Influence of Cone-beam Computed Tomography in Clinical Decision Making among Specialists

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Abstract

Introduction: Clinical information and diagnostic imaging are essential components of preoperative diagnosis. The aim of this study was to determine the influence of cone-beam computed tomographic (CBCT) imaging on clinical decision-making choices among different specialists (prosthodontists, endodontists, oral surgeons, and periodontists) in endodontic treatment planning. A secondary objective was to assess the self-reported level of difficulty in making a treatment choice before and after viewing a preoperative CBCT scan. **Methods:** In accordance with the endodontic case difficulty guidelines of the American Association of Endodontists, 30 endodontic cases with varying degrees of complexity were selected. Each case included clinical photographs, digital periapical radiographs, and a small-volume CBCT scan. In the first evaluation, examiners were given all the information of each case, except the CBCT scan. Examiners were asked to select one of the proposed treatment alternatives and assess the difficulty of making a decision. One month later, the examiners reviewed randomly the same 30 cases with the additional information from the CBCT data. **Results:** The CBCT scans only had a significant influence on the treatment plan when the endodontic case was classified as high difficulty ($P < .05$). The level of difficulty in choosing a treatment choice was significantly more difficult after viewing a preoperative CBCT scan ($P < .05$), with the exception of the endodontists ($P = .033$). After viewing the CBCT scan, the extraction option increased significantly ($P < .05$). **Conclusions:** CBCT imaging has a substantial impact on endodontic decision making among specialists, particularly in high difficulty cases. *(J Endod 2017;43:194–199)*

Key Words

Cone-beam computed tomographic imaging, decision making, dental specialist, treatment planning

Significance

To our knowledge, no previous study has investigated the value of CBCT scanning in treatment planning among dental specialists. Moreover, no attention has been given to endodontic case difficulty assessment and its subsequent difficulty in decision making.

Decision making is 1 of the most challenging aspects of health care delivery. The formulation of a decision to select a specific treatment option is often complex, and it may be based more on personal values and experience than on an objective analysis of treatment benefits, risks, cost, prognosis, and alternatives (1–5).

The decision of whether to retain or extract a tooth must be made using an evidence-based approach (6). The aim of primary, secondary, and apical microsurgery endodontic treatment is to retain teeth; however, this ultimately depends on the overall restorability of the tooth. Dental implants are an ideal replacement for missing or unrestorable teeth. The survival rate of endodontically treated teeth and single-tooth implants is very similar (7–11). Iqbal and Kim (12) concluded in their systematic review that there was no difference in the survival outcome between either of these treatment modalities. Therefore, the decision to perform endodontic or implant treatment should be based on factors other than treatment outcome (12).

Endodontic decision making relies heavily on radiographic interpretation; however, it is well established that there is wide interexaminer variation regarding the treatment of endodontic pathoses (13). At present, periapical (PA) radiographs are routinely used during endodontic treatment as well as afterward to assess treatment outcome (14, 15). However, PA imaging provides a 2-dimensional view of a 3-dimensional structure (16–18). Cone-beam computed tomographic (CBCT) imaging creates 3-dimensional images of the area of interest, allowing the visualization of an individual tooth or the dentition in relation to the surrounding skeletal tissues (19, 20). Unlike conventional radiographic methods, CBCT imaging allows the assessment of an individual tooth or teeth in any view, rather than in predetermined "default" views (21). Thus, CBCT scanning can be used to improve diagnosis and treatment planning and to objectively assess the outcome of endodontic treatment.

Ee et al (22) concluded that a treatment plan might be directly influenced by information gained from a CBCT scan. In their study, the examiners (3 board-certified endodontists) changed their treatment plan after viewing the CBCT scan in 62% of the cases. However, the value of CBCT scanning in treatment planning has not been investigated among other dental specialists nor has the endodontic case difficulty assessment and its subsequent difficulty in making decisions been taken into account.

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The aim of the present study was to determine the influence of CBCT imaging on clinical decision-making choices of different specialists (prosthodontists, endodontists, oral surgeons, and periodontists) when presented with patient scenarios with varying degrees of endodontic complexity. A second objective was to assess the self-reported level of difficulty in making a treatment choice in each different patient scenario before and after viewing a preoperative CBCT scan.

Material and Methods

Study Participants

To obtain the most representative population, we selected different male and female dental specialists who varied in age and clinical experience. These examiners included 40 endodontists, 32 periodontists, 40 prosthodontists, and 28 oral surgeons who had studied a 2-year postgraduate program (as a minimum requirement) and had a private practice limited to their specialty.

Case Selection

Thirty cases were selected from the archives of the Department of Operative Dentistry and Endodontics, Universitat Internacional de Catalunya, Barcelona, Spain. These cases represented a wide range of nonendodontically and endodontically treated teeth (eg, PA radiolucency, underfilling, overfilling, fractured instrument, post, need for coronal restoration, and so on). In accordance with the endodontic case difficulty assessment form of the American Association of Endodontists (23), 10 cases of minimum difficulty (Fig. 1), 10 of moderate difficulty (Fig. 2), and 10 of high difficulty (Fig. 3) were selected. The cases were selected by 2 of the authors (F.A. and G.R.); between them, they had over 30 years of experience in teaching endodontics at both the undergraduate and postgraduate levels.

Each case included at least 2 clinical photographs, 2 parallax digital PA radiographs, and a bitewing (in the case of posterior teeth) radiograph taken with Carestream RVG 6100 (Carestream Health, Rochester, NY) and a small-volume CBCT scan taken with Planmeca 3Ds (Planmeca Oy, Helsinki, Finland). CBCT operating parameters were set at 8.0 mA and 84 kV, and the scanning time was 12 seconds. The smallest possible field of view was used (5 × 8 cm). Each case was shown on a Keynote (Apple, Cupertino, CA) presentation slide. The cases were accompanied by their respective clinical histories including the patient's age and sex; presenting symptoms; clinical signs; and, where relevant, the results of vitality testing. This information was intended to simulate the patient's first visit to a dentist. The relevant information was labeled on each radiograph and CBCT scan. All cases were anonymous.

Procedure

The examiners from each specialty were gathered in the same room and, in order to standardize the terminology used, briefed on the treatment alternatives proposed. Individual data relating to each specialist participant were recorded. The first evaluation presented all the information of each case, except for the CBCT scan. The 30 cases were presented randomly and successively over 1 hour, and the examiners' decisions were recorded.

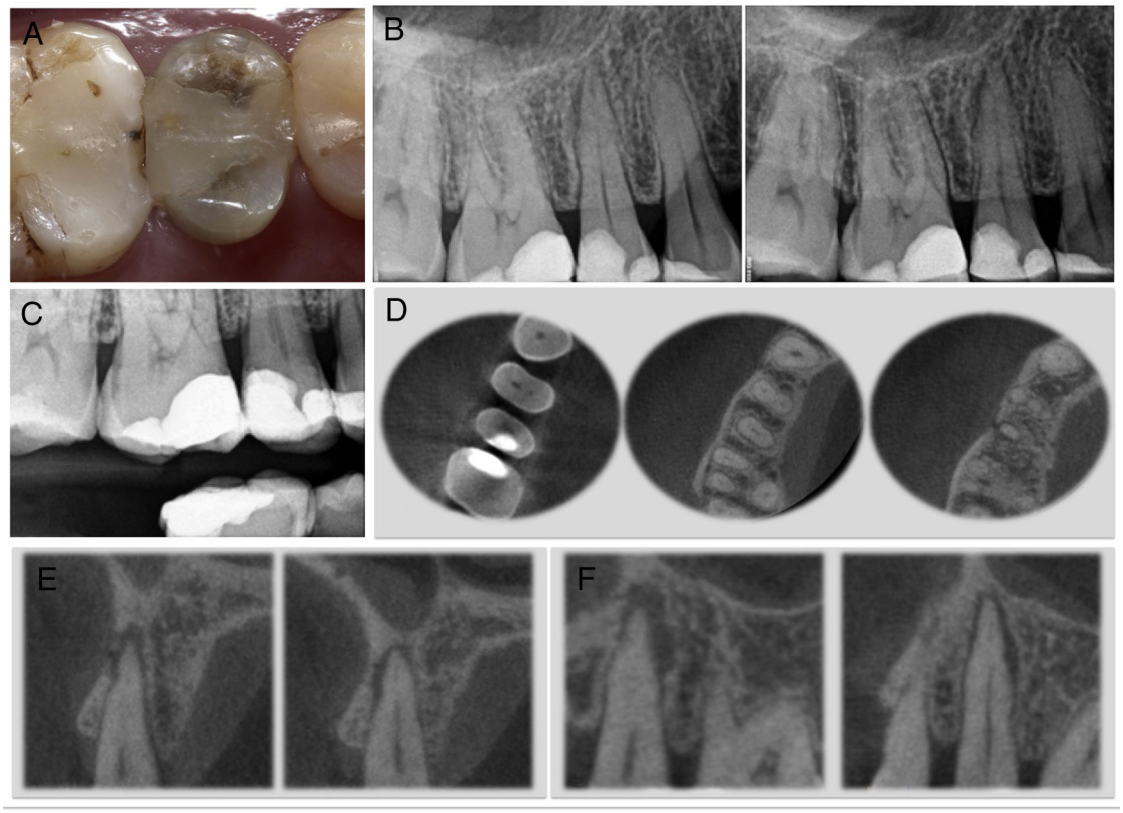

Figure 1. (*A*) A clinical image of the right maxillary second premolar (tooth #4). (*B*) Preoperative PA radiographs of tooth #4 with different horizontal angulations showing a small apical lesion. (*C*) A bitewing radiograph provided more precise and less distorted information about the condition of the pulp chamber and the distance to the alveolar bone crest. Note that the apical lesion can be clearly identified on the (*D*) axial, (*E*) coronal, and (*F*) sagittal slices obtained from CBCT images (ProMax 3Ds [Planmeca Oy, Helsinki, Finland]).