



3D Analysis Based Evaluation of the Inferior Part of the Maxillary Sinus by Facial Index

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Dear Editor in Chief

The maxillary sinus is the largest sinus that requires care during dental treatment since it is close to the teeth (1). Maxillary sinus floor augmentation is performed for severe alveolar bone loss during maxillary implant surgery (2), but complications including perforation of the maxillary sinus floor occur frequently (3-4). While cone-beam computed tomography (CBCT) is currently the most-used technique for observing the structure in the inferior part of the maxillary sinus and evaluating the surgical prognosis, linear rather than three dimensional (3D) measurements are performed (2- 6). The floor of the maxillary sinus is evaluated while considering sex (2-6). Therefore, we aimed to perform 3D evaluations of the inferior part of the maxillary sinus classified by facial index (FI) based on the nasal cavity floor (NCF).

This study analyzed CBCT data of 60 adults (30 males and 60 females) in their 20s who visited the Department of Orthodontics at College of Den-

tistry of Dankook University Cheonan, South Korea, 2020.

The study was conducted after receiving approval from the Institutional Review Board of Dankook University Dental Hospital, South Korea (DKUDH IRB 2020-01-007).

The CBCT data of the subjects were obtained in the Digital Imaging and Communications in Medicine (DICOM) format, and the inferior part of the maxillary sinus was reproduced in three dimensions using the Mimics (Materialise 23, Leuven, Belgium) 3D program.

The measured items were as follows (Fig. 1):

- NCF-F : Height from the maxillary sinus floor to NCF.
- CW :Maxillary sinus floor width in a coronal view.
- SW: Maxillary sinus floor width in a sagittal view.
- V: Maxillary sinus floor volume.
- PNR angle : Angle of the palatal bone and nasal bone recess



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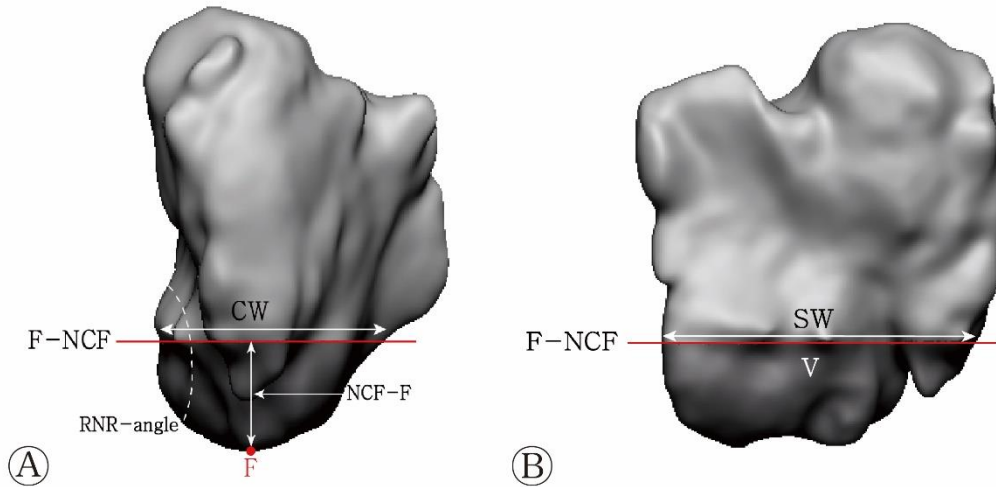


Fig. 1: Inferior part of the maxillary sinus(A. coronal view, B. sagittal view). maxillary sinus Floor(F), nasal cavity floor(NCF), height of the inferior part of the maxillary sinus from the F to the NCF(NCF-F), width of the inferior part of the maxillary sinus in the coronal view(CW), angle at the palatal-nasal recess(PNR angle), width of the inferior part of the maxillary sinus in the sagittal view(SW), volume between the inferior part of the maxillary sinus from the F to the NCF(V)

The SPSS (SPSS 23, IBM, USA) program was used to statistically analyze the measurement parameters, and the Kruskal-Wallis test was performed after verifying that the data conformed to a normal distribution. Significant differences were found between each group (Table 1). The NCF-F height, CW length, SW length, and V size

decreased in the order hyperleptoprosopic > mesoprosopic > leptoprosopic. In contrast, the LPNR angle decreased in the order mesoprosopic > leptoprosopic > hyperleptoprosopic, whereas the RPNR angle decreased in the order leptoprosopic > mesoprosopic > hyperleptoprosopic.

Table 1: Differences in inferior part of the maxillary sinus according to facial index

<i>Measurements</i>	<i>Mesoprosopic (N = 4)</i>	<i>Leptoprosopic (N = 14)</i>	<i>Hyperleptoprosopic (N = 42)</i>	<i>P value</i>
LNCF-F(mm)	12.21(1.68)	10.75(2.41)	13.74(3.80)	<0.05*
LCW	24.54(0.46)	22.54(3.01)	27.64(1.89)	<0.001**
LSW	31.84(0.57)	29.43(2.93)	35.41(3.42)	<0.001**
LV(mm ³)	16.18(6.27)	13.22(19.04)	26.12(19.04)	<0.05*
LPNR angle(°)	131.54(14.07)	121.56(26.60)	119.70(18.64)	>0.05
RNCF-F(mm)	13.37(0.87)	12.61(1.44)	15.02(2.79)	<0.05*
RCW	26.72(1.19)	24.48(1.08)	28.09(2.11)	<0.001**
RSW	31.25(1.05)	28.96(1.69)	32.92(4.42)	<0.05*
RV(mm ³)	20.53(1.02)	14.61(1.78)	32.52(6.61)	<0.001**
RPNR angle(°)	128.21(0.79)	133.04(5.36)	120.35(14.58)	<0.05*

Mean(standard-deviation values)

P values were calculated using the Kruskal Wallis.

*P<0.05, **P<0.001

This study found differences in the inferior part of the maxillary sinus according to the size of the face through the 3D visualization of CBCT data, with the measured dimensions mostly decreasing in the order hyperleptoprosopic > mesoprosopic > leptoprosopic. In addition to the differences associated with sex, which have also been found previously, there were differences according to the size of the face. This indicated that 3D measurements of the inferior part of the maxillary sinus according to the size of the face would enable the clear determination of the anatomical structure in implant surgery and orthodontic treatment. The findings of this study were also expected to be useful in preventing complications that may occur during clinical treatment and may help in the development of new diagnostic methods.

Acknowledgements

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Conflict of interest

The authors declare that there is no conflict of interest.

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