

## **A 3D soft-tissue study of the human external nose region from childhood to old age**

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The external nose is one of the body structures that continue to modify and enlarge throughout life, well beyond the attainment of skeletal maturity. The objective of the current study was to measure: 1. normal sex-related dimensions of external nose (linear distances, ratios, angles, volume and surface area); and 2. growth changes between childhood and old age.

The 3D coordinates of several soft-tissue landmarks on the external nose were obtained by a non-invasive, computerized digitizer in 519 male and 340 female healthy subjects aged 4-73 years. The subjects were divided into 11 non overlapping age groups. From the landmarks, nasal volume and external surface area; nasal and alar base widths, nasal height, nasal bridge length, philtrum length, nasal tip protrusion, right and left nostril lengths, superior and inferior nostril widths; nasal tip protrusion-to-nasal height, and nasal width-to-nasal height ratios; nasal convexity, alar slope, and nasal tip angles were calculated, and averaged for age and sex. Comparisons were performed by factorial analysis of variance.

On average, men had larger nasal external volume and area, linear distances and nasal width-to-height ratio than women ( $p < 0.01$ ); no sex differences were found for the angles and the nasal tip protrusion-to-nasal height ratio. Age significantly influenced all analyzed measurements ( $p < 0.001$ ): nasal volume, area, linear distances increased from childhood to old age, while the nasal tip angle decreased as a function of age. No consistent age-related patterns were found for the ratios and the nasal convexity and alar slope angles. Men and women had different age-related patterns, with significant sex by age interactions ( $p < 0.001$ ). Overall, in most occasions male increments in nasal dimensions were larger than female ones.

Data collected in the present investigation could serve as a data base for the quantitative description of human nasal morphology during normal growth, development and aging. Forensic applications (evaluations of traumas, craniofacial alterations, teratogenic-induced conditions, facial reconstruction, aging of living and dead persons, personal identification) may also benefit from age- and sex- based data banks.

Key words

Digital anthropometry, nose, man, growth, aging