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# PREVALENCE OF ACCESSORY CANALS IN MANDIBLE – A RETROSPECTIVE CONE BEAM COMPUTED TOMOGRAPHY (CBCT) STUDY

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## ABSTRACT

**Background:** Many anatomical variations such as anterior looping, accessory canals of the inferior alveolar nerve are known to exist in the mandible. Such variations are evident with the radiographic examination of mandible using Cone Beam Computed Tomography (CBCT). Complications such as bleeding intra – operatively and paraesthesia post – operatively could be effectively prevented by careful pre – surgical analysis of the scan volumes acquired. This study aims to analyse the prevalence of accessory canals of the inferior alveolar nerve using CBCT.

**Materials and Methods:** This retrospective study was done using 250 CBCT scan volumes taken between August 2018 and August 2019 on patients for the various diagnostic purposes. All volumes were acquired using Sirona Orthophos machine with a Field of View of 8 x 8 cm. All CBCT volumes were viewed using Galileos viewer software. The scans were analysed for the presence and location of accessory canals exiting the buccal and lingual cortical plates of the mandible.

**Results:** Of the 250 scan volumes, 75 cases did not have accessory canals. The numbers of canals observed were grouped into 1, 2, 3, 4 and 5. Single canals were observed in maximum number of patients and 5 canals were observed in only one patient. All canals were observed to be inferior to the level of mental foramen.

**Conclusion:** The presence of accessory canals is found to be quite common (about 70%) in the samples analysed for this study. CBCT provides high resolution images that can be examined in all three planes for better localization of such anatomical variations.

**Keywords: CBCT imaging, Accessory canals, Inferior alveolar nerve, Complications, Implant planning**

## INTRODUCTION

Accessory canals or nutrient canals are those radiolucent canals running through the buccal or lingual cortical plates of the mandible into the trabecular bone seen on different sections of a radiograph **[1]**. These are considered as variations in the course of the inferior alveolar nerve. Numerous accessory canals have been described in the mandible – in the buccal and lingual cortical plates, the midline and the retro molar region **[2]**. These canals are thought to contain the neurovascular bundles and hence can pose a complication during local anaesthesia and surgical procedures involving the mandible namely orthognathic surgeries, implant placement and surgeries for fracture reduction. The morphology and prevalence of the canals are variant. Since the presence of the canals are unknown, many clinicians can misinterpret these radiolucent lines as fracture lines of mandible **[3]**.

An understanding of the presence, prevalence and distribution of these canals in the mandible can be helpful in preventing the complications such as failure of local anaesthetic agents, compression of nerve bundle leading to paraesthesia, intra operative and post-operative haemorrhage and formation of sublingual hematoma.

Cone Beam Computed Tomography (CBCT), a 3D imaging modality that allows diagnostician to view the acquired volume of data to be reformatted in any different plane **[4]**. Use of CBCT has permitted the detailed visualization of such variations in the morphology of the mandible. The tomographic slices on different planes allow better localization of the canals. The aim of this study is to retrospectively analyse the prevalence, location of accessory canals in the mandible using CBCT.

## MATERIALS AND METHODS

This retrospective study included 250 CBCT volumes acquired between August 2018 and August 2019 for diagnostic purposes including implant assessment. The volumes were acquired using Sirona Orthophos (Dentsply, Germany) with a field of View of 8 x 8 cm and slice thickness of 400 μm. All scans were viewed using Galileos Viewer.

The inclusion criteria were patients with age greater than 18 years, dentulous

patients and scan volumes which covered the mandible adequately. The diameter of all accessory canals was measured and those canals with diameter greater than 0.40 mm were included in the study.

The exclusion criteria are presence of artefacts, severe ridge resorption, pre – existing implants, history of craniofacial malformations or anomalies, history of trauma or surgery, inadequate image quality and subsequent scans from the same individual.

The selected scans were analyzed for the presence of accessory canals.

**RESULTS**

The total number of patients included in this study was 250, of which males were 140 and females were 110. Ten scan volumes were excluded based on the exclusion criteria. The age range of the patients was between 19 to 70 years **(Table 1)**. The maximum number of patients was between the age ranges of 19 to 29 years.

Of the included patients, 78 patients did not have accessory canals in the mandible (31.2%). This accounted to 42 males and 36 females. The observed canals were subdivided into 1, 2, 3, 4 and 5 **(Table 2)**.

**Figure 1a** shows the Axial sections of CBCT with mental foramen in the left mandible and **Figure 1b** shows presence of single accessory canal on the left side of mandible (indicated with a yellow arrow) below the level of mental foramen (indicated with a blue arrow). **Figure 2** shows the presence of accessory canals on both the sides of mandible, which are anterior and inferior to the mental foramen.

**Figure 3a and 3b** shows axial sections with accessory canals posterior and anterior to the mental foramen. **Figure 3c** shows tangential sections with accessory canal towards the inferior margin of the mandible.

**Figure 4 and 5** shows cross sectional, tangential and axial sections shows multiple accessory canals from the mandible at various parts of mandible.

The prevalence of accessory canals was 70%. Males had a prevalence of 40% while females had 30%. The location of the canals was inferior to the mental foramen. 127 canals were anterior to the mental foramen and 125 canals were posterior to the foramen.

**Table 1: Age Range of Included Patients**

| Age | No. of Patients |
|---|---|
| 19 – 29 | 8 |
| 30 – 39 | 61 |
| 40 – 49 | 52 |
| 50 – 59 | 24 |
| 60 – 70 | 14 |

| Table 2 : Number of Canals Observed | |
|---|---|
| **No. of Canals** | **No. of Patients** |
| **1** | **91** |
| **2** | **58** |
| **3** | **8** |
| **4** | **4** |
| **5** | **1** |

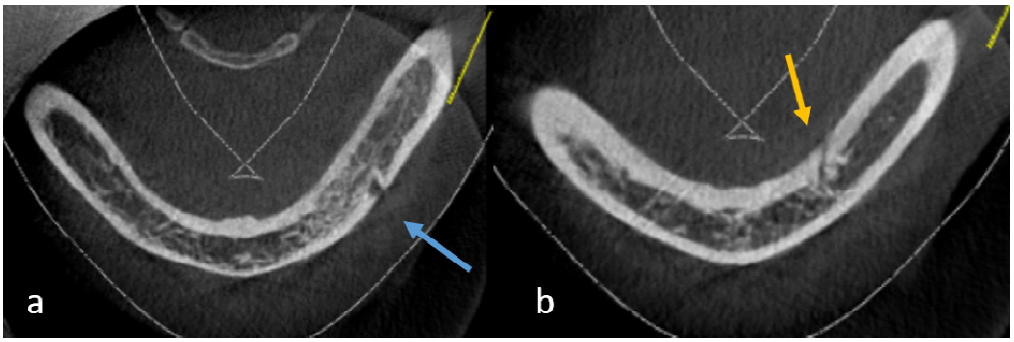


**Figure 1: Single accessory canal**

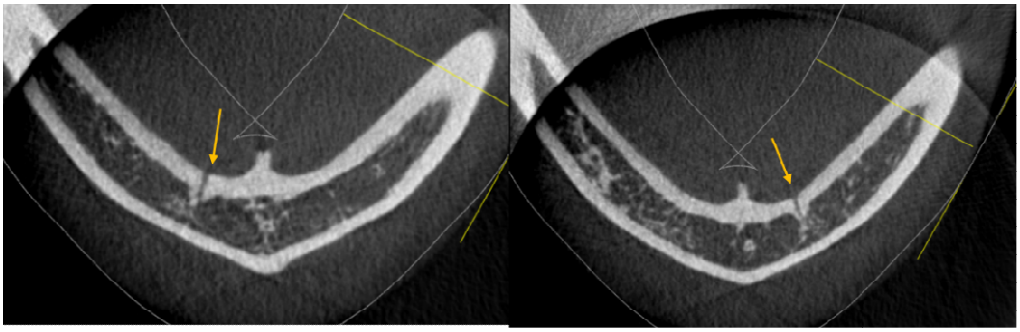

**Figure 2: Bilateral accessory canals in the same patient**

**Figure 3: Three accessory canals**

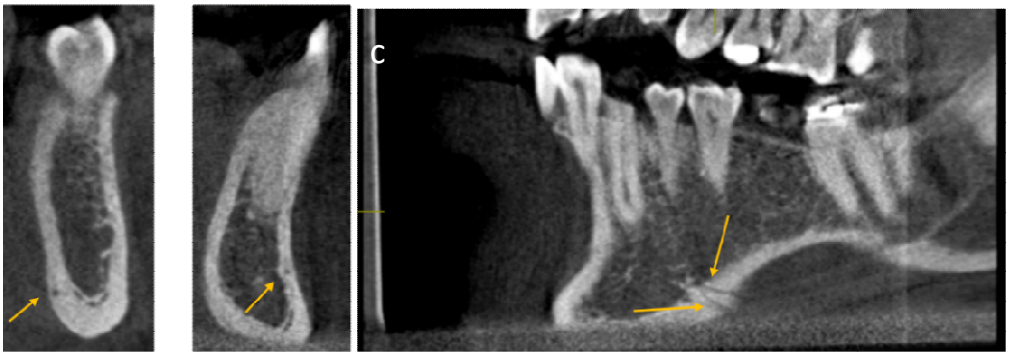


**Figure 4: Four accessory canals**

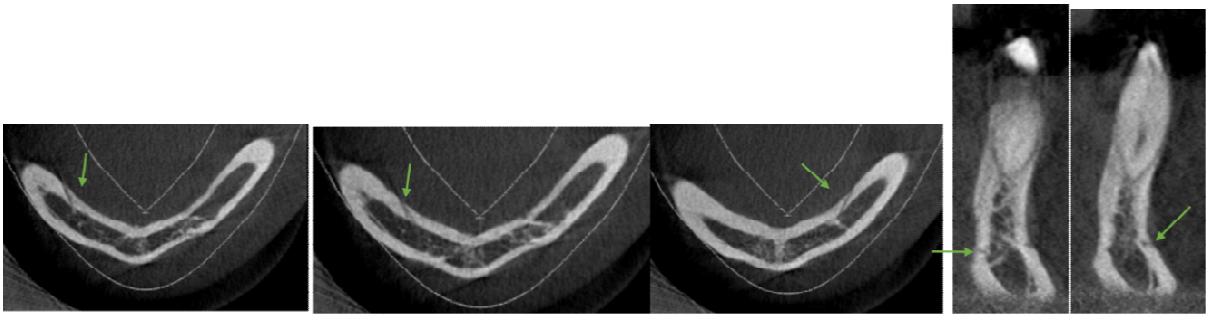

**Figure 5: Five accessory canals**

## DISCUSSION

Cone beam computed tomography (CBCT) is an imaging modality with multiple applications in diagnostic imaging and in dentistry **[5]**. It is used for implant planning, localization of impacted canine or third molars, evaluation of complex fracture, visualization of anatomical variations, localization of mandibular canal, assessment of vertical tooth fracture, detection of accessory canals of tooth, assessment of temperomandibular joint and evaluation of cystic lesions. It is considered a better imaging modality than panoramic radiography as it provides the third axis needed for various analyses and better soft tissue visualization.

Based on SEDENTEXCT guidelines for indication of CBCT in implant planning, it is of principal value in pre – operative assessment and treatment planning but not a 'routine protocol' in post-operative assessment **[6]**. It is considered an indication in post - operative analysis only in situations wherein complications are suspected. Such complications arise due to lack of sequential analysis of the pre – operative CBCT for the presence of accessory canals, anterior loop of the mandibular canal and other anatomical variations occurring in the mandible.

Accessory canals are those canals that may contain neurovascular bundles and can lead to formation of sublingual hematoma and paraesthesia following implant placement. Knowledge of the incidence, prevalence and the location of such canals can help in preventing complications that can become fatal to the patient **[7, 8]**. In the present study, location of all the canals were inferior to the mental foramen. This should be considered in cases of local anaesthesia, fracture reduction and orthognathic surgeries involving the inferior border of the mandible.

Multiple studies have been done for the evaluation of presence and prevalence of accessory canals of the jaw **[3, 9-11]**. The superior and the inferior lingual foramina have been reported to have a prevalence of 85 – 99% and hence were not documented in this study **[9, 12, 13]**.

In a study done by JKM Aps in 2013, there were only 5.3% patients with no accessory

canals. A maximum of 11 accessory canals including lingual canals was reported in the study **[14]**. In this study, 31.2% patients did not have any accessory canals and the maximum number of canals was five excluding lingual canals in the midline of mandible.

In implantology, the mandible is divided into interforaminal zone and the ischemic zone. The interforaminal zone is the zone of mandibular alveolar ridge in between the mental foramina of either sides. The ischemic zone is the posterior mandible on both sides. The presence of accessory canals and the complications that arise due their incidence is most common in the ischemic zone **[15]**. The number of canals located in the interforaminal zone were slightly higher than those canals located posterior to the mental foramen in the present study.

Eshak at al reported a prevalence of accessory canals as 29.8% in the mandible **[3]**. The approximate diameter of branches of mandibular nerve were found to be between 0.40 mm to 3.60 mm **[16]**. This is reason why only accessory canals with diameter above 0.40 mm were only included in this study. The prevalence in this study was 70%, which included only those canals present in the mandible.

## CONCLUSION

CBCT imaging permits visualization of accessory canals of jaws with high accuracy and resolution. The presence of these accessory should be considered when pre – surgical implant planning is done and precautions have to be taken to prevent future complications that might occur when their presence is noted. There is no guidelines given in literature regarding the precautions that can be taken or the 'safe – distance' or 'safe – margin' from an implant to the accessory canal which needs to be formulated. The potential for development of haemorrhage or paraesthesia should be considered when such anatomical variations are encountered.

## REFERENCES

**[1]** Wang PD, Serman NJ, Kaufman E. Continuous radiographic visualization of the mandibular nutrient canals. Dentomaxillofacial Radiology. 2001; 30(2): 131-2.

**[2]** Angelopoulos C. Cone Beam Tomographic Imaging Anatomy of the Maxillofacial Region. Dental Clinics of North America. 2008; 52(4): 731-52.

**[3]** Eshak M, Brooks S, Abdel-Wahed N, Edwards PC. Cone beam CT evaluation of the presence of anatomic accessory canals in the jaws. Dentomaxillofacial Radiology. 2014; 43(4): 20130259.

**[4]** White SC, Pharoah MJ. The Evolution and Application of Dental Maxillofacial Imaging Modalities.

Dental Clinics of North America. 2008; 52(4): 689-705.

**[5]** Scarfe WC. Clinical Applications of Cone-Beam Computed Tomography in Dental Practice. 2006; 72(1): 6.

**[6]** Guidelines on CBCT for Dental and Maxillofacial Radiology SEDENTEXCT.

**[7]** Kalpidis CDR, Setayesh RM. Hemorrhaging Associated With Endosseous Implant Placement in the Anterior Mandible: A Review of the Literature. Journal of Periodontology. 2004; 75(5): 631-45.

**[8]** Givol N, Chaushu G, Halamish-Shani T, Taicher S. Emergency tracheostomy following life-threatening hemorrhage in the floor of the mouth during immediate implant placement in the mandibular canine region. Journal of Periodontology. 2000; 71(12): 1893-5.

**[9]** Scaravilli MS. Mandibular lingual vascular canals (MLVC): Evaluation on dental CTs of a case series. European Journal of Radiology. 2010: 4.

**[10]** Gupta S, Singh P, Soni A. Morphological study of accessory foramina in mandible and its clinical implication. Indian J Oral Sci. 2013; 4(1): 12.

**[11]** Sergey L. Kabak NAS, Yuliya M. Melnichenko, Natallia V. Zhuravleva. Imaging of accessory buccal foramina using cone-beam computed tomography: case reports: Eur. J. Anat.; 2017: 21(3)

**[12]** Sanhueza Á, Briner M, Calvo M, Cisternas A. The Presence of Lingual Foramina and Canals on CBCT on Patients over 18 Years of Age. Int J Morphol. 2018; 36(1): 80-6.

**[13]** Assari A, Almashat H, Alamry A, Algarni B. Prevalence and location of the anterior lingual foramen: A cone-beam computed tomography assessment. Saudi J Oral Sci. 2017; 4(1): 41.

**[14]** Aps JKM. Number of accessory or nutrient canals in the human mandible. Clin Oral Invest. 2014; 18(2): 671-6.

**[15]** Tolstunov L. Implant Zones of the Jaws: Implant Location and Related Success Rate. Journal of Oral Implantology. 2007; 33(4): 211-20.

**[16]** Afsa M, Rahmati H. Branching of mandibular canal on cone beam computed tomography images. Singapore Dent J. 2017; 38: 21-5.