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Withering C's: A Morphometric Cone Beam Computed Tomographic Evaluation of the Cervical Spine

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Abstract

Objective: To analyse and describe findings in the cervical spine (C-spine) encountered in cone-beam computed tomography (CBCT) imaging. A wide range of possible anatomical variations and pathological counterparts will be discussed in the context of the medical and dental literature to clarify their radiographic appearance and clinical implications as a guide for the oral and maxillofacial radiologist (OMR).

Methods: A retrospective analysis will be conducted in Department of Oral Medicine and Radiology from the 3D Cone Beam Conventional Tomography and images will be collected from the radiographic archives, and analysed accordingly. Reports documenting findings in the C- spine will be selected. They will be grouped according to age and gender category, and the findings will be tabulated as degenerative, congenital, or developmental/pathological. Each finding will be discussed with clinical importance and pictorially presented.

Results: Out of a total of 200 CBCT images, 167 images showed a positive cervical vertebra finding among which 75 were males and 92 where females. A total of 383 vertebral findings were elicited wherein more than one finding were noticed in few images. The majority of incidental findings were degenerative in nature.

Conclusion: As technological advances are made within the field of dento-maxillofacial imaging, the use of CBCT provides an opportunity for dental practitioners to access three-dimensional radiographic assessment for their patients. Thus, dentists should recognize the presence of

abnormalities in the cervical spine and, where appropriate, seek consultation or refer the patient to an appropriate provider for further management.

Keywords: CBCT, **C**ervical Spine, Morphometric Analysis, Diagnostic Yield

Introduction

Cone beam computed tomography (CBCT) is a rapidly emerging modality of imaging in the field of dentistry. Its major advantage is a high diagnostic yield in short scanning time and a radiation dose significantly lower than conventional CT. Its clinical applications are numerous, and they are being used both within the hospital as well as a primary care setting. The need for complete interpretation of CBCT images is essential[1]. Though it has a high diagnostic yield which offers an accurate diagnosis, apart from the primary reason for imaging, more additional findings are possible to be missed. One such region is the cervical vertebral column. CERVICAL SPINE is seen especially in medium field-of-view (FOV) and large-FOV scans (Medium FOV- CBCT of Mandible, CBCT of Maxilla & mandible; Large FOV- CBCT of full skull region)[2]. Hence Oral Health care Professionals should recognize the presence of abnormalities in the cervical spine and refer the patient appropriately for necessary management [2]. Many dental practitioners rely on Oral and Maxillofacial radiologists (OMRs) to interpret their CBCT images, using their reports as an educational experience and even for a medicolegal safety net. While OMRs are trained to analyze and interpret 3D imaging of the head and neck, our diagnostic confidence may increase when we are trained to interpret all such additional areas of the head and neck which are covered in a CBCT image[3].

Aim and Objectives

1. To Retrospectively identify a wider range of anatomical variants or pathologies of the C-spine in CBCT images
2. To set forth a database about the identified anatomical variants or pathologies.
3. To discuss their clinical importance with a review of the pertinent literature.

Materials and Methods

A total sample of 200 3-D CBCT images were collected from the Radiology archives of Department of Oral Medicine and Radiology, Meenakshi Ammal dental college and hospital, Chennai, which included Medium FOV and Large FOV images. It included images of individuals ranging between 20 to 70 years of age.

Inclusion criteria: All CBCT scan images taken for dental purposes, with visible cervical spine region.

Exclusion criteria: Pathologies, developmental deformities, incompletely visualised images, Trauma.

The images were assessed in Romexis software and the results were tabulated accordingly.

Statistical Analysis

Descriptive analysis was conducted of demographic data and cervical vertebral findings using means/standard deviations for continuous variables and frequency for categorical variables.

The association between demographics (age and gender) and the presence of findings in the C-spine per disease category (CONGENITAL OR DEGENERATIVE) were analysed using the paired t test. To facilitate such tests, age (years) was categorized as *less than 30, 30 to less than 50, 50 to less than 70.* Furthermore, logistic regression was completed to test whether age or gender can be predictive of degenerative vs. nondegenerative findings.Post hoc test was done to finally tell us that though there is significant difference overall, where exactly those differences lie and how many times each group had the vertebral findings.

Results

Out of a total of 200 CBCT images, 167 images showed a positive cervical vertebral finding among which 75 were males and 92 where females. A total of 383 vertebral findings were elicited wherein more than one finding were noticed in few images. The majority of incidental findings were degenerative in nature. Findings included a total of 88 subchondral cysts, 82 osteophytes, 65 subdental synchondrosis, 46 intervertebral joint space narrowing, 42 bone erosions, 32 sclerotic changes, 12 clefts, 11 facet hypertrophies and 5 congenital joint vertebrae. 152 vertebral findings were noticed in males and 231 vertebral findings were noticed in females (table 1 and table 2).

CONGENITAL				DEGENERATIVE					
MALES	CLEFTS	SUBDENTAL SYNCHONDROSIS	CONGENITAL BLOCK VERTEBRAE/ NON SEGMENTATION	INTERVERTEBRAL JOINT SPACE NARROWING	OSTEOPHYTES	BONE EROSIONS	SUB CHONDRAL CYSTS	FACET HYPERTRO PHY	SCLEROSIS
<30 YRS	0	C-2	-		1		4		
30- 50 YRS (51)	2	C- 9, P- 10	5	6	11	6	14	3	7
50- 70 YRS (39)	0	C-6, P-4	-	12	18	7	20	1	4
TOTAL- 152	2	31	5	18	30	13	38	4	11

Table 1

FEMALES	CLEFTS	SUBDENTAL SYNCHONDROSIS	CONGENITAL BLOCK VERTEBRAE/ NON SEGMENTATION	INTERVERTEBRAL JOINT SPACE NARROWING	OSTEOPHYTES	BONE EROSIONS	SUB CHONDRAL CYSTS	FACET HYPERTRO PHY	SCLEROSIS
<30 YRS		C- 5	-		2	0	7	0	
30- 50 YRS (24)	8	C- 11, P- 6	-	10	20	12	19	4	11
50- 70 YRS	2	C-7, P-5	-	18	30	17	24	3	10
TOTAL-231	10	34	-	28	52	29	50	7	21

Table 2

Table 1 and Table 2 show the number of congenital and degenerative findings in males and females according to various age groups respectively.

Comparison between Degenerative findings in C Spine among gender were done which revealed that between 50 to 70 years of age had a highly significant difference. Comparison between Congenital findings in C Spine among gender were done which revealed that between 50 to 70 years of age had a highly significant difference. In table 3 comparison between gender using t test statistics was done which revealed that less than 30 years group had p value of 0.03 stating that it was significant, 30 to 50 years group had a p value of 0.01 stating that it was highly significant and 50 to 70 years group had a p value of 0.003 stating that it was very highly statistically significant. In table 4, Comparison between congenital and degenerative findings in C Spine among Age were done which revealed that female population had a significant difference when compared to male population. In table 5, Logistic regression analysis of demographics obtained from our study in association with degenerative vs. congenital findings in C spine revealed females between age 50 to 70 years of age had an odds ratio of 5.1 which states that females between 50 to 70 years of age are 5.1 times more prone to develop degenerative changes in the cervical spine than males of the same age group.

Age	Male n (%)	Female n (%)	P value[a]
< 30 years	11 (14.6%)	12 (13.04%)	0.03*
30 – 50 years	43 (57.3%)	51 (56.4%)	0.01**
50- 70 years	21 (28%)	29 (31.4%)	0.003***
Total	75 (100%)	92 (100%)	NA

Table 3: Comparison between gender using t test statistics

Age	Males n (%)	Females n (%)
< 30 years	11 (14.6%)	12 (13.04%)
30 – 50 years	43 (57.3%)	51 (56.4%)
50- 70 years	21 (28%)	29 (31.4%)
P value[a]	<0.02*	<0.001***

Table 4: Comparison between congenital and degenerative findings in C Spine among Age

Exposure variables	Number of subjects	OR	P value
Gender – Female	92	1.7	0.03*
Age (50-70 yrs)	29 (31.4%)	5.1	0.001***

Table 5: Logistic regression analysis of demographics association with degenerative vs. congenital findings in C spine.

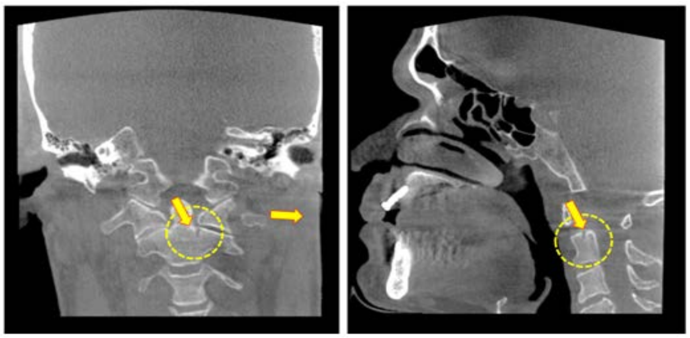

Fig 1: Clefts

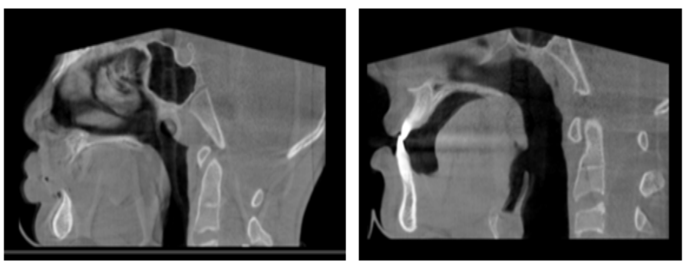

Fig 2: Sub dental synchondrosis

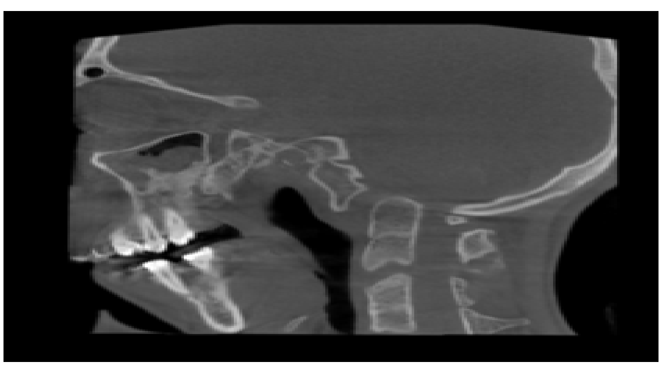

Fig 3: Congenital Block Vertebrae C2-C3

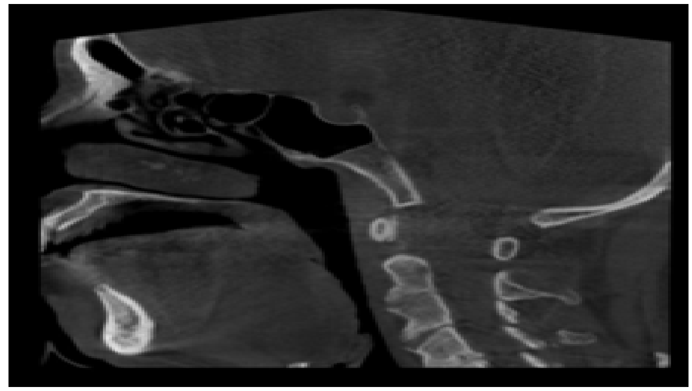

Fig 4: Asymmetric joint space narrowing

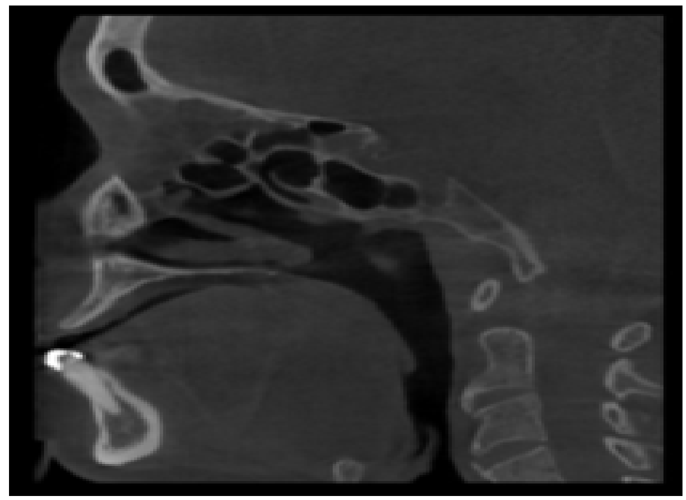

Fig 5: Osteophytes

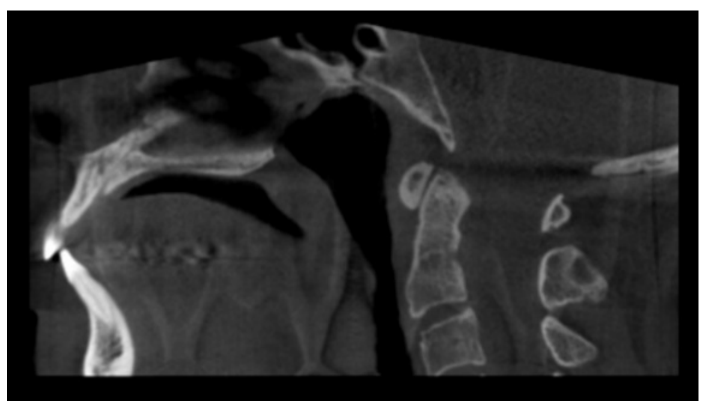

Fig 6: Subchondral cysts

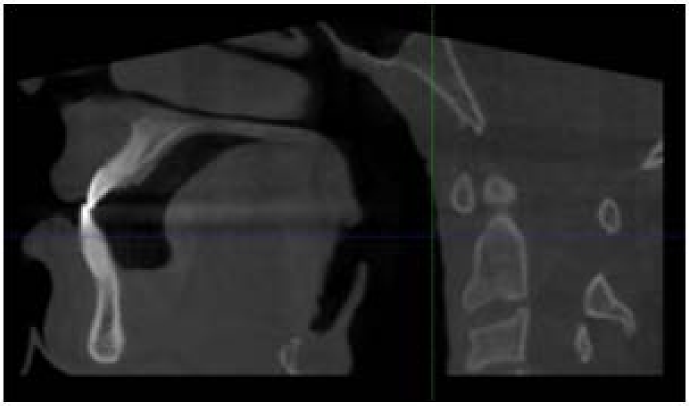

Fig 7: Erosions

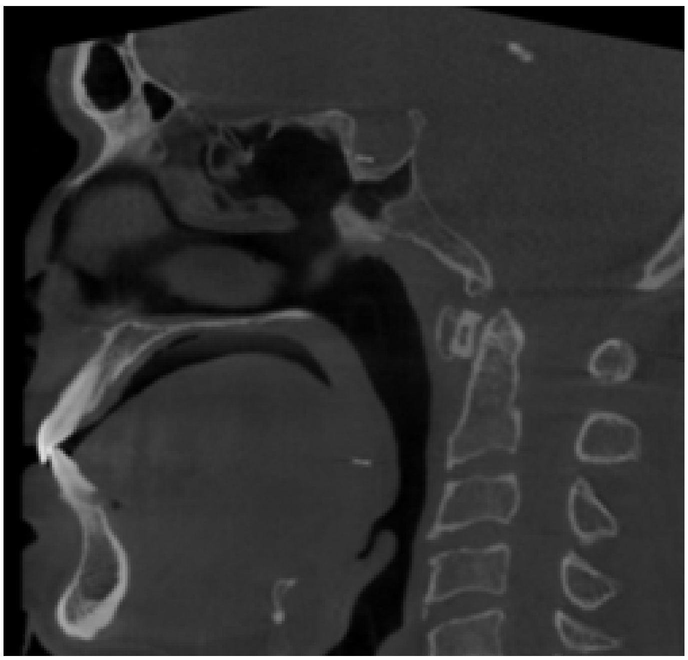

Fig 8: Hypertrophy

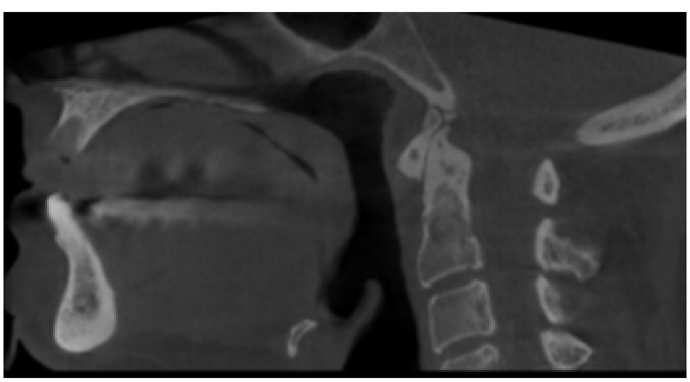

Fig 9: Sclerosis

Discussion

With the expanded use of CBCT equipment in the dental profession, the identification, interpretation, and management of head and neck findings are necessary as some findings require a higher level of expertise and additional advanced imaging modalities. When it comes to findings in the cervical spine the literature is severely lacking, and the pressure on Oral Medicine and Radiologists is great due to the complex anatomy & complicated pathophysiology depiction on CBCT. Similar to the research of Allareddy et al Alsufani et al, more anomalies were detected in women in their fifties and sixties. The majority of the findings were degenerative in nature, which is a possible reason for the higher frequency in the older age group. The logistic regression model shows that the odds of presenting with a degenerative incidental finding in the C-spine were different based on gender and were also 5.1 times higher in females than males if the patient was 50 years old or older.

Clefts are defects in the ossification centres of the vertebrae ranging from partial clefts to total agenesis of the posterior arch. Vertebral clefts can be misdiagnosed as fractures. However, the latter show irregular edges with soft tissue swelling and a history of trauma. Mild neck pain to neurological deficits after minor cervical spine or head injury. It is common in patients with Cleft lip, Cleft Palate or both. In our study, we found about 2 clefts in male population and 10 clefts in female population.

Congenital Block vertebrae is caused due to the failure of separation of 2 or more adjacent vertebrae- C2and C3 junction. It is present as an absence of radiolucent disc space. It is most commonly associated with Klippel Feil syndrome- lateral bending of spine with limited range of motion. Pts are mostly asymptomatic throughout their entire life. In our study,we found 5 block vertebrae in male population.

Degenerative joint disease occurs in two-thirds of people and usually presents in the 4th and 5th decades of life. Studies state that most common level of involvement is C5-C6, then decreases in frequency in descending order towards C2-C3[4]. Hallmarks of joint disease includes joint space narrowing, sclerosis, erosions, and osteophyte formation. In this study 78.7% findings in the C-spine fall under degenerative changes higher than the reported adult literature 9.7% to 45.9% due to the high frequency of older age group in this study as similar to studies by Patcas et al. Changes in the C-spine can be associated with inflammation and 35% to 66% present with neck pain or stiffness[1, 4, 5]. In advanced cases, osteophytes and loose intra-articular bodies can extend anteriorly towards the pharyngeal airway, causing localized narrowing of the upper airway. DJD changes can cause posterior compression of the spinal canal, a condition called Cer*vical Spondylotic Myelopathy,* leading to neurologic dysfunction of the extremities, torso, and sphincters. Such significant changes warrant a referral to the physician to control any symptoms[7, 8].

Conclusion

The authors proposed two reasons that could account for the lower accuracy and consistency of cervical spine findings among Oral Medicine Radiologists. The only joint in maxillofacial region is the TMJ , thus we lack "broader experience in assessment of articulo-osseous pathologies" such as that with general radiologists. Image quality in the midplane of CBCT scans is superior to its periphery and the C-spine is imaged at "the periphery" of the scan with lower resolution. Due to the complex embryogenic tissues in the area, uncommon congenital anomalies mimic aggressive pathoses. As such, these must be recognized and interpreted, with recognition of the potential need for further radiographic investigation beyond what CBCT can offer. It is the professional and ethical obligation of the Oral Medicine Radiologist to ensure adequate documentation and communication to the network of referring dentists, physicians, or medical radiologists, and ultimately the patient.

References

1. H. Popat, N. Drage and P. Durning; Mid-line clefts of the cervical vertebrae – an incidental finding arising from cone beam computed tomography of the dental patient; British Dental Journal Volume 204 No. 6 Mar 22 2008
2. Mohammed A. Husain, DDS,a Sotirios Tetradis, DDS, PhD,b and Sanjay M. Mallya; Intraosseous pneumatocysts of the cervical spine: a report of four cases and review of literature; Oral Surg Oral Med Oral Pathol Oral Radiol;119:e49-e54; Vol. 119 No. 1 January 2015.
3. Noura, A. Alsufyani, BDS, MSc, PhD; Cone Beam CT incidental findings of the cervical spine and clivus: Retrospective analysis and review of the literature; Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology; February 2017; doi: 10.1016/j.oooo.2017.02.011.
4. Sonnesen L, Jensen KE, Petersson AR, Petri N, Berg S, Svanholt P. Cervical vertebral column morphology in patients with obstructive sleep apnoea assessed using lateral cephalograms and cone beam CT. A comparative study. Dentomaxillofacial Radiology. 2013;42:
5. Rudy IS, Poulos A, Owen L, et al. The correlation of radiographic findings and patient symptomatology in cervical degenerative joint disease: A cross-sectional study. Chiropr Man Thera. 2015;23 doi:10.1186/s12998-015-0052-0.
6. Zochling J, Smith EUR. Seronegative spondyloarthritis. Best Pract Res Clin Rheumatol. 2010;24:747-756. doi:10.1016/j.berh.2011.02.002.

7. MH, Quinones-Hinojosa A, Rosenberg WS. Cervical myelopathy associated with degenerative spine disease and ossification of the posterior longitudinal ligament. *Semin Neurol.* 2002;22:143-148. doi:10.1055/s-2002-36537.
8. 26. Hosalkar H, Sankar W, Wills B, Goebel J, Dormans J, Drummond D. Congenital osseous anomalies of the upper cervical spine . *J Bone Joint Surg Am.* 2008;90:337-348. doi:http://dx.doi.org/10.2106/JBJS.G.00014.
9. Sonnesen L, KjA[bar]r I. Anomalies of the cervical vertebrae in patients with skeletal class II malocclusion and horizontal maxillary overjet. *American Journal of Orthodontics & Dentofacial Orthopedics.* 2008:15.
10. Berlin L. Errors of omission. *AJR Am J Roentgenol.* 2005;185:1416-1421. 29. Klimo Jr. P, Rao G, Brockmeyer D. Congenital anomalies of the cervical spine. *Neurosurg Clin North Am.* 2007;18:463-478. doi:10.1016/j.nec.2007.04.005.
11. Kim P, Sarauw MT, Sonnesen L. Cervical vertebral column morphology and head posture in preorthodontic patients with anterior open bite. *AMERICAN JOURNAL OF ORTHODONTICS AND DENTOFACIAL ORTHOPEDICS.* 2014;145:359-366.