A Survey of Cone-beam Computed Tomographic Use among Endodontic Practitioners in the United States

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Abstract

Introduction: Cone-beam computed tomographic (CBCT) imaging is an emerging technology for clinical endodontic practice. The aim of this study was to investigate the acceptance, accessibility, and usage of CBCT imaging among American Association of Endodontists members in the United States by means of an online survey. **Methods:** An invitation to participate in a web-based survey was sent to 3076 members of the American Association of Endodontists. The survey consisted of 8 questions on demographics, access to CBCT machines, field of view (FOV), frequency of use for particular applications, and reasons in case CBCT was not used. **Results:** A total of 1083 participants completed the survey, giving an overall completed response rate of 35.2%; 80.30% of the participants had access to a CBCT scan, of which 50.69% (n = 443) were on-site and 49.31% (n = 431) were off-site, and 19.30% of all respondents denied having access to CBCT imaging. Limited FOV was used by 55.26% participants, 22.37% used larger FOV formats, and the remaining 22.37% were not sure about the format. There was a significantly greater usage of CBCT technology in residency programs (n = 78/84 [92.86%]) compared with practitioners who had finished an endodontic specialty program (n = 796/999 [79.68%]) (χ^2 = 10.30, P = .02). Practitioners used CBCT imaging "frequent" or "always" for internal or external resorptions (47.28%), preoperatively for surgical retreatment or intentional replantation (45.34%), missing canals (25.39%), preoperatively for nonsurgical retreatments (24.91%), differential diagnosis (21.16%), identifying periradicular lesions (18.26%), calcified cases (13.54%), immature teeth (4.71%), and to assess healing (3.87%). There was a significant difference in on-site and off-site CBCT imaging use for any of these applications ($P < .001$). Prevalent reasons for not using CBCT technology were cost (53.79%) and lack of installation space (8.29%). General concerns were expressed about resolution limitations, radiation exposure, and cost to the patient. **Conclusions:** There is a widespread application of CBCT technology in endodontic practice; however, results from the survey also confirmed that the benefit versus risk ratio should always be in favor of the patient if CBCT scans are taken. *(J Endod 2017;■:1–6)*

Key Words

Cone-beam computed tomographic imaging, survey

Significance

CBCT imaging allows 3-dimensional imaging of maxillofacial tissues. It has been shown to provide added diagnostic information compared with 2-dimensional radiography. This survey documented the accessibility and usage of CBCT among endodontic practitioners in the United States.

Cone-beam computed tomographic (CBCT) imaging is a subform of medical computed tomographic (CT) scanning for the imaging of hard tissue structures. In contrast to the fan shape of conventional CT images, the x-rays of CBCT units are divergent in form of a cone, resulting in faster image processing and reduced radiation (1). CBCT scanning for maxillofacial imaging was introduced in 1998 (2). In dentistry, CBCT imaging has been applied in oral surgery, orthodontics, and endodontics. Limited field of view (FOV) options allow small volume scans with minimal distortion at high resolutions and radiation doses up to 15 times lower than conventional CT scans (3), increasing the ability to use CBCT imaging in private practice.

Endodontic applications include the identification of root and root canal anatomy (4); internal, external, cervical, and apical resorptions (5); localization and detection of missed canals (6), separated instruments, and other foreign body materials before retreatment; identification and extent of apical periodontitis (7); diagnosis of endodontic or nonodontogenic diseases as well as follow-up of previous endodontic treatments with unclear clinical signs or symptoms (8); trauma, including root and alveolar fractures (9, 10); and surgical treatment planning (11–13). Various studies documented the greater accuracy and specificity of CBCT imaging to detect endodontic radiographic findings compared with conventional periapical or panoramic radiographs (14–19).

Besides its reliability and application for diagnosis, decision making, and treatment planning, CBCT imaging is receiving increasing recognition as a possible tool to use during actual endodontic treatment. Üstün et al (20) verified great accuracy for length determination using preoperative CBCT scan measurements in cases with large periapical lesions, a situation in which apex locators may be less predictable

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because of periapical resorptive processes. Other studies suggested using CBCT imaging for "guided" endodontic treatment, allowing for more precise procedures with reduced loss of overall tooth structure (21, 22). Although most of these developments happened in the research environment, little is known about the actual implementation and the usage of CBCT imaging in private endodontic practice.

A number of investigations have looked into the acceptance and application of CBCT technology in different fields of dentistry, including its use in oral and maxillofacial surgery (23), orthodontics (24, 25), dental education (25–27), and dental hospital settings (28). These data were mostly collected in the form of surveys or questionnaires. No similar data exist for endodontics. The aim of this study was to investigate the acceptance, accessibility, and usage of CBCT imaging among

1. **Please select your age group:**
   ≤ 35 years
   36-35 years
   46-55 years
   ≥ 56 years
2. **Do you practice:**
   In a solo private practice
   In a group practice
   In a clinic setting (e.g. faculty practices)
   as an Endodontic resident
   I do not practice clinical dentistry actively (e.g. strictly research oriented)
3. **Years since graduating from an endodontic specialty program:**
   ≤ 5 years
   6-10 years
   11-20 years
   ≥ 21 years
4. **Do you have access to a CBCT for your clinical practice?**
   Yes, on-site in the office
   Yes, off-site
   No
5. **If the CBCT is off-site, is it?**
   At a different location within the same office group
   At an oral surgery office
   At an orthodontic office
   At a different endodontic office
   Other dental office
   Not applicable (e.g. CBCT is on-site)
6. **What is the field of view [FOV, volume size] of the CBCT that you are using?**
   Not sure
   Limited/Localized FOV (≤ 5 cm diameter)
   Single Arch FOV (>5-7 cm diameter)
   Inter Arch FOV (>5-7cm diameter)
   Maxillofacial FOV (>10-15 cm diameter)
7. **How often do you use CBCT imaging among the following (Select: Never; Rarely; Occasionally, Frequently; Always)?**
   Calcified cases
   Missing canals
   Immature teeth
   Internal or external resorptions
   Identifying periradicular lesions
   Differential diagnosis
   Preoperatively for non-surgical retreatments
   Preoperatively for surgical retreatments or intentional replantation
   Assess healing
8. **If you do not utilize CBCT technology, what reason best explains why CBCT imaging is not utilized in your practice?**
   Not applicable, I use CBCT technology
   Cost
   Lack of installation space
   I do not think this technology is a necessary benefit
   Other (Please Explain)

Figure 1. A survey of CBCT use among endodontic practitioners in the United States (detailed questionnaire).