SVOA Dentistry

ISSN: 2753-9172

ScienceVolks Open Access

Research Article

Quantifying Radiographs in Endodontics: A Survey

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DOI: https://doi.org/10.58624/SVOADE.2024.05.0187

***Received:** July 24, 2024* ***Published:** August 23, 2024*

Abstract

Purpose: The aim of this study was to investigate the average quantity of radiographs obtained during non-surgical endodontic treatment and trends in endodontic radiography among U.S. members of the AAE.

Materials & Methods: A survey was sent via e-mail to 4,269 active U.S. members of the AAE. Data were collected over a period of approximately 4 months. The number of radiographs reported for non-surgical endodontic treatment was compared across fourteen variables using Kruskal Wallace tests. Chi Square tests of Independence were also used to evaluate trends in endodontic radiography based on three primary categorical variables of interest: years of experience, professional role (PR) and use of CBCT technology.

Results: 412 responses were collected (response rate ~10%). 98.3% of respondents were endodontists while the remaining 1.7% were endodontics residents. 96.1% of respondents reported the use digital radiography, 98.1% use CBCT, 87.1% of respondents reported always using an Electronic Apex Locator (EAL), and only 29.4% of respondents reported using any type of handheld x-ray system. 54.4% reported always taking intra-operative (IO) radiographs. Most respondents selected 6-7 and 8-12 radiographs to be excessive. Kruskal Wallace tests confirmed statistically significant differences between the quantity of radiographs acquired and the categorical variables (i.e., PR, years of experience, the quantity of radiographs respondents reported to be excessive, and the type of radiography used while in residency (conventional vs. digital). The average number of radiographs acquired during non-surgical endodontic treatment was 3 (anterior), 4 (premolar) and 4 (molar). Chi Squared Tests of Independence revealed significant trends in endodontic radiography based on respondents' PR, years of experience, and use of CBCT technology.

Conclusion: There were statistically significant differences in the average quantity of radiographs obtained during non-surgical endodontic treatment amongst respondents of varying PR and years of experience. The use of adjunct technology, type of radiography, and preferred positioning device did not significantly impact the number of radiographs completed. The average number of radiographs acquired during non-surgical endodontic treatment was higher for premolars and molars than anterior teeth.

***Keywords:** Radiographs, CBCT, Years of experience, Non-surgical endodontic treatment*

Introduction

The standard of practice for endodontics depends on the use of radiographic images for diagnosis, treatment, and determination of treatment success. It is generally accepted that a well-angulated radiograph permitting visualization at least 3-4mm beyond the apex, including all periapical pathology, is sufficient for pre-operative diagnosis (1). The same principle applies to recall radiographs used to determine treatment success, with the exception that additional angled radiographs are often required if a treatment is considered questionable or a failure.

Intra-operative radiographic images are intended to be single exposures and have been advocated to aid in treatment (2). The benefits of additional radiographs during endodontic procedures have been identified in the literature, including movement of superimposed structures, location of calcified canals, obturation evaluation, and assessment of intraoperative complications (7, 11). The current recommendations for adjunctive radiography during endodontic treatment are vague. (9, 10).

Radiographs provide essential information but can also present challenges for patients and clinicians. For instance, conventional radiographs used during endodontic treatment are merely a 2-D image of a 3-D object. Thus, they do not consistently replicate the root canal anatomy and important treatment landmarks such as the ideal length of endodontic treatment. As a result, radiographs can unfortunately be over-interpreted or under-interpreted (4, 5) and, therefore, may offer questionable clinical significance during endodontic procedures. Furthermore, obtaining clinically accurate and properly angulated "working" radiographs requires precise positioning and patient compliance, which can be challenging. The process of acquiring chairside radiographs may require multiple attempts, costing the provider time and efficiency. Taking "working" radiographs with the rubber dam in place can be challenging for the clinician and uncomfortable for patients. Finally, studies on patients' perceptions on dental radiographs show a general disdain for the radiation exposure caused by dental radiographs, especially amongst pregnant women (14). Though the amount of radiation dosage to oral and other tissues has been reported to be low and poses minimal risk when using digital radiography, it is still recommended to minimize the overall radiation exposure to patients (1, 2).

Since Sunada's introduction of the electronic apex locator in 1962, it has become possible to more accurately determine the optimal length of endodontic instrumentation and obturation without the need for intraoperative radiographs (12). The use of CBCT in endodontics allows for 3D visualization of the tooth and treatment planning prior to treatment (3, 6, 8). Therefore, the need for intra-operative radiographs has significantly decreased.

Radiographs are needed for endodontic diagnosis, treatment, and follow-up, but they can also be somewhat of a liability in terms of safety, efficiency, productivity, and patient comfort. To the best of our knowledge, no evidence exists that identifies the number of radiographs performed during non-surgical endodontic treatment amongst endodontic providers. Based on the review of the literature, the overall quantity and types of radiographs performed during endodontic treatment ultimately depends on the situation and discretion of the provider. The purpose of this survey was to investigate the average quantity of radiographs obtained during non-surgical endodontic therapy among U.S. members of the AAE. As a secondary objective, we evaluated the influence, if any, of years of experience, PR, and use of CBCT technology on trends in endodontic radiography.

The tested hypotheses were:

1. There is a negative correlation between the use of technology (CBCT imaging, EAL, portable x-ray unit, positioning device, and digital radiography) and the quantity of radiographs obtained during non-surgical endodontic treatment.
2. There is a negative correlation between years of experience and the total amount of radiographs obtained and considered excessive during non-surgical endodontic treatment.
3. There is a significant relationship between PR and the total quantity of radiographs acquired during non-surgical endodontic treatment.
4. There is a tendency to acquire fewer radiographs if trained with conventional radiography while in residency.

The null hypothesis tested was that there are no statistically significant relationships between the variables examined.

Methods & Materials

Survey Design and Distribution

The study design was approved by LSUHSC's institutional review board (#4558). A 10-question pilot survey was constructed that evaluated the quantity of radiographs performed during non-surgical endodontic treatment of anterior, premolar, and molar teeth as well as radiographic trends amongst endodontic providers. The pilot survey was reviewed by endodontic faculty for clarity and appropriateness.

Minor edits were made to the survey questions based on the feedback from the pilot study. Next, a LISTSERV of about 4000 U.S. Active members of the American Association of Endodontists (AAE) was obtained, and the questionnaire was e-mailed to all members. Later, ten responses from dental students and non-endodontics residents were discarded due to violation of the scope of the survey.

A weblink provided by Survey Monkey was sent to respondents via an institutional email address. Participants were bcc'd during the e-mail dissemination of the survey so that each participant's e-mail address was not visible to other participants. All survey responses were collected anonymously via Survey Monkey software without storing respondents' IP addresses during data collection to eliminate bias. The "Multiple Responses" option was turned off, which means respondents were only able to respond once to the survey using the same device. The survey included quantitative answers as well as multiple choice answers from which the respondents could choose one answer. The survey was sent out on 8/1/22 and closed on 12/6/22.

Participation in the survey was voluntary, and participants were able to opt out of the survey at any point if they decided not to complete the survey. However, it was mandatory to answer all proposed questions to submit the survey.

The original data was not shared with anyone other than the initial investigators, but once analyzed, may be subjected to publication. No form of payment or reward was offered to survey participants. An informed consent was presented at the beginning of the survey to inform participants about the nature of the research project before initiating the survey. Those who completed the survey and clicked "done" indicated their consent to participate.

Data Analysis

Data were exported as a comma-separated value (.csv) file and formatted to allow analysis by using R Statistical Software and Excel. The categorical variables of interest (Table 1) were summarized across demographic groups of interest using counts and percentages. Continuous variables (i.e., quantity of radiographs) were summarized reporting means and standard deviations. Unadjusted group comparisons of categorical covariates were made using Chi-square tests and Fisher exact tests when needed. Continuous covariates were compared across groups using Kruskal Wallace/ Wilcoxon rank sum tests. A level of $p<.05$ was considered significant.

Results

Demographics

412 responses were collected (response rate ~10%). Of these, 98.3% of respondents were endodontists while the remaining 1.7% were endodontics residents. 82.5% of respondents had ≤ 25 years of experience. The percentages of respondents who trained with digital and conventional radiography during residency were 83.7% and 16.3%, respectively. 96.1% of respondents reported the use of digital radiography, 98.1% use CBCT, and 0.5% use phosphor plates in current practice. Periapical and bitewing radiographs were acquired by 78.9% and 54.4% of respondents, respectively. 59.5% of respondents preferred the Rinn XCP positioning device for endodontic radiography. 87.1% of respondents reported always using an EAL and only 29.4% of respondents reported using any type of handheld x-ray system. 54.4% reported always taking IO radiographs during non-surgical endodontic treatment. The average number of radiographs acquired by respondents during non-surgical endodontic treatment was 3 (anterior), 4 (premolar) and 4 (molar). Most respondents selected 6-7 and 8-12 radiographs to be excessive. Successively greater quantities of radiographs were acquired for premolars and molars as compared to anterior teeth.

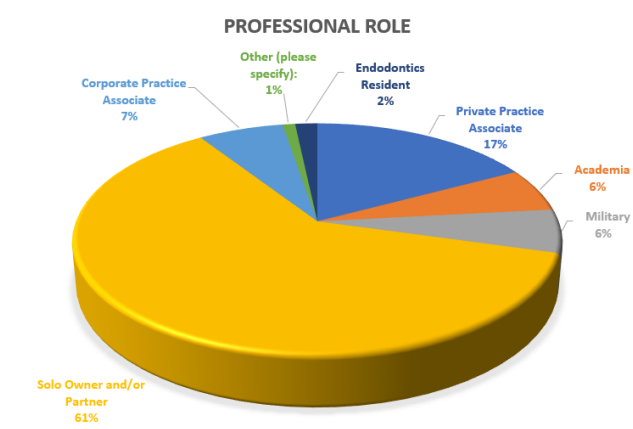

Figure 1A: *Percentages of responses per PR out of a total of 412 responses.*

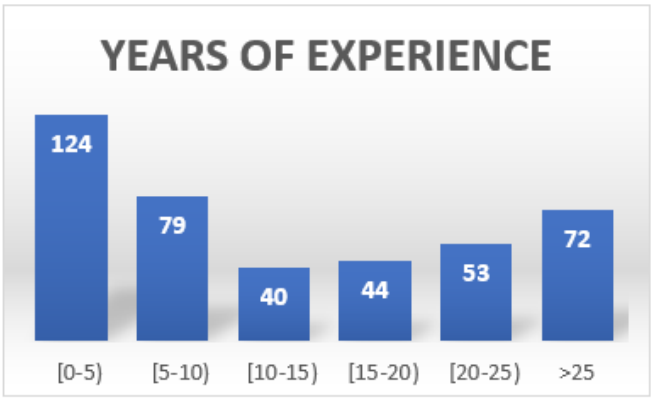

Figure 1B: *Number of responses per years of experience.*

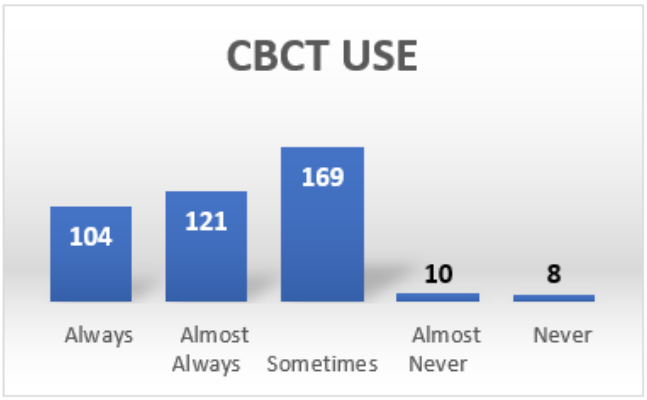

Figure 1C: *Number of responses per use of CBCT.*

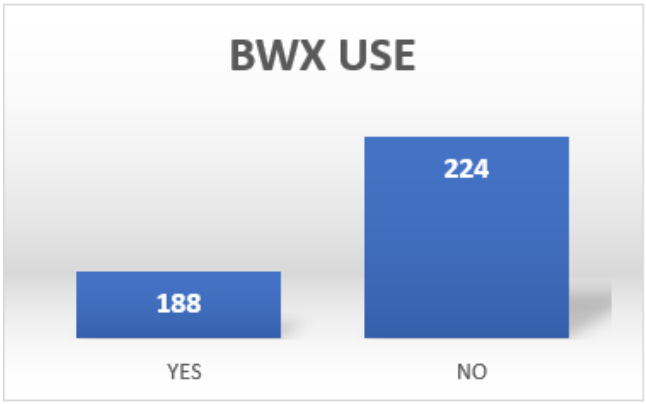

Figure 1D: *Number of responses per use of BWX.*

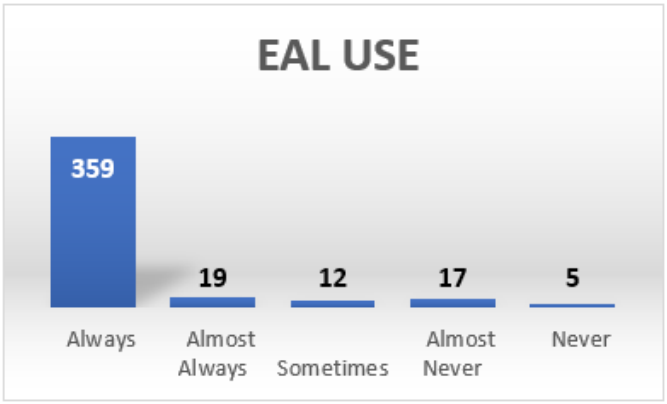

Figure 1E: *Number of responses per use of EAL.*

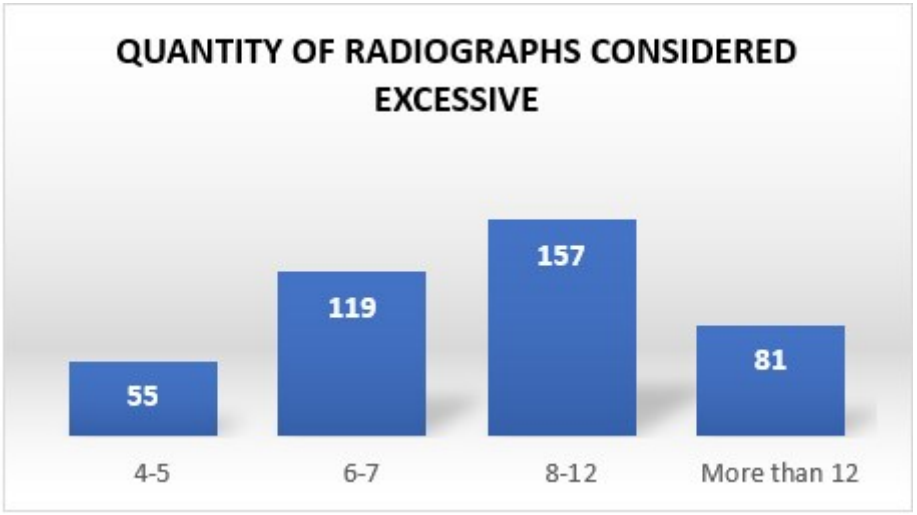

Figure 1F: *Number of responses per number of radiographs considered excessive.*

Differences in the Quantity of Radiographs Obtained

Results of the Kruskal Wallace tests for relationships between the quantity of radiographs obtained and categorical survey questions are depicted in Table 1. Kruskal Wallace tests confirmed statistically significant differences between the quantity of radiographs acquired for non-surgical endodontic treatment and the following variables listed with their degrees of certainty (p): PR (p<.001), use of IO radiographs (p<.001), years of experience (p<.05), the quantity of radiographs respondents reported to be excessive (p<.001), type of radiography used while in residency (p<.05), and use of bitewing (BWX) radiographs (p<.001).

The greatest quantity of radiographs was completed by endodontics residents followed by military endodontists and those in academia (p<.001). There was a positive correlation between the use of intraoperative radiographs and the total quantity of radiographs acquired during non-surgical endodontic treatment (p<.001). Respondents with ≥ 25 years of experience obtained the least number of radiographs during non-surgical endodontic treatment of molars (p<.05). Respondents who considered 8-12 radiographs to be excessive completed the most radiographs while those who deemed 4-5 radiographs to be excessive completed the least amount (p<.001). Procurement of a BWX radiograph was also positively correlated with a greater number of total radiographs obtained during non-surgical endodontic treatment (p<.001). Finally, the use of conventional radiography while in residency was associated with fewer radiographs obtained during non-surgical endodontic treatment of premolar and molar teeth (p<.05).

Table 1: Percentages of responses within each categorical variable group and the average (SD) anterior, premolar, and molar radiographs taken for each group. P-values are reported from Kruskal Wallace tests to determine if the number of radiographs taken differs for each categorical variable. A p-value of <.05 was considered significant.

Categorical Variable:	% of Respondents:	# Anterior Radiographs:	# Premolar Radiographs:	# Molar Radiographs:
Professional Role:		**p<.001**	**p<.001**	**p<.001**
Private Practice Associate	**17.23%**	**3.352** (0.719)	**3.958** (1.02)	**4.268** (1.133)
Academia	**6.07%**	**3.88** (1.092)	**4.48** (1.194)	**5** (1.658)
Military	**6.07%**	**4.24** (1.332)	**4.583** (1.139)	**5.125** (1.424)
Solo Owner and/or Partner	**61.41%**	**3.225** (1.088)	**3.584** (1.287)	**3.832** (1.496)
Corporate Practice Associate	**6.55%**	**3.185** (0.879)	**3.667** (1.177)	**3.889** (1.281)
Other (please specify):	**0.97%**	**3.75** (0.957)	**4.333** (1.211)	**4.5** (1.049)
Endodontics Resident	**1.70%**	**5** (2.449)	**6.286** (2.69)	**7.286** (2.215)
Intraoperative Radiograph Use:		**p<.001**	**p<.001**	**p<.001**
Always	**54.37%**	**3.647** (1.074)	**4.17** (1.273)	**4.549** (1.472)
About Half of the Time	**5.58%**	**3.043** (1.065)	**3.696** (1.396)	**3.957** (1.551)
Usually	**15.05%**	**3.677** (1.021)	**3.968** (1.159)	**4.339** (1.414)
Rarely	**23.54%**	**2.711** (1)	**3.021** (1.181)	**3.124** (1.301)
Never	**1.46%**	**2.5** (0.548)	**3** (1.265)	(1.265)
Type of Radiography Used in Residency:		**p=0.178**	**p=0.003**	**p<.001**
Digital Radiography	**83.74%**	**3.417** (1.139)	**3.904** (1.336)	**4.235** (1.557)
Conventional Film	**16.26%**	**3.194** (1.004)	**3.418** (1.208)	**3.567** (1.34)
Conventional Radiography Use:		**p=0.997**	**p=0.773**	**p=0.632**
Yes	**.49%**	**3.5** (2.121)	**3.5** (2.121)	**3.5** (2.121)
No	**99.51%**	**3.38** (1.117)	**3.827** (1.326)	**4.129** (1.542)
Digital Radiography Use:		**p=0.664**	**p=0.806**	**p=0.823**
Yes	**96.12%**	**3.369** (1.084)	**3.823** (1.308)	**4.124** (1.524)
No	**3.88%**	**3.688** (1.815)	**3.875** (1.784)	**4.188** (2.007)
Periapical Radiograph Use:		**p=0.106**	**p=0.083**	**p=0.073**
Yes	**78.89%**	**3.431** (1.146)	**3.889** (1.354)	**4.194** (1.556)
No	**21.12%**	**3.195** (0.998)	**3.586** (1.196)	**3.874** (1.469)
BWX Radiograph Use:		**p=0.002**	**p<.001**	**p<.001**
Yes	**45.63%**	**3.596** (1.252)	**4.218** (1.433)	**4.59** (1.673)
No	**54.36%**	**3.201** (0.961)	**3.496** (1.132)	**3.737** (1.304)
Phosphor Plate Use:		**p=.678**	**p=.57**	**p=.589**
Yes	**0.5%**	**6** (N/A)	**6** (N/A)	**6** (N/A)
Handheld X-Ray System Use:		**p=0.98**	**p=0.419**	**p=0.924**
Yes	**29.37%**	**3.347** (1.039)	**3.843 (1.232)**	**4.091** (1.489)
No	**70.63%**	**3.395** (1.153)	**3.818 (1.366)**	**4.141** (1.566)
CBCT Use:		**p=0.542**	**p=0.246**	**p=0.188**
Always	**25.24%**	**3.413** (1.103)	**3.769** (1.381)	**4.01** (1.561)
Almost Always	**29.37%**	**3.405** (1.061)	**3.893** (1.109)	**4.248** (1.331)
Sometimes	**41.0%**	**3.367** (1.193)	**3.84** (1.441)	**4.148** (1.682)
Almost Never	**2.43%**	**2.9** (0.568)	**3.1** (0.738)	**3.4** (0.843)
Never	**1.94%**	**3.5** (1.195)	**4.125** (1.642)	**4.25** (1.832)

"Table 1 (continued)"

Preferred Positioning Device:		**p=0.113**	**p=0.157**	**p=0.09**
Snap-A-Ray	**10.44%**	**3.465** (1.077)	**3.907** (1.324)	**4.116** (1.313)
Rinn XCP	**59.47%**	**3.31** (1.132)	**3.784** (1.336)	**4.086** (1.585)
Comfort Wand Universal	**4.37%**	**4** (1.138)	**4.389** (1.539)	**4.944** (1.662)
Dexis Platinum	**9.95%**	**3.195** (0.901)	**3.512** (1.207)	**3.829** (1.564)
None	**7.04%**	**3.621** (1.425)	**4.207** (1.567)	**4.517** (1.661)
Other	**8.74%**	**3.472** (0.941)	**3.778** (0.959)	**4.028** (1.183)
EAL Use:		**p=0.076**	**p=0.228**	**p=0.535**
Always	**87.14%**	**3.343** (1.135)	**3.794** (1.346)	**4.086** (1.541)
Sometimes	**2.91%**	**3.333** (1.073)	**3.5** (1.087)	**3.917** (1.311)
Almost Always	**4.61%**	**3.526** (0.905)	**4.316** (1.108)	**4.474** (1.307)
Almost Never	**4.13%**	**3.882** (1.054)	**4.059** (1.298)	**4.588** (1.97)
Never	**1.21%**	**4** (0.707)	**4.2** (1.095)	**4.6** (1.342)
# of Radiographs Considered Excessive:		**p<.001**	**p<.001**	**p<.001**
4-5	**13.35%**	**2.527** (0.813)	**2.636** (0.847)	**2.764** (0.981)
6-7	**28.88%**	**3** (0.792)	**3.269** (0.98)	**3.471** (1.148)
8-12	**38.11%**	**3.592** (0.933)	**4.121** (1.002)	**4.433** (1.082)
More than 12	**19.66%**	**4.111** (1.423)	**4.877** (1.568)	**5.42** (1.883)
Years of Experience:		**p=0.036**	**p=0.002**	**p=0.002**
0-5	**30.10%**	**3.548** (1.077)	**4.137** (1.284)	**4.476** (1.428)
5-10	**19.17%**	**3.127** (0.992)	**3.608** (1.265)	**3.861** (1.483)
10-15	**9.71%**	**3.65** (1.21)	**4.025** (1.291)	**4.425** (1.567)
15-20	**10.68%**	**3.432** (1.228)	**3.864** (1.44)	**4.068** (1.634)
20-25	**12.86%**	**3.321** (1.156)	**3.679** (1.425)	**3.943** (1.68)
>25	**17.48%**	**3.236** (1.132)	**3.5** (1.245)	**3.819** (1.523)

Pairwise Associations of Categorical Responses:

*Statistically significant relationships were found between **years of experience** and IO radiograph use (p=.014), number of radiographs considered excessive (p=.01), EAL use (p<.001), BWX use (p=.001), Handheld X-ray system use (p<.001), and type of radiography used while in residency (p<.001).*

65.3% of respondents with 0-5 years of experience always acquired intraoperative radiographs as well as 50% of those with ≥ 25 years of experience (p=.014). Respondents with ≥ 25 years of experience used PAs (p<.001), BWXs (p=.001) and NOMAD (p<.001) significantly less than those with less experience. 12.5% of respondents with ≥ 25 years of experience stated they never use an EAL compared to 2.4% of the remaining respondents (p<.001). Most respondents with ≥ 25 years of experience deemed 6-7 radiographs excessive compared to most other respondents who deemed 8-12 radiographs excessive (p=.01). Most respondents trained with digital radiography in residency. A majority of those who used conventional film in residency were from the ≥ 25 years of experience group (p<.001). Together, those in academia and solo owner/partners comprised the highest percentage of respondents who used conventional film in residency (20% and 20.9%, respectively) (p=.020).

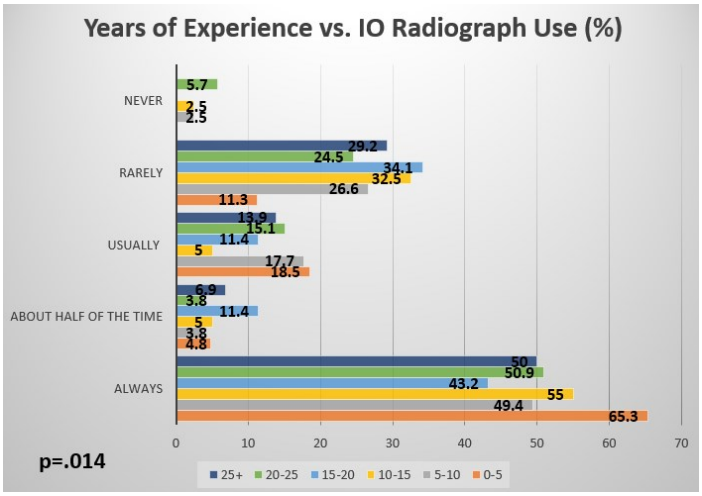

Figure 2A: *Comparison between years of experience and intra-operative (IO) radiograph use.*

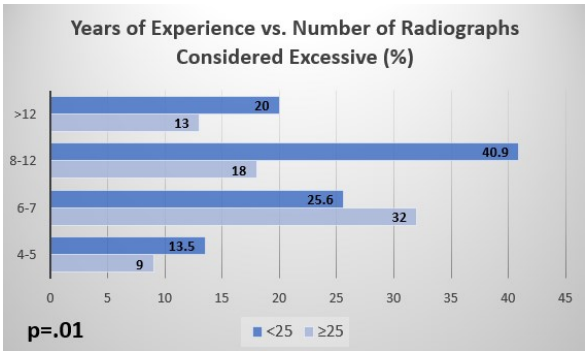

Figure 2B: *Comparison between years of experience and the number of radiographs considered excessive by respondents.*

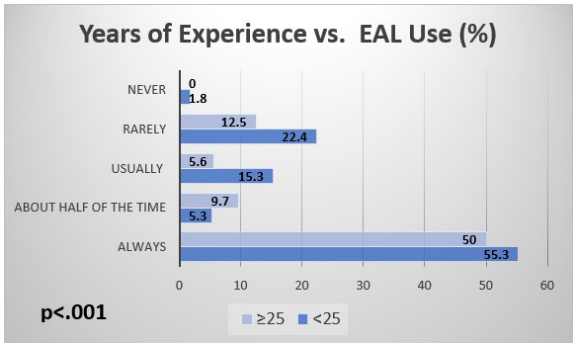

Figure 2C: *Comparison between years of experience and the frequency of an EAL use.*

Statistically significant relationships were found between ***use of CBCT*** *and years of experience (p=.002), EAL use (p=.007), Handheld X-ray System use (p=.002), and PR (p=.012).*

11.1% of those with ≥ 25 years of experience responded almost never to using CBCT compared to 2.9% of those with <25 years of experience (p=.001). An increased use of CBCT was positively correlated with an increased use of the NOMAD (p=0.002). The group which comprised the highest percentage (11.1%) of respondents who almost never use an EAL also comprised the highest percentage (5.6%) of respondents who almost never use CBCT (p=.007). 67.6% of private practice associates and 57.3% of practice owners/partners answered 'almost always' to using CBCT (p=.012).

Years of Experience	CBCT Use				
	Always	About Half of the Time	Usually	Rarely	Never
0-5	65.3	4.8	18.5	11.3	0
5-10	49.4	3.8	17.7	26.6	2.5
10-15	55	5	5	32.5	2.5
15-20	43.2	11.4	11.4	34.1	0
20-25	50.9	3.8	15.1	24.5	5.7
25+	50	6.9	13.9	29.2	0
p=.002					

Figure 3A: *Data comparing the frequency of CBCT use and years of experience represented as percentages of respondents.*

EAL Use	CBCT Use (%)				
	Always	Almost Always	Almost Never	Sometimes	Never
Almost Always	86.7	5.3	4	3.6	4
Sometimes	89.9	3.6	3.6	1.8	3.6
Almost Never	66.7	5.6	11.1	5.6	11.1
p=.007					

Figure 3C: *Data comparing the frequency of CBCT use and the endodontics role.*

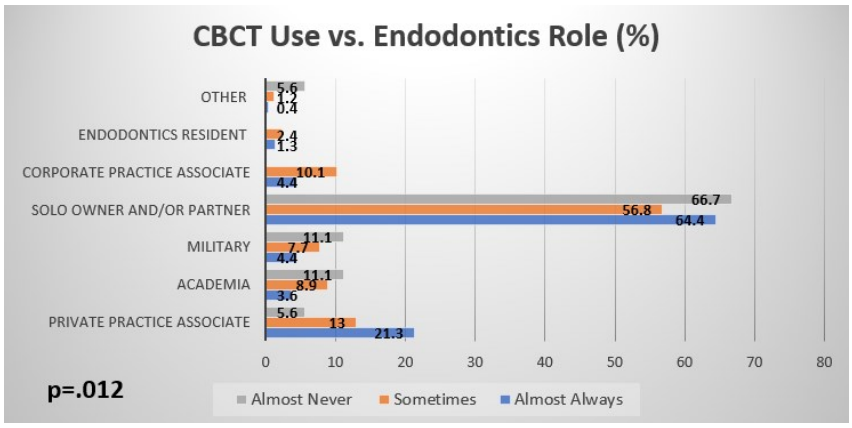

Figure 3C: *Data comparing the frequency of CBCT use and the endodontics role.*

Statistically significant relationships were found between ***PR*** *and use of IO radiographs (p=.004), number of radiographs considered excessive (p=.054), BWX use (p<.001), preferred positioning device (p<.001), and Handheld X-ray system use (p<.001).*

42.9% of endodontic residents considered more than 12 radiographs to be excessive compared to the remaining respondents (p=.054). The majority (62.8%) of private practice owners/partners did not implement BWX radiography during non-surgical endodontic treatment compared to the rest (p<.001). The Rinn XCP was the preferred positioning device reported by all respondents except for endodontics residents and corporate practice associates (p<.001). The 2.4% of respondents who stated they never acquire intra op radiographs were solo owners/partners (p=.004). Handheld X-ray system use was mostly reported by corporate (40.7%) and private practice (39.4%) associates (p<.001).

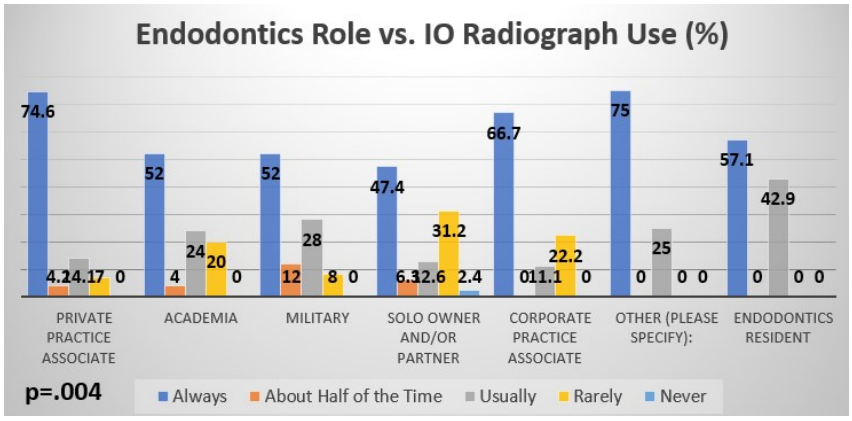

Figure 4A*: Chi-square data comparing the PR and the use of intra-operative radiographs.*

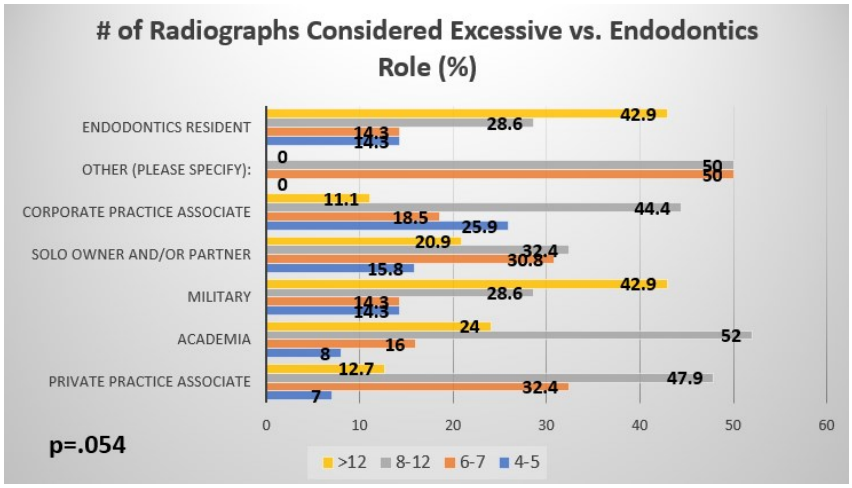

Figure 4B: *Chi-square data comparing the quantity of radiographs considered excessive and the endodontics role.*

*Statistically significant relationships were found between **PR** and use of IO radiographs (p=.004), number of radiographs considered excessive (p=.054), BWX use (p<.001), preferred positioning device (p<.001), and Handheld X-ray system use (p<.001).*

42.9% of endodontic residents considered more than 12 radiographs to be excessive compared to the remaining respondents (p=.054). The majority (62.8%) of private practice owners/partners did not implement BWX radiography during non-surgical endodontic treatment compared to the rest (p<.001). The Rinn XCP was preferred positioning device reported by all respondents except for endodontics residents and corporate practice associates (p<.001). The 2.4% of respondents who stated they never acquire intra op radiographs were solo owners/partners (p=.004). Handheld X-ray system use was mostly reported by corporate (40.7%) and private practice (39.4%) associates (p<.001).

Discussion

The aim of this survey was to determine the average quantity of radiographs performed during non-surgical endodontic treatment. A secondary objective was to investigate if radiographic practices were influenced by years of experience, PR, and use of CBCT. A software-based online survey was created and disseminated to a total of about 4000 endodontists and endodontics residents in the Unites States. The data is meant to serve as a report on current self-reported trends, and not justification nor evidence regarding the appropriateness of such practices.

Contrary to our hypothesis, a statistically significant relationship was not found between the quantity of radiographs obtained and the use of various forms of technology, preferred positioning device or type of radiography employed by providers. Interestingly, of the 1.5% of respondents who stated they never use IO PAs during non-surgical endodontic treatment, 66.7% stated they almost always use CBCT imaging. However, this relationship was not statistically significant. In a past survey, only 10% of respondents indicated that they tended to use an EAL (13), which was contrary to the 85% of respondents who stated they always use an EAL in our survey. The Rinn XCP was the most popular positioning device reported by respondents.

This study confirmed our hypothesis that there is a tendency toward fewer radiographs for non-surgical endodontic treatment with increasing years of experience.

In agreement with our third hypothesis, a significant relationship was found between PR and the total quantity of radiographs acquired during non-surgical endodontic treatment. Endodontics residents, academicians and military endodontists reported a higher quantity of radiographs for anterior, premolar, and molar non-surgical endodontic treatment compared to the remaining respondents.

Finally, trends amongst providers who used conventional film versus digital radiography while in residency were revealed through this survey. Our hypothesis that practitioners who employed conventional film rather than digital radiography reported a lower frequency of intra-operative radiographs was confirmed. This relationship was only statistically significant relative to molar teeth. The lengthy processing time and tedious requirement for accuracy imparted by conventional film compared to digital radiography may be responsible for this outcome.

We found a large discrepancy between the percentage of endodontists and endodontics residents who participated in the survey. One reason for this may be due to variabilities in individuals' AAE designations, which may have impacted their receiving the survey.

Knowledge of the information from this survey may help inform future research and/or policies regarding radiographic procedures during non-surgical endodontic treatment. Furthermore, the survey responses may urge endodontic residents and practicing clinicians alike to reassess the number of radiographs they perform during non-surgical endodontic procedures to increase productivity and patient satisfaction while decreasing overhead and radiation exposure during non-surgical endodontic treatment.

In the future, part two of this research may aim to address the impact, if any, of trends in endodontic radiography on treatment outcomes of non-surgical endodontic procedures.

Conclusion

The average quantity of radiographs obtained for non-surgical endodontic treatment of anterior, premolar and molar teeth varied based on the respondent's professional role, years of experience, use of IO radiographs, use of BWX radiographs, the quantity of radiographs deemed excessive by endodontic providers and the type of radiography (conventional vs. digital) used while in residency. The type of radiography currently used (conventional vs. digital), use of adjunct technology (CBCT, EAL, Handheld X-ray system), and preferred positioning device did not significantly impact the number of radiographs acquired during non-surgical endodontic treatment. Trends in endodontic radiography were also identified amongst respondents with varying professional roles, years of experience, and use of CBCT technology.

Acknowledgement

The authors deny any conflicts of interest.

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Citation: Bains PK, McMullen III AF, Kessler HD, Chapple AG. Quantifying Radiographs in Endodontics: A Survey. *SVOA Dentistry* 2024, 5:5, 164-173. doi:10.58624/SVOADE.2024.05.0187