



VCU

Virginia Commonwealth University
VCU Scholars Compass

Theses and Dissertations

Graduate School

2005

The Predictive Ability of Specific Questions Related to Symptoms in the Diagnosis of Endodontic Disease

Boyd Aaron Vaughn
Virginia Commonwealth University

Follow this and additional works at: <https://scholarscompass.vcu.edu/etd>



Part of the [Endodontics and Endodontology Commons](#)

© The Author

Downloaded from

<https://scholarscompass.vcu.edu/etd/1304>

This Thesis is brought to you for free and open access by the Graduate School at VCU Scholars Compass. It has been accepted for inclusion in Theses and Dissertations by an authorized administrator of VCU Scholars Compass. For more information, please contact libcompass@vcu.edu.

Department of Endodontics, School of Dentistry
Virginia Commonwealth University

This is to certify that the thesis prepared by B. Aaron Vaughn entitled THE PREDICTIVE ABILITY OF SPECIFIC QUESTIONS RELATED TO SYMPTOMS IN THE DIAGNOSIS OF ENDODONTIC DISEASE has been approved by his or her committee as satisfactory completion of the thesis or dissertation requirement for the degree of Master of Science

B. Ellen Byrne, D.D.S., PhD., Assistant Dean of Academic Affairs, School of Dentistry

B. Ellen Byrne, D.D.S., PhD., Assistant Dean of Academic Affairs, School of Dentistry

Russel E. Bogacki, D.D.S., MS., Department of General Practice, School of Dentistry

James R. Lance, D.D.S., Department of Endodontics, School of Dentistry

Frederick R. Liewehr, D.D.S., M.S., Chair, Department of Endodontics, School of Dentistry

Laurie Carter, D.D.S., Ph.D., Director of Advanced Dental Education, School of Dentistry

Dr. F. Douglas Boudinot, Dean of the School of Graduate Studies

April 29, 2005

© B. Aaron Vaughn 2005

All Rights Reserved

**THE PREDICTIVE ABILITY OF SPECIFIC QUESTIONS RELATED TO
SYMPTOMS IN THE DIAGNOSIS OF ENDODONTIC DISEASE**

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

by

B. AARON VAUGHN
D.D.S., University of Texas H.S.C. at San Antonio, 2001

Director: B. ELLEN BYRNE, D.D.S., PH.D.
INTERIM CHAIR, DEPARTMENT OF ENDODONTICS

Virginia Commonwealth University
Richmond, Virginia
June 2005

Acknowledgement

I would like to thank the VCU School of Dentistry Alexander Fellowship and the AAE Grant Foundation for their direct and indirect financial support. I would also like to thank Dr.'s Todd Mellin, Ellen Oertel, and Priscilla Yeung for their help in collecting the data for this project, Dr. James Lance for his editing skills, and my wife Alyson for her support.

Table of Contents

	Page
Acknowledgements.....	ii
List of Tables	iv
List of Figures.....	v
Chapters	
1 Background.....	1
2 Methods and Materials.....	5
3 Statistical Analysis.....	8
4 Results.....	9
5 Discussion.....	10
References.....	16

List of Tables

	Page
Table 1: Response Frequencies for Prevalence Questions.	19
Table 2: Relationships Between Individual Questions and Endodontic Disease.	20

List of Figures

	Page
Figure 1: Survey Questions related to Pain Experience.....	21
Figure 2: Clinical Examination Data Collection Form.....	22

Abstract

THE PREDICTIVE ABILITY OF SPECIFIC QUESTIONS RELATED TO SYMPTOMS IN THE DIAGNOSIS OF ENDODONTIC DISEASE

By B. Aaron Vaughn, D.D.S.

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

Virginia Commonwealth University, 2005

Major Director: B. Ellen Byrne, D.D.S., Ph.D.
Department of Endodontics

The purpose of this study was to test the predictive ability of specific questions in diagnosis of pulpal and periradicular disease in a dental school population. 210 patients were recruited to fill out a questionnaire, and undergo a clinical examination for pulpal and/or periradicular disease.

The Questionnaire asked if the patient had in the last 6 months: 1. a toothache that kept them up at night 2. a toothache that required pain killers 3. facial swelling caused by a tooth 4. injury to any teeth 5. a broken tooth 6. a tooth darker in color than the surrounding teeth 7. a bump, pimple, or boil on the gums. 8. a toothache after eating or drinking

something hot or cold 9. repeated sharp pain in the same area while chewing 10. A toothache or facial swelling that caused them to visit an emergency room.

Examiners were blinded to the responses on the questionnaire and then, based on the clinical examination and testing, determined the presence or absence of endodontic disease. The data was analyzed using univariate logistic regression models.

Results: The most predictive questions were #1 and #2 (p-value <0.001). Only question #10 was not statistically significant.

Conclusion: Patients with pain that wakes them at night or that requires analgesics were greater than 3 times more likely to have endodontic disease at the time of examination.

Background

Prevalence is the number of existing cases of disease at a particular point in time (1). A search of current literature on the prevalence of pulpal and periradicular disease, which usually results in a toothache, has shown that there is little solid information available on the prevalence of this disease in the United States. This is both surprising and worrisome, because without information on the prevalence of this often-debilitating disease, there is poor guidance for decisions on the number of endodontic residents to train and faculty to hire, in addition we do not know where to direct our public health efforts.

The pain caused by pulpal and periradicular disease can have a significant impact on the economic well being of a community, and the ability of individuals to work at home, school, and on the job. Twenty-two percent of adults reported some form of oral-facial pain in the past 6 months according to the Executive Summary of the Surgeon General's report published in 2000 (2). The report also indicates that there are significant disparities in the distribution of many oral diseases in some groups as classified by gender, age, race, and income. For example, poor children are twice as likely to suffer from dental caries as their affluent peers, and they are also more likely to go without treatment.

There are many difficulties in trying to measure the prevalence of this disease by performing clinical examinations in a community. The major difficulties are a skewed

sample and cost. Any sample of the population, at the mall, grocery store, or school, will be skewed. A measure of prevalence will be obtained, but only for the population of people who go to that particular type of mall, grocery store, or school, and at a significant cost. The value of a survey tool to measure the prevalence of this disease is that it more accurately captures the prevalence of pulpal and periradicular disease in a community at a lower cost. If a survey tool could be developed that could identify people at greater risk for endodontic disease, than policy decisions could be implemented to better meet the needs in the community.

In order to test these hypotheses, the project presented in this paper accomplished the following specific aims:

1. Develop a survey tool that can be used as a measure of the prevalence of pulpal and periradicular disease.
2. Test the developed survey tool on a population of dental school patients.
3. Compare specific questions which are most predictive of endodontic disease.

The majority of studies on the prevalence of pulpal and periradicular disease were performed outside of the United States. Nevertheless, the information provided by these studies is useful. In a Dutch population of 184 adults, it was estimated that 44.6% of the patient sample had at least one tooth with radiographic signs of periapical pathology (3). Unfortunately, the results of this study do not reflect the general Dutch population because the study population was composed of patients referred to the Department of Oral Surgery of an Amsterdam hospital for treatment of toothache.

A study in Norway specifically examined urban adults and found that 30% of the study subjects needed endodontic treatment (4). The sample is skewed by the extensive treatment history and high caries risk of the study population, which limits the applicability of their finding on the prevalence of endodontic disease. Again, this study had a population sample that provided little useful information on the prevalence of pulpal and periradicular disease in the general population.

Very few studies of the prevalence of endodontic disease have been performed in the United States. In 1995, a study was performed at the University of Connecticut that examined the quality and prevalence of endodontic treatment (5). The study focused on the quality of endodontic treatment, and treated the tooth as the unit of observation instead of the patient. Most other U.S. studies also examined the quality of endodontic treatment, and secondarily looked at prevalence, not at the individual level, but at the tooth level. For example, 10 patients had 200 teeth, of those teeth, 20% had evidence of endodontic disease or treatment. Overall, the literature implies that there has not yet been a true study of the prevalence of endodontic disease at the individual level in a general population of Americans.

Endodontic diagnosis and treatment comprise an important part of a complete dental treatment plan, yet most epidemiological studies, such as NHANES III, which concentrated on the incidence of caries and periodontal diseases, have overlooked the need to assess the prevalence of pulpal and periradicular disease. This information is essential in assessing the demand for services, the need for specialists, and the number of programs and educators needed.

This study resulted in the development of a survey tool, which predicts the prevalence of pulpal and periradicular disease among population groups categorized by age, gender, race, and income. The survey tool will be used in a future study of the prevalence of pulpal and periradicular disease in the Greater Richmond Area of Virginia. In addition to being a priority of the AAE, this project also contributes to stated needs in the Surgeon General's Report: *Oral Health in America*. The report calls for accelerated growth in understanding the distribution of disease, the building of the proper infrastructure for providing care, and the removal of barriers between people and oral health services. This study will contribute most to the first stated need, an understanding of the distribution of disease, providing the vital information needed to fill the other needs.

Methods and Materials

A survey tool was designed to gather information from respondents on their demographics, their tooth pain experiences during the past 6 months, and their treatment experiences for tooth pain throughout their lifetime. The survey is presented in Figure 1. The demographic questions were modeled after similar questions found in the Brief Risk Factor Surveillance Survey, which were developed by Centers for Disease Control.

Potential patients of the dental school predoctoral clinic must attend a screening visit to determine if their care can appropriately be met by third and fourth year dental students, or if they should be referred to clinicians with more experience and training. Study subjects were recruited from this group of patients after they were screened, regardless if they were accepted into the predoctoral clinic or not. Patients who consented to participation were given the survey presented in Figure 1. They were given as much time as they needed to answer the survey questions. To avoid bias, they did not receive assistance with interpreting the questions, but they did receive assistance reading the survey if necessary. After completion of the survey, the surveys were reviewed to ensure completeness, and then the study subjects were sent for clinical examination in an area separate from where the survey was administered. Clinical examiners did not see the study subject's responses to the survey.

Residents in the graduate endodontic program performed all of the clinical examinations. The primary goal of the clinical examination was to determine whether or not the patient had pulpal and/or periradicular disease. The clinical examiners received training on how to perform the examination before the study started, and received reviews repeatedly throughout the study. After each day of clinical examinations, meetings were held to discuss difficulties and ensure consistency with examination techniques. During these meetings, clinical examination data were reviewed to ensure completeness and accuracy. The clinical examination data form is presented in Figure 2.

When the study subjects presented for clinical examination, the examiner would look for suspicious teeth by reviewing the panoramic radiograph the patient had at screening, asking general questions about past and present tooth pain, and by percussion testing all teeth. Therefore, suspicious teeth were defined as teeth that had one or more of the following:

1. evidence of periapical pathology on the panoramic radiograph;
2. current pain or a history of pain;
3. pain on percussion.

The percussion test was performed as described by Walton and Torabinejad (6). The test for suspicious teeth was a screening exam. Suspicious teeth were then examined more carefully to determine a good clinical diagnosis.

Data were collected on all suspicious teeth to establish as accurate a clinical diagnosis as possible. When possible and appropriate, the following tests were performed: electric pulp testing, palpation, percussion, and thermal testing. Periapical

radiographs were taken of all suspicious teeth to check for previous root canal therapy and evidence of widened periapical periodontal ligaments or periapical radiolucencies. Teeth were examined for cracks or fractures, and surrounding tissues were examined for sinus tracks and swelling. The patient's pain experiences were also evaluated. Based on all of these signs and symptoms, a clinical diagnosis was assigned to each suspicious tooth. Each suspicious tooth received a pulpal diagnosis and a periapical diagnosis. The pulpal diagnosis could have been normal, reversible pulpitis, irreversible pulpitis, or necrosis. The periapical diagnosis could have been normal, chronic apical periodontitis, or acute apical periodontitis. To ensure accuracy, the first 50 patients were examined twice with each examiner collecting data independently. Inconsistencies were evaluated and resolved in study meetings. This process produced a standardized and consistent clinical examination for pulpal and periradicular disease.

A pulp was classified as normal if it responded similarly to control teeth during vitality testing with cold (Endo-Ice) or EPT. Likewise, the periapical tissues were classified as normal if there was no difference to control upon percussion, palpation. Neither the pulp nor the periapex was deemed normal if the examiner interpreted the radiograph as showing a periapical radiolucency.

Statistical Analysis

The data collected from these 210 patients was analyzed by comparing the clinical diagnosis with the yes/no answers on the questionnaire. Odds ratios for the presence of disease were calculated for each individual question. The best question was determined using multiple logistic regression modeling. The dependent variable was whether or not the respondent has endodontic disease. The unit of measure was the individual respondent to the questionnaire. The outcome of interest is whether or not the respondent had endodontic disease, as determined by the clinical examination.

Results

A total of 210 study subjects completed the survey and clinical examination. The average age of the study subjects was 47, with youngest being 18 and the oldest being 83. A total of 63% of the study subjects were female. The majority of study subjects had an income between \$20,000 and \$75,000, and about 10% of the study subjects had an income below \$10,000. Race was grouped into either white or nonwhite, because very few study subjects reported being other than white or black. The total percentage of nonwhite study subjects was 37%.

The most predictive questions were #1 and #2 (p-value <0.001). Only question #10 was not statistically significant. The overall prevalence of endodontic disease was 40%.

Table 1 presents the response frequencies.

Table 2 presents the odds ratios, confidence intervals, and p-values for the prevalence questions.

Discussion

Diagnosis can be the most challenging part of patient care in endodontics. It can be more difficult when the patient no longer has signs or symptoms of an endodontic problem. The history of a patient's pain experience plays a greater role in making an accurate diagnosis in these cases. This information is often gathered by a questionnaire or in an interview. We hypothesized that specific questions presented to the patient could be more helpful than others in coming to an endodontic diagnosis.

Other authors have looked at the possibility that symptoms could lead a clinician to a diagnosis. Klausen et al. looked at 74 patients with acute dental pain at the time of examination and found that a diagnosis of irreversible pulpitis was associated with temperature sensitivity (7). They reported an odds ratio of 9.0 compared to pulpal necrosis with apical periodontitis. They also found an association between periapical disease and tenderness to chewing with an odds ratio of 6.9 compared to pulpitis alone. Cohen, in *Pathways of the Pulp*, states that spontaneous pain "frequently signals irreversible pulpitis (8)." Over time, pain from endodontic disease can be cyclic. In times of an absence of symptoms, one questions how much weight to give to the history of the pain experience.

In one of the classic studies in the endodontic literature, Selzer, Bender and Ziontz showed that clinical symptoms did not correlate to the histologic diagnosis of the pulp (9). In more recent research, there has been data suggesting such a relationship. In one study, B and T lymphocytes were enumerated in dental pulps clinically diagnosed as

having irreversible or reversible pulpitis. It was found that increases in cell counts correlated to increases in severity of clinical symptoms. (10) In the early 60's, Mitchell and Tarplee (11) followed by Hasler and Mitchell (12) found that 90% of patients requesting emergency treatment for relief of pain have pulpal or periapical disease, and therefore are candidates for endodontic therapy.

In a review article in 2000, I.B. Bender reported that 80% of patients who give a previous history of pain manifest histopathologic evidence of irreversible pulpal disease (13). In another publication he states that when mild to moderate pain is present with a previous history of pain in the aching tooth, the pulp is always diseased and requires endodontic therapy or extraction (14). Dr. John Ingle in his text, *Endodontics*, stated that if a patient complains of pain when lying down in the evening, it is indicative of pulpal disease (15).

In this study, the most predictive questions were #1 and #2 (p-value <0.001). Only question #10 was not statistically significant. The overall prevalence of endodontic disease was 40%.

It was interesting that lingering pain to hot or cold was not one of the most predictive questions. Some clinicians feel that this finding during the examination is pathognomonic for irreversible pulpitis. One possible explanation of the result is that there is room for interpretation of the word "lingering". It was observed that the best two questions asked the patient about behavior – pain that hindered sleep, and pain requiring pain medication. We hypothesize that a patient is better able to recall events that alter

behavior. Perhaps if the other questions were reworded to involve behavior, a better result could be obtained. For example, question #7 regarding thermal sensitivity could be changed to: “have you had to avoid hot liquids due to pain in a tooth?”

The question regarding a broken tooth was more valuable than expected. This is likely due to the patient’s perception when a restoration is lost. In reality, the recurrent caries most likely progressed to pulp, and the patient’s only clue to having a problem is the missing filling which was perceived as part of the tooth.

This data could be useful to the clinician in several ways. Questions of greater predictive value have been identified to help gather information important in formulating a clinical diagnosis. A receptionist can implement these questions to better appoint patients for either evaluation or for treatment, thus increasing the practice efficiency. A general practitioner can use this knowledge to help identify patients that would likely be served better by immediate referral to an endodontist.

The results of this study identified questions that could also be used in epidemiological research. The most valuable questions identified in this study could help measure the relative level of disease in a targeted population. For example, the CDC’s Behavioral Risk Factor Surveillance System (BRFSS) tracks health risks throughout the United States. (<http://www.cdc.gov/brfss>)

In 1993, Lipton et al did a large telephone survey of 46,000 people in the US. The respondents reported a toothache in the last 6 months 22% of the time (16). This gives an idea of the amount of people who may benefit from endodontic therapy; however this estimate might be made more accurately with additional questioning.

Callison created two Dental Health Risk Assessment questionnaires for the US Air force in order to identify soldiers who might have a dental emergency within 1 year (17). Yes/no answers to seven questions on the survey were compared to the results of a dental examination. Four of the DHRA questions were very similar to the questions in our study, namely questions regarding history of oral pain, sensitivity to hot or cold, intraoral swelling, and fractured teeth. Callison's study found that the survey tools used were not predictive in identifying patients who may be at risk for a dental emergency in the next year. The first DHRA survey asked about a history of constant pain in the last year. There was some error introduced into the experiment due to patients who had pulpal and/or periapical disease, but also had successful treatment within the last year. These patients would answer the questionnaire in a manner similar to a person with endodontic disease, yet likely none would be found on the exam unless there was a periapical radiolucency. In the later case, a false positive may result as a healing lesion could be mistaken for asymptomatic disease. Our study also included this type of error, but to a lesser degree as the history only included the previous 6 months.

Callison then modified the first questionnaire to specify symptoms that had been treated by a dentist. This improved the predictability of the survey, but not by much. The false positive rate was reduced from 24% to less than 12%. The true positive rate increased from 42% to 46%. In our study, our results showed odds ratios for each individual question, and found a greater than 3 fold increase of risk of having endodontic disease at the time of examination for questions #1 and #2. It was not specified in

Callison's report if the individuals categorized "at risk" had endodontic disease at the time of the examination.

In our study, we chose to use patients who came into the dental school to minimize bias. It allowed us to sample a group as close to the general population as feasible and still remain our research budget. An interesting study would be to repeat this model looking for questions that were predictive for specific diagnoses such as irreversible pulpitis, necrosis, and acute apical periodontitis. Also, excluding the patients who had treatment of endodontic disease during the time period studied would improve the accuracy of the results. It may be of value to separate the question of thermal sensitivity into two questions. Then questions of sensitivity to hot and cold could be compared separately. These changes likely would show a stronger correlation between past symptoms and the presence of endodontic disease.

In conclusion, patients with a history of odontalgia requiring an analgesic were 3.41 times more likely to have pulpal and/or periradicular disease at the time of examination. A positive response to the question regarding "a toothache that required pain killers" was as helpful to the diagnostician as "pain that kept you awake at night".

Literature Cited

Literature Cited

1. Woodward M (1999) *Epidemiology Study Design and Data Analysis* Chapter 1 pp 11 New York Chapman & Hall/CRC.
2. US Department of Health and Human Services. *Oral Health in America: A Report of the Surgeon General-- Executive Summary*. Rockville, MD: US Department of Health and Human Services, National Institute of Dental and Craniofacial Research, National Institutes of Health, 2000.
3. De Cleen MJH Schuurs AHB Wesselink PR Wu MK (1993) Periapical status and prevalence of endodontic treatment in an adult Dutch population *International Endodontic Journal* **26** 112-119.
4. Eriksen HM Bjertness E Orstavik D (1988) Prevalence and quality of endodontic treatment in an urban adult population in Norway *Endod Dent Traumatol* **4** 122-126
5. Buckley M Spangberg LSW (1995) The prevalence and technical quality of endodontic treatment in an American subpopulation *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* **79**: 92-100

6. Walton RE Torabinejad M (2002) *Principle and Practice of Endodontics, 3rd ed.*
Chapter 4 - Diagnosis and Treatment Planning pp 49-70
7. Klausen B, Helbo M, Dabelsteen E. A Differential diagnostic approach to the symptomology of acute dental pain. *Oral Surg Oral Med Oral Pathol* 1985; 59:297-301.
8. Cohen S. *Pathways of the Pulp, 1st ed.* St. Louis: C.V. Mosby Co., 1976; 6-7.
9. Seltzer S, Bender IB, Ziontz M. The dynamics of pulp inflammation: correlations between diagnostic data and actual histologic findings in the pulp. Part I. *Oral Surg* 1963;16:846-71.
10. Hahn CL, Falkler WA Jr, Siegel MA. A study of T and B cells in pulpal pathosis. *J Endod.* 1989;15:20-26.
11. Mitchell DF, Tarplee RE. Painful pulpitis: a clinical and microscopic study. *Oral Surg* 1960; 13:1360 -1370.

12. Hasler JF, Mitchell DF. Analysis of 1628 cases of odontalgia: a corroborative study. *J Indianapolis Dist Dent Soc* 1963; 17:23.
13. Bender IB. Pulpal pain diagnosis - a review. *J Endod* 2000; 3:175-9.
14. Bender IB. Reversible and irreversible painful pulpitis: diagnosis and treatment. *Aust Endod J* 2000; 26:10-4.
15. Ingle J. *Endodontics*, 1st ed. Philadelphia: Lea & Febiger, 1965; 339.
16. Lipton JA, Ship JA, Larach-Robinson D. *J Am Dent Assoc.* 1993 Oct;124(10):115-21.
17. Callison GM. Is Dental Health Risk Assessment Predictive of Dental Health? *Mil Med.* 2005; 170:26-30.

Table 1: Response Frequencies for Prevalence Questions

Question	% of Yes Responses
In the past 6 months, have you had a toothache that kept you awake at night?	30.5
In the past 6 months, have you had to take analgesics (pain killers) for a toothache?	33.3
In the past 6 months, have you had a facial swelling that was caused by a tooth?	14.4
In the past 6 months, have you injured any of your teeth?	20.0
In the past 6 months, have you broken a tooth?	31.4
In the past 6 months, have you noticed any of your teeth turning darker than the teeth around them?	17.6
In the past 6 months, have you noticed a bump, pimple, or boil on your gums?	16.3
In the past 6 months, have you noticed that if you eat or drink something hot or cold, you get a toothache that lasts for a few minutes?	44.3
In the past 6 months, have you had repeated sharp pain in the same area while chewing?	28.1
In the past 6 months, have you visited an emergency room or emergency center for treatment of a toothache or facial swelling related to a tooth?	15.2

Table 2: Relationships Between Individual Questions and Endodontic Disease.

	Odds Ratio (OR)	95% CI	P-Value
Question #1			
No response	1.0		
Yes response	3.39	1.84-6.24	<0.001
Question #2			
No response	1.0		
Yes response	3.41	1.88-6.21	<0.001
Question #3			
No response	1.0		
Yes response	2.29	1.05-5.02	0.038
Question #4			
No response	1.0		
Yes response	2.86	1.43-5.73	0.003
Question #5			
No response	1.0		
Yes response	2.59	1.42-4.73	0.002
Question #6			
No response	1.0		
Yes response	2.11	1.03-4.32	<0.042
Question #7			
No response	1.0		
Yes response	2.25	1.07-4.74	<0.032
Question #8			
No response	1.0		
Yes response	2.20	1.25-3.88	<0.006
Question #9			
No response	1.0		
Yes response	2.39	1.30-4.42	<0.005
Question #10			
No response	1.0		
Yes response	1.46	0.69-3.12	<0.326

Figure 1: Survey Questions related to Pain Experience

Section:	Question:	Please write or circle your answer.
Prevalence	1. In the past 6 months, have you had a toothache that kept you awake at night?	y / n
	2. In the past 6 months, have you had to take analgesics (pain killers) for a toothache?	y / n
	3. In the past 6 months, have you had a facial swelling that was caused by a tooth?	y / n
	4. In the past 6 months, have you injured any of your teeth?	y / n
	5. In the past 6 months, have you broken a tooth?	y / n
	6. In the past 6 months, have you noticed any of your teeth turning darker than the teeth around them?	y / n
	7. In the past 6 months, have you noticed a bump, pimple, or boil on your gums?	y / n
	8. In the past 6 months, have you noticed that if you eat or drink something hot or cold, you get a toothache that lasts for a few minutes?	y / n
	9. In the past 6 months, have you had repeated sharp pain in the same area while chewing?	y / n
	10. In the past 6 months, have you visited an emergency room or emergency center for treatment of a toothache or facial swelling related to a tooth?	y / n

Figure 2: Clinical Examination Data Collection Form

Patient Name:		Chart Number:			
Examiner:		Date:			
	Tooth Number				
	#	#	#	#	#
Test					
EPT					
Palpation					
Percussion					
Cold					
Warm					
Sinus Tract					
Pain					
Previous RCT					
Periapical Radiolucency					
Swelling Associated					
Crack or Fracture					
Diagnosis					
Standardization Information:					
EPT	1 - 80				* Missing Values – leave blank or write reason
Palpation	0 - no	1 - yes			
Percussion	0 - no	1 - yes			
Thermal Stimulus	0 - none	1 - short	2 - continuous		
Sinus Tract	0 - no	1 - yes			
Pain	0 - none	1 - spontaneous	2 - diffuse	3 - localized	
Previous RCT	0 - no	1 - yes			
Periapical Radiolucency	0 - normal	1 - thickened PDL	2 - apical radiolucency		
Swelling	0 - no	1 - yes			
Crack or Fracture	0 - no	1 - yes			
Does this patient have pulpal and/or periradicular disease?					
			Yes	No	