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Comparison of treatment planning decisions when combining CBCT and digital radiography verses digital radiography alone

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A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Dentistry at Virginia Commonwealth University.

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Abstract

COMPARISON OF TREATMENT PLANNING DECISIONS WHEN COMBINING CBCT AND DIGITAL RADIOGRAPHY VERSES DIGITAL RADIOGRAPHY ALONE

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A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Dentistry at Virginia Commonwealth University.

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Cone beam computed tomography (CBCT) is the recommended imaging modality of choice for evaluating previous endodontic treatment (1). The aim of this study was to compare treatment planning decisions made when evaluating previous endodontic treatment to determine if treatment planned and projected prognosis differs when digital radiography is used alone or in combination with CBCT. A retrospective chart review was conducted. Patients for whom a CBCT was taken were included in the study. Twenty-eight patients qualified. Patient's periapical digital radiographs (Dexis©) were evaluated by 2 calibrated endodontists, a treatment plan was identified and a prognosis was projected. Later the same radiographs were viewed with CBCT scan. The CBCT provided significant information 75% of the time. CBCT provided the only information for an accurate diagnosis 17% of the time. Prognosis changed 38% of the time when CBCT was added. An unfavorable or questionable prognosis changed to favorable 30% of the time.

Introduction

Cone beam computed tomography (CBCT) is one of the most recent innovations in imaging modalities. Since its approval by the Food and Drug Administration in March 2001, use in dentistry has steadily increased (2). Improvements in imaging quality coupled with decreased radiation exposure have resulted in acceptance of the modality as a viable primary and secondary digital imaging option for endodontics.

CBCT is a radiographic technology which allows the viewer to see scans/images in three-dimensions. The source of the X-ray rotates between 180 and 360 degrees around the head of the patient. This cone shaped radiograph captures a volume of data or Field of View (FOV) which is made up of smaller parts of data call voxels. Voxels are small, three-dimensional, squares of radiographic data which are combined to form a larger "scan" of view. These voxels are isotropic (equal in height, length, and depth) making the image geometrically accurate in any plane (3). This data can then be viewed in three planes of view: Axial, Sagittal, and Coronal.

Radiographic imaging in dentistry has evolved over time. As early as the 1950's, radiography with standard film was used regularly in dentistry. Digital radiography began to replace film in the late 1990's and early 2000's. Dr. Frances Mouyen introduced digital radiography in dentistry in France in 1987. It was known as Radiovisiography by Trophy (RVG, formerly Tre-trophy Radiology Inc., Marietta, GA). The FDA approved its use in 1998 (4, 5). Nair and others discussed the value of digital radiography. Advantages cited were contrast

enhancements, magnification of images, the ability to view the image/x-ray immediately after exposure, less use of environmentally harmful developing chemicals, and ease of archiving and transmission (5).

With all the advantages of digital radiography, there are still disadvantages. These include compression of 3-dimensional (3D) anatomy, geometric distortion, and anatomic superimposition (6). While CBCT allows for better representation of a tooth's 3D anatomy the added radiation exposure to the patient compared to standard digital radiography is of concern. One way to reduce patient exposure is by limiting the field of view (7). CBCT can be performed in multiple sizes, 5 cm x 5 cm, 10cm x 5 cm, 8 cm x 8 cm, 10 cm x 10 cm, 17 cm x 11 cm, and 17 cm x 13.5 cm. These varying sizes are necessary depending on the disease being evaluated and what structures are desired to be viewed. Resolution and radiation dose depend on the size of scan taken. The larger the scan, the greater the radiation exposure and lower the resolution of the scan. The most common scan size used in endodontics is the limited field of view (FOV) 5 cm x 5 cm. This is ideal for most endodontic applications where a single quadrant is of concern rather than an entire arch or the entire dentition. A smaller field of view allows for the highest possible resolution and lowest radiation exposure. Resolution provided by 5cm x 5cm at 70 or 90 voxels allows for assessment of loss of the lamina dura and widening of the periodontal ligament (PDL) necessary for diagnosis of periapical pathosis (8, 9, 10). The American Association of Endodontists in their Colleagues for Excellence on *Cone Beam Computed Tomography in Endodontics*, recommended for most endodontic applications, a limited or focused FOV over a large volume CBCT. This document states that "A limited FOV CBCT provides: 1) increased resolution to improve the diagnostic accuracy of endodontic-specific tasks such as the

visualization of small features including calcified/accessory canals, and missed canals, 2) highest possible resolution, 3) decreased radiation exposure to the patient, 4) time savings due to smaller volume to be interpreted, 5) smaller area of responsibility and 6) focus on anatomical area of interest." (11)

Ludlow and White (1) documented the radiation exposure of a CBCT scan and compared this to the radiation exposure of a periapical film. For the Kodak™ 9000 3D CBCT Limited FOV 5x5 scan (Figure 1), the effective dose for maxillary posterior teeth is 9.8uSv. For mandibular posterior teeth the effective dose is 38.3uSv. This was compared to a single digital periapical radiograph or a single days' worth of background radiation at sea level. Based on their studies, a maxillary posterior CBCT is the equivalent of 0.78 periapical radiographs and a mandibular posterior CBCT is the equivalent of 6.38 periapical radiographs. The ALARA (as low as reasonably achievable) principle is an important aspect to consider in determining the need for a CBCT. Accurate diagnosis often requires multiple periapicals due to anatomic superimposition or geometric distortion. Radiation exposure should be the least amount needed to accurately diagnose. The ALARA principle applies whether it is traditional digital radiographs or a CBCT. In cases such as a maxillary molar where two periapicals are often indicated, the decision to take a CBCT may be warranted and in line with the ALARA principle.

Ionizing Radiation Dosages (approximate)

Activity	Effective Dose in µSv	Dose as Days of Equivalent Background Radiation
1 day background radiation, sea level	7-8	1
1 digital PA radiograph	6	1
4 dental bite-wing radiographs, F-speed film	38	5
FMX; PSP or F-speed film	171	21
Kodak® CBCT focused field, anterior	4.7	0.71
Kodak® CBCT focused field, maxillary posterior	9.8	1.4
Kodak® CBCT focused field, mandibular posterior	38.3	5.47
3D Accuitomo, J. Morita	20	3
NewTom 3G, ImageWorks	68	8
Chest x-ray	170	25
Mammogram	700	106
Medical CT, head	2,000	243
Medical Cat Scan (Spiral CT abdomen)	10,000	1,515
Federal Occupation Safety Limit per Year	50,000	7,575

Figure 1. Ionizing Radiation Dosages (approximate)

When compared with traditional radiographs, CBCT has proven to have distinct advantages in identifying anatomic structures and presence of periapical lesions (12, 13, 14, 15, 16). Studies have also shown it advantages over conventional radiography in identifying anatomic structures and lesions. Velvart (17) found that CBCT was able to more accurately find and measure anatomic structures and their distance from endodontic areas of concern. They also determined CBCT was able to identify endodontic lesions with 100% accuracy, whereas, conventional radiography was only able to identify lesions with 78% accuracy. The increased accuracy should result in more appropriate diagnosis and improved decision making in the management of complex endodontic cases (18).

Endodontics has a particular interest in the advantages of CBCT primarily due to its ability to allow clinicians to better visualize specific areas without superimposition of other

anatomic structures (18, 19), identify lesions which may not be visible on conventional radiography, assess tooth internal and external anatomy and to see endodontically important structures not visible on two-dimensional radiography. A scan also provides the ability to detect smaller areas of concern than traditional radiography, especially areas of low density (20).

Treatment planning is particularly challenging in endodontic retreatment procedures where initial nonsurgical endodontic treatment has not resulted in the desired outcome. Diagnosis attempts to identify etiology of treatment failure. Recommended treatment is often guided by what is or is not known about the anatomy of the tooth. Traditionally this anatomy was re-evaluated prior to retreatment with traditional periapicals. Today CBCT is an option. The advantages provided by CBCT are of particular interest, because it may provide added information, therefore increased understanding that should result in increased success of retreatment.

The American Association of Endodontists (AAE) and American Academy of Oral and Maxillofacial Radiology (AAOMR) in their Joint Position Statement, *Use of Cone Beam Computed Tomography in Endodontics 2015 Update*, gave scientifically based guidelines regarding the use of CBCT in endodontic treatment (1).

Recommendation 7 states: "Limited FOV CBCT should be the imaging modality of choice when evaluating the nonhealing of previous endodontic treatment to help determine the need for further treatment, such as nonsurgical, surgical, or extraction". Recommendation 8 states: "Limited FOV CBCT should be the imaging modality of choice for nonsurgical retreatment to assess endodontic treatment complication, such as overextended root canal oburation material, separated endodontic instruments, and localization of perforations". Liang et

al (21) identified the factors that impact the outcome of root canal treatment with both periapical radiographs and CBCT. They found that periapical lesions were identified with periapical radiographs in 18 roots (12%) compared with 37 roots (25%) with CBCT.

The position statement stressed the importance of accurate treatment planning in these cases by stating that "incorrect, delayed, or inadequate endodontic diagnosis and treatment planning placed the patient at risk and may result in unnecessary treatment". This was supported by a study performed by Ee et al (22) where treatment planning decisions using CBCT verses intraoral radiographs were compared to the gold standard of diagnosis. When intraoral radiographs were used an accurate diagnosis was reached in 36%-40% of cases, as compared to the CBCT where an accurate diagnosis was reached in 67%-83% of cases.

Ameida et al (23) also studied the impact of CBCT on diagnosis. In their study the examiner submitted a preliminary diagnosis before CBCT examination and then again, after the CBCT examination. Results were plotted and diagnosis was changed 35% of the time after the CBCT was examined. They concluded "CBCT has a substantial impact on diagnosis".

There has always been an ongoing discussion in endodontics, as to whether the additional information provided by CBCT actually effects the treatment which is ultimately performed. In other words, does the added information provided by CBCT cause significant changes to endodontic treatment planned by endodontists?

Many studies have shown CBCT to be more effective and beneficial when compared to standard periapical radiographs in detecting apical pathology (24, 25, 26, 27). Patel et al found more periapical lesions using CBCT than with standard radiography. In a follow-up study of the prevalence of periapical lesion of roots, he found periapical lesions in 20% of roots with

radiographs. With CBCT, periapical lesions were found in 48% of teeth treatment planned for endodontic therapy. Also, a significant difference in outcome diagnosis was found between the two modes of radiography.

Lofthag-Hansen et al (15) confirmed similar findings in his retrospective chart review study. They found more information was visible with CBCT than periapical films. They recommended the use of CBCT to better visualize the anatomy of roots and canals and to better understand the size and location of a lesion. Low and colleagues in a study of posterior maxillary teeth referred for surgery found that 34% more lesions were detected with CBCT that radiographs (28).

The aim of this study was to compare treatment planning decisions made when evaluating previous endodontic treatment to determine if treatment planned and projected prognosis differs when digital radiograph is used alone or in combination with CBCT.

Materials and Methods

Institutional review board approval was obtained prior to this study (VCU IRB#: HM200003015). This study utilized a retrospective dental chart review design. Sample consisted of a random selection of patients who presented to the VCU Endodontic Graduate Practice for evaluation for possible root canal retreatment between January 2011 and January 2015 for whom both standard 2-D radiographs and a cone-beam computed tomography (CBCT) image was obtained prior to recommending retreatment. Patients younger than 18 or older than 89 years of age were not included in the study. Pregnant patients were not included in the study. Once identified as part of the sample for the study, the patient's radiographic images (2-D and 3-D CBCT) were de-identified.

All CBCT scans were taken with the Carestream 9300 system (Carestream Health; Rochester, HY). All CBCT images were taken using a limited field of view (5 x 5 cm) and a voxel size of 0.090mm. Operating parameters were set at 2-10mA, 60-90 kV, and 12 seconds. CBCT images were analyzed using a Dell Optiplex 990 computer (Dell SA, Geneva, Switzerland). All PA's were taken with digital Dexis ™ sensor and view as described.

Patient charts which meet the inclusion criteria were reviewed by two endodontists who independently, under the same testing conditions, arrived at a recommended treatment and prognosis when limited to 2-dimensional images (PA's) only or with 2-dimensional images

(PA's) and CBCT combined. Examiners were allowed to manipulate the CBCT and PA's in any manner that was consistent with manufacturer's recommendations.

This study evaluated radiographs/CBCT in a "screening" mode. This is to say, the examiners viewed only the radiographic/CBCT images and came to a decision as to what treatment was recommended based on the images only. They were not provided with any diagnostic testing to help in their decisions. This was an effort to single out the benefits and value of radiographs and CBCT alone.

Study Phase I (Standard radiographs alone):

Once data was collected and de-identified it was presented individually and in random order to two endodontists. Each examiner was calibrated using a defined set of PA's and CBCT scans. All data was manipulated in the manufacturer's software. Each examiner was given the necessary time they felt they needed to evaluate the provided radiographs and come to a final decision as to what treatment they would recommend/perform. Once this was completed they immediately completed a REDCap survey/data sheet (Figure 1). This data sheet consisted of questions and data regarding their examination of the radiographs, pathology seen or not seen, lesion, lesion size, recommended treatment and prognosis of recommended treatment.

Study Phase II (Standard radiographs and CBCT):

On a different day, at least two weeks later, the two endodontists were presented with the same radiographs as well as the patient's CBCT image. All could be manipulated in the manufacturer's software. Each examiner was given the necessary time they felt they needed to evaluate the provided radiographs and CBCT and come to a final decision as to what treatment they would recommend/perform. Once this was completed they immediately completed the exact

same REDCap survey/data sheet as in Study phase 1, again consisting of questions and data regarding their examination of the radiographs, pathology seen or not seen, lesion, lesion size, recommended treatment and prognosis of recommended treatment.

Also, at this sitting a series of questions were presented (included in the phase 2 REDCap survey/data sheet) designed to determine the subjective usefulness of the CBCT. The questionnaire consisted of five subjective statements. The examiner chose the statement that best described the usefulness of the CBCT. A small comments section was also included where the examiner could explain their choice, if desired.

Study Phase III (Statistical Analysis):

The radiographic treatment plan and radiographic + CBCT treatment plan was then compared using descriptive statistics (counts and percentages) and McNemar's chi-square test to determine consistency where applicable. Additionally, inter-rater reliability was assessed using Kappa Statistic. All data analysis was performed in SAS EG 6.1 with a significance level of 0.05.

Results

A total of 28 cases were reviewed first with radiographs alone and then with radiographs + CBCT by two reviewers, for a total of 56 total cases reviewed. Each reviewer responded to a set of questions upon review of each set of materials (radiograph, radiograph + CBCT).

Diagnostic Ability

The impact of the CBCT on diagnosis was ascertained through the question "Which best describes the impact of the CBCT on your diagnosis?" The response choices are listed in Table 1 and ranged from "the CBCT confused my understanding" to "the CBCT provided the only information that aided in my ability to diagnose". None of the evaluators responded that the CBCT had no or detrimental influence on the diagnosis, rather all felt the CBCT had at least some impact on their ability to diagnose the case. Seventy-five percent (75%) of the time the reviewers stated that the CBCT had a significant effect on the understanding of the case and improved diagnostic accuracy, while 16% of the time "the CBCT provided the only information that aided in my ability to diagnose the case".

Table 1: Perceived Impact of CBCT on Diagnosis

Which best describes the impact of the CBCT on your diagnosis?	Frequency	Percent
The CBCT confused my understanding and made it difficult to diagnose the case.	0	0%
The CBCT had no effect on my understanding of the case.	0	0%
The CBCT had some effect on my understanding of the case, but not significantly.	5	9%
The CBCT had a significant effect on my understanding of the case which improved diagnostic accuracy.	42	75%
The CBCT provided the only information that aided in my ability to diagnose the case.	9	16%

Treatment Modifications

Reviewers were asked to select a treatment plan for each case both when reviewing the radiograph alone and with the combined radiograph + CBCT. It was of particular interest to determine the percent of cases where the reviews resulted in the same treatment plan, when the treatment plan changed from non-surgical to a surgical procedure (i.e. microsurgery), and when the treatment changed retreatment to an extraction. Of the 56 cases reviewed, 43% resulted in treatment plan modifications when reviewed with both radiograph and CBCT. The percent of cases that were treatment planned for re-treatment with radiographs alone that changed to extraction after radiographs and CBCT was 7%. A total of 15% were changed to a surgical procedure (microsurgery). While the additional information from the CBCT did result in more proposed extractions, it also resulted in some proposed saved teeth. With the radiograph alone, 10 teeth were planned for extraction, but only 8 were confirmed by the radiograph and CBCT

combination, resulting in "saving" 20% of teeth planned for extraction. Complete results are given in Table 2.

Table 2: Treatment Plan Breakdown

Treatment Planned	Radiograph	Radiograph and CBCT
Extraction	18% (10/56)	32% (18/56)
NSReTx	41% (23/56)	14% (8/56)
None	5% (3/56)	13% (7/56)
Surgery	36% (20/56)	41% (23/56)

Prognosis

Each reviewer was also asked to predict case prognosis when reviewing the radiograph and again with the combined radiograph and CBCT. Using McNemar's Chi-square to test for differences in the projected prognosis, there was evidence of a difference between the perceived prognosis with the radiograph alone and the radiograph/CBCT combination ($P = 0.0078$). Results are given in Table 3 and Table 4.

Table 3: Projected Prognosis

		CBCT and Radiograph		
		Favorable	Questionable	Unfavorable
Radiograph Alone	Favorable	26	2	0
	Questionable	16	5	2
	Unfavorable	1	2	2

Table 4: Breakdown of Projected Prognosis

	Radiograph	CBCT and Radiograph
Favorable	50%	77%
Questionable	41%	16%
Unfavorable	9%	7%

For 41% of the cases, the projected prognosis changed. There were 17 instances (30%) where the evaluator stated the treatment had questionable or unfavorable prognosis with the radiograph alone, but the addition of the CBCT resulted in a change in projected prognosis to favorable. The majority of the shift was a decrease in the projected prognosis of "Questionable" from 41% to 16% (Table 4)

Inter-rater Reliability

In order to assess the consistency of the two raters, a Kappa Statistic was calculated to determine the agreement between the two raters on the proposed treatment both with the radiograph alone and with the addition of the CBCT. When treatment planning with the radiograph alone, the agreement was k=0.22 and with the addition of the CBCT, the agreement increased, marginally, to k=0.28. **Table 5** and **Table 6** contain the results for this comparison.

Table 5: Rater Agreement Radiograph Alone

	Rater A			
Rater B	Extraction	NSReTx	None	Surgery
Extraction	1	4	0	1
NSReTx	3	5	0	0
None	0	2	0	1
Surgery	0	4	0	7

Table 6: Rater Agreement Radiograph and CBCT

	Rater A			
Rater B	Extraction	NSReTx	None	Surgery
Extraction	3	3	1	7
NSReTx	0	1	1	0
None	1	2	1	0
Surgery	0	0	0	8

Discussion

Correct diagnosis is the key factor in successful endodontic treatment. If an accurate diagnosis is not achieved, treatment success can suffer, the health of the patient could be at risk and teeth can be prematurely lost.

Understanding the etiology of an endodontic problem is the desire of every endodontist. This study was designed to determine if the added information provided by the CBCT allows the clinician to more accurately understand and determine the etiology of endodontic pathology in cases where a tooth has already been previously treated and therefore, make a more accurate treatment plan with an accurate prognosis.

In every case, this study resulted in the CBCT having at least some effect on the clinician's ability to diagnose. In 75% of the cases the clinician stated the CBCT had significant effect on their understanding and ability to treatment plan each case and 16% of the time stated it provided the only information that helped in treatment planning the case. In summary, in 91% of the cases the clinician felt the CBCT had a significant effect on treatment planning.

These results suggest that a significant percentage of retreatment cases would benefit from a CBCT scan. This finding does not discount a clinician's ability to understand and interpret standard radiographs or to minimize clinical years of experience, but suggests that CBCT is valuable in understanding and planning treatment in endodontic retreatment cases, even for experienced endodontists.

It is interesting to note how often prognosis changed once the CBCT was viewed. Prognosis changed in 41% of the cases. Ideally, any clinician would prefer to have an "improvement" of prognosis accompanied with a CBCT. Whether prognosis improves or is worsened was not the goal of this study. The goal was to observe, after viewing a CBCT, if the projected prognosis would change, therefore resulting, hopefully, in a more accurate post-treatment prognosis, which would lead to more predictable treatment for patients. This premise was supported by results showing 34% of the cases had an improvement of projected prognosis. It is important to note that unfavorable prognosis' decreased from 9% to 7%. Although this difference is not significant, the decreased number of cases diagnosed as unfavorable, can be considered a positive result.

The total percentage of changes in projected prognosis was significant at 41%. This is in line with similar studies (22, 23), but with a more specific criteria, non-surgical root canal treatment only. All other studies looked at a variety of endodontic treatment scenarios. Accuracy of prognosis prediction is paramount in retreatment where persistent disease is present and patient treatment costs are often substantial.

A weakness of the study is the inter-rater reliability which ranged between 22%-28%, without CBCT and with CBCT, respectively. When treatment planning with the radiograph alone, the agreement was k=0.22 and with the addition of the CBCT, the agreement increased, marginally, to k=0.28. The degree of the agreement was fair. This was not surprising, however, because only two reviewers and only 28 cases were used. In the classic study by Goldman utilizing film, agreement between 6 examiners was found to be less that 50% (29). However, in a similar study Tewary and Hartwell, using digital radiography, found the overall agreement

between examiners was also fair (0.2-0.4) (30). Difference in agreement between examiners when viewing radiographs or CBCT scans may be indicative of differing preferences for treatment. Perhaps with more reviewers and larger sample size agreement between examiners would improve.

One of the most dramatic results of the study was related to treatment recommendations. In 43% of the cases a change in treatment was recommended when the CBCT was viewed. A total of 18% of cases changed from other treatment to extraction. This suggests how important it is to gather as much information as possible prior to treatment. The position paper on CBCT given by the AAE and AAOMR (1) states: "Limited FOV CBCT should be the imaging modality of choice when evaluating the non-healing of previous endodontic treatment to help determine the need for further treatment". It also states, "Limited FOV CBCT should be the imaging modality of choice for nonsurgical retreatment to assess endodontic treatment complications, such as overextended root canal obturation material, separated endodontic instruments, and localization of perforations." the AAE and AAOMR appear to express the importance and value of CBCT in non-surgical retreatment cases.

Our results clearly indicate that CBCT imagining causes changes in both treatment planning and prognosis. In all cases the CBCT had at least "some effect" on understanding *each case and in 91% of cases the reviewers stated the CBCT had a "significant effect".* This suggests that even if treatment or prognosis does not change, the added information, provided by the CBCT, is a benefit to the clinician. These findings support the rationale for the use of CBCT as presented in the AAE and AAOMR Position Paper.

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Appendices

SURVEY AND RESEARCH REVIEWER DATA SHEETS

Treatment Plan Data Sheet and DUDS

Rater:
- ◯ Rater A
- ◯ Rater B

What is the axiUm ID _____

What are the patients' first and last initials (i.e. JD for John Doe)? _____

Which sources are you considering:
- ◯ Radiograph(s) alone
- ◯ Radiograph(s) and CBCT

What pathology, if any, do you see on the image(s)? Select all that apply.
- ☐ No pathology
- ☐ Widened PDL
- ☐ PARL
- ☐ Fracture
- ☐ Resorption
- ☐ Perforation(s)
- ☐ Missed canal(s)
- ☐ Inadequate fills (long or short)
- ☐ Inadequate fills (Density, taper, etc)
- ☐ Other

In regards to WIDENED PDL: Indicate which root(s) are involved. Check all that apply.
- ☐ Single root
- ☐ B
- ☐ L
- ☐ M
- ☐ D
- ☐ P
- ☐ MB
- ☐ DB
- ☐ Other

Since you indicated there is a PARL, which root/root apices is it associated with? Check all that apply.
- ☐ Single root
- ☐ B
- ☐ L
- ☐ M
- ☐ D
- ☐ P
- ☐ MB
- ☐ DB
- ☐ Other

Is the PARL combined on those root apices?
- ☐ Yes
- ☐ No
- ☐ N/A

PARL: What is the estimated height of the lesion (in mm)? _____

PARL: What is the estimated width of the lesion (in mm)? _____

PARL: What is the estimated depth of the lesion (in mm)? _____

Since you indicated inadequate fill, was it:
- ◯ Long
- ◯ Short

Since you indicated inadequate fill, how [inadequate_fill] was the fill (in mm)? _____

Since you selected other pathology, please specify. _____

What treatment(s) would you plan on performing?

- ☐ None
- ☐ NSReTx (no expectation of missed anatomy)
- ☐ NSReTx (expectation of missed anatomy)
- ☐ Perforation repair (any type)
- ☐ Microsurgery
- ☐ Extraction (due to suspected cracked tooth)
- ☐ Extraction (other)
- ☐ Other

Since you selected other treatment, please specify. _____

What do you feel is the prognosis of your planned treatment?

- ◯ Favorable
- ◯ Questionable
- ◯ Unfavorable

Which best describes the impact of the CBCT on your diagnosis?

- ◯ The CBCT confused my understanding and made it difficult to diagnose the case.
- ◯ The CBCT had no effect on my understanding of the case.
- ◯ The CBCT had some effect on my understanding fo the case, but not significantly.
- ◯ The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
- ◯ The CBCT provided the only information that aided in my ability to diagnose the case.

Comments: _____

Record ID	Survey Timestamp	Rater	Masked Chart ID	Which sources are you considerin	Wh+H:AWat pathology, if any, do	What pathology, if any, do_0001	What pathology, if any, do_0002	What pathology, if any, do_0003	What pathology, if any, do_0004
22	10Jul2015 15:25:34	B	1	Radiograph(s) alone	Unchecked	Checked	Unchecked	Unchecked	Unchecked
126	04Sep2015 14:35:14	B	1	Radiograph(s) and CBCT	Checked	Unchecked	Unchecked	Unchecked	Unchecked
58	17Aug2015 18:06:02	A	1	Radiograph(s) alone	Unchecked	Unchecked	Checked	Unchecked	Unchecked
92	19Aug2015 16:04:27	A	1	Radiograph(s) and CBCT	Unchecked	Checked	Unchecked	Unchecked	Unchecked
5	10Jul2015 14:16:13	B	2	Radiograph(s) alone	Unchecked	Checked	Checked	Checked	Unchecked
110	04Sep2015 12:01:22	B	2	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Unchecked	Unchecked
40	31Jul2015 11:00:36	A	2	Radiograph(s) alone	Unchecked	Unchecked	Checked	Unchecked	Unchecked
76	19Aug2015 14:33:47	A	2	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Unchecked	Unchecked
14	10Jul2015 14:57:38	B	3	Radiograph(s) alone	Unchecked	Unchecked	Checked	Unchecked	Unchecked
119	04Sep2015 13:17:39	B	3	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Unchecked	Unchecked
50	31Jul2015 11:33:54	A	3	Radiograph(s) alone	Unchecked	Unchecked	Checked	Checked	Unchecked
85	19Aug2015 15:30:35	A	3	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Checked	Unchecked
8	10Jul2015 14:30:27	B	4	Radiograph(s) alone	Unchecked	Unchecked	Checked	Unchecked	Unchecked
113	04Sep2015 12:29:40	B	4	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Unchecked	Unchecked
43	31Jul2015 11:10:53	A	4	Radiograph(s) alone	Unchecked	Unchecked	Checked	Unchecked	Unchecked
79	19Aug2015 14:47:07	A	4	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Unchecked	Unchecked
21	10Jul2015 15:21:59	B	5	Radiograph(s) alone	Unchecked	Checked	Checked	Unchecked	Unchecked
125	04Sep2015 14:28:21	B	5	Radiograph(s) and CBCT	Checked	Unchecked	Unchecked	Unchecked	Unchecked
57	17Aug2015 18:03:18	A	5	Radiograph(s) alone	Unchecked	Unchecked	Checked	Unchecked	Unchecked
91	19Aug2015 16:01:27	A	5	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Unchecked	Unchecked
12	10Jul2015 14:50:30	B	6	Radiograph(s) alone	Unchecked	Unchecked	Checked	Unchecked	Unchecked
117	04Sep2015 13:00:57	B	6	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Unchecked	Unchecked
47	31Jul2015 11:25:36	A	6	Radiograph(s) alone	Unchecked	Unchecked	Checked	Unchecked	Unchecked
83	19Aug2015 15:17:51	A	6	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Checked	Unchecked
132	04Sep2015 15:35:38	B	7	Radiograph(s) and CBCT	Unchecked	Checked	Unchecked	Unchecked	Unchecked
98	19Aug2015 17:03:02	A	7	Radiograph(s) and CBCT	Unchecked	Checked	Unchecked	Unchecked	Unchecked
29	10Jul2015 15:45:26	B	7	Radiograph(s) alone	Checked	Unchecked	Unchecked	Unchecked	Unchecked
65	17Aug2015 18:29:02	A	7	Radiograph(s) alone	Checked	Unchecked	Unchecked	Unchecked	Unchecked
25	10Jul2015 15:34:53	B	8	Radiograph(s) alone	Unchecked	Unchecked	Checked	Unchecked	Checked
129	04Sep2015 15:12:14	B	8	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Unchecked	Unchecked
61	17Aug2015 18:18:43	A	8	Radiograph(s) alone	Checked	Unchecked	Unchecked	Unchecked	Unchecked
95	19Aug2015 16:18:07	A	8	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Unchecked	Unchecked
2	10Jul2015 13:57:48	B	9	Radiograph(s) alone	Unchecked	Unchecked	Checked	Unchecked	Checked
107	04Sep2015 11:30:33	B	9	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Unchecked	Unchecked
37	31Jul2015 10:41:49	A	9	Radiograph(s) alone	Unchecked	Unchecked	Checked	Unchecked	Unchecked
73	19Aug2015 13:55:00	A	9	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Checked	Unchecked
6	10Jul2015 14:22:34	B	10	Radiograph(s) alone	Unchecked	Checked	Checked	Unchecked	Checked
111	04Sep2015 12:14:37	B	10	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Unchecked	Unchecked
41	31Jul2015 11:04:04	A	10	Radiograph(s) alone	Unchecked	Unchecked	Checked	Unchecked	Unchecked
77	19Aug2015 14:38:51	A	10	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Unchecked	Unchecked
7	10Jul2015 14:27:12	B	11	Radiograph(s) alone	Unchecked	Unchecked	Checked	Checked	Unchecked
112	04Sep2015 12:22:50	B	11	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Unchecked	Unchecked
42	31Jul2015 11:07:07	A	11	Radiograph(s) alone	Unchecked	Unchecked	Checked	Unchecked	Unchecked
78	19Aug2015 14:43:15	A	11	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Checked	Unchecked
1	10Jul2015 13:54:34	B	12	Radiograph(s) alone	Unchecked	Unchecked	Checked	Unchecked	Checked
106	04Sep2015 11:22:47	B	12	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Unchecked	Unchecked
36	31Jul2015 10:35:55	A	12	Radiograph(s) alone	Unchecked	Unchecked	Checked	Unchecked	Unchecked
72	19Aug2015 13:49:58	A	12	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Checked	Unchecked
10	10Jul2015 14:38:57	B	13	Radiograph(s) alone	Checked	Unchecked	Unchecked	Unchecked	Unchecked
115	04Sep2015 12:48:14	B	13	Radiograph(s) and CBCT	Unchecked	Unchecked	Unchecked	Unchecked	Checked
45	31Jul2015 11:15:48	A	13	Radiograph(s) alone	Checked	Unchecked	Unchecked	Unchecked	Unchecked
81	19Aug2015 15:08:13	A	13	Radiograph(s) and CBCT	Unchecked	Unchecked	Unchecked	Unchecked	Unchecked
33	42195.66311	B	14a	Radiograph(s) alone	Unchecked	Unchecked	Checked	Unchecked	Unchecked
34	42195.66602	B	14b	Radiograph(s) alone	Unchecked	Unchecked	Checked	Unchecked	Unchecked
136	42251.67218	B	14a	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Unchecked	Unchecked
137	42251.67294	B	14b	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Unchecked	Unchecked
69	42233.78227	A	14a	Radiograph(s) alone	Unchecked	Unchecked	Checked	Unchecked	Unchecked
70	42233.78307	A	14b	Radiograph(s) alone	Unchecked	Unchecked	Checked	Unchecked	Unchecked
102	42235.72456	A	14a	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Unchecked	Unchecked
103	42235.72525	A	14b	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Unchecked	Unchecked
55	31Jul2015 12:09:17	A	15	Radiograph(s) alone	Unchecked	Unchecked	Checked	Unchecked	Unchecked
19	10Jul2015 15:15:09	B	15	Radiograph(s) alone	Unchecked	Unchecked	Checked	Unchecked	Unchecked
124	04Sep2015 14:08:02	B	15	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Unchecked	Unchecked
90	19Aug2015 15:52:13	A	15	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Unchecked	Unchecked
17	10Jul2015 15:07:27	B	16	Radiograph(s) alone	Unchecked	Checked	Checked	Unchecked	Checked
122	04Sep2015 13:48:45	B	16	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Unchecked	Checked
53	31Jul2015 11:56:38	A	16	Radiograph(s) alone	Unchecked	Unchecked	Checked	Unchecked	Unchecked
88	19Aug2015 15:42:10	A	16	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Unchecked	Checked
3	10Jul2015 14:01:34	B	17	Radiograph(s) alone	Unchecked	Unchecked	Checked	Unchecked	Unchecked
108	04Sep2015 11:42:59	B	17	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Unchecked	Unchecked
38	31Jul2015 10:48:39	A	17	Radiograph(s) alone	Unchecked	Unchecked	Checked	Unchecked	Unchecked
74	19Aug2015 14:23:08	A	17	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Unchecked	Unchecked
9	10Jul2015 14:34:48	B	18	Radiograph(s) alone	Unchecked	Checked	Checked	Unchecked	Unchecked
114	04Sep2015 12:39:14	B	18	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Unchecked	Unchecked
44	31Jul2015 11:13:34	A	18	Radiograph(s) alone	Unchecked	Unchecked	Checked	Unchecked	Unchecked
80	19Aug2015 15:03:18	A	18	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Unchecked	Unchecked
35	10Jul2015 16:01:15	B	19	Radiograph(s) alone	Unchecked	Unchecked	Checked	Checked	Unchecked
138	04Sep2015 16:19:20	B	19	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Unchecked	Unchecked
71	17Aug2015 18:50:02	A	19	Radiograph(s) alone	Unchecked	Unchecked	Checked	Unchecked	Unchecked
104	19Aug2015 17:33:27	A	19	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Unchecked	Unchecked
32	10Jul2015 15:52:49	B	20	Radiograph(s) alone	Checked	Unchecked	Unchecked	Unchecked	Unchecked
135	04Sep2015 16:02:19	B	20	Radiograph(s) and CBCT	Unchecked	Checked	Unchecked	Unchecked	Unchecked
68	17Aug2015 18:42:51	A	20	Radiograph(s) alone	Unchecked	Checked	Unchecked	Unchecked	Unchecked
101	19Aug2015 17:16:16	A	20	Radiograph(s) and CBCT	Checked	Unchecked	Unchecked	Unchecked	Unchecked
28	10Jul2015 15:43:22	B	21	Radiograph(s) alone	Unchecked	Unchecked	Checked	Unchecked	Checked
131	04Sep2015 15:30:21	B	21	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Unchecked	Checked
64	17Aug2015 18:26:24	A	21	Radiograph(s) alone	Unchecked	Unchecked	Checked	Unchecked	Unchecked
97	19Aug2015 16:59:13	A	21	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Unchecked	Unchecked
31	10Jul2015 15:50:35	B	22	Radiograph(s) alone	Unchecked	Unchecked	Checked	Unchecked	Unchecked
134	04Sep2015 15:54:09	B	22	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Unchecked	Unchecked
67	17Aug2015 18:41:27	A	22	Radiograph(s) alone	Unchecked	Unchecked	Checked	Unchecked	Unchecked
100	19Aug2015 17:13:10	A	22	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Unchecked	Unchecked
30	10Jul2015 15:48:08	B	23	Radiograph(s) alone	Unchecked	Unchecked	Checked	Unchecked	Unchecked
133	04Sep2015 15:48:15	B	23	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Unchecked	Unchecked
66	17Aug2015 18:33:22	A	23	Radiograph(s) alone	Unchecked	Unchecked	Checked	Unchecked	Unchecked
99	19Aug2015 17:07:22	A	23	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Unchecked	Unchecked
52	31Jul2015 11:49:04	A	24	Radiograph(s) alone	Unchecked	Unchecked	Unchecked	Unchecked	Unchecked
16	10Jul2015 15:03:32	B	24	Radiograph(s) alone	Unchecked	Checked	Unchecked	Unchecked	Unchecked
87	19Aug2015 15:37:52	A	24	Radiograph(s) and CBCT	Unchecked	Unchecked	Unchecked	Unchecked	Unchecked
121	04Sep2015 13:38:15	B	24	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Unchecked	Unchecked
13	10Jul2015 14:54:30	B	25	Radiograph(s) alone	Unchecked	Unchecked	Unchecked	Unchecked	Checked
118	04Sep2015 13:11:07	B	25	Radiograph(s) and CBCT	Unchecked	Checked	Unchecked	Unchecked	Checked
48	31Jul2015 11:28:22	A	25	Radiograph(s) alone	Unchecked	Unchecked	Unchecked	Unchecked	Unchecked
84	19Aug2015 15:24:20	A	25	Radiograph(s) and CBCT	Checked	Unchecked	Unchecked	Unchecked	Unchecked
18	10Jul2015 15:10:14	B	26	Radiograph(s) alone	Unchecked	Unchecked	Checked	Unchecked	Unchecked
123	04Sep2015 13:56:37	B	26	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Unchecked	Unchecked
54	31Jul2015 12:00:28	A	26	Radiograph(s) alone	Unchecked	Unchecked	Checked	Unchecked	Unchecked
89	19Aug2015 15:47:38	A	26	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Unchecked	Unchecked
15	10Jul2015 15:01:03	B	27	Radiograph(s) alone	Unchecked	Unchecked	Checked	Unchecked	Unchecked
120	04Sep2015 13:27:26	B	27	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Unchecked	Unchecked
51	31Jul2015 11:43:24	A	27	Radiograph(s) alone	Unchecked	Unchecked	Checked	Checked	Unchecked
86	19Aug2015 15:35:04	A	27	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Checked	Unchecked
11	10Jul2015 14:45:37	B	28	Radiograph(s) alone	Unchecked	Unchecked	Unchecked	Unchecked	Unchecked
116	04Sep2015 12:56:42	B	28	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Unchecked	Unchecked
46	31Jul2015 11:21:36	A	28	Radiograph(s) alone	Unchecked	Unchecked	Checked	Unchecked	Unchecked
82	19Aug2015 15:15:09	A	28	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Checked	Unchecked
59	17Aug2015 18:08:01	A	29	Radiograph(s) alone	Unchecked	Unchecked	Checked	Unchecked	Unchecked
4	10Jul2015 14:10:05	B	30	Radiograph(s) alone	Unchecked	Checked	Unchecked	Checked	Unchecked
109	04Sep2015 11:52:46	B	30	Radiograph(s) and CBCT	Unchecked	Unchecked	Unchecked	Unchecked	Unchecked
39	31Jul2015 10:56:42	A	30	Radiograph(s) alone	Unchecked	Unchecked	Unchecked	Unchecked	Unchecked
75	19Aug2015 14:30:32	A	30	Radiograph(s) and CBCT	Unchecked	Unchecked	Checked	Unchecked	Unchecked

Record ID	What pathology, if any, do_0005	What pathology, if any, do_0006	What pathology, if any, do_0007	What pathology, if any, do_0008	What pathology, if any, do_0009	In regards to WIDENED PDL: Indic	In regards to WIDENED PDL:_0001	In regards to WIDENED PDL:_0002
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126	Unchecked	Unchecked	Unchecked	Unchecked	Unchecked	Unchecked	Unchecked	Unchecked
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Record ID	In regards to WIDENED PDL:_0003	In regards to WIDENED PDL:_0004	In regards to WIDENED PDL:_0005	In regards to WIDENED PDL:_0006	In regards to WIDENED PDL:_0007	In regards to WIDENED PDL:_0008	Since you indicated there is a P	Since you indicated there i_0001
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Record ID	Since you indicated there i_0002	Since you indicated there i_0003	Since you indicated there i_0004	Since you indicated there i_0005	Since you indicated there i_0006	Since you indicated there i_0007	Since you indicated there i_0008	Is the PARL combined on those rc
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Record ID	Is the PARL combined on tho_0001	Is the PARL combined on tho_0002	PARL: What is the estimated heig	PARL: What is the estimated widt	PARL: What is the estimated dept	Since you indicated inadequate f	Since you indicated inadequ_0001
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126	Unchecked	Unchecked					
58	Unchecked	Checked	2	1			
92	Unchecked	Unchecked					
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76	Checked	Unchecked	4	4	6		
14	Unchecked	Checked	5	5			
119	Unchecked	Checked	8.7	5.1	6		
50	Unchecked	Checked	12	7			
85	Unchecked	Checked	11	6	6.5		
8	Checked	Unchecked	4	4			
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3	Unchecked	Checked	10	10		Long	6
108	Unchecked	Checked	19.1	19.1	18.1	Long	5.3
38	Unchecked	Checked	20	20		Long	6
74	Unchecked	Checked	21.5	19	18	Long	6
9	Checked	Unchecked	7	4			
114	Checked	Unchecked	6.2	4.1	6.9		
44	Unchecked	Checked	8	7			
80	Unchecked	Checked	7.5	4	7		
35	Unchecked	Checked	7	9			
138	Unchecked	Checked	4.8	7.5	6.8		
71	Unchecked	Checked	8	7			
104	Unchecked	Checked	7	5	7		
32	Unchecked	Unchecked				Short	3
135	Unchecked	Unchecked				Short	6.2
68	Unchecked	Unchecked					
101	Unchecked	Unchecked					
28	Unchecked	Checked	5.5	4.2		Short	2
131	Unchecked	Checked	5.3	4.2	4.8	Short	2
64	Unchecked	Checked	5.5	4			
97	Unchecked	Checked	5	4	4.5		
31	Unchecked	Checked	1	2		Short	1
134	Unchecked	Checked	1.5	3.1	3.3		
67	Unchecked	Checked	3	4			
100	Unchecked	Checked	1	2.5	3		
30	Unchecked	Checked	8	9		Short	2
133	Unchecked	Checked	9.1	11.3	8.9	Short	2.4
66	Unchecked	Checked	10	10		Short	2.5
99	Unchecked	Checked	11.5	11	10	Short	2
52	Unchecked	Unchecked					
16	Unchecked	Unchecked					
87	Unchecked	Unchecked					
121	Unchecked	Checked	5	2.7	5		
13	Unchecked	Unchecked					
118	Unchecked	Unchecked					
48	Unchecked	Unchecked					
84	Unchecked	Unchecked					
18	Checked	Unchecked	5	5		Short	1
123	Checked	Unchecked	5.6	4.8	5.6		
54	Unchecked	Checked	5	5		Short	1
89	Unchecked	Checked	6.5	4.5	6		
15	Unchecked	Unchecked	8	10			
120	Unchecked	Unchecked	10.4	11.7	8.8		
51	Unchecked	Unchecked	12	11			
86	Unchecked	Unchecked	12	12	8.5		
11	Unchecked	Unchecked					
116	Unchecked	Checked	5	7.5	7.7		
46	Unchecked	Checked	5	5			
82	Unchecked	Checked	9	9	9		
59	Unchecked	Checked	4	4			
4	Unchecked	Unchecked					
109	Unchecked	Unchecked					
39	Unchecked	Unchecked					
75	Checked	Unchecked	11	6.5	10		

Record ID	Since you selected other patholo	What treatment(s) would you plan	What treatment(s) would you_0001	What treatment(s) would you_0002	What treatment(s) would you_0003	What treatment(s) would you_0004
22		Unchecked	Checked	Unchecked	Unchecked	Unchecked
126		Checked	Unchecked	Unchecked	Unchecked	Unchecked
58		Unchecked	Unchecked	Checked	Unchecked	Unchecked
92		Checked	Unchecked	Unchecked	Unchecked	Unchecked
5	Furcation finding	Unchecked	Unchecked	Unchecked	Unchecked	Checked
110		Unchecked	Unchecked	Unchecked	Unchecked	Checked
40		Unchecked	Unchecked	Unchecked	Unchecked	Checked
76		Unchecked	Unchecked	Unchecked	Unchecked	Checked
14		Unchecked	Unchecked	Unchecked	Unchecked	Checked
119		Unchecked	Unchecked	Unchecked	Unchecked	Checked
50		Unchecked	Unchecked	Unchecked	Unchecked	Checked
85		Unchecked	Unchecked	Unchecked	Unchecked	Unchecked
8		Unchecked	Checked	Unchecked	Unchecked	Unchecked
113		Unchecked	Checked	Unchecked	Unchecked	Checked
43		Unchecked	Unchecked	Unchecked	Unchecked	Checked
79		Unchecked	Unchecked	Unchecked	Unchecked	Checked
21		Unchecked	Unchecked	Checked	Unchecked	Unchecked
125		Checked	Unchecked	Unchecked	Unchecked	Unchecked
57		Unchecked	Unchecked	Checked	Unchecked	Unchecked
91		Unchecked	Unchecked	Checked	Unchecked	Unchecked
12		Unchecked	Unchecked	Unchecked	Unchecked	Checked
117		Unchecked	Unchecked	Unchecked	Unchecked	Checked
47		Unchecked	Unchecked	Unchecked	Unchecked	Checked
83		Unchecked	Unchecked	Unchecked	Unchecked	Unchecked
132		Unchecked	Unchecked	Checked	Unchecked	Unchecked
98		Checked	Unchecked	Unchecked	Unchecked	Unchecked
29		Unchecked	Checked	Unchecked	Unchecked	Unchecked
65		Checked	Unchecked	Unchecked	Unchecked	Unchecked
25		Unchecked	Checked	Unchecked	Unchecked	Unchecked
129		Unchecked	Unchecked	Unchecked	Unchecked	Checked
61		Unchecked	Checked	Unchecked	Unchecked	Unchecked
95		Unchecked	Unchecked	Unchecked	Unchecked	Checked
2		Unchecked	Unchecked	Unchecked	Unchecked	Checked
107		Unchecked	Unchecked	Unchecked	Unchecked	Checked
37		Unchecked	Unchecked	Unchecked	Unchecked	Checked
73		Unchecked	Unchecked	Unchecked	Unchecked	Unchecked
6	Lateral lesion extent of distal root , mid-root mesial Furcation lesion	Unchecked	Unchecked	Unchecked	Unchecked	Unchecked
111	Lateral periodontitis	Unchecked	Checked	Unchecked	Unchecked	Unchecked
41		Unchecked	Unchecked	Unchecked	Unchecked	Unchecked
77		Unchecked	Unchecked	Unchecked	Unchecked	Unchecked
7		Unchecked	Unchecked	Unchecked	Unchecked	Unchecked
112		Unchecked	Unchecked	Unchecked	Unchecked	Checked
42		Unchecked	Unchecked	Checked	Unchecked	Unchecked
78		Unchecked	Unchecked	Unchecked	Unchecked	Unchecked
1	Mid-root lesion	Unchecked	Unchecked	Unchecked	Unchecked	Unchecked
106		Unchecked	Unchecked	Unchecked	Unchecked	Unchecked
36	B apex	Unchecked	Checked	Unchecked	Unchecked	Unchecked
72		Unchecked	Unchecked	Unchecked	Unchecked	Unchecked
10		Unchecked	Checked	Unchecked	Unchecked	Unchecked
115		Checked	Unchecked	Unchecked	Unchecked	Unchecked
45		Checked	Unchecked	Unchecked	Unchecked	Unchecked
81	radiolucency midroot B aspect	Unchecked	Unchecked	Unchecked	Unchecked	Unchecked
33		Unchecked	Unchecked	Unchecked	Unchecked	Checked
34		Unchecked	Unchecked	Unchecked	Unchecked	Checked
136		Unchecked	Unchecked	Unchecked	Unchecked	Checked
137		Unchecked	Unchecked	Unchecked	Unchecked	Checked
69		Unchecked	Unchecked	Unchecked	Unchecked	Checked
70		Unchecked	Unchecked	Unchecked	Unchecked	Checked
102		Unchecked	Unchecked	Unchecked	Unchecked	Unchecked
103		Unchecked	Unchecked	Unchecked	Unchecked	Unchecked
55		Unchecked	Unchecked	Unchecked	Unchecked	Unchecked
19		Unchecked	Unchecked	Unchecked	Unchecked	Checked
124		Unchecked	Unchecked	Unchecked	Unchecked	Checked
90	Involves multiple teeth (23-27), 26 and 27 appear to be pushed apart apically	Unchecked	Unchecked	Unchecked	Unchecked	Unchecked
17		Unchecked	Unchecked	Checked	Unchecked	Unchecked
122		Unchecked	Unchecked	Checked	Unchecked	Unchecked
53		Unchecked	Unchecked	Unchecked	Unchecked	Unchecked
88		Unchecked	Unchecked	Unchecked	Unchecked	Unchecked
3		Unchecked	Checked	Unchecked	Unchecked	Checked
108		Unchecked	Checked	Unchecked	Unchecked	Checked
38		Unchecked	Checked	Unchecked	Unchecked	Checked
74		Unchecked	Unchecked	Unchecked	Unchecked	Unchecked
9	Mid-root lesion	Unchecked	Unchecked	Checked	Unchecked	Unchecked
114	Lateral periodontitis due to either possible ML canal strip perforation or vertical root fracture.	Unchecked	Unchecked	Unchecked	Unchecked	Unchecked
44		Unchecked	Unchecked	Unchecked	Unchecked	Unchecked
80		Unchecked	Unchecked	Unchecked	Unchecked	Unchecked
35		Unchecked	Unchecked	Unchecked	Unchecked	Checked
138		Unchecked	Unchecked	Unchecked	Unchecked	Checked
71		Unchecked	Unchecked	Unchecked	Unchecked	Checked
104		Unchecked	Unchecked	Unchecked	Unchecked	Checked
32		Unchecked	Unchecked	Checked	Unchecked	Unchecked
135		Unchecked	Unchecked	Checked	Unchecked	Unchecked
68		Unchecked	Unchecked	Checked	Unchecked	Unchecked
101		Checked	Unchecked	Unchecked	Unchecked	Unchecked
28		Unchecked	Unchecked	Checked	Unchecked	Unchecked
131		Unchecked	Unchecked	Unchecked	Unchecked	Checked
64		Unchecked	Unchecked	Unchecked	Unchecked	Checked
97		Unchecked	Unchecked	Unchecked	Unchecked	Checked
31		Unchecked	Unchecked	Unchecked	Unchecked	Checked
134		Unchecked	Unchecked	Unchecked	Unchecked	Checked
67		Unchecked	Unchecked	Unchecked	Unchecked	Checked
100		Unchecked	Unchecked	Unchecked	Unchecked	Checked
30		Unchecked	Unchecked	Checked	Unchecked	Unchecked
133		Unchecked	Unchecked	Unchecked	Unchecked	Checked
66		Unchecked	Unchecked	Unchecked	Unchecked	Checked
99		Unchecked	Unchecked	Unchecked	Unchecked	Checked
52	lateral radiolucency D aspect	Unchecked	Unchecked	Unchecked	Unchecked	Checked
16	lateral root lesion	Unchecked	Checked	Unchecked	Unchecked	Unchecked
87	radiolucency D aspect of root apical third	Unchecked	Unchecked	Unchecked	Unchecked	Checked
121	Lateral periodontitis	Unchecked	Unchecked	Unchecked	Unchecked	Checked
13		Unchecked	Unchecked	Unchecked	Unchecked	Checked
118		Unchecked	Unchecked	Unchecked	Checked	Unchecked
48	radiolucency in pulp chamber, possibly from initial access	Checked	Unchecked	Unchecked	Unchecked	Unchecked
84		Checked	Unchecked	Unchecked	Unchecked	Unchecked
18		Unchecked	Checked	Unchecked	Unchecked	Unchecked
123		Unchecked	Checked	Unchecked	Unchecked	Unchecked
54		Unchecked	Unchecked	Checked	Unchecked	Unchecked
89		Unchecked	Unchecked	Checked	Unchecked	Unchecked
15		Unchecked	Unchecked	Checked	Unchecked	Unchecked
120		Unchecked	Unchecked	Checked	Unchecked	Unchecked
51		Unchecked	Unchecked	Unchecked	Unchecked	Unchecked
86		Unchecked	Unchecked	Unchecked	Unchecked	Unchecked
11	circumferential finding mid to apical root	Unchecked	Checked	Unchecked	Unchecked	Unchecked
116		Unchecked	Unchecked	Unchecked	Unchecked	Checked
46		Unchecked	Unchecked	Unchecked	Unchecked	Unchecked
82		Unchecked	Unchecked	Unchecked	Unchecked	Unchecked
59		Unchecked	Unchecked	Checked	Unchecked	Unchecked
4	Mid-root lesion suggestive of root fracture 3mmx7mm defect	Unchecked	Unchecked	Unchecked	Unchecked	Unchecked
109	Lateral periodontitis secondary to suspected vertical root fracture	Unchecked	Unchecked	Unchecked	Unchecked	Unchecked
39	radiolucency midroot M root, M and D aspect	Unchecked	Unchecked	Checked	Unchecked	Unchecked
75		Unchecked	Unchecked	Unchecked	Unchecked	Unchecked

Record ID	What treatment(s) would you_0005	What treatment(s) would you_0006	What treatment(s) would you_0007	Since you selected other treatme	What do you feel is the prognosi	Which best describes the impact
22	Unchecked	Unchecked	Unchecked		Questionable	
126	Unchecked	Unchecked	Unchecked		Favorable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
58	Unchecked	Unchecked	Unchecked		Favorable	
92	Unchecked	Unchecked	Unchecked		Favorable	The CBCT provided the only information that aided in my ability to diagnose the case.
5	Unchecked	Unchecked	Unchecked		Questionable	
110	Unchecked	Unchecked	Unchecked		Favorable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
40	Unchecked	Unchecked	Unchecked		Favorable	
76	Unchecked	Unchecked	Unchecked		Favorable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
14	Unchecked	Unchecked	Unchecked		Questionable	
119	Unchecked	Unchecked	Unchecked		Favorable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
50	Unchecked	Unchecked	Unchecked		Questionable	
85	Checked	Unchecked	Unchecked		Favorable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
8	Unchecked	Unchecked	Unchecked		Questionable	
113	Unchecked	Unchecked	Unchecked		Questionable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
43	Unchecked	Unchecked	Unchecked		Favorable	
79	Unchecked	Unchecked	Unchecked		Favorable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
21	Unchecked	Unchecked	Unchecked		Questionable	
125	Unchecked	Unchecked	Unchecked		Favorable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
57	Unchecked	Unchecked	Unchecked		Favorable	
91	Unchecked	Unchecked	Unchecked		Favorable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
12	Unchecked	Unchecked	Unchecked		Favorable	
117	Unchecked	Unchecked	Unchecked		Favorable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
47	Unchecked	Unchecked	Unchecked		Favorable	
83	Checked	Unchecked	Unchecked		Favorable	The CBCT provided the only information that aided in my ability to diagnose the case.
132	Unchecked	Unchecked	Unchecked		Favorable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
98	Unchecked	Unchecked	Unchecked		Questionable	The CBCT had some effect on my understanding fo the case, but not significantly
29	Unchecked	Unchecked	Unchecked		Favorable	
65	Unchecked	Unchecked	Unchecked		Favorable	
25	Unchecked	Unchecked	Unchecked		Questionable	
129	Unchecked	Unchecked	Unchecked		Favorable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
61	Unchecked	Unchecked	Unchecked		Favorable	
95	Unchecked	Unchecked	Unchecked		Favorable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
2	Unchecked	Unchecked	Unchecked		Questionable	
107	Unchecked	Unchecked	Unchecked		Questionable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
37	Unchecked	Unchecked	Unchecked		Favorable	
73	Checked	Unchecked	Unchecked		Favorable	The CBCT provided the only information that aided in my ability to diagnose the case.
6	Unchecked	Checked	Unchecked		Unfavorable	
111	Unchecked	Unchecked	Unchecked		Unfavorable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
41	Checked	Unchecked	Unchecked		Unfavorable	
77	Unchecked	Checked	Unchecked		Favorable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
7	Checked	Unchecked	Unchecked		Unfavorable	
112	Unchecked	Unchecked	Unchecked		Questionable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
42	Unchecked	Unchecked	Unchecked		Favorable	
78	Checked	Unchecked	Unchecked		Favorable	The CBCT provided the only information that aided in my ability to diagnose the case.
1	Checked	Unchecked	Unchecked		Questionable	
106	Checked	Unchecked	Unchecked		Unfavorable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
36	Unchecked	Unchecked	Unchecked		Favorable	
72	Checked	Unchecked	Unchecked		Favorable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
10	Unchecked	Unchecked	Unchecked		Favorable	
115	Unchecked	Unchecked	Unchecked		Questionable	The CBCT provided the only information that aided in my ability to diagnose the case.
45	Unchecked	Unchecked	Unchecked		Favorable	
81	Unchecked	Checked	Unchecked		Favorable	The CBCT provided the only information that aided in my ability to diagnose the case.
33	Unchecked	Unchecked	Unchecked		Favorable	
34	Unchecked	Unchecked	Unchecked		Favorable	
136	Unchecked	Unchecked	Unchecked		Favorable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
137	Unchecked	Unchecked	Unchecked		Favorable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
69	Unchecked	Unchecked	Unchecked		Questionable	
70	Unchecked	Unchecked	Unchecked		Questionable	
102	Unchecked	Unchecked	Checked	refer for biopsy, possible cyst	Unfavorable	The CBCT provided the only information that aided in my ability to diagnose the case.
103	Unchecked	Unchecked	Checked	refer for biopsy, possible cyst	Unfavorable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
55	Checked	Unchecked	Unchecked		Favorable	
19	Unchecked	Unchecked	Unchecked		Questionable	
124	Unchecked	Unchecked	Unchecked		Favorable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
90	Unchecked	Checked	Unchecked		Favorable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
17	Unchecked	Unchecked	Unchecked		Questionable	
122	Unchecked	Unchecked	Unchecked		Favorable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
53	Unchecked	Checked	Unchecked		Favorable	
88	Unchecked	Checked	Unchecked		Favorable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
3	Unchecked	Unchecked	Unchecked		Questionable	
108	Unchecked	Unchecked	Unchecked		Questionable	The CBCT had some effect on my understanding fo the case, but not significantly
38	Unchecked	Unchecked	Unchecked		Questionable	
74	Unchecked	Checked	Unchecked		Favorable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
9	Unchecked	Unchecked	Unchecked		Questionable	
114	Checked	Unchecked	Unchecked		Unfavorable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
44	Checked	Unchecked	Unchecked		Favorable	
80	Checked	Unchecked	Unchecked		Favorable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
35	Unchecked	Unchecked	Unchecked		Questionable	
138	Unchecked	Unchecked	Unchecked		Favorable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
71	Unchecked	Unchecked	Unchecked		Favorable	
104	Unchecked	Unchecked	Unchecked		Favorable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
32	Unchecked	Unchecked	Unchecked		Favorable	
135	Unchecked	Unchecked	Unchecked		Favorable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
68	Unchecked	Unchecked	Unchecked		Questionable	
101	Unchecked	Unchecked	Unchecked		Favorable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
28	Unchecked	Unchecked	Unchecked		Favorable	
131	Unchecked	Unchecked	Unchecked		Favorable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
64	Unchecked	Unchecked	Unchecked		Favorable	
97	Unchecked	Unchecked	Unchecked		Favorable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
31	Unchecked	Unchecked	Unchecked		Favorable	
134	Unchecked	Unchecked	Unchecked		Favorable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
67	Unchecked	Unchecked	Unchecked		Favorable	
100	Unchecked	Unchecked	Unchecked		Favorable	The CBCT had some effect on my understanding fo the case, but not significantly
30	Unchecked	Unchecked	Unchecked		Questionable	
133	Unchecked	Unchecked	Unchecked		Favorable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
66	Unchecked	Unchecked	Unchecked		Favorable	
99	Unchecked	Unchecked	Unchecked		Favorable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
52	Unchecked	Unchecked	Unchecked		Favorable	
16	Unchecked	Unchecked	Unchecked		Questionable	
87	Unchecked	Unchecked	Unchecked		Favorable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
121	Unchecked	Unchecked	Unchecked		Favorable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
13	Unchecked	Unchecked	Unchecked		Questionable	
118	Unchecked	Unchecked	Unchecked		Questionable	The CBCT had some effect on my understanding fo the case, but not significantly
48	Unchecked	Unchecked	Unchecked		Favorable	
84	Unchecked	Unchecked	Unchecked		Favorable	The CBCT had some effect on my understanding fo the case, but not significantly
18	Unchecked	Unchecked	Unchecked		Questionable	
123	Unchecked	Unchecked	Unchecked		Favorable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
54	Unchecked	Unchecked	Unchecked		Questionable	
89	Unchecked	Unchecked	Unchecked		Questionable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
15	Unchecked	Unchecked	Unchecked		Questionable	
120	Unchecked	Unchecked	Unchecked		Favorable	The CBCT provided the only information that aided in my ability to diagnose the case.
51	Checked	Unchecked	Unchecked		Favorable	
86	Checked	Unchecked	Unchecked		Favorable	The CBCT provided the only information that aided in my ability to diagnose the case.
11	Unchecked	Unchecked	Unchecked		Unfavorable	
116	Unchecked	Unchecked	Unchecked		Questionable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
46	Unchecked	Checked	Unchecked		Favorable	
82	Checked	Unchecked	Unchecked		Favorable	The CBCT provided the only information that aided in my ability to diagnose the case.
59	Unchecked	Unchecked	Unchecked		Favorable	
4	Unchecked	Checked	Unchecked		Unfavorable	
109	Checked	Unchecked	Unchecked		Unfavorable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.
39	Unchecked	Unchecked	Unchecked		Questionable	
75	Checked	Unchecked	Unchecked		Favorable	The CBCT had a significant effect on my understanding of the case that improved diagnostic accuracy.

Record ID	Comments	Complete?
22		Complete
126	Very slight widening of distal root (distal aspect)	Complete
58		Complete
92		Complete
5		Complete
110		Complete
40		Complete
76		Complete
14		Complete
119		Complete
50		Complete
85		Complete
8		Complete
113		Complete
43		Complete
79		Complete
21		Complete
125	If no symptoms, then don't recommend treatment	Complete
57		Complete
91		Complete
12		Complete
117		Complete
47		Complete
83		Complete
132		Complete
98		Complete
29		Complete
65		Complete
25		Complete
129		Complete
61		Complete
95		Complete
2		Complete
107		Complete
37		Complete
73		Complete
6		Complete
111	guarded re-treatment prognosis	Complete
41		Complete
77		Complete
7		Complete
112		Complete
42		Complete
78		Complete
1		Complete
106	suspect crack or strip perforation	Complete
36		Complete
72		Complete
10		Complete
115	Resorption repair probably has guarded prognosis - recommend observation	Complete
45		Complete
81		Complete
33		Complete
34		Complete
136	Tooth #10.	Complete
137	Tooth #11.	Complete
69		Complete
70		Complete
102		Complete
103		Complete
55		Complete
19		Complete
124	Cbct appears to have been taken 2 weeks after 2D images of re-treatment 9/12/11	Complete
90		Complete
17		Complete
122	Furcation finding.	Complete
53		Complete
88		Complete
3		Complete
108		Complete
38		Complete
74		Complete
9		Complete
114	Poor treatment prognosis. Healing with extraction expected.	Complete
44		Complete
80		Complete
35		Complete
138		Complete
71		Complete
104		Complete
32		Complete
135		Complete
68		Complete
101		Complete
28		Complete
131		Complete
64		Complete
97		Complete
31		Complete
134		Complete
67		Complete
100		Complete
30		Complete
133		Complete
66		Complete
99		Complete
52		Complete
16		Complete
87		Complete
121		Complete
13		Complete
118		Complete
48		Complete
84		Complete
18		Complete
123		Complete
54		Complete
89		Complete
15		Complete
120		Complete
51		Complete
86		Complete
11		Complete
116	Poor surgical prognosis due to extent of buccal and lingual bone loss and lack of crest of bone	Complete
46		Complete
82		Complete
59		Complete
4		Complete
109	Attempts to retain the tooth would probably unfavorable - healing after extraction is favorable	Complete
39		Complete
75		Complete

Vita

Dr. McKay Packer was born on June 19, 1976, in Salt Lake City Utah. Dr. Packer received his Bachelor of Science in Medical Biology from the University of Utah in 2003. He received his Doctor of Dental Surgery in 2006 from Virginia Commonwealth University, School of Dentistry. Dr. Packer owned his own general dentistry practice for 8 years. He then enrolled in the Advanced Specialty Program in Endodontics at Virginia Commonwealth University, School of Dentistry. Dr. Packer is a member of the AAE and ADA and will enter private practice in Fort Wayne, Indiana. He will graduate from Virginia Commonwealth University with a Master of Science in Dentistry and a Certificate in Endodontics.