STUDY OF THE NASAL SEPTUM AND ITS VARIATIONS THROUGH DYNAMIC NAVIGATION USING A NEW CONE-BEAM COMPUTED TOMOGRAPHY SOFTWARE IN A BRAZILIAN SUBPOPULATION

Maria Cristina Araújo Estrela[1]
Matheus Rodrigues de Araújo Estrela[2]
Mike Reis Bueno[3]
Carlos Estrela[4]
Cyntia Rodrigues de Araújo Estrela[5]

Faculdade de Medicina da Universidade Evangélica de Goiás – UniEVANGÉLICA[1, 2]
Centro de Radiologia e Imagens Orofaciais, CROIF, Cuiabá[3]
Faculdade de Odontologia da Universidade Federal de Goiás[4]
Universidade Evangélica de Goiás – UniEVANGÉLICA[5]

ABSTRACT

Objective: To determine the frequency of nasal septum deviation (NSD) and the anatomical variations of the nasal septum, in dynamic navigation using a new cone-beam computed tomography software in a Brazilian subpopulation. **Material and method**: The study sample consisted of 200 cone-beam computed tomography exams from patients of both sexes. The inclusion criteria involved exams that presented the nasal septum within the field of view. For the determination of nasal septum deviation, in cone-beam computed tomography images, the following were related: gender, age, nasal septum deviation (presence or absence). The method for determining the anatomical variations of the nasal septum, in cone-beam computed tomography images, included the Mladina classification. Statistical analysis was performed using the Statistical Package for the Social Sciences software, version 20 (SPSS, Chicago, IL), with variables described as frequencies and percentages and evaluated by the chi-square test. There was a prevalence of female individuals and in the age group between 31 and 50 years. 51.00% of the sample presented a normal nasal septum. Among the population that presented septum deviation, it was observed that 15.50% presented Type III deviation, while 13.50% presented Type I deviation, 8.50% presented Type II deviation, 4.50% presented Type IV deviation, 4.0% Type V deviation, 3.50% Type VI deviation, and 0.50% Type VII deviation.

Keywords: Anatomy; nasal septum; maxillary sinus; cone-beam computed tomography

INTRODUCTION

Pathologies of the paranasal sinuses are considered important health problems on different continents (TAGHILOO & HALIMI, 2019). Rhinosinusitis has as one of its causes the blockage of the sinus ostium. This anatomical structure is located in the nasolateral area called the osteomeatal complex, which under normal conditions provides adequate drainage and ventilation of the paranasal sinuses. Among the paranasal sinuses, the maxillary sinus consists of a cavity located in the body and zygomatic process of the

maxilla, with characteristics compared to a quadrangular pyramid, having the lateral wall of the nasal cavity as its base and the zygomatic bone as its apex (BROOK, 2006).

The human nasal cavity involves a midline septum, separating the right and left cavity. Nasal septum deviation (NSD) consists of a misalignment of the bone or cartilage of the nasal septum (or both) from the midline, which can lead to respiratory diseases caused by reduced volume in the nasal cavity, with prevalence ranging from 0.93%--55% among different populations, but with higher prevalence in adults, reaching 90% (YILDIRIM & OKUR, 2003; MLADINA *et al.,* 2008). Nasal septum deviation can cause headache due to inflammation of the paranasal sinuses, breathing difficulty, nasal obstruction that impairs nasal breathing and reduces nasal airflow; ultimately, nasal septum deviation can alter craniofacial development and the morphology of the facial skeleton, causing mouth breathing, skeletal open bite, transverse maxillary deficiency with crossbite, increased nasal airway resistance, or even anosmia (loss of smell) (YILDIRIM & OKUR, 2003);

The diagnosis of nasal septum deviation is based on clinical examination associated with tests such as rhinoscopy, endoscopy, multislice computed tomography (CT), and magnetic resonance imaging. Some authors have presented multislice computed tomography as the standard image for precise analysis of the paranasal sinuses and nasal cavity. Other studies point out that this imaging exam has a higher cost and exposes the patient to a considerably higher radiation dose when compared to cone-beam computed tomography (CBCT) (LUDLOW *et al*., 2015).

The clinical incorporation of computed tomography (CT), and cone-beam computed tomography (CBCT) represented an extraordinary advance in health areas (medicine and dentistry), enabling greater accuracy in the diagnosis of infectious processes. Several studies have verified the importance of tomographic examination for the analysis of the morphological characteristics of the maxillary sinus and its relationship with the roots of the upper teeth (ESTRELA *et al*.,2016,2018; BUENO et al.,2018, 2021). A sophisticated CBCT software (e-Vol DX^®^) was recently developed with significant potential to aid in improving image quality. This software allows for high-resolution images due to submillimeter voxel sizes, dynamic navigation of images in various planes, the possibility to change volume parameters, such as slice thickness, slice intervals, data correction through image filters,

and manipulation of brightness and contrast (BUENO *et al.*, 2018, 2021; ESTRELA *et al.*, 2018).

Based on the importance of knowledge of human anatomy and its anatomical correlations, the appreciation of multidisciplinary in health areas (such as medicine and dentistry), and the information obtained from sophisticated 3D imaging exams, the present study seeks a perspective to determine the frequency of nasal septum deviation and the anatomical variations of the nasal septum, in dynamic navigation using a new cone-beam computed tomography software, in a Brazilian subpopulation, which justifies and highlights the clinical significance of the present study.

METHODOLOGY

In this cross-sectional study, the sample consisted of 200 cone-beam computed tomography exams from patients indicated for diagnostic purposes, from January 2015 to December 2020. As it is a retrospective study for the analysis of cone-beam computed tomography exams recorded in a secondary database, a waiver of the free and informed consent form (FICF) was requested. This work is part of a larger and comprehensive study, approved by the Research Ethics Committee of the Federal University of Goiás (CAAE: 06486919.0.0000.5083).

The inclusion criteria for the imaging exams involved those that presented the nasal septum within the field of view. The exclusion criteria included exams that presented bone alterations associated with systemic diseases, benign and/or malignant neoplasms in the jaws and maxillary sinus, cleft palate, and a previous history of nasal surgery.

The anatomical variations of the nasal septum were verified in the cone-beam computed tomography images, visualized with the aid of the CBCT software (e-Vol DX), analyzed and tabulated in an Excel spreadsheet. The criteria for determining the anatomical variations of the nasal septum, in cone-beam computed tomography images, were related to gender, age, nasal septum deviation (presence or absence) and its type according to the Mladina classification (Mladina et al., 2008).

All described criteria were tabulated in an Excel spreadsheet. The analysis of the cone-beam computed tomography images was performed using a specific filter of the e-Vol DX software (Bueno *et al.*, 2018). All analyses were performed by two examiners

jointly, specialists in radiology and imaging, with experience in cone-beam computed tomography (CBCT) exams for over ten years. The examiners were previously calibrated through the analysis of exams that follow the inclusion and exclusion criteria of the work, totaling 10% of the sample. In the absence of consensus, a third examiner, with the same qualification, was called for a final decision.

RESULTS

There was a prevalence of female individuals (60.5%) and 54.50% of individuals in the age group between 31 and 50 years. It was found that 51.00% of the sample presented a normal nasal septum, meaning this population did not present septum deviation, but 49.00% demonstrated nasal septum deviation.

It was found that 51.00% of the sample presented a normal nasal septum. Among the population that presented septum deviation, i.e., 98 individuals, it was observed that 15.50% presented Type III deviation (deviation located within the nasal cavity, at the level of the middle concha), while 13.50% presented Type I deviation (deviation of the anterior or cartilaginous part of the nasal septum in the region of the nasal valve, but which does not touch the valve), 8.50% presented Type II deviation (deviations of the anterior or cartilaginous part of the nasal septum in the region of the nasal valve, but which touches the nasal valve), 4.50% presented Type IV deviation (doubly curved septum, S-shaped, in which the anterior curve is usually located in the region of the nasal valve, while the posterior curve is situated deeper within the nasal cavity), 4.0% Type V deviation (deviation located in the bony septum and contains an almost horizontal bony spur), 3.50% Type VI deviation (unilateral bony spur parallel to the horizontal plate that has a protrusion on one side and a 'groove' on the other) and 0.50% Type VII deviation (combination of two or more types of the aforementioned deviations).

CONCLUSION

There was a prevalence of female individuals in the age group between 31 and 50 years. 51.00% of the sample presented a nasal septum without deviation. Among the population that presented deviation, it was observed that 13.50% presented Type I deviation, 8.50% presented Type II deviation, 15.50% presented Type III deviation, 4.50% presented Type IV deviation, 4.0% Type V deviation, 3.50% Type VI deviation, and 0.50% Type VII deviation (combination of two or more types of the aforementioned deviations).

ACKNOWLEDGMENTS:

CNPq scholarship

REFERENCES:

Brook I. Sinusitis of odontogenic origin. Otolaryngology-Head and Neck Surgery 2006; 135:349-355.

Bueno MR, Estrela C, Azevedo BC, Diogenes A. Development of a new cone-beam computed tomography software for endodontic diagnosis. Braz Dent J 2018; 29:517-529.

Bueno MR, Estrela C, Granjeiro JM, Estrela MRA, Azevedo BC, Diogenes A. Cone-beam computed tomography cinematic rendering: clinical, teaching and research applications. Braz Oral Res 2021; 22:35: e024.

Estrela C, Nunes CABCM, Guedes OA, *et al.* Study of anatomical relationship between posterior teeth and maxillary sinus floor in a subpopulation of the Brazilian central region using cone-beam computed tomography - Part 2. Braz Dent J 2016; 27:9-15.

Estrela C, Couto GS, Bueno MR, Bueno KG, Estrela LRA, Porto OCL, Diogenes A. Apical foramen position in relation to proximal root surfaces of human permanent teeth determined by using a new cone-beam computed tomographic software. J Endod 2018; 44:1741-1748.

Ludlow JB, Timothy R, Walker C, Hunter R, Benavides E, Samuelson DB, et al. Effective dose of dental CBCT—a meta-analysis of published data and additional data for nine CBCT units. Dentomaxillofacial Radiology 2015; 44:20140197

Mladina R, Cujić E, Subarić M, Vuković K. Nasal septal deformities in ear, nose, and throat patients: An international study. Am J Otolaryngol 2008; 29:75-82.

Taghiloo H, Halimi Z. The frequencies of different types of nasal septum deviation and their effect on increasing the thickness of maxillary sinus mucosa. J Dent Res Dent Clin Dent Prospects. 2019 Summer;13(3):208-214.

Yildirim I, Okur E. The prevalence of nasal septal deviation in children from Kahramanmaras, Turkey. Int J Pediatr Otorhinolaryngol 2003; 67:1203-6.