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UNIFORMED SERVICES UNIVERSITY OF THE HEALTH SCIENCES
POSTGRADUATE DENTAL COLLEGE
SOUTHERN REGION OFFICE
2787 WINFIELD SCOTT ROAD, SUITE 220
JBSA FORT SAM HOUSTON, TEXAS 78234-7510
https://www.usuhs.edu/pdc

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Name of Candidate: MAJ Alexandra Rihani
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THESIS/MANUSCRIPT APPROVED: DATE:

Manuel Peláez, DMD, MS
Periodontist [redacted] 10 June 2020

Manuel Pelaez, LTC, DC
DENTAC Research Director, FORT BRAGG
Committee Chairperson

DELGADO.STEVEN.PATRICK.1504231719 Digitally signed by DELGADO.STEVEN.PATRICK.1504231719 Date: 2020.06.10 10:28:19 -04'00' 10 June 2020

Steven Delgado, MAJ, DC
PROGRAM DIRECTOR, ENDODONTICS, FORT BRAGG
Committee Member

10 June 2020

Kimberly Lindsey, COL, DC
ASSISTANT DIRECTOR, ENDODONTICS, FORT BRAGG
Committee Member

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Alexandra Rihani, MAJ DC
Endodontic Residency Ft. Bragg
Uniformed Services University
Date: **10 JUNE 2020**

A Survey of Surgical Trends Among Military Endodontists

A. Rihani[1], S. Delgado[1], D. Kersten[1], T. Beltran[2]

[1]Fort Bragg Endodontic Residency Program, NC
[2]Womack Army Medical Center, Fort Bragg, NC

According to the results of a 2008 survey, 91.2% of American Association of Endodontists members were performing endodontic surgery [1]. In a military setting, factors such as cost of surgery or replacement of existing restorations do not play as important a role as in private sector endodontic settings and may influence decision making regarding frequency of endodontic surgery.

There are various reasons that non-surgical root canal therapy may not be successful. Some factors that are often mentioned in the endodontic literature include missed canals, improper isolation, complicated anatomy, persistent peri-radicular infections and iatrogenic complications [2]. If initial root canal therapy and subsequent non-surgical retreatment are unsuccessful, apical surgery is often an option to eradicate periapical disease. Patients and clinicians may also select apical surgery instead of non-surgical retreatment in order to preserve existing coronal restorations in certain situations.

Endodontic surgery outcomes have improved significantly over the past 30 years as a result of technological advancements. Modern endodontic microsurgical techniques include the use of the dental operating microscope, ultrasonic root end cavity preparation, and improved biocompatible root filling materials. Setzer et al. reported the overall success rate of endodontic microsurgery to be 94%, compared to 59% for traditional root-end surgery [3]. Various other studies have also demonstrated healing rates over 90% for microsurgical retreatment [4-6].

In 2000, the FDA approved the use of Cone Beam Computed Tomography (CBCT) for dental imaging. Clinicians use limited field of view CBCT imaging to aid in the treatment planning of endodontic surgery due to its ability to avoid superimposition of overlying anatomical structures [7]. The use of CBCT allows better visualization of important anatomical structures that may pose risks during surgery, such as the inferior alveolar nerve canal, mental foramen, and maxillary sinus. Clinicians also gain knowledge about factors that can affect surgical access, such as cortical wall thickness and proximity of roots to anatomic landmarks. Increasing CBCT utilization rates by endodontists may increase the predictability of peri-radicular surgery. In the 2015 AAE/AAOMR joint position statement, CBCT is recommended as the imaging modality of choice for endodontic pre-surgical treatment planning [8].

The purpose of this study is to determine the frequency, technology utilization and selected methods of performing apical surgery for U.S. Military endodontists. Additionally, this survey will also inquire about military endodontists' comfort levels with certain aspects of apical surgery and their levels of experience gained during residency and post-residency training.

Methods

A link to a web-based 17 question survey was emailed to Army, Navy and Air Force endodontists [See Box 1]. Data was collected during the months of September and November of 2019. The survey instrument included questions evaluating each provider's clinical experience as well as questions designed to assess current surgical trends among military endodontists. The survey was designed to require no more than 5 minutes to complete.

Descriptive statistics were used for frequency of responses. Chi-square test of independence was used for pairwise comparisons. In cases where one or more cells had a count of 5 or fewer, Fischer's exact test was substituted. Pooling of response categories was conducted for certain questions due to limited survey response rates. Significance was declared at $P < 0.05$ for all tests. All data was analyzed by using SPSS version 25.0 (SPSS, Chicago, IL).

Results

In total, 90 individuals completed the survey. The majority of respondents (n = 40; 44.44%) who completed the survey indicated that they were U.S. Army endodontists. The remainder was comprised of 26 Air Force dentists (28.89%) and 24 Navy dentists (26.67%). There were no differences noted between the experience levels of respondents based on service branch. Respondent characteristics are shown in Table 1.

A non-linear trend was observed between number of years of experience and responses to the question "My endodontic residency adequately prepared me to perform endodontic microsurgery"($P < 0.001$). **The majority of residents (n = 9, 56.3%) indicated that they neither agreed nor disagreed with the statement. Only 6 residents (37.5%) agreed with the statement. In contrast, 89.5% (n = 34) of individuals with less than 5 years of Endodontic experience and 67.6% (n = 23) of those with more than 5 years of experience indicated agreement with the statement.** (REMOVED from poster) Interestingly, 23.5% (n = 8) of individuals with greater than 5 years of experience in endodontics indicated strong disagreement with the statement. This dissatisfaction is double the rate indicated by endodontic residents (n=1; 6.3%) and those with less than 5 years of experience (n=2; 5.3%).

Respondents' perception of the amount of preparation they received during residency training was not impacted by the number of surgeries performed during residency, $P = 0.06$. Additionally, residency surgical training experience was similar among endodontists regardless of the number of years since completing residency, $P = 0.11$. Most respondents (n = 65; 73.9%) reported performing 15 or fewer surgeries during residency. Only 13.6% (n = 12) reported more than 25 surgeries during residency.

As expected, completion of additional post-residency continuing education increased with time post-residency, $P < 0.01$. **The percentage of respondents who completed additional training rose from 6.3% (n=1) among residents**, to 39.5% (n = 15) among those with less than 5 years of experience, to 67.6% (n = 23) of endodontists with more than 5 years of endodontic experience.

When examining the number of surgeries performed each year, nearly one-fifth of all respondents (n = 17; 19.3) indicated they had not performed apical surgeries during the past year. Of those who reported performing apical surgeries within the previous 12 months, 29.5% (n=26)

stated they performed between 1 and 5 such surgeries while 51.1% (n = 45) reported performing 6 or more surgeries. No difference in completed surgeries was found between individuals with less than 5 years' experience and those with greater than 5 years of experience, P = 0.10.

Following the question regarding number of apical surgeries, respondents were asked if they regularly utilized CBCT for surgeries. Among endodontic residents and individuals with less than 5 years' experience in endodontics, 100% (n = 9 and n= 36 respectively) of those who performed apical surgeries indicated they used CBCT. Of those endodontists with more than 5 years of experience, only 81.5% (n=22) reported regular use of CBCT, suggesting a relationship between respondent's experience and utilization of CBCT, P = 0.01.

Next respondents were asked "when orthograde retreatment is an option, how important is it for this to be performed prior to apical surgery". Nearly all respondents (n = 87; 98.8%) stated that it was "very important" or "somewhat important". Additionally, when considering locations to perform apical surgery, the majority (n = 75; 87.2%) of respondents indicated that they would perform apical surgery on mandibular posterior teeth. However, only 22.1% (n = 19) stated they would perform the surgery on palatal roots of maxillary molars. Respondent experience was not related to any of the preceding three questions, all P > 0.05)

Respondents were also asked to rate their perceived difficulty on various surgical steps (see Table 2). Difficulty rating were not found to vary with experience (all P > 0.05). On average, half of respondents (51.1%) found the steps somewhat difficult. The least challenging surgical step was filling the root end with 31 respondents (35.6%) indicating they had no difficulty with the step. Conversely, 26 respondents (29.9%) perceived root end preparation to be moderately or very difficult. The respondents were evenly split with regard to the material they use for root end filling. Half (n = 49; 55.7%) stated they used MTA, and the other half indicated using some other bioceramic.

Respondents were asked about the importance of static guide usage in apical surgery as well as the importance of placing bone grafting material after apical surgery. In both questions, endodontic experience was not a factor in individuals' responses (both P > 0.05). Most respondents (n = 52; 59.1%) indicated that it was somewhat or very important to use a static guide in apical surgery. The majority (n = 57; 64.8%) of respondents also indicated that placing bone grafting material after apical surgery was rarely or not at all important.

Finally, respondents were asked if they referred endodontic microsurgery or placed implants. 100% of respondents stated they did not place implants and only 3 individuals referred surgery.

Discussion

There are very few studies in the published literature with regard to surgical trends among endodontists. A study published in 2008 detailed some trends, indicating that 91.2% of American Association of Endodontist (AAE) members were performing root-end surgery [1]. The results of this survey indicate that approximately 82% of military endodontists have performed surgery as part of their practice in the last year. The disparity between rates of military endodontists who perform surgery compared to AAE members may be due to the number of military endodontist who may be serving as mentors in an educational setting

overseeing residents who are performing the majority of surgeries or serving in non-clinical roles. One shortcoming of this survey was that no questions delineating roles as clinical, non-clinical or educator were asked.

When analyzing the number of surgeries performed by military endodontists, 70% performed less than 20 surgeries yearly, while 18% did not perform surgeries at all. This is compared results of two other surveys indicating that surgery comprises 7.2% of their practice procedure volume [9] and on average, AAE members perform from 1 to 5 surgeries in an average month [1]. 30% of military endodontists reported the same number or surgeries performed in a single *year*. A factor that my contribute to the lower number of military endodontist performing surgery and the lower total number of surgeries performed in the military may be due to lack of prohibitive cost factors associated non-surgical retreatment as a first option prior to surgery.

Among military endodontists, a non-linear trend observed with respect to residency training satisfaction, possibly indicating shifting views over time. 23.5% of individuals with greater than 5 years of experience indicated strong disagreement that endodontic residency surgical training prepared them for practice. (ON POSTER WE CHANGED TO ¾ DID FEEL PREPARED) This is a rate double that of endodontic residents (6.3%) and those with less than 5 years of experience (n=2; 5.3%). The non-linear trend may result from greater experience and proficiency over time altering views of the individual's proficiency, or perhaps diminished memory or appreciation for the training combined with additional training from CE course diluting the perceived impact of residency. 44% of military endodontists have completed any additional post-residency surgical training, either didactic or hand-on. This is compared to 33.3% of AAE respondents who felt that their endodontic residency surgical training was inadequate, and 47.9% who completed additional post-residency surgical training [1].

When considering CBCT use, endodontic residents and individuals with less than 5 years' experience in endodontics, 100% (n = 9 and n= 36 respectively) of those who performed apical surgeries indicated they used CBCT. Endodontists with more than 5 years of experience, only 81.5% reported regular use of CBCT. This seems logical considering residency programs are likely to be equipped with on-site CBCT machines and those who recently trained are more likely to have had surgical training with CBCT. These results are similar to those found by Alzamzami et al in 2019, indicating that approximately 91.8% of endodontists use CBCT imaging in their practice, with 86% of endodontists having access to CBCT in their office [10]. Utilization of CBCT in surgical treatment planning is beneficial as it has been shown that CBCT increased endodontists' confidence to diagnose and plan treatment, when compared with periapical radiographs [11].

The last 2 questions of the survey are of interest to note. 100% of military endodontists stated that they do not place implants in their dental practice. This is not surprising as results of two surveys of AAE members showed few endodontists placing implants. A 2009 survey found that while 57% of respondents supported endodontists placing implants only 5.7% of respondents actually place implants as part of their practice [12]. These results were similar to other surveys that indicated 6.6% and 7.7% of AAE members were placing implants as part of their practice [1, 9]. Only 3/90 respondents indicated that they referred endodontic surgery outside their practice.

Conclusion

The results of this survey indicate that military endodontists are performing fewer surgeries than their civilian counterparts. Almost three quarter of respondents with more than 5 years of experience stated that their endodontic residency did adequately prepare them to perform endodontic surgery. When considering the difficulty of various surgical steps, most military endodontists viewed access, root end preparation and filling as moderately difficult. Most military endodontists have access to CBCT for use in treatment planning surgical cases and few respondents are referring cases outside their practice. None of the survey respondents stated that they place implants as part of their surgical training.

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BOX 1

1. What is your branch of service?

Army
Air Force
Navy

2. How long have you been in practice as an endodontist?

I am currently an endodontic resident
5 years or less
6-10 years
11-20 years
Greater than 20 years

3. To what extent do you agree with the following statement: "My endodontic residency adequately prepared me to perform endodontic microsurgery"?

Strongly Agree
Agree
Neither agree nor disagree
Disagree
Strongly Disagree

4. How many surgeries did you complete in residency?

1-15
16-25
Greater than 25

5. Have you completed additional post-residency training in endodontic microsurgery?

Yes: Hands-on CE course
Yes: Didactic CE course
No

6. How many apical surgeries did you perform in the last year?

1-5
6-20
21-40
Greater than 40
I did not perform apical surgery in the last year

7. During the apical surgeries you performed last year, did you utilize CBCT regularly?

Yes
No
I did not perform surgeries in the last year

8. When orthograde retreatment is an option, how important is it for this to be performed prior to apical surgery?

Very important
Somewhat important
Rarely important
Not important at all

9. Do you perform apical surgery on mandibular posterior teeth?

Yes
No

10. Do you perform apical surgery on palatal roots of maxillary molars?

Yes
No

11. How would you rate the level of difficulty of the following surgical step: Access/Visualization?

Not difficult
Somewhat difficult
Moderately difficult
Very Difficult

12. How would you rate the level of difficulty of the following surgical step: Root end preparation?

Not difficult
Somewhat difficult
Moderately difficult
Very difficult

13. How would you rate the level of difficulty of the following surgical step: Root end filling?

Not difficult
Somewhat difficult
Moderately difficult
Very difficult

14. When performing root end filling, what material do you use?

MTA
Bioceramics other than MTA
Other

15. Regardless of your personal frequency of use, how would you rate the importance of static guide (3-D printing) usage in apical surgery?

Very important
Somewhat important
Rarely important
Not important at all

16. Regardless of your personal frequency of use, how would you rate the importance of placing bone grafting material after performing apical surgery?

Very important
Somewhat important
Rarely important
Not important at all

17. Do you refer endodontic microsurgery?

Yes, to another endodontist within my practice location
Yes, to another endodontist outside my practice location
Yes, to an oral surgeon
No

18. Do you place implants as part of your endodontic practice?

Yes
No

Table 1. Respondent Characteristics, n (%)

Number of years experience	Total	Branch of Service			P
		Army	Air Force	Navy	
Currently in residency	14 (21.2)	10 (25.0)	4 (15.4)	2 (9.1)	0.49
Less than 5 years	27 (40.9)	14 (35.0)	13 (50.0)	11 (50.0)	
Greater than 5 years	25 (37.9)	16 (40.0)	9 (34.6)	9 (40.9)	

Table 2. Perceived Difficulty of Surgical Steps, n (%)

Surgical step	Difficulty Rating		
	Not Difficult	Somewhat Difficult	Moderately or Very Difficult
Access / visualization	10 (11.4)	51 (58.0)	27 (30.7)
Root end preparation [a]	21 (24.1)	40 (46.0)	26 (29.9)
Root end filling [a]	31 (35.6)	43 (49.4)	13 (14.9)
Total	62 (23.7)	134 (51.1)	66 (25.2)

[a] Number of responses do not sum to 88 due to non-response.

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