

## Simonart's Bands and Facial Growth in Unilateral Cleft Lip and Palate Patients: A Cephalometric Analysis

Swati Saraswata Acharya<sup>1</sup>, Pritam Mohanty<sup>2</sup>, Nivedita Sahoo<sup>2</sup>, Snigdha Gowd<sup>3</sup>, Srinivas Baratam<sup>4</sup>, Gojja Sreedevi<sup>2</sup>

### Contributors:

<sup>1</sup>Senior Lecturer, Department of Orthodontics, Institute of Dental Sciences, SOA University, Bhubaneswar, Odisha, India; <sup>2</sup>Reader, Department of Orthodontics, Kalinga Institute of Dental Sciences, KIIT University, Bhubaneswar, Odisha, India; <sup>3</sup>Professor and Head, Department of Orthodontics, Kalinga Institute of Dental Sciences, KIIT University, Bhubaneswar, Odisha, India; <sup>4</sup>Professor, Department of Orthodontics, Kalinga Institute of Dental Sciences, KIIT University, Bhubaneswar, Odisha, India.

### Correspondence:

Dr. Acharya SS. Department of Orthodontics, Institute of Dental Sciences, SOA University, Bhubaneswar, Odisha, India. Phone: 91-9556515589, Email: swati.acharya.tmdc@gmail.com

### How to cite the article:

Acharya SS, Mohanty P, Sahoo N, Gowd S, Baratam S, Sreedevi G. Simonart's bands and facial growth in unilateral cleft lip and palate patients: A cephalometric analysis. J Int Oral Health 2016; 8(1):53-57.

### Abstract:

**Background:** Simonart's bands are confined to the soft tissue adhesions between medial and lateral margins of the cleft in the lip, nostril, or between the divided alveolar processes. A cephalometric analysis was carried out to see if Simonart's bands at birth are associated with craniofacial growth.

**Materials and Methods:** Mixed longitudinal data from 5 years through 18 years was evaluated for 260 individuals with complete unilateral cleft lip and palate (UCLP) in Sri Sri Bordha Hospital, 90 with Simonart's bands, and 170 without. A cephalometric analysis was carried out to the significant relationship with facial growth.

**Results:** No major differences were detected between individuals with or without Simonart's bands though the presence of these bands was associated with a larger cranial base angle and slightly more favorable maxillomandibular relationship. The findings are drawn based on embryogenesis, primary surgery, and secondary surgery.

**Conclusion:** The cephalometric terms for patients' with Simonart's bands in UCLP patients have a negligible impact on facial growth.

**Key Words:** Cephalometric analysis, embryogenesis, facial growth, Simonart's bands, unilateral cleft lip and palate

### Introduction

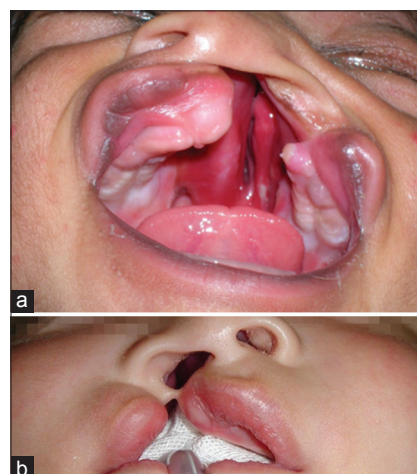
The relatively high prevalence of unilateral cleft lip and palate (UCLP) is the greatest interest being focused for studies. However, in approximately one-third of subjects with complete unilateral clefts, a Simonart's band is present at birth. Previous studies were inconsistent in reporting the various analyzes of craniofacial development. The lack of reference to the presence or absence of adhesions in other

studies might indicate that various authors have disregarded the presence of Simonart's bands. The individuals who have a complete UCLP may have less disturbed growth and development as the pre-operative maxillary and nasal distortion are less severe because of the restraining influence of the soft tissue band. Hence, tissue deficiency is less, and surgery is also facilitated.

Simonart's bands are confined to the soft tissue adhesions between medial and lateral margins of the cleft in the lip, nostril, or between the divided alveolar processes. Approximately, 80% of Simonart's band in this sample were situated at the base of the nostril and had skin coverage while the rest 20% were mucosal and bridged the cleft in the alveolar process (Figure 1).

### Morphogenesis

Prior to the formation of the upper lip, the medial nasal, lateral nasal, and maxillary processes are in continuity at their bases, but are separated from each other by discrete processes on facial margins as reported by Ferguson,<sup>1</sup> Ferguson and Honig.<sup>2</sup> Immediately after the closure of the maxillary processes with medial and lateral processes, the lateral nasal process has a peak of cell division. Lots of factors depress the rate of cell proliferation in the lateral nasal process to reduce its size resulting in the failure of closure of medial nasal process. Growth perturbation of any of these processes can lead to failure of closure with a spectrum of clefts of lip representing an embryonic fusion line.<sup>2</sup> Two possible mechanisms for the occurrence of Simonart's bands is the limited fusion of lateral



**Figure 1:** (a) Unilateral complete cleft of the lip and palate, (b) unilateral complete skeletal cleft with a Simonart's band.

and medial nasal processes or defective cell death programming in epithelial surfaces (Figure 2). These bands could result from post fusion rupture of tissues as explained by Goss.<sup>3,4</sup>

**Materials and Methods**

**Subjects**

Out of 260 individuals with complete UCLP in Sri Sri Bordha Hospital, 90 were with Simonart's bands and 170 without these bands. Table 1 clearly shows a listing of the sample population for gender and Simonart's bands of skin and mucosa. Subjects had received all kinds of treatment Sri Sri Bordha Hospital and team. All the subjects had lateral and frontal cephalograms.

**Surgical management**

Both the groups of UCLP along with UCLP with Simonart's bands (UCLP+S) have same primary surgery but differences are evident for the history of secondary surgical procedures (Table 2).

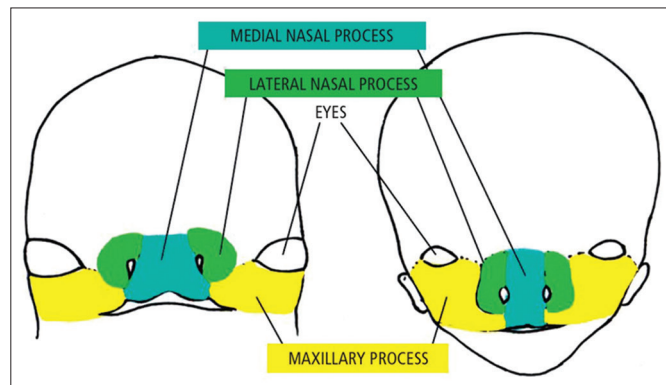
**Cephalometric analysis**

From the lateral cephalograms, 45 variables describing the skeletal dimensions and 27 variables describing the soft tissue outline was calculated. On the anterior-posterior cephalograms, 6 variables were analyzed. Full details of the radiographic technique, digitization with landmark definitions are described. Data for the 8 angular variables representing the main features of craniofacial form as suggested by Goss<sup>3</sup> have been listed (Table 3). The landmarks and references are illustrated in Figures 3 and 4.

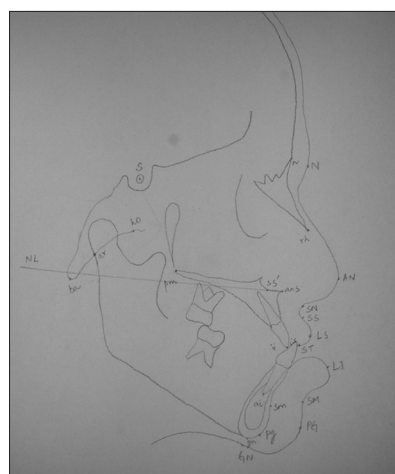
**Statistical analysis**

Because the potential number of comparisons of means between UCLP and UCLP+S groups was in excess, 50 significant

t-tests could be expected to arise by chance alone at 5% level. Consequently, repeated measure analysis of variance for 8



**Figure 2:** The limited fusion of lateral and medial nasal processes or defective cell death programming in epithelial surfaces.



**Figure 3:** Cephalometric landmarks for lateral projection.

**Table 1: Sample according to cleft type.**

Sex	UCLP			UCLP+S						Total
	Left	Right	Total	Left	Right	Total	Left	Right	Total	
Male	95	35	125	25	15	45	3	2	5	50
Female	32	15	52	17	11	23	5	2	7	30
Total	127	50	177	42	26	68	8	4	12	80

UCLP: Unilateral cleft lip and palate

**Table 2: Secondary surgical procedure.**

Procedure	n (%)				P value*
	Complete		Simonart's bands		
	1 or more	2 or more	1 or more	2 or more	
Sulcusplasty	11 (6.2)	1 (0.6)	11 (13.8)	-	0.079
Pharyngoplasty	38 (21.5)	-	14 (17.5)	-	0.572
Closure of fistula	41 (23.2)	4 (2.3)	12 (15.0)	2 (2.5)	0.183
Bone grafting	112 (63.3)	3 (1.7)	52 (65.0)	1 (1.3)	0.900
Lip/nose revision	97 (54.8)	34 (19.2)	18 (22.5)	5 (6.3)	0.000
Lip revision	41 (23.2)	4 (2.3)	17 (21.3)	2 (2.5)	0.858
Nose revision	44 (24.9)	16 (9.0)	5 (8.3)	1 (1.3)	0.001
Abbe flap	1 (0.6)	-	-	-	1.000

\*The proportion receiving 1 or more secondary procedure in either group are compared using a Chi-square test

variables of primary interest was performed according to Winer,<sup>5</sup> gender being a variable as co-variable.

**Results**

The results are illustrated in Tables 3-10 from repeated measures of analysis of variance.

Cranial base angle (n-s-ba) was 2 degrees more obtuse in UCLP+S across the age range ( $P=0.01$ ). The maxillomandibular relationship (ss-n-sm) was more favorable in UCLP+S ( $P=0.03$ ), but never more than 1.8°, and maxillary prominence measured at the anterior nasal spine (s-n-ans) was more prominent. There were no significant differences in mandibular prominences (s-n-pg). In both the groups, there was even no significant differences for upper face angulation (NSL-NL) and lower face angulation (NL-ML). The lateral displacement of the anterior nasal spine from the midline as observed on frontal cephalograms (Figure 5) reduced overtime in both the groups though was similar.

**Table 3: Variables n-s-ba.**

N-s-ba	Complete			Simonart's band		
	Sample	Mean	SD	Sample	Mean	SD
5 or less	101	131.2	4.8	43	132.7	3.9
6	106	131.2	5.1	47	132.4	4.4
7	97	131.3	5.1	53	132.7	4.1
8	103	131.4	4.2	48	132.0	4.3
9	100	131.5	4.5	42	132.1	4.4
10	104	131.6	4.9	43	132.4	4.7
11	101	130.7	4.8	42	132.2	4.0
12	96	130.3	4.9	40	132.6	4.8
13	100	130.8	5.3	45	132.5	4.4
14	89	130.7	4.9	35	133.1	3.9
15	83	130.6	4.7	31	132.8	4.8
16	77	130.8	4.8	20	133.2	4.0
17	72	130.1	5.2	27	130.9	5.4
18 or more	104	130.0	4.9	27	132.0	4.3

The difference between groups was statistically significant ( $P=0.014$ ). There was no significant change over time ( $P=0.200$ ), SD: Standard deviation

**Table 4: Variables s-n-ss.**

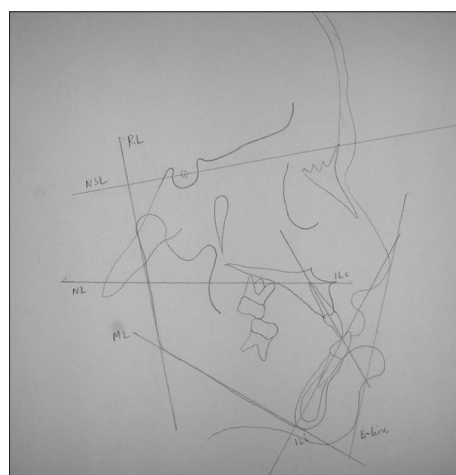
S-n-ss	Complete			Simonart's band		
	Sample	Mean	SD	Sample	Mean	SD
5 or less	102	80.0	4.1	44	78.7	3.0
6	107	79.1	3.8	48	78.7	3.9
7	97	78.0	3.9	53	77.8	4.0
8	103	76.7	3.6	48	77.3	3.5
9	100	76.5	3.5	42	76.9	3.5
10	104	76.2	3.2	43	76.3	3.8
11	101	75.7	3.6	42	76.5	4.1
12	94	75.2	3.9	40	74.6	3.8
13	100	75.7	3.5	45	75.6	3.5
14	90	74.7	3.7	35	74.9	4.1
15	83	74.9	3.3	31	74.5	3.9
16	77	73.5	3.7	20	74.2	4.2
17	73	73.6	3.5	27	75.5	4.3
18 or more	104	74.0	3.7	27	75.1	4.1

The difference between groups was not statistically significant ( $P=0.305$ ). There was a significant change overtime ( $P<0.001$ ), SD: Standard deviation

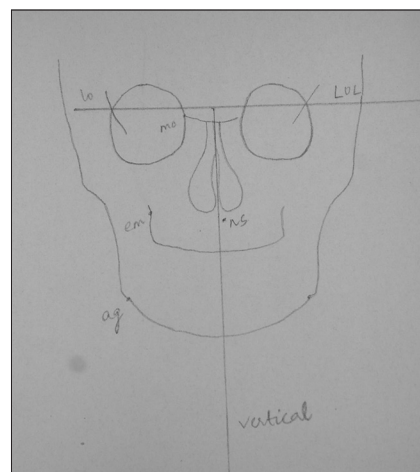
**Discussion**

There have been many studies assessing dental anomalies in patients with CLP. However yes, it is very difficult to draw comparisons directly. 31% of patients classified as CLP have Simonart's bands.<sup>6,7</sup> There are many failures to specify cleft severity and even precision of radiographic assessments.<sup>8,9</sup> The lower prevalence found the study by Silva on dental casts in adults may be because of subclinical rupture of bands in adults. The prevalence of Simonart's bands was higher for the left side in UCLP and for the right side in UCL.

Clefts that involve the primary and secondary palate are more frequent. Such clefts tend to be complete with smaller remnants of soft tissue at the nasal base or alveolar mucosa. Therefore, the prevalence of Simonart's bands in clefts of primary palate is definitely much higher than in complete clefts of the primary and secondary palate as shown in the previous studies of Semb.



**Figure 4:** Cephalometric planes for lateral projection. In addition to these shown, imaginary vertical and horizontal planes were constructed at 90° to the Frankfort plane to provide values s-pm (vertical) and s-pm (horizontal). Films were oriented with Frankfort plane on the X-axis of the digital table.



**Figure 5:** Cephalometric landmarks for the frontal projection.

Table 5: Variables s-n-ans.

s-n-ans	Complete			Simonart's band		
	Sample	Mean	SD	Sample	Mean	SD
5 or less	102	83.4	4.0	44	78.7	2.5
6	107	82.5	3.6	48	78.7	4.1
7	97	82.1	4.0	53	77.8	3.8
8	103	81.1	3.6	48	77.3	3.5
9	100	81.3	3.7	42	76.9	3.7
10	104	81.4	3.4	43	76.3	3.5
11	101	80.7	4.3	42	76.5	3.8
12	94	80.3	4.2	40	74.6	3.7
13	100	81.2	4.0	45	75.6	3.4
14	90	80.4	4.5	35	74.9	3.9
15	83	80.3	4.3	31	74.5	4.2
16	77	79.1	4.2	20	74.2	4.4
17	73	79.7	4.6	27	75.5	4.6
18 or more	104	79.7	4.4	26	75.1	4.4

The difference between groups was statistically significant (P=0.0006). There was a significant change over time (P<0.001), SD: Standard deviation

Table 6: Variable as ss'-pm.

Ss'-pm	Complete			Simonart's band		
	Sample	Mean	SD	Sample	Mean	SD
5 or less	102	44.7	3.0	44	43.6	2.9
6	106	45.4	2.6	48	44.5	2.9
7	97	44.9	2.9	53	44.7	2.8
8	103	44.5	3.0	48	44.8	2.8
9	100	45.4	2.7	42	45.2	2.8
10	104	45.2	2.8	43	45.9	3.2
11	101	44.9	2.9	42	46.0	3.3
12	94	45.0	3.1	40	44.8	3.4
13	100	45.9	2.8	45	46.2	3.5
14	90	45.5	3.2	35	46.0	3.4
15	83	45.8	2.9	31	46.4	2.9
16	77	45.1	3.1	20	46.0	4.6
17	73	45.5	3.4	26	46.5	4.1
18 or more	104	45.4	3.5	26	47.5	4.0

The difference between groups was not statistically significant (P=0.094). There was a significant change over time (P<0.001), SD: Standard deviation

Table 7: Variable ss-n-sm

Ss-n-sm	Complete			Simonart's band		
	Sample	Mean	SD	Sample	Mean	SD
5 or less	100	5.7	2.8	43	5.0	2.7
6	105	4.8	3.2	47	4.3	3.5
7	97	3.7	3.2	53	3.4	3.0
8	103	2.5	3.1	48	2.8	2.6
9	98	2.2	3.3	41	2.3	2.1
10	104	1.6	2.9	44	2.1	3.1
11	99	1.3	2.8	41	2.1	3.2
12	94	0.1	3.3	38	1.1	2.6
13	100	0.3	2.9	44	1.4	3.1
14	90	0.2	3.1	35	0.9	2.3
15	83	-	3.0	31	-0.1	2.7
16	77	-2.0	3.3	20	-0.7	3.0
17	73	-1.8	3.7	27	-0.2	2.6
18 or more	104	-1.9	3.8	28	-0.3	2.9

The reduced segmental displacement in patients with a Simonart's band allowed less traumatic lip repair and hard palate closure with a vomer flap which could be a reason

Table 8: Variable NSL-NL.

NSL-NL	Complete			Simonart's band		
	Sample	Mean	SD	Sample	Mean	SD
5 or less	102	8.6	3.7	44	10.0	3.2
6	107	8.9	3.3	48	9.9	3.9
7	97	8.3	3.3	53	9.6	3.5
8	103	8.8	3.7	48	9.9	3.5
9	100	9.1	3.4	42	8.9	3.1
10	104	8.5	3.2	43	9.6	3.7
11	101	8.6	3.8	42	9.1	3.3
12	94	9.0	3.8	40	8.9	3.7
13	100	8.3	3.9	45	9.0	3.0
14	90	8.1	3.8	35	9.7	2.8
15	83	7.9	4.2	31	9.4	2.7
16	77	8.2	4.3	20	9.4	2.8
17	73	8.6	4.0	27	9.2	4.1
18 or more	104	8.3	4.3	27	9.6	3.7

The difference between groups was not statistically significant (P=0.202). There was a significant change over time (P<0.028), SD: Standard deviation

Table 9: Variable NL-ML.

NL-ML	Complete			Simonart's band		
	Sample	Mean	SD	Sample	Mean	SD
5 or less	102	27.2	5.2	44	25.8	4.4
6	107	26.8	5.4	48	26.6	4.9
7	97	27.9	6.1	53	25.1	4.8
8	103	26.9	6.3	48	25.7	5.1
9	100	26.4	5.8	42	26.0	4.2
10	104	27.4	6.1	43	26.0	5.5
11	101	27.1	6.3	42	26.3	6.2
12	94	26.4	6.3	40	27.2	5.2
13	100	27.3	6.1	45	26.8	4.7
14	90	27.3	6.5	35	26.9	4.8
15	83	28.2	6.3	31	25.9	6.0
16	77	26.7	6.0	20	24.5	5.5
17	73	26.0	6.4	27	26.0	6.3
18 or more	104	25.9	6.6	27	26.4	6.1

The difference between groups was not statistically significant (P=0.590). There was a significant change over time (P<0.206), SD: Standard deviation

Table 10: Variable "ANS linear displacement."

N-s-ba	Complete			Simonart's band		
	Sample	Mean	SD	Sample	Mean	SD
5 or less	55	1.8	1.6	33	1.5	1.8
6	73	1.7	1.7	38	1.9	1.8
7	66	2.0	2.0	38	1.5	1.7
8	71	1.5	1.8	38	1.3	1.4
9	73	1.7	1.8	32	1.1	1.9
10	76	2.0	1.6	33	1.9	1.4
11	81	1.3	1.7	34	1.5	1.9
12	78	1.6	1.9	33	1.0	1.6
13	83	1.9	1.9	38	1.3	1.6
14	80	1.6	1.8	31	1.2	1.9
15	67	1.6	1.6	31	1.1	1.6
16	72	1.6	1.9	20	1.1	1.7
17	71	1.4	2.1	26	1.7	2.0
18 or more	91	1.5	1.7	26	1.1	1.7

The difference between groups was not statistically significant (P=0.111). There was a significant change over time (P<0.047), SD: Standard deviation

for the greater maxillary prominence when measured at the anterior nasal spine and better maxillomandibular relationship



in UCLP+S group. As stated by Ross<sup>10,11</sup> in 1987, lip surgery is not considered to be a threat to midfacial growth potential. Mars and Houston<sup>12</sup> even stated that the group which had a lip and palate repair had major maxillary growth retardation.

The slight more favorable maxillomandibular relationship may be because of the underlying morphologic differences reflected in the presence of a Simonart's band. In UCLP+S, the teratogenic insult is milder during cell proliferation and fusion of the original embryonic processes of the midface, so there is deficient tissue. The difference in cranial base angulation may be because of the morphologic and embryologic differences.

Finally, the septal and alar cartilages develop and chondrify in early fetal life and assume permanent distortions in the presence of cleft.<sup>13,14</sup> The intrauterine disposition of major and minor segments has a crucial bearing on the post natal skeletal abnormality of the nose and its minimization can be an advantage of the presence of Simonart's bands though not detectable by cephalometry.<sup>15,16</sup> This explains the difference in relation to the smaller number of secondary operations in the UCLP+S group.

### Conclusion

The lack of major benefit for patients in whom segmental displacement had been naturally prevented by Simonart's bands infers that pre-surgical orthopedics has negligible impact on facial growth as nasal distortions are already established at birth.

The differences in skeletal form due to the presence of Simonart's bands are minor as evident from the cephalometric analysis.

### References

1. Ferguson MW. Craniofacial embryology. In: Shaw WC, (Editor). Orthodontics and Occlusal Management, London: Heinemann in Press; 1993.
2. Ferguson MW, Honig LS. Experimental fusion of the naturally cleft, embryonic chick palate. J Craniofac Genet Dev Biol Suppl 1985;1:323-37.
3. Goss AN. Intra-uterine healing of fetal rat oral mucosal, skin and cartilage wounds. J Oral Pathol 1977;6(1):35-43.
4. Goss AN. Post-fusion cleft of the fetal rat palate. Cleft Palate J 1977;14(2):131-9.
5. Winer BJ. Statistical Principles in Experimental Design, 2<sup>nd</sup> ed. New York: McGraw-Hill; 1971.
6. Nolla CM. The development of the permanent teeth. J Dent Child 1960;27:254-66.
7. da Silva Filho OG, Santamaria M Jr, da Silva Dalben G, Semb G. Prevalence of a Simonart's band in patients with complete cleft lip and alveolus and complete cleft lip and palate. Cleft Palate Craniofac J 2006;43(4):442-5.
8. Ranta R. A review of tooth formation in children with cleft lip/palate. Am J Orthod Dentofacial Orthop 1986;90(1):11-8.
9. Suzuki A, Watanabe M, Nakano M, Takahama Y. Maxillary lateral incisors of subjects with cleft lip and/or palate: Part 2. Cleft Palate Craniofac J 1992;29(4):380-4.
10. Ross RB. Treatment variables affecting facial growth in complete unilateral cleft lip and palate. Cleft Palate J 1987;24(1):5-77.
11. Ross RB. Treatment variables affecting facial growth in complete unilateral cleft lip and palate. Part 7. An overview of treatment and facial growth. Cleft Palate J 1994;24:71-7.
12. Mars M, Houston WJ. A preliminary study of facial growth and morphology in unoperated male unilateral cleft lip and palate subjects over 13 years of age. Cleft Palate J 1990;27:7-10.
13. Semb G. Effect of alveolar bone grafting on maxillary growth in unilateral cleft lip and palate patients. Cleft Palate J 1988;25(3):288-95.
14. Semb G. A study of facial growth in patients with bilateral cleft lip and palate treated by the Oslo CLP Team. Cleft Palate Craniofac J 1991;28(1):22-39.
15. Smahel Z, Brejcha M. Differences in craniofacial morphology between complete and incomplete unilateral cleft lip and palate in adults. Cleft Palate J 1983;20(2):113-27.
16. Semb G, Shaw WC. Pharyngeal flap and facial growth. Cleft Palate J 1990;27(3):217-24.