Nostril Asymmetry: Microform of Cleft Lip Palate? An Anthropometrical Study of Healthy North American Caucasians

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Eight surface measurements of the nose and quality of nostril type and ala shape helped in the classification of 184 *nostril asymmetries* found in 1312 healthy North American Caucasians six to 18 years of age.

Twenty-one of 1312 persons (1.6%) revealed severe degrees of nostril asymmetry characterized by uneven level of the alar base, asymmetries in the width of the nostril floor and length of the columella, and deviations in the columella and nasal bridge. This variation was most similar to the nasal disfigurement found in noncleft members of cleft families (Fukuhara and Saito, 1963; Tolarová et al., 1971). In order to accept this variation as a microform of the cleft anomaly, further anthropometrical study of the noses of noncleft members of cleft families will be required.

Microforms of the cleft lip palate anomaly in the area of the nose have been referred to as "nostril asymmetry" (Mills et al., 1968; Pashayan and Fraser, 1971; Gabka, 1973), "deviated nostril" or "eccentric shape of nostril" (Fukuhara, 1964), "asymmetric shape of nose" (Fukuhara and Saito, 1963), "asymmetrical insertion" or "lowering of ala nasi" or "irregularities in vicinity of nostrils" (Tolarová et al., 1969; Tolarová, 1971). These terms are practically synonyms. They indicate the changes in the structures bordering the nostrils or the effect of changes on the nares themselves.

This slightly apparent deformity has been recognized as a true microform of cleft lip palate malformation by some investigators (Fukuhara, 1964; Tolarová et al., 1969; Tolarová, 1971; Gabka, 1973) but not by others (Mills et al., 1968; Pashayan and Fraser, 1971).

Surface changes of the nose (nares) were determined visually in the majority of studies (Fukuhara, 1963; Mills et al., 1968; Tolarová et al., 1969), but only one study attempted to investigate the problem quantitatively (photogrammetrically) (Pashayan and Fraser, 1971). Disfigurement was investigated in cleft lip palate families (Fukuhara and Saito, 1963; Mills et al., 1968; Tolarová et al., 1969; Pashayan and Fraser, 1971), in a small group of healthy adults (Pashayan and Fraser, 1971), and in a healthy Bohemian population (Tolarová et al., 1969).

The purpose of the present report is:

(1) to define the variations in size and shape in soft structures resulting in asymmetry of the nares,

(2) to help in the detection of nostril asymmetries which are remindful of mild forms of cleft lip by employing direct surface measurements of the nose,

(3) to establish the incidence of various types of nasal asymmetries in North American healthy Caucasians and thus to contribute to anthropogenetic research on healthy populations.

Materials and Methods

Eight surface measurements and two qualitative examinations of the nose were carried out by one of the authors (LGF) in 1312 healthy North American Caucasians in 13 age groups between six and 18 years with an equal number of males and females in each group.

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Definitions

Configuration of the alar base refers to the shape of the terminal portion of the nasal ala bordering the nares from below. These parts may be symmetrical or one of them may be thinner and shorter, thereby placing the alar base landmark (sbal) in a higher position (Figure 1 A).

Dislocation of the alar base refers to the unilaterally lower location of the landmark (subalare) at the base of the ala in the frontal plane without differences in configuration of the alae (Figure 1 B).

The side of asymmetry was determined on the basis of the side of

(1) change in configuration or dislocation of the alar base and

(2) the unusual character of the nostril type or size and findings in the adjacent structures.

Measurements

1. Difference between the levels of the alar bases was judged by (a) measuring the lateral vertical height of the upper lip on both sides (Farkas and Lindsay, 1971) (Fig. 2 a–a_1), (b)

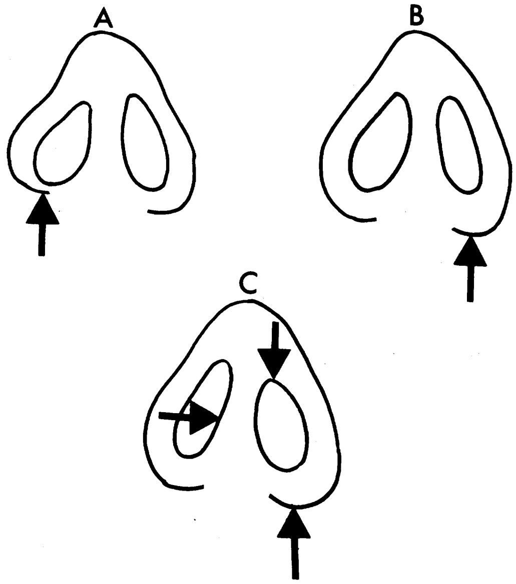

FIGURE 1. A–asymmetry in alar base configuration: the right lower portion of the ala is thinner; therefore, the subalare point was higher located (arrow). B–ala base level difference caused by downward dislocation of the lower portion of the left ala, shifting the subalare point to a lower location (arrow). C–severe form of nostril asymmetry schematically. Arrows indicate the failures.

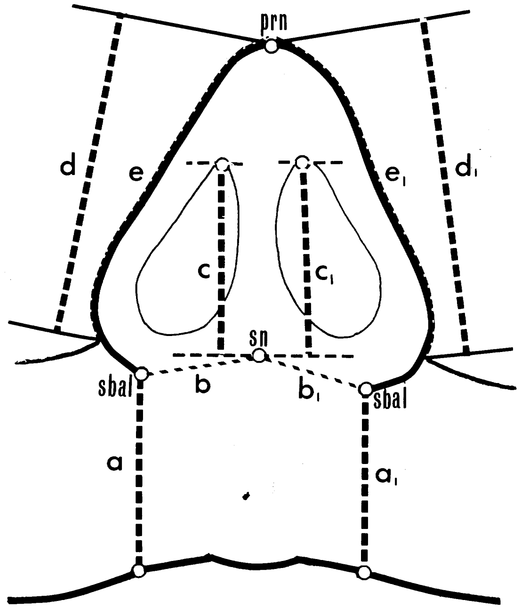

FIGURE 2. Measurements in the area of the soft nose. a–a_1 lateral vertical height of the upper lip indicating the relative position of ala bases (sbal). b–b_1 width of the nostril floor. c–c_1 length of the columella. d–d_1 projective length of the nasal ala. e–e_1 surface length of the nasal ala. sn–landmark at the base of the columella (subnasale). sbal–landmark of the alar base (subalare). prn–landmark at the tip of the nose (pronasale).

determining the difference between the mutual position of the subalare landmarks (Lindsay and Farkas, 1972),

2. measuring the width of the nostril floors by sliding caliper between the base of columella (subnasale) and the ala base (subalare) (Figure 2 b–b_1),

3. determining the length of the columella on both sides (Farkas and Lindsay, 1971) (Figure 2 c–c_1),

4. establishing the projective length of the nasal ala on both sides (Lindsay and Farkas, 1972) (Figure 2 d–d_1),

5. measuring the length of the nasal ala on the skin surface between the base line of the ala and the tip of the nose on both sides (Figure 2 e–e_1) using a soft measuring tape,

6. measuring the deviation of the columella (Lindsay and Farkas, 1972),

7. and determining the deviation of the nasal bridge (Lindsay and Farkas, 1972).

Qualitative Signs

1. Nostril qualities were judged by type and size. The type of nares was identified by

using Topinard's classification (1885) in modification (Farkas and Lindsay, 1971). One of the characteristics of the nostril types is the various inclinations of the longitudinal axis of the nares. The size of the nostril opening was judged visually, giving the approximate estimate of difference between nares.

2. Ala shape was judged as flat, angled, or curved.

Grouping of nostril asymmetries into three classes (mild, moderate, and severe) was carried out according to the extent and/or quality of anatomical changes in (1) alar base (2) nasal floor (3) columella and (4) nasal bridge. Changes in ala length and shape were of secondary importance.

This material was analyzed by using the statistical method of the standard error of the difference (Huges, 1967).

Results

General Findings

Nostril asymmetries were found in 14.05% of the healthy subjects (184 of 1312). These were slightly more frequent in males (98) than in females (86) and occurred significantly more often on the left (56%, 103 of 184) than on the right side (44%, 81 of 184) (SED = 5.1, Diff. 12). Twelve-to-18 year-old subjects had significantly more asymmetrical nostrils (16.9%, 120 of 708) than had individuals six to 11 years of age (10.6%, 64 of 604) (SED = 1.9, Diff. 6.3).

Table 1 shows the frequency of the individual classes of nostril asymmetries. The largest group was *the mild form*, 84.2% of all asymmetries of the nares (155 of 184). These were characterized by changes in *one* of the main nasal structures such as in the columella (114) or alar base (9). In a small subgroup, the dominant failure was the asymmetry in size and type of the nostril only (17.8%, 33 of 185). *Moderate nostril asymmetries* formed the smallest group (4.3%, 8 of 184) and were characterized by dominant changes in the alar base, which was located higher (2) or lower (6) and in the columella but not in the nostril floor. *Severe nostril asymmetries* (11.4%, 21 of 184) exhibited changes in all main structures of the soft nose, including the alar base, the columella, and the nostril floor (Fig. 1 C).

Quantitative Changes in Structures Surrounding the Nares (Table 2) Nasal Ala

Asymmetry between the levels of subalare (sbal) at the base of the alae (2.9%, 38 of 1312) caused by disfigurement (0.8%, 10 of 1312) was slightly greater (1.7 mm) than following dislocation (2.1%, 28 of 1312) of the alar base (1.5 mm). Both in moderate (8) and severe nostril asymmetries (21), one-third of the uneven levels of the alar bases were caused by disfigurement and two-thirds by dislocation. The smallest average level difference (1.1 mm) was found in 9 patients with alar base dislocation in the group with mild asymmetries (155).

Asymmetries between the projective lengths of the alae were the least frequent signs accompany-

TABLE 1. Classification of 184 Nostril Asymmetries Found in 1312 Healthy North American Caucasians 6–18 Years of Age

Degree of Asymmetry	*Anatomical Changes*	*N*	*%*	*Total (N = 1312)* *N*	*%*
Mild	Simple nostril asymmetry	10	5.4	155	11.8
	Nostril and other fine asymmetries	22	11.9		
	Columella length and/or direction asymmetries	114	62.0		
	Mild dislocation of alar base	9	4.9		
Moderate	Unilateral change in configuration of alar base	2	1.0	8	0.6
	Dislocation of alar base	6	3.3		
Severe	Unilateral change in configuration of alar base	8	4.3	21	1.6
	Dislocation of alar base	13	7.1		
	Total	184	100.0	184	14.0

TABLE 2. Quantitative Changes in Structures Surrounding the Nares in Mild, Moderate and Severe Nostril Asymmetries

Anatomical Changes			*Changes in Millimeters or Degrees*								
			Mild (155)		*Moderate (8)*		*Severe (21)*		*Total 184*		*Range and Difference (Standard error of difference)*
Measurement	*Sign*	*Finding*	*N*	*Mean*	*N*	*Mean*	*N*	*Mean*	*N*	*Mean*	
Alar Base Location	Change in Configuration (in mm)	higher located	—	—	2	1.5	8	1.8	10	1.7	Range 1–3
	Dislocation (in mm)	lower located	9	1.1	6	1.8	13	1.5	28	1.5	Range 1–3
Nasal Ala Lengths	Asymmetry in Projective lengths (in mm)	shorter	12	1.4	–	–	3	2.7	15	1.7	Range 1–4
		longer	13	1.3	–	–	1	4.0	14	1.5	Range 1–4
	Asymmetry in surface lengths (in mm)	shorter	17	1.5	2	1.5	4	2.0	23	1.6	Range 1–3
		longer	23	1.6	–	–	1	1.0	24	1.6	Range 1–3
Nostril Floor Widths	Asymmetry (in mm)	narrower	22	1.2	–	–	11	1.6	33	1.4	Range 1–4
		wider	18	1.5	–	–	10	1.5	38	1.5	Range 1–4
Columella Lengths	Asymmetry (in mm)	shorter	54	1.2	–	–	6	1.2	60	1.2	Significantly more shorter measurements; S.E.D. = 4.3, Diff. 17.9
		longer	16	1.1	3	1.0	8	1.3	27	1.1	
Columella Direction	Deviation (in degrees)	to asymmetrical nostril	31	4.0	4	3.8	4	8.0	39	4.4	Significantly more to the opposite side. S.E.D. = 4.7, Diff. 16.8
		to opposite side	57	4.4	4	3.5	9	5.3	70	4.5	
Nasal Bridge Direction	Deviation (in degrees)	to asymmetrical nostril	31	4.1	5	5.4	8	4.3	44	4.3	Range: 2°–10°; Significantly more to side of asymmetrical nostril; S.E.D. = 4.1, Diff. 8.7
		to opposite side	27	3.3	–	–	1	2.0	28	3.3	

ing the nostril asymmetries (15.8%, 29 of 184) caused in equal number by shorter (15) and longer measurements (14), with slightly greater asymmetry in shorter measurements. The percentage of length asymmetries was slightly greater in severe (4 of 21) than in mild degree asymmetries (25 of 155). It was not seen in moderate forms. In the severe degrees of nostril asymmetry the average difference between the asymmetrical alae was greater than in mild degrees of asymmetry.

Asymmetries in surface length of the alae were slightly more frequent (25.5%, 47 of 184) than projective length asymmetries. Shorter measurements (23) were almost equal in number and of the same extent (1.6 mm) as those of longer measurements (24). The asymmetry was observed in 25.8% in mild, 25% in moderate and 23.08% in severe forms.

NOSTRIL FLOOR

Asymmetrical nostril floor widths were recorded in one-third of all noses with asymmetry of nares (61 of 184). The floor was slightly more often narrower (33 of 184) than wider (28 of 184) with similar degrees of asymmetry. Asymmetrical nostril floor width was present in all nares of severe asymmetry, but not in the moderate group. In the mild forms this floor asymmetry was found in one-quarter of the cases. The asymmetry caused by narrowing of the floor was slightly greater on average in severe forms (1.6 mm) than in the mild forms (1.2 mm). Asymmetry caused by widening of the floor was the same in mild and severe forms (1.4 mm).

COLUMELLA

Asymmetry between the two lengths of columella was recorded in almost half of all asymmetrical nostrils (47.3%, 87 of 184). They were more frequently associated with severe asymmetries (67%, 14 of 21) than with moderate (38%, 3 of 8) or mild forms (45%, 70 of 155). The columella on the side of the affected nostrils was shorter in 60 of the 87 cases (69%) and longer in only 27 cases (31%). The average difference in both instances was about the same (1.2 mm).

Deviations of the columella most frequently accompanied asymmetrical nostrils (58.9%, 109 of 184). The columella was directed significantly more often to the opposite side (64.2%, 70 of 109) than to the asymmetrical nostril (35.8%, 39 of 109) with almost the same degree of deviation (4.4°–4.5°) (SED = 6.5, Diff. 28.4).

Deviated columellae were found in all moderate (8), in 61.9% of severe (13 of 21) and in 56.8% (88 of 155) of mild nostril asymmetries. The greatest average deviation of 8° (range 2°–12°) was recorded on the side of the affected nares in the severe form.

NASAL BRIDGE

Deviation of the nasal bridge was the third most frequent sign of the asymmetrical nares (40.8%, 75 of 184) after columella deviation and asymmetry in lengths of the columella. The nasal bridge was directed significantly more often to the side of nostril asymmetry (58.7%, 44 of 75) than to the opposite side (37.3%, 28 of 75) (SED = 8.0, Diff. 21.4). Deviation was slightly greater to the affected nostril (4.3°) than to the contralateral side (3.3°).

Deviation of the nasal bridge was found in smallest percentage in the mild forms (37.4%, 58 of 155), more frequently in moderate (62.5%, 5 of 8) and severe degrees of asymmetry (42.9%, 9 of 21). The extent of deviation was similar in all forms (about 4°).

QUALITY CHANGES (TABLE 3)

Nostril asymmetries included a combination of

1. nares of different types, found in 6.8% (89 of 1312) of the population and in almost half of all nostril asymmetries (89 of 184);
2. nares of different sizes, recorded in 7.2% (95 of 1312) of the population and in over half of nostril asymmetries (95 of 184).

In mild forms, asymmetries of the nostrils were slightly more often caused by differences in size (80 of 155) than in type (75 of 155). This size-type relationship becomes significantly more frequent in moderate forms (size: 6 of 8, Type: 2 of 8; SED = 21.7, Diff. 50). In severe forms nostril asymmetries caused by combinations of types (12 of 21) prevailed over size-asymmetries (9 of 12) although insignificantly.

Size-asymmetries were found in a significantly higher percentage in males (61.1%, 58 of 95) than in females (38.9%, 37 of 95) (SED = 7.1, Diff. 22.2), contrary to the type-asymmetries which exhibited insignificant difference between females (49 of 89) and males (40 of 89). Both variations of nostril asymmetries were significantly more frequent in older than in younger age groups (Table 4).

Asymmetry in configuration of alae (Table 3), either flat, angled or more curved on one side, was found in less than one-fifth of all nostril asymmetries (36 of 184). They bordered the asymmetrical nostril in a significant majority (77.8%, 28 of 36) in comparison with the opposite side (22.2%, 8 of 36) (SED = 9.8, Diff. 55.6). Ala shape asymmetries were reported in slightly more males (19) than females (17), and significantly more often around the left (77.8%, 28 of 36) than the right nostril (22.2%, 8 of 36) (SED = 9.8, Diff. 55.6). Older individuals had more ala shape asymmetries (20 of 36) than younger subjects (16 of 36) (Table 4).

Flattening of the ala on one side was the most frequent ala shape asymmetry (22 of 184), followed by angled ala (12 of 184) and more curved ala (2 of 184).

Discussion

Searching for microforms of anomalies in any part of the human body postulates a perfect knowledge of normal variations, assessed both quantitatively and qualitatively, in a representative sample of healthy population. Controversies in determining the nasal microform of cleft lip/palate anomaly are caused by a lack of objective criteria (Mills et al., 1968). Evidently, surface measurements are not the only way in detection of minor defects, but represent a definite progress in this effort.

Studies reporting a high percentage of nostril asymmetries in healthy populations were carried out on relatively small samples. The criteria for nostril asymmetries were general and subjective when judged visually (Mills et al., 1968), but not even the measurements of

TABLE 3. Qualitative Changes of Soft Nose in 1312 Healthy North American Caucasians 6 to 18 Years of Age

Qualitative Signs		*Degree of Asymmetry*			*Total (184)*		*Differences (Standard Error of Difference)*
		Mild (155)	*Moderate (8)*	*Severe (21)*			
Change	*Quality*	*N*	*N*	*N*	*N*	*%*	
Nostril Asymmetry	Type	75	2	12	89	48.4	*In moderate forms:* Significantly more size than type asymmetries of nostrils; S.E.D. = 21.7, Diff. 50.
	Size	80	6	9	95	51.6	
	Total	155	8	21	184	100.0	
Ala Shape Asymmetry	Flat	17	1	4	22	12.0	
	Angled	11	—	1	12	6.5	
	More Curved	1	1	–	2	1.1	
	Total	29	2	5	36	19.6	

TABLE 4. Qualitative Changes of Soft Nose by Sex and Age in 184 Healthy North American Caucasians With Nostril Asymmetries

		Asymmetry of			*Differences (Standard Error of Difference)*
		Nostril		*Ala*	
		Type	*Size*	*Shape*	
		N	*N*	*N*	
Sex	Male	40	58	19	Significantly more males with size asymmetry: S.E.D. = 7.1, Diff. 22
	Female	49	37	17	
	Total	89	95	36	
Age (Years)	6–11	36	28	16	Significantly more type and size asymmetries of nostrils in older age groups; Size: S.E.D. = 6.6, Diff. 41; Type: S.E.D. = 7.4, Diff. 19.2
	12–18	53	67	20	
	Total	89	95	36	

nostril length and width taken on photographs (Pashayan and Fraser, 1971) could accurately establish a nostril asymmetry.

Measurements of all areas of the soft nose revealed those structures which contributed most in creating and influencing the degree of asymmetry. Unilateral changes in the thickness of the lower terminal portion of ala, as seen in our population sample (0.8%, 10 of 1312) offer some explanation for the finding of "highly located" alar bases (2.6%) in healthy Bohemians (2270, Tolarová et al., 1969). In that study the frequency of lower located alar bases was shown to be twice (4.8%) that of our study (2.1%, 28 of 1312). In the Bohemian study the "highly located" alar base was reported more often on the right, while the downward shifting of the base was reported more on the left. Both variations were found more frequently in females. In our study both alar base variations were seen more often on the right side, but were distributed equally between the sexes. The discrepancy in statistics can be explained by the fact that visual examination of Bohemian subjects was less accurate and age groups were markedly varied from our own.

Some metric findings of severe nostril asymmetry, i.e. narrower nasal floor or deviation of the nasal bridge to the opposite side than the nostril asymmetry, do not seem to fit into the expected picture of the cleft lip/palate microform. The intention of this paper was to show the variety of nostril asymmetries in normal population accompanied with metric data. Which of these measurements will be the most important in order to define the microform is not known at this time; it will become evident after a detailed anthropometrical study of noses of the non-cleft members of cleft families. In the meantime, the only criteria we had was the verbal description of microform of cleft and its photographs published in the works of Fukuhara and Saito, 1963, and Tolarová et al., 1971. The similarity in configuration of noses in our study and those studies, and the small frequency of severe nostril asymmetries in healthy population (1.6%, 21 of 1312) advocate the acceptance of them as the most serious manifestations of normal variations; *in order to accept them as microforms*, further investigation would be necessary as mentioned above.

Our hope is that this publication will encourage similar studies in families of cleft lip/palate patients with the final goal being the production of objective signs of the cleft lip/palate microform.

Conclusions

1. Eight surface measurements and 2 qualitative signs of the nose were used to establish three classes of nostril asymmetries in 1312 healthy North American Caucasians, ranging in age from 6 to 18 years.

2. 88.6% of all nostril asymmetries (163 of 184) were recorded as normal variations (mild and moderate forms).

3. Nostril asymmetry of severe degree was found in 1.6% and consisted of changes in alar base location, nasal floor, columella and nasal bridge. This type of asymmetry was remindful of microform of cleft lip/palate anomaly.

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