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Knowledge and Attitude of Iranian Dentists towards Cone-Beam Computed Tomography

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A B S T R A C T

Objectives: We aimed to evaluate the knowledge and attitude of Iranian dentists towards cone-beam computed tomography (CBCT).

Materials and Methods: A 20-item questionnaire was distributed among 410 Iranian dentistry graduates attending the 56th Congress of Iranian Dental Association held in Tehran, Iran. The questionnaire included items on demographic characteristics, namely full name, age, gender, work experience, type of current activity (individual or group), and the highest educational level. In addition, the questionnaire contained items on the knowledge and attitude of dentists. The obtained data were analyzed using statistical tests.

Results: In this study, 49.3% and 22.4% of the subjects were male and female, respectively, 47.1% of whom used CBCT, while 49.8% did not. In detail, 72.2% of the dentists used the technique to evaluate the location of implants, whereas 19.7%, 3.2%, and 2.7% of the subjects applied it to localize the inferior alveolar nerve (IAN), evaluate the location of implants and localize the IAN, and perform cephalometric analysis, respectively. The main causes of lack of prescription of CBCT entailed high cost (80%), high rate of patient absorbed dose (27.6%), insufficient number of CBCT centers (46.3%), and the long duration of the process (15.6%).

Conclusion: CBCT is an advantageous imaging technique in dentistry. Considering the increased application of CBCT in dentistry, attending workshops could help train dentists to use the technique.

Keywords: Cone-Beam Computed Tomography; Dentists; Attitude; Knowledge; Radiology

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INTRODUCTION

Cone-beam computed tomography (CBCT) is an imaging technique currently applied for maxillofacial regions [1]. Compared to CT, CBCT imposes lower costs, occupies less space, has higher scanning speed and more limited imaging capability (head and neck), and imposes less radiation risk to patients. These features have turned CBCT into a more appropriate imaging modality compared to

CT [2]. However, some of the weaknesses of this method include beam hardening, dispersion from the dental materials, and poor contrast in soft tissues [3,4].

CBCT systems operate by concentrating a cone-shaped X-ray beam in a two-dimensional (2D) detector, which rotates 360 degrees or less around the patient's head to produce 2D images. Following that, the cone-beam algorithm is applied to the data to generate three-dimensional (3D) images [5,6].

Some of the applications of CBCT include the evaluation of the jaws before dental implant placement, oral, facial, and structural examinations for orthodontic treatments, temporomandibular joint (TMJ) examination, evaluation of the position of the maxillary wisdom teeth in relation to the inferior alveolar nerve (IAN), and the examination of pathologic lesions, cysts, and tumors [7]. Although several CBCT educational courses have been sporadically held, there is a scarcity of ongoing training courses on CBCT in the curriculum of dentistry students. Considering the increased accessibility of CBCT, acquiring information on the knowledge and attitude of dentists towards this state-of-the-art technology is of paramount importance.

Despite its abundant benefits, information obtained from CBCT requires a considerable level of experience for image interpretation, that is, untrained dentists will possibly have high error rates in the interpretation of CBCT images. Therefore, having knowledge about CBCT is a contemporary necessity [8]. Herein, we sought to evaluate the knowledge and attitude of Iranian dentists towards CBCT.

MATERIALS AND METHODS

Three radiologists and one epidemiologist designed the initial plan of the questionnaire. To assess the transparency and the relevance of the questions, six radiologists were asked to rate these two indices for all the items on a five-point Likert scale (completely transparent, completely non-transparent, appropriate, completely appropriate, and completely inappropriate).

The items that were assigned as completely transparent and appropriate by six or at least four experts were included in the questionnaire without any changes. Therefore, all items have remained intact in this study. Twenty dental students, who were given the questionnaire again after one month, examined the relative test-retest reliability of the questionnaire. All items obtained a Cronbach's Alpha coefficient higher than 0.8.

This study was conducted among Iranian dentists attending the 56th Congress of Iranian Dental Association during May 17th-20th, 2016, in Tehran, Iran. We used a structured 20-item questionnaire that contained items on demographic information, that is, full name, age, gender, work experience, type of current activity (individual or group), and the highest level of education, as well as items on the knowledge and attitude of dentists.

The participants were allocated 10-12 minutes to complete the questionnaire. After collecting the questionnaires, they were coded, and the obtained data were entered into Microsoft Excel® (Microsoft Corp., Redmond, Washington, USA). Data analysis was performed in SPSS software (version 24; SPSS Inc., Chicago, IL, USA). The linear regression model was run to assess the effects of age, gender, expertise, and years of professional practice on the scores of knowledge and attitude. In addition, binary logistic regression was performed to assess the effect of age, gender, expertise, type of current activity (individual or group), work experience, knowledge of CBCT, and attitude toward this technique on the use or non-use of CBCT. The standard sample size was estimated to be 410 samples using the sample size formula and considering alpha=0.05, optimum IP, and delta=0.01. Moreover, a t-test was used to compare the knowledge and attitude of people with and without the experience of using this system. Below is the questionnaire about the knowledge and attitude of dentists towards CBCT imaging technique (Figure 1).

Figure 1: Questionnaire on the knowledge and attitude of dentists

Note: You can write your full name if desired.
This only prevents the repeated completion of the questionnaire; the final evaluations will be based on codes.
Name……Age……Gender……
Work experience: below 5 years ☐ 5-10 years ☐ 10-20 years ☐ above 20 years ☐
Type of current activity: Individual ☐ Group in clinics ☐
Highest level of education: General dentist ☐ Dental specialist (type of specialty) ☐
Do you use CBCT images? Yes ☐ No ☐

Knowledge questions

1. Which item shows the accurate order of the amount of radiation exposure to the patient?
A) CBCT> head CT> panoramic
B) Head CT > panoramic > CBCT
C) Head CT > CBCT > panoramic
D) Panoramic > head CT > CBCT

2. How is the size of CBCT equipment and its occupied space compared to CT?
A) Less B) More C) Equal D) No opinion

3. How is the scanning duration of CBCT relative to CT?
A) Less B) More C) Equal D) No opinion

4. Which of the techniques below provides a clearer image of the soft tissues?
A) CT B) CBCT C) Conventional tomography D) Panoramic

5. What is the most common application of CBCT?
A) Evaluation of implant location C) Three-dimensional (3D) cephalometric analysis
B) Localization of the inferior alveolar nerve (IAN) D) No opinion

6. Is wearing a lead apron by patients necessary during CBCT?
A) Yes B) No C) No opinion

7. Which of the following techniques provides higher clarity in the evaluation of periapical and periodontal lesions and root fractures?
A) CT B) CBCT C) No opinion

8. Which of the following conditions involves the highest use of CBCT? (You can choose more than one alternative).
Evaluation of the inserted implant ☐
Evaluation of impacted canines ☐
Evaluation of the location of implants before placement ☐
Cephalometric analysis ☐
Evaluation of tooth decay ☐
The routine evaluation of orthodontic patients ☐
Evaluation of root fracture ☐
Evaluation of periodontal condition ☐
No opinion ☐

Attitude questions

What is your opinion about these statements?

1. It is better to prescribe CBCT for all implant patients.
A) Completely agree B) Agree C) No opinion D) Disagree E) Completely agree

2. CBCT can be an alternative to panoramic or conventional radiography.
A) Completely agree B) Agree C) No opinion D) Disagree E) Completely agree

3. The provision of reports and opinions by a radiologist along with CBCT is necessary.
A) Completely agree B) Agree C) No opinion D) Disagree E) Completely agree

4. The use of CBCT is essential in case of the proximity of the wisdom tooth to the IAN.
A) Completely agree B) Agree C) No opinion D) Disagree E) Completely agree

5. What is the main cause of CBCT nonprescription? (You can choose more than one alternative).
A) High rates of radiation exposure to the patient
B) High costs
C) Insufficient number of centers with CBCT
D) The long duration of preparing the images and their results
E) No opinion

RESULTS

Overall, 49.3% and 22.4% of the subjects were male and female, respectively, and the remaining participants did not mention their gender. In addition, 15.9% of the respondents had 10-20 years of experience, whereas 20.2% had more than 20 years of work experience. In terms of the type of current activity, 56.3%, 19.5%, and 11.7% worked individually, in groups and clinics, and both individually and in groups, respectively. Moreover, 79.5% of the subjects were general dentists and 7.8% were dental specialists. Of all the participants, 47.1% used CBCT, while 49.8% did not use this technique. In the knowledge section, the order of radiation exposure was asked in the first item. In this regard, 37.3% proposed that CT had the highest radiation exposure rate, followed by CBCT and panoramic techniques. In the items concerning the size of the CBCT device and its occupied space compared to CT, 53.9% believed that CBCT was smaller, whereas 9.8% held the opposite opinion. In terms of CBCT scan time compared to CT, 59.3% of the dentists believed that the duration of the CBCT scan was shorter relative to CT. Furthermore, 12.9% attributed higher scan duration to CBCT, and 5.6% considered an equal duration for both devices.

In the next item, the participants were asked which of the mentioned techniques provided a clearer image of the soft tissues. According to the results, 36.3%, 15.1%, 8%, and 4.1% chose tomography, CBCT, CT, and panoramic techniques, respectively. As for the most conventional application of CBCT, 72.2% of the dentists used it to evaluate the location of implants, whereas 19.7%, 3.2%, and 2.7% of the subjects applied it to localize the IAN, evaluate the location of implants and localize the IAN, and perform cephalometric analysis, respectively.

In another item, 52.2% of the participants believed that wearing a lead apron is necessary. Another item in the knowledge section was about the clarity of images for root fracture and periapical and periodontal lesions in CT and CBCT techniques, where 75.1% and 12% of the respondents selected CBCT and CT, respectively. In the final question of the knowledge section, dentists were asked about the application of CBCT in dentistry. In this regard, 83.9% of the subjects selected the evaluation of implant location before placement, while 61.5%, 57.6%, 41%, 12.7%, 6.3%, 3.4%, and 3.2% mentioned the evaluation of the inserted implant, location of impacted canines, root fracture, cephalometric analysis, periodontal condition, tooth decay, and the routine examination of orthodontic patients, respectively.

In another section of the questionnaire related to the attitude of dentists towards CBCT, 38.5% agreed that this technique must be prescribed for all implant patients. In addition, 33.9% selected the alternative of “completely agree”, whereas 16.1% and 3.2% chose “disagree” and “completely disagree” alternatives, respectively. In another item about the suitability of CBCT as an alternative to panoramic or conventional radiography, 52.4% disagreed while 16.6% agreed.

As to the necessity of reports and opinions of a radiologist along with CBCT, 46.1%, 32%, and 5.6% of the participants selected the “agree”, “completely agree”, and “disagree” alternatives, respectively. In another item on the necessity of the use of CBCT in case of the proximity of the wisdom tooth to the IAN in panoramic radiography, 40% and 29% selected the alternatives of “agree” and “completely agree” in terms of prescription of CBCT. In the final item, respectively 80.2%, 27.6%, 46.3%, and 15.6% of the subjects believed that high costs, high rates of radiation exposure, insufficient number of centers equipped with CBCT, and long duration of the imaging process accounted for the lack of routine prescription of CBCT imaging. The results finally showed that the knowledge and attitude of people making use of CBCT were higher than those who did not ($P<0.001$).

DISCUSSION

Radiographic examination plays an important role in dental treatments. According to the as low as reasonably achievable (ALARA) principle, the radiation dose to the patient must be minimized. This principle, along with dose reduction techniques, must be

considered in 3D imaging, especially in the head and neck area [9]. Similar to many technologies that have been accepted by experts and patients and have become normalized after being specialized, CBCT has also changed from a specialized tool in dentistry to a standard and common imaging technique for dental implants, orthodontics, orthognathic surgery, and endodontics due to its low cost, ease of access, and reduction of radiation exposure [10].

Research in dental radiology mainly focuses on digital systems and radiation protection. Meanwhile, the current study aimed to evaluate the effect of training on the use of CBCT. To evaluate the knowledge and attitude of Iranian dentists, this cross-sectional study was conducted among 410 participants using questionnaires. According to the results, those working in groups in clinics had a higher level of knowledge compared to those working individually.

Moreover, age was found to have an inverse relationship with knowledge in the present research, meaning that the higher the age of dentists, the lower was their knowledge about CBCT. In this study, gender, work experience, and the highest level of education were not significantly related to the knowledge of dentists about CBCT. In addition, no variable affected the attitude of the subjects towards CBCT. Our results showed that various factors were at play in the application of CBCT, namely gender, type of current activity (individual or group), and educational level such that males, dental specialists, and those who worked in groups in clinics used this technique more frequently. Regarding the order of radiation exposure, most of the participants held that the rate of radiation exposure in descending order was as follows: CT > CBCT> panoramic radiography.

Similarly, Ramani and Kalra [9] concluded that lower radiation dose to the patient was the most important advantage of CBCT over CT. Consistent results were obtained by Chau and Fung [11], Qirresh et al [12], Sudhakar et al [13], and Balabaskaran and Srinivasan [14].

In the current study, the respondents were asked about the visualization of soft tissues by radiation techniques. The majority of the participants believed that conventional tomography provided a clearer image of the soft tissues. Aditya et al [8] reported that CBCT has a high application in the evaluation of soft tissue pathologies, which is inconsistent with our findings. Regarding the most common applications of CBCT, Aditya et al [8] concluded that the highest application of CBCT was in implant treatment. Moreover, Qirresh et al [12] and Kamburoğlu et al [1] marked that CBCT was mostly used in implant treatment, followed by endodontics. In the mentioned research, CBCT was presented as a more efficient technique in the evaluation of periapical and periodontal lesions and root fracture, which is in line with the results obtained by Aditya et al [8] and Qirresh et al [12]. In the latter [12], in addition to the evaluation of soft tissues, muscles and lymph nodes were examined by CBCT.

In our study, CBCT was mostly applied for the evaluation of implant location before placement and the localization of impacted canines. Further, this technique had the least application in the routine examination of orthodontic patients and tooth decay assessment, which was consistent with the results obtained by Balabaskaran and Srinivasan [14] and Reddy et al [2], whereas it was not congruent with the results reported by Ramani and Kalra [9] and Durack and Patel [15].

Furthermore, we assessed some factors that were not evaluated in similar studies. Dentists believed that CBCT occupies less space, and the scan time is shorter compared to CT. They also held that the use of a lead apron during CBCT imaging is necessary. In the present study, the majority of the subjects reported that CBCT could not be used as an alternative to the routine imaging techniques, which is consistent with the results obtained by Qirresh et al [12]. In the mentioned study, the lack of prescription of CBCT was due to its high cost, which is in line with the results obtained by Shetty et al [16] and Yalcinkaya et al [17]. Moreover, some issues were surveyed in the attitude section of the current research,

which were not explored in similar studies. In this regard, the dentists believed that CBCT prescription is essential for all implant patients, especially in case of the proximity of the wisdom tooth to the IAN. Moreover, the participants surmised that image interpretation requires consultation with a maxillofacial radiologist.

CONCLUSION

According to the results of the current research, Iranian dentists had poor knowledge and attitude towards CBCT, despite its high prescription rate. Moreover, the knowledge and attitude of those using this technique were higher compared to those who did not. Therefore, theoretical and practical training courses should be incorporated into the curriculum of dentistry students. Dentists could be educated in this regard in the form of exclusive courses and through workshops held in congresses.

CONFLICT OF INTEREST STATEMENT

None declared.

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