

The Assessment of Dentists' Knowledge Regarding Indications of Cone Beam Computed Tomography in Qazvin, Iran

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Background: Cone beam computed tomography (CT) has recently become effective for oral and maxillofacial imaging.

Objectives: The aim of this study was to assess the knowledge of dentists regarding cone beam computed tomography.

Materials and Methods: In this descriptive cross sectional study, a questionnaire regarding cone-beam computed tomography (CBCT) was distributed amongst 100 dentists (general and specialist) in Qazvin, Iran. Their level of knowledge was compared in each section on the basis of age, gender, years of employment and last educational status and analyzed by the SPSS software and Mann-Whitney test.

Results: Data analysis showed that 4% of dentists had very low, 16% had low, 50% had medium, 19% had good and 11% had in very good level of knowledge. The average of dentists' knowledge was 57 ± 18 . According to the statistical results, there was a significant difference between level of knowledge and age, years of employment and educational degree ($P < 0.05$). Age and years of employment had a reverse relationship with level of knowledge and specialists had greater awareness. There was no significant difference between level of knowledge and sex ($P > 0.05$).

Conclusions: Overall, dentists had an average level of knowledge for CBCT. It is recommended for qualification programs to be held for dentists to strengthen their awareness toward cone beam computed tomography.

Keywords: Knowledge; Dentist; Cone - Beam Computed Tomography

1. Background

Cone-beam computed tomography (CBCT) is a new technology, in which two-dimensional detectors and conical beam are used instead of fan X-rays in conventional computed CT. In this technique, volumetric data are collected by rotating of beam and detectors around the desired structure (1). The main advantage of CBCT is its high sharpness of axial images compared to conventional CTs (2). Ludlow and colleagues showed that CBCT dosages can be different according to the manufacturer company, type of machine, type of observer and level of elective exposure factors (3).

In the recent years, this technology has been used to prepare cross-sectional images from maxillofacial structures. Cone-beam computed tomography has less exposure time and cost compared to conventional CT. The beams rays are confined for head and neck only. Lower dosage of X-rays and ability to take different images from a certain structure and also possibility of reconstruction in sagittal and coronal views, all make CBCT a convenient technology (4-6). The disadvantages of CBCT are its low resolution of soft tissue and scattering beams from tooth tissue (6). Usual indications of CBCT in dentistry are implantation, orthodontic treatments, assessment

of temporomandibular joint (TMJ), relationship of third mandibular molar with inferior alveolar nerve block and presence of tumors and cysts (7). Cone-beam computed tomography makes images by centralizing the X-ray beam with a conical form on a two-dimensional detector, which rotates 360 degree around the patients' head to make images. Next the algorithm of conical beam is applied on this data, and thus the technologist can make reconstructions of the curve and two-planar with different thicknesses on each side and achieve clear and actual three-dimensional images from bone and tooth tissue (8-10).

According to the significance of CBCT in dental treatments, it seems that assessment of dentists' awareness for indications of this system is important. There is only one research related to this subject which has been done at Ankara University among dental students (11).

2. Objectives

This study was done to assess the knowledge of dentists regarding indications of CBCT images during 2012 and 2013 in Qazvin city, Iran.

3. Materials and Methods

This study received an exemption from the Institutional Review Board (registration number: 591) of the dentistry faculty, Qazvin University of Medical Sciences. Out of 124 dentists, who received the self-administered questionnaires (Figure 1), 100 dentists participated in this research. The statistical society included both general dentists and specialists. The questionnaire was designed considering the studies of Kamburoglu et al. (11), which were done in two universities in Ankara (4). The question-

naire included demographic data (age, sex, years of employment, educational degree) and fifteen questions regarding the CBCT technology. The questions assessed the knowledge of dentists about indications of CBCT. There was no compulsion for answering the questionnaire and dentists were ensured, that the results of this study will be used only for educational purposes of the dental society and will not be used for evaluating the dentists.

In this pilot survey, analysis of data was done by the SPSS software version 11.5 (IBM, New York, NY) and Mann-Whitney and Kruskal-Wallis tests.

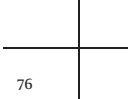
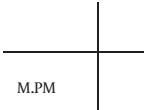
<p>1. A single CBCT examination a. can be complementary for panoramic views b. can be prescribed on the basis of patient's complaint c. must be justified for each patient to demonstrate the benefits outweigh the risks d. referring for a CBCT practitioner must not supply result and history of clinical investigations</p>	<p>9. For which of followings, indication of CBCT is not indispensable? a. Doubt in severe bone resorption b. Doubt in position of mandibular canal for implantation in the anterior part of lower jaw c. Doubt in morphology of ridge d. Doubt in position of mandibular canal for implantation in the posterior part of jaw</p>
<p>2. Which of followings is justifiable for indication of CBCT? a. only be used when traditional techniques cannot give new information b. can be apply without taking clinical examinations c. CBCT can be used routinely for effective treatments d. none of the above</p>	<p>10. Orthodontics application of CBCT cannot be for a. lip cleft b. palatal cleft c. impacted canine d. assessment of airways</p>
<p>3. Which of following specifications for the CBCT compared CT is true? a. More contrast b. More cost c. Higher dose d. lower accuracy for soft tissue</p>	<p>11. Which of followings in implant surgery is not correct? a. CBCT images must be taken after clinical examination and conventional radiographies b. CBCT technique must be applied with minimum dose c. CBCT is a standard technique for implantation d. In some cases per apical radiography can be helpful</p>
<p>4. The major indication of CBCT in Iran is for assessment of a. inferior alveolar nerve block for removing wisdom teeth b. implant sites c. pathological lesions d. bone density</p>	<p>12. Which of followings is not the indication of CBCT? a. CBCT images can only assess the quantity of bone b. CBCT images can assess quantity and quality of bone c. CBCT images can assess the success of bone graft d. Diagnosis of osteomyelitis</p>
<p>5. For which of following diagnostic imaging tasks, CBCT cannot be used? a. position of temporomandibular disk b. position of condyle in glenoid fossa c. condyle fracture d. ankylosis</p>	<p>13. CBCT cannot be indicated for a. impacted mandibular third molars adjacent the mandibular canal b. alveolar bone assessment in edentulous area for implant placement c. diagnostic accuracy instead of panoramic view as an alternative technique d. assessment of condylar erosion</p>
<p>6. Which of followings is not an indication for use of CBCT? a. assessment of apical cyst b. soft tissue evaluation c. sinus evaluation d. detection of fractures in the posterior part of mandible</p>	<p>14. Intra oral radiographies compare to CBCT are justifiable for a. interproximal caries b. measuring the ridge height c. extension of pathological lesions d. (a) and (b)</p>
<p>7. Which of following statements regarding CBCT is correct? a. It can show only vertical root fractures b. It can show only horizontal root fractures c. All kinds of root fractures can be detected by CBCT d. CBCT cannot detect root fractures</p>	<p>15. Which of following orders for prescription is correct? (implantation of 6 and 7 mandibular right teeth)</p> <p>a. </p> <p>b. </p> <p>c. lower right quadrant</p> <p>d. Lower jaw</p>
<p>8. CBCT can be used for evaluating the a. erosion of TMJ b. position of disk c. morphology of disk d. width of disk</p>	

Figure 1. Questionnaire for Evaluation Dentist's Knowledge Regarding Indications of Cone-Beam Computed Tomography

4. Results

Dentists' relative frequency distribution for demographic data on the basis of age, gender, number of years for employment, educational degree, as well as frequency of distribution on the basis of knowledge are indicated in Table 1.

Note: Out of 124 questionnaires, which were distributed among dentists, 100 were answered.

Dentists' relative frequency distribution for the fifteen questions related to CBCT were as follows: Question 1: prescribing CBCT: 38 (38%) answers were correct and 62 (62%) were incorrect; Question 2: justifiability for indications of CBCT: 84 (84%) were correct and 16 (16%) were incorrect; Question 3: comparing CT and CBCT: 20 (20%) were correct and 80 (80%) were incorrect; Question 4: most common indications of CBCT: 83 (83%) were correct and 17 (17%) were incorrect; Question 5: CBCT and TMJ: 48 (48%) were correct and 52 (52%) were incorrect; Question 6: contraindication of CBCT: 82 (82%) were correct and 18 (18%) were incorrect; Question 7: indication of CBCT in root fractures: 79 (79%) were correct and 21 (21%) were incorrect; Question 8: CBCT and articular disc: 47 (47%) were correct and 53 (53%) were incorrect; Question 9: indication of CBCT for implant surgery in edentulous patients: 41 (41%) were correct and 59 (59%) were incorrect; Question 10: contraindication of CBCT in orthodontics: 75 (75%) were correct and 25 (25%) were incorrect; Question 11: contraindications of CBCT in implant surgery: 23 (23%) were correct and 77 (77%) were incorrect; Question 12: contra indication of CBCT: 65 (65%) were correct and 35 (35%) were incorrect; Question 13: comparing CBCT with orthopantomogram (OPG): 57 (57%) were correct and 43 (43%) were incorrect; Question 14: comparing CBCT with intraoral radiographies, 70 (70%) were correct and 30 (30%) were incorrect; Question 15: order for prescription, 39 (39%) were correct and 61 (61%) were incorrect.

The grading scales for evaluating the level of knowledge were as follows; 0 - 20 was considered as very low; 20 - 40 was considered as low; 40 - 60 was considered as average; 60 - 80 was considered as high, and 80 - 100 was considered as very high. Average level of knowledge was 57 ± 17 , lowest mark was 13 and highest mark was 100; 80% had an average level of awareness.

A P value of < 0.05 obtained from the Kruskal-Wallis test showed that there was a significant difference between knowledge of different age groups. Mann-Whitney test was done for analyzing differences among subgroups; for less than 30 and 35 to 40 ($P = 0.005$), for less than 30 and above 40 ($P = 0.021$), 30 to 35 and 35 to 40 ($P = 0.003$), 30 to 35 and above 40 years ($P = 0.02$), there was a significant difference among subgroups. According to the mean and median of all groups, awareness was higher in the younger age groups. The Pearson's correlation coefficient was used for further analysis of these two variables and confirmed the relationship between these two variables. Also $r = -0.304$ showed a reverse relationship, indicating that with increasing age there was decreasing knowledge (Ta-

ble 2). The P value obtained from the Mann-Whitney test showed that there was no significant difference between knowledge of different genders (Table 3).

The P value of < 0.05 obtained from the Kruskal-Wallis test showed that there was a significant difference between knowledge of people with various numbers of years for employment. Mann-Whitney test was done for analyzing differences among subgroups; for less than 5 years of occupation and 10 to 15 ($P = 0.002$), and for less than 5 years and over 15 years ($P = 0.045$). According to the means and medians of all groups, awareness was higher in groups with lower number of years for employment. The Pearson's correlation coefficient was used for further analysis of these two variables and confirmed the relationship between these variables. A P value of 0 showed that there was a relationship and $r = -0.326$ confirmed a reverse relationship between the two variables, indicating that as the number of years of occupation increase, there is a decrease in knowledge (Table 4). A P value of < 0.05 , obtained from the Mann-Whitney test showed that there was a significant difference between knowledge and education degree. Means and medians confirmed that knowledge of specialists was more than general dentists (Table 5).

Table 1. Demographic Characteristics of Dentists' Relative to Cone-Beam Computed Tomography Knowledge

Characteristic	No. (%)
Gender	
Male	47 (47%)
Female	53 (53)
Age	
Less than 30 years	33 (33)
30 - 35 years	36 (36)
35 - 40 years	11 (11)
Over 40 years	19 (19)
Years for employment	
Less than 5 years	54 (54)
5 - 10 years	22 (22)
10 - 15 years	13 (13)
Over 15 years	11 (11)
Educational degree	
General	75 (75)
Specialist	25 (25)
Frequency distribution on the basis of knowledge	
Very low	4 (4)
Low	16 (16)
Average	50 (50)
High	19 (19)
Very high	11 (11)

Table 2. Comparison of Knowledge Scores by Age

Age	Mean	Median	Standard Deviation	P value
Less than 30 years	61.4	60	18	0.003
30 – 35 years	60.5	53.5	17.7	
35 – 40 years	44.3	46	13.4	
Over 40 years	49	46	15.9	

Table 3. Comparison of Knowledge Scores by Gender

Gender	Mean	Median	Standard Deviation	P value
Male	53.1	53.3	15.6	0.06
Female	59.8	60	19.5	

Table 4. Comparison of Knowledge Scores According to Number of Years for Employment

Number of Years for Employment	Mean	Median	Standard Deviation	P value
Less than 5 years	61.3	60	18	0.008
5 - 10 years	55.4	50	18	
10 - 15 years	46	46.6	9	
Over 15 years	49	46.6	19	

Table 5. Comparison of Knowledge Scores by Educational Degree

Educational Degree	Mean	Median	Standard Deviation	P value
General	70.4	73.3	18.6	0.000
Specialist	52.1	46.6	15.4	

5. Discussion

This study was done for evaluating dentists' knowledge regarding cone beam computed tomography. One hundred dentists including general dentists and specialists participated in this descriptive cross-sectional study. Females and those aged 30 to 35 had maximum frequency, according to frequency distribution. Those aged less than 30 years had the maximum level of knowledge (61.4 %), and level of knowledge decreased with increase in age. The inverse relationship between age and knowledge could be because 1) technology of CBCT has only been used in the last ten years and 2) the most common usage of CBCT is for implantation and in Iran young dentists are more involved in this field. Regarding the level of knowledge on the basis of gender, no significant differences were found between males and females. This finding was similar to Kamburoglu' research that evaluated dental student's knowledge for CBCT (11), and assessment of dentists' knowledge for prescribing conventional radiographies by Mahdizadeh et al. (12) and Ardakani et al. (5).

Regarding the number of years of employment, there was a significant difference in the knowledge of individuals with different numbers of years of employment; as the number of years of employment increased awareness decreased. This was similar to Bardal's study comparing

dentists that had graduated previously with those that had recently graduated regarding prescription of intra-oral radiology and panoramic views (13). According to level of knowledge on the basis of educational degree, there was a significant difference between level of knowledge and educational degree; specialist had greater awareness compared to general dentists. This was similar to a study done by Mahdizadeh et al. (12), which showed that specialists had greater knowledge about CT and MRI compared to other convention intraoral radiographies. Cone-beam computed tomography has one of the most important roles for diagnosis in dentistry. This research showed that dentists in Qazvin city had an average level of knowledge regarding cone beam CT. It is recommended that qualification programs must be held for dentists to increase their awareness toward cone beam computed tomography. Dentists must gain more knowledge about indications and contraindications of CBCT.

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Authors' Contributions

Co-authors helped in designing, analysis of the results and writing of the current manuscript.

References

1. Bianchi SD, Lojaco A. . 2D and 3D images generated by cone beam computed tomography (CBCT) for dentomaxillofacial investigations. *CARS*. 1998 Amsterdam. Elsevier: pp. 792-7.
2. Ito K, Gomi Y, Sato S, Arai Y, Shinoda K. Clinical application of a new compact CT system to assess 3-D images for the preoperative treatment planning of implants in the posterior mandible A case report. *Clin Oral Implants Res*. 2001;**12**(5):539-42.
3. Ludlow JB, Davies-Ludlow LE, Brooks SL, Howerton WB. Dosimetry of 3 CBCT devices for oral and maxillofacial radiology: CB Mercuray, NewTom 3G and i-CAT. *Dentomaxillofac Radiol*. 2006;**35**(4):219-26.
4. Scarfe WC, Farman AG, Sukovic P. Clinical applications of cone-beam computed tomography in dental practice. *J Can Dent Assoc*. 2006;**72**(1):75-80.
5. Ezoddini Ardakani F, Sarayesh V. Knowledge of Correct Prescription of Radiographs among Dentists in Yazd, Iran. *J Dent Res Dent Clin Dent Prospects*. 2008;**2**(3):95-8.
6. Scarfe WC, Farman AG. What is cone-beam CT and how does it work? *Dent Clin North Am*. 2008;**52**(4):707-30.
7. White SC. Cone-beam imaging in dentistry. *Health Phys*. 2008;**95**(5):628-37.
8. Feldkamp LA, Davis LC, Kress JW. Practical cone-beam algorithm. *J Opt Soc Am*. 1984;**1**(6):612-9.
9. De Vos W, Casselman J, Swennen GR. Cone-beam computerized tomography (CBCT) imaging of the oral and maxillofacial region: a systematic review of the literature. *Int J Oral Maxillofac Surg*. 2009;**38**(6):609-25.
10. White SC, Pharoah MJ. The evolution and application of dental maxillofacial imaging modalities. *Dent Clin North Am*. 2008;**52**(4):689-705.
11. Kamburoglu K, Kursun S, Akarslan ZZ. Dental students' knowledge and attitudes towards cone beam computed tomography in Turkey. *Dentomaxillofac Radiol*. 2011;**40**(7):439-43.
12. Mahdizadeh M, Fazaelpour M, Namdari A. Evaluation of dentists' awareness of how to prescribe correct radiographs in Isfahan in 2010-2011. *J Isfahan Dent Sch*. 2012;**7**(5):637-42.
13. Bardal R, Rahimi R, Ahmadi Motamayel F. A Comparative Study of the Previously Graduated Dentists' Knowledge versus those Recently Graduated as to Proper Prescription of Interaoral Radiography and Panoramic Views. *J Dent Shiraz Univ Med Univ*. 2011;**12**(3):195-205.