

# KNOWLEDGE AND ATTITUDES OF JORDANIAN AND POLISH DENTAL INTERNS TOWARDS CONE BEAM CT IMAGING

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## ABSTRACT

**Introduction:** Knowledge about cone beam computed tomography (CBCT) among dental personnel is paramount topic and being investigated in many countries all over the world.

**Objectives:** The aim of this study was to assess and compare knowledge and attitudes of Jordanian and Polish dental interns towards CBCT.

**Materials and methods:** This cross-sectional study was performed using a questionnaire composed of 17 questions related to CBCT. The questionnaire was distributed to 89 Jordanian and 103 Polish dental interns, and  $\chi^2$  test was applied for data analysis.

**Results:** The majority of dental interns (range, 55.2-94.3%) correctly answered questions related to CBCT knowledge, and showed positive attitudes towards CBCT. Polish dental interns had higher scores in most of the questions related to CBCT basic knowledge, and there was a statistically significant difference in various responses ( $p < 0.05$ ).

**Conclusion:** Both Jordanian and Polish dental interns have a good level of knowledge and positive attitudes towards CBCT. To enhance knowledge and attitudes among dental interns, dental faculties should provide more courses related to CBCT.

**KEY WORDS:** cone beam CT, knowledge, attitudes, dental interns, Jordanian, Polish.

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## INTRODUCTION

Today in dental office, digital radiography is a widely used radiographic modality due to its' advantages, such as time saving, reduction of amount of radiation, removal of imaging errors, image enhancement, data stor-

age, communication with other practitioners, and easier viewing of patients' images on a monitor [1]. Cone beam computed tomography (CBCT) is an advanced digital imaging modality that operates by focusing a cone-shaped X-ray beam on a two-dimensional (2D) detector that rotates 360° or less around the patient's head, to produce

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a sequence of 2D images. A cone beam encryption is then applied to this data set, allowing the operator to extract planar and curved reconstructions of variable thicknesses in any orientation, and create accurate three-dimensional (3D) bone and soft-tissue surface images [2]. Three-dimensional data of dental structures and related anatomy without superimpositions help dentists to diagnose complex cases and plan desirable treatments more reliably. Knowledge of the advantages and implementation of this method create a tendency among dental staff to use CBCT imaging according to the exact needs. However, since the technology is relatively new, more time may be needed to achieve an adequate and suitable role for this technic to be implemented in dental office [3].

Despite the ample benefits, information obtained from CBCT requires considerable experience in the interpretation of images; untrained dentists may present high error rates in interpretation of CBCT images. Knowledge of CBCT is therefore an essential need [4].

There are many studies evaluating the current experience and attitudes of general practitioners and dental interns in the assessment and use of CBCT [1-5]. However, to the authors' knowledge, there is no study, which investigated dental interns in different educational structures with different curriculums. Therefore, the aim of the present study was to assess and compare knowledge and attitudes of Jordanian and Polish dental interns towards CBCT.

## OBJECTIVES

The aim of this study was to assess and compare knowledge and attitudes of Jordanian and Polish dental interns towards CBCT.

## MATERIAL AND METHODS

A total of 192 questionnaires were distributed to 89 Jordanian and 103 Polish dental interns. In addition to demographic data, including age, gender, and years of professional experience, participants were requested to answer 17 multiple-choice questions related to CBCT (Appendix 1). First 9 questions were about general awareness and attitudes towards CBCT, and remaining 8 questions were to assess and compare CBCT basic knowledge among participants. All procedures were followed in accordance with ethical standards of the responsible committee on human experimentation (institutional and national) as well as with the Helsinki Declaration of 1964 and subsequent versions. Data were analyzed using IBM SPSS statistics v. 21 (SPSS Inc., Chicago, IL, USA). Descriptive statistical methods (frequency, percent, valid percent, and cumulative percent) were applied to evaluate data. Multi-response method was used to describe multi-answer questions.  $\chi^2$  test was performed to compare qualitative data.  $P$ -value  $< 0.05$  was considered significant.

## RESULTS

The study included 192 respondents, of which 89 were Jordanians and 103 Polish interns' volunteers, who responded to the questionnaire. Two-third of them were in their twenties, and about the same portion were females. Regarding their experience, more than half of the respondents presented over 9 months' of experience compared with 40% of the respondents between 5 to 8 months of experience (less than 10% with less than 3 months of experience) (Table 1). Among all the respondents, lecture was the most reliable source of knowledge, with 38.3% (Table 2). Only 27.1% of the respondents attended workshops regarding cone beam

TABLE 1. Respondents' characteristics

Factor	Number	Percent	Valid percent	Cumulative percent
Nationality				
Jordanian	89	46.4	46.4	46.4
Polish	103	53.6	53.6	100.0
Age				
22-29	128	66.7	66.7	66.7
30-35	59	30.7	30.7	97.4
> 35	5	2.6	2.6	100.0
Gender				
Male	66	34.4	34.4	34.4
Female	124	64.6	64.6	99.0
K	2	1.0	1.0	100.0
Experience, months				
1-4	15	7.8	7.8	7.8
5-8	77	40.1	40.1	47.9
> 9	100	52.1	52.1	100.0
Total	192	100.0	100.0	

TABLE 2. Responses of participants on CBCT source of knowledge

Valid	Response	Response		Percent of cases
		Number	Percent	
	Reading	68	24.82	35.42
	Conference	54	19.71	28.13
	Lecture	105	38.32	54.69
	Workshop	15	5.47	7.81
	GP	22	8.03	11.46
	Family and friends	2	0.73	1.04
	No idea	8	2.92	4.17
	Total	274	100.0	142.70

**TABLE 3.** Response of participants on the attendance of any workshops regarding CBCT

		Number	Percent	Valid percent	Cumulative percent
Valid	Yes	52	27.1	27.1	27.1
	No	67	34.9	34.9	62.0
	No, but I will attend if I have a chance	73	38.0	38.0	100.0
	Total	192	100.0	100.0	

**TABLE 4.** Response of participants on the indication for referring patients for CBCT

		Response		Percent of cases
		Number	Percent	
Valid	Lower radiation dose	143	34.1	74.5
	Shorter scanning time	74	17.7	38.5
	Less expensive	20	4.8	10.4
	Occupies less space	27	6.4	14.1
	Easier to maintain	71	16.9	37.0
	Image processing is easier due to limited beam	68	16.2	35.4
	No idea	16	3.8	8.3
	Total	419	100.0	218.2

**TABLE 5.** Responses of participants if they have referred patients for CBCT imaging or have told them about it

		Number	Percent	Valid percent	Cumulative percent
Valid	Yes	121	63.0	63.0	63.0
	No	70	36.5	36.5	99.5
	No idea	1	0.5	0.5	100.0
	Total	192	100.0	100.0	

**TABLE 6.** Responses of participants on the cost of CBCT for one image

		Number	Percent	Valid percent	Cumulative percent
Valid	10-50 JD	44	22.9	22.9	22.9
	10-100 JD	9	4.7	4.7	27.6
	50-100 JD	108	56.3	56.3	83.9
	100-200 JD	20	10.4	10.4	94.3
	No idea	11	5.7	5.7	100.0
	Total	192	100.0	100.0	

computed tomography, but 38% were willing to attend if they have a chance (Table 3). Regarding indications for referring patients for CBCT, low radiation dose and rapid scanning time were the main ones (Table 4). The majority of participants (63%) said they have referred or told their patients about CBCT imaging (Table 5). More than half of the participants believed that the cost for one CBCT image was between 50 to 100 Jordanian dinars (Table 6).

**TABLE 7.** In which cases would you choose using cone beam computed tomography?

		Response		Percent of cases
		Number	Percent	
Valid	Implant dentistry	178	16.7	92.7
	Extraction of impacted teeth and nerve tracing	137	12.9	71.4
	Evaluation of tumors or cysts	153	14.4	79.7
	Orthodontic assessment	46	4.3	24.0
	Orthognathic surgeries	112	10.5	58.3
	Facial fractures	119	11.2	62.0
	Endo treatment	111	10.4	57.8
	Sinus pathologies	74	7.0	38.5
	TMJ pathologies	82	7.7	42.7
	Caries diagnosis	7	0.7	3.6
	Periodontal diseases	24	2.3	12.5
	All the above	16	1.5	8.3
	Other	4	0.4	2.1
	No need	1	0.1	0.5
	Total	1,064	100.0	554.2

**TABLE 8.** To what extent do you think cone beam computed tomography would be used in routine dental practice in the near future?

		Number	Percent	Valid percent	Cumulative percent
Valid	In all areas of dentistry	101	52.6	52.6	52.6
	For selected dental applications	54	28.1	28.1	80.7
	It would not be commonly used in routine practice	33	17.2	17.2	97.9
	No idea	4	2.1	2.1	100.0
	Total	192	100.0	100.0	

Table 7 illustrates responses to the question on cases, in which CBCT was used. More than half of the respondents (52.6%) believed that CBCT would be used in all areas of dentistry in the near future (Table 8). In the question regarding the stage of education, at which lectures about CBCT should be included, 56.3% of the participants declared clinical phase, and both pre-clinical and doctoral phase scored 43.2% and 3.1% answers, re-

spectively; there was no answer for ‘There is no need’ (Table 9). Seventy-six percent felt satisfied with the use of CBCT at their workplace (Table 10). Among questions related to CBCT basic knowledge (if this technique offers enhanced diagnosis at lower dose than CT), more than 80% indicated the right answer, which meant absolutely correct. When the participants were asked about principal difference between CBCT and CT, 55.2% of them

**TABLE 9.** Which year of dental education should include lectures on cone beam computed tomography?

		Response		Percent of cases
		Number	Percent	
Valid	Pre-clinical phase	83	42.1	43.2
	Clinical phase	108	54.8	56.3
	Doctoral phase	6	3.0	3.1
	Total	197	100.0	102.6

**TABLE 10.** Are you satisfied with the use of cone beam computed tomography?

		Number	Percent	Valid percent	Cumulative percent
		Valid	Yes	146	76.0
	No	11	5.7	5.7	81.8
	No idea	35	18.2	18.2	100.0
	Total	192	100.0	100.0	

**TABLE 11.** Responses of participants about CBCT basic knowledge

		Frequency	Percent	Valid percent	Cumulative percent
<b>Q10: Does cone beam computed tomography offers enhanced diagnosis at lower dose than computed tomography?</b>					
Valid	Wrong answer	37	19.3	19.3	19.3
	Right answer	155	80.7	80.7	100.0
<b>Q11: What do you think is the principal difference between cone beam computed tomography and computed tomography?</b>					
Valid	Wrong answer	86	44.8	44.8	44.8
	Right answer	106	55.2	55.2	100.0
<b>Q12: Are the radiation dose and risk from CBCT generally higher than the conventional dental radiography (IOPA, panoramic), but lower than the conventional CT scans?</b>					
Valid	Wrong answer	39	20.3	20.3	20.3
	Right answer	153	79.7	79.7	100.0
<b>Q13: Can CBCT be considered a replacement for standard digital radiographs (panoramic, periapical)?</b>					
Valid	Wrong answer	79	41.1	41.1	41.1
	Right answer	113	58.9	58.9	100.0
<b>Q14: Does CBCT contains more detailed information on maxillofacial region than other 2D images?</b>					
Valid	Wrong answer	11	5.7	5.7	5.7
	Right answer	181	94.3	94.3	100.0
<b>Q15: Is CBCT considered useful in evaluation of hard tissue pathology?</b>					
Valid	Wrong answer	13	6.8	6.8	6.8
	Right answer	179	93.2	93.2	100.0
<b>Q16: Is CBCT considered useful in evaluation of soft tissue pathology?</b>					
Valid	Wrong answer	64	33.3	33.3	33.3
	Right answer	128	66.7	66.7	100.0
<b>Q17: Can CBCT be ordered before taking history and clinical examination?</b>					
Valid	Wrong answer	13	6.8	6.8	6.8
	Right answer	179	93.2	93.2	100.0
	Total	192	100.0	100.0	

correctly answered that CT shows more radiation compared with CBCT. When questioned about “The radiation dose and risk from CBCT is generally higher than the conventional dental radiography (IOPA, intra-oral peri-apical radiograph, panoramic) but lower than conventional CT scans”, which was true, around 80% correctly answered the question. Moreover, 58.9% of the participants correctly answered the question that CBCT cannot be considered a replacement for standard digital radiographs (panoramic, periapical), which was true. As much as 94.3% of the participants answered that CBCT contains more detailed information of maxillo-facial region than other 2D images, which was also true. Only 6.8% of the respondents gave the wrong answer

for the fact that CBCT is considered useful in evaluation of hard tissue pathology. Around two-third of the participants confirmed the fact that CBCT is not useful in evaluating soft tissue pathology. Also, as few as 6.8% of the participants did not know that CBCT cannot be ordered before taking history and clinical examination (Table 11).

When comparing between Jordanian and Polish interns’ basic knowledge about CBCT, out of eight questions, Polish interns answered six questions with higher scores, out of which four showed statistically significant difference. Jordanian interns presented higher scores in two questions, where only one question displayed statistically significant difference (Table 12).

**TABLE 12.** Comparison of responses between Jordanian and Polish interns about CBCT basic knowledge

Nationality		Frequency	Percent	Valid percent	Cumulative percent	p-value
Q10: Does cone beam computed tomography offers enhanced diagnosis at lower dose than computed tomography?						
Jordanian	Wrong answer	18	20.2	20.2	20.2	0.755
	Right answer	71	79.8	79.8	100.0	
	Total	89	100.0	100.0		
Polish	Wrong answer	19	18.4	18.4	18.4	
	Right answer	84	81.6	81.6	100.0	
	Total	103	100.0	100.0		
Q11: What do you think is the principal difference between cone beam computed tomography and computed tomography?						
Jordanian	Wrong answer	47	52.8	52.8	52.8	0.038**
	Right answer	42	47.2	47.2	100.0	
	Total	89	100.0	100.0		
Polish	Wrong answer	39	37.9	37.9	37.9	
	Right answer	64	62.1	62.1	100.0	
	Total	103	100.0	100.0		
Q12: Are the radiation dose and risk from CBCT generally higher than the conventional dental radiography (IOPA, panoramic), but lower than conventional CT scans?						
Jordanian	Wrong answer	25	28.1	28.1	28.1	0.013**
	Right answer	64	71.9	71.9	100.0	
	Total	89	100.0	100.0		
Polish	Wrong answer	14	13.6	13.6	13.6	
	Right answer	89	86.4	86.4	100.0	
	Total	103	100.0	100.0		
Q13: Can CBCT be considered a replacement for standard digital radiographs (panoramic, periapical)?						
Jordanian	Wrong answer	26	29.2	29.2	29.2	0.001**
	Right answer	63	70.8	70.8	100.0	
	Total	89	100.0	100.0		
Polish	Wrong answer	53	51.5	51.5	51.5	
	Right answer	50	48.5	48.5	100.0	
	Total	103	100.0	100.0		

**TABLE 12.** Cont.

Nationality		Frequency	Percent	Valid percent	Cumulative percent	p-value
Q14: Does CBCT contains more detailed information on maxillofacial region than other 2D images?						
Jordanian	Wrong answer	7	7.9	7.9	7.9	0.236
	Right answer	82	92.1	92.1	100.0	
	Total	89	100.0	100.0		
Polish	Wrong answer	4	3.9	3.9	3.9	
	Right answer	99	96.1	96.1	100.0	
	Total	103	100.0	100.0		
Q15: Is CBCT considered useful in evaluation of hard tissue pathology?						
Jordanian	Wrong answer	10	11.2	11.2	11.2	0.022**
	Right answer	79	88.8	88.8	100.0	
	Total	89	100.0	100.0		
Polish	Wrong answer	3	2.9	2.9	2.9	
	Right answer	100	97.1	97.1	100.0	
	Total	103	100.0	100.0		
Q16: Is CBCT considered useful in evaluation of soft tissue pathology?						
Jordanian	Wrong answer	37	41.6	41.6	41.6	0.024**
	Right answer	52	58.4	58.4	100.0	
	Total	89	100.0	100.0		
Polish	Wrong answer	27	26.2	26.2	26.2	
	Right answer	76	73.8	73.8	100.0	
	Total	103	100.0	100.0		
Q17: Can CBCT be ordered before taking history and clinical examination?						
Jordanian	Wrong answer	3	3.4	3.4	3.4	0.081
	Right answer	86	96.6	96.6	100.0	
	Total	89	100.0	100.0		
Polish	Wrong answer	10	9.7	9.7	9.7	
	Right answer	93	90.3	90.3	100.0	
	Total	103	100.0	100.0		

\*\*Statistically significant at  $p < 0.05$

## DISCUSSION

The results of the study showed that most dental interns (range, 55.2-94.3%) correctly answered the questions related to CBCT knowledge, which reflects good level of knowledge among Jordanian and Polish dental interns and is in line with few studies conducted in India, Turkey, Iran, and Middle East [6-9]. In other previous studies [3-5, 10-15], the level of knowledge among dentists, interns, and specialists was inadequate and varying depending on several factors, such as age, years of experience, and specialty. Although all participants were non-specialist, they were young graduates, which can explain the good level of knowledge among them. Moreover, since CBCT technology was adopted 10 years ago in Jordan and Poland, it helped the participants to

be introduced early to this method and to learn about CBCT technology during their undergraduate studies.

Third of our participants did not attend any workshop related to CBCT, which was expected, since they reported that lectures were the main source of knowledge on CBCT. Reading was the second source of learning about CBCT, which means that the participants preferred the non-paid way of learning. At the same time, more than third of them were willing to attend workshops related to CBCT, and this reflects their positive attitude towards CBCT.

The main advantages of CBCT over conventional CT scan include low radiation dose and short scanning time [16]; the participants were aware about these benefits, and around half of them referred patients having that in mind. Similarly, around half of them were also aware about the cost of single CBCT scan, which is around 100

US dollars. This can be considered expensive for some participants and patients [14, 17]; therefore, around one third of the participants have not referred their patients for CBCT scan due to high cost of the procedure.

In agreement with Aditya and Kamburoğlu *et al.* [4, 6], participants referred patients mainly for implant planning, since implants are considered one of the most successful choice for replacing missing teeth [18]. Around two-third of them were satisfied with the use of CBCT, and referred different cases for CBCT. Again, this showed the positive attitude and high motivation towards CBCT technology, as shown in previous studies [5, 7, 11, 13]. Half of them thought that CBCT would be used routinely in all areas of dentistry, and one quarter believed that CBCT can be used in selected dental applications. This reflect why most of the respondents believed that CBCT education must be included in undergraduate studies, with slight tendency towards clinical education.

The last eight questions in the questionnaire were used to assess and compare basic CBCT knowledge among Jordanian and Polish interns. As mentioned earlier, the majority of dental interns (range, 55.2-94.3%) correctly answered the questions related to CBCT knowledge. According to clinical guidelines for using CBCT [19], CBCT is associated with higher dose in comparison with dental radiographs and lower dose in comparison with CT. CBCT contains more data than other 2D images, but cannot be used to replace them routinely. As other diagnostic tools, CBCT must be obtained after taking history and clinical examination, bearing in mind that its' usefulness is confined to hard tissue pathology. Polish dental interns presented higher scores in 6 out of 8 questions. This can be attributed to the average teaching hours dedicated for teaching CBCT in dental schools. In Jordan, the average teaching hours is 2 compared with 4 hours dedicated for teaching CBCT in Poland.

## CONCLUSIONS

In conclusion, both Jordanian and Polish dental interns present a good level of knowledge and positive attitudes towards CBCT. To enhance knowledge and attitudes among dental interns, dental faculties should provide more courses related to CBCT.

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## CONFLICT OF INTEREST

The authors declare no conflict of interest.

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## APPENDIX 1

### Questionnaire: Knowledge and attitudes of Jordanian and Polish dental interns towards cone beam CT

Name of the intern: .....

Phone number: .....

Age: .....

Gender:

Male

Female

Years of professional experience:

1-4 months

5-8 months

More than 9 months

1. How did you get to know about cone beam computed tomography?

A: Reading

B: Conferences

C: Lectures

D: Workshop

E: General practice (GP)

F: Family and friends

G: No idea

2. Did you attend any workshops on cone beam computed tomography?

A: Yes

B: No

C: No, but I will attend if I have a chance

3. Which of the following is an indication for referring patients for CBCT (multiple answers accepted):

A: Lower radiation dose

B: Shorter scanning time

C: Less expensive

D: Occupies less space

E: Easier to maintain

F: Image processing is easier due to limited beam

G: No idea

4. Have you ever referred/told your patients for/about cone beam computed tomography imaging?

A: Yes

B: No

C: No idea

5. What do you think is the cost of cone beam computed tomography for one image?

A: 10-50 JD

B: 50-100 JD

C: 100-200 JD

D: No idea

6. In which cases would you choose to use cone beam computed tomography (multiple answers accepted)?

A: Implant dentistry

B: Extraction of impacted teeth and nerve tracing

C: Evaluation of tumors or cysts

D: Orthodontic assessment

E: Orthognathic surgeries

F: Facial fractures

G: Endodontic treatment (vertical root fracture, locating additional canal)

H: Sinus pathologies

I: TMJ pathologies

J: Caries diagnosis

K: Periodontal diseases

L: All the above

M: Other

N: No need

7. To what extent do you think cone beam computed tomography would be used in routine dental practice in near future?

A: In all areas of dentistry

B: For selected dental applications

C: It would not be commonly used in routine practice

D: No idea

8. Which year of dental education should include lectures on cone beam computed tomography?

A: Pre-clinical phase

B: Clinical phase

C: Doctoral phase

D: There is no need

9. Are you satisfied with the use of cone beam computed tomography?

A: Yes

B: No

C: No idea

10. Does cone beam computed tomography offers enhanced diagnosis at lower dose than computed tomography?

A: Yes

B: No

C: No idea

11. What do you think is the principal difference between cone beam computed tomography and computed tomography?

A. Computed tomography is more accurate than cone beam computed tomography

B. Cone beam computed tomography is more accurate than computed tomography

C. Computed tomography has more radiation than cone beam computed tomography

D. No idea



12. Are the radiation dose and risk from cone beam computed tomography generally higher than the conventional dental radiography (IOPA, panoramic), but lower than conventional CT scans?

- A: Yes
- B: No
- C: No idea

13. Can CBCT be considered a replacement for standard digital radiographs (panoramic, periapical)?

- A: Yes
- B: No

14. Does CBCT contains more detailed information on maxillofacial region than other 2D images?

- A. Yes
- B. No

15. Is CBCT considered useful in evaluation of hard tissue pathology?

- A: Yes
- B: No

16. Is CBCT considered useful in evaluation of soft tissue pathology?

- A: Yes
- B: No

17. Can CBCT be ordered before taking history and clinical examination?

- A: Yes
- B: No