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Acoustic rhinometry of the Indian and Anglo-Saxon nose*

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SUMMARY

The internal and external geometry of the nose has previously been shown to differ between Anglo-Saxon, Chinese, and Negro noses. It is therefore important to define the normal geometric nasal parameters of a given race, so as to detect the abnormal nose. We present acoustic rhinometric data, with height-adjusted figures, examining the nasal minimum cross-sectional area (MCA), the distance to the nostril from the MCA, and the MCA between 0-6 cm. These data show no significant differences between Indian and Anglo-Saxon noses.

Key words: acoustic rhinometry, race, Anglo-Saxon, Indian

INTRODUCTION

The term Caucasian is defined as being of Indo-European origin in The Oxford English Dictionary. This may imply a common ancestry between the two peoples and, if true, this would suggest that their physical parameters could be similar. There are usually considerable differences in the internal and external geometry of the nose between ethnic races. This is evident from both cephalometric and rhinomanometric studies (Williams, 1957; Hillberg et al., 1989; Calhoun et al., 1990). It is therefore important to establish the normal parameters specific to a given race, so as to identify the "abnormal" nose. The technique of acoustic rhinometry is increasingly being used for research and as a clinical tool to assess the efficacy of rhinological treatment. A recent study at the Royal National Throat Nose & Ear Hospital (Morgan et al., 1995) describes racial differences in terms of internal nasal geometry dimensions using acoustic rhinometry, a technique introduced by Hillberg et al. (1989) which has proved useful for assessment of the nasal cavity. This work established the "norm" for Chinese, Africans and Anglo-Saxons. Here, we present a comparison between Indian and Anglo-Saxon noses in terms of height, external nasal dimensions and acoustic rhinometry.

MATERIAL AND METHODS

Subjects

Twenty Indian adults were compared with 20 Anglo-Saxon adults. For the purpose of this study, we define the Indian race as the indigenous population of the Indian subcontinent or their direct descendants. Each subject was rhinologically asymptomatic and clinically normal. The age range of volunteers entered into the trial was 18-62 years. There was an equal sex mix in each racial group.

Methods

A full medical history was taken from each subject; any person with a history of rhinological symptoms or who had undergone previous nasal surgery was excluded from this investigation. The nose of each subject was examined by anterior rhinoscopy and with a 4-mm 0° Hopkins' nasal endoscope. Any patient in whom anatomical or pathological abnormalities were detected was also excluded from the study.

External measurements of the nose were taken with engineers' measuring callipers. Each measurement was repeated and confirmed. The parameters assessed were: (1) nasal width; (2) height; (3) length; and (4) the nostril aperture. The subject's height, weight, sex and age was recorded in each case. Acoustic rhinometry was then performed, using an ECCOVISION Acoustic Rhinometer (model AR-1103; Hood Laboratories, Pembroke, MA, USA). Silastic nosepieces were used and were selected for each individual according to the size and shape of the nose. Care was taken to establish a good hermetic seal and to avoid any distortion of the nostrils. Ten stable measurements were made and the mean and standard deviation were ealeulated. Two puffs of 0.1% xylometazoline metered-dose nasal spray were then introduced into each nostril. After 10 min, acoustic rhinometry was repeated. Statistical analysis was performed on a microcomputer using software packages; Statgraphics (Statgraphics Corp., release 2.6) and Arcus ProStat (Medical Computing, DOS version 3).

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The main parameters within the nasal cavity analysed were minimal cross-sectional area (MCA), the distance at which this occurred (D), nasal volume from 0–4 cm^3 (V), mean cross-sectional area at 0 and 1–6 cm (MA), and the cross-sectional area at 10 points in the nose (0–6 cm in 5-mm incremental steps) analysed as a series (A), as shown in Figure 1. Mean measurements from left and right nostrils were used (n = 20 for each group). Multiple linear regression, with a stepwise technique, was used to evaluate the effect of the various population characteristics on each parameter. For the series A, multifactorial analysis of variance was used with area by distance as the main variable and sex, race and congestion states as factors. Subsequent positive findings were then further examined by Scheffe multiple-range testing. Confidence intervals were assessed by grouped linear regression and co-variance analysis. Significance at the 5% level was deemed acceptable. The nasal index data was subjected to a modified t-test, with significance assessed at the 5% level.

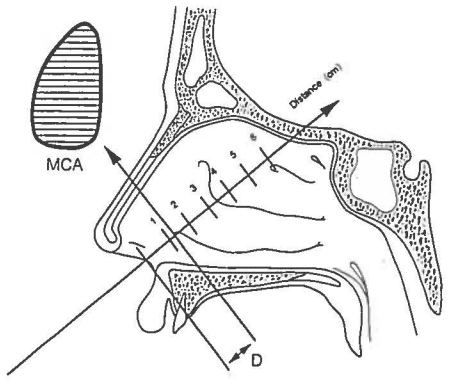

Figure 1. Diagram to show the minimum cross-sectional area (MCA), distance to the MCA, and mean cross-sectional area (MA) at 0–6 cm.

RESULTS

The two groups studied were well-matched for weight and age (Table 1). The difference in mean average height of the two groups was significant and was the only parameter which correlated with external nasal dimension (for uncorrected data, see Table 2a and Figure 2). Accordingly, a correction factor was used to adjust the two study populations to a standard height of 1.68 m, enabling direct comparison between the two groups (for corrected data, see Table 2b and Figure 3).

It can be seen from Table 2c and Figures 3–4 that there are no significant differences between the two study groups in terms of their internal nasal geometry, as expressed by the MCA, distance to the nostril from the MCA, and the mean cross-sectional area between 0–6 cm, excepting the measured volume of the nasal cavity at 4 cm^3 which is significant (p=0.02).

Table 1. Population characteristics in terms of age (years), weight (kg), and height (m). The data are expressed as mean±SD.

	Anglo-Saxon	Indian
age	33±10	39.1±12
weight	70±13	63±13.6
height	1.7±0.1	1.66±0.1

Table 2a. Uncorrected data monitoring acoustic rhinometry results (MCA: minimum cross-sectional area (cm^2); D: distance from nostril to MCA (cm); Vol: volume of the segment 0-4 cm (cm^3); MA: mean cross-sectional area at 0-6 cm (cm^2); suffix d: values recorded in the decongested nose). The data are expresed as mean±SD.

	Anglo-Saxon	Indian
MCA (sample mean/cm^2)	0.71±0.15	0.70±0.16
MCA.d (sample mean/cm^2)	0.77±0.16	0.76±0.22
D (sample mean)	1.16±0.69	1.34±0.63
D.d (sample mean)	0.99±0.51	1.07±0.52
Vol (sample mean)	4.70±0.83	4.52±1.14
Vol.d (sample mean)	5.59±0.71	4.88±1.21
MA (sample mean)	1.46±0.32	1.46±0.35
MA.d (sample mean)	1.77±0.25	1.58±0.40

Table 2b. Acoustic parameters with corrected means and population estimates, means adjusted to standard height of 1.68 m (c.i.: 95% confidence intervals for estimate of adjusted population mean). For abbreviations and definitions, see Table 2a.

	Anglo-Saxon	Indian
MCA:		
corrected mean	0.70	0.70
c.i.	0.67-0.77	0.63-0.77
MCA.d:		
corrected mean	0.76	0.77
c.i.	0.69-0.84	0.69-0.85
D:		
corrected mean	1.12	1.37
c.i.	0.84-1.41	1.10-1.66
D.d:		
corrected mean	0.96	1.09
c.i.	0.74-1.19	0.87-1.32
Vol:		
corrected mean	4.69	4.52
c.i.	4.23-5.15	4.06-4.96
Vol.d:		
corrected mean	5.55	4.83
c.i.	5.08-6.02	4.36-5.30
MA:		
corrected mean	1.46	1.46
c.i.	1.36-1.62	1.30-1.61
MA.d:		
corrected mean	1.75	1.59
c.i.	1.60-1.90	1.44-1.74

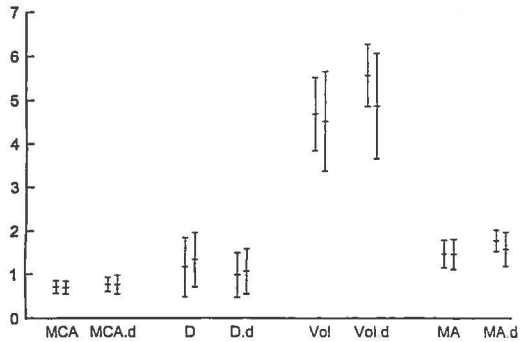

Figure 2. The acoustic parameters as presented in Table 2a, expressed as mean results±SD (Anglo-Saxon noses on left; Indian noses on right).

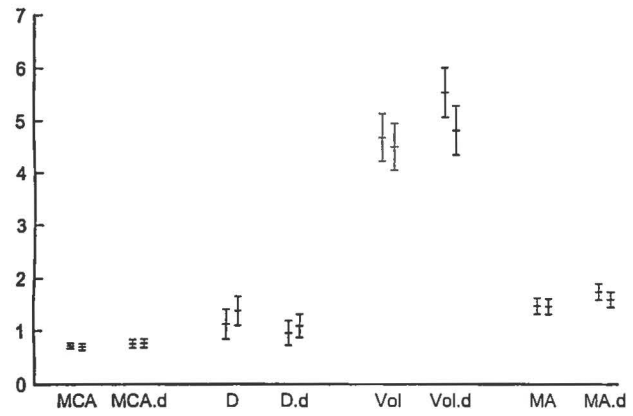

Figure 3. The acoustic parameters as shown in Table 2b, expressed as mean results±95% confidence intervals (Anglo-Saxon noses on left; Indian noses on right).

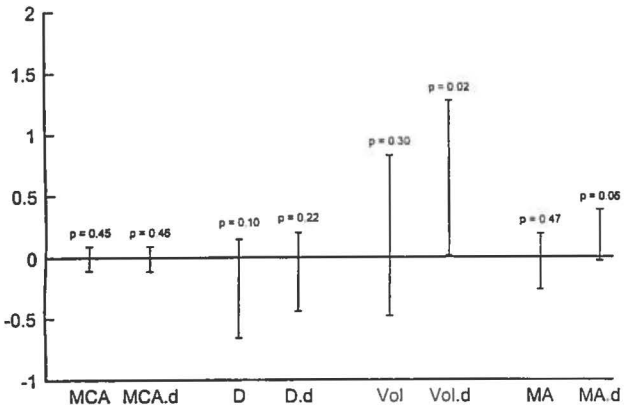

Figure 4. Acoustic parameters showing differences between corrective means±95% confidence intervals from Table 2c.

Table 2c. Differences between corrected means (c.i.: 95% confidence intervals for the difference in adjusted population means; p: probabilty of two samples coming from the same population). For abbreviations and definitions, see Table 2a.

	Anglo-Saxon versus Indian
MCA:	
c.i.	-0.10 to 0.09
p	0.45
MCA.d:	
c.i.	-0.11 to 0.09
p	0.46
D:	
c.i.	-0.66 to 0.15
p	0.10
D.d:	
c.i.	-0.44 to 0.20
p	0.22
Vol:	
c.i.	-0.48 to 0.83
p	0.30
Vol.d:	
c.i.	0.02 to 1.28
p	0.02
MA:	
c.i.	-0.26 to 0.19
p	0.47
MA.d:	
c.i.	-0.03 to 0.39
p	0.06

DISCUSSION

The racial origin of mankind can be predicted by the external shape of the nose, as defined by the nasal index, which is a ratio of nasal width to height (Topinard, 1879; Williams, 1957). This was thought by Williams (1957) to be the most useful test for distinguishing between ethnic races. Cottle (1953) stressed the use of the nasal index as a tool in the diagnosis and evaluation of rhinological problems. Calhoun (1990) suggested that as nasal shape and size varies with different racial groups, then it follows that different normal ranges would be appropriate in such racial groups. In fact, Calhoun (1990) found no difference in the rates of nasal air flow or resistance parameters between Negroes and Caucasians using rhinomanometry. In a previous study at this Institution (Morgan et al., 1995), distinct differences in nasal cavity geometry, as measured by acoustic rhinometry, were demonstrated between Anglo-Saxon, Oriental, and Negro adults. This included measurements of the MCA, the distance from the nostril to this area, the volume of the segment 0–4 cm^3, and the mean cross-sectional area between 0–6 cm (Haight and Cole, 1983). In this study, with comparable data for Caucasians, we have shown that there is no difference between Indian and Anglo-Saxon nasal geometry, in terms of MCA, distance to the nostril from the MCA, and the mean cross-sectional area between 0–6 cm. The volume at 0–4 cm is significantly different between the two groups. This could be a genuine racial characteristic, but more likely the similarity of the MCA at 0-6 cm between the two groups suggests it may be artifactual and could reflect the small sample size. The data presented shows little difference between Anglo-Saxon and Indian noses, and that no correction apart from height need be applied to data from Indian patients. In 1878, Topinard compared the cephalic index, derived from the ratio of the maximum anterior-posterior length to the maximum width, of Indian and Anglo-Saxon skulls. These anthropomorphic data revealed no differences in the cephalic index between four Indian groups - that is, from peoples of Assam, Southern Himalayas, Central India and The Coromondal Coast, who represent the major subgroups of India - and the European group (Topinard, 1879; Coon, 1963). Such findings concur with our data on nasal geometry and further indicate a possible common ancestral origin between the two peoples.

CONCLUSION

There are differences between Anglo-Saxon, Negro and Chinese noses in terms of acoustic rhinometry and external nasal parameters which would require different normal ranges to interpret acoustic rhinometric data. However, data from Anglo-Saxon and Indian noses would appear to be similar and thus requires no corrections.

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