Original Article

Canalis Sinuosus: A Case Report And Review Of Literature

Dr. Ashish Chandra[1], Dr. Anmol Bagaria[2], Dr. Chahatbir singh Randhawa[3], Dr. Jenil Jagdishbhai Malaviya[4], Dr. Rajan Patel[5], Dr. Sidhant Nayak[6]

[1]BDS, MDS, Oral Medicine and Radiology, Institute of Dental Studies and Technologies, Modinagar, Uttar Pradesh;
[2]BDS, MSc., PGDCA, FFA, FFO, Private Practitioner, Mumbai;
[3]General practitioner, Canada;
[4,5]BDS, Goenka Research Institute of Dental Science, Gujarat;
[6]BDS, PG 2nd Year, Oral and Maxillofacial Surgery, Awadh Dental College and Hospital, Jamshedpur, Jharkhand.

Corresponding author
Dr. Ashish Chandra, BDS, MDS, Oral Medicine and Radiology, Institute of Dental Studies and Technologies, Modinagar, Uttar Pradesh;
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Abstract

The Canalis Sinuosus (CS) is a neurovascular canal, through which the Anterior Superior Alveolar Nerve (ASAN) passes and then curves medially in path between the nasal cavity andthe maxillary sinus, reaching the premaxilla in the canine to incisor region. The purpose of thisarticle is to report two cases with the presence of Canalis Sinuosus, in order to alert and guide professionals and discuss the morphology of this anatomical variation avoiding postsurgical disorders. The cases revealed the presence of Canalis Sinuosus in Cone Beam Computed Tomography (CBCT) imaging. The knowledge of this anatomical variation is essential for professionals, because attention to this region prevents irreversible damage. Therefore, the useof advanced imaging is recommended during the treatment planning stages and in patients undergoing surgery treatment and after surgery in this area.

Keyword: Canalis Sinuosus (CS), Anterior Superior Alveolar Nerve (ASAN), Cone Beam Computed Tomography (CBCT), Advanced Imaging, Anterior Maxilla, Maxillary Surgery.

Introduction:

The Canalis Sinuosus (CS) and its double curved course was first described by Wood-Jones in1939.[1] It is a neurovascular canal where Anterior Superior Alveolar Nerve (ASAN) and its vessels are located, they form dental plexus in the canine region. CS innervates from maxillaryincisors to canine and neighbouring soft tissues.[1,2]

CS is analysed using Cone Beam Computed Tomography (CBCT) because of its detailed imaging. It's a neurovascular bundle that runs through posterior portion of the Infra-Orbital Foramen (IOF) and runs through a twisted path in a bone channel, lateral to the nasal cavity. Regarding its position, CS was well defined as a canal that emerges roughly 25 mm behind theIOF and descends to the orbital floor, curves medially to the anterior wall of the maxillary sinus, and proceeds to the anterior nasal aperture. Anatomic variations of CS are seen in anterior maxilla.[3,4]

Importance:

Preoperative examination of maxilla before any surgical procedure on CBCT imaging is necessary to avoid complications (hemorrhage, paresthesia, anesthesia, pain).[3] The main factorcausing complications are dental implant placement. CBCT provides highly reliable, high- resolution images with small slice thickness that enables detailed visualization of course of CS.CBCT shows frequency, location, diameter and its variations.[5] Canine is important because of its anatomical strength that support implants in this region. Theproximity to CS to implants

can compromise Osseo-integration. It is also associated with highrisk in orthognathic surgery (Le-Fort I fracture) which may damage CS and other adjacent neurovascular bundles.[7]

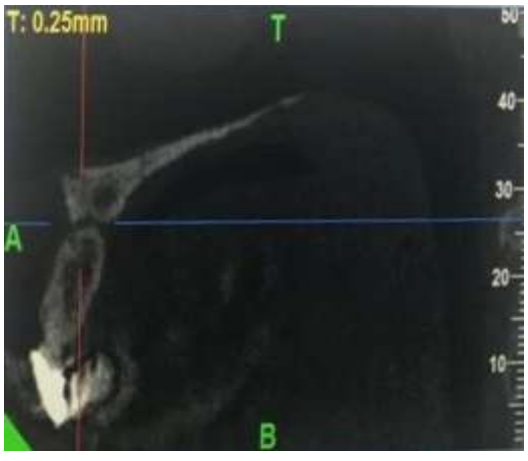
Case Report:

CBCT evaluation of anterior maxilla was analysed in CBCT scan of patient. CBCT examinations was performed in PAYAYA CBCT machine (85 kVp,7 mA) with different FOV and images were reconstructed into axial, coronal, sagittal planes with Tirana software. CBCTimages revealed the presence of CS in close proximity to the canine. CS is observed in axial, cross-sectional, coronal and sagittal reconstructions as a wide,radiolucent path, adjacent to left canine apex, present under the anterior part of the nasal floorand extending upwards to the anterior nasal wall. It also revealed linear radiolucent track of CS, in the right canine-first premolar region.

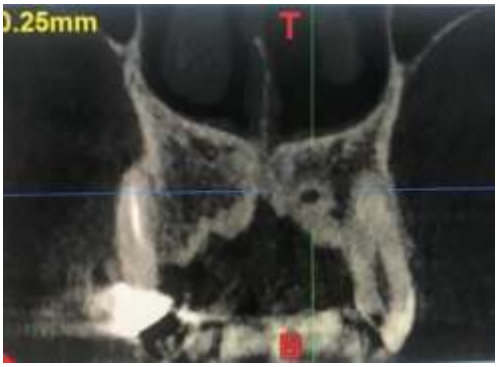
Case 1:

- Patient Particulars: Age/Gender - 38 years/ Male
- Underwent CBCT of the maxilla for the planning of implant placement.
- Sequential sagittal sections along the latero-medial plane and sequential coronal sections along the postero-anterior plane revealed a canal extending from the lateral wall of the nasal fossa on the left side and following a course skirting its margin, up toits inferior limit, corresponding to the natural path of part of the CS.

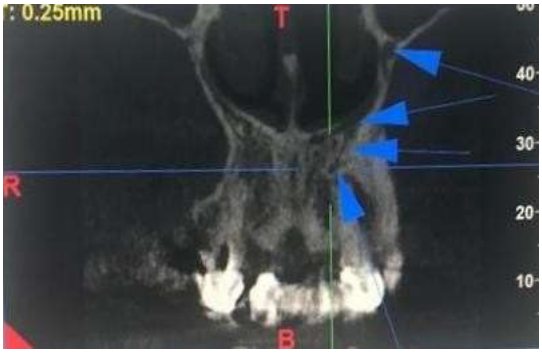
A



B



C



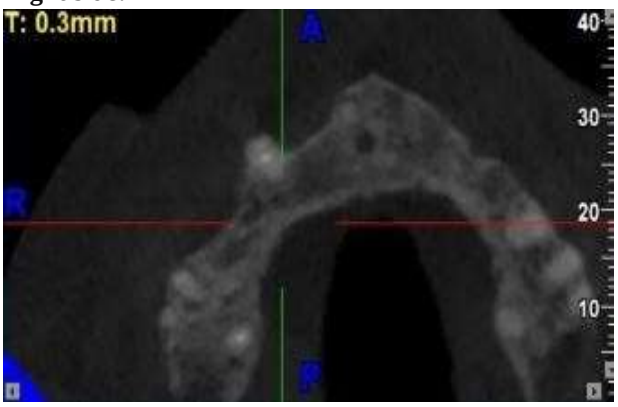
D

Figure 1: CBCT Image Reconstruction: Axial (A), Sagittal (B) and Coronal (C, D) sections showing the course of canalis sinuosus which is seen extending from nasal fossa to the apex oftooth 23.

Case 2:

- Patient Particulars: Age/Gender - 38 years/ Male.
- Underwent CBCT of the maxilla for the planning of rehabilitative treatment with dentalimplants.
- Sequential sagittal sections along the latero-medial plane and sequential coronal sections along the postero-anterior plane revealed a canal extending from the lateral wall of the nasal fossa on both the sides and following a course skirting its margin, up to its inferior limit, corresponding to the natural path of part of the CS.

Right side:



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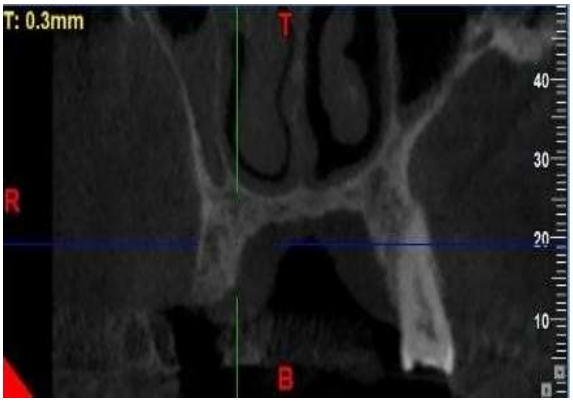
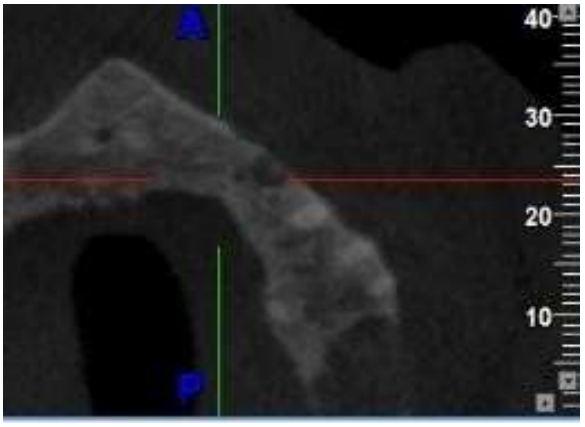


B

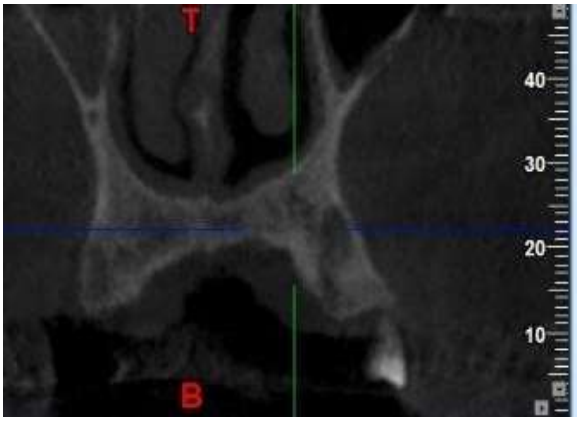
C

Figure 2: CBCT Image Reconstruction: Axial (A), Coronal (B) and Sagittal (C) and sections showing the course of canalis sinuosus which is seen extending from nasal fossa to the apex oftooth 13.

Left side:



A



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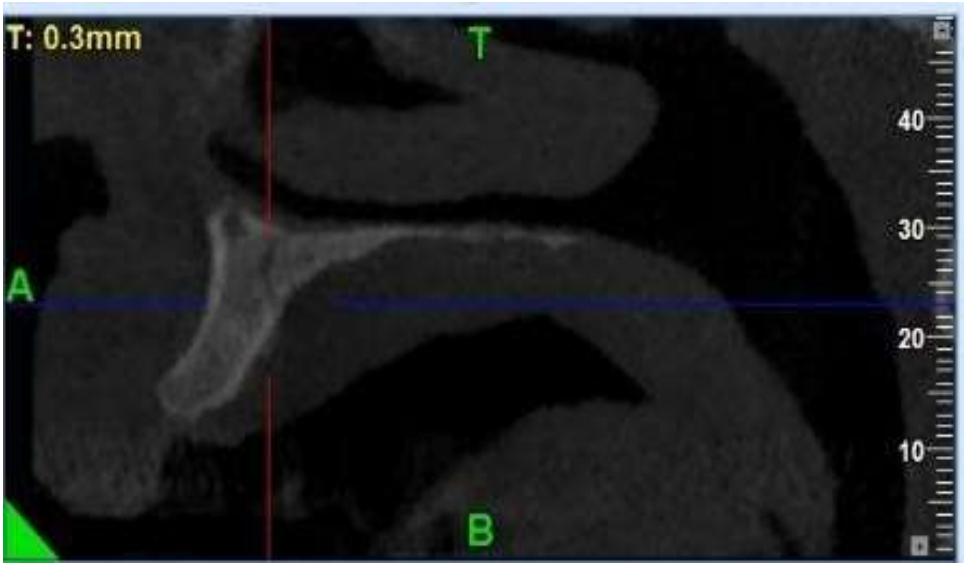

C

Figure 3: CBCT Image Reconstruction: Axial (A), Coronal (B) and Sagittal (C) and sections showing the course of canalis sinuosus which is seen extending from nasal fossa to the Left Edentulous Canine region.

Discussion:

ASAN is a branch of ION which supplies the incisors, canines and soft tissues of maxillary anterior region[1,2]. It communicates with the Middle Superior Alveolar Nerve (MSAN) and forms the superior dental plexus.

The ASAN is more than one-third the size of the parent trunk and traverses the anterior wall ofthe maxilla in a distinct bone canal called CS (anterior superior alveolar canal) owing to its double curved course[1,3,4]. CS originates from the infraorbital canal posterior to the infraorbitalforamen and in an antero-lateral direction. After reaching the anterior wall of the maxilla, it turns medial to run below the infraorbital foramen crossing the antrum wall from lateral to medial. Once the canal reaches the nasal aperture, it loops inferiorly and descends along the piriform opening[1].

The knowledge of CS and ASAN carries significant clinical implications of the anterior maxilla.[7] With the precise imaging modality like CBCT, visualisation of its pathway and morphology has become easier. In both cases incidental finding of anterior maxilla is discussedin which CS was noticed on CBCT examination indicated for various pathology of the anteriormaxilla. The dentist was informed about the same which helped in better treatment planning and prognosis of the patient.

There are a few cases of CS on Pubmed based search for term “Canalis Sinuosus” and “CBCTanalysis of CS” from 1999-2022 which revealed 18 relevant results out of which eight were case reports, making this the nineth case report in this category.

S. No.	Year	Author	Types of Imaging	Age/Sex of patient	Findings in the case report
1.	2018	Leven AJ etal	IOPA and CBCT	32/M	A radiolucent canal was seen running on the palatalaspect of permanent maxillary left lateral incisor and on the distopalatal aspect of permanentmaxillary right lateral incisor within the bone.
2.	2017	Shah PN et al	IOPA and CBCT	60/M	The adjunct branch of CS is seen mimicking external root resorption in permanent maxillaryright central incisor.
3.	2017	Arruda JA etal	CBCT	51/F	CS is located between apical portion of implant in the maxillary lateral incisor and the right canineregion.
4.	2017	Rusu MC etal	CBCT	74/M	Multiple accessory canals (ACs) were seen deriving from canalis sinuosus, which opened opposite each frontal tooth.
5.	2017	McCrea SJJ	IOPA, Occlusal and CBCT	55/F	A radiolucent canal is present between the apical portion of maxillary left canine and the nasopalatine canal.
6.	2015	Torres MG etal	CBCT	47/F	The accessory branch of CS was located in hard palate and slightly medial in relation to maxillary left canine.
7.	2012	Neves FS etal	CBCT	54/F	Accessory canal seen bilaterally extending adjacentto the maxillary lateral incisor.
8.	1999	Shelley AMet al	IOPA	35/M	Canalis sinuosus displayed as a periapical radiolucency with corticated borders in maxillary left canine.

Table 1. Pubmed based survey results for reported cases of Canalis Sinuosus publishedbetween 1999-2022.

CS has been classified into seven types according to their location relative to theteeth/incisive foramen region by de Oliveira-Santos C et al. [15].

These are as follows:

1. Central incisor region
2. Between the central and lateral incisor region3.Lateral incisor region
3. Canine region
4. First premolar region
5. Lateral to incisive foramen
6. Posterior to incisive foramen

Conclusion:

The knowledge of these important anatomic structures and neurovascular channels through which ASAN and its

further branch (Canalis Sinuosus) passes is of extreme importance for theunderstanding of anterior maxilla. It confirms that CS can be well evident as well as poorly evident in different cases. This article will guide the surgeons about anatomical variation present in this region, better treatment planning, to reduce post-surgical complications and further yield better prognosis of the patients.

Conflicts of Interest:

The authors declare that there are no conflicts of interest regarding the publication of this paper.

References:

1. Von Arx T, Lozanoff S. Anterior superior alveolar nerve (ASAN). Swiss Dent J. [1] 2015;125(11):1202-09.
2. Arruda JA, Silva P, Silva L, Álvares P, Silva L, Zavanelli R, et al. Dental implant in the canalis sinuosus (CS): A case report and review of the literature. Case Rep Dent. [2] 2017;2017:4810123.
3. Jones FW. The anterior superior alveolar nerve and vessels. J Anat. [3] 1939;73(4):583-91.
4. Song WC, Kim JN, Yoo JY, Lee JY, Won SY, Hu KS. Microanatomy of the infraorbitalcanal (IOC) and its connecting canals in the maxilla using 3-D reconstruction of microcomputed tomographic images. J Craniofac Surg. [4] 2012;23(4):1184-87.
5. Leven AJ, Sood B. Pathosis or additional maxillary neurovascular channel? A case report. J Endod. [5] 2018;44(6):1048-51.
6. Shah PN, Arora AV, Kapoor SV. Accessory branch of canalis sinuosus(CS) mimickingexternal root resorption: a diagnostic dilemma. J Conserv Dent. [6] 2017;20(6):479-81.
7. Rusu MC, Sandulescu M, Bichir C, Muntianu LAS. Combined anatomical variations :The mylohyoid bridge, retromolar canal and accessory palatine canals branched from the canalis sinuosus(CS). Ann Anat. [7] 2017;214:75-79.
8. McCrea SJJ. Aberrations causing neurovascular damage in the anterior maxilla [8] during dental implant placement. Case Rep Dent. 2017;2017:5969643.
9. Torres MG, Vidal MT, Crusoé-Rebello IM, de Faro Valverde L. Branch of the canalissinuosus (CS): a rare anatomical variation - A case report. Surg Radiol Anat. [9] 2015;37(7):879-81.
10. Neves FS, Crusoé-Souza M, Franco LC, Caria PH, Bonfim-Almeida P, Crusoé- [10] Rebello I. Canalis sinuosus: a rare anatomical variation. Surg Radiol Anat. 2012;34(6):563-66.
11. Shelley AM, Rushton VE, Horner K. Canalis sinuosus mimicking a periapical [11] inflammatory lesion. Br Dent J. 1999;186(8):378-79.
12. Gurler G, Delilbasi C, Ogut EE, Aydin K, Sakul U. Evaluation of the morphology [12]of the canalis sinuosus using cone-beam computed tomography in patients with maxillary impacted canines. Imaging Sci Dent. 2017;47(2):69-74.
13. Orhan K, Gorurgoz C, Akyol M, Ozarslanturk S, Avsever H. Folia Morphol (Warsz). An anatomical variant : evaluation of accessory canals of the canalis sinuosus (CS) using Cone Beam Computed Tomography. Folia Morphol (Warsz). [13] 2018;77(3):551-57.
14. Ghandourah AO, Rashad A, Heiland M, Hamzi BM, Friedrich RE. CBCT analysis of canalis sinuosus accessory intraosseous canals in the maxilla. [14] Ger Med Sci. 2017;15:Doc 20.
15. De Oliveira-Santos C, Rubira-Bullen IR, Monteiro SA, León JE, Jacobs R. [15]Neurovascular anatomical variations in the anterior palate observed on CBCT images.Clin Oral Implants Res. 2013;24(9):1044-48.
16. Manhães Júnior LR, Villaça-Carvalho MF, Moraes ME, Lopes SL, Silva MB, Junqueira JL. Location and classification of Canalis sinuosus for CBCT: avoiding misdiagnosis. Braz Oral Res. [16] 2016;30(1):49.