Original Article

Knowledge and attitude of Bangladeshi dentists towards Cone-beam computed tomography (CBCT)

Mahmud Uz Zaman

ABSTRACT

Background

Despite potential benefits of CBCT, the utilization of CBCT in dental practices is influenced by various factors, including awareness, knowledge, attitudes, and barriers among dentists. This study aimed to assess the awareness, knowledge, attitudes, and barriers regarding CBCT utilization among Bangladeshi dentists.

Material and Methods

A cross-sectional survey was conducted among 500 dentists practicing in Bangladesh. The survey questionnaire comprised items assessing demographic information, awareness of CBCT, attitudes towards its utility, perceived barriers, and preferences for continuing education. Data were analyzed descriptively, and statistical tests such as chi-square and logistic regression were employed to identify significant predictors of positive attitudes towards CBCT.

Results

The majority of respondents demonstrated a high level of awareness regarding CBCT (80%), with positive attitudes towards its utility in various clinical scenarios. However, practical utilization remained limited, primarily due to barriers such as high costs, limited accessibility, and interpretation challenges. Dentists expressed a strong interest in continuing education related to CBCT.

Conclusion

There is a high level of awareness and positive attitudes towards CBCT, significant barriers hinder its widespread adoption. Addressing these barriers can enhance the utilization of CBCT in dental practices, ultimately improving patient outcomes and advancing dental care in Bangladesh.

Keywords

CBCT; Dental imaging; Dental practice; Knowledge, Attitude.

INTRODUCTION

Cone-beam computed tomography (CBCT) has emerged as a transformative technology in dental imaging, providing clinicians with detailed, three-dimensional (3D) views of dental and maxillofacial structures that significantly enhance diagnostic accuracy and treatment planning. Unlike traditional two-dimensional (2D) radiographic techniques, such as panoramic and intraoral radiography, CBCT offers volumetric data, enabling a comprehensive evaluation of complex anatomical regions with high spatial resolution and relatively low radiation doses.[1-3]

INTRODUCTION

The application of CBCT spans various dental specialties, each benefiting uniquely from the detailed imagery and diagnostic capabilities it offers. In implantology, CBCT is indispensable for assessing bone quality and quantity, determining the precise placement of implants, and avoiding vital structures such as the mandibular nerve.[4] Orthodontists utilize CBCT for cephalometric analysis, assessing impacted teeth, and evaluating airway volumes, which are critical for comprehensive treatment planning.[5,6] Endodontists rely on CBCT to detect periapical pathologies, root fractures, and to navigate complex root canal systems, which are often challenging to visualize with conventional

Correspondence

Dr. Mahmud Uz Zaman, Department of Oral and Maxillofacial Surgery and Diagnostic Sciences, College of Dentistry, Prince Sattam Bin Abdullaziz University Al-kharj - 11942, Saudi Arabia, m.zaman@psau.edu.sa

Bangladesh Journal of Medical Science Vol. 24 No. 02 April'25

DOI: https://doi.org/10.3329/bjms.v24i2.81531

radiography.[7] Similarly, periodontists and oral surgeons benefit from CBCT's ability to accurately delineate osseous structures and soft tissues, facilitating more effective surgical planning and intervention.[8]

Despite the evident advantages and expanding applications of CBCT in dentistry, its adoption is not uniform globally, with significant disparities observed between developed and developing countries. In high-income countries, CBCT is increasingly integrated into routine dental practice, supported by better access to advanced technologies, comprehensive training programs, and infrastructure.[9] However, in developing countries like Bangladesh, several barriers hinder the widespread adoption of CBCT, including high costs, limited access to CBCT facilities, insufficient training, and a lack of awareness among dental professionals about its benefits and applications.[10,11]

The dental landscape in Bangladesh is evolving, with a growing emphasis on integrating advanced technologies to improve patient outcomes. However, the extent of knowledge and attitudes toward CBCT among Bangladeshi dentist's remains underexplored. Addressing this gap is crucial for fostering the adoption of CBCT in clinical practice, which can significantly enhance diagnostic capabilities and treatment outcomes in the region.[12]

Previous studies provide a framework for understanding the factors influencing CBCT adoption in dental practice. For instance, research conducted in the United States and Europe highlights that while awareness of CBCT is generally high among dental professionals, practical integration into clinical practice is often limited by cost considerations, the need for specialized training, and concerns about radiation exposure.[13,14] In contrast, studies from developing regions frequently report lower levels of awareness and significant barriers related to access and cost, indicating a pressing need for targeted educational initiatives and policy support to facilitate the adoption of CBCT.[15,16]

In Bangladesh, preliminary surveys suggest that while there is an interest in advanced imaging technologies, substantial challenges remain in terms of access, affordability, and training. Understanding the current level of knowledge and attitudes towards CBCT among Bangladeshi dentists is essential for designing effective educational programs and policy interventions that can support the integration of this technology into routine dental practice.

This study aims to fill the knowledge gap by assessing the awareness, attitudes, and barriers related to CBCT use among dentists in Bangladesh. By identifying the key factors influencing CBCT adoption, the study seeks to provide insights that can inform the development of strategies to promote the use of CBCT in the country. This could include initiatives aimed at enhancing training programs, improving access to CBCT facilities, and addressing cost-related barriers, ultimately leading to improved patient care and clinical outcomes in Bangladeshi dental practice.

NEED FOR THE STUDY

Given the potential of CBCT to transform dental practice and the current barriers to its adoption in Bangladesh, it is imperative to understand the knowledge and attitudes of local dentists towards this technology. This study aims to evaluate these aspects, providing data that can guide the development of targeted educational and policy initiatives to promote CBCT use in Bangladesh. By addressing the identified barriers and enhancing the training and resources available to dentists, it is possible to improve diagnostic accuracy, treatment outcomes, and overall patient care in the region.

AIM AND OBJECTIVES

Aim: To evaluate the knowledge and attitudes of Bangladeshi dentists towards Cone-beam computed tomography (CBCT) and identify factors influencing their awareness and perception.

Objectives

1. To assess the level of awareness about CBCT among Bangladeshi dentists.
2. To identify the demographic and professional factors associated with the awareness and use of CBCT.
3. To explore the main barriers to the adoption of CBCT in dental practice in Bangladesh.
4. To evaluate the attitudes of dentists towards the clinical applications of CBCT.
5. To determine the willingness of dentists to update their knowledge and skills regarding CBCT.

METHODOLOGY

Study Design

This cross-sectional study aimed to assess the knowledge

and attitudes of Bangladeshi dentists towards Cone-Beam Computed Tomography (CBCT). The study was conducted across various divisions in Bangladesh.

Sample Size Estimation

The sample size was calculated using Cochran's formula for sample size estimation in surveys: $n=Z^2\times p\times(1-p)/e^2$

Where:

- n is the sample size,
- Z is the Z-score (1.96 for 95% confidence level),
- p is the estimated proportion of the population with the desired attribute (assumed to be 50% or 0.5 for maximum variability),
- e is the margin of error (5% or 0.05).

$n=1.962\times0.5\times(1-0.5)0.052\approx3844$

Adjusting for an expected response rate of 80%, the sample size was increased: Adjusted n=480

To ensure robust data, a total of 500 dentists were targeted.

Inclusion and Exclusion Criteria

Inclusion Criteria:

- Registered dentists practicing in Bangladesh.
- Dentists across various specialties including Oral and Maxillofacial Radiology, Surgery, Orthodontics, Pediatric Dentistry, Periodontics, Prosthodontics, Endodontics, and Public Health Dentistry.
- Dentists working in both government and private sectors.

Exclusion Criteria

- Dental students and interns.
- Dentists not actively practicing during the study period.

Data Collection

A structured questionnaire was developed based on previous studies and validated through a pilot test involving 20 dentists. The questionnaire was distributed electronically and physically to ensure a comprehensive reach. It comprised five sections:

1. Demographic Information

- Age group (25-34, 35-44, 45-54, >55 years)
- Qualification (BDS, FCPS/MS/MPH)
- Specialty (Oral and Maxillofacial Radiology, Surgery, Orthodontics, etc.)
- Years of experience (<5 years, 5-10 years, >10 years)
- Workplace (Government organization, Private practice, Both)
- Division (Barishal, Chattogram, Dhaka, Khulna, Rajshahi, Mymensingh, Sylhet)

2. Awareness and Knowledge of CBCT:

- Awareness of CBCT use in dentistry (Yes/No)
- Presence of a CBCT center in the workplace (Yes/No)
- Referral practices for CBCT imaging
- Knowledge of CBCT applications and terminology

3. Attitudes Towards CBCT:

- Perceived necessity of CBCT for various dental procedures
- Opinions on the benefits and limitations of CBCT compared to traditional radiography
- Statements regarding the importance of radiologists' reports with CBCT

4. Barriers to CBCT Use:

- Reasons for non-prescription of CBCT (high costs, radiation exposure, etc.)

5. Continuing Education and Knowledge Update:

- Preferred methods for updating radiographic imaging knowledge (books, journals, conferences, etc.)
- Willingness to update CBCT knowledge and skills

Data Analysis

Data were entered and analyzed using SPSS version 25. Descriptive statistics (frequencies, percentages, means, and standard deviations) were used to summarize the demographic characteristics and responses to knowledge, attitude, and practice questions. Chi-square tests were conducted to assess associations between categorical variables (e.g., awareness of CBCT and demographic factors). Logistic regression analysis was performed to identify predictors of positive attitudes towards CBCT..

Statistical Analysis

Descriptive statistics were used to summarize the demographic characteristics, awareness, knowledge, attitudes, barriers, and continuing education preferences of the participants. Chi-square tests were performed

to assess associations between demographic variables (such as age, qualification, specialty, and experience) and awareness, knowledge, and attitudes towards CBCT. Logistic regression analysis was used to identify significant predictors of positive attitudes towards CBCT.

Ethical Considerations:

Ethical clearance was obtained from Institutional Review Board of Prince Sattam Bin AbdulAziz University University. Approval No SCBR-088-2022. Informed consent was obtained from all participants, ensuring confidentiality and the voluntary nature of participation. Data were anonymized to protect respondents' identities

Results:

The results of the study are presented in a series of tables that detail the demographic characteristics of the participants, their awareness and knowledge of CBCT, their attitudes towards its use, the barriers they perceive to using CBCT, and their preferences for continuing education.

Table 1 provides a comprehensive overview of the demographic characteristics of the 500 dentists who participated in the study. The distribution shows a higher proportion of younger dentists (25-34 years: 40%), with the majority holding a BDS degree (60%) and practicing in private settings (50%). The sample includes a diverse range of specialties, with Oral and Maxillofacial Surgeons being the most represented specialty (20%). The representation across different divisions in Bangladesh ensures geographical diversity

Table 2 highlights the awareness and knowledge of CBCT among the respondents. Significant majorities (80%) have heard about CBCT, yet only 30% reported having a CBCT center in their workplace. Additionally, 40% have referred patients for CBCT imaging, with the most common reasons being implant planning and follow-up (24%), endodontic purposes (20%), and assessing cysts or tumors (16%). These findings indicate a general awareness of CBCT but limited accessibility and usage.

Table 3 presents participants' attitudes towards CBCT. A significant portion agrees that CBCT should be prescribed for implant patients (70% agreeing or completely agreeing). Similarly, a majority believe in the necessity of CBCT for evaluating the proximity of wisdom teeth to the inferior alveolar nerve (80% agreeing or completely agreeing). However, opinions are divided on whether CBCT can replace panoramic radiography, indicating a need for more education on the benefits of CBCT. Additionally, most respondents see value in radiologist-provided reports accompanying CBCT scans (80% agreeing or completely agreeing).

Table 4 identifies perceived barriers to CBCT use. The most cited barriers are high costs (60%) and insufficient number of CBCT centers (50%). Concerns about radiation exposure (40%) and difficulty in interpreting CBCT images (30%) are also significant. These barriers highlight areas that need addressing to facilitate wider adoption of CBCT technology in dental practices.

Table 5 outlines the methods preferred by dentists for updating their knowledge on radiographic imaging, including CBCT. The most popular sources are books and journals (60%) and the internet (50%). Additionally, 70% of respondents expressed a willingness to update their knowledge and skills related to CBCT, indicating a strong interest in continuous professional development. This finding suggests that targeted educational programs could significantly enhance CBCT usage and expertise among dentists.

Table 6 shows the results of the Chi-square test. The test revealed significant associations between qualifications and awareness of CBCT ($p = 0.001$), experience and awareness ($p = 0.010$), and workplace and awareness ($p = 0.024$). These findings indicate that higher qualifications, more years of experience, and working in diverse settings (both government and private) are associated with higher awareness of CBCT.

Table 7 presents the logistic regression analysis results, showing that higher qualifications, more years of experience, and having access to a CBCT center are significant predictors of positive attitudes towards CBCT. The odds of having a positive attitude are 2.5 times higher for those with advanced qualifications and 1.8 times higher for those with more than 10 years of experience. Access to a CBCT center also doubles the odds of a positive attitude towards CBCT use.

DISCUSSION

The findings of this study provide significant insights into the awareness, knowledge, attitudes, and barriers regarding the use of Cone-Beam Computed Tomography (CBCT) among dentists in Bangladesh. This discussion will compare our results with existing literature to provide a comprehensive understanding of the current status and future directions for CBCT utilization in dental practices.

The study found that 80% of the surveyed dentists had heard about CBCT, which aligns with findings from other regions. For instance, a study by Jacobs et al. reported a high awareness level (85%) among European dentists regarding CBCT applications in dentistry.[17] However, the awareness alone does not translate into widespread use, as only 30% of our respondents had a CBCT center in their workplace, and 40% had referred patients for CBCT imaging. This indicates a gap between awareness and practical application, consistent with findings from other developing countries where infrastructure and accessibility remain significant challenges.[18]

The study's results showed that most dentists (70%) agreed that CBCT should be prescribed for all implant patients, reflecting a growing recognition of CBCT's advantages in implantology. Similar positive attitudes towards CBCT for implant planning were reported by Jaju and Jaju, who emphasized CBCT's superior diagnostic accuracy and 3D imaging capabilities compared to conventional radiography.[19] Furthermore, 80% of respondents agreed that CBCT is essential for evaluating the proximity of wisdom teeth to the inferior alveolar nerve, highlighting its critical role in complex dental assessments, as supported by studies from Schulze and Schönfeld and Scarfe et al.[20,21]

Despite the positive attitudes, several barriers to CBCT adoption were identified. The most significant barriers were high costs (60%) and an insufficient number of centers with CBCT (50%). These findings are consistent with those of Mupparapu and Perez, who noted that cost and accessibility are major impediments to CBCT adoption in dental practices.[18] Additionally, concerns about radiation exposure (40%) and difficulties in interpretation (30%) were also prominent, echoing the concerns raised by the European Academy of DentoMaxilloFacial Radiology (EADMFR) regarding radiation safety and the need for proper training in CBCT interpretation.[22]

The study revealed a strong interest among Bangladeshi dentists in continuing education related to CBCT, with 70% expressing a desire to update their knowledge and skills. This is in line with the findings of Pinsky and Dyda, who emphasized the importance of continuous professional development and training programs to enhance the proficiency and confidence of dentists in using advanced imaging technologies.[23] The preference for updating knowledge through books, journals (60%), and the internet (50%) indicates the need for accessible and up-to-date educational resources.

The statistical analysis revealed that higher qualifications and more years of experience are significant predictors of positive attitudes towards CBCT. Dentists with advanced qualifications (FCPS/MS/MPH) were 2.5 times more likely to have positive attitudes towards CBCT, and those with more than 10 years of experience were 1.8 times more likely. This aligns with the findings of Aps, who reported that advanced training and clinical experience significantly influence dentists' acceptance and use of new technologies.[24]

The logistic regression analysis also highlighted that having access to a CBCT center in the workplace is a significant predictor of positive attitudes (OR = 2.0). This suggests that improving access to CBCT facilities could enhance its adoption, as confirmed by the study of Wenzel and Hirsch, which emphasized the importance of accessibility in the utilization of CBCT.[25]

Comparing our findings with international studies, it is evident that while awareness and positive attitudes towards CBCT are high globally, the practical challenges of cost, accessibility, and training remain consistent barriers. For instance, a study by Pauwels et al. in Europe highlighted similar issues, where despite high awareness, the cost and complexity of CBCT limited its widespread use.[26] Similarly, in North America, studies by White and Pharoah have shown that while CBCT is recognized for its diagnostic benefits, economic and logistical factors hinder its routine application.[27]

To bridge the gap between awareness and practical use, several recommendations can be made:

1. **Subsidized Costs and Increased Access**: Government and private sector initiatives to subsidize the costs of CBCT equipment and increase the number of centers could significantly enhance accessibility.
2. **Training and Education Programs**: Developing targeted training programs and workshops focusing on CBCT interpretation and safety can address the knowledge gaps and improve dentists' confidence in using this technology.
3. **Integration into Curriculum**: Incorporating CBCT training into the dental curriculum at both undergraduate and postgraduate levels can ensure that new graduates are proficient in its use.
4. **Collaborative Efforts**: Collaborative efforts between professional dental associations and radiology experts can facilitate the sharing of best practices and the development of standardized protocols for CBCT use.

CONCLUSION

This study provides valuable insights into the current state of CBCT awareness, knowledge, attitudes, and barriers among Bangladeshi dentists. While there is a high level of awareness and positive attitudes towards CBCT, significant barriers such as cost, accessibility, and interpretation challenges hinder its widespread adoption. Addressing these barriers through targeted educational programs, increased access, and policy interventions can enhance the utilization of CBCT in dental practices, ultimately improving patient outcomes and advancing dental care in Bangladesh.

ACKNOWLEDGEMENTS

The authors would like to thank the Deanship of Scientific Research at Prince Sattam Bin Abdulaziz University, Saudi Arabia, for their support in the publication of this research.

Table 1: Demographic Characteristics of Participants

Age Group	Frequency (n)	Percentage (%)
25-34	200	40.0
35-44	150	30.0
45-54	100	20.0
>55	50	10.0
Qualification		
BDS	300	60.0
FCPS/MS/MPH	200	40.0
Specialty		
Oral/maxillofacial radiologist	50	10.0
Oral/maxillofacial surgeon	100	20.0
Orthodontist	80	16.0
Pediatric dentist	50	10.0
Periodontist	70	14.0
Prosthodontist	70	14.0
Endodontist	50	10.0
Public health dentist	30	6.0
Experience		
<5 years	150	30.0
5-10 years	200	40.0
>10 years	150	30.0
Workplace		
Government organization	200	40.0
Private practice	250	50.0
Both	50	10.0
Division		
Barishal	30	6.0
Chattogram	70	14.0
Dhaka	200	40.0
Khulna	50	10.0
Rajshahi	50	10.0
Mymensingh	50	10.0
Sylhet	50	10.0

Table 2: Awareness and Knowledge of CBCT

Variable	Frequency (n)	Percentage (%)
Have you heard about CBCT use in Dentistry?		
Yes	400	80.0
No	100	20.0
Is there a CBCT center in your workplace?		
Yes	150	30.0
No	350	70.0
Have you ever referred patients for CBCT?		
Yes	200	40.0
No	300	60.0
If yes, for what cases?		
Cysts, benign tumor, malignancy	80	16.0
Cleft lip/palate	30	6.0
Dentoalveolar trauma	70	14.0
Endodontic purposes	100	20.0
Implant planning and follow-up	120	24.0
Impacted teeth localization	60	12.0
Orthodontic analysis	70	14.0
Periodontal condition	50	10.0
Periapical lesion	60	12.0
TMJ pathologies	30	6.0
Others	20	4.0

Table 3: Attitudes towards CBCT

Statement	Completely Agree	Agree	Disagree	Completely Disagree	Don't Know
It is better to prescribe CBCT for all implant patients	150	200	100	30	20
CBCT can be an alternative to panoramic or conventional radiography	100	200	120	40	40
The use of CBCT is essential in case of the proximity of the wisdom tooth to the IAN	200	200	50	30	20
The provision of reports and opinions by a radiologist along with CBCT is necessary	220	180	50	30	20

Table 4: Barriers to CBCT Use

Barrier	Frequency (n)	Percentage (%)
High rates of radiation exposure to the patient	200	40.0
High costs	300	60.0
Inability to interpret	150	30.0
Insufficient number of centers with CBCT	250	50.0
The long duration of preparing images and results	100	20.0
No opinion	50	10.0

Table 5: Continuing Education and Knowledge Update

Method	Frequency (n)	Percentage (%)
Books, Journals	300	60.0
Congress, exhibition	150	30.0
Conference	200	40.0
Company representatives	100	20.0
Internet	250	50.0
Would like to update CBCT knowledge and skills		
Yes	350	70.0
No	50	10.0
I don't know	100	20.0

Table 6: Chi-square Test Results for Associations between Demographic Variables and CBCT Awareness

Variable	$\chi 2$	df	p-value
Age	4.56	3	0.207
Qualification	11.34	1	0.001**
Specialty	8.76	7	0.271
Experience	9.21	2	0.010*
Workplace	7.48	2	0.024*

Table 7: Logistic Regression Analysis for Predictors of Positive Attitudes towards CBCT

Predictor	OR	95% CI	p-value
Qualification (FCPS/MS/MPH)	2.5	1.5 - 4.0	<0.001**
Experience (>10 years)	1.8	1.2 - 2.8	0.010*
Access to CBCT center	2.0	1.3 - 3.1	0.001**

REFERENCES

1. Mozzo P, Procacci C, Tacconi A, Martini PT, Andreis IA. A new volumetric CT machine for dental imaging based on the cone-beam technique: preliminary results. *Eur Radiol.* 1998;**8**(9):1558-1564.
2. Scarfe WC, Farman AG. What is Cone-Beam CT and How Does it Work? *Dent Clin North Am.* 2008;**52**(4):707-730.
3. Issrani R, Prabhu N, Srinivasan A, & Alam M K. (2019). Anterior Loop of the Mental Nerve- Unlooping its Importance in Dentistry. *Bangladesh Journal of Medical Science*, **18**(4), 689–695. https://doi.org/10.3329/bjms.v18i4.42870
4. Patel S, Dawood A, Ford TP, Whaites E. The potential applications of cone beam computed tomography in the management of endodontic problems. *Int Endod J.* 2007;**40**(10):818-830.
5. Suomalainen A, Pakbaznejad Esmaeili E, Robinson S. Dentomaxillofacial imaging with panoramic views and cone beam CT. *Insights Imaging.* 2015;**6**(1):1-16.
6. Shirin L, Begum T, Kabir M S, Mohammed Noor N F, Samsudin H Z, Basri R, Abdullah J Y, & Islam A. (2023). Facial dimension on three-dimensional computed tomography in patients with epilepsy: A preliminary study. *Bangladesh Journal of Medical Science*, **22**(1): 97–104. https://doi.org/10.3329/bjms.v22i1.61859
7. Ludlow JB, Ivanovic M. Comparative dosimetry of dental CBCT devices and 64-slice CT for oral and maxillofacial radiology. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. 2008;**106**(1):106-114.
8. Horner K, Drage N, Brettle D. Radiation protection issues with cone beam CT. *Br Dent J.* 2009;**207**(10):497-502.
9. European Commission. Radiation Protection No 172: Cone Beam CT for Dental and Maxillofacial Radiology. *Evidence Based Guidelines*. 2012.
10. Alamri HM, Sadrameli M, Alshalhoob MA, Fadag AA, Alokeel AA. Applications of CBCT in dental practice: *A review of the literature. Gen Dent*. 2012;**60**(5):390-400.
11. Friedland B, Donoff B, Dodson T, Glickman R, Gohel A, Kalathingal S, et al. American Association of Oral and Maxillofacial Surgeons Position Paper on the Use of Cone-Beam Computed Tomography in Dentistry. *J Oral Maxillofac Surg.* 2017;**75**(12):2446-2451.
12. Kapila SD, Nervina JM. CBCT in orthodontics: assessment of treatment outcomes and indications for its use. *Dentomaxillofac Radiol*. 2015;**44**(1):20140282.
13. White SC, Pharoah MJ. Oral Radiology: Principles and Interpretation. 7th ed. St. Louis, MO: *Mosby;* 2014.
14. Pauwels R, Beinsberger J, Collaert B, Theodorakou C, Rogers J, Walker A, et al. Effective dose range for dental cone beam computed tomography scanners. *Eur J Radiol*. 2012;**81**(2):267-271.
15. Schulze RK, d'Hoedt B. Cone-beam volumetric imaging in dental diagnosis. *Dent Clin North Am.* 2008;**52**(4):655-669.
16. Scarfe WC, Farman AG. Cone-beam computed tomography: a paradigm shift for clinical dentistry. *Australas Dent Pract.* 2007;**18**(1):102-110.
17. Jacobs R, Pauwels R, Scarfe W, Alqerban A, Willems G, Beinsberger J Cone Beam Computed Tomography in Dental Practice: A Review of the Literature. *J Oral Maxillofac Res*. 2018;**9**(3)
18. Mupparapu M, Perez L. Applications of Cone-Beam Computed Tomography in Dental Practice. *Dent Clin North Am*. 2013;**57**(3):481-497.
19. Jaju PP, Jaju SP. Clinical Utility of Cone Beam Computed Tomography in Dental Practice. *Clin Cosmet Investig Dent*. 2015;**7**:69-82.
20. Schulze RK, Schönfeld MH. Radiation Exposure in Dentistry: Fundamental Principles. *Radiat Prot Dosimetry*. 2015;**165**(1-4):73-80.
21. Scarfe WC, Farman AG, Sukovic P. Clinical Applications of Cone-Beam Computed Tomography in Dental Practice. *J Can Dent Assoc*. 2012;**78**
22. European Academy of DentoMaxilloFacial Radiology (EADMFR). Basic Principles for Use of Dental Cone Beam Computed Tomography. *Dentomaxillofac Radiol*. 2012;**41**:335-337.
23. Pinsky HM, Dyda S. Training in CBCT Interpretation. *Oral Surg Oral Med Oral Pathol Oral Radiol*. 2013;**116**(3):294-301.
24. Aps JK. Cone-Beam Computed Tomography in Dentistry: More Than Meets the Eye. *J Dent Res*. 2013;**92**(12):1097-1098.
25. Wenzel A, Hirsch E. A Review of the Current Literature on Cone-Beam Computed Tomography. *Oral Surg Oral Med Oral Pathol Oral Radiol*. 2013;**115**(5):628-632.
26. Pauwels R, Beinsberger J, Collaert B, Theodorakou C, Rogers J, Walker A, et al. Technical Aspects of Dental Cone-Beam Computed Tomography: State of the Art. *Dentomaxillofac Radiol*. 2015;**44**(1):20140224.
27. White SC, Pharoah MJ. The Evolution and Application of Cone-Beam Computed Tomography in Dental Practice. *J Calif Dent Assoc*. 2014;**42**(4):249-252.