ISSN: 0976-3031

Available Online at http://www.recentscientific.com

CODEN: IJRSFP (USA)

International Journal of Recent Scientific Research
Vol. 8, Issue, 9, pp. 19867-19870, September, 2017

International Journal of Recent Scientific Research

DOI: 10.24327/IJRSR

Research Article

STUDY OF FRONTAL SINUSES IN CBCT

Shamshad Begum., Gaurav Kataria and Neha Sharma

Sh Shiv Kumar VPO Lohian Khas Distt Jalandhar Punjab 144629

DOI: http://dx.doi.org/10.24327/ijrsr.2017.0809.0776

ARTICLE INFO

Article History:

Received 06th June, 2017
Received in revised form 14th July, 2017
Accepted 23rd August, 2017
Published online 28th September, 2017

ABSTRACT

Frontal sinuses are air filled cavities which are mostly paired and lobulated in shape. They are located posterior to the superciliary arches in between the two bony tables of frontal bone. They are usually symmetrical, with septum between both. Sometimes one or both sinuses may be missing. Frontal sinuses are usually absent at the time of birth, starts developing at the second year of life and reaches full size at second decade of life.1 Belaldavar C *et al* (2014)2 determined that the development of the frontal sinus is completed by the age of 20 years and after that remains stable until bone resorption occurs during advanced age which may lead to increase in size. Schuller (1921)3 first studied frontal sinus and revealed information about its uniqueness in shape, complexity and individuality which plays an important role in human identification. The correlation of morphology of frontal sinus in accordance with age shows smaller sized sinus in women. CBCT is a reliable tool in the assessment of the anatomical structures in detail with their accurate measurements. The latest CBCT units have a higher resolution, lower exposure, are less expensive and faster imaging accompanied by fewer problems of geometric distortion.4 This radiographic modality can be used in understanding the sinuses anatomy. The aim of this study is to evaluate the reliability of Cone Beam Computed Tomography in order to identify gender and age of individual.

INTRODUCTION

Frontal sinuses are air filled cavities which are mostly paired and lobulated in shape. They are located posterior to the superciliary arches in between the two bony tables of frontal bone. They are usually symmetrical, with septum between both. Sometimes one or both sinuses may be missing. Frontal sinuses are usually absent at the time of birth, starts developing at the second year of life and reaches full size at second decade of life.[1] Belaldavar C *et al* (2014)[2] determined that the development of the frontal sinus is completed by the age of 20 years and after that remains stable until bone resorption occurs during advanced age which may lead to increase in size.

Schuller (1921)[3] first studied frontal sinus and revealed information about its uniqueness in shape, complexity and individuality which plays an important role in human identification. The correlation of morphology of frontal sinus in accordance with age shows smaller sized sinus in women.

CBCT is a reliable tool in the assessment of the anatomical structures in detail with their accurate measurements. The latest CBCT units have a higher resolution, lower exposure, are less expensive and faster imaging accompanied by fewer problems of geometric distortion.[4] This radiographic modality can be used in understanding the sinuses anatomy.

The aim of this study is to evaluate the reliability of Cone Beam Computed Tomography in order to identify gender and age of individual.

MATERIALS AND METHOD

27 patients were evaluated which comprised of 17 males and 10 females with age ranged from 14 to 68 years which was further divide into group I (<30 years), group II (30-50 years) and group III (>50 years). The CBCT examinations were made using a Kodak CS 9300 digital imaging system (Care Stream Dental LLC, Atlanta, GA, USA) and software CS 3D Imaging V3.2.9. A proper protocol was considered while taking CBCT scan of patient. The mid saggital plane was aligned perpendicular to the horizontal plane. The DICOM images were generated and converted into CS 3D Imaging V3.2.9. software. The visualization of sections in the three spatial dimensions (axial, sagittal and coronal sections) was done and each record was stored properly with patients name, age and gender. The scanwere evaluated for presence (bilateral or unilateral) or absence or hypo/hyperplasia of frontal sinus.(Fig 1)

Corresponding author:* **Shamshad Begum
Sh Shiv Kumar VPO Lohian Khas Distt Jalandhar Punjab 144629

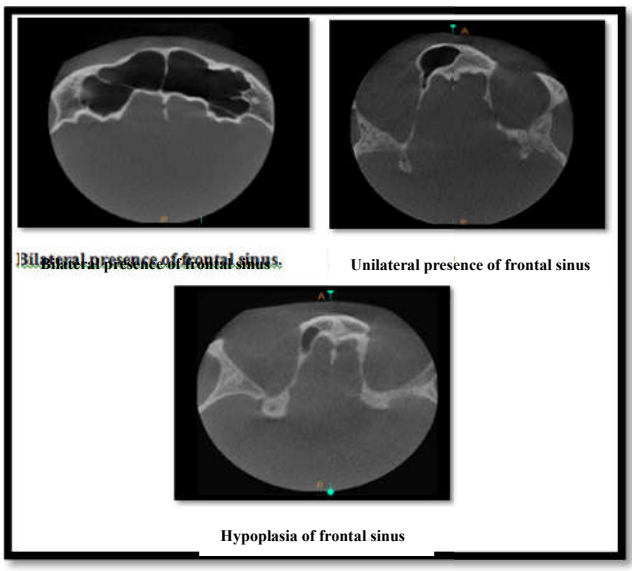

Fig 1 Presence/absence of frontal sinus

The morphometric measurements of frontal sinus was done by selecting linear measurements tool from the software and selecting reference points.(Fig 2)

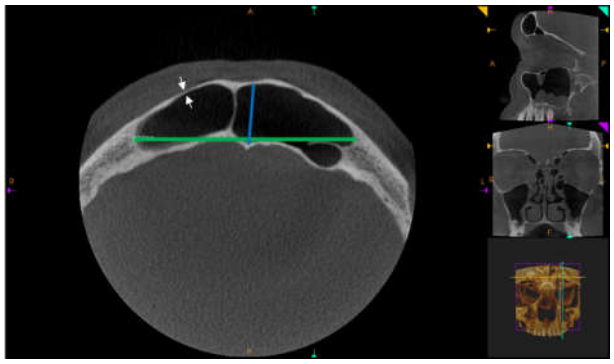

Fig 2 morphometric measurements of frontal sinus.(maximum width- green line, maximum depth- blue line, thicknessof anterior wall of frontal sinus- white arrows)

1. Maximum depth (anteroposterior dimension) of frontal sinus on the axial images was calculated at the level of the orbital roof by taking two reference points one at anteriormost aspects of sinus and another at posteriormost aspects of sinus.
2. Maximum width (mediolateral dimension) of frontal sinus was calculated at the level of the orbital roof with reference points were the most lateral limits of the sinus.
3. Area of frontal sinus.
4. The thickness of anterior wall on the axial images at the level of the orbital roof was measured.

The statistical software namely SPSS 19.0 was used to analyze the data and Microsoft excel have been used to generate graphs and tables.

RESULTS

Out of 27 subjects bilateral presence of frontal sinus was seen in 22 (81.5%) subjects amongst whom 16 were males and 6 were females. Unilateral presence was seen in 5(18.5%) subjects amongst which 1 was males and 4 were females (Table 1). Out of 5 subjects, who were having unilateral presence, 2 cases showed hypoplastic frontal sinus. By applying Chi-Square test, results were found to be statistical significant between genders (p=0.047).

Table 1 Presence of frontal sinuses among gender

GENDER	Frontal sinus		Total	p value
	Bilateral	Unilateral		
Males	16 94.1%	1 5.9%	17 100.0%	**0.047**
Females	6 60.0%	4 40.0%	10 100.0%	
Total	22 81.5%	5 18.5%	27 100.0%	

The mean depth of frontal sinus (FSD) in males was 18.888 mm (SD ±6.2126 mm) and in females was 13.420 mm(SD ±6.6954 mm). The mean mediolateral dimension of frontal sinus (FSML) in males was 57.818 mm (SD ±17.1515 mm) and in females was 32.370 mm (SD ±23.4809 mm). The mean area of frontal sinus (FSA) in males was 1105.44 mm^2 (SD ±560.84 mm^2) and in females was 532.70 mm^2 (SD ± 552.41 mm^2). The mean depth, mean mediolateral dimension and mean area of frontal sinus was significantly greater in males than females ($p<0.05$) (table 2). The mean thickness of anterior wall of frontal sinus (FSTAW) in males was 1.747 mm (SD ± 0.52mm) and in females was 2.14 mm (SD ± 0.64 mm) which was greater in females than males but not statistically significant between genders (p= 0.096).

Table 2 morphometric measurements of frontal sinus

Parameter	Gender	No. of subjects	Mean	Std. Deviation	t- value	p value
FSD (mm)	M	17	18.888	6.2126	2.14	.042
	F	10	13.420	6.6954		
FSML (mm)	M	17	57.818	17.1515	3.24	.003
	F	10	32.370	23.4809		
FSA (mm^2)	M	17	1105.4459	560.84557	2.57	.016
	F	10	532.7010	552.41862		
FSTAW(mm)	M	17	1.747	.5210	1.7	.096
	F	10	2.140	.6467		

- FSD- Frontal Sinus Depth
- FSML-Frontal Sinus Mediolateral Dimension
- FSA- Frontal Sinus Area
- FSTAW- Frontal Sinus Thickness of Anterior Wall

The mean depth of frontal sinus in group I, group II and group III was 15.725mm, 17.244 mm and 18.567 mm respectively. The mean mediolateral dimension of frontal sinus in group I, group II and group III was 41.04 mm, 51.5 mm and 58.43 mm respectively Group III had the greatest dimension than the group II followed by group I. The mean area of frontal sinus in group I, group II and group III was 771.52 mm^2, 905.98 mm^2 and 1117.9 mm^2 respectively. Group III had the greatest area than the group II followed by group I which was considered as statistically non significant among age groups. ($p>0.05$) The mean thickness of anterior wall of frontal sinus in group I, group II and group III was 2.05mm, 1.88 mm and 1.56 mm respectively. Group I had the greatest dimension than the group II followed by group III which was considered as statistically non significant among age groups. ($p>0.05$)

DISCUSSION

The uniqueness of anatomic structures and their variations can be implied for identification of deceased individuals. Matching ante mortem and post mortem records in cases of severely

mutilated bodies is an important aspect of identification. In cases of severe soft tissue destruction and where finger prints and DNA identification does not prove to be successful comparative radiological techniques are important tool. Among the all radiographic modalities, Cone Beam Computed Tomographic scans of such bodies can be used with high accuracy and precision in forensic identification as the obtained images have high resolution and better 3 Dimensional orientations.

In our study, bilateral presence of frontal sinus was seen in 22(78.6%) subjects and unilateral was seen in 5(17.9%) subjects. Similar findings were recorded by Vidya CS *et al* (2014)[5] who found out of 50 cases, bilateral presence of frontal sinus was seen 34(68%) of cases and unilateral presence in 15(30%) of cases. Another study conducted by Patil N *et al* (2012)[6] revealed 96 (96%) subjects having bilateral frontal sinus and 3(3%) having unilateral frontal sinus. In a study conducted by Raoof TM *et al* (2013)[7] anatomical variations of frontal sinus were studied among 100 individuals, 94 (94%) cases showed bilateral presence of frontal sinus, 3(3%) cases showed total absence and 3(3%) cases showed unilateral absence.

Gender wise comparison presence of frontal sinus in our study revealed, bilateral presence of frontal sinus more in males i.e. 16(94.1%) as compare to females i.e. 6(60.0%) and unilateral presence in was more in females i.e. 4 (40.0%)as compared to males i.e. 1(5.9%). This implies that females exhibits greater percentage of unilateral presence/absence of frontal sinus which was found to be statistically significant (p=0.047). These finding were in agreement with study done by Aydinliog˘lu A(2003)[8] who found unilateral absence of frontal sinus more in females (5.9%) than in males (3.8%). Another study conducted by Belaldevar *et al* (2014)[2] noticed unilateral absence of frontal sinus in 5 (3.33%) females and 2(1.3%) males. However Yoshino M (1987)[4] found unilateral absence more in males 14.3% as compared to femalesi.e.7.1% in Japanese population. Nowak R(1977)[9] also found unilateral absence of frontal sinus more in males (3.6%) as compare to females (2.8%) in German population.

Morphometric measurements of frontal sinus are useful for forensic identification as they are highly variable and even show variation among monozygotic twins. Also these measurements are relatively stable during adult life.[6.] The mean depth (anteroposterior dimension) of frontal sinus in our study was significantly higher in males as compared to females (p=0.042). Similar studies were done by Pondé J. M (2003)[10] who found significantly higher anteroposterior dimension in males then females (P<0.001). In contrast to our study, Pondé J. M (2008)[1] reported that mean anteroposterior dimension of frontal sinus was 8.02 mm in males and 7.79 mm in females with no statistically significance seen between genders. (p=0.937).

The mean mediolateral dimension of frontal sinus in our study was significantly higher in males as compared to females (p=0.003). Our findings were similar to Belaldevar *et al* (2014)[2] who found width of frontal sinus at right side to be 2.64cm in males and 2.22cm in females, and on left side to be 2.33cm in males and 1.94cm in females with a highly significant difference between males and females (P<0.05). Study done by Pondé J.M (2003)[10] reported significantly higher mediolateral diameters in males than in females.(P<0.01). In contrast to our study, Pondé J. M (2008)[1] reported that there was no significantly difference (P=0.197) between males 44.59 mm and females 37.91 mm although dimension in males are greater than females.

The mean area of frontal sinus in our study was significantly higher in males as compared to females (p=0.016). Similar results were reported by Schuller (1943)[11] who found frontal sinuses to be bigger in males than in females. Verma S et al (2014)[12] also found out the mean area in males to be 1041.8 mm^2 which were significantly (p=0.01) larger than females 783.3 mm^2.

The mean thickness of anterior wall of frontal sinus in our study was found to be greater in females than males but not statistically significant (p=0.096). A study conducted by Johnson P *et al* (2011)[13] reported maximum thickness in females to be 2.1mm and 2.1mm in males which was not statistically significant. (p=0.82) and it was in accordance with our study. The determination of thickness of frontal sinus helps in its ultrasonic examination, where the probe is held against it.

CONCLUSION

Therefore two frontal sinuses can never be of same dimensions and symmetry which showed the uniqueness of frontal sinus. Males exhibit more bilateral presence and females exhibit more unilateral presence. The morphometric measurements were found to be greater in males than females. The reason being morphological difference in cranium between males and females are primarily determined by genetic factors, although nutrition, hormone and muscular factory also play an important role. CBCT provides an excellent method for examining frontal sinus due to its high accuracy and may be useful to support gender and age determination in forensic medicine.

References

1. Pondé JM, Andrade RN, Via JM, Metzger P, Teles A. Anatomical Variations of the Frontal Sinus. *Int. J. Morphol*. 2008; 26(4):803-808.
2. Belaldavar C, Vijayalakshmi S Kotrashetti, Hallikerimath SR, Alka DK. Assessment of frontal sinus dimensions to determine sexual dimorphism among Indian adults. *J Forensic Dent Science* 2014; 6:25-30.
3. Schuller A. A note on the identification of skull X-Ray pictures of the frontal sinus. *Med. J. Aust*. 1943; 25(1):554-6.
4. Yoshino M, Miyasaka S, Sato H. Classification system of the frontal sinus patterns by radiography: Its applications to identification on the unknown skeletal remains. *Forensic Sci. Int*.1987; 34(4):289-299.
5. Vidya CS, Shamasundar NM. Computerized Tomographic study of frontal sinus patterns in skulls of South Indian Population. *International Journal of Scientific and Research Publications*.2014; 4(9):1-5.
6. Patil N, Karjodkar FR, Sontakke S, Sansare K, Salvi R.Uniqueness of radiographic patterns of the frontal sinus for personal identification. *Imaging Science in Dentistry* 2012;42:213-7
7. Raoof TM, Saeed KA, Mahmood KA. Anatomical variation of frontal sinuses evaluated by CT scan in

relation to age and sex in Sulaimani city. *JSMC*. 2013;3(1):33-45
8. Aydinliog˘lu A, Kavakli A, Erdem S. Absence of frontal sinus in Turkish individuals. *Yonsei Med J.* 2003; 44:215-218.
9. Nowak R, Mehls G. Aplasia of the sinus maxillares and frontales under the special regard of pneumatisation of cleft Patients. *Anat Anz.*1977; 142:441-450.
10. Pondé, JM; Metzger P, Amaral G, Machado M, Prandini M. Anatomic variations of the frontal sinus. *Minim. Invasive Neurosurg.*2003; 46(1):29-32.
11. Schuller A. A note on the identification of skulls by x-ray pictures of the frontal sinuses. *Med J Aust*. 1943; 1:554-56.
12. Verma S, Mahima VG, Patil K.Radiomorphometric analysis of frontal sinus for sex determination. *J Forensic Dent Sci*. 2014; 6(3):177-182.
13. Johnson P, Jannert M, Strömbeck S and Kasim A. Computed tomography measurements of different dimensions of maxillary and frontal sinuses. BMC Medical Imaging. 2011; 11(8):1-7.

How to cite this article:

Shamshad Begum.2017, Gaurav Kataria and Neha Sharma., Study of Frontal Sinuses In CBCT. *Int J Recent Sci Res.* 8(9), pp. 19867-19870. DOI: http://dx.doi.org/10.24327/ijrsr.2017.0809.0776

****