Research Article

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Assessment of Characteristics of Supernumerary Teeth: A Cone Beam Computed Tomography Study

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ABSTRACT

Introduction: Supernumerary teeth (ST) are supplementary teeth or tooth substances that develop in addition to the usual configuration of 20 deciduous and 32 permanent teeth. The aetiology of ST is not well understood. Using regular radiographs, it is sometimes impossible to identify and formulate therapy plans for the purpose of predicting and surmounting potential complications.

Objective: To assess the characteristics of supernumerary teeth in cone beam computed tomography (CBCT).

Methodology: A descriptive cross-sectional study was conducted from 2021 November to 2023 October after ethical approval from institutional review committee of Kantipur Dental College. A total of 180 supernumerary teeth samples were retrospectively collected by convenience sampling method and evaluated. Data collected were entered in Microsoft Excel sheet and analysed.

Result: Overall, 180 ST were found in 142 patients (107 males; 35 females). Among them, 110 patients had one ST, 28 had two, three had three, and one had five ST. The supernumeraries were maxillary in 110 and mandibular in 32 patients respectively. A total of 109 teeth were found in the anterior area, 33 were in the premolar region and 38 in the molar region. The teeth were mainly odontomatous (61) followed by conical (52 teeth), supplemental (42 teeth), and tuberculate (25 teeth). Normally oriented were 115 teeth, 34 were inverted, and 31 were transverse.

Conclusion: The ST greatly differ in position, shape, number, location, and may have abnormal eruption path. The CBCT provides valuable information about morphology, position, angulation and location of ST, thus aiding in an accurate diagnosis.

Keywords: Characteristics; cone beam computed tomography; diagnosis; supernumerary teeth.

INTRODUCTION

Supernumerary teeth (ST) may be defined as the supplementary teeth that are more than 20 in the deciduous dentition or more than 32 in the permanent dentition. The exact aetiology of supernumerary teeth is unknown. However,

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majority of supernumerary teeth are considered to develop because of horizontal proliferation of dental lamina.[1] Heredity is also believed to be an important aetiological factor in the occurrence of supernumerary teeth. However, it does not follow a simple Mendelian pattern.[2]

There are various classifications of supernumerary teeth. Commonly they are classified according to location and morphology. Locational variations include mesiodens, paramolars, distomolars, and parapremolars. Variations in shape consist of conical types, tuberculate types, supplemental teeth, and odontomas. Therefore, supernumerary teeth may vary from a simple odontoma, through a conical or tuberculate tooth to a supplemental tooth which closely resembles a normal tooth. The site and number of supernumeraries can also greatly vary.[2]

Thorough clinical and radiographic examination is required for detection of supernumerary teeth because they are associated with many complications such as crowding, delayed eruption, impaction, abnormal diastema, cystic lesions, ectopic eruption, root resorption of adjacent teeth, and so forth. An early diagnosis is always important because it allows an early intervention, a more favourable prognosis, and minimal complications.[3]

It is laborious to use regular radiographs, to identify and formulate therapy plans for the purpose of predicting and surmounting potential complications. Normal and pathologic disorders such as odontomas, ST, developmental abnormalities, and traumatic injuries can all benefit from cone beam computed tomography (CBCT) to obtain precise and accurate data. The major advantage of CBCT is three-dimensional (3-D) geometric accuracy compared to two-dimensional (2-D) radiographs.[4]

Hence, this study was conducted with an aim to assess the characteristics of supernumerary teeth like morphology, distribution, orientation, location, and eruption status in CBCT.

METHODOLOGY

A descriptive cross-sectional study was conducted from 2021 November to 2023 October (two years) after obtaining ethical approval from Institutional Review Committee (IRC) of Kantipur Dental College (Reference number: 26/023). Written informed consent was waived for this study since it only included the retrospective records of CBCT (Figure 1). The tenets of Declaration of Helsinki were adhered throughout the study. The data collection was done from the Department of Oral Medicine, Diagnosis, and Radiology. A total of 180 supernumerary teeth samples were evaluated by using the formula $n = z^2pq/e^2$; where p = (64.6%) which was taken from the study conducted by Guo et al.[5]; q = 0.646; z = 1.96; and e = 7%. Convenience sampling technique was done for the data collection purpose. Inclusion criteria were all the CBCT image taken via CS 9300 care stream, Germany machine using the standard protocol at 85kV, 6.3mA, 11.30s, voxel size of 300mm and 17*13.5 cm field of view of normal patients done during 2021 November to 2023 October. Exclusion criteria were CBCT of the patients previously diagnosed with syndromes, cleft lip and palate, or those with cleidocranial dysplasia. The CBCT of poor quality were also excluded from study. Single examiner was used for the interpretation of CBCT. Data was collected, entered in Microsoft excel sheet and analysed. Descriptive statistics like frequency and percentage were calculated.

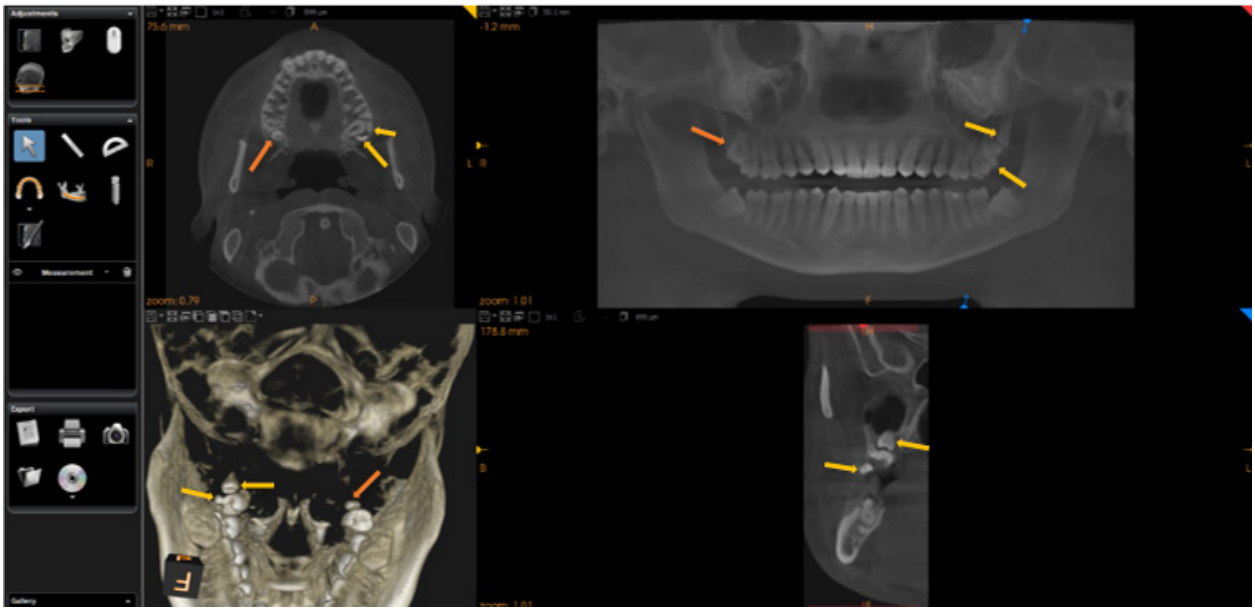

Figure 1: Cone beam computed tomography image showing supernumerary teeth in the posterior maxilla; position of supernumerary teeth in axial plane, panoramic view, three-dimensional view, and sagittal plane. The orange arrow indicates supernumerary teeth in the right maxilla, while the yellow arrow represents supernumerary teeth in the left maxilla.

RESULT

Altogether, there were 142 CBCT out of which, 107 (75.35%) were of males and 35 (24.65%) were of females, with a total of 180 supernumerary teeth (Figure 2).

Out of 142 CBCT, 110 CBCT (77.50%) had one supernumerary teeth, 28 (19.70%) had two, three (2.10%) had three, and one (0.70%) had five supernumerary teeth. Male patients exhibited higher number in all groups of supernumerary teeth, except in the group with five supernumerary teeth, where the only case was of a female patient. The supernumerary teeth were maxillary in 110 (77.46%) patients and mandibular in 32 (22.54%) patients. The distribution of supernumerary teeth was nearly equal between the right and left sides: 58 (40.85%) and 62 (43.66%) ST respectively and the lowest frequency was observed at the midline that was 22 (15.49%). The permanent dentition

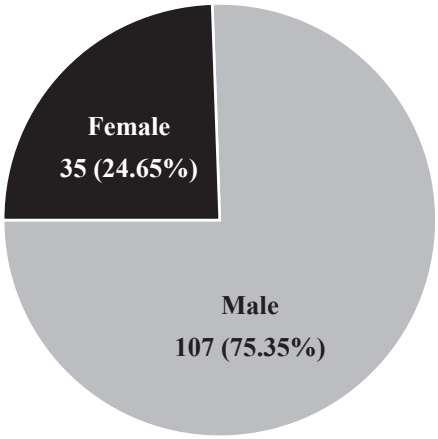

Figure 2: Showing distribution of supernumerary teeth among male and female.

exhibited the highest number of supernumerary teeth, followed by mixed dentition. Whereas deciduous dentition had the least number of supernumerary teeth. Maximum CBCT showed the ST in the anterior region which were 88 (61.98%) (Table 1).

The supernumerary teeth have been classified based on their morphologic type (Table 2). The ST were mainly odontoma in type (61 teeth, 33.89%), followed by conical (52 teeth, 28.89%), supplemental (42 teeth, 23.33%), and tuberculate (25 teeth, 13.89%). Overall, 138 ST (76.67%) were located in maxilla whereas, only 42 (23.33%) ST were located in mandible. A total of 109 teeth (60.56%) were found in anterior area, 33 (18.33%) teeth in premolar region and 38 (21.11%) teeth in the molar region. Most supernumerary teeth showed normal orientation, especially odontoma (51 teeth, 83.60%). Inverted orientation was noted mostly in conical supernumerary teeth (19 teeth, 36.54%). Tuberculate was observed the most in transverse orientation (11 teeth, 44%). Majority of the supernumerary teeth were found within the arch (94 teeth, 52.22%), especially supplemental type (32 teeth, 76.91%) (Table 2).

A total of 115 ST were normally oriented, 34 teeth were inverted and 31 teeth were transverse oriented. Maxilla was the most common site for supernumerary teeth in all orientations, and notably, all inverted supernumeraries were confined to the maxillary arch. Normally oriented teeth were more evenly distributed among all three-region compared to inverted (30 teeth, 88.24%) and transverse (23 teeth, 74.19%) of which prevalence was observed the highest in anterior region. Most supernumerary teeth were unerupted, with inverted teeth showing an even higher prevalence of non-eruption (33 teeth, 97.06%). Normal orientation was dominated by odontomas (51 teeth, 44.35%), inversion by conical (19 teeth, 55.88%), and transverse orientation by tuberculate type (11 teeth, 35.48%). Most supernumerary teeth were found within the arch, especially in normal orientation (67 teeth, 58.27%). Inverted and transverse oriented teeth were often on the palatal side with no findings on labial-palatine and labial orientation respectively (Table 3).

Out of 180 ST, 149 teeth were unerupted, whereas 31 teeth were erupted. Unerupted supernumerary teeth were more prevalent across all categories,

Table 1: Distribution of supernumerary teeth according to patient and anatomic characteristics, n (%).

Variable		Number of CBCT				Total (n=142)
		1 (n = 110)	2 (n = 28)	3 (n = 3)	5 (n = 1)	
Gender	Male	86 (78.18)	19 (67.86)	2 (66.67)	-	107 (75.35)
	Female	24 (21.82)	9 (32.14)	1 (33.33)	1 (100)	35 (24.65)
Arch	Maxilla	85 (77.27)	24 (85.71)	1 (33.33)	-	110 (77.46)
	Mandible	25 (22.73)	4 (14.29)	2 (66.67)	1 (100)	32 (22.54)
Region	Anterior	69 (62.73)	19 (67.86)	-	-	88 (61.98)
	Premolar	21 (19.09)	3 (10.71)	2 (66.67)	1 (100)	27 (19.01)
	Molar	20 (18.18)	6 (21.43)	1 (33.33)	-	27 (19.01)
Side	Right	44 (40)	11 (39.29)	2 (66.67)	1 (100)	58 (40.85)
	Left	49 (44.55)	12 (42.86)	1 (33.33)	-	62 (43.66)
	Midline	17 (15.45)	5 (17.85)	-	-	22 (15.49)
Dentition	Deciduous	3 (2.72)	1 (3.58)	-	-	4 (2.82)
	Mixed	14 (12.73)	9 (32.14)	-	-	23 (16.20)
	Permanent	93 (84.55)	18 (64.28)	3 (100)	1 (100)	115 (80.98)

including arch, region, orientation, morphology, and sagittal position. The supplemental type was the most frequent among erupted teeth (14 teeth, 45.16%) whereas odontomas accounted for the majority of unerupted teeth (58 teeth, 38.92%). With respect to sagittal position, the majority of erupted supernumerary teeth were situated within the arch (24 teeth, 77.41%). However, a diverse distribution was observed in the unerupted teeth. Unerupted teeth were most commonly situated within the arch (70 teeth, 46.98%), followed by palatal (56 teeth, 37.58%), labial palatine (13 teeth, 8.73%) and labial (10 teeth, 6.71%) positions (Table 4).

Table 2: Distribution of supernumerary teeth according to tooth morphology, n (%).

Variable		Conical (n = 52)	Tuberculate (n = 25)	Supplemental (n = 42)	Odontoma (n = 61)	Total (n = 180)
Side	Right	21 (40.38)	4 (16)	16 (38.10)	34 (55.74)	75 (41.67)
	Left	19 (36.54)	11 (44)	23 (54.76)	25 (40.98)	78 (43.33)
	Midline	12 (23.08)	10 (40)	3 (7.14)	2 (3.28)	27 (15)
Arch	Maxilla	51 (98.08)	25 (100)	23 (54.76)	39 (63.93)	138 (76.67)
	Mandible	1 (1.92)	-	19 (45.24)	22 (36.07)	42 (23.33)
Region	Anterior	47 (90.38)	24 (96)	15 (35.71)	23 (37.70)	109 (60.56)
	Premolar	-	1 (4)	19 (45.24)	13 (21.32)	33 (18.33)
	Molar	5 (9.62)	-	8 (19.05)	25 (40.98)	38 (21.11)
Sagittal position	Palatal	26 (50)	10 (40)	8 (19.04)	18 (29.50)	62 (34.44)
	Labial	3 (5.77)	-	-	8 (13.12)	11 (6.12)
	Labial Palatine	3 (5.77)	4 (16)	2 (4.77)	4 (6.56)	13 (7.22)
	Within arch	20 (38.46)	11 (44)	32 (76.19)	31 (50.82)	94 (52.22)
Orientation	Normal	23 (44.23)	7 (28)	34 (80.95)	51 (83.60)	115 (63.89)
	Inverted	19 (36.54)	7 (28)	1 (2.38)	7 (11.48)	34 (18.89)
	Transverse	10 (19.23)	11 (44)	7 (16.67)	3 (4.92)	31 (17.22)

Table 3: Distribution of supernumerary teeth according to direction and location, n (%).

Variable		Normal (n = 115)	Inverted (n = 34)	Transverse (n = 31)	Total (n = 180)
Arch	Maxilla	77 (66.96)	34 (100)	27 (87.10)	138 (76.67)
	Mandible	38 (33.04)	-	4 (12.90)	42 (23.33)
Region	Anterior	56 (48.69)	30 (88.24)	23 (74.19)	109 (60.56)
	Premolar	28 (24.35)	1 (2.94)	4 (12.90)	33 (18.33)
	Molar	31 (26.96)	3 (8.82)	4 (12.91)	38 (21.11)
Eruption status	Erupted	28 (24.35)	1 (2.94)	2 (6.45)	31 (17.22)
	Unerupted	87 (75.65)	33 (97.06)	29 (93.55)	149 (82.78)
Morphology	Conical	23 (20)	19 (55.88)	10 (32.25)	52 (28.89)
	Tuberculate	7 (6.08)	7 (20.59)	11 (35.48)	25 (13.89)
	Supplemental	34 (29.57)	1 (2.94)	7 (22.59)	42 (23.33)
	Odontoma	51 (44.35)	7 (20.59)	3 (9.68)	61 (33.89)
Sagittal position	Palatal	37 (32.18)	14 (41.18)	11 (35.48)	62 (34.44)
	Labial	9 (7.82)	2 (5.88)	-	11 (6.12)
	Labial palatine	2 (1.73)	-	11 (35.49)	13 (7.22)
	Within arch	67 (58.27)	18 (52.92)	9 (29.04)	94 (52.22)

Table 4: Distribution of supernumerary teeth according to eruption type and location, n (%).

Variable		Erupted (n = 31)	Unerupted (n = 149)	Total (n = 180)
Arch	Maxilla	28 (90.32)	110 (73.82)	138 (76.67)
	Mandible	3 (9.68)	39 (26.08)	42 (23.33)
Region	Anterior	23 (74.19)	86 (57.71)	109 (60.56)
	Premolar	2 (6.46)	31 (20.81)	33 (18.33)
	Molar	6 (19.35)	32 (21.48)	38 (21.11)
Orientation	Normal	28 (90.32)	87 (58.38)	115 (63.89)
	Inverted	1 (3.23)	33 (22.14)	34 (18.89)
	Transverse	2 (6.45)	29 (19.48)	31 (17.22)
Morphology	Conical	11 (35.48)	41 (27.51)	52 (28.89)
	Tuberculate	3 (9.68)	22 (14.76)	25 (13.89)
	Supplemental	14 (45.16)	28 (18.79)	42 (23.33)
	Odontoma	3 (9.68)	58 (38.92)	61 (33.89)
Sagittal position	Palatal	6 (19.36)	56 (37.58)	62 (34.45)
	Labial	1 (3.23)	10 (6.71)	11 (6.11)
	Labial palatine	-	13 (8.73)	13 (7.22)
	Within arch	24 (77.41)	70 (46.98)	94 (52.22)

DISCUSSION

Extra teeth that emerge in addition to the standard dental formula are referred to as supernumerary teeth. There are various clinical issues caused by extra teeth and are related to interference with adjacent teeth's natural eruption, which can result in delayed eruption, impaction, or misalignment. Supernumerary teeth may have a normal morphology or may be rudimentary and may have different shape anomalies. These may be found in mandible or maxilla or both with locational variations (anterior or posterior). The ST may be single, or multiple, and also may erupt or remain impacted. Some cases of impacted supernumeraries are asymptomatic and are only detected during radiological examinations. Radiographs have been proved valuable in evaluation of the location, position, morphology, and nature of these anomalies for proper diagnosis and treatment planning.

The occurrence of ST has obvious gender predilection. In this study, the discovery rate of ST in males is 75.35% whereas of females is 24.65%, which is similar to the results reported by Herath et al.[6] and Demirizet et al.[7] This difference among genders may be due to difference in races and research methods. Furthermore, the proportion of ST in the maxillary anterior region was found to be 60.56% and 18.33% in the premolar and 21.11% in molar regions.

Supernumeraries appear in a variety of shapes, the most common in the present study being the odontoma type 33.88%, followed by conical teeth 28.89%, then by supplemental teeth 23.33%, and tuberculate 13.89% which is different from the study conducted by Rajab and Hamdan where 74.8% conical, 11.9% tuberculate, 6.9% supplemental, and 6.4% odontoma were found among the study population. The differences in methodology (like orthopantomogram, occlusal radiographs) for detection and the studied population could account for the difference.[8]

In this study, 17.22% of the supernumerary teeth were erupted which is comparable to Sharma's study.[9] Supernumerary teeth may develop in the

direction of normal eruption, appear inverted, transverse, assume an ectopic position, or follow an abnormal path of eruption. As for the relationship between the direction and eruption of the ST, 90.32% had normal orientation, 3.23% had inverted orientation and 6.45% were placed in the transverse direction which is similar to the study conducted by Guo et al.[5]

Supernumerary teeth may occur in both dentitions, but they are most frequently seen in the permanent dentition.[5] In this study the reported prevalence of supernumerary teeth for the permanent dentition was found to be 80.98%. The prevalence of supernumerary teeth in deciduous dentition was 2.82%, which is similar to the study conducted by Kokten et al.[10]

Periapical, occlusal, and panoramic radiographs are usually able to provide the required information; however, these modalities do not always provide sufficient information concerning the 3-D relationship between supernumerary or ectopically impacted teeth and structures for surgical planning. As a result, more advanced imaging techniques can, on occasion, is required.[11]

Moreover, CBCT is able to clearly show the intraosseous location, inclination, and morphology of impacted or supernumerary teeth, as well as their distances from adjacent roots, teeth, and the cortical bone. The CBCT can present relevant information, for instance, the accurate position of a supernumerary teeth in respect of critical structures, including adjacent root apices, and orientation in the jaw. At the same time, it can also measure the distance between ST and adjacent tooth roots and cortical bone, avoiding errors caused by bone overlap and other factors. CBCT is a good method to interpret ST and is more accurate than 2-D image examination.[12] In treatment approach, supernumerary teeth's shape, position, and its potential effect on adjacent teeth should be taken into consideration. Therefore, compared to 2-D images, in this study, which was performed using CBCT, it had the chance of more detailed examinations and evaluations of supernumerary teeth.[13]

Limitation of this study is that since the data were collected from single centre, generalisation to whole population of the country cannot be done.

CONCLUSION

The supernumeraries were more in maxillary arch compared to mandibular arch. Majority of supernumerary teeth were found in the anterior area, followed by molar and premolar region. The teeth were mainly odontomatous followed by conical, supplemental and tuberculate. majority of the supernumerary teeth were normally oriented.

In conclusion, CBCT can accurately analyse the location of supernumerary teeth and their secondary effects and provide the treatment plan on that basis. The CBCT is undoubtedly an essential tool for diagnosing the characteristics of supernumerary teeth and provides valuable information about tooth position, roots, morphology and relationship of teeth to adjacent structures as well. According to the findings from this study, it can be said that CBCT can offer useful information for diagnosis, detailed evaluation of supernumerary teeth, and treatment planning that conventional radiographs are unable to provide.

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