ANALYSIS OF THE RELATIONSHIP BETWEEN NASAL SEPTUM DEVIATION AND INCREASED SINUS MUCOSA THICKNESS AND INFLAMMATORY CHANGES IN THE MAXILLARY SINUS RESULTING FROM PERIAPICAL INFECTIONS, THROUGH DYNAMIC NAVIGATION USING NEW CONE-BEAM COMPUTED TOMOGRAPHY SOFTWARE IN A BRAZILIAN SUBPOPULATION

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ABSTRACT

Objective: To determine the relationship between nasal septal deviation (NSD) and increased sinus mucosal thickness and inflammatory changes in the maxillary sinus resulting from periapical infections, using dynamic navigation with new cone beam computed tomography software. Material and method: The study sample consisted of 200 cone-beam computed tomography scans of patients of both sexes. The inclusion criteria were images involving those who had the nasal septum within the field of view. To determine the relationship between nasal septum deviation and sinus mucosa thickening, the types of nasal septum deviation were correlated. Results: The evaluation of the relationship between nasal septum deviation and increased mucosal thickness showed that 61% had no changes in the mucosa, of which 32.50% had no DSN, and 11.50% had Type III deviation. The relationship between nasal septum deviation and the maxillary sinus showed that 61% had no changes in the maxillary sinus, and of this total, 32.50% did not have DSN. In the relationship between nasal septum deviation and periapical infection, 44.50% of individuals did not present infection and, of these, 21.00% did not have DSN and 18.90% presented Type III deviation. Conclusion: In the evaluation of the relationship between nasal septum deviation and increased mucosal thickness, it was found that 61% of individuals did not present changes in the mucosa, however 32.5% presented type III DSN. In the relationship between DSN and periapical infection, 44.5% did not present infection and of these, 21% did not present deviation.

Keywords: Nasal septum; Maxillary sinus; Nasal septum deviation; Cone-beam computed tomography.

INTRODUCTION

The human nasal cavity involves a septum in the midline, separating the right and left cavities. Nasal septum deviation (NSD) consists of a misalignment of bone or cartilage (or

both) of the nasal septum from the midline, which can lead to respiratory diseases caused by a reduction in volume in the nasal cavity (YILDIRIM & OKUR, 2003; MLADINA *et al.,* 2008).

A deviated nasal septum can cause headaches due to inflammation of the paranasal sinuses, difficulty breathing, nasal obstruction that impairs nasal breathing and reduces nasal airflow. Finally, a deviated nasal septum can alter craniofacial development and facial skeleton morphology, causing mouth breathing, skeletal open bite, transverse maxillary deficiency with crossbite, increased nasal airway resistance, or even anosmia (GUYURON *et al.*, 1999; YILDIRIM & OKUR, 2003; HARTMAN *et al.*, 2016). This deviation also plays an important role in nasal congestion, cosmetic nasal problems, increased nasal airway resistance, snoring, and facial asymmetry, and can precipitate subsequent infections in the paranasal sinuses, upper respiratory tract, and middle ear, as well as causing disorders of the development of the palate and paranasal sinuses. Nasal obstruction is one of the most common symptoms in patients with NSD (HARTMAN *et al.,* 2016; de PAULA *et al.*, 2022).

Cone-beam computed tomography (CBCT) is a diagnostic tool for evaluating the paranasal sinuses that is widely requested by dental surgeons and otolaryngologists, as it offers many advantages over CT, such as shorter acquisition time, limited irradiation area, image accuracy, and reduced radiation dose for the patient. (ESTRELA et *al.,* 2018; BHATTACHARYYA, 2010).

In this sense, the objective of this study is to determine the relationship between nasal septum deviation and increased sinus mucosa thickness and inflammatory changes in the maxillary sinus resulting from periapical infections, using dynamic navigation with new cone-beam computed tomography software in a Brazilian subpopulation.

METHODOLOGY

In this cross-sectional study, the sample consisted of 200 cone beam computed tomography scans (200 nasal septums and 400 maxillary sinuses, from patients of both sexes, selected from a database of a private clinic (CROIF, Center for Radiology and Orofacial Imaging of Cuiabá, Brazil), from patients referred for diagnostic purposes between January 2015 and December 2020. As this is a retrospective study for the analysis of cone-beam computed tomography scans recorded in a secondary database,

exemption from the informed consent form (ICF) was requested. This work is part of a larger, comprehensive study approved by the Research Ethics Committee of the Federal University of Goiás (CAAE: 06486919.0.0000.5083). Anonymized images were used to preserve the identity of the subjects, and a database use agreement was signed.

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

All criteria described were tabulated in an Excel spreadsheet. Tomographic examinations will be standardized so that the maxillary sinuses are aligned from an axial point of view; the sagittal and coronal planes will be used to keep the long axis of the sample transverse to the ground, oriented to correct parallax error. The analysis of 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 jointly by two examiners, specialists in radiology and imaging, with more than ten years of experience in cone-beam computed tomography (CBCT) examinations. The examiners were calibrated beforehand by analyzing exams that met the inclusion and exclusion criteria of the study, corresponding to 10% of the sample. In the absence of consensus, a third examiner with the same qualifications was called in to make the final decision.

RESULTS

The evaluation of the relationship between nasal septal deviation and increased sinus mucosal thickness with dynamic navigation in cone beam computed tomography images using the software and-Vol DX software showed that 61% of individuals had no changes in the sinus mucosa, of which 32.50% had no DSN and 11.50% had Type III deviation. Thirty-nine percent presented thickening of the sinus mucosa, of which 16.50% presented a septum without deviation and 9.00% presented Type I deviation.

Analysis of the relationship between nasal septal deviation and the maxillary sinus showed that 61% of individuals had no changes in the maxillary sinus, of which 32.50%

had no DSN and 11.50% had Type III deviation. Thirty-nine percent of individuals presented changes in the maxillary sinus, of which 33.50% presented thickening of the sinus mucosa and 5.50% presented partial opacification of the maxillary sinus.

The observation of the relationship between nasal septal deviation and periapical infection, in cone beam computed tomography images, was based on the classification of Mladina et al. (2008) and its correlation with the following criteria for periapical infection: 1. Absence of periapical infection; 2. Primary periapical infection; 3. Secondary periapical infection. Verification of this relationship showed that 44.50% did not have periapical infection, of which 21.00% had a normal nasal septum and 9.00% had a Type III deviation. 9.50% had primary periapical infection, of which 6.00% did not have DSN. 46.00% had secondary periapical infection, of which 22.00% had a nasal septum without deviation.

CONCLUSION:

The evaluation of the relationship between nasal septal deviation and increased sinus mucosa thickness showed that 122 (61%) individuals had no changes in the sinus mucosa, of which 65 (32.50%) had a normal nasal septum and 23 (11.50%) had Type III deviation. Seventy-eight (39%) individuals presented thickening of the sinus mucosa, of which 33 (16.50%) had a non-deviated nasal septum and 18 (9.00%) had a Type I deviation. In observing the relationship between nasal septum deviation and periapical infection, 89 (44.50%) individuals did not present periapical infection, of which 42 (21.00%) had a nasal septum without deviation and 18 (9.00%) had Type III deviation. Nineteen (9.50%) individuals had primary periapical infection, of which 12 (6.00%) had a nasal septum without deviation. Ninety-two (46.00%) had secondary periapical infection, of which 44 (22.00%) had a nasal septum without deviation.

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BIBLIOGRAPHICAL REFERENCES

Bhattacharyya N. The role of CT and MRI in the diagnosis of chronic rhinosinusitis. Curr. Allergy Asthma Rep. 2010; 10(3):171-4. doi:10.1007/s11882-010-0103-5.

de Paula SBS, Nunes LA, de Oliveira Ruellas AC, de Castro ACR. Influence of nasal septum deviation on fluctuating asymmetries of the nasomaxillary complex: A cross-sectional study. J Anat. 2022 Dec;241(6):1273-1286.

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

Guyuron B, Uzzo CD, Scull H. A practical classification of septonasal deviation and an effective guide to septal surgery. Plast Reconstr Surg 1999; 104:2202–9.

Hartman, C., Holton, N., Miller, S., Yokley, T., Marshall, S., Srinivasan, S. et al. (2016) Nasal septal deviation and facial skeletal asymmetries. Anatomical Record, 299, 295–306.

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.

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