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Research Article

Comparative evaluation of dental computed tomographic software program in the analysis of jaw lesions in comparison with panoramic radiographs

Anindita Saha[1], Asish Kumar Das[2]*, Sailendranath Biswas[3], Vineet Nair[4]

[1]Department of Oral Medicine and Radiology, Burdwan Dental College & Hospital, Burdwan, West Bengal, India
[2]Department of Oral & Maxillofacial Surgery, Burdwan Dental College & Hospital, Burdwan, West Bengal, India
[3]Department of Oral and Maxillofacial Pathology, Burdwan Dental College & Hospital, Burdwan, West Bengal, India
[4]Department of Periodontia, Burdwan Dental College & Hospital, Burdwan, West Bengal, India

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***Correspondence:**
Dr. Asish K. Das,
E-mail: adasmds@gmail.com

ABSTRACT

Background: Dental radiology has long played an exciting and critical diagnostic role in dentistry. The development of novel imaging modalities like computed tomography (CT) and magnetic resonance imaging (MRI) has revolutionized dental and medical diagnosis. However the role of conventional radiography in dentistry remains unparalleled. The current study was undertaken to evaluate the effectiveness of dental CT software compared to panoramic radiography in evaluation of the jaw lesions.

Methods: Twenty cases of maxillary and mandibular jaw lesions were examined radiographically by digital panoramic radiography orthopantomography (OPG) and dental CT software. The radiographic images obtained with these two examination modalities were compared for visualization of antero-posterior extent of the lesion, dimension of the lesion, cortical bone involvement, tooth displacement, root resorption, involvement of the maxillary sinus, delineation of the neurovascular canal, presence or absence of calcification, imaging diagnosis of the lesion (cystic/solid).

Results: The dental CT program rated significantly ($P<0.001$) higher in all points examined than the panoramic radiography. The dental CT program was found to be superior for detecting cortical bone involvement ($P<0.02$) and delineation of the mandibular canal ($P<0.02$) to the conventional CT program.

Conclusions: Dentascan offers better characterization of the pathologic processes due to its ability to differentiate between different tissue types based on their Hounsfield units. Hence it can define the contents of the pathology as cystic or solid and thus predict the diagnosis of the lesion.

Keywords: Computed tomography, Dentascan, Intraosseous jaw lesions, Orthopantomogram, Radiology

INTRODUCTION

Dental radiology has long played an exciting and critical diagnostic role in dentistry. Recent decades have seen the development of computed tomography (CT), magnetic resonance imaging (MRI), nuclear medicine and ultrasonography imaging modalities that have revolutionized dental and medical diagnosis.[1] Despite the development of these novel imaging modalities, the role of conventional radiography in dentistry remains unparalleled. However, the use of conventional radiography is not free from limitations. They are two dimensional representations of a three dimensional structure. They do not provide precise relationship of the critical anatomic structures like neurovascular bundle and the maxillary sinus with the lesion.[2] CT has been used to obtain detailed information on the internal anatomic structures of the jaws. Since most of the maxillary and the mandibular structures run parallel to the plane of the axial and coronal scans, neither of these images clearly delineates their vertical height and bucco-lingual distance. Furthermore, the maxillary and mandibular structures also influence the sensitivity of axial and coronal scans. In consequence, they rarely present an exact cross-section; instead, they look like oblique sections. Another common disadvantage of the conventional CT examination is the presence of streak artefacts from dental restorations that degrade the scan images.[3]

So the dental computed tomographic software program was developed for investigation of the maxillofacial structure. The evaluation of the maxillofacial complex has been completely revolutionized with the development of this dental computed tomographic reformatting program in multislice CT scan. The term “Dental CT” does not represent a particular imaging modality, but rather a specific investigation protocol. The main features of this protocol include the acquisition of axial scans of the jaws with the highest possible resolution together with curved and orthoradialmultiplanar reconstructions.[4-6] Although various authors have reviewed the efficacy of the dental computed tomography software program in the evaluation of maxillofacial pathologies, literature comparing the accuracy and diagnostic value of this software in multislice CT with conventional orthopantomography is scant, with only three researchers Abrahams JJ et al, Lenglinger FX et al and Krennmair G et al comparing the two imaging modalities in the assessment of odontogenic cysts.[7-9] So, the present study was undertaken to explore the clinical usefulness of Dental CT software in 64 slice CT in the analysis of various lesions of the jaws in comparison with panoramic radiographs.

METHODS

A total of twenty patients with suspected intra-osseous jaw lesions in the middle or lower third of the face were included in the study after obtaining prior approval of the Hospital Ethical Committee. The protocol for assessing the jaw lesions included detailed clinical examination followed by screening with digital panoramic radiograph. In cases where three dimensional assessments were deemed necessary for surgery, a CT scan was performed and only those patients with detailed history, panoramic radiograph and CT scan were included in this study. Final diagnosis was established by means of histopathological examination. All the patients were informed about the radiation risks and a written consent was obtained from all the recruited subjects.

Clinical examination was followed by digital panoramic radiographic imaging (Kodak 8000C digital panoramic and cephalometric system at exposure parameters of 66kVp, 12mA and 14 msec) (Figure 1) and CT scanning (Philips Brilliance 64 slice CT scanner) (Figure 2) for all the patients. 1mm contiguous axial scans were obtained using bone window settings (2000 HU with 400 HU in centre), 120 mm field of view (FOV) for mandible and 100 mm field of view (FOV) for maxilla, 512×512 matrix, table feed of 1 mm, scan time of one second and exposure parameters 140 kVp and 70 mA. After the examination, the axial slices were transferred to a workstation (Figure 3) to perform multi-planar reconstructions by the dental planning software program (Philips visualization software). The findings on the panoramic radiograph and on the axial, panoramic and cross-sectional views (Figure 4) obtained with the dental CT software in 64 slice CT were compared for visualization of the extent of the lesion in the antero-posterior direction, dimension of the lesion, (Figure 5; 6a, 6b) cortical bone involvement, tooth displacement, root resorption, maxillary sinus and neurovascular canal involvement, presence or absence of calcification and for predicting the content and thereby to diagnose the lesion.

The data were analyzed using the SPSS statistical software version 11.5. Since the data were highly subjective, a descriptive analysis was reported for most of the parameters namely, extent of the lesion, cortical bones involvement and imaging diagnosis of the lesion. Paired t-test was applied for the comparative analysis of the antero-posterior and supero-inferior dimension of the lesion and a P value less than 0.05 was considered statistically significant. The rest of the findings were compared using kappa statistic and based on it a kappa value between 0.60 and 0.80 was considered to be a good agreement between the two imaging modalities**.**

RESULTS

Out of the 20 subjects selected for the study, there were 16 males (80%) and the rest were females (20%). Their age ranged from 12-57 years with the mean age being 33 years. Eleven patients (55%) had lesions involving the mandible while nine of them (45%) showed maxillary involvement. Of the 20 cases, histopathological examination diagnosed ten lesions (50%) as cysts (Figure 7a, 7b), six as benign tumors (30%), three as malignancies (15%) and one lesion (5%) as an inflammatory condition (Figure 11). Distribution of the cases with clinical findings, radiographic findings (Figure 8) and histopathological diagnosis is depicted in Table 1.

Extent of the lesion: In nine cases (45%) the extent shown by Dentascan was more than that was evident in the panoramic radiographs. The extension of the lesion as revealed by the Dentascan images were assumed to be true as the software provided images in 1:1 ratio (Table 2).

Dimension of the lesion: Statistically there was no significant difference in the mean antero-posterior (OPG - 33.14 ± 16.6, DCT - 31.6 ± 15.87, p = 0.063) and supero-inferior dimensions (OPG - 24.98 ± 16.07, DCT - 25.55 ± 15.73, p = 0.408) of the lesion using the two imaging modalities (Figure 12).

Table 1: Co-relation between clinical diagnosis, panoramic radiographic findings, dental CT diagnosis and histopathologic diagnosis of the lesions.

Age in yrs	Sex	Location of lesion	Clinical diagnosis	Panoramic radiographic findings	Dental CT diagnosis	Histopathologic diagnosis
19	M	Ant. maxilla	Radicular cyst	Well defined radiolucency	Cystic content	Radicular cyst
17	M	Ant. maxilla	Radicular cyst	Well defined radiolucency around impacted mesiodens	Cystic content	Dentigerous cyst around impacted mesiodens
57	F	Rt. post. mandible	Residual cyst	Well defined radiolucency	Semi solid content	Unicystic ameloblastoma
55	F	Rt. maxilla	Malignancy	Ill-defined radiolucency	Solid content	Squamous cell carcinoma
50	M	Lt. post. mandible	Malignancy	Ill-defined radiolucency	Solid content	Squamous cell carcinoma
23	M	Lt. post. mandible	Osteomyelitis	Ill-defined radiolucency	Hypodense area with multiple focal hyperdensities	Osteomyelitis
19	M	Lt. maxilla	Dentigerous cyst	Well defined radiolucency around impacted 28	Cystic content	Dentigerous cyst around impacted 28
32	M	Lt. maxilla	Radicular cyst	Well defined radiolucency	Cystic content	Radicular cyst
26	M	Rt. post. mandible	Radicular cyst/ Dentigerous cyst	Well defined radiolucency	Semi solid content	Calcifying epithelial Odontogenic tumor
53yrs	F	Lt. post. mandible	Fibro-osseous lesion	Ill-defined radioopacity	Solid content	Osteosarcoma
12	M	Rt. post. mandible	Radicular cyst	Well defined radiolucency	Cystic content	Radicular cyst
42	M	Ant. mandible	Odontogenic tumor	Well defined radiolucency	Solid content	Solid ameloblastoma
36	M	Rt. post. mandible	Radicular cyst	Well defined radiolucency	Cystic content	Radicular cyst
23	M	Rt. maxilla	Radicular cyst	Well defined radiolucency	Cystic content	Radicular cyst
48	M	Lt. post. mandible	Odontogenic tumor	Well defined radioopacity	Solid content	Complex odontome
38	M	Rt. post. mandible	Residual cyst	Well defined radiolucency	Cystic content	Odontogenic keratocyst
18	F	Lt. maxilla	Dentigerous cyst	Well defined radiolucency around impacted 23	Cystic content with focal hyperdensities	Adenomatoid Odontogenic tumor
29yrs	M	Lt. maxilla	Radicular cyst	Well defined radiolucency	Cystic content	Radicular cyst
39yrs	M	Rt. post. mandible	Odontogenic tumor	Well defined radioopacity	Solid content	Complex odontome
24yrs	M	Ant. maxilla	Radicular cyst	Well defined radiolucency	Semi-solid content	Infected radicular cyst

Table 2: Comparison between Panoramic radiograph and Dental CT image in the evaluation of antero-posterior extent and dimensions of lesion.

A-P Extent & Dimensions of the lesion in OPG				A-P Extent & Dimensions of the lesion in Dental CT			
AP extent	AP dimension	SI dimension	ML dimension	AP extent	AP dimension	SI dimension	ML dimension
11 to 14	20.9mm	14.6mm	NA	12 to 16	17.9mm	11.6mm	16.9mm
12 to 23	34.8mm	23.0mm	NA	11 to 23	30.0mm	25.0mm	35.0mm
45 to Rt. ramus	70.4mm	34.7mm	NA	45 - Rt. ramus	68.6mm	38.2mm	27.2mm
14 to 18	32.0mm	32.4mm	NA	12 to 18	36.0mm	33.0mm	28.0mm
33 to 36	24.1mm	17.0mm	NA	32 to 37	30.0mm	21.0mm	31.9mm
34 to 35	18.5mm	16.2mm	NA	34 to 36	20.8mm	17.3mm	11.0mm
26 to 28	38.1mm	32.1mm	NA	26 to 28	33.1mm	40.0mm	25.9mm
21 to 22	24.1mm	17.2mm	NA	21 to 23	20.7mm	15.1mm	15.0mm
44 to 47	49.5mm	25.7mm	NA	43 to 47	45.0mm	25.0mm	35.0mm
35 to Lt. sigmoid notch	75.0mm	85.0mm	NA	35 to Lt. sigmoid notch	71.0mm	80.0mm	70.0mm
45 to 46	21.3mm	16.1mm	NA	45 to 47	17.6mm	15.2mm	14.1mm
35 to 43	40.7mm	16.4mm	NA	35 to 43	37.2mm	16.2mm	11.6mm
45 to 46	22.2mm	10.1mm	NA	45 to 46	19.3mm	8.2mm	12.1mm
11 to 15	29.0mm	26.8mm	NA	11 to 15	24.0mm	26.4mm	22.9mm
36 to 38	25.4mm	15.5mm	NA	36 to 38	21.9mm	19.6mm	16.1mm
48 to Rt. retromolar area	18.0mm	20.1mm	NA	48 to Rt. retromolar area	20.1mm	19.7mm	13.2mm
21 to 25	27.6mm	23.7mm	NA	21 to 25	29.7mm	22.4mm	20.5mm
21 to 22	15.4mm	12.4mm	NA	21 to 22	12.6mm	11.5mm	14.9mm
47 to Rt. ramus	26.6mm	36.8mm	NA	47 - Rt. ramus	30.5mm	37.4mm	27.4mm
13 to 26	49.2mm	23.7mm	NA	14 to 26	46.0mm	28.1mm	28.4mm

Figure 1: Patient positioning in the Kodak 8000C digital panoramic and cephalometric system.

Figure 2: Patient positioning in the Philips Brilliance 64 slice CT scanner.

Table 3: Comparison between panoramic radiograph and Dental CT image in evaluation of cortical bone involvement.

Case	Cortical bone involvement in OPG	Cortical bone involvement in DCT
1.	Cannot assess	Breach in Rt. nasal floor and Rt. palatine bone
2.	Cannot assess	Breach in buccal cortex of Lt. maxilla, Lt. nasal floor and Lt. palatine bone
3.	Breach in superior cortex and thinning of inferior cortex of Rt. mandible	Breach in superior and lingual cortex and thinning of inferior and buccal cortex of Rt. mandible
4.	Cannot assess	Breach in buccal and palatal cortex of Rt. maxilla
5.	Cannot assess	Breach in buccal and lingual cortex of Lt. mandible
6.	Breach in inferior cortex of Lt. mandible	Breach in buccal and inferior cortex of Lt. mandible
7.	Cannot assess	Breach in Lt. nasal wall and buccal and palatal cortex of Lt. maxilla
8.	Cannot assess	Breach in buccal and palatal cortex of Lt. maxilla and Lt. nasal floor
9.	Cannot assess	Breach in buccal and lingual cortex of Rt. mandible
10.	Breach in superior cortex of Lt. mandible	Breach in superior, buccal and lingual cortex of Lt. mandible. "sun-ray" appearance with respect to buccal and lingual cortex
11.	Cannot assess	Breach in buccal cortex of Rt. mandible
12.	Cannot assess	Breach in buccal and lingual cortices of Lt. mandible
13.	Cannot assess	Breach in buccal and lingual cortex of Rt. mandible
14.	Cannot assess	Breach in buccal and palatal cortex of Rt. maxilla and Rt. nasal floor
15.	Cannot assess	No breach
16.	Cannot assess	Breach in buccal and lingual cortex of Rt. mandible
17.	Cannot assess	Thinning of buccal and palatal cortex of Lt. maxilla. Lt. nasal floor displaced upwards
18.	Cannot assess	Breach in buccal and palatal cortex of Lt. maxilla
19.	Breach in superior cortex of Rt. mandible	Breach in superior and buccal cortex and thinning of inferior cortex of Rt. mandible
20.	Nasal floor displaced upwards	Nasal floor displaced upwards

Table 4: Comparison between panoramic radiographic image and dental CT image in evaluation of tooth displacement, root resorption, presence of calcifications, maxillary sinus and inferior alveolar canal involvement.

Parameters	OPG		DCT		% agreement	Kappa	p-value
	Yes	No	Yes	No			
Tooth displacement	9	11	9	11	100	1	<0.001
Root resorption	7	13	8	12	95	0.894	<0.001
Calcifications	3	17	5	15	90	0.692	0.001
Sinus Involvement	2	7	2	7	77.78	0.357	0.284
Inferior Alveolar Canal Involvement	2	9	7	4	54.54	0.225	0.237

Cortical bone involvement: Cortical bone involvement could be appreciated on the panoramic radiographs in only five cases (25%). Dentascan portrayed cortical bone involvement (Figure 9a) in any of the three planes (buccal cortex, palatal/ lingual cortex, superior cortex, inferior cortex) in all the cases (Table 3).

Tooth displacement: With respect to this criterion, there was complete agreement (100%) between the two imaging modalities (k= 1, p <0.001) (Table 4, Figure 13)

Root resorption: Panoramic radiographs showed root resorption in seven cases (35%) whereas Dentascan depicted root resorption in eight cases (40%) (Table 4, Figure 14). A good agreement (95%) was seen between panoramic radiography and Dentascan after statistical analysis (k = 0.894, p <0.001).

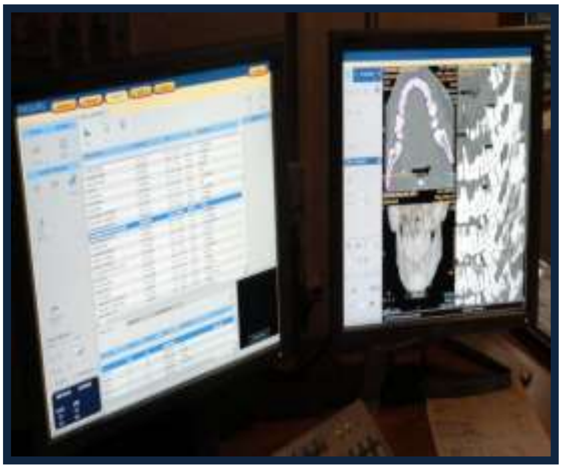

Figure 3: Post-processing CT work station.

Figure 4: A representative axial CT section reconstructed with the dental CT software to display 3 sets of images: panoramic, cross-sectional and three-dimensional image.

Figure 5: Panoramic radiograph showing antero-posterior & supero-inferior dimension of lesion.

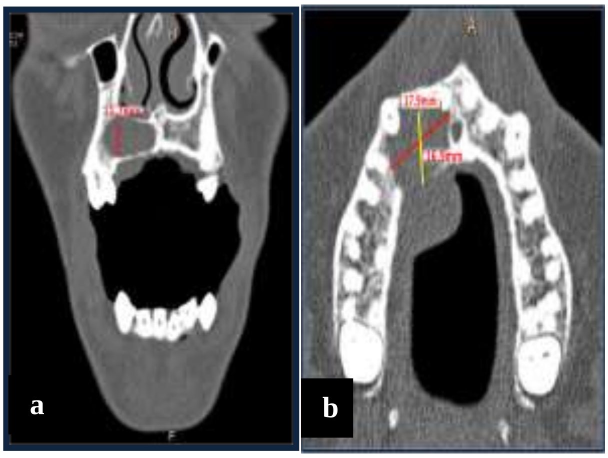

Figure 6: (a) Coronal CT image showing supero-inferior dimension of lesion; (b) Axial CT image showing antero-posterior and bucco-palatal dimension of lesion.

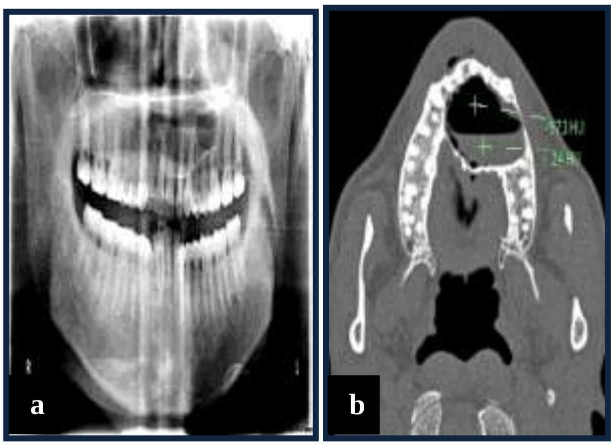

Figure 7: Infected radicular cyst: Well-defined, homogeneous radiolucency extending from 12 to 26 in a panoramic radiograph.

Figure 8: Panoramic radiograph showing a well-defined homogeneous radiolucency in impacted 23.

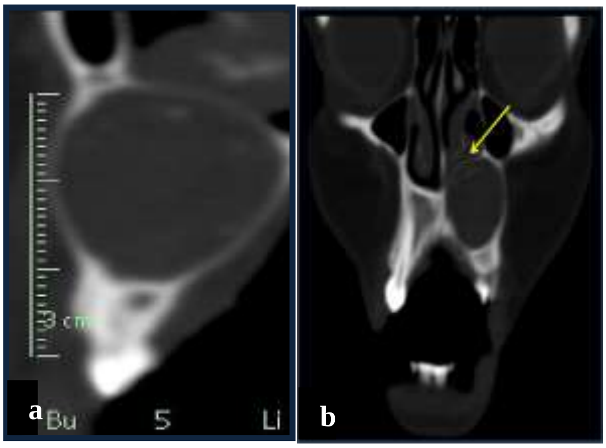

Figure 9: (a) Ortho-radial section showing thinning of buccal and palatal cortex of maxilla; (b) Coronal CT section showing upward displacement of nasal floor by lesion (arrow).

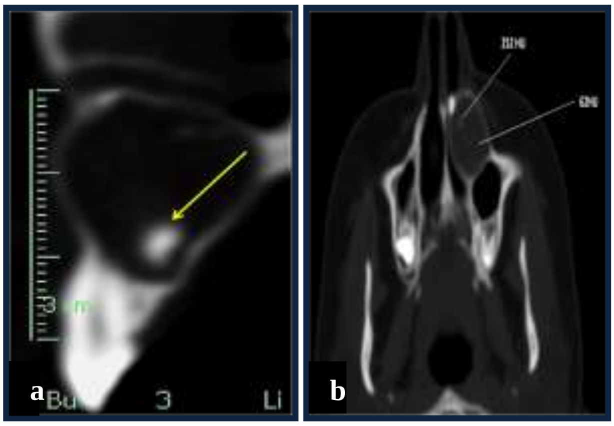

Figure 10: (a) Ortho-radial section showing presence of calcifications within the lesion (arrow); (b) Different hounsfield units showing contents of the lesion: 252 HU (Calcifications), 62HU (Soft tissue).

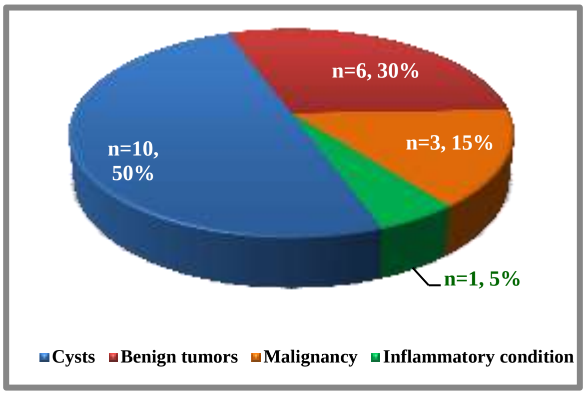

Figure 11: Distribution of patients according to their histopathological diagnosis.

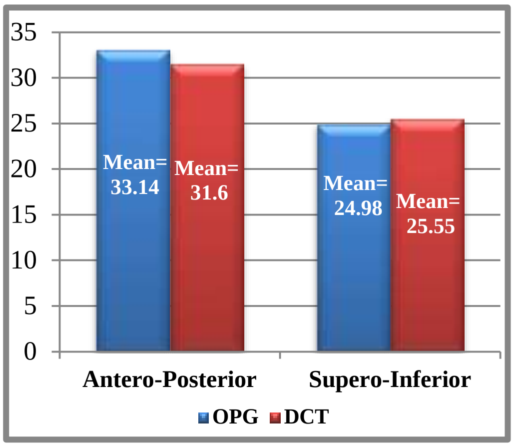

Figure 12: Comparison between panoramic radiograph & dental CT image in the evaluation of antero-posterior and supero-inferior dimensions (in mm) of the lesion.

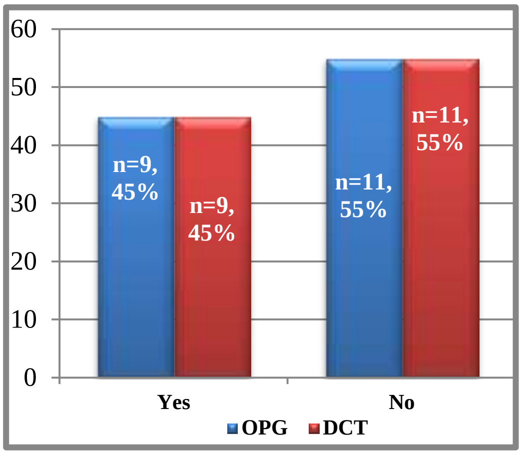

Figure 13: Comparison between panoramic radiograph and dental CT image in evaluation of tooth displacement by the lesion.

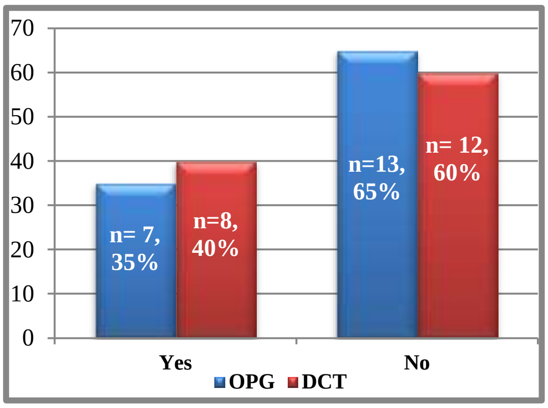

Figure 14: Comparison between panoramic radiograph and dental CT image in evaluation of root resorption by the lesion.

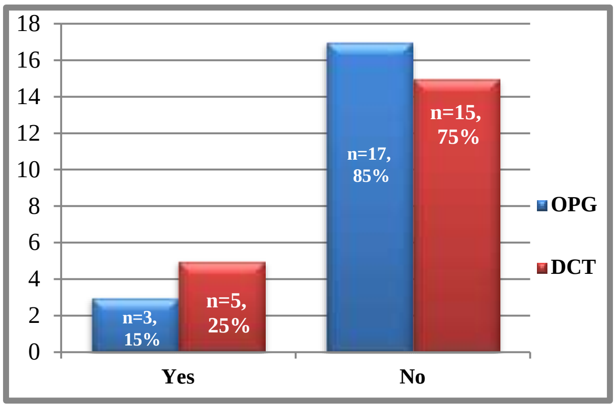

Figure 15: Comparison between panoramic radiograph and dental CT image in evaluation of presence/ absence of intra-lesional calcifications.

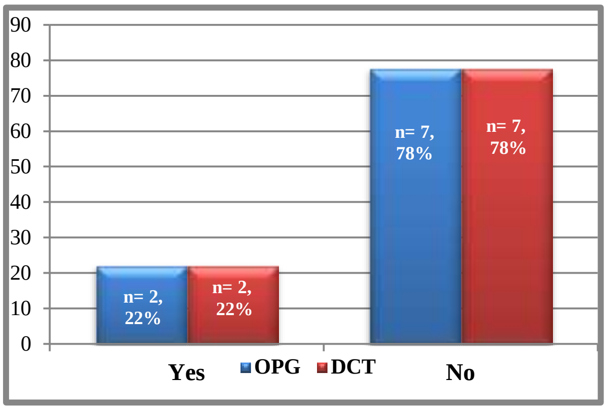

Figure 16: Comparison between panoramic radiograph and dental CT image in evaluation of maxillary sinus involvement by pathology.

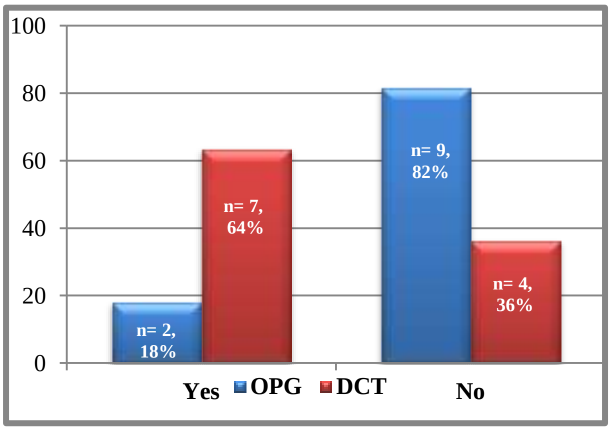

Figure 17: Comparison between panoramic radiograph and dental CT image in evaluation of inferior alveolar nerve involvement by pathology.

Presence or absence of calcifications

The information delineated by OPG and Dentascan were compatible in 18 cases, with 3 cases demonstrating the presence of calcifications and 15 cases with no evidence of calcifications (Figure 15). However in two cases of osteomyelitis and a case of adenomatoid odontogenic tumor where panoramic radiographs failed to reveal the presence of sequestrum and intra-lesional calcifications (Fig. 10a) respectively, information regarding the same was provided by the Dentascan images. Statistical analysis, however, revealed good agreement (90%) between the two imaging modalities (k = 0.692, p =0.001) (Table 4).

Involvement of maxillary sinus

Of the nine cases involving the maxilla, both panoramic radiography and Dentascan showed sinus involvement in one case and there was no evidence of sinus involvement in six cases. However in the remaining two cases, both the imaging modalities showed contradictory results. Dentascan images (Figure 9b, Figure 16) rated better than panoramic radiographs in the evaluation of maxillary sinus involvement by the lesion (k = 0.357, p = 0.284).

Involvement of the inferior alveolar canal

Of the 11 cases with mandibular lesions, the findings between the two imaging modalities were compatible in six cases, with both portraying nerve involvement in two cases and no evidence of nerve involvement in four cases. However in the remaining five cases, panoramic radiograph did not show any evidence of nerve involvement, while Dentascan depicted inferior alveolar canal involvement in all the cases. (k = 0.225, p = 0.237) (Table 4, Figure 17).

Imaging diagnosis of the lesion

Given its ability to differentiate between different tissue types based on their Hounsfield units (Fig.10b), the observer was able to provide better imaging diagnosis with Dentascan. However in some cases like cysts and odontomes the observer was able to make reasonably correct imaging diagnosis with panoramic radiographs).

DISCUSSION

Introduced in the mid-1980s, Dentascan is a CT software program that allows the mandible and maxilla to be imaged in three planes: axial, panoramic and cross-sectional. Since then, it has been widely used pre-operatively for implant surgery, until recently, when the software has also shown immense promise in the evaluation of the osseous mandible and maxilla and has been reported to be useful in head and neck surgery.[10]

The study population included 20 patients with intraosseous jaw lesions. Histopathological examination diagnosed ten lesions as cysts (50%), six as benign tumors (30%), three as malignancies (15%) and one lesion as an inflammatory condition (5%). In assessing the extent of the lesion in the present study, Dentascan could visualize the extent of the pathology in more correct proportion than did panoramic radiography. To the best of our knowledge, literature comparing these two imaging modalities in assessing the extent of an intra-osseous jaw lesion is not available till date.

In the present study, panoramic radiography and Dentascan both rendered equally good visualization of the antero-posterior and supero-inferior dimensions of the lesion. However, the major disadvantage of the two-dimensional radiographic method is that it does not allow visualization of the medio-lateral dimension of the lesion. Krennmair et al compared conventional panoramic radiography with Dental CT in the evaluation of 12 mandibular cysts.[9] According to their study, Dental CT rendered significantly better images for calculating the cystic volume than conventional panoramic radiography ($p<0.01$). Further with the Dental CT they were able to calculate the size of the mandibular cyst by assessing the slice thickness and cystic area at the cross-sectional image.

Panoramic radiographs failed to provide adequate information regarding cortical bone involvement. Of the 20 cases, panoramic radiographs could depict cortical involvement in only five cases, four with mandibular lesions and one with a maxillary pathology. However additional information like breach in the buccal cortex in the case of osteomyelitis, osteosarcoma and odontome or involvement of the lingual cortex in the case of ameloblastoma was not available from the panoramic radiographs. Contrary to the radiographic findings, Dentascan yielded information regarding cortical bone involvement in all the cases. Cross-sectional images were shown to be most valuable for assessment of cortical bone involvement by the pathologic process. These views permitted better operative planning with regard to the extent of resection and the reconstructive requirements. With this information, improved pre-operative patient counselling was offered. This finding in our study was similar to the findings noted by Hertzanu et al in his study on computed tomography of mandibular ameloblastoma.[11]

In this study, panoramic radiography and Dentascan both provided equally good visualization of adjacent tooth displacement by the lesion. This was because in all the included cases there was only mesial or distal displacement of the teeth by the pathology which were adequately visualized on the two dimensional panoramic radiographs. Given the absence of a case with palatal/ lingual tooth displacement, the additional bucco-palatal/ lingual views yielded by the software were of no significance in our study.[12] It is noteworthy to mention that literature comparing Dental CT and panoramic radiography in evaluation of tooth displacement by the lesion is not available till date. Poor resolution of the panoramic radiograph often makes it difficult to determine if a tooth root is eroded due to a peri-apical lesion. This determination is important for proper patient care because it allows the dental surgeon to decide his treatment plan. The oblique sagittal views in the Dentascan images could better delineate the root morphology, depicting root resorption in eight cases unlike panoramic radiography which identified root resorption in only seven cases, failing to do so in one case of maxillary radicular cyst. Studies on the odontogenic cysts, impacted and displaced teeth have shown that program should be the study of choice in evaluating the root resorption.[8,9]

In the present study, Dental CT rendered better visualization of maxillary sinus involvement as compared to panoramic radiographs. Of the nine cases having maxillary pathology, two cases involved the maxillary sinus. While both imaging modalities had an agreement in a case of dentigerous cyst, only Dentascan depicted sinus involvement in a case of alveolar carcinoma of the left maxilla. Interestingly, in a case of radicular cyst where maxillary sinus involvement was suspected based on the panoramic radiographs, Dentascan proved it to be false positive.

In a review by Abrahams JJ et al the author stated that in the imaging of oro-antral fistula, Dental CT scores superior to panoramic radiography and conventional CT scan because dental reformatting CT programs use thin axial CT slices to reformat multiple cross-sectional and panoramic views and have the major advantage of projecting any artifacts from dental structures into a plane orthogonal to the plane of fistula.[13] These images are therefore free of artifacts and hence improve interpretation. Similar findings have been reported in case series by Yanagisawa et al.[4]

The mandibular canal can be visualized on standard radiographic scans in most cases. However, these images do not disclose the position of the nerve in a bucco-lingual direction. Occasionally, the bone surrounding the nerve cannot be discerned, and the course of the canal cannot be identified on a panoramic radiograph. In these cases, exact information on the course of the neurovascular bundle can be obtained only with cross-sectional images. The bucco-lingual position of the mandibular canal can be discerned only on axial or coronal scans or even better on correctly scaled cross-sectional images of the mandibular ridge. In the present study, Dentascan scored superior to panoramic radiography in the identification of the inferior alveolar nerve.[14-16] Of the 11 cases with mandibular lesions, Dentascan demonstrated mandibular canal involvement in seven cases unlike panoramic radiographs which depicted the same in only two patients with ameloblastoma and odontogenic keratocyst. Unlike the two-dimensional panoramic radiographs, the cross sectional views obtained with Dentascan allowed exact identification of the displacement of the mandibular canal by the pathologic processes. This finding was also in agreement with the previous studies.[8-10] Cho BH et al showed multi-planar reformatted CT images clearly defined the exact location of the mandibular canal in their study on odontogenic cysts.[14]

The thin sections and bone window algorithm that the Dentascan program uses have the further advantage of depicting subtle calcifications that might be a possible clue to the differential diagnosis.[17] In this study, unlike the radiographic images, Dentascan yielded additional information by revealing the presence of sequestrum and intra-lesional calcifications in the cases of osteomyelitis and adenomatoid odontogenic tumor.

Dentascan offers better characterization of the pathologic processes due to its ability to differentiate between different tissue types based on their Hounsfield units. The Hounsfield units range from -1000 to +1000 and each correspond to a different level of beam attenuation by a specific tissue density. In the present study, Dental CT images proved superior to the panoramic radiographs in predicting the contents of the lesion and thus its diagnosis. In the case of a maxillary radicular cyst where the panoramic radiograph demonstrated a homogeneous, well-defined radiolucency, Dentascan images provided additional information regarding its semi-solid content. The case was histopathologically confirmed as an infected radicular cyst. Dental CT also favoured the diagnosis of adenomatoid odontogenic tumor and mandibular osteomyelitis by demonstrating the presence of calcifications in both the cases. Again in the case of osteosarcoma, unlike the radiographic findings, a “sun-ray” appearance with respect to the buccal and lingual cortex could be appreciated on the Dentascan images which envisaged its diagnosis.[18-20]

CONCLUSION

The following were the important findings of the study:

- The extent of the lesion as shown by Dentascan was more than that was evident in the panoramic radiographs.

- Unlike panoramic radiography, Dentascan provided additional information by defining the medio-lateral dimension of the pathology.

- In evaluation of cortical bone involvement by the lesion, Dentascan was better in depicting the lesion in all the three planes.

- The oblique sagittal views in the Dentascan images could better delineate the root morphology and root resorption by the lesion. Dentascan images were better than panoramic radiographs in the evaluation of maxillary sinus involvement by the pathology.

- Dentascan proved superior in its ability to trace the course of the inferior alveolar canal and to demonstrate its relationship with the lesion.

- Unlike panoramic radiography, the thin sections and bone window algorithm used by the Dentascan program have the advantage of depicting subtle calcifications that might be a possible clue to the differential diagnosis.

- Dentascan offers better characterization of the pathologic processes due to its ability to differentiate between different tissue types based on their Hounsfield units. Hence it can define the contents of the pathology as cystic or solid and thus predict the diagnosis of the lesion.

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