ORIGINAL ARTICLE

Evaluation of Postsurgical Dentofacial Deformities in Children Operated for Correction of Cleft Lip and Palate—A Cross-sectional Study

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Abstract

Aim: The aim of this study is to evaluate the various dentofacial deformities in children who were surgically managed for cleft lip and palate (CLP).

Materials and methods: The study was carried out in 100 surgically managed cleft lip palate children between the ages of 4 years and 15 years. After eliciting a detailed history, a thorough intraoral and extraoral examination was done and details were recorded in a printed proforma with photographs.

Design: Cross-sectional study.

Statistical analysis used: All the data were analyzed using SPSS 11.5 software for evaluation using the Chi-square test.

Results: A wide range of surgical, dental, and functional problems among the surgically managed CLP patients were seen.

Conclusion: The timing of direct lip repair showed a significant influence on the severity of dentofacial deformities. Lip repair before the age of 1 increases the severity of the deformity.

Keywords: Cleft lip, Cleft palate, Cleft lip and palate.

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Introduction

"What lies behind us and what lies before us are tiny matters compared to what lies within us"—*Ralph Waldo Emerson*

Every new smile on the face of a cleft lip palate child brings us closer to our goal…

A cleft is a fissure or an opening.[1] CLP is the second commonest birth defect.[2] It can occur as a single entity or as a combination. Cleft lip (CL) is caused due to the failure of fusion of the maxillary process with the medial nasal process during the 4th–5th week of intrauterine life.[1] Cleft palate (CP) results from a lack of fusion of the palatine shelves.[3]

The World Health Organization in April 2012 reported that birth defects such as CLP occur in about 1 per 500–700 of all live births.[2] In India, the incidence of the cleft is 1 in every 600–1000 births.[4]

No single factor can be considered to be responsible for the occurrence of CLP and, hence, the term multifactorial inheritance is used commonly. This term implicates the fact that CLP is under the influence of genetic as well as environmental factors.[5]

Fujino et al.[6] reported that an increased incidence of CP in Japan was due to the increased frequency of consanguineous marriage. A positive association was found between the first-degree consanguinity and nonsyndromic CLP. Newcombe[7] reported that this is because of the increase in homozygosity. Saaxen et al.[8] found a strong positive association between CLP and antineurotic agents such as benzodiazepines.

Various problems associated with CLP include difficulty in feeding, hearing, and speech impairment, with other associated problems like psychological problems and dental problems.[9]

Feeding problems make it difficult to obtain adequate nutrition. This is due to the insufficient suction to pull milk from the nipple, excessive air intake during feeding thereby requiring several burpings, choking, nasal discharge, and excessive time required for nourishment.[10]

With an increase in the severity of the cleft, the severity of the dental problems also increases. The most commonly affected tooth is the maxillary lateral incisor which is in the line of the cleft caused by the disruption of the dental lamina. Other anomalies may include agenesis of teeth, supernumerary teeth, concurrent agenesis, and supernumerary teeth within or adjacent the cleft and disorders of morphogenesis (size and shape).[11]

Usually, an interdisciplinary team approach to provide integrated cleft care is mandatory.[4] Obturator construction aids in feeding for those infants born with complete CLP. Pashayan and McNab recommended using a standard crosscut nipple that provides improved ejection of milk into the infant's mouth with minimal effort.[9]

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Preventive dental care is extremely important in the cleft patients as optimum dental health is essential for the total rehabilitation of the patients.[4] The present day society demands from the medical and health profession the total personality development of such an individual so that he/she is not a stigma as well as a burden on the society.[9]

Surgical management of CLP is to be carried out at an appropriate age. Closure of the CL is initiated early which significantly improves the infant's appearance and may thereby relieve parental apprehensions and enhances acceptance of the child.[12] Surgical closure of the CL may be accomplished shortly after birth. A general "rule of ten" (10 weeks of age, 10 pounds of body weight, and 10 g of hemoglobin and WBC count not less than 10,000 per cu mm of blood) is commonly used in determining optimal timing for lip closure.[13] The commonest technique of CL repair is Millard's rotation advancement technique, as it is a very simple design to execute.[9]

Closure of the palate is accomplished between 12 and 24 months of age. The primary purpose of palate closure by 2 years of age is to facilitate the acquisition of normal speech, because this correlates with the age at which most children develop speech. It also improves the quality of hearing and deglutition by the alignment of the CP musculature.[12]

Postsurgically, repair of the lip and palate can cause secondary growth disturbances like nasal form, nasal asymmetry, and distortion of the upper lip. There can be scarring of the philtral area with a diminished or absent philtral groove.[14,15]

This study was mainly planned to bring about the significant relationship between the timing of CLP repair and the severity of extraoral and intraoral deformities.

Materials and Methods

The study was carried out in 100 children who were surgically managed for CLP by the Smile Train Center at the Vinayaka Missions Hitech Hospital, Salem. The children were randomly selected and were between the age group of 4 and 15 years, in which 57 were males and 43 were females.

Informed written consent was obtained from the parents of each child who participated in the study. Before the commencement of the study, ethical committee clearance was obtained from the Institutional Ethical Committee Board (Ref: VMSDC/IEC/Approval no. 014).

Inclusion Criteria

- Children who were surgically managed for CLP
- Ages between 4 and 15 years
- Children without any associated syndromes

Exclusion Criteria

- Patients who had undergone any presurgical orthopedic appliance therapy
- Patients who are undergoing any orthodontic treatment
- Patients who underwent any cosmetic surgery/orthognathic surgery/revision surgeries.

A detailed medical, personal, and family history was obtained from each child and their parents on a printed proforma. The type of cleft was noted according to Kernahan's stripped Y classification. A thorough intraoral and extraoral examination was done under visible daylight. Intraoral and extraoral photographs were taken using a digital camera and deformities were evaluated and recorded in the proforma obtained earlier (Figs 1 to 4).

Fig. 1: Armamentarium for patient examination

Fig. 2: Protective measures undertaken

Fig. 3: Examination of patient

Statistical Analysis

The details, thus, obtained were subjected to statistical evaluation using SPSS 11.5 software and evaluated using the Chi-square test.

Fig. 4: Tooth brushing model to educate the CLP patients

Results

The overall distribution of children with CLP showed unilateral cleft lip and palate (UCLP) with 51% followed by bilateral cleft lip and palate (BCLP) with 29% and CL with 13% (Table 1). When the timing of lip repair was assessed for extraoral dentofacial deformities, nasal septum deviation, notching of the upper lip, short upper lip, cupid's bow distortion, deficient vermillion border, flattened ala of nose, the presence of extraoral scar was noticed between 0 and 1 year of age following repair which was statistically significant with a *p* value of 0.001 (Table 2).

When the timing of lip repair was assessed for intraoral dentofacial deformities, the occurrence of cleft in the alveolus, premaxillary protrusion, congenitally missing tooth, hypodontia, aberrations in crown shape, microdontia, rotation of tooth and hypoplasia were noticed when the lip repair was done between 0 and 1 year of age and it was statistically significant with a *p* value of 0.001 (Tables 3 and 4). The timing of palatal repair did not have any significant influence on the severity of the extraoral dentofacial deformities (Table 5). The timing of palatal repair had a significant influence on the severity of upper arch constriction, premaxillary protrusion, supernumerary teeth and hypodontia which was statistically significant with a *p* value of 0.001 (Table 6).

Discussion

CLP is a common birth defect that affects all major racial and ethnic groups of the population. They present with a wide range of skeletal

Table 1: Distribution of the cleft deformity in cleft lip palate cases

	Sex					
	Male		*Female*		*Total*	
Distribution of cleft deformity	*N*	*%*	*N*	*%*	*N*	*%*
Bilateral CLP	15	15	14	14	29	29
Unilateral CLP	33	33	18	18	51	51
Cleft of lip only	6	6	7	7	13	13
Cleft of palate only	1	1	1	1	2	2
Median cleft	2	2	3	3	5	5
Total	57	57	43	43	100	100

Table 2: Association b/w timing of lip repair and extraoral dentofacial deformities

		Timing of lip repair														
		0		*0–1 year*		*1–2 years*		*2–3 years*		*4–6 years*		*7–9 years*				
		N	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*Total*	*Chi-square*	*p-value*
Nasal septum deviation	Yes	1	1	61	61	18	18	4	4	7	7	3	3	94	21.93	0.001**
	No	2	2	2	2	2	2							6		
Notching of lip	Yes			63	63	19	19	4	4	7	7	3	3	96	75.26	<0.001**
	No	3	3			1	1							4		
Short upper lip	Yes			63	63	18	18	4	4	7	7	3	3	95	62.11	<0.001**
	No	3	3			2	2							5		
Cupid's bow distortion	Yes			63	63	19	19	4	4	7	7	3	3	96	75.26	<0.001**
	No	3	3			1	1							4		
Deficient vermillion border	Yes			63	63	18	18	4	4	7	7	3	3	95	62.11	<0.001**
	No	3	3			2	2							5		
Flattened ala of nose	Yes			63	63	18	18	4	4	7	7	3	3	95	62.11	<0.001**
	No	3	3			2	2							5		
Presence of scar	Yes			63	63	20	20	4	4	7	7	3	3	97	100.00	<0.001**
	No	3	3											3		
Total	3	3	63	63	20	20	4	4	7	7	3	3	100			

*Significant at 5%
**Significant at 1%

Table 3: Association b/w timing of lip repair and intraoral dentofacial deformities

		Timing of lip repair														
		0		*0–1 year*		*1–2 years*		*2–3 years*		*4–6 years*		*7–9 years*				
		N	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*Total*	*Chi-square*	*p-value*
Anterior crossbite	Yes	1	1	44	44	15	15	3	3	7	7	2	2	72	5.24	0.387
	No	2	2	19	19	5	5	1	1			1	1	28		
Posterior unilateral crossbite	Yes			12	12	2	2			2	2			16	3.70	0.594
	No	3	3	51	51	18	18	4	4	5	5	3	3	84		
Posterior bilateral crossbite	Yes			22	22	9	9	3	3	4	4	1	1	39	5.85	0.321
	No	3	3	41	41	11	11	1	1	3	3	2	2	61		
Upper arch constriction	Yes	3	3	60	60	19	19	4	4	7	7	2	2	95	5.81	0.325
	No			3	3	1	1					1	1	5		
Residual fistula in palate	Yes	1	1	21	21	8	8			2	2			32	3.97	0.553
	No	2	2	42	42	12	12	4	4	5	5	3	3	68		
Cleft in alveolus	Yes			59	59	16	16	2	2	5	5	2	2	84	25.29	<0.001**
	No	3	3	4	4	4	4	2	2	2	2	1	1	16		
Total		3	3	63	63	20	20	4	4	7	7	3	3	100		

*Significant at 5%
**Significant at 1%

and dental abnormalities even after they undergo any primary surgical correction. This study is focused mainly to evaluate the various postsurgical dentofacial deformities in surgically managed CLP patients.

Surgical repair of the CLP leads to various secondary growth disturbances including anomalies in nasal form, nasal asymmetry, and distortion of the upper lip. Various skeletal deformities also exist in all unilateral CLP due to the abnormal growth of the skeleton during the pre- and the postnatal period.

In the present study, the etiology associated with the occurrence of CLP was predominantly seen in children whose parents had a history of consanguinous marriage constituting to 44% among the various other etiological factors of CLP. This was similarly reported by Jabber et al.,[16] Alamoudi et al.,[17] and Fujino et al.[18] who stated that most of the CLP children were born for parents who had a history of consanguinity.

In the present study, this familial tendency for CLP was noted in 13%. This was similar to the study reported by Drillien et al.[19] where one in three children with CLP had some relatives with similar congenital defects and thereby suggested that genetic factor plays as the most important causative factor in CLP.

The number of children with UCLP was found to be more common with 51% similar to a study reported by Manyama et al.[20] with a male predilection. The present study showed that deformities seen were 48% in males and 42% in females with a ratio of 8:7 which is in accordance with a study reported by Marilyn[21] who reported that CLP occurs twice as often in boys as in girls.

Kernahan[22] suggested that Kernahan's stripped Y classification not only acts as a symbolic representation of the CLP deformity but also describes the exact condition of the patient embryologically, clinically, and pathologically. So this classification was preferred in the study as it was found to be very simple, reproducible, and it describes the progress of the patient before, during, and after treatment.

Extraoral Deformities (Figs 5 to 15)

In the present study, 40% of the children presented with a concave profile, 43% with convex profile, 17% with a straight profile, 26% of the males, and 14% of females had a concave profile. This was similarly reported by Paradowska-Stolarz[23] who found in his study that CLP-affected boys had a significantly longer mandibular ramal length when compared to girls.

Bichara et al.[24] reported that impaired maxillary sagittal growth was observed in patients with UCLP as a consequence of lip surgical repair which was similarly observed in the present study also wherein 59% of the children had disturbances in the maxillary growth after the primary repairs.

Most of the children in the present study was noted with deficient maxilla and this was similar to the study by Kremenak et al.[25] and Farronato et al.[26] who reported that lip repair could have a negative influence on the maxillary growth and they suggested that the best timing to carry out a lip repair would be between the third and the sixth month of age.

A study reported by Bishara et al.[27] in patients repaired with unilateral CLP, the nasal septum and columella were deviated towards the non-cleft side from the facial midline and this was similarly found in the present study also.

Pensler[28] reported that when direct lip repair is done, the tension caused when the segments are approximated leading to variouspostsurgical deformities of lip like notching of the upper lip, cupid's bow distortion, short upper lip, deficient vermilion border, flattened ala of nose and presence of extraoral scar. In the present study, 96% of the children showed notching of the upper lip with cupid's bow distortion; 95% had a short upper lip, deficient vermilion border, and flattened ala of nose; 97% showed the presence of an extraoral scar.

Similarly Mulliken[29] reported that in children operated for CLP, the philtrum is bowed, wide, undimpled, asymmetric, and lacks a white ridge and this is because the prolabial vermillion mucosa is preserved and the lateral labial elements hang like swags.

Table 4: Association b/w timing of lip repair and intraoral dentofacial deformities

		Timing of lip repair														
		0		*0–1 year*		*1–2 years*		*2–3 years*		*4–6 years*		*7–9 years*				
		N	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*Total*	*Chi-square*	*p-value*
Protrusion of premaxilla	Yes			42	42	12	12	2	2	3	3			59	11.06	0.050*
	No	3	3	21	21	8	8	2	2	4	4	3	3	41		
Crowding in upper arch	Yes	2	2	45	45	17	17	3	3	7	7	2	2	76	4.11	0.534
	No	1	1	18	18	3	3	1	1			1	1	24		
Angle's class iii molar relation	Yes	1	1	8	8	6	6			2	2	1	1	18	5.51	0.356
	No	2	2	55	55	14	14	4	4	5	5	2	2	82		
Congenitally missing tooth	Yes			58	58	17	17	4	4	7	7	3	3	89	26.93	<0.001**
	No	3	3	5	5	3	3							11		
Premature tooth loss	Yes			15	15	4	4			1	1			20	3.21	0.667
	No	3	3	48	48	16	16	4	4	6	6	3	3	80		
Ectopically erupted teeth	Yes	2	2	61	61	19	19	3	3	7	7	2	2	94	11.88	0.036
	No	1	1	2	2	1	1	1	1			1	1	6		
Supernumerary teeth	Yes	1	1	49	49	14	14	2	2	6	6	2	2	74	4.99	0.417
	No	2	2	14	14	6	6	2	2	1	1	1	1	26		
Hypodontia	Yes			42	42	9	9			6	6	1	1	58	15.95	0.007**
	No	3	3	21	21	11	11	4	4	1	1	2	2	42		
Aberrations in crown shape	Yes	1	1	59	59	19	19	3	3	7	7	3	3	92	16.95	0.005**
	No	2	2	4	4	1	1	1	1					8		
Microdontia	Yes			56	56	19	19	3	3	7	7	2	2	87	24.06	<0.001**
	No	3	3	7	7	1	1	1	1			1	1	13		
Macrodontia	Yes			25	25	8	8	1	1	3	3			37	4.15	0.529
	No	3	3	38	38	12	12	3	3	4	4	3	3	63		
Total		3	3	63	63	20	20	4	4	7	7	3	3	100		

		Timing of lip repair														
		0		*0–1 year*		*1–2 years*		*2–3 years*		*4–6 years*		*7–9 years*				
		N	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*Total*	*Chi-square*	*p-value*
Rotated tooth	Yes	1	1	60	60	19	19	4	4	7	7	3	3	94	20.68	0.001**
	No	2	2	3	3	1	1							6		
Hypoplasia	Yes	2	2	54	54	16	16	3	3	7	7	2	2	84	3.29	0.655
	No	1	1	9	9	4	4	1	1			1	1	16		

*Significant at 5%
**Significant at 1%

Intraoral Deformities (Figs 16 to 33)

Lithovius et al.[30] and Hardwicke et al.[31] evaluated the incidence of fistula inthe palate of surgically managed CLP patients and reported that patients with CLP were more likely to develop postoperative palatal fistulas than patients with CP. About 32% of the children in the present study who were surgically managed for CLP had a residual fistula in the palate.

Galante et al.[32] stated that dental anomalies are extremely common in children with CLP. As the severity of the cleft increases, the number and the severity of the patient's dental problem also increase. One of the characteristic findings was that most of the dental anomalies were present along the line of the cleft.

Dental Anomalies

Shi et al.[33] reported that deformed dental arch is a common postsurgical deformity in CLP patients. The present study also shows that a large number of children about 76% had crowding of teeth in the upper arch with 95% having upper arch constriction.

Paradowska Stolarz et al.[34] reported that the commonest malocclusions seen in patients with clefts were crossbites and class III malocclusions. It was also supported by another study done by Hellquist et al.[35] where there was a high prevalence of anterior crossbite. In this present study when the crossbite was evaluated, 72% of the children had an anterior crossbite, 16% posterior unilateral crossbite, and 39% showed bilateral posterior crossbite.

Tereza[36] reported that enamel structural alterations are frequent in permanent central incisors adjacent to the alveolar cleft and 84% of the children presented with hypoplastic teeth in the present study.

Obłoj et al.[37] reported that hypodontia was the most common dental defect in the line of the cleft and it was found similarly in the

Table 5: Association b/w timing of palatal repair and extraoral dentofacial deformities

		Timing of palatal repair																		
		0		*0–1 year*		*1–2 years*		*2–3 years*		*4–6 years*		*7–9 years*		*9–12 years*		*12–14 years*				
		N	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*Total*	*Chi-square*	*p-value*
Nasal septum deviation.	Yes	13	13	10	10	33	33	17	17	7	7	6	6	7	7	1	1	94	3.05	0.880
	No	1	1			3	3	2	2									6		
Notching of lip	Yes	14	14	10	10	34	34	17	17	7	7	6	6	7	7	1	1	96	4.21	0.755
	No					2	2	2	2									4		
Short upper lip	Yes	14	14	10	10	34	34	17	17	6	6	6	6	7	7	1	1	95	4.52	0.719
	No					2	2	2	2	1	1							5		
Cupid's bow distortion	Yes	14	14	10	10	34	34	17	17	7	7	6	6	7	7	1	1	96	4.21	0.755
	No					2	2	2	2									4		
Deficient vermillion border	Yes	14	14	10	10	34	34	17	17	6	6	6	6	7	7	1	1	95	4.52	0.719
	No					2	2	2	2	1	1							5		
Flattened ala of nose	Yes	14	14	10	10	34	34	17	17	6	6	6	6	7	7	1	1	95	4.52	0.719
	No					2	2	2	2	1	1							5		
Presence of scar	Yes	14	14	10	10	34	34	18	18	7	7	6	6	7	7	1	1	97	2.53	0.925
	No					2	2	1	1									3		
Total		14	14	10	10	36	36	19	19	7	7	6	6	7	7	1	1	100		

present study with 58% of hypodontia and it was seen commonly close to the line of cleft. Premolar hypodontia was also seen in the children in the present study which was found to be similar to the study reported by Olin et al.[38]

Peg laterals, another dental anomaly, were reported by Maciel et al.[39] which present a high prevalence of shape alterations. In the permanent dentition, the lateral incisor may be missing in 20–26% of cases of UCL and in 50% of complete UCLP which was also found to be in accordance with the present study where 89% of the children had congenitally missing teeth.

Ectopic eruption of teeth was seen in 94% and this was similar to a study reported by Olievera Lima et al.[40] who reported a high prevalence of ectopic eruption of the permanent maxillary first molar in surgically managed CLP patients, whereas Silva[41] reported that ectopic eruption of the maxillary first molar was observed in 20% of individuals with complete CLP.

About 74% of the cases in the study had the presence of supernumerary teeth. This was in accordance with a study reported by Fishman[42] who suggested that patients with CLP presented a high prevalence of hypodontia and supernumerary teeth and this could be due to a genetic component.

Surgical management of CLP should be carried out at an appropriate age. In the present study, 63% of the children who underwent direct lip repair before 1 year of age had nasal septum deviation, notching of lips, short upper lip, cupid's bow distortion, deficient vermillion border, and flattened ala of the nose which were all statistically significant. All these findings were reported similarly by the studies conducted by Filho and Saunders et al.[43]

Among the intraoral deformities, the timing of lip repair has a significant influence on the occurrence of the cleft in the alveolus, premaxillary protrusion, congenitally missing a tooth, hypodontia, aberrations in a crown shape, microdontia, rotation of tooth, and hypoplasia when lip repair was done before 1 year of age. This was in accordance with a study report by Krauss et al.[44] who suggested that trauma from early surgical repair of CLP and related scar tissue formation contributes to the presence of hypoplastic and missing incisors on the cleft side.

However, the present study here observed that the timing of repair of cleft palate does not significantly influence the occurrence of dentofacial anomalies. Trindade et al.[45] also suggested that it is the lip repair that adversely affects dentofacial morphology rather than the palatal surgery.

The findings from the present study suggest poor dental arch relations in the majority of the cases who were surgically managed for CLP. So this study shows that there is a need to supplement a definitive treatment protocol to manage the postsurgical deformities. Future studies can be directed towards analyzing the type of repair undertaken during the surgical procedure.

Conclusion

CLP can present with considerable variation in severity and form. Generally, the wider and more extensive clefts are associated with the significant dentofacial deformity. Direct surgical repair of the lip and palate leads to various secondary growth disturbances including anomalies in nasal form, nasal asymmetry, and distortion of the upper lip.

Table 6: Association b/w timing of palatal repair and intraoral dentofacial deformities

		Timing of palatal repair																		
		0		*0–1 year*		*1–2 years*		*2–3 years*		*4–6 years*		*7–9 years*		*9–12 years*		*12– 14 years*			*Chi-*	
		N	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*Total*	*square*	*p-value*
Anterior crossbite	Yes	7	12.48	0.086	9	28	28	10	10	5	5	6	6	6	6	1	1	72	12.48	0.086
	No	7			1	8	8	9	9	2	2			1	1			28		
Posterior unilateral crossbite	Yes	1	12.11	0.097	5	6	6	3	3					1	1			16	12.11	0.097
	No	13			5	30	30	16	16	7	7	6	6	6	6	1	1	84		
Posterior bilateral crossbite	Yes	1	13.97	0.052	4	14	14	6	6	5	5	4	4	4	4	1	1	39	13.97	0.052
	No	13			6	22	22	13	13	2	2	2	2	3	3			61		
Upper arch constriction	Yes	10	19.91	0.006	10	36	36	18	18	7	7	6	6	7	7	1	1	95	19.91	0.006**
	No	4						1	1									5		
Residual fistula in palate	Yes	1	12.44	0.087	2	16	16	7	7	1	1	3	3	1	1	1	1	32	12.44	0.087
	No	13			8	20	20	12	12	6	6	3	3	6	6			68		
Cleft in alveolus	Yes	10	11.40	0.122	10	33	33	15	15	5	5	6	6	4	4	1	1	84	11.40	0.122
	No	4	4			3	3	4	4	2	2			3	3			16		
Total		14	14	10	10	36	36	19	19	7	7	6	6	7	7	1	1	100		

		Timing of palatal repair																		
		0		*0–1 year*		*1–2 years*		*2–3 years*		*4–6 years*		*7–9 years*		*9–12 years*		*12–14 years*			*Chi-*	
		N	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*Total*	*square*	*p-value*
Protrusion of pre-maxilla	Yes	3	3	5	5	27	27	10	10	5	5	6	6	2	2	1	1	59	20.62	0.004**
	No	11	11	5	5	9	9	9	9	2	2			5	5			41		
Crowding in upper arch	Yes	10	10	8	8	24	24	14	14	7	7	6	6	6	6	1	1	76	6.81	0.449
	No	4	4	2	2	12	12	5	5					1	1			24		
Angle's class III molar relation	Yes	5	5	1	1	6	6	3	3			2	2	1	1			18	6.29	0.506
	No	9	9	9	9	30	30	16	16	7	7	4	4	6	6	1	1	82		
Congenitally miss-ing tooth	Yes	11	11	9	9	32	32	16	16	7	7	6	6	7	7	1	1	89	4.61	0.708
	No	3	3	1	1	4	4	3	3									11		
Premature tooth loss	Yes	2	2	2	2	6	6	5	5	2	2	3	3					20	6.71	0.460
	No	12	12	8	8	30	30	14	14	5	5	3	3	7	7	1	1	80		
Ectopically erupted teeth	Yes	12	12	10	10	35	35	17	17	6	6	6	6	7	7	1	1	94	5.44	0.606
	No	2	2			1	1	2	2	1	1							6		
Supernumerary teeth	Yes	5	5	8	8	31	31	13	13	4	4	6	6	6	6	1	1	74	17.90	0.012*
	No	9	9	2	2	5	5	6	6	3	3			1	1			26		
Hypodontia	Yes	3	3	8	8	23	23	10	10	2	2	5	5	6	6	1	1	58	17.41	0.015*
	No	11	11	2	2	13	13	9	9	5	5	1	1	1	1			42		
Aberrations in crown shape	Yes	12	12	9	9	35	35	16	16	6	6	6	6	7	7	1	1	92	5.30	0.623
	No	2	2	1	1	1	1	3	3	1	1							8		
Microdontia	Yes	11	11	8	8	33	33	15	15	6	6	6	6	7	7	1	1	87	5.20	0.636
	No	3	3	2	2	3	3	4	4	1	1							13		
Macrodontia	Yes	4	4	6	6	15	15	6	6	2	2	2	2	1	1	1	1	37	6.77	0.453
	No	10	10	4	4	21	21	13	13	5	5	4	4	6	6			63		
Total		14	14	10	10	36	36	19	19	7	7	6	6	7	7	1	1	100		

		Timing of palatal repair																		
		0		*0–1 year*		*1–2 years*		*2–3 years*		*4–6 years*		*7–9 years*		*9–12 years*		*12–14 years*				
		N	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*Total*	*Chi-square*	*p-value*
Rotated tooth	Yes	12	12	10	10	35	35	16	16	7	7	6	6	7	7	1	1	94	7.57	0.372
	No	2	2			1	1	3	3									6		
Hypoplasia	Yes	9	9	9	9	33	33	14	14	5	5	6	6	7	7	1	1	84	10.88	0.144
	No	5	5	1	1	3	3	5	5	2	2							16		
	No	9	9	2	2	11	11	9	9	3	3	2	2	1	1			37		
Total		14	14	10	10	36	36	19	19	7	7	6	6	7	7	1	1	100		

*Significant at 5%
**Significant at 1%

Fig. 5: Nasal septum deviation and notching of lip

Fig. 6: Short upper lip

Fig. 7: Cupid's bow distortion

Fig. 8: Deficient vermilion border

Fig. 9: Flattened ala of nose

Fig. 10: Flattened dome of nose

Fig. 11: Presence of extraoral scar

Fig. 12: Columellar deficiency

Fig. 13: Presence of midface deficiency

Fig. 14: Presence of mandibular prognathism

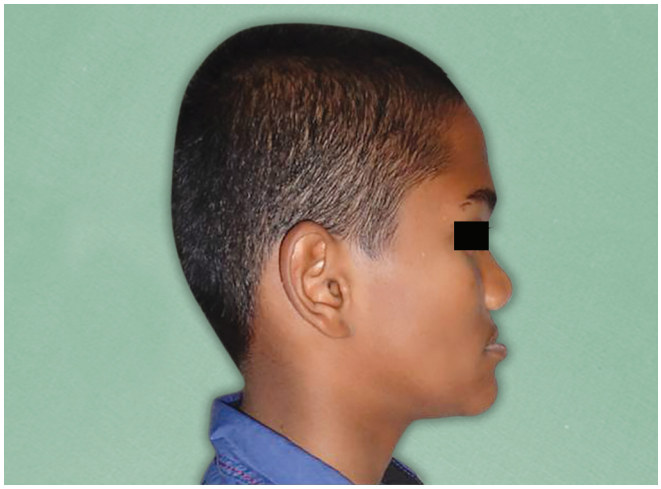

Fig. 15: Patient with a concave profile

Fig. 16: Presence of residual fistula in hard palate

Fig. 17: Presence of complete oronasal residual fistula

Fig. 18: Cleft in the alveolus

Fig. 19: Protruding premaxilla

Fig. 20: Mobile premaxillary segments

Fig. 21: Anterior cross-bite

Fig. 22: Posterior unilateral cross-bite

Fig. 23: Posterior bilateral cross-bite

Fig. 24: Constricted upper arch

Fig. 25: Congenitally missing tooth

Fig. 26: Ectopically erupted tooth

Fig. 27: Supernumerary tooth

Fig. 28: Aberrations in crown shape

Fig. 29: Peg laterals

Fig. 30: Microdontia

Fig. 31: Macrodontia

Fig. 32: Rotation of tooth

Fig. 33: Hypodontia

Clinical Significance

The timing of lip repair showed a significant influence on the severity of dentofacial deformities. Lip repair before the age of 1 increases the severity of the deformity.

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