Gender Variations in Frontal Sinus Anatomy, as Determined by Computed Tomography: Implications for Cranioplasty and Sinus Surgery

Matthew K. Lee, BA1; Osamu Sakai, MD, PhD2; Jeffrey H. Spiegel, MD, FACS1
1Department of Otolaryngology – Head and Neck Surgery, Boston University School of Medicine
2Department of Radiology, Boston University School of Medicine

ABSTRACT

Surgery in and around the frontal sinus is utilized for a variety of indications including trauma, neoplasm, and sinusitis. Additionally, alteration in the appearance of the frontal bone / anterior skull may be sought by patients for cosmetic reasons, such as those seeking to reduce undesired facial masculinity.

Regardless of the indication for bony surgery of the frontal bone / anterior skull, knowledge of the anatomy of the frontal sinus is essential in best preparing the surgeon to achieve the desired cosmetic goal without precipitating untoward events. The goal of this study was to expand upon the current base of anatomical knowledge by quantifying gender variations in frontal sinus and forehead anatomy through the use of computed tomography imaging.

INTRODUCTION

This is a computer-assisted anatomical measurement study utilizing existing maxillofacial computed tomography (CT) studies performed at our institution. Consecutive one hundred male and fifty female (a total of 150 patients) who underwent maxillofacial CT between the dates of 1/1/2008 and 6/11/2008 were enrolled in this study.

All CT studies were performed by 64 multidetector-row CTs (Lightspeed, VCT, GE Medical Systems, Milwaukee, WI). Contiguous axial 1.25 mm thick slices were obtained through the maxillofacial bones, and all CT measurements were made on bone algorithm reconstructed and bone windowed images using an independent workstation (GE Advantage Windows, GE Medical Systems, Milwaukee, WI).

Frontal sinus dimensions and forehead measurements were taken at midline and at 10, 20, and 30 mm to the left and right of midline using sagittal, coronal, and axial images. These measurements are illustrated in Figures 1, 2, 3, and 4. The data was analyzed for significant differences between measurements made at the selected points in the frontal sinus, for left to right variations, and for gender variations.

For continuous variables, Student’s t-test analysis was used. Fisher’s exact test was used to assess for gender difference in the frequency of frontal sinus protrusion past the ideal slope line.

RESULTS

Mean anterior table thickness ranged from 2.6 to 4.1 mm and was thinnest at 10 mm left and right of midline (2.9 and 2.6 mm). Mean anteroposterior depth of the frontal sinus ranged from 8.0 to 9.3 mm and did not vary significantly at any distance from midline. Frontal sinus height was greatest at midline (mean = 24.5 mm) and progressively lessened at lateral distances. Mean total width at the level of the supraorbital ridge was 52.2 mm. For all measurements, no significant left to right variation was noted. Comparing between genders, males were found to have greater dimensions in most frontal sinus measurements, though these differences were only found to be significant at or close to midline. The male forehead was marked by more acute nasofrontal angle (119.9° versus 133.5°) and a steeper posterior forehead inclination (-7.2° versus -3.5°). The glabella was wider in males (44.4 versus 33.9 mm) and more frequently protruded beyond the ideal forehead slope line (51% vs. 30%).

CONCLUSIONS

Our study has confirmed many of these findings in addition to providing further data on the three-dimensional anatomy of the frontal sinus. Importantly, our study quantifies and supports the concept of a prominent glabella as a distinctively masculine trait. Statistically significant gender variations in the supraorbital ridge were only found at or close to midline, in the area identified as the glabella. Here, males clearly possessed a more prominent forehead features as measured by the greater thickness of the anterior table, deeper anteroposterior dimensions, and a wider and more anteriorly protruding glabella.

REFERENCES