Clinical and Experimental Health Sciences

Evaluation of the accessory canals of canalis sinuosus via Cone Beam CT

Nurşat Türker, Duygu Göller Bulut, Seval Bayrak

Bolu Abant İzzet Baysal University, Faculty of Dentistry, Department of Oral and Maxillofacial Radiology, Faculty , Bolu, Türkiye.

Correspondence Author: Nurşat Türker
E-mail: nursatturker93@outlook.com
Received: 15.03.2023 **Accepted:** 22.08 2023

ABSTRACT

Objective: Canalis sinuosus (CS) is a common anatomical variation in the anterior maxilla that originates from the infraorbital canal and carries the anterior superior alveolar nerve and vessels. This study aimed to examine the presence, frequency, and features of CS and its accessory canals (ACs) using cone beam computed tomography (CBCT) images.

Methods: A total of 495 CBCT images were retrospectively analyzed in axial, sagittal, and coronal sections. Patient age and sex, presence or absence of CS, location as right, left, or bilateral if CS was present, and number of ACs were recorded. In addition, the end regions of the ACs were recorded as central incisor, central-lateral incisor, lateral incisor, lateral incisor-canine, and canine regions. All recorded data were statistically analyzed.

Results: At least one CS was found in 54 (10.9%) of 495 CBCT images. CS(s) were bilateral in 26 (48.2%) cases and unilateral in 28 (51.8%; 25 on the left and 3 on the right side). The ACs of the CS predominantly terminated in the lateral incisor region (p =.025). The frequency of CS was not statistically different between males and females (p =.313).

Conclusion: Accessory canals in the anterior maxilla are mostly associated with branches of the CS. In the current study, the prevalence of CS was 10.9%, and most of the CSs were opening in the lateral incisor region. Detection of accessory canals in the anterior maxilla and examination of this region with CBCT will prevent misdiagnoses and postoperative complications arising from damage to these structures.

Keywords: Anatomical Variation, anterior maxilla, canalis sinuosus, cone-beam CT

1. INTRODUCTION

Dental procedures, such as dental implant placement, orthognathic surgery, extraction of supernumerary and/or impacted teeth, cyst and tumor surgery, and endodontic and periodontal surgery, are frequently performed on the anterior maxilla (1,2). Before performing these procedures, any variations in the anatomy of this region should be identified to avoid damage to neurovascular structures.

The maxillary nerve, one of the branches of the trigeminal nerve, divides into the posterior superior alveolar nerve, the nasopalatine nerve, the greater palatine nerve, and the infraorbital nerve. The infraorbital nerve passes through the infraorbital foramen, which divides into a lateral branch called the canalis sinuosus (CS), through which the anterior superior alveolar (ASA) nerve passes (3). The ASA nerve is a branch of the infraorbital nerve that passes through the CS after exiting the infraorbital foramen.

The CS reaches the anterior edge of the nasal cavity from the anterior end of the inferior nasal concha and opens at the side of the nasal septum in front of the incisive canal (4). Its opening is typically anterior to the incisive canal, although it shows anatomical variations in the anterior palatine called accessory canals (3-6). The ASA nerve innervates the incisors and canines (6,7). The CS contains the ASA nerve and its associated arteries and veins (4,8). Clinicians do not devote attention to this anatomical formation unless it causes complications, such as bleeding or paresthesia. Dentists sometimes misdiagnose CS as a periapical lesion, and it is difficult to identify on conventional radiographs (3).

Although two-dimensional imaging methods such as periapical and panoramic radiography are widely used in dentistry, they do not provide sufficient information for in-depth analysis of anatomical structures due to limitations such as distortion, superposition, and magnification. Three-dimensional imaging with cone beam

DOI: 10.33808/clinexphealthsci.1265279

computed tomography (CBCT), on the other hand, provides high-resolution cross-sectional images and detailed examination at low radiation doses compared with helical computed tomography (CT). CBCT also significantly reduces the overlap of images, permits linear and angular measurements, and allows for multiplanar reconstruction of images (9-12). A detailed three-dimensional evaluation using CBCT thus provides information regarding anatomical variations that can help clinicians avoid damaging anatomical and neurovascular structures.

The aim of this study was to confirm the presence and reveal the frequency and characteristics of CS accessory canals using CBCT examination.

2. METHODS

The study protocol, including all changes and revisions, was carried out according to the principles described in the Declaration of Helsinki. The local ethics committee of Bolu Abant İzzet Baysal University approved the study (Protocol No:173/2020).

Images of 495 patients between 16-81 years of age who underwent CBCT between 2015 and 2020 at the Department of Oral and Maxillofacial Radiology for reasons such as impacted teeth, cysts, and tumors, and implant evaluation were selected and retrospectively evaluated.

The CBCT images were acquired using an i-CAT imaging system (Imaging Sciences International, Hatfield, PA, USA) with the following parameters: 120 kVp and 15 mA, 0.3 mm voxel size, and 4.8 sec. exposure time. Images were analyzed using the i-CAT Vision Q imaging software (Imaging Sciences International, Hatfield, PA, USA). The maxillary sinuses, dental arches in the upper alveolar process from the lower edge of the orbit, and posterior region of the maxilla were included in the field of view (FOV) of all individuals' CBCT images. The FOV sizes of the images were 16x6 cm, 16x8 cm, and 16x10 cm.

Images were excluded if any artifact prevented the examination of the anterior maxilla. Patients with pathological disorders such as trauma, congenital malformations, implanted plates and screws, bone graft material, cysts, tumors, supernumerary and/or impacted teeth, foreign bodies, and fractures in the anterior maxilla were excluded from the study population.

Tomographic examinations were evaluated by an oral and maxillofacial radiologist with 3 years of experience. Multiplanar images with 0.3 mm slice thickness were examined in detail in the radiographs studied. The CS was first defined in the coronal section, and then the sections were continued to be scanned by scrolling. CS was recorded as present in the presence of corticated, partially corticated or uncorticated bone canal, any bone canal other than the NPC in the anterior maxilla, and any bone canal detected in all three (coronal sagittal, and axial) sections of the CBCT (Figure 1a, 1b, and Figure 2). The presence or absence of the CS, the location of the CS (right or left) if present, and the total number of accessory canals were noted for each patient. The location of the end of the CS trajectory was characterized as central incisor, central–lateral incisor, lateral incisor, lateral incisor–canine, and canine regions. Patient age and sex were recorded. In order to calculate the intra-observer reliability, the images of 55 patients were re-evaluated 1 month later by the same observer.

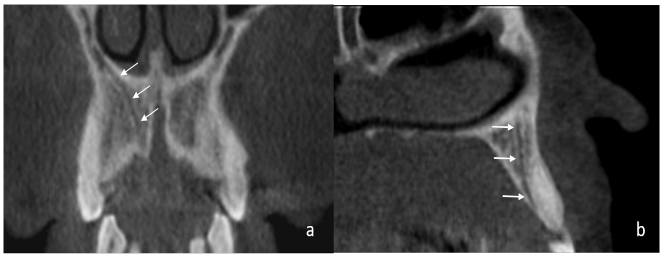

***Figure 1. (a)** Right unilateral CS on coronal section (white arrows), **(b)** CS on sagittal section (white arrows).*

***Figure 2.** Unilateral CS on axial section (white arrow)*

Statistical Analysis

Descriptive statistics were performed on the collected data and presented as numbers, percentages, means, and standard deviations. The Shapiro–Wilk test was used to test the assumption of normality. The relationship between categorical variables was examined using the chi-square test.

All analyses were performed using the Statistical Package for the Social Sciences software (SPSS version 24.0, Inc., Chicago, IL, USA). A level of $p < .05$ was accepted as the level of significance.

3. RESULTS

The intra-observer agreement was found to be high (Intra-observer correlation coefficient was 0.889). In this study, a total of 495 images of 246 males (mean age 45.89 ± 15.81 years) and 249 females (mean age 42.74 ± 14.77 years) were evaluated. The mean age of the patients was 44.30 ± 15.36 years.

Table 1 shows the distribution of CS and age according to sex. At least one CS accessory canal was found in 54 (10.9%) images. The incidence of accessory canals was higher in women than in men, although the difference was not statistically significant (p =.313).

Table 1. *Presence of the Canalis sinuosus according to gender*

	Female (n=249)	Male (n=246)	Total
CS absent (%)	218 (87.6)	223 (90.7)	441 (89.1)
CS present (%)	31 (12.4)	23 (9.3)	54 (10.9)
Total	249 (100)	246 (100)	495 (100)

n: number of cases

Table 2 presents the data on the presence of CS according to age. No difference was found between age groups in the presence of CS (p =.956). CS was bilateral in 26 (48.2%) and unilateral in 28 (25 on the left, 3 on the right) of the 54 patients. The prevalence of CS was significantly higher on the left than on the right (p =.014) (Table 3).

Table 2. *CS presence according to age groups Presence of the CS according to age groups*

Age Groups (Years)	Absent n (%)	Present n (%)	Total
16-19	26 (%89,7)	3 (%10,3)	29
20-29	69 (%87,3)	8 (%12,7)	77
30-39	72 (%90)	8 (%10)	80
40-49	94 (%90,4)	10 (%9,6)	104
50-59	97 (%87,4)	14(%12,6)	111
60-69	64 (%88,9)	8 (%11,1)	72
70-79	19 (%95)	1 (%5)	20
Total	441	54	495

n, number of cases; CS, Canalis sinuosus

Table 3. *CS presence according to sides*

CS	Right	Left	p value
Absent	466^a	444^b	*.014
Present	29^a	51^b	

CS, Canalis sinuosus

The CS accessory canals predominantly terminated in the lateral incisor region (p =.025) (Figure 3).

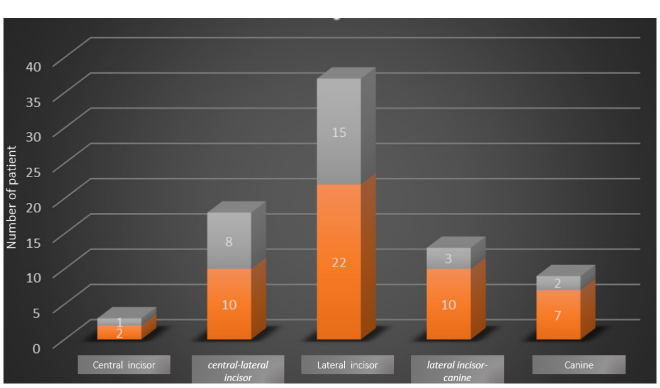

Figure 3. *The end of the CS trajectory. Orange bar shows left side and gray bar shows right side.*

4. DISCUSSION

Mandibular and maxillary nerve structures and their courses have been described in numerous articles and anatomy textbooks (13-15). Considering the previous data in the literature, it is clear that these nerve structures have several anatomical variations, some of which require careful clinical examination (16). The infraorbital canal gives a small branch, called the CS, near the midpoint of the lateral aspect of the face, through which the ASA nerve passes. The CS, a neurovascular canal containing the ASA nerve, artery, and vein, is an anatomical structure that is not sufficiently understood by clinicians (17). The ASA nerve reaches the anterior maxillary region and innervates the incisors, canines, and soft tissues in this region (6).

The integrity of the CS may be compromised in craniofacial trauma, after Le Fort 1 osteotomy, and during dental surgery. Sensory complications, such as localized hypoesthesia, paresthesia, and neuropathic pain, may occur due to damage to the ASA nerve.

If surgeons do not consider the presence of accessory canals, patients may be at increased risk of experiencing neurosensory changes, excessive bleeding, or other complications during surgical procedures (5). Due to the proximity of the CS accessory canals to the apex of the teeth, inappropriate treatment may be performed without proper knowledge of the patient's anatomy (8).

Except for a few case reports in which symptoms of pain and paresthesia have been reported (18-21), no evidence is available regarding the effects and clinical significance of surgical injury to the accessory canals of the canalis sinuosus or anterior maxilla. More clinical studies are needed to support the clinical significance of CS.

This study investigated the prevalence of CS and the termination of its trajectory on CBCT images. CS was found in the anterior maxilla in 10.9% of the 495 patients in the present study. The prevalence of CS was reported by Ghandourach et al. (22) as 67.6%, by Von Arx et al. (2) as 55.1%, by Aoki et al. (3) as 66.5%, by Machado et al. (1) as 51.7%, by de Oliveira Santos et al. (6) as 15.7%, by Anatoly et al. (23) as 67%, by Fernandes et al. (24) as 18%, and by Shan et al. (25) as 36.9%.

In the studies on Turkish population, the prevalence of CS was determined by Tomrukçu et al. (17) as 34.6%, by Orhan et al. (26) as 70.8%, while Beyzade et al. (27) and Gürler et al. (5) found the prevalence of CS as 100%. In our study, the prevalence of CS was found to be lower than in previous studies.

Significant difference between the prevalence may be derived from variety of reasons like methodological differences (voxel size, using of different CBCT scanners, different exposure parameters, inclusion/exclusion criterias etc), racial differences, study groups' distribution or may be just coincidental.

In another study on Turkish population, Sekerci et al. (28) analyzed the presence of the accessory foramina and canals having a diameter of at least 1 mm within the premaxilla in 368 pediatric patients using CBCT. Eighty-two patients had additional canals; in 6 of them, the canals presented as a direct extension of the CS. There are not many studies on this subject in the pediatric group. In addition, since our study population did not include pediatric patients, a comparison could not be made.

Similar to the studies by Ghandourach et al. (22) and Manhaes Junior et al. (29), the frequency of CS in this study did not differ significantly between genders. While some previous studies found a higher prevalence of CS in males (1,3,24), Şekerci et al. (28) and Anatoly et al. (23) found more CS accessory canals in females. The results of the studies are variable regarding the difference in the frequency of CS between the genders. These discrepancies may be due to differences in the male-to-female ratio in the populations studied or racial differences.

In this study, we detected 48.2% bilateral and 51.8% unilateral accessory canals arising from the CS. In comparison, Aoki et al. (3) reported 54.14% bilateral and 45.86% unilateral CS, de Oliveira Santos et al. (6); 21.4% bilateral and 78.6% unilateral CS, Wanzeler et al. (16); 87% bilateral and 1% unilateral CS, Beyzade et al. (27); %94.5 bilateral and %5.5 unilateral CS, Anatoly et al. (23); %45.7 bilateral and %54.3 unilateral CS and Gürler et al. (5) and Ghandourach et al. (22) both reported 100% bilateral CS. The prevalence rates of CS in this study and previous studies differ according to the sides. Previous studies used different voxel size and slice thicknesses and considered a diameter of less than 1 mm to identify CS. The differences in the results may be due to these methodological inconsistencies.

In the present study, we did not observe a significant difference in the presence of CS between age groups. Similarly, previous studies have reported no association between the presence of CS and patient age (3,6,16,23). However, in the study by Von Arx et al. (2), no one under the age of 20 had an accessory canal, whereas more than one accessory canal was observed in older people. In the study of Gürler et al. (5), five out of six patients under 20 years of age had an accessory canal. In this study, the prevalence of CS in under the age of 20 was found to be similar to other age groups. The prevalence of CS differed between studies according to age groups. Differences in age distribution, observer subjectivity, and image-related dissimilarities in the studies may account for the differing results.

In our study, the endpoint of the CS occurred predominantly in the lateral incisor region by 46.25%. Similarly, Manhaes Junior et al. (29) evaluated 500 CBCT images and reported that the location of this anatomical variation was the palatine of the lateral incisor. Similarly, Neves et al. (4) and Gürler et al. (5) reported that the CS opened to the foramina on the palatal portion of the lateral incisor. Fernandes et al. (24), Anatoly et al. (23) (33.5%), and Beyzade et al. (27) (46.8%) reported that the CS was most frequently opened to the lateral incisor region. Ghandourach et al. (22) observed that the lateral canine region (27.8%) on the left side was the most common location, followed by the central incisor region (22.2%). Aoki et al. (3) showed that 44.39% of CSs terminated in the central incisor region, 21.95% terminated in the lateral incisor region, and 14.15% terminated in the canine region. Shan et al. (25) stated that CSs were most frequently opened to the central and lateral incisor regions (61.9%). In several additional previous studies, (1,2,6) the most common termination location was the central incisor region. When the bucco-palatal localization of the ACs is evaluated, Machado et al. (1) reported that only 5.1% of ACs had a terminal ending at the buccal cortical plate, and Tomrukçu et al. (17) reported that 3 out of 214 ACs had a terminal ending at the buccal cortical plate. Beyzade et al. (27) showed that the terminal ends of all ACs are located in the palatal cortical plate. Similar to Beyzade et al. (27), in our study, in all cases ACs had a terminal ending at the palatal cortical plate.

Most of the studies in the literature were performed with CBCT, but the lack of standardization in the methodology of the studies led to different results. In addition, it is not clearly stated that the structure evaluated in the studies is the main CS canal or an accessory branch. In this study, the CS terminate in the alveolar process of the anterior maxilla was evaluated. Therefore, no comment on its origin has been made.

The main limitation of the present study is that the voxel size of the images is 0.3 mm. Smaller accessory canals can be seen, and more accurate results can be obtained in images with higher resolution obtained with a smaller voxel. The other limitation of the present study is that only one observer's results are included in the study.

5. CONCLUSION

The prevalence of CS in this study was 10.9%, and the most common endpoint of the CS was the lateral incisor region at 46.25%. There was no difference in the prevalence of CS between genders or age groups. Identification of the CS by CBCT is crucial to preventing complications and optimizing patient prognosis.

Funding: *The author(s) received no financial support for the research.*
Conflicts of interest: *The authors declare that they have no conflict of interest.*
Ethics Committee Approval: *This study was approved by Ethics Committee of Bolu Abant İzzet Baysal University (approval date and number: 07.07.2020/173)*
Peer-review: *Externally peer-reviewed.*
Author Contributions:
Research idea: NT.
Design of the study: NT, DGB,SB.
Acquisition of data for the study: NT.
Analysis of data for the study: DB.
Interpretation of data for the study: SB.
Drafting the manuscript: NT.
Revising it critically for important intellectual content: NT, DGB, SB.
Final approval of the version to be published: NT, DGB, SB.

REFERENCES

[1] Machado VC, Chrcanovic BR, Felippe MB, Manhães Júnior LR, de Carvalho PS. Assessment of accessory canals of the canalis sinuosus: a study of 1000 cone beam computed tomography examinations. Int J Oral Maxillofac Surg. 2016;45:1586–1591. DOI:10.1016/j.ijom.2016.09.007

[2] von Arx T, Lozanoff S, Sendi P, Bornstein MM. Assessment of bone channels other than the nasopalatine canal in the anterior maxilla using limited cone beam computed tomography. Surg Radiol Anat. 2013;35:783–790. DOI:10.1007/s00276.013.1110-8

[3] Aoki R, Massuda M, Zenni LTV, Fernandes KS. Canalis sinuosus: Anatomical variation or structure? Surg Radiol Anat. 2020;42:69–74. DOI: 10.1007/s00276.019.02352-2

[4] Neves FS, Crusoé-Souza M, Franco LC, Caria PH, Bonfim-Almeida P, Crusoé-Rebello I. Canalis sinuosus: A rare anatomical variation. Surg Radiol Anat. 2012;34:563–566. DOI: 10.1007/s00276.011.0907-6

[5] Gurler G, Delilbasi C, Ogut EE, Aydin K, Sakul U. Evaluation of the morphology of the canalis sinuosus using cone-beam computed tomography in patients with maxillary impacted canines. Imaging Sci Dent. 2017;47:69–74. DOI: 10.5624/isd.2017.47.2.69

[6] de Oliveira-Santos C, Rubira-Bullen IR, Monteiro SA, León JE, Jacobs R. Neurovascular anatomical variations in the anterior palate observed on CBCT images. Clin Oral Implants Res. 2013;24:1044–1048. DOI: 10.1111/j.1600-0501.2012.02497.x

[7] von Arx T, Lozanoff S. Anterior superior alveolar nerve (ASAN). Swiss Dent J. 2015;125(11):1202–1209.

[8] Shelley AM, Rushton VE, Horner K. Canalis sinuosus mimicking a periapical inflammatory lesion. Br Dent J. 1999;186:378–379. DOI: 10.1038/sj.bdj.4800116

[9] Allareddy V, Vincent SD, Hellstein JW, Qian F, Smoker WR, Ruprecht A. Incidental findings on cone beam computed tomography images. Int J Dent. 2012;2012:871532. DOI:10.1155/2012/871532

[10] Warhekar S, Nagarajappa S, Dasar PL, Warhekar AM, Parihar A, Phulambrikar T, Airen B, Jain D. Incidental findings on cone beam computed tomography and reasons for referral by dental practitioners in indore city (m.p). J Clin Diagn Res. 2015;9:Zc21–4. DOI: 10.7860/JCDR/2015/11705.5555

[11] Price JB, Thaw KL, Tyndall DA, Ludlow JB, Padilla RJ. Incidental findings from cone beam computed tomography of the maxillofacial region: A descriptive retrospective study. Clin Oral Implants Res. 2012;23:1261–1268. DOI: 10.1111/j.1600-0501.2011.02299.x

[12] Ferlin R, Pagin BSC, Yaedú RYF. Canalis sinuosus: A systematic review of the literature. Oral Surg Oral Med Oral Pathol Oral Radiol. 2019;127(6):545-551. DOI: 10.1016/j.oooo.2018.12.017

[13] Ducic I, Yoon J. Reconstructive options for inferior alveolar and lingual nerve injuries after dental and oral surgery: An evidence-based review. Ann Plast Surg. 2019;82(6):653–660. DOI: 10.1097/SAP.000.000.0000001783

[14] Shimotakahara R, Lee H, Mine K, Ogata S, Tamatsu Y. Anatomy of the lingual nerve: Application to oral surgery. Clin Anat. 2019;32:635–641. DOI: 10.1002/ca.23361

[15] Zheng JP, Song M, Zhan XX, Li CZ, Zong XY, Zhang YZ. Endoscopic approach to the trigeminal nerve: An anatomic study. J Craniomaxillofac Surg. 2014;42:674–682. DOI: 10.1016/j.jcms.2013.09.014

[16] Wanzeler AMV, Marinho CG, Junior SMA, Manzi FR, Tuji FM. Anatomical study of the canalis sinuosus in 100 cone beam computed tomography examinations. Oral Maxillofac Surg. 2015;19:49–53. DOI: 10.1007/s10006.014.0450-9

[17] Tomrukçu DN, Köse TE. Assesment of accessory branches of canalis sinuosus on CBCT images. Med Oral Patol Oral Cir Bucal. 2020;25:e124–e30. DOI: 10.4317/medoral.23235

[18] McCrea SJJ. Aberrations causing neurovascular damage in the anterior maxilla during dental implant placement. Case Rep Dent. 2017;2017:5969643. DOI: 10.1155/2017/5969643

[19] Politis C, Agbaje J, Van Hevele J, Nicolielo L, De Laat A, Lambrichts I, Jacobs R. Report of neuropathic pain after dental implant placement: A case series. Int J Oral Maxillofac Implants 2017;32(2):439-444. DOI: 10.11607/jomi.5241

[20] Rodríguez-Lozano FJ, Sanchez-Pérez A, Moya-Villaescusa MJ, Rodríguez-Lozano A, Sáez-Yuguero MR. Neuropathic orofacial pain after dental implant placement: Review of the literature and case report. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2010 ;109(4):e8-12. DOI: 10.1016/j.tripleo.2009.12.004

[21] Arruda JA, Silva P, Silva L, Álvares P, Silva L, Zavanelli R, Rodrigues C, Gerbi M, Sobral AP, Silveira M. Dental implant in the canalis sinuosus: A case report and review of the literature. Case Rep Dent. 2017;2017:4810123. DOI: 10.1155/2017/4810123

[22] Ghandourah AO, Rashad A, Heiland M, Hamzi BM, Friedrich RE. Cone-beam tomographic analysis of canalis sinuosus accessory intraosseous canals in the maxilla. Ger Med Sci. 2017;15:Doc20. DOI: 10.3205/000261

[23] Anatoly A, Sedov Y, Gvozdikova E, Mordanov O, Kruchinina L, Avanesov K, Vinogradova A, Golub S, Khaydar D, Hoang NG, Darawsheh HM. Radiological and morphometric features of canalis sinuosus in Russian population: Cone-beam computed tomography study. Int J Dent. 2019;2019:2453469. DOI: 10.1155/2019/2453469

[24] Fernandes J, Rohinikumar S, Nessapan T, Rani D, Abhinav RP, Gajendran P. CBCT Analysis of prevalence of the canalis sinuosus on the alveolar ridge in the site of endosseous implant placement: A retrospective study. J Long Term Eff Med Implants. 2022;32(2):45-50. DOI: 10.1615/JLongTermEffMedImplants.202.203.9656

[25] Shan T, Qu Y, Huang X, Gu L. Cone beam computed tomography analysis of accessory canals of the canalis sinuosus: A prevalent but often overlooked anatomical variation in the anterior maxilla. J Prosthet Dent. 2021;126(4):560-568. DOI: 10.1016/j.prosdent.2020.05.028

[26] Orhan K, Gorurgoz C, Akyol M, Ozarslanturk S, Avsever H. An anatomical variant: Evaluation of accessory canals of the canalis sinuosus using cone beam computed tomography. Folia Morphol (Warsz). 2018;77(3):551-557. DOI: 10.5603/FM.a2018.0003

[27] Beyzade Z, Yılmaz HG, Ünsal G, Çaygür-Yoran A. Prevalence, radiographic features and clinical relevancy of accessory canals of the canalis sinuosus in cypriot population: A retrospective Cone-Beam Computed Tomography (CBCT) Study. Medicina (Kaunas). 2022;58(7):930. DOI: 10.3390/medicina58070930

[28] Sekerci AE, Cantekin K, Aydinbelge M. Cone beam computed tomographic analysis of neurovascular anatomical variations other than the nasopalatine canal in the anterior maxilla in a pediatric population. Surg Radiol Anat. 2015;37:181–186. DOI: 10.1007/s00276.014.1303-9

[29] Manhães Júnior LR, Villaça-Carvalho MF, Moraes ME, Lopes SL, Silva MB, Junqueira JL. Location and classification of Canalis sinuosus for cone beam computed tomography: Avoiding misdiagnosis. Braz Oral Res. 2016;30:e49. DOI: 10.1590/1807-3107BOR-2016.vol30.0049

How to cite this article: Türker N, Göller Bulut D, Bayrak S. Evaluation of the accessory canals of canalis sinuosus via Cone Beam CT. Clin Exp Health Sci 2024; 14: 200-204. DOI: 10.33808/clinexphealthsci.1265279