Morphology of Adult Face After Repair of Isolated Cleft Palate in Childhood

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Many cephalometric studies have been made of patients with isolated cleft palate (*22, 23, 27, 28*) but no papers report measurements of the surface of the face to identify morphological changes in the soft tissues of the face.

The purpose of this paper is:

1) to complete the data about facial morphology in dults after cleft palate surgery in childhood,

2) to determine whether the extent of the cleft palate had a significant influence on the development of the face,

3) to discover minor morphological changes on the face and head which may escape attention in a routine examination.

Materials and Methods

We studied 42 patients, 17 men and 25 women between 16 and 20 years of age, whose isolated cleft palates (12 severe and 30 incomplete) had been repaired at The Hospital for Sick Children.

The palates were repaired by a modified Dorrance pushback operation at the age of approximately two years (*19*). Nineteen patients had orthodontic treatment. Nine patients had had a secondary repair, a palatal fistula had been closed in eight patients and the palate had been completed by pharyngeal flap in the ninth.

Our controls were 100 healthy Canadians, 50 men and 50 women.

Our measurements of the facial surface and of the head were those widely used in anthropometry (*15, 21, 33*) but adapted for the purpose of assessing results of plastic surgery (*3, 6, 12, 13*).

This paper presents 14 measurements, eight of the face in general and six of the nose and upper lip in detail, and seven qualitative signs, the methods of examination being as described in a previous paper (*7*).

Measurements

1. Bitragion diameter (t-t)
2. Bizygomatic diameter (zy-zy)

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3. Bitragion-subnasale arc (t-sn-t)
4. Bitragion-menton arc (t-gn-t)
5. The height of the profile of the face (n-gn)
6. The height of the lower profile of the face (sn-gn)
7. The height of the upper profile of the face (n-sto)
8. The height of the lower third of the facial profile (sto-gn)
9. The height of the nose (n-sn)
10. The width of the nose (al-al)
11. The length of the columella (measured on both sides)
12. The medial vertical height of the upper lip (sn-sto)
13. The lateral vertical height of the upper lip (measured on both sides (sbal-ls)
14. The width of the labial fissure (ch-ch).

Qualitative Signs

1. The quality of the profile was noted to be normal, with recessed or flattened mid-face (pseudoprognathic and "dish face"), or with prominent midface and hypoplastic chin ("bird-like" profile).
2. The configuration of the nasal tip
3. The configuration of the nasal alae
4. The shape of the nostrils
5. The vermilion border of the upper lip
6. The vermilion of the upper lip
7. The position of the labial fissure (normal or oblique).

For statistical evaluation of results we applied chi-quadrate, Student's T-test, and the statistical analysis of the significance of the observed difference based upon computation of the standard error of the difference (*16*).

Results

A. Horizontal Measurements of the Face. The results are given in Table 1.

No significant difference in the bitragion diameter was apparent between the patients of the study group and the controls.

The bizygomatic diameter was significantly less in both male and female patients than in the controls.

Both horizontal arcs of the face were significantly less in patients than in controls.

B. Profile Measurements of the Face. Table 2 shows that the height of the facial profile was greater in patients than in the controls but the difference was significant in males only. Patients and controls showed almost no difference in the heights of the upper facial and lower facial profiles. The lower third of the facial profile, however, was significantly higher in the cleft patients than in the controls.

C. Measurements of the Nose. The heights of the nose and of the columella were similar in patients and controls; the width of the nose was

TABLE 1. Horizontal measurements of the face (in millimeters).

measurements	*sex*	*patients (42)*					*controls (100)*					*differences T-test*
		N	*max*	*min*	*mean*	*SDV*	*N*	*max*	*min*	*mean*	*SDV*	
bitragion diameter (t-t)	M	12	153	128	142.8	7.1	50	157	135	145.2	4.7	not significant
	F	20	142	120	133.1	6.9	50	146	122	135.3	5.2	not significant
bizygomatic diameter (zy-zy)	M	12	142	123	134.4	7.6	50	148	130	138.6	4.3	T-value: 2.577, df 58, $p > 0.02$ significantly smaller in patients
	F	20	134	115	124.5	6.0	50	143	120	131.2	4.6	T-value: 5.033, df 68, $p > 0.001$ significantly smaller in patients
bitragion-subnasale arc (t-sn-t)	M	17	292	240	271.5	16.3	50	320	270	286.2	9.5	T-value: 4.532, df 65, $p > 0.001$ significantly smaller in patients
	F	25	283	218	257.0	15.5	50	296	251	273.0	10.0	T-value: 5.403, df 73, $p > 0.001$ significantly smaller in patients
bitragion-menton arc (t-gn-t)	M	17	330	260	294.8	18.2	50	351	294	313.7	11.1	T-value: 5.097, df 65, $p > 0.001$ significantly smaller in patients
	F	25	308	248	277.4	17.8	50	313	262	292.0	11.6	T-value: 4.273, df 73, $p > 0.001$ significantly smaller in patients

TABLE 2. Profile measurements of the face (in millimeters).

measurements	*sex*	*patients (42)*					*controls (100)*					*difference T-test*
		N	*max*	*min*	*mean*	*SDV*	*N*	*max*	*min*	*mean*	*SDV*	
height of facial profile (n-gn)	M	17	137	115	126.1	6.4	50	138	110	122.1	7.1	T-value: 2.054, df 65, $p > 0.05$ significantly greater in patients
	F	25	134	99	117.4	8.2	50	135	101	114.5	7.4	not significant ($p > 0.20$)
height of upper facial profile (n-sto)	M	17	86	70	76.5	4.2	50	87	66	76.4	4.6	not significant
	F	25	79	60	71.7	4.7	50	79	62	70.2	4.1	not significant
height of lower facial profile (sn-gn)	M	17	81	62	71.2	5.5	50	80	59	68.0	4.9	not significant
	F	25	80	53	66.0	6.4	50	74	51	63.5	5.0	not significant
height of lower third of facial profile (sto-gn)	M	17	58	42	49.5	4.5	50	55	39	45.9	3.7	T-value: 3.277, df 65, $p > 0.01$ significantly greater in patients
	F	25	56	39	45.6	4.1	50	52	35	43.6	3.5	T-value: 2.212, df 73, $p > 0.05$ significantly greater in patients

significantly smaller in patients than in controls and the columella was thinner in patients than in controls although the difference was significant in women only (Table 3).

Four patients had asymmetry in the lengths of the right and left nasal ala, with a maximal difference of 3 mm.

A dislocation of the alar base in the frontal plane was observed in 11 out of 42 patients (26.2%), a high figure in comparison with that obtained in our controls (6 out of 100) or with the 4.88% in Middle European population (*31*).

The incidence of microforms of the cleft lip in our patients (26.2%) was similar to the 27.03% found in a cleft-palate population in Central Europe (*31*). Alar base dislocation occurred more often on the right side (*8*) than on the left (*3*) in our patients, although in the Middle European cleft palate population it occurred more frequently on the left. In our controls the alar base dislocation was equal on both sides.

D. Measurements of the Upper Lip. Table 4 shows that of the lip measurements only the width of the labial fissure was significantly different in patients and controls, being shorter in the former.

Even though the *average* lateral vertical height of the upper lip did not differ on the right and left sides, an asymmetry in lateral height was found in 11 patients out of 42 (26.19%), mostly on the right side, with a maximum difference of 4 mm., the degree of lip asymmetry being in direct relationship to the alar base dislocation on the same side. The incidence of such a lip deformity was significantly less in controls (6%), the asymmetry occurring equally on both sides.

Qualitative Signs

In slightly less than one-third of the patients (13/42 cases) we found a deformity of the facial profile. In half of these cases malocclusion was present; in the other half the bite was normal.

Among the abnormal facial profiles, three were pseudoprognatic, five were slightly bird-like and five were slightly dishface. Of the patients with bird-like profiles, only one had malocclusion, while three of the patients with dishface profiles had abnormal bite. All patients with bird-like profiles had varying degrees of hypoplasia of the mandible, a condition also found in two of the controls (2%). In another two controls a pseudoprognatic profile was recorded (2%), one of them with malocclusion. Profile deformities were significantly less frequent in controls (2/100) than in patients (13/42).

The nasal tips of patients were never deformed. Unilateral flat nasal ala was observed in two patients out of 42 (4.5%) but in none of the controls.

Nostril asymmetry occurred in four out of 42 patients (9.6%) and in four out of 10 controls (4%). The difference in the two figures was not significant.

TABLE 3. Measurements of the nose (in millimeters).

measurements	*sex*	*patients (42)*					*controls (100)*					*differences T-test*
		N	*max*	*min*	*mean*	*SDV*	*N*	*max*	*min*	*mean*	*SDV*	
height of nose (n-sn)	M	17	62	49	54.9	3.4	50	60	46	54.3	3.7	not significant
	F	25	59	46	51.4	3.0	50	59	44	50.5	3.5	not significant
width of nose (al-al)	M	17	37	28	32.6	2.7	50	41	31	35.0	2.2	T-value: 3.644, df 65, p > 0.001 significantly smaller in patients
	F	25	36	26	29.9	2.4	50	39	29	32.5	2.2	T-value: 4.704, df 73, p > 0.001 significantly smaller in patients
length of columella	M											
	rt	17	15	10	11.7	1.3	50	16	10	12.3	1.3	not significant
	lt	17	15	10	11.7	1.3	50	16	10	12.3	1.3	not significant
	F											
	rt	25	15	10	12.2	1.3	50	15	9	12.2	1.3	not significant
	lt	25	15	10	12.1	1.3	50	15	9	12.2	1.3	not significant
width of columella	M	17	12	6	7.8	1.2	50	10	7	8.2	0.7	not significant (p = 0.1)
	F	25	9	6	7.2	0.7	50	9	6	7.9	0.7	T-value: 4.084, df 73, p > 0.001 significantly smaller in patients

TABLE 4. Measurements of the upper lip (in millimeters).

measurements	*sex*	*patients (42)*					*controls (100)*					*differences T-test*
		N	*max*	*min*	*mean*	*SDV*	*N*	*max*	*min*	*mean*	*SDV*	
medial vertical height (sn-sto)	M	17	26	19	21.7	2.0	50	26	18	22.0	2.1	not significant
	F	25	25	14	20.3	2.8	50	24	16	19.6	2.1	not significant
lateral vertical height (subalare-vermilion border)	M											
	rt	17	21	12	16.2	2.3	50	21	11	16.5	2.0	not significant
	lt	17	19	13	16.2	2.3	50	21	11	16.3	2.1	not significant
	F											
	rt	25	19	6	14.2	3.1	50	20	10	14.5	1.9	not significant
	lt	25	19	7	14.2	3.0	50	20	10	14.7	2.0	not significant
width of labial fissure (ch-ch)	M	17	52	38	45.7	4.0	50	60	49	53.7	2.8	T-value: 9.079, df 65, $p > 0.001$ significantly smaller in patients
	F	25	51	34	42.4	3.6	50	57	44	50.1	3.4	T-value: 9.112, df 73, $p > 0.001$ significantly smaller in patients

In the control group the most frequent nostril shape was type 2 (69 cases) followed by type 1 (20 cases), type 3 (6 cases) and type 4 (1 case). In the isolated cleft palate group the most frequent nostril shape was type 1 (19 cases, 45.2%) followed by 2 (17 cases, 40.5%) and type 3 (2 cases, 4.7%).

A combination of types 1 and 2 was found in three of the patients with asymmetric nostrils; the fourth patient had a combination of types 2 and 3. The type 2 and 3 nostrils were always associated with an alar base dislocation of 2 to 4 mm. and sometimes with defects in the bony structure of the nose (deviation of the nasal bridge, nasal septum dislocation and nasal root asymmetry) and with deformities of the soft nose (unilateral nasal ala hypoplasia, unilateral shortening of the columella and deviation of the columella).

No deformity was found in the vermilion line or in the mucous membrane of the upper lip in our study group. Two patients out of 42 had an oblique labial fissure. This deformity was not found in controls.

Associated Deformities of the Face and Head. We thoroughly examined the orbits, nose, upper lip, mandible and ears and recorded any deviation from the normal shape or position and any asymmetry in size.

The total number of associated deformities in these regions was 177 in 42 cleft palate patients, that is, 4.2 associated deformities of the face per cleft palate patient compared with 2.6 per control. The difference between patients and controls is not significant.

Both in the cleft palate group and controls the ears are one of the most deformed (97 deformities in 42 cleft palate patients and 20 deformities in 100 controls), followed by the nose (32 deformities in 42 cleft palate patients and 28 deformities in 100 controls) and by the orbits (25 deformities in 42 cleft palate patients and 21 deformities in 100 controls). Of the upper lip and labial fissure defects 15 were in the cleft palate group and 6 were in controls. Mandible deformities occurred in 8 cleft palate patients and in 2 controls.

In all other regions of the face, with the exception of the ears, the frequency of the deformities was significantly higher in cleft palate patients than in controls.

A detailed description of associated deformities will be given in a separate paper.

The Distribution of the Qualitative Signs and the Metric Findings of the Face According to the Extent of the Cleft Palate. Profile deformities and deformities of the orbits were similar in quality and frequency whether the cleft palate was incomplete or severe.

Nasal deformities (nasal ala asymmetry and nostril asymmetry) and oblique labial fissure were found only in patients with incomplete cleft palate.

The frequency of shape deformities in patients with incomplete cleft

palate was higher (15/30) than in patients with severe forms (3/12) but the difference was not significant.

For both forms of cleft palate, the main profile and horizontal measurements of the face did not show any significant difference. In female patients, the medial-vertical and both lateral-vertical heights of the upper lip were significantly greater with incomplete cleft palate than with severe cleft palate.

Discussion and Conclusion

The high narrow face found in patients with isolated cleft palate and found by the authors also in adults after repair of unilateral cleft lip palate and bilateral cleft lip palate (*7, 8*) may be a late combined result of the original embryonal damage and of surgical repair (*14, 20, 24, 25, 30*). It has been stated that the repeated surgical procedures might cause some compression in the maxilla (*1, 2, 3*). In the present study only 19% of the patients had secondary surgery on the palate.

The significantly higher lower third of the facial profile (sto-gn) of patients compared with that of controls signifies that this part of the face has a fair growth potential although in young children with isolated cleft palate the mandible is usually primarily smaller (*14, 26*).

Surprising was the relatively high frequency of nasal deformities in our patients. These deformities are described by some investigators as microforms of the cleft lip-palate (*2, 4, 10, 11, 32*). If this view is accepted, the presence of the cleft lip-palate microforms might cause isolated cleft palate to be reclassified as Group 1 of Fogh-Andersen's genetical classification, instead of as Group II (*9*).

In the cleft palate group, the significantly narrower bi-alar diameter of the nose and the significantly shorter labial fissure, as compared with those for controls, are the consequence of the altered growth process in the middle face.

The narrow and almost vertically prolonged nostril type in the patients reflected the compressed vestibule of the nose. The fact that in the cases of combination of type 1 and type 2 nostrils some additional deformities of the nose were found on the side of type 2 may support our belief that the narrow and vertically elongated nostrils can be considered common in adults with this type of cleft.

Coupe and Subtelny (*5*) reported that the width of the nasal cavity, as assessed by cephalometric laminography in 40 children under 3 years of age with isolated cleft palate, was significantly greater than that in controls. We suggest that a direct relationship exists between the width of the nose and the width of the nasal cavity. If this hypothesis is correct, the significantly smaller bi-alar diameter in adult cleft palate patients may signal a narrower or a normal nasal cavity.

Our study showed a high number of anomalies associated with isolated cleft palate—a finding in accordance with the experience of many investi-

gators, although the reported frequency of the associated anomalies varied from 18.5% (*18*) to 52.5 %(*17*).

The orbital region, the nose, the upper lip and the chin were significantly more damaged than in the controls. Stiegler and Berry (*29*) found more than four times as much structure deformities in cleft palate families (0.45%) than in average population (0.1%).

The extent of the cleft palate did not effect either the frequency of the associated deformities of the face and head, or the majority of the measurements of the face.

Summary

The facial contour was measured by anthropometric methods in 42 Canadian adults who had isolated cleft palate repaired in childhood by the modified Dorrance pushback operation at the Hospital for Sick Children.

Fourteen metric and seven qualitative signs concerning the nose, upper lip and the face were evaluated and compared with similar data from 100 healthy Canadians (50 men and 50 women), as were the associated anomalies in five regions of the face.

The present paper is part of a morphological study of the face in 145 adults who had cleft lip and/or palate repaired in childhood.

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