

# Anthropometric anatomical and morphological nose widths in Canadian Caucasian adults

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The ratio of morphological (bilar diameter [al-al]):anatomical (alar base width [ac-ac]) nose width defines the quality of the soft nose contours. Quantitative data on ac-ac and its relationship to al-al, and the relationship of both nose widths to face width (bizygomatic diameter) have not been available in the literature. To correct this, the anatomical and morphological widths of the nose were measured anthropometrically in an ethnically mixed group of 120 healthy, young adult, Caucasian Canadians, and the ratios of nose widths:face width (which greatly influences nasofacial harmony in the frontal view) calculated. In 80% of subjects, the morphological (classical) nose width was larger than the anatomical nose width, which has close contact with the underlying skeleton. Mean nose width was 24.9% (ac-ac) and 26.1% (al-al) of the face width. This study may help in the corrective surgery of disproportions between the two nose-width measurements in patients with cleft lip nose, and in the restoration of harmony between the nose and face widths.

**Key Words:** *Anthropometry, Nasal width measurement, Nasofacial harmony*

## **Largeur anthropométrique, anatomique et morphologique du nez chez les adultes canadiens de race blanche**

**RÉSUMÉ :** Le ratio entre la largeur morphologique (diamètre bialaire [al-al]) et anatomique (largeur de la base alaire [ac-ac]) du nez définit la qualité des contours de la partie souple du nez. Les données quantitatives sur le ratio ac-ac et son rapport avec le ratio al-al, de même que le lien de ces deux mesures du nez par rapport à la largeur du visage (diamètre bizygomatique) sont inexistantes dans la littérature. Pour corriger cette lacune, les largeurs anatomiques et morphologiques du nez ont été mesurées anthropométriquement chez un groupe d'origines ethniques diverses de 120 jeunes adultes canadiens de race blanche et on a calculé les rapports largeur du nez:largeur du visage (qui influe considérablement sur l'harmonie nasofaciale vue de face). Chez 80 % des sujets, le nez morphologique (classique) était plus large que le nez anatomique, ce qui est en proche corrélation avec le squelette sous-jacent. La largeur moyenne du nez était de 24,9 % (ac-ac) et de 26,1 % (al-al) par rapport à la largeur du visage. Cette étude pourrait être utile à la chirurgie correctrice des disproportions entre deux mesures de largeur du nez chez des patients qui présentent une fessure labiale et dans les chirurgies visant une meilleure harmonie entre les largeurs du nez et du visage.

In physical anthropology, the bilar diameter (al-al) of the nose has long been accepted to be the width of the soft nose (1). Anthroposcopic examination of children with repaired unilateral or bilateral cleft lip and palate has revealed noticeable disproportions between the width of the nose and the width of the face. Disharmonies have also been observed between the alar base width (ac-ac) measured between the facial insertions of the alar bases and the classical al-al of the soft nose (2). These anthroposcopic findings motivated us to assess quantitatively ac-ac and its relationship to al-al, as

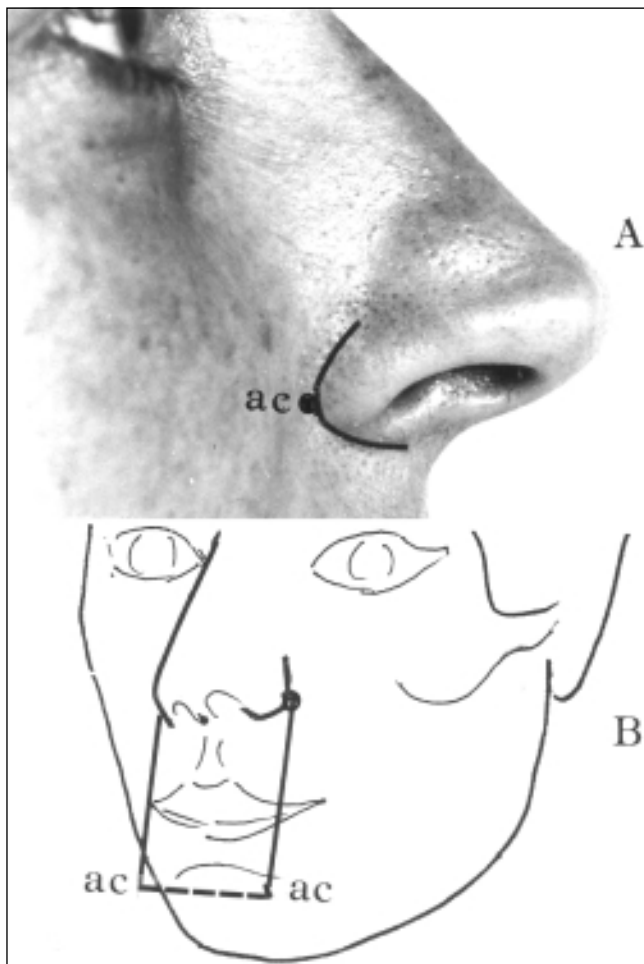
well as the relationship of both nose-width measurements to face width (bizygomatic diameter [zy-zy]). Such quantitative data have not been available in the literature.

The aim of this study was to quantify and report the differences between al-al and ac-ac measurements in healthy young adult Caucasian Canadians, the proportion between the width of the face and both nasal width measurements, and sex-related differences in the findings.

## **SUBJECTS AND ASSESSMENT METHODS**

The study group consisted of 120 healthy adult Caucasian Canadians (60 males and 60 females, 18 to 40 years of age) of mixed ethnic origin – Anglo-Saxon (38%), Latin (29%), Slavic (16%), German (5%) and people of miscellaneous ethnic origin (12%).

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**Figure 1** A The ala crest point (*ac*), the most lateral spot on the curved base line of the ala (the facial point of the ala). B The anatomical width of the nose (the alar base width)

**Definitions**

The *anatomical width* of the nose (*ac-ac*) is the linear projective distance measured between each ala crest point located at the most lateral spot of the curved baseline of the ala (Figure 1A,B) and is regarded as the facial insertion points of the alae (3).

The *morphological width* of the nose (*al-al*) is the classical soft nose width (1) measured between the most lateral point on the curved surface of each ala (Figure 2A).

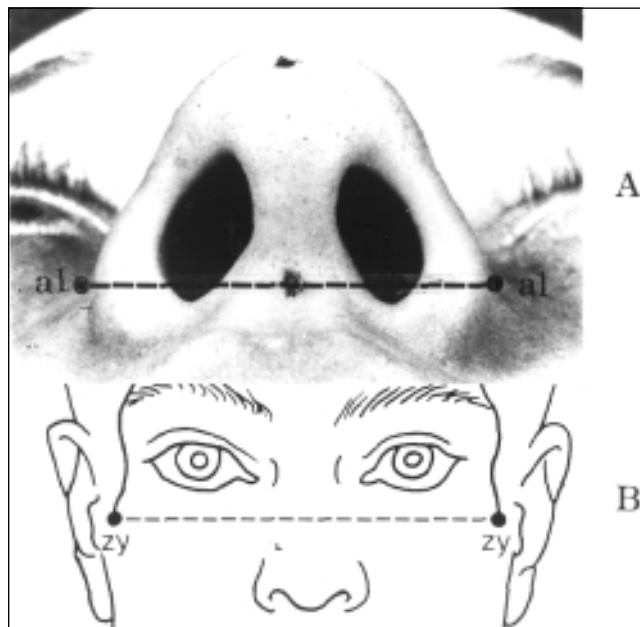
The *face width* or upper face width (*zy-zy*) is the linear projective distance measured between the zygions of the zygomatic arch, indicating the widest part of the face (Figure 2B).

The *nasofacial index* expresses the nose width (*ac-ac* or *al-al*) as a percentage of the face width.

Mean *numeric difference* is calculated from the difference between the nose width measurements *ac-ac* and *al-al* for each individual.

**Anthropometric technique**

Measurements were taken by one of the authors with a sliding caliper for the nose width measurements and a spreading caliper for the face width. Findings were recorded in millimetres.



**Figure 2** A The alare (*al*), the most lateral points on the curved surface of the alae. The morphological width of the nose is the bialar diameter. B The (upper) face width is the bizygomatic diameter. *zy* Zygion

**Statistical analysis**

Student's *t* test was used to analyze the nose width measurements. Statistical significance was mild ( $P=0.05$ ), moderate ( $0.01 < P < 0.02$ ) or severe ( $P \leq 0.001$ ) (4). Variations between *ac-ac* and *al-al* measurements were expressed in percentages and analyzed by standard error of difference (5).

**RESULTS**

**Nasal width measurements**

The mean value of the anatomical nose width was severely significantly smaller than the morphological mean (Table 1). Sex-related differences between the anatomical (*ac-ac*) and morphological (*al-al*) nose widths also reached severely significant levels, with smaller anatomical width measurements in both men and women.

In four-fifths of the individuals studied, the anatomical nose width (*ac-ac*) was smaller than the morphological width (*al-al*) (Table 2). In nine subjects, the anatomical nose width was mildly larger than the morphological nose width; in 15, the two measurements were identical. Statistical analysis revealed significant differences between the frequency of having an anatomical width narrower than the morphological width versus either of the other two variations. The difference in frequency between individuals having an anatomical width wider than or equal to the morphological width was not significant.

**Nasofacial index variations in the study group**

Nose width calculated as a percentage of face width was smaller when calculated with the anatomical nose width (24.9%) than when calculated with the morphological nose width (26.1%).

## DISCUSSION

A harmonious relationship between the soft nose width and face width is one of the requirements of a well balanced face. A close relationship between the soft nose width and the underlying facial skeleton was suggested in the last century (6,7). Later, the apertura piriformis was proclaimed as the main factor influencing the size of the soft nose (8-10). The importance of the ac-ac measurement was emphasized in corrective surgery (11). The influence of the location, shape and size of apertura piriformis on the positions of facial insertion points of the alar bases was better understood during the anthropometric analysis of patients with cleft lip nose deformity (2). Because the soft nose width (al-al) is influenced only secondarily, via the anatomical nose width (ac-ac), by the bony skeleton, the morphological nose width is a more appropriate term for al-al.

Our study showed that the mean anatomical width measurement was significantly smaller (Table 1) than the morphological width, and markedly more frequently so (Table 2). The mean difference between the two nose widths was mild, but the range was relatively wide (Table 2). In males, both nasal measurements were severely significantly larger ( $P \leq 0.001$ ) than in females (Table 1).

Variations between the positions of the alar base facial insertions and the alar points of al-al could be caused by the variations in the size of apertura in a healthy population reported by Saksena (12). Such variations in apertura size can be expected in children with cleft lip palate with varying width of the cleft in the alveolar process. The varying degree of cleft leads to the various types of cleft lip nose in children after lip repair.

In the study group, the ratio of anatomical nose width (ac-ac): face width revealed slightly smaller values, as in the neo-classical nasofacial canon (al-al equals one-quarter zy-zy) (13), which was originally established for al-al. When al-al was used, the nasofacial index was larger than the classical canon value. In clinical practice, we recommend that both proportion indexes be determined.

A detailed facial anthropometric examination will help the plastic surgeon discover the disharmonies or disproportions between the two main width measurements of the soft nose, which is important for restoration of harmony within

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TABLE 1

Quantitative differences between anatomical and morphological nasal width measurements in Caucasian, young adult, Canadian males and females

Study subjects	n	Nose width (mm) (mean±SD)		P
		Anatomical (ac-ac)	Morphological (al-al)	
All subjects	120	33.3±3.4	34.9±3.4	0.003*
Males	60	35.0±3.0	36.9±2.8	0.0001 <sup>†</sup>
Females	60	31.6±2.8	32.9±2.7	

\*Statistical difference in mean nose widths between anatomical and morphological measurements was severely significant; <sup>†</sup>Statistical difference between males and females (anatomical or morphological) was severely significant. ac-ac Alar base width; al-al Bialar diameter

TABLE 2

Frequencies of variations in width relationships between anatomical (alar base width [ac-ac]) and morphological (bialar diameter [al-al]) nose width measurements and their numeric differences in the individuals studied

Variation	n	%	Numeric difference (mm)	
			Mean	Range
ac-ac = al-al	15	12	0	
ac-ac > al-al	9	8	1.5	1 to 2
ac-ac < al-al	96	80	1.8	1 to 6
All subjects	120	100	1.8	1 to 13

The differences between ac-ac < al-al and ac-ac = al-al (by standard error of difference [SED] = 12.3, difference 67.5) and between ac-ac < al-al and ac-ac > al-al (SED=9.6, difference 72.5) were statistically significant

the soft nose's framework. It is equally essential to determine the quality of relationship between the face width and each of the two nose width measurements. These proportion index values help to calculate the changes required to eliminate any visually striking horizontal disproportion between the nose and the face width.

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