

A Retrospective, Radiographic Outcomes Assessment of 1960 Initial Posterior Root Canal Treatments Performed by Endodontists and Dentists

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Abstract

Introduction: The Air Force Dental Service has established evidence-based treatment standards for endodontics, including 3-dimensional filling of the canal system, cuspal coverage restoration of endodontically treated posterior teeth, and use of rubber dam. The purpose of this retrospective study was to determine the effect of these standards on outcomes of initial posterior root canal treatments (RCTs) completed by Air Force (AF) and civilian dentists with and without accredited postgraduate training. **Methods:** Treatment and follow-up radiographs of AF members who had an initial posterior RCT completed in 2011 were evaluated. A survey of all radiographs was performed to determine the (1) RCT obturation quality, (2) healing of periapical pathosis, and (3) presence and quality of cuspal coverage restorations. **Results:** A total of 2262 RCTs were examined, with 1960 RCTs meeting inclusion criteria for at least 1 evaluation category. For RCT obturation quality, 1810 RCTs were evaluated, and 96.0% were considered adequate. For cuspal coverage restorations, 1856 RCTs were evaluated, and of these 2.7% were inadequately restored. Healing of periapical pathosis was 91.5% and 85.7% for AF and referred civilian providers, respectively. Survivability was 94.4% for endodontists, 95.3% for AF general dentists with additional training, 87.9% for AF general dentists without additional training, and 78.4% for civilian general dentists. Overall, survivability was 94.1% for a follow-up period ranging up to 47 months, with a mean of 27 months. **Conclusions:** In this retrospective, radiographic analysis, evidence-based practices as followed in the Air Force Dental Service and accredited postgraduate training resulted in improved treatment outcomes. (*J Endod* 2017; ■:1–5)

Key Words

Cuspal coverage restoration, evidence-based treatment standards, root canal treatment, success failure, treatment outcomes

Endodontics is rich with research identifying factors that positively influence root canal treatment (RCT) outcomes. Factors include apical preparation size (1), termination of obturation material in relation to the radiographic apex (2), cuspal coverage restorations (3–5), and use of a rubber dam (6). With this research, the Air Force (AF) Dental Service established evidence-based treatment standards for endodontics to ensure airmen receive high-quality, safe dental care (7). These standards are taught at the AF postgraduate endodontic residencies, the AF advanced education in general dentistry (AEGD) residencies, and AF bases worldwide through continuing education lectures. Adherence to these evidence-based standards is evaluated through the service's monthly peer-review program that reviews treatment notes and radiographs. These treatment standards are necessary for an airmen population, who commonly find themselves on short-notice deployments to remote locations where dental services may be nominal.

According to the 2006 American Dental Association Survey of Dental Services Rendered, more than 15 million initial RCTs are completed annually (8). General dentists complete nearly three quarters of these treatments, approximately 85% of anterior, 77% of bicuspid, and 64% of molar RCTs (8). Winward et al (9) evaluated nearly 3500 posterior endodontically treated teeth, of which more than 52% of treatments were judged poor largely because of an inadequate or irregular taper of obturation material, inadequate apical preparation size, voids in the obturation material, and obturation material considerably short of the radiographic apex. In addition, inadequate cuspal coverage restoration was associated with 97.5% of posterior endodontically treated teeth deemed hopeless and requiring extraction (9). This percentage is similar to Salehrabi and Rotstein (10), whose 8-year outcome assessment of more than 1.4 million endodontically treated teeth determined a lack of cuspal coverage restoration was found in 85% of the teeth that required extraction. There have been many additional studies exploring the correlation between adequate coronal restoration and endodontic treatment success. Ray and Trope (3) concluded restoration quality had a greater impact on treatment outcome than RCT quality. In a systematic review, Gillen et al (5) concluded both adequate

Significance

Evidence-based practices and accredited postgraduate training resulted in improved treatment outcomes.

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Clinical Research

endodontic treatment and adequate restoration increased positive treatment outcomes. Furthermore, the use of a rubber dam during endodontic treatment is linked to higher success rates because of elimination of bacterial (re)contamination of the root canal system from the oral cavity (6, 11, 12). However, it has been reported that only 60% of general dentists always use a rubber dam during RCTs (13).

Dental implants have gained considerable popularity as a treatment option for diseased teeth, which previously would have been treated with endodontic therapy. Iqbal and Kim (14) reported survivability rates greater than 95% for single-tooth implants, which is similar to the 97.1% survivability rate of endodontically treated teeth published by Salehrabi and Rotstein (10) following their large epidemiological study. It is important to clarify the success and survivability rates of endodontic therapies performed to evidence-based standards, including cuspal coverage restorations, to assist providers with negotiating the best long-term treatment option for teeth with pulpal disease.

The main purpose of this retrospective, radiographic analysis was to assess the outcome of initial posterior RCTs completed by AF and referred civilian providers through the Active Duty Dental Plan. Treatment outcomes were judged by RCT obturation quality, healing of periapical pathosis, and presence and quality of complete cuspal coverage restorations.

Materials and Methods

A list of AF members who had an initial bicuspid or molar RCT completed by an AF or referred civilian provider through the Active Duty Dental Plan between July 1, 2011, and October 15, 2011, was compiled. The providers were divided into AF endodontists (AEs),

civilian endodontists (CEs), AF general dentists, and civilian general dentists (CDs). AF general dentists were further divided based on their amount of additional training in an AEGD residency as follows: AF general dentists with no additional training (AD0s), AF general dentists with 1 year additional training (AD1s), and AF general dentists with 2 years additional training (AD2s). The primary investigator reviewed all pre- and postoperative radiographs, including bitewing, periapical, and panoramic radiographs, taken as part of the initial posterior RCT using MiPACS dental enterprise viewer software (LEAD Technologies Inc, Charlotte, NC). The dates of any postoperative radiographs were recorded to calculate the recall and survivability periods. The images were deidentified, exported into a Microsoft Office PowerPoint (Microsoft, Redmond, WA) presentation against a black background without image compression preserving resolution, and assigned an image number. Two board-certified endodontists evaluated all images for RCT obturation quality, healing of periapical pathosis, and presence and quality of complete cuspal coverage restoration.

The RCT obturation was considered adequate (OA) if radiographs showed obturation of all canals with a uniform taper, free of voids, and termination between 0 and 2 mm from the radiographic apex. The RCT was considered inadequate if radiographs showed obturation with an irregular taper, large voids, or termination beyond or greater than 2 mm from the radiographic apex. Obturation was also judged inadequate if radiographs showed inadequately repaired perforations or separated instruments that could not be bypassed (Fig. 1A).

Periapical pathosis was classified as either present or absent. Periapical pathosis was assessed with criteria using a periapical index



Figure 1. (A) Representative examples of teeth deemed to have (1 and 2) adequate and (3–5) inadequate RCT obturation. (B) RCT teeth with periapical pathosis (1) present and (2) absent at the 42-month recall and periapical pathosis (3) present and (4) healing at the 11-month recall. (C) (1 and 2) Adequate and (3–5) inadequate cuspal coverage restorations.

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