was durable indication that parental smoking was associated with a greater than before danger of having CBL (Wyszynski *et al*. 1997; Little *et al*. 2004). Concerning nourishment, multi-vitamin enhancements were not established as being a defensive aspect (Loffredo *et al*. 2001). Several visceral researches have revealed that a nutrient insufficiency of folic acid and Zinc augmented the danger of consuming a cleft (Warkany & Petering. 1972; Bienengraber *et al*. 2001; Malek *et al*. 2004). Contacts to certain organic materials; for example, agricutural compounds, retinoids (Vitamin A derivatives), corticosteriods, some anticonvulsants drugs e.g. diazepam, carbamazipine, phenobarbital, or a viral contamination similarly proliferations the danger for clefts and other genetic abnormalities (Dolovich *et al*. 1998; Park-Wyllie *et al*. 2000; Acs *et al.* 2005; Romitti *et al*. 2007).

Table 1. List of the genetical abnormalities normally or irregularly introduced with either CBL or iCP (Shprintzen, 2002).

Syndrome	**CLP**	**iCP**
Craniofrontonasal disorder	normally	normally
Del (18p)	normally	normally
Ectrodactyly-Ectodermal dysplasia-Cleft lip and palate disorder	normally	normally
Filliform adhesions with clefting disorder	normally	normally
Niikawa-Kuroki disorder	normally	normally
Oculoauriculovertebral spectrum	normally	normally
Opitz disorder	normally	normally
Popliteal pterygium disorder	normally	normally
Trisomy 13	normally	normally
van der Woude disorder	normally	normally
Cri du chat disorder	irregularly	normally
Escobar disorder	irregularly	normally
Fetal Alcohol disorder	irregularly	normally
Hay-Wells disorder	irregularly	normally
Rapp-Hodgkin disorder	irregularly	normally
Treacher Collins disorder	irregularly	normally
Wolf-Hirschhorn disorder	irregularly	normally
Cryptophthalmos disorder	irregularly	irregularly
Down disorder	irregularly	irregularly
Oculodentodigi disorder	irregularly	irregularly
Robinow disorder	irregularly	irregularly

Hereditary influences are also significant. In non-syndromic CBL, certain development causes and metabolic enzymes such as TGFA, TGFß3 and MTHFR had been rigorously seen (Wong & Hagg. 2004; Zeiger *et al*. 2005; Vieira 2006; Mossey *et al*. 2009; Jagomagi *et al*. 2010). Genetical arrays had been defined for

relatives with conditions e.g. the van der Woude disorder. The gene TBX22, IRF6 and PVRL1, which reasonably connections with disorders, also associates to an occurrence of a non-syndromic CBL (Carinci *et al*. 2007; Park *et al*. 2007; Ferrero *et al*. 2010). It indications to assumption that a few genetic influence that associates to any syndromic CBL might possibly rapid the threats of having non-syndromic CBL (Wong & Hagg, 2004). Spontaneous mutations are possibly to have the occurrence for unusual diseases, with clefts/cracks as a feature, at a relatively stable all through periods. The investigation in genetic material-syndrome relationship is still a extensive puzzling arena for forthcoming investigation.

All these predisposing factors for cleft lip disorder but in reality it could be unknown factor or power (could be Allah) with reference of Quran Allah says in chapter 36 verse 82- **"KUN FAYA KUN**" (Be it will be).

So the cause of cleft lip could be **"KUN FAYA KUN."**

3.3 Role of Genetics

CBL/P is influenced by the achievement and the alteration of numerous and several genetic factor. The situation can also be liable of the modification of the genetic material or relate with genetic alteration, which is the reason for the malformations. The expression of the syndrome (syndromic and non-syndromic) have been associated to few deficient genetic material and their receptors (Riley and Murray. 2007), such as FGF8 and FGFR1 genes.

TGFβ is one more domestic genetic material intricate in the development of the cleft on both side of the lip or one side of the lip, in specific: TGFβ3, with the inactivation of its receptor TGF3βR2 (Lidral *et al.* 1998) and the inactivation of BMP7 (Zouvelou *et al.* 2009) (Wurdak *et al*. 2005). Several investigators verified the comprising of transcription factors in the pathogenesis of CBL/P: modification in MSX1 (Satokata and Maas. 1994) (van den Boogaard *et al*. 2000), TBX22 (Braybrook. 2001) and IRF6 (Zucchero *et* al. 2004). Parental

liquor consumption (Molina-Solana *et al.* 2013), parental direct and indirect tobacco smoking (Wyzynski *et al.* 1997, Sabbagh *et al.* 2015), parental illness through initial gestation (Hashmi *et al.* 2010) and some compounds for example contact with the antileptic medications: carbamazepine (phenytoin and valproic acid), thalidome, herbicides for example dioxin and retinoid acid had revealed to be teratogenic and reason genetic deficiencies and rises the danger for CBL/P (Brito *et al.* 2012). Gene-environmental relations with CBL had similarly broadly investigated. It had been recommended that environmental influences might interrupt the dangerous role of this genetic factor throughout the lip and palate creation (Brito *et al*. 2012, Mossey *et al.* 2009).

Fig.3.1.: Inheritance Pattern of Cleft Lip

3.4 Prevalence of Cleft Lip /Palate

The general prevalence of orofacial cracks is approximately 1 to 2.21 cases/1000 births. The occurrence of CBL and CBL/P differs amongst nations, socioeconomic position, tribal or cultural sets (Derijcke *et al*. 1996). Dependable statistics of prevalence was not obtainable in certain portions of the uiverse and there was relatively extensive variety among processes in altered nations. In overall the frequency of CBL and CBL/P in the European inhabitants was

greater than occurrence of cleft palate (Doray *et al.* 2012, Magdalenić-Meštrovic & Bagatin 2005). Incidence of CBL and CBL/P were abundant in Asia (China, Japan) and portions of Latin America and few in South Africa, southern Europe and Israel. Incidence of cleft palate was abundant in some region of Northern Europe (Finland, Norway) and Canada and few in some area of Latin America and South Africa (Tolarová & Cervenka 1998).

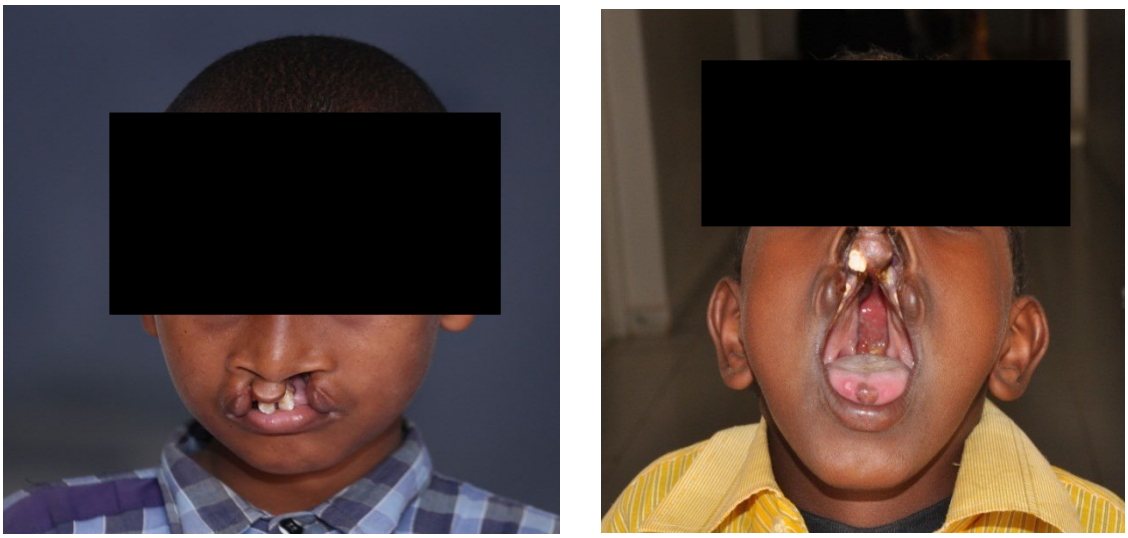


Fig.3.2: Incidence of Bilateral Cleft Lip and Palate.

Meanwhile 1963 all genetic deformities that had been identified throughout the 1st year of life or later had described to general catalogue (Rintala 1986). In Finland the total occurrence of CBL and CBL/P is 0.96 and the frequency of cleft lip is 1.36 per 1000 births. There is some local difference among dissimilar cleft categories. Common cleft type is Cleft palate which is found in Northern and Eastern Finland and CBL/P found in Southern and Western parts of Finland. The occurrence of Cleft palate in Oulu University Hospital (OUH) zone among 1993 and 2011 was 1.78 per 1000 childbirths and abortions and frequency of CBL/P was 1 per 1000 births and abortions (National Institute for Health and Welfare 2013). The incidence of CBL and CBL/P differs by sex and laterality. CBL/P was recurrent in men and sequestered cleft palates were frequent in

females **(Stanier & Moore 2004).** Splits involving the mouths ensue regularly on the left-hand sideways than the right-hand sideways in CBL and CBL/P cases (**Blanco-Davila 2003, Hagberg *et al.* 1998, Jensen *et al.* 1988).**

3.5 Anatomical features

The artificial muscles round the mouths are divided into double categories: the several portions of the orbicularis oris muscle and muscles that were round the orbicularis oris muscle. The muscle was separated into four fragments and every fragment resembles to one quadrant of the mouths. The muscle fibers didn't straightly attribute to jawbone and initiating on the profound external of the membrane, superiorly from maxilla and inferiorly from mandible. The orbicularis oris attachments into the mucous skin of mouths and muscle fibers in the philtrum and attribute on the nasal septum. The orbicularis oris performances as an oral sphincter containing mouths closure, protuberance and pressing. The superficial muscles of the superior lip were: the levator labii superior is, levator labii superior is alaeque nasi and zygomaticus main and minor. The levator anguli oris was a profound muscle of superior lip. The levator muscles upraise the superior lip and the zygomaticus muscles bump the lip domineeringly and sideways. The superficial muscle of inferior lip was the depressor anguli oris and the profound muscles of inferior lip were: the depressor labii inferioris and the mentalis muscle. These muscles were liable for dragging the inferior lip inferiorly and sideways and the mentalis muscle lifts and obtrudes inferior lip (Berkovitz *et al.* 2009, Baker 2010) (**Fig 3.3**.).

The insufficiency or the not-attached among maxillary and medial nasal procedures (36th/37th day of gestation) reasons labiomaxillary clefts (Delaire and Precious. 1986). These will lead to several phenotypes and medical presenting of the abnormality:

- Cleft Lip (CL): That abnormality will involve one side of the lip (unilateral) or both side of the lip (bilateral). This abnormality would be two types: complete or incomplete. The complete system, soft tissue disruption spreads among open

edge of the higher lip and base of the nose with snags in skin, mucosa, bone and muscles totality and irregularity of nose (Farronato *et al*. 2014). The incomplete arrangement disturbs merely the open edge to the lip lacking include the nose and the entireness of the adjacent soft tissue.

- Cleft Lip and Palate (CBLP): CBLP are categorized by a fissuration which apprehensions upper side of the lip, maxillary bone, alveolar bone and hard/soft palate. There were dual types of cleft: the one side of cleft (CSL) and the bilateral type/CBL type. The CSL is classified by a fissuration to the alveolar bone among the lateral incisor and the canine guiding of the naso-palatine channel; So, CSL was the central of tough and soft palate generating an oro-nasal communiqué from the muscle movement of tongue on the palatal procedures (Farronato *et al*. 2014). The CBL is classified by the fissuration to both edges encounter in communication of the naso-palatine channel working on palate all the time in the central (Farronato *et al*. 2014).

Fig. 3.3: Muscular configurations of the lips. Green: musculus orbicularis oris, orange: musculus levator angulis oris, yellow: musculus zygomaticus minor & major, blue: musculus levator labii superioris, purple: musculus depressor labii inferioris, red: musculus mentalis

- Cleft Palate (CP): Cleft Palate is includes simply the palate: cleft hard and soft palate or cleft soft palate only. Commonly, fissuration advances to naso-palatine channel up to soft palate. To recognize this kind of modification was enormously

significant to decide and recognize the essential development and prospects of intercession on the muscles intricate and negotiated by the pathology.

Researches revealed in what way CBL systems have expressively better tissues insufficiency than the CSL and CP (Lo LJ *et al*. 2003), therefore they might be careful as the most severe arrangements to face in the multidisciplinary restoration.

3.6 Phenotypic Features of Bilateral Cleft Lip

3.6.1 Dental Abnormalities

Cleft patients/subjects face several dental abnormalities than persons deprived of CBL/P. Tooth agenesis, microdontia, malpositioned teeth, transposition, supernumerary tooth and numerous abnormalities were steadily recurrent in CBL/P subjects. Teeth impaction likewise inclines to be extra corporate. Concerning teeth agenesis, rejecting third molars, lateral incisors and premolars were maximum frequently scatterbrained through no substantial variances concerning every person's cleft position. Subjects lacking clefts extent extra agenesis of the lateral incisors. Teeth agenesis happens more recurrently in individuals with thorough CBL/P, cleft on the one side or both side of the lip, and also in those with incomplete cleft on the both side of the lip and palate (CBL/P and CP), when matched with persons without clefts. The deficiency of maxillary left lateral incisors was meaningfully related by cleft on the one side of the lip (right clefts). In compare, right lateral incisors were most usually lacking with cleft on the one side of the lip (left clefts). (**Jugessur *et al.* 2009; Letra *et al*. 2007**)

3.6.2 Speech pathology

Usual speech needs the muscles which mark up the velopharyngeal sphincter exertion in a co-ordinated technique. Deficiencies in some feature of the nasopharyngeal anatomy or physiology might bring to velopharyngeal stupidity,

which was categorized mainly by irregularities in nasality (hyper- or hypo-nasality and nasal air emission). (**Jugessur et al. 2009**)

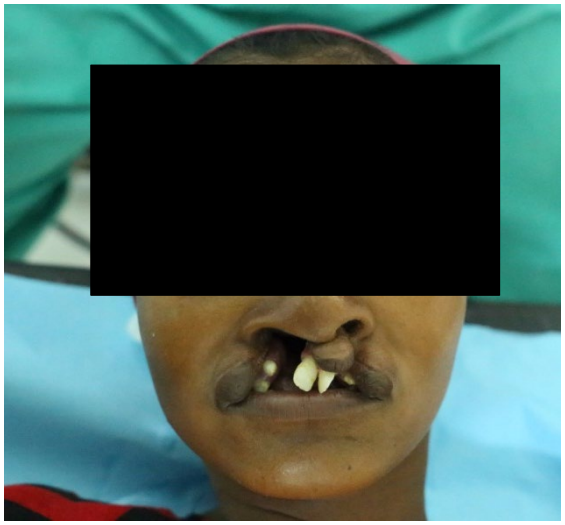


Fig.3.4: Dental Anomalies of Bilateral Cleft Lip

3.6.3 Bones of the skull and face (Craniofacial) morphology

The bones of the skull and face morphology were categorized by eminent premaxilla, a retrognatic maxilla, abridged posterior maxillary height and a minor, retruded mandible. The prolabium was lacking of some muscle threads. The nostrils were overextended, and the tip of the nose was broad. The columella seems to remain reduced or absent, and incase prolabium frequently appears to remain combined straight to the tip of the nose. (**da Silva Filho *et al.* 1998**)

3.6.4 Bones of the skull and face (Craniofacial) morphology of adult with un-operated BCL/P

- A prominent premaxilla which reasons an overset stretching starting 10 to 16 mm and that outcomes in a great facial convexity
- A minor mandible by an dangerous clockwise revolution in relation to the cranial base
- A reduced mandible through a perpendicular development design, outcomes in an obtuse gonial viewpoint and a extended anterior inferior face height

- A conspicuous premaxilla and minor mandible, causing in dangerous antero-posterior inequality among the jaws
- A propensity near retro-clination of incisor teeth in together jaws
- Lesser proportions of the cranial foundation, but no modification in cranial base angulation
- Compact posterior facial height. (**da Silva Filho *et al.* 1998**)

Upper dental arch morphology:

- Sexual characteristics had difference outcome on the maxillary arches of cleft and without cleft subjects; important modifications were existing in without cleft subjects (wider and longer arches in men), but not in the unoperated subjects.
- Mature with un-operated BCL/P had an anteriorly advanced tightening to the superior dental arch in together sexual category and a meaningfully lengthier maxillary dental arch, that was recognized to the premaxillary frontal prognosis. (**da Silva Filho, de Castro Machado. 1998**).

3.7 Environmental influences

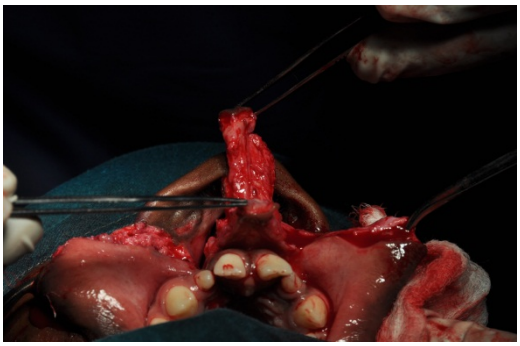
The surrounding environment can firmly impact the extent of these deformities. Parental smoking is the primary peri-conceptional time which reason the alteration of some genetic material, manipulating metabolic pathways and the progression of that malformation (Little *et al.* 2002) (Shi *et al*. 2008) (Shi *et al*. 2007) (Wu *et al*. 2010).

High alcohol consumption in peri-conceptional period can increase the risk (DeRoo *et al.* 2008), and teratogens for example valproic acid could be related with Cleft Palate (Jentink *et al*. 2010). Although nourishing deficiency can stimulus the risk of CBL/P, for example folate insufficiency (Johnson and Little. 2008), but further researches is needed, in the upcoming, to clear up this characteristic which sign to the actual effects. New ecological disclosure for example contaminations, radiation, anxiety, fatness and hyperthermia could

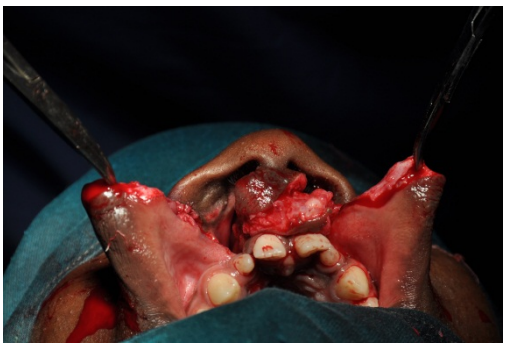
reason for CBL/P (Shahrukh Hashmi *et al.* 2010; Mossey *et al*. 2009; Mossey *et al.* 2007).

3.8 Surgical Procedure

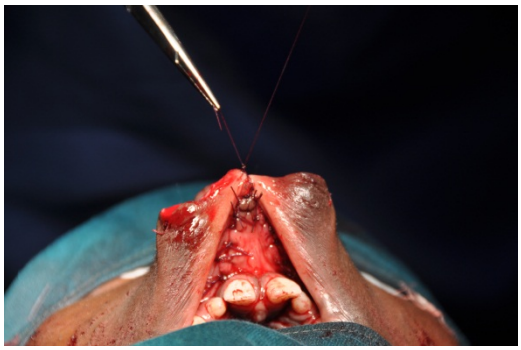
The lip connection technique according to Millard procedures in patient with a CBL (Fig.3.5). When designs the incision-lines, the flaps inside the prolabial island are planned horizontally separation a philtrum of closely usual form and measurement. The prolabial vermilion rests intact. On occasion, particularly in subjects with a very extensive premaxilla, it was essential to spread the opening to the nasal vestibulum beside the piriform opening, to organize the alar sources, which had to be situated on maximum of the premaxilla and to be stable to the anterior nasal spine.



Dissect prelabium or premaxilla



Dissect prelabium or premaxilla



Sulcous formation and clouser of labial fistula

Very good Length of sulcous

Fig.3.5. Surgical Procedure of a Bilateral Cleft Lip Patient by Modified Millard Techniques

While all edges and all flaps were scratch and organized, the first phase of the restoration was to injection the alar bases into the premaxilla at the anterior nasal spine. By dragging together the alar bases to the midline the cleft margins adjacent in the prolabium, whereas the vermilion edges could be locked and form the back of the initial lip restoration. The following phase was to introduce the flaps onto the subalar gap.

Lastly the skin of the lateral lip rudiments is sutured together with two or three mattress sutures, which run crosswise the prolabial island. The most cranial cross-suture has to be hanged around the anterior nasal spine.

There was not at all essential for suture elimination as the superiority of the scar was immaterial. It was smoothly superior to leave the sutures, to avoid the smallest amount of danger of wound break down. (**Bitter. 2001**)

3.9 Diagnosis

The diagnosis of CBL could be completed in several stages: antenatal and perinatal stages (Farronato *et al*. 2014). It requires a multidisciplinary method, because numerous experts can be involved in the analysis. Anomaly scan is currently identifying CBL in uterus since around 22 week of pregnancy, although if wrong positive and missed defects had described. This technique could be failed in case of minor CBL; orofacial (OFCs) splits are frequently not revealed till delivery. It is evident that the gynaecologist acts important part for early identification (Kaufman. 1991; Strauss. 1999).

Throughout the pregnancy period, sub-mucous clefts of palate might be existent, but it is very tough to identify initially (McWilliams. 1991). The initial identification in pregnancy period permits the parents to a multidisciplinary carefulness group for an appropriate counseling and help. If CBL/P is identified

in pregnancy periods it could be useful to organize for a neonatologist or a pediatrician to be presented at the time of delivery to identify possible respiratory complications or other hereditary abnormalities (Farronato *et al.* 2014).

A pediatrician has to detect and approve the structural deficiencies and to regulate the medical procedure of the deformity. In the perio-natal stage the oral cavity and the entire palate must be well observed. Tongue depressor and palpation were suitable techniques to differentiate submucosal changes. The existence or not- existence of tooth, gradation of hard and soft palate clefting, existence or not- existence of the uvula, indication of pitting of the lips or palate, nasal spitting out of fluids, a bifid uvula or a luminous crucial region in palate were extra significant symbols for the pediatrician (Habel *et al*. 1996).

Other physical abnormalities are occasionally related with CBL for example velopharyngeal inadequacy (VPI); if the precise examinations used to disclose these malformation were affirmative, operation is suggested. It was clear that the significance of a watchful investigation of the newborns in delivery chamber, to detect any airway or physical complications that could be advised a related hereditary disorder (Arosarena. 2007).

3.10 Treatment

The limited times of lifecycle are the ideal for the main valuation of the adolescent by CBL team. The ultimate management strategy of carefulness is conveyed in a group consultation and talked to the family of the youngster. Consistent observing by the carefulness group was suggested, to witness the development and future ear, nose and throat, speech and developing problems (Kasten. 2008).

It was significant to quickly recommend the parents around the birth of a kid through a genetic deficiency. Specialists or a pediatrician must support them and transfer the update immediately possible. Preferably the parents must be

interconnecting with associate to the multidisciplinary carefulness group inside 24 hours of delivery (Kasten. 2008). At first period next to the birth, the maximum significant difficulties that could be proficient were breathing and breastfeeding problems. Distinct training and care must be provided to parents, and a lactation specialist or speech therapist would work by parents (Habel *et al*. 1996).

The fabrication of baby plates (presurgical orthopedics) (Winters and Hurwitz. 1995) is requested as a useful scheme for breast-feeding development and simplification of CBL restoration. Currently there was no indication to care or dishonor any of this statements and the training rests empirical. Additional techniques to support youngster and parent with feeding difficulties were special magnums and teats, manufactured in an extensive diversity, demonstrating the obstinate complications experienced by clinicians. Nasogastric suckling is not every time mandatory and it would be evaded if thinkable. In its place, a nasopharyngeal airway is crucial in case of impediment and either austere breathing difficult due to the anatomical deformities.

The ideal technique and method for the operating interference differs reliant by the center inspected. Maximum of the British center restoration lips 3 months afterward natal and palate among 6 to 12 months. The pre-surgical orthopedic procedures might be used. Casting strategies are positioned to support change the alveolar segments. This might be engaged in combination with the membrane redraping with nasal alveolar molding.

Other wordy technique was the "functional repair" by Delaire (Smith *et al*. 1995). Several oral-maxillofacial physicians supporter of this technique influence improved results for mid-face development compared with methods frequently functional by plastic surgeons. Besides, cross research in Europe revealed a reduced outcome for the purpose technique related to the common technique achieved by plastic surgeons.

A significant portion of the lip restoration comprises nasal recontouring and restoration of the sphincter of the lip. Again, efforts were completed to re-establish the nasal thickness if required (Farronato *et al*. 2014). Restoration of the CP (cleft palate) is generally completed after 9 months of age. In earlier, operation was implemented about 4-6 y of age, but this was harmful for the patient's speech improvement. It was suggested to execute surgical procedure when the kid initiates to improve plosives "b, d and g" in speech (at about 11-12 months of old) (Farronato *et al*. 2014). Operating modification may be essential, but they have to be implemented after the complete total curing has happened and tender tissues have become softer (Winters and Hurwitz. 1995).

In preschool ages the main complications are: language and verbal improvement, ear nose and throat observing, somatic progress and improvement, and common dental health. In certain subjects, straight afterwards operation, consequent speech disorders can happen, needing numerous intrusions (around 75% of patients) all through juvenile and teenage years to succeed satisfactory language construction and verbal competency (Winters and Hurwitz. 1995; Habel *et al*. 1996; Witzel *et al*. 1984).

Features that might be caused language syndromes are: dental and occlusal difficulties, oro-nasal fistulas, hearing complications and velo-pharyngeal inadequacy. Kids with CP are topic to the identical reasons that motivation the language and speech improvement in patients lacking clefts: neural, perceptive, progressive, environmental, and sensitive guidance (Sell *et al*. 1994).

The treatment of language and speech patterns could be operating or non-operating, by means of palatal working out appliances, language bulb, biofeedback language treatment or an obturator. Generally the language improvement happens about 6 years of age, and this is the greatest time to start language treatment (Winters and Hurwitz. 1995) and to observe language improvement frequently with an orthodontic and clinical supervision (Farronato *et al*. 2012).

The orthodontic treatment of dental deformities generally arises in the school age years, till maturity. In the beginning, no vigorous orthodontic management was mandatory, but the orthodontist could intricate in the assembly of a palatal obturator to relief in nurturing for the period of initial stages. The orthodontist is firmly intricate in the therapy with the discharge of the primary and permanent dentition. In specific, if the cleft includes the alveolar development the teeth might be irregular, twisted, and supernumerary or lacking.

A systematic appearance at the dentist and decent oral hygiene was suggested. A vigorous occlusal management was to elude up to stable dentition was recognized (Habel *et al*. 1996). For the period of the school years orthodontic treatment, alveolar bone grafting and emotional supports were the chief involvement in subjects with CBL. The alveolar bone grafting creates a normal alveolar design by which tooth could explode and consequently relocated orthodontically.

All through these techniques the specialists could likewise restoration and adjust fistulas and the presence of the nose. In subjects through several lip and palate operations the maxillary development could be improved and subsequent in a hypoplastic maxilla and fatten up mid-face. The insignificant cases could be operated only with an orthodontic usage, whereas the main and austere maxillary insufficiencies are operated with Le Fort I advancement (the similar method for insignificant and bigger discrepancies). These kinds of intercession are generally done after the whole development and mature of the face, to evade a another intervention.

Through the school years, the orthodontist had a significant role. The ultimate orthodontic management could development 3 to 4 years afterward bone grafting stage (about 12-13 y). Management of the initial mixed dentition frequently includes maxillary partial braces and maxillary development. Time and again patients with CBL improve a maxillary retrusion that can be operated with an anterior orthopaedic protraction.

Development before bone grafting was superior, and leads to finest outcomes in specific in strictly restrained arches (Winters and Hurwitz. 1995). In the child age, completely the emotional difficulties and complications in community relationships might operated with a self-acceptance treatment and encouraging association with parents.

Throughout teenage years, the orthodontist might operate with orthodontic applications entirely the residual difficulties regarding tooth arrangement. In this time could similarly seem certain conflict not apparent earlier. Few research's on adults revealed that the initial palatal operation could liable for such development difficulty of the face, but this management is essential for an acceptable language progress during childhood (Cagáňová *et al*. 2014).

3.11 Conclusion

CBL (Cleft on the both side of the lip) are genetic deficiencies that disturb several arrangements and roles for example language, inhalation, nourishment, esthetics, development and growth of the craniofacial region. The actual etiology was still unidentified, but ecological and hereditary influences were intricate in that malformation. There was not only one phenotypes or medical image regarding that malformation, and that was why was still so tough to discover a distinctive way to resolve and management this deformity. The expression could be diverse and dependent by the specific and even the management can lead to altered effects reliant by each patient's situation, even in patients with the same deformity. Perhaps there are numerous methods to achieve a decent outcome. All operations can regulate scar tissues that could be change and prevent the regular facial development.The technique of the clinical involvement was verbalized through useful and esthetics features, and also through the development age. It was clear that a clinical involvement to rebuild the irregular constructions was essential to assurance an acceptable development and purpose. Greatest outcomes were gained with operating and orthodontic management.

Chapter-IV

MATERIALS AND METHODS

4. MATERIALS AND METHODS

4.1. Type of the Study

Retrospective observational study.

4.2. Place of the Study

1. Madaripur Sadar Hospital and International free surgical Camp in Bangladesh.

2. Emergency Observation ward, Dhaka Dental College, Dhaka.

4.3. Study Period

June 2015 to December 2018

4.4. Study Population

The subjects of this research were CBL/P patients who were treated at the Dhaka Dental College, Dhaka, International free surgical Camp in Bangladesh and Madaripur Sadar Hospital, Bangladesh during the study.

4.5. Sampling

Random sampling considering exclusion and inclusion criteria of patients in the study.

4.6. Inclusion Criteria

- The following inclusion criteria was considered for selection of the study sample.
  Patients born with complete bilateral cleft lip.
- All cases were done under general anaesthesia with orotracheal intubation.
- Patients with a soft tissue band up to 5mm in width were included.
- Only patients whom their parents gave voluntary consent were selected.

4.7. Exclusion Criteria

- Patients who present with other types of cleft than complete Bilateral Cleft lip.
- Patients with Unilateral Cleft lip.

4.9. Methodology

History and clinical examination of the patients was performed.

- The study period was from June 2015 to December 2018.
- A total of 75 BCL patients were taken for study.
- All these patients were evaluated thoroughly by History, Clinical and Laboratory methods.

4.9.1. Data Collection

All demographic, clinical and laboratory data were recorded in a pre-designed data collection sheet.

4.9.2. Ethical approval

The research protocol was accepted by the institutional review board of Rajshahi Medical College, Rajshahi. Informed written consent was obtained from each patient attendant after briefing about the research. Data were collected in an approved data collection form.

4.9.3. Statistical Analysis

The collected data was checked and coded manually and entered into a computer. The numerical data obtained from the study was examined and significant difference calculated by using statistical methods. Data was stated in frequency, percentage, mean ± SD as applicable. Chi-square test, student's t-test and Fishers exact test or others were used for comparison between groups as applicable. All data were analyzed by using computer based SPSS (statistical program for social science) program version 17.0 for Windows. P-value of less than 0.05 was considered statistically significant.

4.9.4. Surgical Procedure:

As bilateral cleft surgery is always challenging. Due to abnormal anatomical position of pre-maxilla or pre-labium, same tissue. Pre-labium is too short or too much protected.

And long term post-operative aesthetic outcome is not that satisfactory. Some surgeons believe and practice if you dissect the pre-labium it might necrossed.

Some surgeons practice the right and left side cleft tissue to join with pre-labium without any rotational advancement of orbicularis muscles.

The long term impact of this practice will be shortening of pre-labium and make very ugly in competent lip formation.

Fig.4.1 Ugly lip formation (Other techniques)

Some surgeons practice only closure of two layers, muscles and skin layers without closing of mucous layer. This practice will bring two problem. One, it will make bilateral labial fistula. premaxilla will be protected and lip will remain short.

So, the concentration of research work will be mainly on prelabium and mobilization of orbicularis muscles to brings all the abnormally attached tissue to the normal position and lengthen the lip to normal size. Disect the prelabium, which is always remain short. Design and cut the prelabium tissue and lengthen the short prelabium to normal length of the lip.

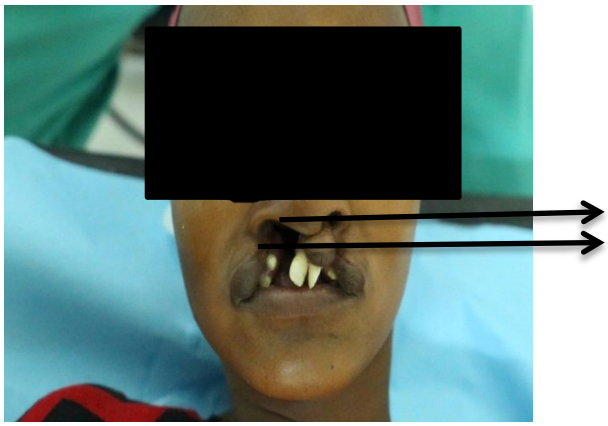


Fig.4.2 Before Surgery

Fig.4.3 After Surgery

No.2 My concentration will be on mucous layer which is most important for cleft surgery. Closer of mucous layer correctly and built up the sulcous layer with normal length is the foundation of cleft surgery.

This layer will avoid the labial fistula. Allow the normal development of maxilla and pre-maxilla, many cleft post-surgical complications arise due to surgeons fault, like labial or palatal fistula, deform nose, vermillion notch, short lip, scaring, velopharengial inefficiency, Fibrosis of pre-labium etc.

To correct all these post operation complication is difficult and the result never comes 100% satisfactory always. The result of 1st surgery is excellent if it is done correctly.

In many techniques, all these complications can be avoided and bring the excellent long term post-operative result with normal growth of lip-nose structures.

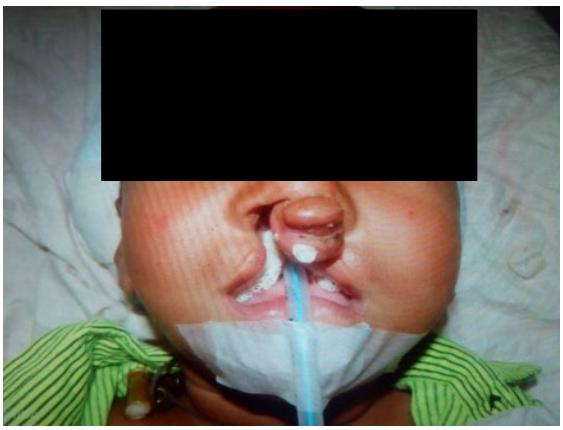


Fig.4.4 Before Surgery of a Complete Bilateral Cleft Lip

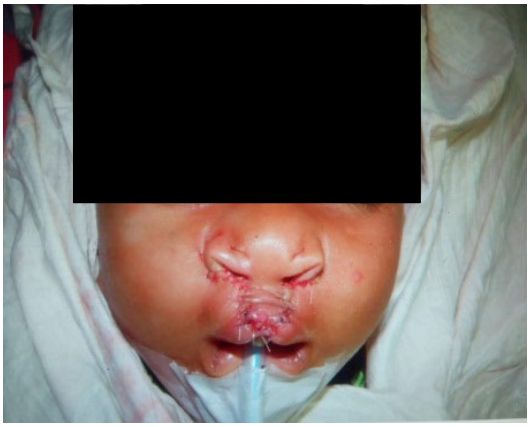


Fig.4.5 After Surgery of a Complete Bilateral Cleft Lip by Modified Millard Techniques

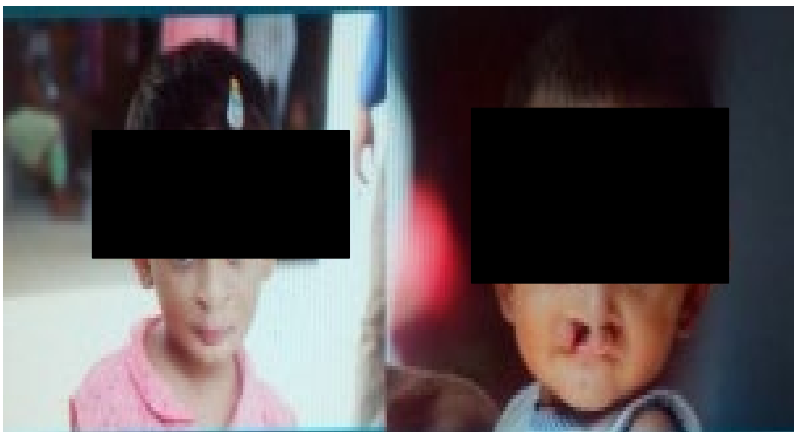


Fig.4.6 Before and After Surgery of a Complete Bilateral Cleft Lip by Modified Millard Techniques

To save and respect 2-3 mm normal soft tissue that is mucous layer of pre-labium can give long term excellent post-operative result without any scar at vermillion border which is very common in manchester technique.

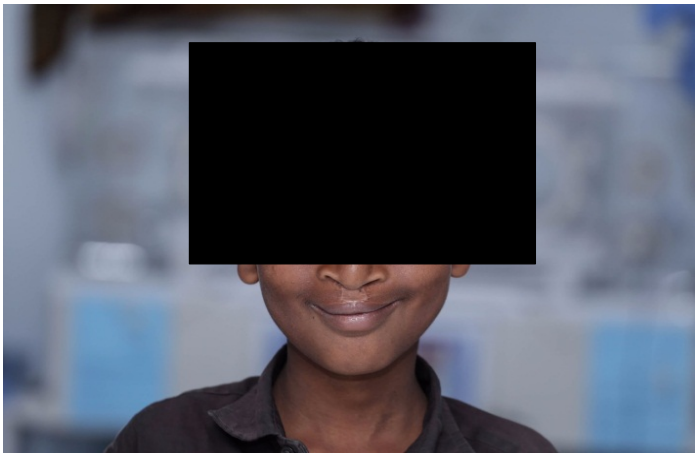


Fig.4.7 Scar Formation of Vermillion Border by Manchester Techniques.

Chapter-V

RESULTS

5. RESULTS

In this study 75 patients/subjects were included to the hospital. Among the isolated patients/subjects, both male and female actively existed. According to Wikipedia cleft lip and palate occurs in about 1 to 2 per 1000 births in developed world. But there is no authentic data for male female ratio of cleft lip and palate. Among the respondents' majority of them (Group-A, 62% and Group-B, 64%) were male where (Group-A, 38% and Group-B, 36%) were female. Age group evaluation is very important for that current study. The table below (Table 5.1) reveals that among the respondents 29.33% were between 11 to 15 years of age where 22.67% were 6-10 years, 17.33% were 16-20 years and only 14.67% were between 3-5 years of age. The study area for the current study was mostly occupied by Muslim communities. So, among the respondents' majority (Group-A, 58% and Group-B, 52%) were Muslims, (Group-A, 30% and Group-B, 32%) were Hindus, (Group-A, 4% and Group-B, 0%) were Buddhist where (Group-A, 6% and Group-B, 24%) participants followed other religion. Occupation of parent may have an important role for occurring cleft lip and palate. Some industrial hazards should fetch under study. Majority (Group-A, 46% and Group-B, 48%) of the patients' mothers were occupied themselves as house wife and only (Group-A, 6% and Group-B, 24%) were worked as daily laborer. Whereas, majority (Group-A, 44% and Group-B, 28%) of the patients' fathers were occupied themselves as farmer, (Group-A, 32% and Group-B, 24%) were service holder, (Group-A, 14% and Group-B, 24%) were occupied with business and only (Group-A, 10% and Group-B, 24%) were worked as daily laborer. There are lots of evidence corroborated that History of cleft lip in maternal family played a certain role for cleft lip. Among the respondents (Group-A, 2% and Group-B, 32%) had family history of cleft lip and (Group-A, 98% and Group-B, 68%) had no previous history. In case of paternal family, the respondents (Group-A, 4% and Group-B, 20%) had family history of cleft lip and (Group-A, 96% and Group-B, 80%) had no previous history. Usually

bilateral cleft lip is a complex disorder which is persists with some other associated disorders. Among the respondents (Group-A, 28% and Group-B, 32%) had cleft palate, (Group-A, 24% and Group-B, 28%) had speech disorder, (Group-A, 22% and Group-B, 12%) had ear infection and (Group-A, 14% and Group-B, 8%) had alveolar cleft. It is a common phenomenon of the occurrence of the cleft on the both side of the lip along with cleft palate. In that research it happened frequently. Problems associated in food intake (Group-A, 42% and Group-B, 56%), (Group-A, 22% and Group-B, 20%) had problems in school going, (Group A, 16% and Group-B, 12%) had friendless and (Group-A, 0% and Group-B, 52%) had a marriage problems.

Table 5.1: Demography and Characteristics of Bilateral Cleft Lips (BCL)

Demography	Group A (3-15 years, n=50)		Group B (> 15 years, n=25)		P-value
	Numbers	Percentage	Numbers	Percentage	
Gender					
Male	31	62	16	64	0.322
Female	19	38	9	36	
Age					
3-5	11	14.67			0.526
6-10	17	22.67			
11-15	22	29.33			
16-20			13	17.33	
>20			12	16.0	
Religion of the patient/subject					
Muslim	29	58	13	52	0.711
Hindu	15	30	8	32	
Buddhist	2	4	0	0	
Others	4	8	4	16	
Occupation of patient`s/ mother					
House wife	23	46	12	48	0.631
Service	15	30	3	12	
Business	9	18	4	16	
Daily laborer	3	6	6	24	

Occupation of patient`s father					
Farmer	22	44	7	28	0.261
Service	16	32	6	24	
Business	7	14	6	24	
Daily laborer	5	10	6	24	
Birth order of the patient					
1st	19	38	8	32	0.379
2nd	23	46	5	20	
3rd	7	14	11	44	
4th	1	2	1	4	
History of cleft lip in maternal family					
Present	1	2	8	32	0.177
Absent	49	98	17	68	
History of cleft lip in paternal family					
Present	2	4	5	20	0.908
Absent	48	96	20	80	
Associated physiological problem with bilateral cleft lip					
Cleft palate	14	28	8	32	0.163
Alveolar cleft	7	14	2	8	
Ear infection	11	22	3	12	
Speech disorder	12	24	7	28	
None	6	12	5	20	
Associated social problem with bilateral cleft lip					
Food intake	21	42	14	56	
School	11	22	5	20	
Friendless	8	16	3	12	
Marriage	0	0	13	52	

5.1. Types and Detection of Bilateral Cleft lip

In the modern era we are well equipped to diagnose cleft lip before the birth of the child. Now a days 4D ultrasound is available to find out these types of disorders. In our current study only 2.66% cases were diagnosed before birth by using ultrasound technique but majority (97.33%) were not diagnosed by ultrasound (Table 5.2 and Fig. 5.1). The cleft lip patents, were taken as sample of these study had some previous history of taking treatment from different orientation. 26.67% were getting spiritual treatment, 14.67% had experienced

homeopathic treatment and 4% were treated by barefoot doctors. Whereas, 54.67% did not experienced any treatment before.

The bilateral cleft lip is divided into two groups such as complete and incomplete. The pattern of cleft lip which extends to the nose is termed as complete and that does not extend to the nose is termed as incomplete. In the current study 57.33% cases were complete where 42.67% cases were incomplete type of cleft lip. It is a very common of presence of cleft palate with the bilateral cleft lip. In that research it also happened frequently. We found associated cleft palate with bilateral cleft lip in 29.36% cases. But in case of majority (70.67%), did not find any association of the bilateral cleft lip along with cleft palate.

Table 5.2: Types and Detection of Bilateral Cleft lip of the study subjects.

	Numbers of CBL (n=75)	**Percentage**	**P-value**
Diagnosis of cleft lip before birth by ultrasound			
Diagnosed	2	2.66	0.546
Not diagnosed	73	97.33	
Treatment taken for cleft lip before surgical intervention			
Spiritual treatment	20	26.67	0.317
Homeopathic	11	14.67	
By village doctor	03	4.0	
No treatment taken	41	54.67	
Nature of cleft lip			
Complete	43	57.33	0.853
Incomplete	32	42.67	
Associated palatal cleft			
Present	22	29.36	0.637
Absent	53	70.67	

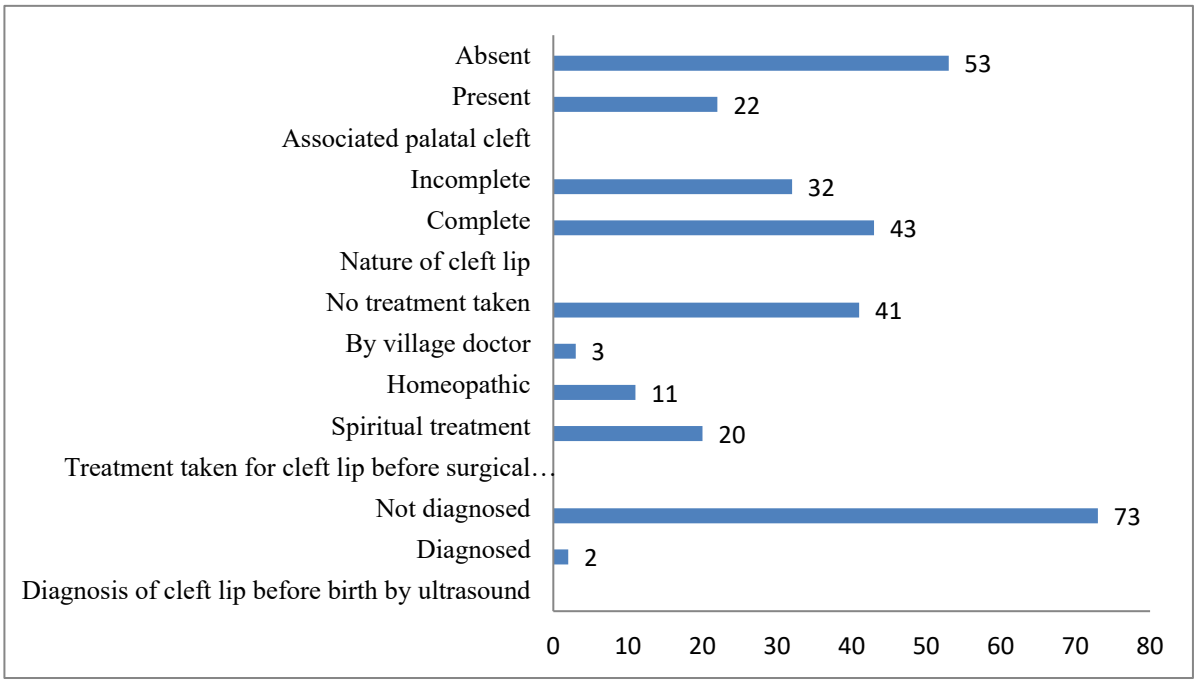


Fig.5.1: Bar Diagram showing Bilateral Cleft lip of the study subjects.

5.2. Lip Structure of Bilateral Cleft lip Subjects Before surgery

Pre-operative lip length measurement was very essential for that study. The lip length was measured by the summation of the length (mm) of lip angle of one side of the Cupid`s bow, the width of cupid`s bow and the length of Cupid`s bow to the angle of another side of lip. In this study, 43 cases of complete bilateral cleft lip where in 3-5 years patients the average lip length was 67 mm, 6-10 years patients the average lip length was 76mm, in 11-15 years patients the average lip length was 79mm, in 16-20 years patients the average lip length was 77 mm and in case patients of more than 20 years the average lip length was 83mm before the surgical intervention (Table 5.3 and Fig. 5.2).

On the other hand 32 cases of incomplete bilateral cleft lip where in 3-5 years patients the average lip length was 63 mm, 6-10 years patients the average lip length was 66 mm, in 11-15 years patients the average lip length was 68 mm, in 16-20 years patients the average lip length was 73 mm and in case patients of more than 20 years the average lip length was 75 mm before the surgical

intervention. Correction of lip height is mandatory for bilateral cleft lip surgery. For this reason, it was essential to measure the pre-operative lip height of the bilateral cleft lip subjects. Then measured the lip height by measuring the distance of collumella to cupid's bow of different aged patients. In that study, 43 cases of complete bilateral cleft lip patients and 32 cases of incomplete bilateral cleft lip patients before the surgical intervention.

Lip width/thickness of bilateral cleft lip patients pre-operatively was compulsory. According to the measurement we categorized the group as Normal, Too thick, Too thin. In the current study, 43 cases of bilateral complete cleft lip and 32 cases of bilateral incomplete cleft lip patients of different ages. The system of measuring nostril width by summation of alar base of one side to columella, columella width and columella to alar base of another side. In the existing study we measured the nostril width of 75 cases of different aged group patients. In the 3-5 years aged group the average nostril width was 35 mm, In the 6-10 years aged group the average nostril width was 39 mm, In the 11-15 years aged group the average nostril width was 44 mm, In the 16-20 years aged group the average nostril width was 46 mm and among the age group where patients were more than 20 years of age had average nostril width of 49 mm before the surgical intervention.

Table 5.3: Nature of Bilateral Cleft lip Subjects Before surgery

Lip Measurements (mm)	CBL Type	Age groups (Years)		P-value
		Group-A 3-15 n=50	Group-B 16>20 n=25	
Average lip length	**complete**	32%	11%	0.0001***
	incomplete	20%	12%	0.0001***
Average lip height	**complete**	32%	11%	0.747
	Incomplete	20%	12%	0.563
Average lip width/thickness	**complete**	32%	11%	0.899
	incomplete	20%	12%	0.952
Average nostril width		52%	23%	0.0001***

***very highly significant

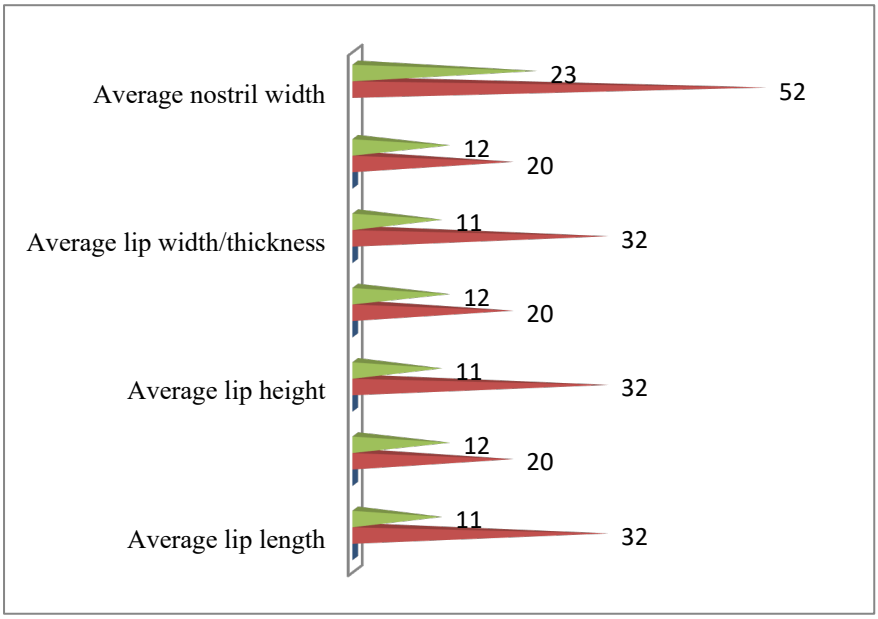


Fig.5.2: Bar Diagram showing Lip Structure of Bilateral Cleft lip Subjects Before surgery

5.3. Length and Size of Lip-Nose Measurements of Bilateral Cleft lip Subjects Before surgery

In this study, different forms of columella condition were found. Among them 24% were normal, 57.33% were short, 13.34% were wide base and 5.33% were narrow base.

The nasal septum also may have changed due to bilateral cleft lip condition. Vermilion border is an important component for treating the cleft lip patients. In bilateral cleft lip patients, the vermilion border might be normal, notched or deformed. In the existing study, 43 cases of bilateral complete cleft lip patients, where 18.60% had normal vermilion border, 76.75% had notched vermilion border and 4.65% had deformed vermilion border before the surgical intervention and 32 cases of bilateral incomplete cleft lip patients, where 18.75% had normal vermilion border, 75% had notched vermilion border and 6.25% had deformed vermilion border before the surgical intervention.

Cupid`s bow plays an important role for lip formation. Pre-operatively we observed three kinds of Cupid`s bow like normal, narrow and wide. In the group

of complete bilateral cleft lip patients were 43 and incomplete bilateral cleft lip patients were 32 cases.

The philtrum area above the upper lip is often deformed due to cleft lip occurrence. In the current study we got 43 cases of complete bilateral cleft lip patients. Among them 11.62% had normal philtrum where 88.38% had short philtrum before the surgical intervention and 32 cases of incomplete bilateral cleft lip patients. Among them 12.5% had normal philtrum, 9.38% had narrow philtrum, 6.25% had wide philtrum where 88.38% had short philtrum (Table 5.4 and Fig. 5.3 to 5.6).

Table 5.4: Length and Size of Lip-Nose Structures of Bilateral Cleft lip Subjects Before surgery

Length and Size of Lip-Nose (mm)	CBL Type	Subjects	Frequency	Percentage	P-value
Columella		Normal	18	24.0	0.0001***
		Short	43	57.33	
		Wide base	10	13.34	
		Narrow base	4	5.33	
Nasal septum		Normal	30	40	0.701
		Deviated	45	60	
Condition vermilion border	complete	Normal	8	18.60	0.470
		Notched	33	76.75	
		Deformed	2	4.65	
	incomplete	Normal	6	18.75	0.845
		Notched	24	75.0	
		Deformed	2	6.25	
Condition of Cupid`s bow	complete	Normal	6	13.95	0.298
		Narrow	4	9.30	
		Wide	33	76.75	
	incomplete	Normal	5	15.62	0.023
		Narrow	3	9.38	
		Wide	24	75.0	
Condition of Philtrum	complete	Normal	5	11.62	0.464
		Narrow	0	0	
		Wide	0	0	
		Short	38	88.38	
	incomplete	Normal	4	125	0.611
		Narrow	3	9.38	
		Wide	2	6.25	
		Short	23	71.87	

***very highly significant

Fig.5.3: Length and Size of Lip-Nose Structures of Bilateral Cleft lip Subjects Before surgery.

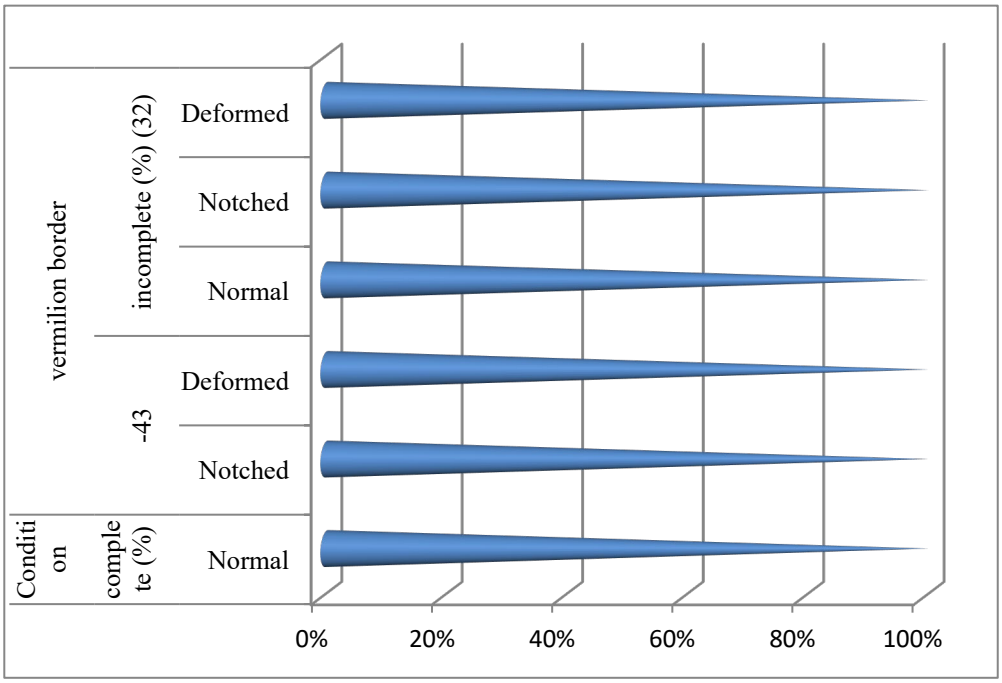


Fig.5.4: Bar-Diagram Showing Condition Vermilion Border of Bilateral Cleft Lip Subjects before Surgery

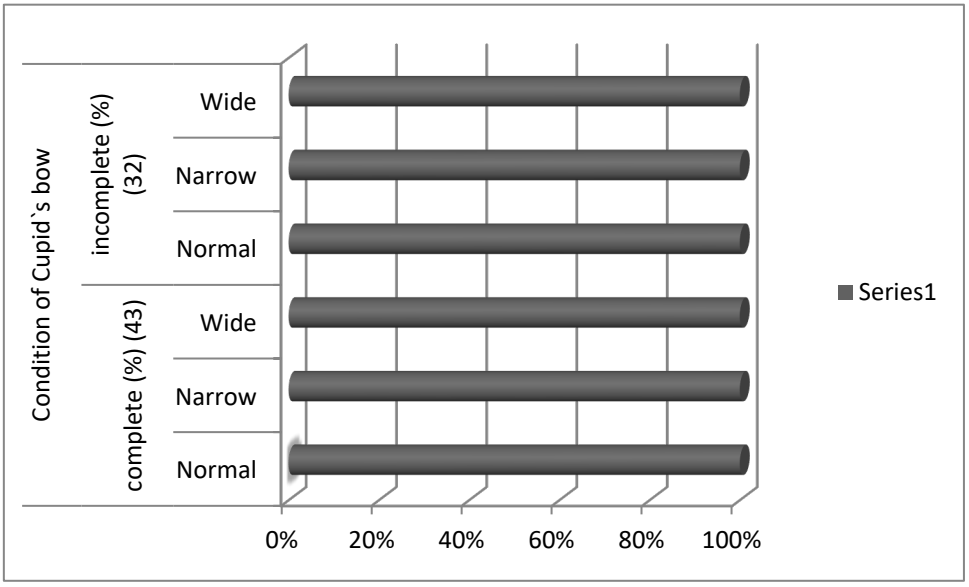


Fig.5.5: Bar-Diagram Showing Condition of Cupid`S Bow of Bilateral Cleft Lip Subjects before Surgery

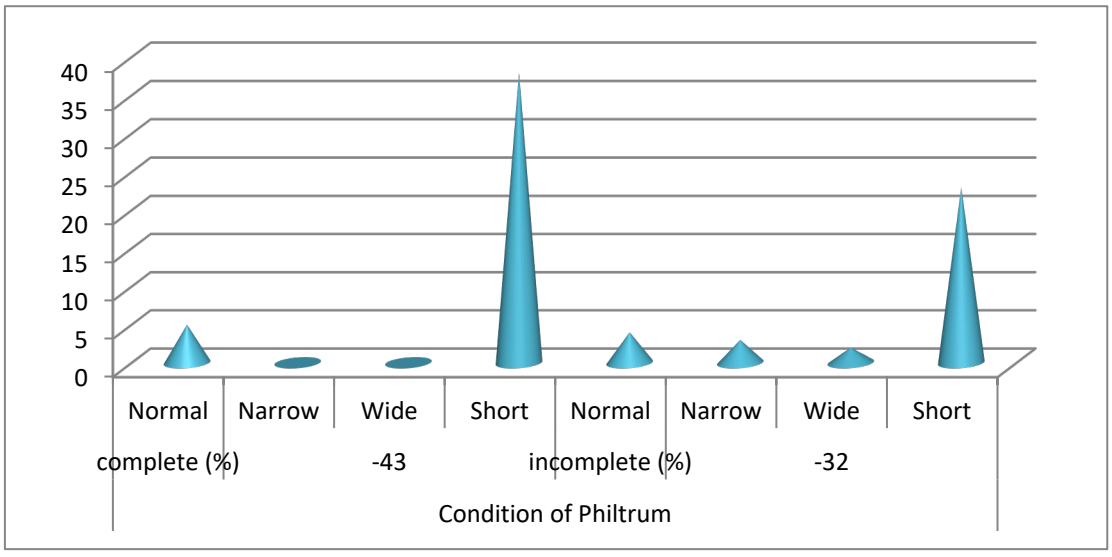


Fig.5.6: Bar-Diagram Showing Condition of Philtrum of Bilateral Cleft Lip Subjects before Surgery

5.4. Lip-Nose Correction of Bilateral Cleft Lip after Surgery

The table reveals a comparison representation of before and after the average lip length of complete bilateral cleft lip patients. In the 3-5 years patients the average lip length before surgery was 67 mm and after 3 month of surgery it was 51mm where after 6 month it became 50.5 mm. In the 6-10 years patients, the average lip length before surgery was 76 mm and after 3 month of surgery it was 57mm where after 6 month it became 56.5 mm. In the 11-15 years patients the average lip length before surgery was 79 mm and after 3 month of surgery it was 63mm where after 6 month it became 62.5mm, In the 16-20 years patients the average lip length before surgery was 77 mm and after 3 month of surgery it was 70 mm where after 6 month it became 69.6 mm and patients of more than 20 years, the average lip length before surgery was 83 mm and after 3 month of surgery it was 76 mm where it became 75.5 mm after 6 month of surgical intervention.

In case of incomplete bilateral cleft lip patients, 3-5 years patients the average lip length before surgery was 63 mm and after 3 month of surgery it was 57 mm where after 6 month it became 56.5 mm, In the 6-10 years patients the average lip length before surgery was 66 mm and after 3 month of surgery it was 59 mm where after 6 month it became 58 mm, In the 11-15 years patients the average lip length before surgery was 68 mm and after 3 month of surgery it was 63 mm where after 6 month it became 63 mm, In the 16-20 years patients the average lip length before surgery was 73 mm and after 3 month of surgery it was 70mm where after 6 month it became 70 mm and patients of more than 20 years, the average lip length before surgery was 75mm and after 3 month of surgery it was 71mm where it became 71 mm after 6 month of surgical intervention.

This table discloses association of before and after the average lip height of complete bilateral cleft lip patients and incomplete bilateral cleft lip patients.

After surgical intervention of complete bilateral cleft lip patients (43 cases), the lip width/thickness in certain interval. In the 3-5 years aged group patients the

average lip width was normal in 91.67% cases and 8.33% cases showed too thick lip thickness. In the 6-10 years aged group patients the average lip thickness after the surgery was normal in 81.82% cases, 9.09% cases showed too thin and 9.09% showed too thick lip width. In the 11-15 years aged group patients the average lip width after surgery was normal in 88.89% cases. In the 16-20 years aged group patients the average lip thickness after the surgery was normal in 85.72% cases and the patient group of more than 20 years age, the average lip width after the surgery was normal in 100% cases.

In case of incomplete bilateral cleft lip patients (32 cases), the lip width/thickness in certain interval. In the 3-5 years aged group patients the average lip width was normal in 75% cases and 12.5% cases showed too thick lip thickness. In the 6-10 years aged group patients the average lip thickness after the surgery was normal in 85.72% cases, 14.28% cases showed too thick. In the 11-15 years aged group patients the average lip width after surgery was normal in 100% cases. In the 16-20 years aged group patients the average lip thickness after the surgery was normal in 88.89% cases and the patient group of more than 20 years age, the average lip width after the surgery was normal in 100% cases. This table also reveals the average nostril width of bilateral cleft lip patients, before and 6 month after surgical intervention (Table 5.5 and Fig. 5.7 to 5.13).

Table 5.5: Comparison of Lip-Nostril Corrections of Bilateral Cleft Lip before and after Surgery.

Lip-Nostril Correctios	Type	Before/ After	Folloup Period	Age groups (Years)					P-value
				Group-A 3-15			Group-B 16>20		
				3-5 Y	6-10 Y	11-15 Y	16-20 Y	>20 Y	
Average lip length (mm)	complete	before		67	76	79	77	83	0.0001***
		after	3 month	51	57	63	70	76	
			6 month	50.5	56.5	62.5	69.6	75.5	0.0001***
	incomplete	before		63	66	68	73	75	0.001***
		after	3 month	57	59	63	70	71	
			6 month	56.5	58	63	70	71	0.001***
Average lip height (mm)	complete	before		24	25	31	32	32	0.0001***
		after	3 month	23	24	28	29	31	
			6 month	22.5	23.5	27.5	29	30.5	0.0001***
	incomplete	before		28	28	33	35	37	0.0001***
		after	3 month	24	25	28	29	31	
			6 month	23.5	24.5	28	28.5	30.5	0.0001***
Average lip thickness (mm)	complete	before	Normal	9	8	6	4	2	0.369
			Too thick	2	2	2	2	1	
			Too thin	1	1	1	1	1	
		6 month after	Normal	11	9	8	6	4	
			Too thick	1	1	1	1	0	
			Too thin	0	1	0	0	0	
	incomplete	before	Normal	5	4	3	6	2	0.547
			Too thick	2	2	1	2	1	
			Too thin	1	1	1	1	0	
		6 month after	Normal	6	6	5	8	3	
			Too thick	1	1	0	1	0	
			Too thin	1	0	0	0	0	
Average nostril width (mm)		before		35	39	44	46	49	0.0001***
		6 month after		28	32	35	39	43	

***very highly significant

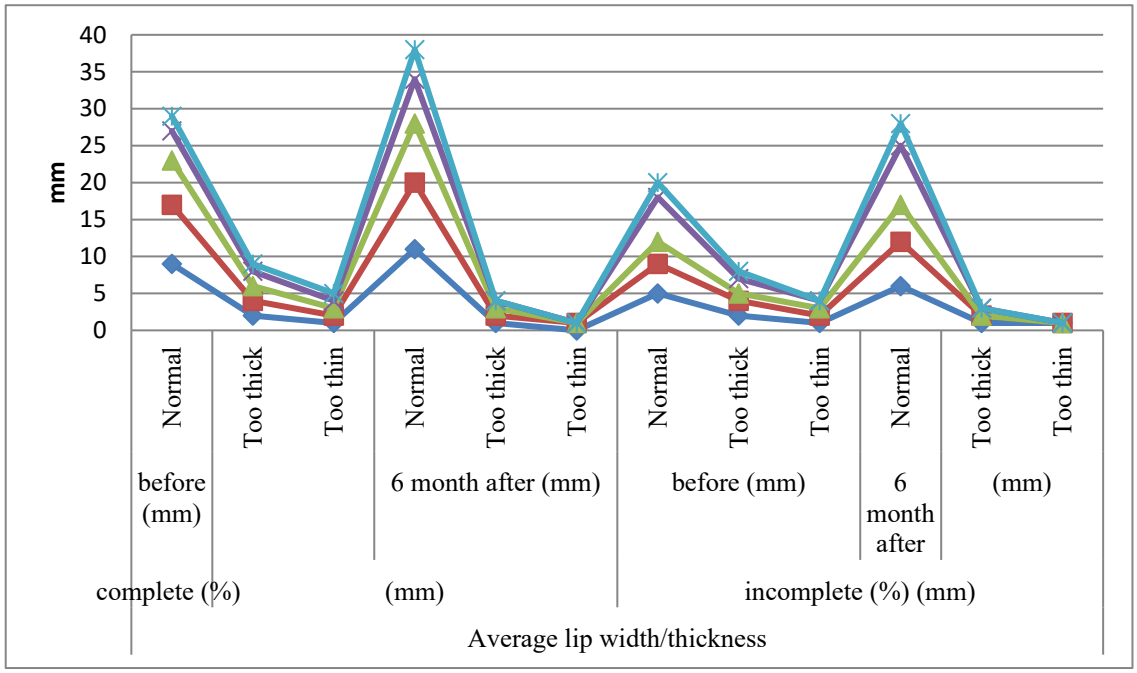


Fig.5.7: Line-Diagram Showing Average Lip Width/Thickness of Bilateral Cleft Lip after Surgery

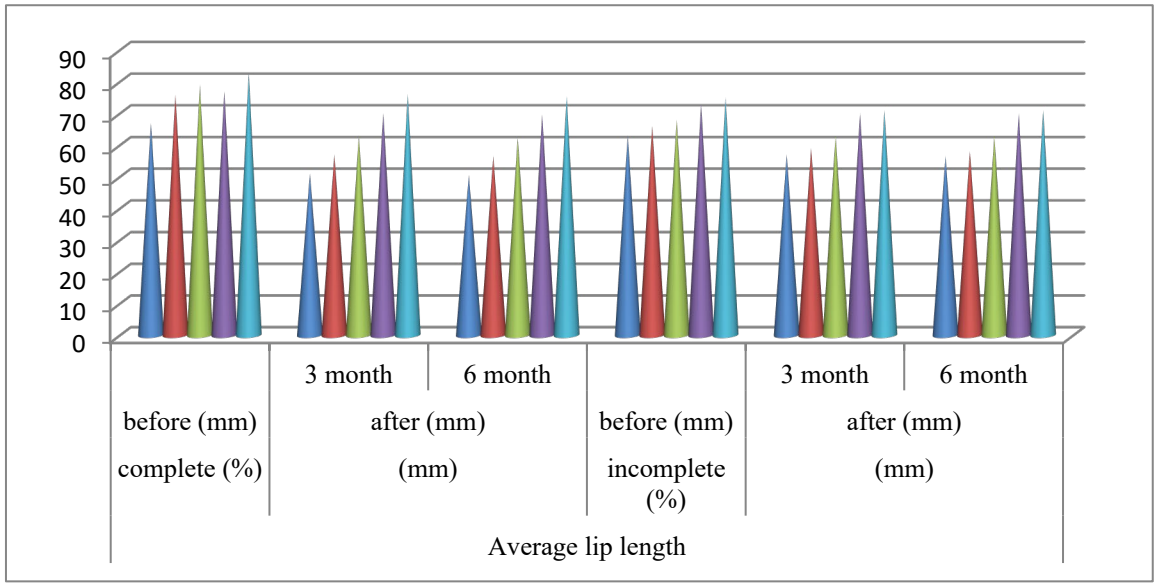


Fig.5.8: Bar-Diagram Showing Average Lip Length of Bilateral Cleft Lip after Surgery

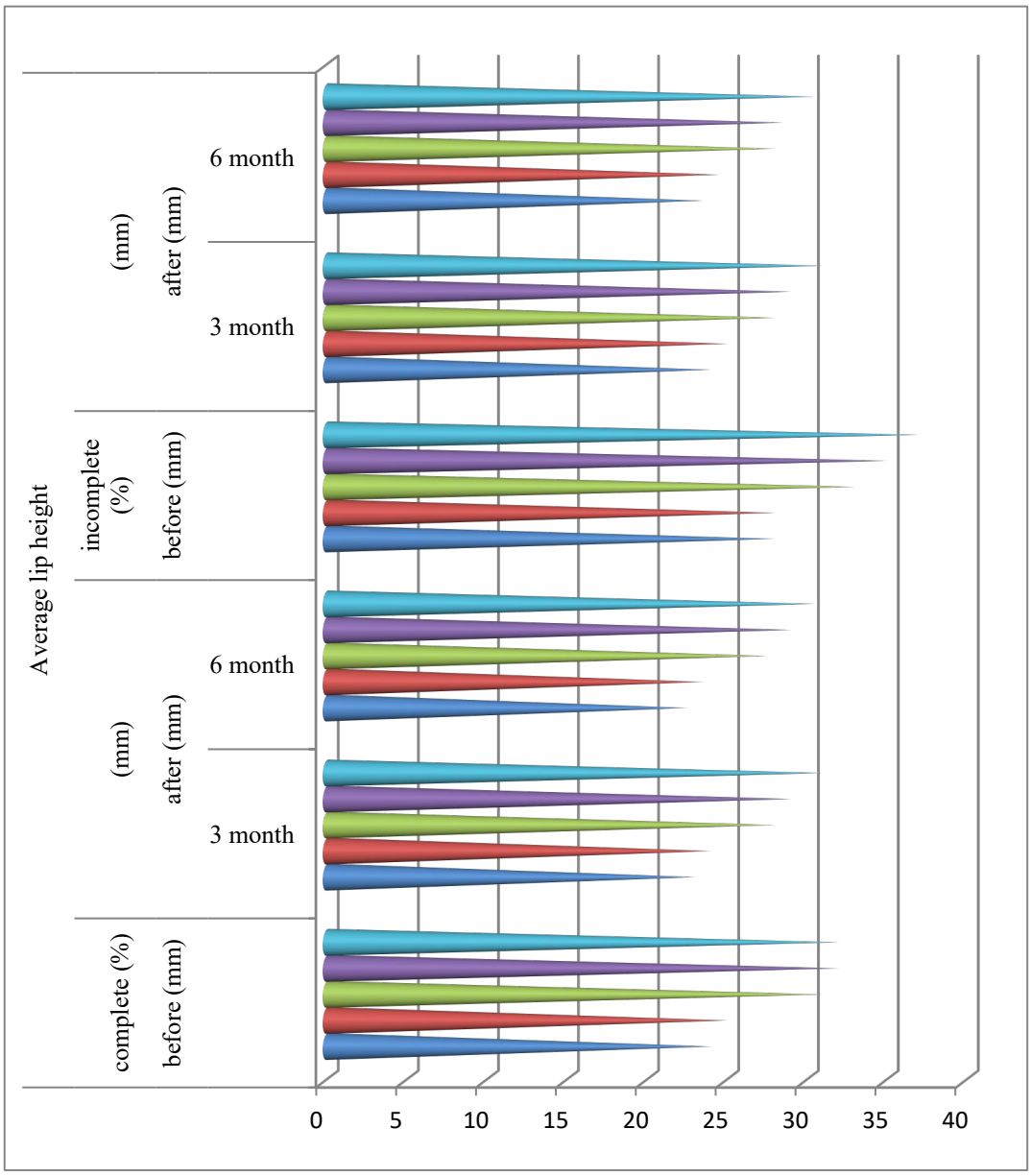


Fig.5.9: Bar-Diagram Showing Average Lip Height of Bilateral Cleft Lip after Surgery

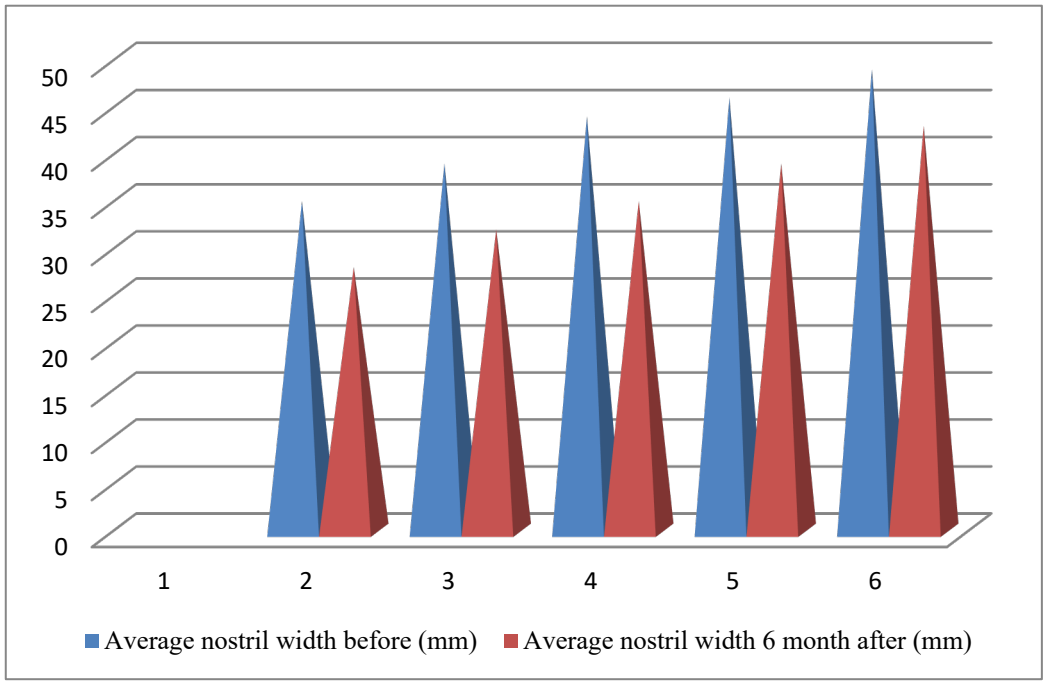
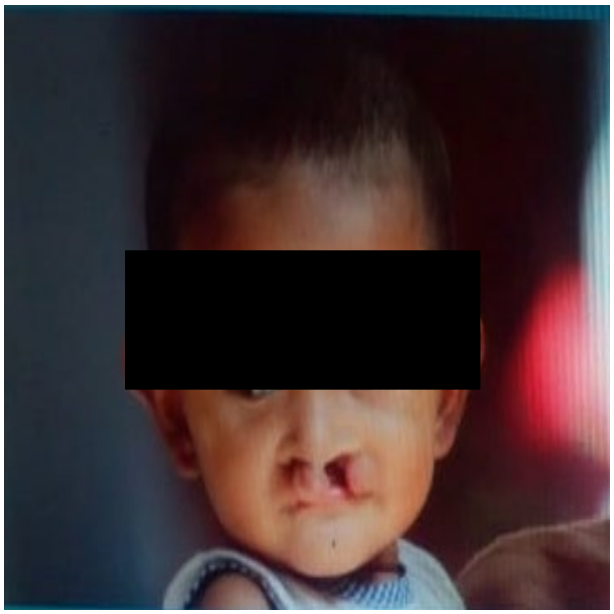
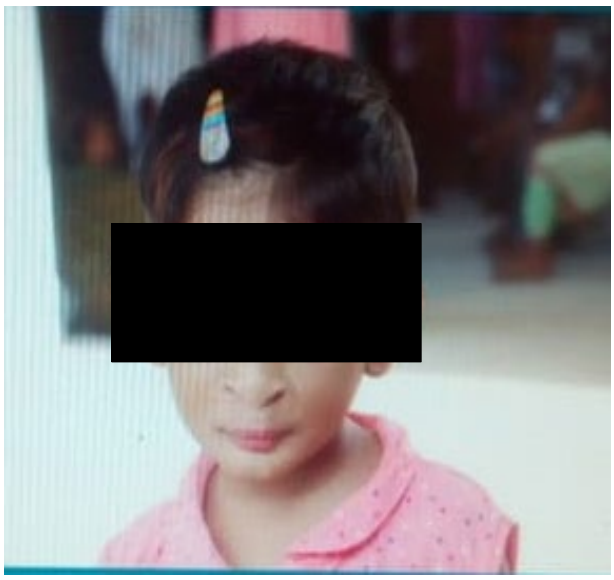


Fig.5.10: Bar-Diagram Showing Average Nostril Width of Bilateral Cleft Lip after Surgery

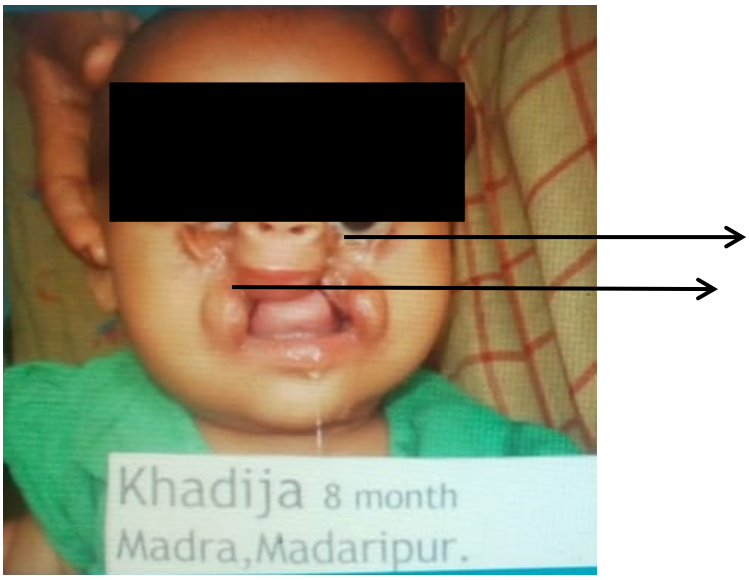


Before

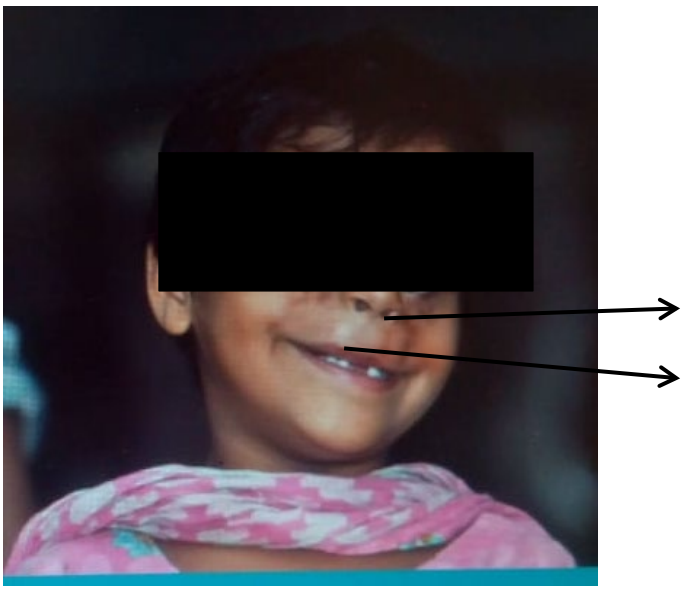


After

Fig.5.11: Bilateral Cleft Lip and Palate Repair by Modified Millard's Techniques.



Before



After

Fig.5.12: Facial Cleft (Bilateral Cleft) repair by Modified Millard's techniques.

Fig.5.13: Lip-Nose Structures (Bilateral Cleft) repair by Modified Millard's techniques.

5.5. Length and Size of Lip-Nose Structures of Bilateral Cleft lip Subjects Before and After Surgery

In the current study, different forms of columella condition were seen. Among them 24% were normal, 57.33% were short, 13.34% were wide base and 5.33% were narrow base before surgery and after surgery 80% were normal and 20% were short.

The nasal septum also may have changed due to bilateral cleft lip condition. In the current study, 40% of normal nasal septum where 60% of them get deviated before the surgical intervention and after surgical intervention 97.33% normal, 2.67% deviated.

Vermilion border is a significant component for the cleft lip deformities patient. In bilateral complete cleft lip patients/subjects, the vermilion border might be normal, notched or deformed. In the existing study, before and after the surgical intervention, normal percentages of vermilion border were increased. In bilateral incomplete cleft lip patients, before and after the surgical intervention, normal percentages of vermilion border were increased.

Cupid`s bow plays an important role for lip formation. Pre-operatively we saw three types of Cupid`s bow such as normal, narrow and wide. 43 cases were found in the group of complete bilateral cleft lip patients and 32 cases in incomplete bilateral cleft lip patients.

The philtrum area above the upper lip is often deformed due to cleft lip occurrence. In the current study, 43 cases of complete bilateral cleft lip patients and 32 cases of incomplete bilateral cleft lip patients. Among them, before and after the surgical intervention normal philtrum were increased from 11.62% to 95.35% Table 5.6 and Fig. 5.14 to 5.18).

Table 5.6: Follow up of Length and Size of Lip-Nose Structures of Bilateral Cleft lip Subjects Before and After Surgery

Lip-Nose Structures		Type	Comparison				p-value
			Before surgery		6 months after surgery		
			Frequency	%	Frequency	%	
Columella		Normal	18	24.0	60	80.0	0.635
		Short	43	57.33	15	20.0	
		Wide base	10	13.34	0	0	
		Narrow base	4	5.33	0	0	
Nasal septum		Normal	30	40	73	97.33	0.248
		Deviated	45	60	2	2.67	
Vermilion Border	Complete	Normal	8	18.60	36	83.72	0.092
		Notched	33	76.75	6	13.96	
		Deformed	2	4.65	1	2.32	
	Incomplete	Normal	6	18.75	28	87.5	0.240
		Notched	24	75.0	3	9.37	
		Deformed	2	6.25	1	3.13	
Cupid`s bow	Complete	Normal	6	13.95	40	93.02	0.001
		Narrow	4	9.30	1	2.33	
		Wide	33	76.75	2	4.65	
	Incomplete	Normal	5	15.62	29	90.63	0.055
		Narrow	3	9.38	2	6.25	
		Wide	24	75.0	1	3.12	
Philtrum	Complete	Normal	5	11.62	41	95.35	0.885
		Narrow	0	0	2	4.65	
		Wide	0	0	0	0	
		Short	38	88.38	0	0	
	Incomplete	Normal	4	12.5	27	84.38	0.233
		Narrow	3	9.38	4	12.5	
		Wide	2	6.25	1	3.12	
		Short	23	71.87	0	0	

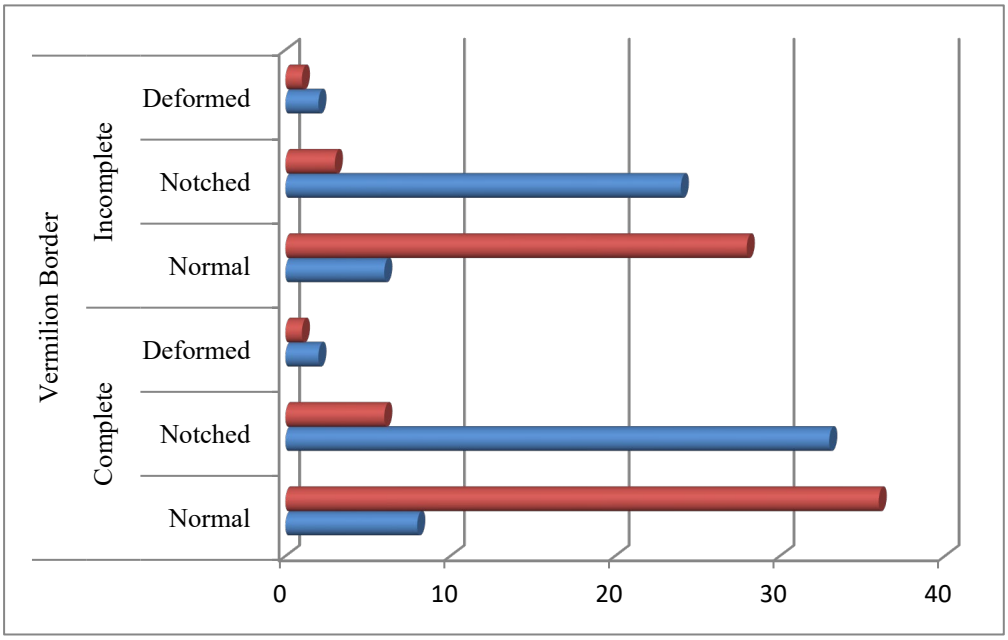


Fig.5.14: Bar-Diagram Showing Vermilion Border Bilateral Cleft lip Subjects Before and After Surgery

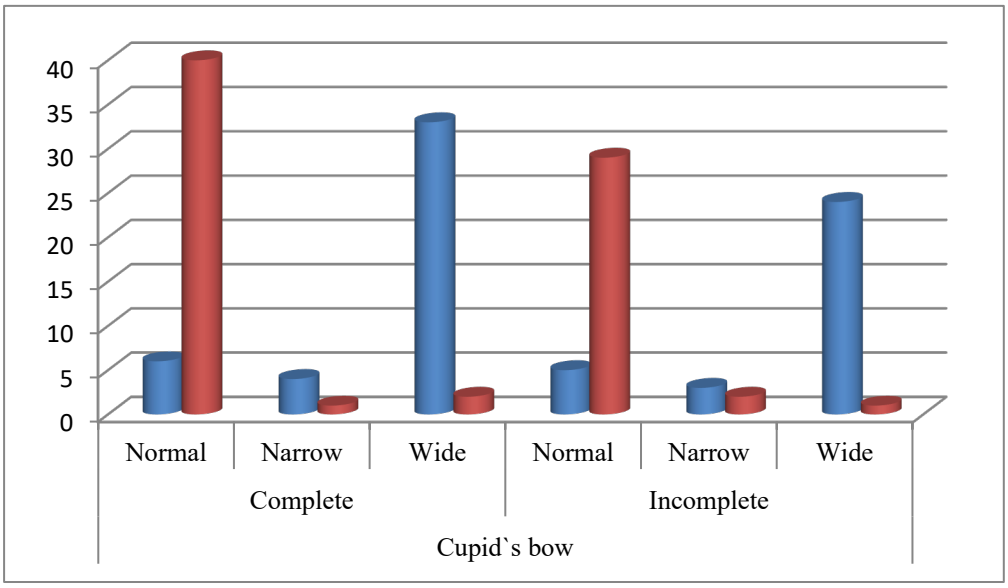


Fig.5.15: Bar-Diagram Showing Cupid`S Bow Bilateral Cleft Lip Subjects Before and After Surgery

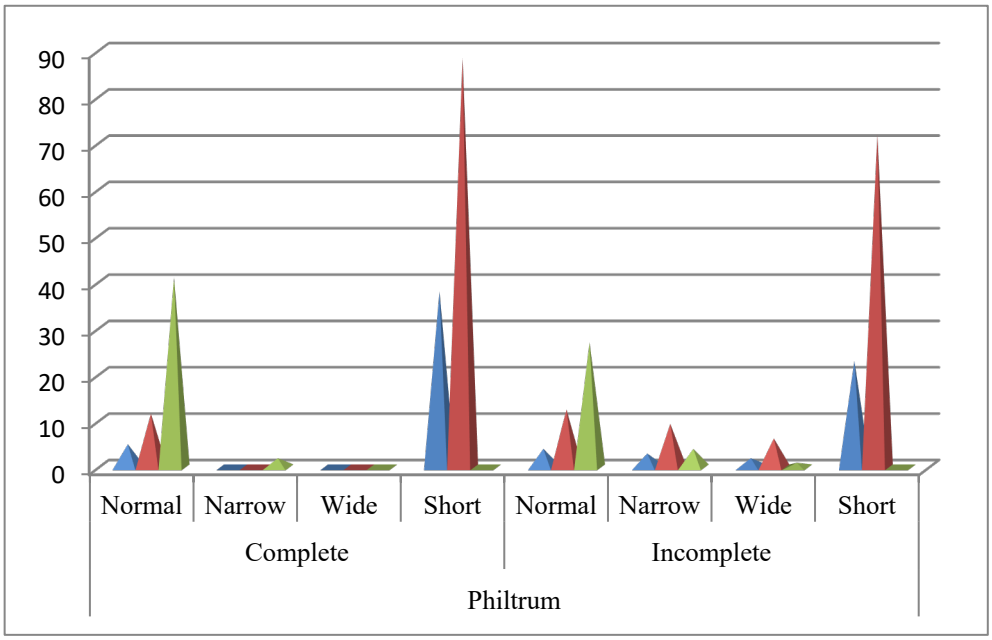
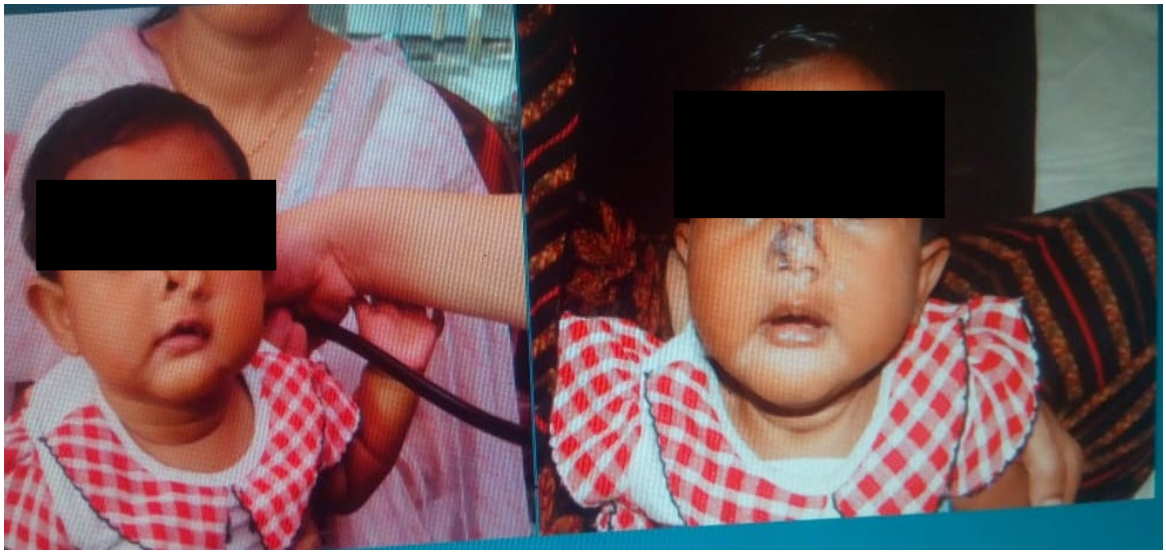
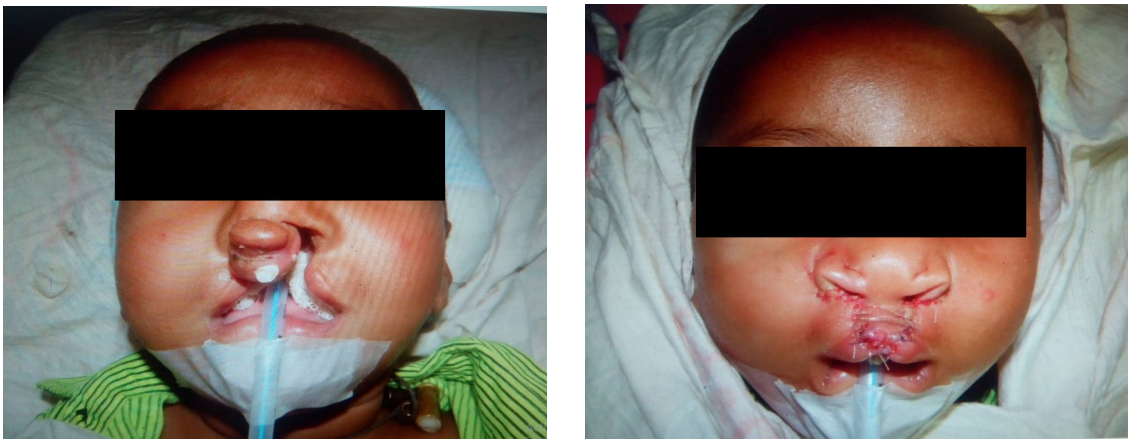


Fig.5.16: Bar-Diagram Showing Philtrum Bilateral Cleft Lip Subjects Before and After Surgery



Before **After**

Fig.5.17: Nasal Cleft Repair by Modified Millard's Techniques.



Before **After**

Fig.5.18: Length and Size of Lip-Nose Structures of Bilateral Cleft Lip Subjects Before and After Surgery by Modified Millard's Techniques.

5.6. Post-Surgical Scaring and Bilateral Cleft Lip Repair

Scar mark formation after surgical intervention is a common phenomenon. In the current study we were remarkably cognizant to avoid poor scar mark. And at the end of the study we found 86.67% scar mark which were aesthetic, 13.33% scar mark were satisfactory and poor scar mark were (Fig. 5.19 to 5.20).

Scar mark after surgery	Frequency	%	P-value
Aesthetic	65	86.67	0.771
Satisfactory	10	13.33	
Poor	0	0	
Total	75	100	

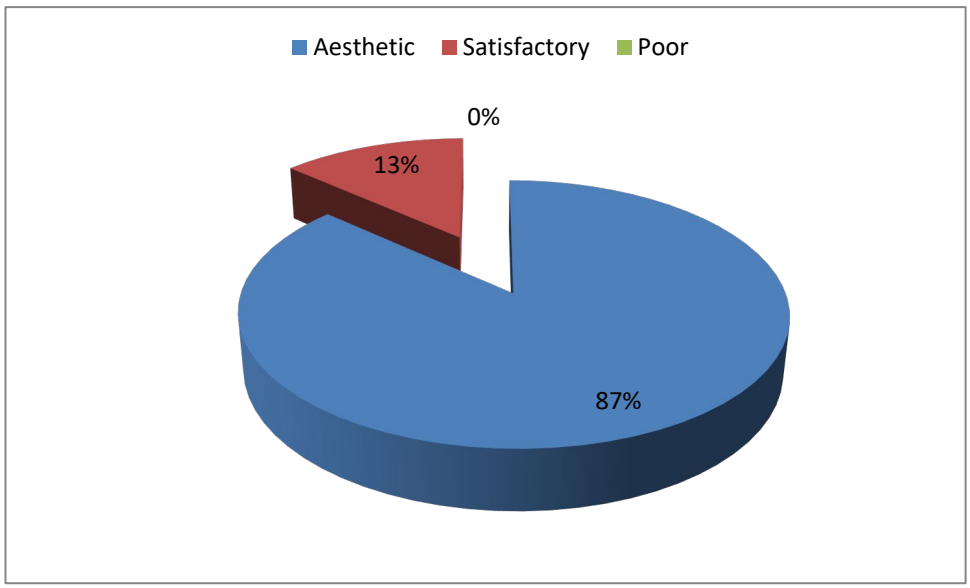
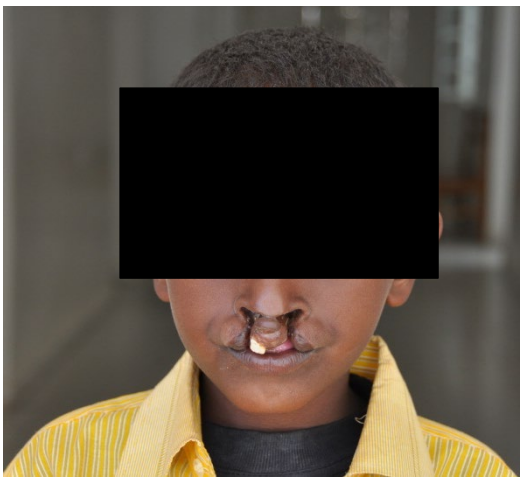
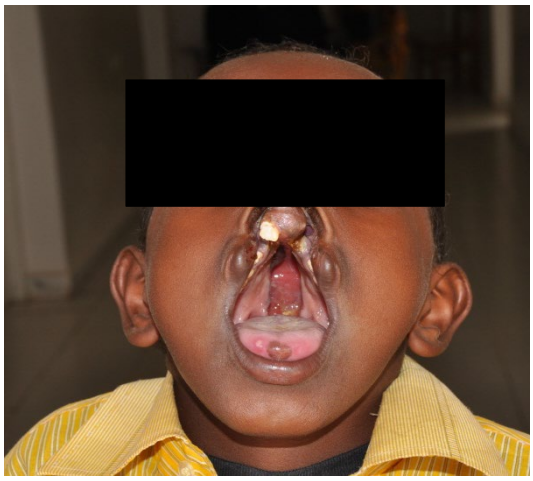


Fig.5.19: Pie-Chart Showing Post-Surgical Scar Mark After Surgery

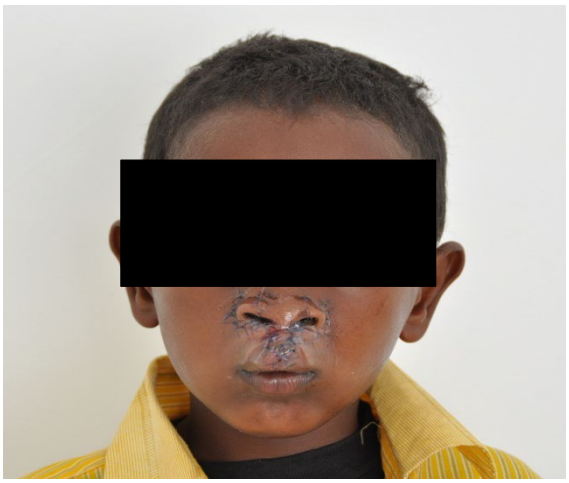




Bilateral Cleft Lip

Bilateral Cleft Palate

Before



Repair of Bilateral Cleft Lip and Palate

After

Fig.5.20: Post-Surgical Repair of Bilateral Cleft Lip and Palate.

Chapter-VI

DISCUSSION

6. DISCUSSION:

In bilateral cleft lip deformity, the anatomic characteristic is shown separately dependent on the level of the early embryological miscarriage and on the level of anomalous development after delivery (Veau *et al*. 1936). Although, it was well-known that maximum success might be achieved by identifying the level of fetal miscarriage through the precise pre-surgical assessment. The anatomic malformation of the cleft on the both side of the lip (complete cleft lip) was inclined by the abnormal tissue developed from the mesoderm, such as skeleton and muscles, and, later it has the mechanism similar to the anatomic malformation of unilateral cleft lip. The nasal septum and nasal bone are situated straight without deviation in case of nasal abnormality (CBL). However, if the periodontal tissue was adhered to any side or if a Simonart band was present, it could show a shape related to CSL (Cleft on the one side of the lip). In case of alar cartilage deformity, bilateral cleft lip displays arrangement related to CSL, but the flaring and buckling of the lateral angle of the nasal cartilage seem to be more austere. (McComb. 1975)

In CBL, columella tends to be short because the alar cartilage is spreading extensively. Present of fibrous adipose tissues between the nasal tip and the alar cartilage excessively, developing the blunt nasal tip. (Potter. 1968; Steinstrom and Oberg. 1961), complete CBL is developed embryo-logically by the failure of the mesodermal reinforcement of both maxillary procedures, and the migration of nasofrontal procedure appears to be normal. In incomplete CBL, muscular fibers are detected in the prolabium, which suggests the partial migration of muscles.

In bilateral cleft lip, the morphologic characteristic are determining by some intrinsic and extrinsic factors. (Mulliken. 1992) The intrinsic factors are wide and columella short, nasal tip bifid with a horizontally oriented nostril axis. The alar cartilage shows hypoplasia. It is also caudally rotated, and subluxated from the upper lateral cartilage. The genu is extended and the tissue of the alar margin

is hypo-plastic. These intrinsic elements result in primary abnormality. The extrinsic factors are the secondary changes which coming from the complete bilateral cleft lip repair. If the deformity is corrected by the conventional methods, the medial crus of the alar cartilage are pulled infero-posteriorly which make the columella shorter. If the lateral labial segment is absorbed without shortening, despite the fact that the vertical length of the lateral labial segment is long, the alar and the lateral crus of the alar cartilage will be cephalad displaced. As a result, the alar dome will get arched, and the space between the genu will get broader, causing relocate of the malformation more problematic in later times.

Several methods have been introduced to the repair of BCL, with their own advantages and deficiencies. In BCL repair, most researchers suspended the time of modification of nasal malformation and focused on the system of expansion the columella. There are 2 types of methods which bring tissues to the columella. Number one, bring the tissues from the upper lip, which is the fork flap method defined by Millard. (Millard. 1958) The other technique is demonstrated by Cronin. The method in which, the nasal dorsum, alar margin, and nasal floor tissues brings to the columella (Cronin. 1958). Such techniques leave a scar mark through the columella-labial connection, and the scar surrounds the prolabium, and thus, the prolabium becomes obtruded rather than depressed. Besides, Millard's techniques, the columella-labial position may be acute, more severe by the accompanied scar (Mulliken.1995).

So, the disadvantages of other techniques of bilateral cleft surgical cases if we study this picture in Tennison techniques for example.

Tennison techniques **Modified Millard techniques**

Fig. 6.1. Advantages of Modified Millard techniques over Tennison techniques.

In this picture the defects are:

1. There is no continuity of orbicularis oris muscle with pre-maxilla as a result there are bilateral hypertropy of oris muscle of upper lip.

2. There are bilateral vermillion notch

3. There are bilateral defect of nasal floor

4. There is shortness of upper lip mainly the premaxillary area, which make the extra work of lower lip at the end even the lower lip has hypertropy.

5. Widening of filtral ridge

6. Scar formation on the skin

Because of discontinuity of oris muscle which pull the premaxilla, hamper the normal growth of premaxilla results the shortness of upper lip.

Manchester techniques **Modified Millard techniques**

Fig. 6.2: Advantages of Modified Millard techniques over Manchester techniques

In manchester techniques, Normally the incision was given at vermillion border of premaxilla. The normal mucous layer of premaxilla discard in this techniques. As a result long term surgical outcome is not aesthetic because of there is abnormal scar formation at cupid bow area.

Manchester techniques

Fig. 6.3: Abnormal scar formation at cupid bow area

In this study techniques, save this mucous layer of premaxilla.

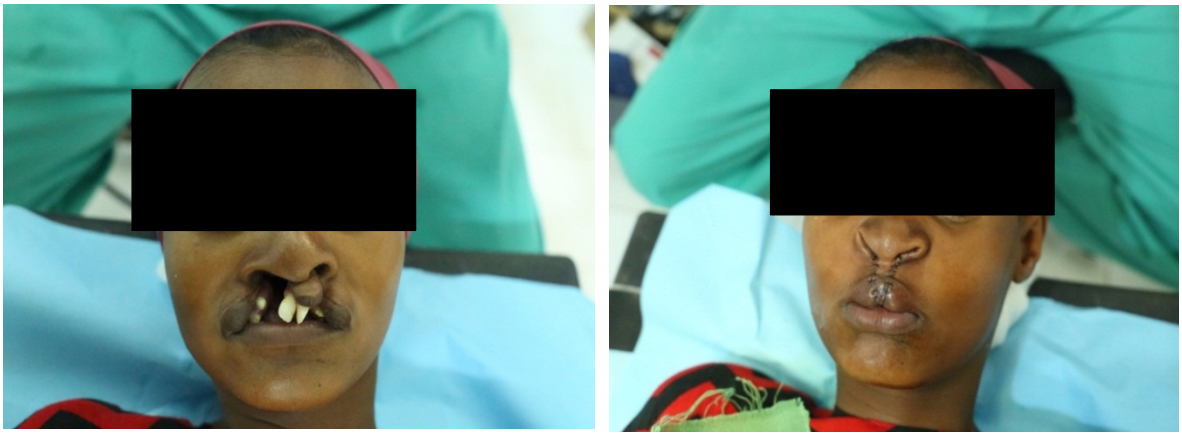


Fig. 6.4: Modified Millard techniques

To save this 2-3 mm of normal tissue (mucous membrane of premaxilla) gives an excellent long term aesthetic result.

Dissection of premaxilla:

Many surgeons believe and practice not to dissect the premaxilla. It is believed that, if dissect premaxilla it could be necrossed. In many years Bilateral cleft surgical practice always disect the premaxilla with resasons:

a) If it is disect, it can lengthen the premaxillary tissue which is always short.

b) After lengthening it is very easy to lengthen the lip up to the satisfactory normal lip length.

c) If it is disect then another big advantage, it can close the mucous layer without any chance of post-surgical formation of labial fistula (which is another very common post-operative complication of Bilateral cleft surgery)

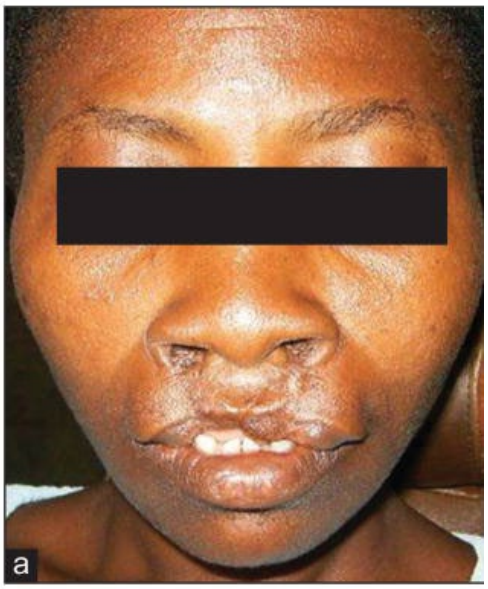


Fig.6.5: Manchester techniques repair.

d) With this mucous closure it can built very good length of sulcous formation, which will give you long term normal growth of premaxilla.

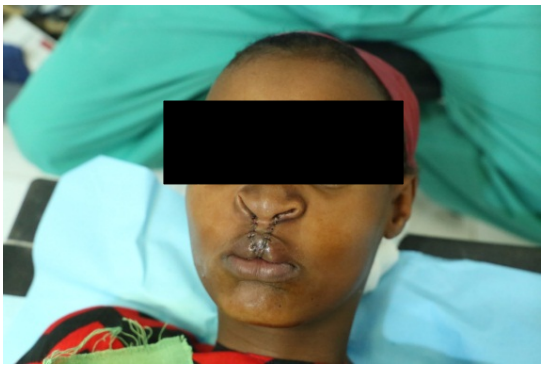


Fig.6.6: Modified Millard techniques

These are very important points of dissecting premaxilla.

Muscular dissection and rotation:

In this study techniques (modified millard techniques), separate the oris muscles from abnormal attachment. area and rotate that muscles, then bring the peripheral and central fibers of orbicularis muscles criss cross over dissected premaxilla that gives –

1) Continuity of oris muscles

2) Helps to build up the floor of nose.

3) Give good length of upper lip

In long terms it gives a very good post-surgical aesthetic outcome.

So, in this techniques, can avoid unnecessary post-surgical complication which was dissect before in tennison and Manchester techniques.

We can avoid scar formation at cupid bow area which is very common in Manchester techniques.

In this techniques can avoid discontinuity of oris muscles and inadequate development of premaxilla in Tennison techniques which results the shortness of upper lip.

Some surgeons criticize about millard post-operative technique regarding decreasing total lip length. This shrinkage depends upon the dissection and proper rotation of abnormally attached oris muscles fibres.
If somebody can dissect and rotate the abnormal oris muscles fibers (including peripharalis and centralis fibres) and bring all those muscles in normal position with normal length of the lip in that condition there will be no significant post-operative contractions of lip length.
This dissection, separation of abnormal attachment and rotation of oris muscles will help to bring equal level of protected premaxilla of Bilateral cleft cases.

No other technique like premaxillary osteotomy needed to bring the protected premaxilla down. Once, release the oris muscles gently or nicely and rotate it automatically everything will be equal level.

Disadvantage of premaxillary osteotomy never reunite the fracture bone of premaxilla always it remain unstable. So it is better not to do any premaxillary osteotomy.

There is some quality needed for the bilateral cleft surgery. So, Quality of a Surgeon in cleft surgery are-

1. A surgeon need to dedicate his professional time and practice to do a perfect surgery because many post-operative cleft surgical complication arise due to surgeons fault.

2. No surgeon should compromise with above all these important factors to get a good satisfactory aesthetic surgical outcome.

Different treatment procedures (pre-operative and post-operative orthodontic treatment, different age of the patient's at the time of the surgery, different methods of surgery) might affect post-operative outcomes. In CBL, operations in different cleft centers were implemented at the different age of the patient's varying from 3 years to more than 20 year, mostly from 11 to 15 years (29.33%). In the current research, all operations were completed at the Cleft Center, and only the skilled physicians operated the patients using the same treatment protocol (modified Millard method). Therefore, these factors gave the improved possibility to compare different operational procedures eliminating the influence of different treatment protocols, patient's age at the time of operation, and specialists' knowledge on the postoperative outcomes. Up to now, numerous procedures of the evaluation of cleft lip plasty have been suggested.

According to the Tennison procedure, even very wide clefts are succeeded by single surgery (Chowdri *et al*. 1990). In the present study, patients were divided

into two separate subgroups, such as group-A (3 to 15 years) and group-B (15 to >20 years).

Although, the impact of cleft width on esthetic results were very much possible to estimate. The cleft lip patents, were taken as sample of these study had some previous history of taking treatment from different orientation. 26.67% were getting spiritual treatment, 14.67% had experienced homeopathic treatment and 4% were treated by village doctors. Whereas 54.67% did not experienced any treatment before. In our current study only 2.66% cases were diagnosed before birth by using ultrasound technique.

The ultimate aims in cleft lip operation are evading of nasal abnormalities (Numa *et al*. 2006). There are few data that the Millard system gave better outcomes in the formation of the nostrils than the Tennison method (fig.6.1) (Tan and Atik. 2007). It might be concluded that millard method has advantages but none of the other techniques showed considerably better outcomes in the development of the nostrils. In primary cleft lip plasty, it would be sensible to isolate such components as lip and nose. CBL repair straightly do not include rhinoplasty, but during primary cheiloplasty, new nostrils are formed, and the connection of the nasal cartilages is also transformed. There is ongoing discussion at what place skin incision in nostril area must be done to mobilize the alar cartilage during primary cleft lip plasty or it must be done during secondary surgery, how and where with to fix mobilized cartilages, to use or not to use postoperative stents (Nagy and Mommaerts. 2007).

The aims of Bilateral Cleft lip repair contain the construction of a complete upper lip with suitable perpendicular length and symmetry, restoration of the underlying muscular structures to succeed regular function, and the managing of the related nasal abnormality. The Tennison–Randall and Millard's rotational advancement flap procedure rests the most recognized systems. With the need of time and situation, definite changes in both procedures are made and

combinations of both have been utilized. But in this research modified Millard's techniques is far better than Tennison techniques (fig.6.1).

The studies by Linas Zaleckas *et al* (Zaleckas *et al*. 2011) and Tomohiro Yamada *et al* (Yamada *et al.*2002) where in, they detected better symmetry of the Cupid's bow been restored by use of Tennison's method but in this study (modified Millard's) the findings are far better than the reported study.

Therefore, the current research suggested that modified Millard's technique gave better outcomes with respect to white roll match, alar base symmetry, Cupid's bow symmetry and the lip length. Conversely, in case of post-operative, the incisional scars on patients treated with Modified Millard's procedure was considerably better than those patients treated using Tennison- Randall technique.

In Manchester techniques, a small prolabium raises ample size after operation. Secondary malformations such as miserable nose, tiny columella and widespread cupid's bow persisted to be resolved in some cases even by the Manchester repair. Secondary repair of a very depressed nose and small columella is implemented at the age of 4-6 years. In such cases, modified Millard's techniques on the upper lip and extended the short columella, while at the same time repairing the widespread cupid's bow. (fig.6.2)

Chapter-VII

Recommendation

7. RECOMMENDATION:

In Modified Millard techniques can avoid discontinuity of or is muscles and inadequate development of premaxilla but in Tennison techniques which results the shortness of the upper lip.

Factors for the recommendation of that aesthetic surgical outcome are—

1. Skilled and Trained surgeon
2. Fine quality of instruments
3. Quality suture materials with different size.
4. Use of different size suture materials in different layers of cleft surgery.
5. Size and sharpness of needles use for cleft surgery
6. Tightening of knot especially at for prevention of post-operative scar formation.
7. Distance of suture from incision line is important for prevention of scar formation.
8. Handling of skin layer by instrument such as tooth adson forcep can cause micro scar formation.
9. Government and Non-government relation should build up.
10. Our government should proper steps for the involvement of the international NGOs.
11. Further study on this field can be possible.
12. Arrange frequently international cleft seminar.

REFERENCES

8. REFERENCE

Acs N.; Banhidy F.; Puho E. & Czeizel AE. Maternal influenza during pregnancy and risk of congenital abnormalities in offspring. 2005. Birth Defects Res A Clin Mol Teratol, 73(12), 989-996.

Arosarena OA. Cleft lip and palate. 2007.*Otolaryngol Clin North Am.* 40(1):27-60'.

Arvedson J. & Brodsky L. Feeding with craniofacial anomalies. 2002. In J. C. Arvedson & L. B. Brodsky (Eds.), Pediatric swallowing and feeding: Assessment and management (2nd ed.) (pp. 527–561). Albany, NY:Singular Publishing Group.

Asling CW.; Nelson MM.; Dougherty HD.; Wright HV.; Evans HM. The development of cleft palate resulting from maternal pteroylglutamic (folic) acid deficiency during the latter half of gestation in rats. 1960.*Surg Gynecol Obstet.*; 111: 19-28.

Baker EW. Muscles of the skull & face: muscles of facial expression: mouth. 2010. In Baker EW (ed) Head and neck anatomy for dental medicine. New York, Stuttgart. Thieme: 24-38.

Baker EW. Oral cavity & perioral regions: muscles of soft palate & pharynx. 2010. In Baker EW (ed) Head and neck anatomy for dental medicine. New York, Stuttgart. Thieme: 212-214.

Beaty TH.; Murray JC.; Marazita ML.; Munger RG.; Ruczinski I.; Hetmanski JB *et al.* A genome-wide association study of cleft lip with and without cleft palate identifies risk variants near MAFB and ABCA4. 2010. *Nat Genet.* 42(6):525-9.

Berkovitz BKB.; Holland GR.; Moxham BJ. Regional topography of the mouth and related areas. 2009. In: Taylor A (ed) Oral anatomy, histology and embryology. Edinburg, London, New York, Oxford, Philadelphia, St Louis, Sydney, Toronto. Mosby Elsevier: 62-81.

Bienengraber V.; Malek F.; A. Moritz K.U.; Fanghanel J.; Gundlach K.K. & Weingartner J. Is it possible to prevent cleft palate by prenatal administration of folic acid? An experimental study. 2001. Cleft Palate Craniofac J, 38(4), 393-398.

Bitter K. Repair of bilateral clefts of lip, alveolus and palate. Part 1: A refined method for the lip-adhesion in bilateral cleft lip and palate patients. 2001. J Craniomaxillofac Surg. 2001 Feb;29(1):39-43. PubMed PMID: 11467493. Epub 2001/07/27. eng.

Blanco-Davila F. Incidence of cleft lip and palate in the northeast of Mexico: a 10-year study. 2003. J Craniofac Surg 14(4): 533-537.

Boklage, Charles E. *How new humans are made cells and embryos, twins and chimeras, left and right, mind/selfsoul, sex, and schizophrenia*.2010. Singapore: World Scientific. p. 283. *ISBN 9789812835147*. *Archived* from the original on 2017-09-10.

Botto LD. ;Erickson JD. ;Mulinare J .;Lynberg MC. ;Liu Y. Maternal fever, multivitamin use, and selected birth defects: evidence of interaction? 2002. *Epidemiology.*; 13: 485-488.

Br J Orthod. The Clinical Standards Advisory Group (CSAG) Cleft Lip and Palate Study. **1998.** Feb;25(1):21-30. Sandy J(1), Williams A, Mildinhall S, Murphy T, Bearn D, Shaw B, Sell D, Devlin B, Murray J. Author information: (1)Division of Child Dental Health, University of Bristol Dental School, Bristol, U.K.

Braybrook C.; Doudney K.; Marçano AC.; Arnason A.; Bjornsson A.; Patton MA.; Goodfellow PJ.; Moore GE.; Stanier P. The T-box transcription factor gene TBX22 is mutated in X-linked cleft palate and ankyloglossia. 2001.*Nat Genet.* 29(2):179-83,

Brito LA.; Meira JG.; Kobayashi GS.; Passos-Bueno MR. Genetics and management of the patient with orofacial cleft. 2012. Plast Surg Int 2012 article ID: 782821.

Broadbent TR.; Fogh-Andersen P.; Berlin AJ.; Karfik V.; Matthews DN.; Pfeifer G. Report of the Subcommittee on Nomenclature and Classification of Clefts of Lip, Alveolus and Palate and Proposals for Further Activities.1969. Newsletter of the International Confederation for Plastic and Reconstructive Surgery [Monograph]. Amsterdam,

Brophy TW. Cleft Lip and Palate. 1923. Philadelphia: P. Blakiston's Son and Co.

Brophy TW. Cleft palate and harelip procedures. 1921. Int J Orthod Oral Surg.;7:319–330.

Butali A.; Adeyemo WL. An Overview of Cleft Care in Nigeria. 2011. Nigerian Postgraduate Medical Journal.;18:151–153. [PubMed]

Butali A.; Mossey PA.; Adeyemo WL.; Jezewski PA.; Onwuamah CK.; Ogunlewe MO.; Ugboko VI.; Adejuyigbe O.; Adigun AI.; Abdur-Rahman LO.; Onah.; Audu RA.; Idigbe EO.; Mansilla MA.; Dragan EA.; Petrin AL.; Bullard SA.; Uduezue AO.; Akpata O.; Osaguona AO.; Olasoji HO.; Ligali TO.; Kejeh BM.; Iseh KR.; Olaitan PB.; Adebola AR.; Efunkoya E.; Adesina OA.; Oluwatosin OM.; Murray JC. Nigeria.; CRAN Collaboration. Genetic studies in the Nigerian population implicate an MSX1 mutation in complex oral facial clefting disorders. 2011. Cleft Palate Craniofac J.;48:646–653.

Butali A.; Mossey PA. Epidemiology of orofacial clefts in Africa: methodological challenges in ascertainment. 2009. Pan African Medical Journal.; 2:2–5. [PubMed: 21532898]

Cagá?ová V.; Borský J,.; Smahel Z.; Velemínská J**.** Facial growth and development in unilateral cleft lip and palate: comparison between secondary alveolar bone grafting and primary periosteoplasty. 2014. *Cleft Palate Craniofac J.* 51(1):15-22.,

Calzolari E.; Pierini A.; Astolfi G.; Bianchi F.; Neville AJ.; Rivieri F. Associated anomalies in multi-malformed infants with cleft lip and palate: an epidemiological study of nearly 6 million births in 23 EUROCAT registries. 2007. *Am J Med Genet A.*; 143: 528-537.

Carinci F.; Scapoli L.; Palmieri A.; Zollino I. & Pezzetti F. Human genetic factors in nonsyndromic cleft lip and palate: an update. 2007. Int J Pediatr Otorhinolaryngol, 71(10), 1509-1519.

Chowdri NA.; Darzi MA.; Ashraf MM. A comparative study of surgical results with rotation-advancement and triangular fl ap techniques in unilateral cleft lip. 1990.Br J Plast Surg;43:551-6.

Christensen K.; Mitchell LE. Familial recurrence-pattern analysis of nonsyndromic isolated cleft palate--a Danish Registry study. 1996. *Am J Hum Genet.* 58(1):182-90.

Clarren SK.; Anderson B. & Wolf LS. Feeding infants with cleft lip, cleft palate, or cleft lip and palate. 1987. Cleft Palate Journal, 24, 244–249.

Cooper ME.; Stone RA.; Liu YE.; Hu DN.; Melnick M.; Marazita ML. Descriptive epidemiology of nonsyndromic cleft lip with or without cleft palate in Shanghai, China, from 1980 to 1989. 2000. Cleft Palate Craniofac J.;37:274–80.

Cooper-Brown L.; Copeland S.; Dailey S.; Downey D.; Petersen MC.; Stimson C. & Van Dyke DC. Feeding and swallowing dysfunction in genetic syndromes. 2008. Developmental Disabilities Research Reviews, 14, 147–157. doi:10.1002/ddrr.19

Cronin TD. Lengthening columella by use of skin from nasal floor and alae. 1958. Plast Reconstr Surg Transplant Bull;21:417Y426

da Silva Filho OG.; Carvalho Lauris RC.; Capelozza Filho L.; Semb G. Craniofacial morphology in adult patients with unoperated complete bilateral cleft lip and palate. 1998.Cleft Palate Craniofac J. 1998 Mar;35(2):111-9. PubMed PMID: 9527307. Epub 1998/04/04. eng.

da Silva Filho OG.; de Castro Machado FM.; de Andrade AC.; de Souza Freitas JA.; Bishara SE. Upper dental arch morphology of adult unoperated complete bilateral cleft lip and palate. American journal of orthodontics and dentofacial orthopedics : official publication of the American Association of Orthodontists, its constituent societies, and the American Board of Orthodontics. 1998. Aug;114(2):154-61. PubMed PMID: 9714280. Epub 1998/08/26. eng.

Davis JS.; Ritchie HP. Classification of congenital clefts of the lip and palate with a suggestion for recording these cases. 1922. JAMA.;79:1323–1327

Del Prete S.; D'urso A.; Tolevski Meshkova D.; Coppotelli E. Cleft lip and palate: A review of the literature. 2014. Webmed Central Orthodontics;5:WMC004783.

Delaire J.; Precious D**.** Influence of the nasal septum on maxillonasal growth in patients with congenital labiomaxillary cleft. 1986. *Cleft Palate J.* 23(4):270-7.

Derijcke A.; Eerens A.; Carels C. The incidence of oral clefts: a review. 1996. Br J Oral Maxillofac Surg 34(6): 488-494.

DeRoo LA.; Wilcox AJ.; Drevon CA.; Lie RT. First-trimester maternal alcohol consumption and the risk of infant oral clefts in Norway: a population-based case-control study. 2008. *Am J Epidemiol.* 168(6):638-46,

Dinwiddie R. Congenital upper airway obstruction. (2004). Paediatric Respiratory Reviews, 5, 17–24. doi:10.1016/j.prrv.2003.10.001

Dolovich LR.; Addis A.; Vaillancourt JM.; Power JD.; Koren G. & Einarson TR. Benzodiazepine use in pregnancy and major malformations or oral cleft: meta-analysis of cohort and case-control studies.1998.BMJ, 317(7162), 839-843.

Doray B.; Badila-Timbolschi D.; Schaefer E.; Fattori D.; Monga B.; Dott B.; Favre R.; Kohler M.; Nisand I.; Viville B.; Kauffmann I.; Bruant-Rodier C.; Grollemund P.; Rinkenbach R.; Astruc D.; Gasser B.; Lindner V.; Marcellin L.; Flori E.; Girard-Lemaire F.; Dollfus H. Epidemiology of orofacial clefts (1995-2006) in France (congenital malformations of Alsace registry). 2012. Arch Pediatr 19(10): 1021-1029.

Douglas B. The role of environmental factors in the etiology of "so-called" congenital malformations: I—deductions from the presence of cleft lip and palate in one of identical twins, from embryology and from animal experiments. 1958. *Plast Reconstr Surg.*; 22: 94-108.

"Facts about Cleft Lip and Cleft Palate". October 20, 2014. Archived from the original on 8 May 2015. Retrieved 8 May 2015.

Farronato G.; Cannalire P.; Martinelli G.; Tubertini I.; Giannini L.; Galbiati G.; Maspero C. Cleft lip and/or palate: review. 2014 .*Minerva Stomatol.* 63(4):111-26,

Farronato G.; Giannini L.; Riva R.; Galbiati G.; Maspero C. Correlations between malocclusions and dyslalias. 2012. *Eur J Paediatr Dent.* 13(1):13-8,

Ferrero GB.; Baldassarre G.; Panza E.; Valenzise M.; Pippucci T.; Mussa A. *et al*. A heritable cause of cleft lip and palate--Van der Woude syndrome caused by a novel IRF6 mutation. Review of the literature and of the differential diagnosis. 2010. Eur J Pediatr, 169(2), 223-228.

Fogh-Andersen P. Inheritance of harelip and cleft palate. 1942. Copenheigen. Busck.

Gorlin RJ.; Cohen MM.; Hennekam RCM. Orofacial cleft syndromes. In Gorlin RJ (ed). Syndromes of head and neck. 2010. Oxford Univeristy Press: 943-971.

Habel A.; Sell D.; Mars M. Management of cleft lip and palate.1996. *Arch Dis Child.* 74(4):360-6,

Hagberg C.; Larson O.; Milerad J. Incidence of cleft lip and palate and risks of additional malformations.1998. Cleft Palate Craniofac J 35(1): 40-45.

Harkins CS.; Berlin A.; Harding RL.; Longacre JJ.; Snodgrasse RM. A classification of cleft lip and cleft palate. 1962. Plast Reconstr Surg Transplant Bull.;29:31–39

Hashmi S.; Gallaway MS.; Waller DK.; Langlois PH.; Hecht TH. Maternal fever during early pregnancy and the risk of orofacial clefts. 2010. Birth Defects Res A Clin Mol Teratol 88(3): 186-194.

Hernández-Diaz S.; Werler MM.;Walker AM.;Mitchell AA. Folic acid antagonists during pregnancy and the risk of birth defects. 2000.*N Engl J Med.*; 343: 1608-1614

Hwang YS.; Lin CH.; Coster WJ.; Bigsby R. & Vergara E. Effectiveness of cheek and jaw support to improve feeding performance of preterm infants.2010. American Journal of Occupational Therapy, 64, 886–894.

ICBDMS. International Clearinghouse for Birth Defects Monitoring Systems.2001. Annual report (with data for 1999). Rome: ICBDMS.

Iregbulem LM. The incidence of cleft lip and palate in Nigeria. 1982. Cleft Palate J.;19:201–5. [PubMed]

Jagomagi T.; Nikopensius T.; Krjutskov K.; Tammekivi V.; Viltrop T.; Saag M. *et al.* MTHFR and MSX1 contribute to the risk of nonsyndromic cleft lip/palate. 2010. Eur J Oral Sci, 118(3), 213-220

Jensen BL.; Kreiborg S.; Dahl E.; Fogh-Andersen P. Cleft lip and palate in Denmark, 1976-1981: epidemiology, variability, and early somatic development.1988. Cleft Palate J 25(3): 258-269.

Jentink J.;Loane MA.; Dolk H.; Barisic I.; Garne E.; Morris JK.; de Jong-van den Berg LT. and Group. EUROCAT Antiepileptic Study Working**.** Valproic acid monotherapy in pregnancy and major congenital malformations. 2010. *N Engl J Med.* 362(23):2185-93,

Johnson CY.; Little J. Folate intake, markers of folate status and oral clefts: is the evidence converging? 2008. *Int J Epidemiol.* 37(5):1041-58,

Jugessur A.; Farlie PG.; Kilpatrick N. The genetics of isolated orofacial clefts: from genotypes to subphenotypes. 2009. Oral Dis. 2009 Oct;15(7):437-53. PubMed PMID: 19583827. Epub 2009/07/09. eng.

Kasten EF.; Schmidt SP.; Zickler CF.; Berner E.; Damian LA.; Christian GM.; Workman H.; Freeman M.; Farley MD.; Hicks TL. Team care of the patient with cleft lip and palate.2008. *Curr Probl Pediatr Adolesc Health Care.* 38(5):138-58,

Kaufman FL. Managing the cleft lip and palate patient.1991. *Pediatr Clin North Am.* 38(5):1127-47,

Kernahan DA.; Stark RB. A new classification for cleft lip and cleft palate. 1958. Plast Reconstr Surg Transplant Bull.;22:435–441.

Kernahan DA. The striped Y—a symbolic classification for cleft lip and palate. 1971. Plast Reconstr Surg.;47:469–470

Kummer A. Cleft palate & craniofacial anomalies: Effects on speech and resonance. 2013. Clifton Park, NY: Cengage Learning.

Letra A.; Menezes R.; Granjeiro JM.; Vieira AR. Defining subphenotypes for oral clefts based on dental development. 2007. J Dent Res. Oct;86(10):986-91. PubMed PMID: 17890676. Pubmed Central PMCID: 2222667. Epub 2007/09/25. eng.

Lidral AC.; Romitti PA.; Basart AM.; Doetschman T.; Leysens NJ.; Daack-Hirsch S.; Semina EV.; Johnson LR.; Machida J.; Burds A.; Parnell TJ.; Rubenstein JL.; Murray JC. Association of MSX1 and TGFB3 with nonsyndromic clefting in humans. 1998. *Am J Hum Genet.* 63(2):557-68,

Little J CA.; Munger RG. Tobacco smoking and oral clefts: a meta-analysis. 2004. Bull World Health Organ.; 82:213-8.

Little J.; Cardy A.; Munger RG. Tobacco smoking and oral clefts: a meta-analysis. 2002. *Bull Worls Health Organ.* 82:213-8,

Lo LJ.; Wong FH; Chen YR.; Lin WY.; Ko EW**.** Palatal surface area measurement: comparisons among different cleft types. 2003. *Ann Plast Surg.* 50(1):18-23; discussion 23-4.

Loffredo LCM.; Freitas JAS.; Grigolli AAG. Prevalence of oral clefts from 1975 to 1994. 2001.Brazil, Revista de Saúde Pública, , vol. 35 (pg. 571-575)

Magdalenić-Meštrovic M.; Bagatin M. An epidemiological study of orofacial clefts in Croatia 1988-1998. 2005. J Craniomaxillofac Surg 33(2): 85-90.

Malek FA.; Moritz KU.; Fanghanel J. & Bienengraber V. Reduction of procarbazine-induced cleft palates by prenatal folic acid supplementation in rats. (2004). Pathol Res Pract, 200(1), 33-40.

Masarei AG.; Sell D.; Habel A.; Mars M.; Sommerlad BC. & Wade A. The nature of feeding in infants with unrepaired cleft lip and/or palate compared with healthy noncleft infants. 2007. The Cleft PalateCraniofacial Journal, 44, 321–328. doi:10.1597/05-185.

McComb H. Primary repair of the bilateral cleft lip nose.1975. Br J Plast Surg;55:596Y601.

McWilliams BJ. Submucous clefts of the palate: how likely are they to be symptomatic? 1991. *Cleft Palate Craniofac J.* 28(3):247-9.

McWilliams CA. Book reviews: Cleft Lip and Palate, by Truman W. Brophy. 1924. Ann Surg.;79:154–157.

Millard DR Jr. Columella lengthening by a forked flap. 1958.Plast Reconstr Surg Transplant Bull;22:454Y457

Molina-Solana R.; Yáñez-Vico RM.; Iglesias-Linares A.; Mendoza-Mendoza A.; Solana-Reina E. Current concept on the effect of environmental factors on cleft lip and palate. 2013. Int J Oral Maxillofac Surg 42(2): 177-184.

Mossey PA.;Davies JA.;Little J. Prevention of orofacial clefts: does pregnancy planning have a role? 2007.*Cleft Palate Craniofac J.*; 44: 244-250.

Mossey PA.; Little J. Epidemiology of oral clefts: an international perspective. 2002. In: Wyszynski DF, ed Cleft lip and palate: from origins to treatment New York: Oxford University Press.:127-58.

Mossey PA.; Little J.; Munger RG.; Dixon MJ.; Shaw WC. Cleft lip and palate. 2009. *Lancet.* 374(9703):1773-85,

Mulliken JB. Bilateral complete cleft lip and nasal deformity: An anthropometric analysis of staged to synchronous repair.1995. Plast. Reconstr. Surg., 96: 9.

Mulliken JB. Correction of the bilateral cleft lip nasal deformity: evaluation of a surgical concept. 1992.Cleft Palate Craniofac J; 29:540Y545

Murray J. Gene/environment causes of cleft lip and/or palate. 2002.Clinical genetics.; 61(4): 248-56.

Nagy K.; Mommaerts MY. Analysis of the cleft-lip nose in submental-vertical view, part I–reliability of a new measurement instrument.2007.J Craniomaxillofac Surg;35(6-7):265-77.

National Institute for Health and Welfare. Congenital anomalies 1993-2010, statistical report.2013. http://urn.fi/URN:NBN:fi-fe 201402284344, cited 2014/06/06.

Niswander JD.;MacLean CJ.;Chung CS.;Dronamraju K. Sex ratio and cleft lip with or without cleft palate.1972. *Lancet.*; 2: 858-860.

Numa W.; Eberlin K.; Hamdan US. Alar base flap and suspending suture: a strategy to restore symmetry to the nasal alar contour in primary cleft-lip rhinoplasty. 2006. Laryngoscope;116(12):2171-7.

Park JW.; McIntosh I.; Hetmanski JB.; Jabs EW.; Vander Kolk CA.; Wu-Chou YH. *et al.* Association between IRF6 and nonsyndromic cleft lip with or without cleft palate in four populations. 2007. Genet Med, 9(4), 219-227.

Park-Wyllie L.; Mazzotta P.; Pastuszak A.; Moretti ME.; Beique L.; Hunnisett L.;
et al. Birth defects after maternal exposure to corticosteroids:prospective cohort study and meta-analysis of epidemiological studies. 2000. Teratology, 62(6), 385-392.

Pearson GD.; Kirschner RE. Surgery for cleft palate and velopharyngeal dysfunction. 2011. Semin Speech Lang 32(2): 179-190.

Perkins JA.; Sie KC.; Milczuk H. & Richardson MA. Airway management in children with craniofacial anomalies.1997.The Cleft Palate-Craniofacial Journal, 34, 135–140. doi:10.1597/1545-1569(1997) 034<0135:AMICWC>2.3.CO;2

Pigott RW. Organisation of cleft lip and palate services. 1992. *Br J Plast Surg.*, pp. 45(5):385-387.

Pigott RW. Organisation of cleft lip and palate services--results of a questionnaire. 1992.Br J Plast Surg. Jul;45(5):385–387.

Potter J. The nasal tip in bilateral hare tip. 1968. Br J Plast Surg;21:173Y179

Riley BM.; Murray JC. Sequence evaluation of FGF and FGFR gene conserved non-coding elements in non-syndromic cleft lip and palate cases. 2007. *Am J Med Genet A.* 143A(24):3228-34.

Rintala A. Epidemiology of orofacial clefts in Finland: a review.1986. Ann Plast Surg 17(6): 456-459.

Rittler M.;Lopez-Camelo J.;Castilla EE. Sex ratio and associated risk factors for 50 congenital anomaly types: clues for causal heterogeneity.2004. *Birth Defects Res A Clin Mol Teratol.*; 70: 13-19

Romitti PA.; Herring AM.; Dennis LK. & Wong-Gibbons DL. Metaanalysis: pesticides and orofacial clefts.2007. Cleft Palate Craniofac J, 44(4), 358-365.

Sabbagh HJ.; Hassan MH.; Innes NP.; Elkodary HM.; Little J.; Mossey PA. Passive
smoking in the etiology of non-syndromic orofacial clefts: a systemic review and meta-analysis. 2015. PLoS One 10(3): e0116963.

Satokata I.; Maas R. Msx1 deficient mice exhibit cleft palate and abnormalities of craniofacial and tooth development. 1994.*Nat Genet.* 6(4):348-56.

Sell D.; Harding A.; Grunwell P**.** A screening assessment of cleft palate speech (Great Ormond Street Speech Assessment).1994. *Eur J Disord Commun.* 29(1):1-15,

Shahrukh Hashmi S.; Gallaway MS.; Waller DK.; Langlois PH.; Hecht JT and Study National Birth Defects Prevention. Maternal fever during early pregnancy and the risk of oral clefts.2010. *Birth Defects Res A Clin Mol Teratol.* 88(3):186-94.

Shi M.; Christensen K.; Weinberg CR.; Romitti P.; Bathum L.; Lozada A.; Morris RW.; Lovett M.; Murray JC**.** Orofacial cleft risk is increased with maternal smoking and specific detoxification-gene variants.2007.*Am J Hum Genet.* 80(1):76-90.

Shi M.; Wehby GL.; Murray JC**.** Review on genetic variants and maternal smoking in the etiology of oral clefts and other birth defects.2008.*Birth Defects Res C Embryo Today.* 84(1):16-29,

Shprintzen RJ. Terminology and classification of facial clefting. In MP. Mooney & MI. Siegel (Eds.), Understanding craniofacial anomalies: The etiopathogenesis of craniosynostoses and facial clefting. 2002.(pp. 17-28): New York : Wiley-Liss, cop.

Shprintzen RJ.; Siegel-Sadewitz VL.; Amato J.; Goldberg RB.; Opitz JM. & Reynolds JF. Anomalies associated with cleft lip, cleft palate, or both.1985.American Journal of Medical Genetics, 20, 585–595.

Smith WP.; Markus AF.; Delaire J**.** Primary closure of the cleft alveolus: a functional approach.1995.*Br J Oral Maxillofac Surg.* 33(3):156-65.

Sperber GH. Formation of the primary palate, in Cleft Lip and Palate: From Origin to Treatment.2002a.ed Wyszynski D. F., editor. (New York, NY: Oxford University Press;), 5–13. [Google Scholar]

Sperber GH. Palatogenesis: closure of the secondary palate, in Cleft Lip and Palate: From Origin to Treatment.2002b. ed Wyszynski D. F., editor. (New York, NY: Oxford University Press;), 14–24. [Google Scholar]

Spina V. A proposed modification for the classification of cleft lip and cleft palate. 1973.Cleft Palate J.;10:251–252.

Stanier P.; Moore G. Genetics of cleft lip and palate: syndromic genes contribute to the incidence of non-syndromic clefts.2004.Hum Mol Genet 1(13): R73-R81.

Steinstrom SJ.; Oberg TRH. The nasal deformity in unilateral cleft lip.1961. Plast Reconstr Surg Transplant Bull;28:295Y305.

Strauss RP. The organization and delivery of craniofacial health services: the state of the art.1999.*Cleft Palate Craniofac J.* 36(3):189-95.

Tan O.; Atik B. Triangular with Ala nasi (TAN) repair of unilateral cleft lips: a personal technique and early outcomes.2007. J Craniofac Surg;18(1):186-97.

Tolarová MM.; Cervenka J. Classification and birth prevalence of orofacial clefts. 1998.Am J Med Genet 75(2): 126-137.

van den Boogaard MJ.; Dorland M.; Beemer FA.; van Amstel HK**.** MSX1 mutation is associated with orofacial clefting and tooth agenesis in humans.2000. *Nat Genet.* 24(4):342-3.

Vanderas AP. Incidence of cleft lip, cleft palate, and cleft lip and palate among races: a review.1987. Cleft Palate J Jul;24(3):216-225.

Veau V.; Politzer G. Embryologic du becde-lievere Le Palais primaire.1936.Ann Anat Pathol Anat Norm Med-Chir;13:275

Veau V.; Recamier J.; ´ Bec-de-Lievre. Formes Cliniques, Chirurgie `. Paris: Masson; 1938.

Veau V. Division palatine. 1931. Paris. Masson.

Veau V. Division Palatine: Anatomie, Chirurgie, Phonetique ´ . 1931.Paris: Masson;

Veau. Bec-de-livere. 1938. Paris, Masson,.

Vieira AR. Association between the transforming growth factor alpha gene and nonsyndromic oral clefts: a HuGE review.2006.Am J Epidemiol, 163(9), 790-810.

Warkany J. & Petering HG. Congenital malformations of the central nervous system in rats produced by maternal zinc deficiency.1972. Teratology, 5(3), 319-334.

Watkins SE.; Meyer RE.; Strauss RP.; Aylsworth AS. "Classification, epidemiology, and genetics of orofacial clefts".April 2014.Clinics in Plastic Surgery. **41** (2): 149–63. doi:10.1016/j.cps.2013.12.003. PMID 24607185.

WHO. Human Genetics Programme: Global strategies to reduce the health-care burden of craniofacial anomalies: report of WHO meetings on international collaborative research on craniofacial anomalies. World Health Organization, Geneva2002

Winters JC.; Hurwitz DJ**.** Presurgical orthopedics in the surgical management of unilateral cleft lip and palate.1995.*Plast Reconstr Surg.* 95(4):755-64.

Witzel MA.; Salyer KE.; Ross RB. Delayed hard palate closure: the philosophy revisited.1984.*Cleft Palate J.* 21(4):263-9.

Wong FK. & Hagg U. An update on the aetiology of orofacial clefts.2004. Hong Kong Med J, 10(5), 331-336.

World health organization. Global registry and database on craniofacial anomalies. in: organization, W.H. (Ed.) Report of a WHO Registry Meeting on Craniofacial Anomalies. 2003. Geneva, Switzerland, World Health Organization.

Wu T.; Liang KY.; Hetmanski JB.; Ruczinski I.; Fallin MD.; Ingersoll RG.; Wang H.; Huang S.; Ye X.; Wu-Chou YH.; Chen PK.; Jabs EW.; Shi B.; Redett R.; Scott AF.; Beaty TH. Evidence of gene-environment interaction for the IRF6 gene and maternal multivitamin supplementation in controlling the risk of cleft lip with/without cleft palate.2010.*Hum Genet.* 128(4):401-10

Wurdak H.; Ittner LM.; Lang KS.; Leveen P.; Suter U.; Fischer JA.; Karlsson S.; Born W.; Sommer L**.** Inactivation of TGFbeta signaling in neural crest stem cells leads to multiple defects reminiscent of DiGeorge syndrome.2005.*Genes Dev.* 19(5):530-5.

Wyszynski DF.; Duffy DL.; Beaty TH. Maternal cigarette smoking and oral clefts: a meta-analysis.1997.Cleft Palat Craniofac J 34(3): 206-210.

Yamada T.; Mori Y.; Minami K.; Mishima K.; Sugahara T. Three-dimensional facial morphology, following primary cleft lip repair using the triangular flap with or without rotation advancement.2002.Journal of Craniomaxillofacial Surgery.; 30: 337–342.

Zaleckas L.; Linkevičienė L.; Olekas J.; Kutra N. The Comparison of Different Surgical Techniques Used for Repair of Complete Unilateral Cleft Lip. 2011.Medicina (Kaunas).; 47: 85-90

Zeiger JS.; Beaty TH. & Liang KY. Oral clefts, maternal smoking, and TGFA: a meta-analysis of gene-environment interaction.2005.Cleft Palate Craniofac J, 42(1), 58-63.

Zouvelou V.; Luder HU.; Mitsiadis TA.; Graf D**.** Deletion of BMP7 affects the development of bones, teeth, and other ectodermal appendages of the orofacial complex.2009. *J Exp Zool B Mol Dev Evol*312B(4):361-74,

Zucchero TM.; Cooper ME.; Maher BS.; Daack-Hirsch S.; Nepomuceno B.; Ribeiro L.; Caprau D.; Christensen K.; Suzuki Y.; Machida J.; Natsume N.; Yoshiura K.; Vieira AR.; Orioli IM.; Castilla EE.; Moreno L.; Arcos-Burgos M.; Lidral AC.; Field LL.; Liu YE.; Ray A.; Goldstein TH. Interferon regulatory factor 6 (IRF6) gene variants and the risk of isolated cleft lip or palate.2004.*N Engl J Med.* 351(8):769-80,

APPENDICES

APPENDICES

APPENDIX-I

The goals of treatment for the child with a clef lip/ palate are:

- Repair the birth defect (lip, palate, nose)
- Achieve normal speech, language and hearing
- Achieve functional dental occlusion and good dental health
- Optimize psychosocial and developmental outcomes
- Minimize costs of treatment
- Facilitate ethically sound, family-centered, culturally sensitive care

APPENDIX-II

Seven key themes are important for achieving these goals:

- Early assessment and intervention is imperative and should begin in the newborn period with referral to a Clef Lip/Palate Team. When clef lip/palate is diagnosed prenatally referral to a team should be offered.

- An interdisciplinary clef lip/palate team is needed because clef lip/palate outcomes are in surgical, speech, hearing, dental, psychosocial and cognitive domains.

- Providers with training and expertise in clef lip/ palate care are needed because of the complexity of treatment interventions.

- Continuity of care is essential because outcomes are measured throughout the child's life and team care is linked to improved outcomes.

- Proper timing of interventions is critical because of the interaction of facial growth, dental occlusion and speech.

• Coordination of care is necessary because of the complexity of the medical, surgical, dental and social factors that must be considered in treatment decisions.

• Better early management leads to better outcomes, fewer surgeries and lower costs.

APPENDIX-III

Overview: Summary of Key Interventions by Age

Note: Tis table is only a *summary* and does not contain every intervention that could be needed by a particular child at a certain age. For more details see pages referenced.

Age Range	Intervention
Prenatal	• Refer to clef lip/palate team • Medical diagnosis and genetic counseling • Address psychosocial issues • Provide feeding instructions • Make feeding plan
Birth-1 month	• Refer to clef lip/palate team • Medical diagnosis and genetic counseling • Address psychosocial issues • Provide feeding instructions and monitor growth • Begin presurgical orthopedics if indicated
1-4 months	• Monitor feeding and growth • Repair clef lip • Monitor ears and hearing • Begin/continue presurgical orthopedics if indicated
5-15 months	• Monitor feeding, growth, development • Monitor ears and hearing; consider ear tube • Repair clef palate

	• Instruct parents in oral hygiene
16-24 months	• Assess ears and hearing • Assess speech-language • Monitor development
2-5 years	• Assess speech-language; manage VPI* • Monitor ears and hearing • Consider lip/nose revision before school • Assess development and psychosocial adjustment
6-11 years	• Assess speech-language; manage VPI • Orthodontic interventions • Alveolar bone graft • Assess school/psychosocial adjustment
12-21 years	• Jaw surgery, rhinoplasty (as needed) • Orthodontics; bridges, implants as needed • Genetic counseling • Assess school/psychosocial adjustment

*VPI = velopharyngeal insufciency.