Cone-beam computed tomography as an aid in early diagnosis of furcation involvement of young age smoker and non smoker subjects (comparative study)

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Abstract: *Background.Cone-beam computed tomography is a new application of Computed Tomography that generates three-dimensional data at lower cost and absorbed doses than conventional Computed Tomography found in the practice of medical radiology. The objectiveness of this study was To explore the diagnostic values of cone beam Computed Tomography (CBCT) in the determination of periodontal furcation involvements in molar area.in smoker and non smoker young subjects*

Materials and Methods: *forty subjects were included in the study ,they were free from any systemic disease their age group were range between 15-20 years old , they were divided in to two groups each group composed of 20 subjects first groups was smokers, they were smoke at least 10 cigarettes per day , smoking status was assessed by means of a self reported questionnaire which include :whether the subject had ever used any tobacco products , number of cigarettes smoke per day in addition to recording name of the subjects, age and gender while the second group was non-smokers free from any systemic disease For Cone-beam computed tomography scanning, the system we use in our study was Kodak 9500 CBCT*

Results: *there was an equal number of male and female in smokers group while in non –smokers group the number of male was 13 while the number of female was7.inter group comparison of means of plaque and gingival index show anon significant difference between smokers and non smokers group where the p-value>0.05while Inter group comparison for the furcation involvement using cone beam computed tomography show a highly significant differences between smoker group and non –smoker group at p-values 0.000 .intra group comparison between gender show non significant difference for furcation involvement .correlation using pearson r between number of cigarettes and number of sites founded in each patients was a highly significant*

Conclusion: *Cone-beam computed tomography imaging has the potential to replace intraoral imaging for the assessment of periodontal architecture especially in buccal and lingual aspect. However, clinical studies would be helpful in supporting this conclusion. Also Cone-beam computed tomography may be a useful and more practical clinical tool than digital subtraction radiography for the assessment of changes in periodontal bone over time*

Keywords: *Cone-beam computed tomography*

I. Introduction:

Periodontitis is an inflammatory disease of bacterial origin that results in the progressive destruction of the tissues that support the teeth, specifically the gingiva, periodontal ligament, and alveolar bone. Although there have been significant advances in the understanding of the cause and pathogenesis of periodontal disease over the past 40 years, the traditional methods by which clinicians diagnose periodontal disease have remained virtually unchanged. The diagnosis of periodontal disease relies almost exclusively on clinical parameters and traditional dental radiography. Clinicians use clinical and radiographic findings to diagnose patients according to the classification scheme developed at the 1999 International Workshop for the Classification of Periodontal Diseases and Conditions. These traditional diagnostic tools have some significant shortcomings. Clinical assessments such as probing depth (PD) and clinical attachment level are somewhat subjective and time consuming and therefore underutilized in general dental practice(1) .Cone-beam computed tomography (CBCT) is a new application of Computed Tomography (CT) that generates three-dimensional (3D) data at lower cost and absorbed doses than conventional CT found in the practice of medical radiology(2) Data from the craniofacial region are often collected at higher resolution in the axial plane than those from conventional CT systems (3). In addition, these systems do not require a large amount of space and can easily fit into most dental practices today. Vandenberghe and coworkers (4) investigated periodontal bone architecture using two dimension charge-coupled device (2D CCD) and 3D full-volume CBCT-based imaging modalities. Periodontal bone levels and defects were assessed and evaluate two human skulls' visualization of lamina dura, crater defects, furcation involvements, contrast, and bone quality were also evaluated.

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They concluded that CBCT image measurements of periodontal bone levels and defects were comparable to intraoral radiography. It was found that CBCT images demonstrated more potential in the morphologic description of periodontal bone defects and conversely, the CCD images provided more bone details(5). Misch and colleagues demonstrated that CBCT was as accurate as direct measurements using a periodontal probe and as reliable as radiographs for interproximal areas. In a recent review of currently published literature on CBCT for periodontology, Kasaj and Willershausen (6) conclude that the low dosage and superior image quality in comparison with conventional CT are promising for periodontal applications, especially in the areas of intrabony defects, dehiscence or fenestration defects, ,periodontal cysts, and in the diagnosis of furcation-involved molars.

II.   Materials And Methods:

Subjects included in this study were drawn from patients attending the special health center for dentistry in Al –Sadar city for orthodontic or surgical treatment(mainly impacted teeth) , they were free of any systemic disease and their age groups were range between 15to 20years old. We divided them in to two groups the first group was smoker composed from 20 subjects ,they were smoked at least 10 cigarettes per day for the last two years, smoking status was assessed by means of a self reported questionnaire which including :whether the subject had ever used any tobacco products , number of cigarettes smoked per day in addition to recording name of the subjects, age and gender while the second group was 20 non smokers and each group composed from male and female .oral examination was performed for each patient for recording periodontal variables for all the teeth of the patients except the third molar. The collected data include: plaque index according to Sillness &Loe 1964 and gingival index according to Loe 1967 .For CBCT scanning, the system we use in our study was Kodak 9500 CBCT installed in the centre. CBCT utilizes a cone shaped source of radiation and flat panal detector that it acquires a full volume of images in a single rotation with no need for patient's movement. Each participant take radiograph by using CBCT should stand in a especial position then trigger the x-ray with the remote control,then release the patients while waiting for the 3D image reconstruction after that we open the imaging window in Kodak dental imaging software to access the patient record and to open the acquired 3D image. For measurement of furcation involvement which is measured in coronal view ,we measure the CEJ-Ac distance in molar teeth under the supervision of special radiologist(the bone loss occur when the distance is more than 1.5mm)the measurement of CEJ-Ac distance by choosing the ruler option of the Kodak soft ware program. Statistical analysis used in this study was descriptive statistics that includes statistical tables, mean, Standard deviation and inferential statistics which include t-test and pearson correlation

III.   Results:

40 subjects were included in the study divided in to two groups each group composed of 20 subjects.The descriptive statistics for gender was described in table (1) there was an equal number of male and female in smokers group while in non –smokers group the number of male was 13 while the number of female was7.

Table (1) the descriptive statistics for gender distribution.

	No of male	No of female
Smokers	10	10
Non-smokers	13	7

Table 2 show the number and percentage of subjects that had furcation involvement as diagnosed by CBCT the highest level was in smokers group as it was 18 while the lowest was in non-smokers group as it was 5

Table 2 the descriptive statistics for furcation involvement.

	Yes	No	Furcation involvement%
Smokers	18	2	90%
Non-Smokers	5	15	25%

It was clearly shown that the mean of plaque index were elevated in Smokers compared with non-smokers, the mean of GI of non smokers group was higher than that of smokers group .,inter group comparison show anon significant difference for plaque index while a significant difference was found in gingival index between smoccker and nonsmockers group by using t-test as shown in table3

Table (3) Descriptive statistics and Inter group Comparison of means of plaque index and gingival index between smokers and non- smokers.

Group

	Group	Mean	± SD	T-test	P-value	Sig
PLI	Smokers	1.30	0.50	1.456	0.126	NS
	Non-Smokers	1.14	0.43			
GI	Smokers	0.923	0.311	2.678	0.007	S
	Non-Smokers	1.12	0.32			

Inter group comparison for the furcation involvement using t-test show ahighly significant differences between smoker group and non –smoker group at p-values 0.000 as shown in table 4

Table 4 inter groups comparison for furcation involvement.

	Smokers &non-smokers	Sig
t- test	0.000132	HS

Also inter group comparison between males and female showed significant differences for furcation involvement between groups as shown in table 5

Table 5 inter-group comparison of gender using t-test.

	t-test	Sig
Male in smokers&non-smokers	0.00516	S
Female in smokers &non-smokers	0.0067	S

While intra group comparison between male and female in each group by using t-test show anon significant difference as shown in table 6

Table6 intra- group comparison of furcation involvement by gender using t-test

	t-test	Sig
Male and female in smokers	1	NS
Male and female in non-smokers	0.176	NS

Table (7) show correlation using pearson r between number of cigarettes and number of sites involved by furcation founded in each patients was a highly significant.

Table 7 Pearson correlation between No of sites& No of cigarettes

	No of sites& No of cigarettes	Sig
Pearson correlation	0.997	HS

IV.   Disscution

In this study our analyses showed that there was a significant destruction in furcation area between smoker and non smoker subjects in spite of gender in measurements of buccal and lingual defects, so CBCT proved superior to conventional radiography. This was in agreement with the investigators that they concluded that CBCT offered a significant advantage over conventional radiography(5)., since diagnostic approaches including clinical probing and intraoral radiography have shown several limitations in their reliability(9). Clinical probing is dependent on the probing force, while periapical radiographs or bitewings may over- or underestimate the amount of bone loss due to projection errors. One of the main drawbacks of intraoral radiography is the overlap of anatomical structures and lack of three-dimensional (3D) information. This often hinders a true distinction between the buccal and lingual cortical plate and complicates the evaluation of periodontal bone defects, especially the infrabony lesions and furcation involvements(11,12). Studies have shown that CT assessment of alveolar bone height and infra bony pockets is reasonable, accurate, and precise(7-8).however , the quantity of radiation exposure appears to be one of the main problems preventing CBCT scans from becoming a standard imaging procedure for dentistry patients(,10)

Our statistical data base confirms the existence of correlations between the number of cigarette that the subject smoke per day and number of sites that show furcation involvement , this is due to the increased level of tobacco and nicotine metabolism with the increased number of cigarette smoked per day.So that in a conclusion CBCT imaging has the potential to replace intraoral imaging for the assessment of periodontal architecture especially in buccal and lingual aspect due to more accurate assessment,which is due to the inherent 3D character of the CBCT data and absence of overlapping structures,The maxillary trifurcations could hardly be

detected or interpreted.by digital radiograph but this over comed by CBCT wich showed more potential in the morphological description of periodontal bone crater and furcation involvements. However, clinical studies would be helpful in supporting this conclusion. Also CBCT may be a useful and more practical clinical tool than digital subtraction radiography for the assessment of changes in periodontal bone over time.

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