

# A Panoramic Survey of Air Force Basic Trainees: How Research Translates into Clinical Practice

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## Abstract

**Introduction:** The purposes of this study were to examine the following in young adults residing in the United States: (1) the prevalence of teeth with root canal therapy (RCT) and teeth in need of RCT, (2) how frequently treatment practices associated with success as cited in the literature are found in posterior teeth with RCT, and (3) which treatment practices are associated with periradicular pathology. **Methods:** Panoramic radiographs taken of all basic trainees entering the US Air Force in 2011 were evaluated in a 2-part review. A general survey of all radiographs was performed to determine the prevalence of teeth with and teeth in need of RCT. All panoramic radiographs that showed a posterior tooth with RCT were evaluated in detail to consider the presence and quality of cuspal coverage restorations, the quality of RCT, and the presence of periradicular pathology. **Results:** A total of 35,811 panoramic images were evaluated. Ten percent of basic trainees had existing RCT, whereas 5% showed a need for RCT. The total number of posterior teeth with RCT was 3,455. Nearly half of these teeth had either no cuspal coverage or an unacceptable cuspal coverage restoration. Almost one third of the existing RCT was considered inadequate based on best treatment practices. Approximately 25% of teeth with RCT had periradicular pathology present. A strong correlation was found between the quality of RCT and the absence of periradicular pathology. Of RCT teeth deemed hopeless, 97.5% had no cuspal coverage restoration present. **Conclusions:** Factors cited in the literature as being associated with success are lacking in the dental treatment of young adults residing in the United States. (*J Endod* 2014;40:1332–1337)

## Key Words

Cuspal coverage, prevalence, restoration, root canal, root canal treatment, standard of care, success failure, treatment outcomes

Dental research in all of its forms essentially tries to answer the question “what works?” Endodontic research, in particular, looks at “what works” in the treatment or prevention of apical periodontitis. Ideally, dental professionals should incorporate “what works” into practice. The challenge that researchers, teaching institutions, professional dental associations, and practitioners face is how to systematically identify and incorporate best treatment practices into patient care.

Years of endodontic research have found a variety of treatment practices that correlate with improved treatment outcomes. The following is a partial list of these treatment factors that when put into practice have been shown to improve endodontic outcomes: the level of instrumentation and obturation in relation to the apex (1, 2), canal taper (3), apical preparation size (4, 5), the use of a rubber dam (6, 7), the type of irrigants and medicaments used (8–12), the absence of procedural complications such as perforations or separated instruments (13, 14), how teeth are restored, and the quality of these restorations (15–20).

The Air Force is in the unique position of sending people all over the world, many times to places and in circumstances where access to dental care is limited. Under these circumstances, “what works,” takes on added importance. The Air Force Dental Corps is tasked with the responsibility of preventing, when possible, dental emergencies from interfering with an airman’s ability to do his or her duty. In an effort to prevent endodontic emergencies, the Air Force has developed evidence-based treatment standards that dictate best treatment practices for endodontic therapy, how endodontically treated teeth are restored, and how pathology is accounted for (21).

With the goal of preventing dental emergencies, the Air Force Dental Corps has a standardized method of identifying dental needs, providing needed dental treatment, and readdressing treatment not meeting minimum Air Force treatment standards. Looking at the dental condition of incoming trainees provides information about the existing dental needs and general state of dental care of young adults in the United States. Besides being used as a planning tool for the Air Force, this information can potentially be used by teaching institutions, dental associations, public health organizations, and dental practitioners to create a systematic approach to establish or improve standards of care for endodontically treated teeth.

The purposes of this study were to examine the following in young adults residing in the United States:

1. The prevalence of teeth with root canal therapy (RCT) and teeth in need of RCT
2. How frequently treatment practices associated with success as cited in the literature are found in posterior teeth with RCT
3. Which treatment practices are associated with periradicular pathology

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## Materials and Methods

Upon entering the Air Force, all basic trainees (BMTs) undergo a dental screening. Digital panoramic radiographs are made as part of the initial in-processing and are stored on a secure server (Lackland Air Force Base Digital Dental Radiology Server). The panoramic radiographs of BMTs entering the Air Force between January 1, 2011, and December 31, 2011, were evaluated in a 2-part review: a general survey of all panoramic radiographs and a detailed survey of those panoramic radiographs that showed a posterior tooth with RCT.

### General Survey

A general examination was performed of all panoramic radiographs by the principal investigator for the following information: the total number of teeth present (excluding third molars), the number and location of endodontically treated teeth, and the number and location of nonendodontically treated teeth with radiographic signs of periradicular pathosis. The collected data were compiled in an Excel spreadsheet.

### Detailed Survey

All panoramic images that showed RCT of posterior teeth (premolars and molars) were enhanced using MiPACS dental enterprise viewer software (LEAD Technologies Inc, Charlotte, NC). The images were de-identified and exported into a PowerPoint (Microsoft, Redmond, WA) presentation. Each image was put on a separate slide against a black background and assigned an image number. A detailed examination of the compiled images was done jointly by 2 board-certified endodontists. Each endodontically treated posterior tooth was evaluated for the following information.

### Endodontic Treatment

Endodontic treatment was considered adequate (AE) if the obturation showed a uniform taper with no voids and was terminated between 0–2 mm from the radiographic apex; all canals were treated, and no perforations were present (Fig. 1A). Endodontic treatment was considered inadequate (IE) if the obturation showed minimal or irregular taper or voids or if it terminated either beyond or shorter than 2 mm from the apex. Treatment was also considered IE if there was an empty post space, separated instrument, missed canal, or perforation (Fig. 1B).

### Cuspal Coverage Restoration

Cuspal coverage restorations were categorized as being adequate (ACC), inadequate (ICC), or none. ACC covered the occlusal surface and appeared to be sealed with no signs of caries or open margins (Fig. 2A); otherwise, it was considered inadequate (Fig. 2B). If the restoration did not cover the occlusal surface or was not present, it was categorized as none (Fig. 2C). The quality of the restorations in the “none” category was not evaluated, so this category included both sealed and unsealed restorations.

### Periradicular Status

The periradicular status of endodontically treated teeth was categorized as having no pathology present (NP) or pathology present. The periradicular status was considered to have no pathology if the periodontal ligament space was normal or only slightly widened (Fig. 2D); otherwise, it was considered to have pathology present (Fig. 2E).

## Air Force Treatment Standards

For the purposes of this study, a tooth was considered to not meet minimum Air Force standards if it was in a condition that could potentially result in a dental emergency within 12 months if not treated. This would include teeth with signs of pulpal or periapical pathology and posterior RCT teeth without a sealed cuspal coverage restoration. In practice, these teeth would require an endodontic evaluation but not necessarily treatment. Treatment would not be required, for instance, if RCT had been recently completed or if it could be established that a periapical lesion was in the process of healing.

If there was a difference of opinion between the 2 examiners as to how a certain treatment factor should be classified, the default was to give the treatment factor the benefit of the doubt and place it in the more adequate category. The results of the detailed panoramic survey were compiled in an Excel spreadsheet.

### Statistical Analysis

Differences between groups were examined statistically using the chi-square test. A *P* value <.01 was considered to indicate statistically significant differences.

## Results

### General Survey

A total of 35,811 panoramic images including 990,120 teeth were evaluated. A total of 10% (3,592) of BMTs including 4,944 teeth had existing RCT. A total of 5.3% (1,910) of BMTs including 2,789 teeth required RCT. Figure 3A and B show the distribution of teeth with and those that required RCT. A total of 9.5% (3,414) of BMTs needed treatment of some form (initial RCT, RCT revision, and/or cuspal coverage restoration) in order to meet minimum Air Force Treatment Standards.

### Detailed Survey

RCT of a posterior tooth was found in 7.2% (2,582) of BMTs, which included 3,455 teeth. AE was present in 68.9% (2,380) of cases. Table 1 shows the distribution of treatment factors associated with IE and the percent of teeth with NP associated with each of those factors. ACC was found in 51.5% (1,775) of posterior RCT teeth. When AE was combined with ACC, only 37% (1,277) had both treatment factors present. Figure 4A shows the distribution of combined treatment factors to include the quality of RCT and the presence/quality of cuspal coverage restorations.

### Pathology Associated with Treatment Factors

Overall, 75.5% (2,609) of posterior teeth with RCT had NP; 85.1% (2,025) of teeth with AE had NP, whereas 54.3% (584) of teeth with IE had NP. The difference was statistically significant (*P* < .0001). Teeth with ACC had NP 77.2% (1,374) of the time. Teeth with ICC and no cuspal coverage restoration had NP 68.5% (226) and 75.1% (1008) of the time, respectively. The only significant difference noted was between ACC and ICC (*P* < .0005). The distribution of combined treatment factors associated with no pathology is shown in Figure 4B. Within the groups of AE and IE, there was no significant difference between the presence/quality of cuspal coverage groups and the absence of pathology. When the presence/quality of cuspal coverage groups were compared between the AE and IE categories, a statistically significant difference in the absence of pathology was noted between all restoration groups in the AE category compared with all restoration groups in the IE category. Of posterior RCT teeth deemed hopeless and needing extraction, 97.5% had no cuspal coverage restoration present.

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