THE UTILIZATION OF CASE DIFFICULTY ASSESSMENT WHEN DETERMINING ENDODONTIC REFERRAL

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ABSTRACT

MARCUS C. CURRY, DDS: The utilization of case difficulty assessment when determining endodontic referral (Under the direction of Eric M. Rivera, DDS, MS; Daniel J. Caplan, DDS, Phd; Fabricio B. Teixeira, DDS, MS, PhD)

The purpose of this study was to address the effectiveness of the American Association of Endodontists Case Difficulty Assessment Form (AAECDAF) to determine whether a dentist would treat or refer an endodontic case. Specifically, our aims were to a. determine if practicing dentists utilized the AAECDAF to rate the difficulty of each case, and b. determine the practicing dentists' perceived importance of the conditions present on the AAECDAF. 1,434 dentists practicing in the USA completed a confidential, self-administered electronic survey via a secure website. 9.5% of respondents utilized the AAECDAF when determining the difficulty of an endodontic case. 30.5% of the conditions present on the AAECDAF were deemed to be mostly to critically important to practicing dentists when making a determination to treat or refer an endodontic case. However, those deemed to be critically important were previous endodontic caces with complications, difficult diagnosis, resorption, and canals not visible on radiograph.

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LIST OF ABBREVIATIONS

Abbreviation

AAE	American Association of Endodontists
AAECDAF	American Association of Endodontists Case Difficulty Assessment Form
ADA	American Dental Association
DETI	Dutch Endodontic Treatment Index
ETC	Endodontic Treatment Classification
НМО	Health Maintenance Organization
RIOTN	Restorative Index of Treatment Need
UCSF	University of California at San Francisco
UNC	University of North Carolina
US	United States

CHAPTER 1 THE UTILIZATION OF CASE DIFFICULTY ASSESSMENT WHEN DETERMINING ENDODONTIC REFERRAL

Abstract

The purpose of this study was to address the effectiveness of the American Association of Endodontists Case Difficulty Assessment Form (AAECDAF) to determine whether a dentist would treat or refer an endodontic case. Specifically, our aims were to a. determine if practicing dentists utilized the AAECDAF to rate the difficulty of each case, and b. determine the practicing dentists' perceived importance of the conditions present on the AAECDAF. The null hypothesis was that there was no difference in the percentage of dentists who utilized the AAECDAF and those who did not. An additional hypothesis was that there was no difference between the number of conditions perceived to be important and the number of conditions perceived not to be important. 1,434 dentists practicing in the United States completed a confidential, selfadministered electronic survey via a secure website. 9.5% of the dentists surveyed utilized the AAECDAF when determining the difficulty of an endodontic case. 30.5% of the conditions present on the AAECDAF were deemed to be mostly to critically important to practicing dentists when making a determination to treat or refer an endodontic case. 83.5% of practicing dentists performed endodontic treatment. 96.2% of participants referred patients to an endodontist. Several conditions present on the AAECDAF were deemed to be critically important when determining to refer: previous endodontic access with complications, confusing and complex signs and symptoms, resorption, and canals not visible on radiograph.

Conclusion: The majority of dentists who participated in the current study did not utilize the AAE Case Difficulty Assessment Form when determining whether to treat or refer an endodontic case. Furthermore, participating dentists perceived some conditions present on the AAE Case Difficulty Assessment Form to be mostly to critically important.

Introduction

According to the American Dental Association (ADA) 1999 Survey of Dental Services Rendered, 14,054,200 root canal therapy procedures were performed in 1998. General dentists completed 77% of these endodontic procedures. Endodontists rendered 22% of these root canal treatments. With the enormous amounts of endodontic procedures completed on a yearly basis, knowledge regarding diagnosis and treatment are needed by those who provide treatment. The treating dentist must utilize his/her knowledge of diagnosis, root canal morphology, and experience to determine if endodontic referral is indicated.

Another study has reported that 20% of general dentists refer all endodontic cases to endodontists, and another 20% never refer endodontic cases (9). The remaining 60% of general dentists selectively pick and choose what cases to treat and to refer (9) (Figure 1). The objective of both the general dentist and the endodontist should be to provide the patient with the highest quality, most competent endodontic care. In order to provide the highest quality, and most competent endodontic care, practitioners need a method to determine when to refer and when to treat. The endodontic referral process plays a vital role during the diagnostic phase of treatment. The decision to treat or refer has been a topic among practitioners for years.

In 1992, Rosenburg and Goodis from the University of California at San Francisco (UCSF) published an article in the Journal of the American Dental Association discussing the topic of endodontic referral (29). In this article, case selection was expounded upon, and defined as a systematic means of assessing cases for the general dental practitioner in an effort to avoid a variety of treatment mishaps. The UCSF Endodontic Case Selection provided a means for rating and determining the complexity of each endodontic case. Each consideration was categorized as uncomplicated, moderately complicated, or complicated. Based on the result of the categorization, a general practitioner could determine whether a case should be referred.

The Canadian Academy of Endodontics (Figure 2) formulated a case difficulty assessment form in 1998. This form consists of thirteen conditions that examine different aspects of the patient, tooth, and dental history. Each condition present on the list is categorized in one of three risk groups. These groups are average risk, high risk, and very high risk. Each group is assigned a value. Those conditions present in the average risks have a value of 1 unit. High-risk conditions are valued at 2 units, and those in very high-risk conditions have a value of 5 units. Practitioners are advised to systematically go through the form and check all conditions that apply to the patient and/or tooth being treated. Once all conditions have been evaluated, the values of all applicable conditions are summed. A total sum of 15 to 17 units, the case difficulty assessment is deemed to be Class I. Class II difficulty assessment is given to cases that range from 18 to 25 units. Any sum that exceeds twenty-five units gets placed in the Class III difficulty assessment group. The case difficulty assessment form affords the practitioner the opportunity to assess difficulty and determine whether each case is within his/her ability level.

The American Association of Endodontists (AAE), in 1999 has formulated a case difficulty assessment form. The AAE has since release a revised version in 2006 (Figure 3), to assist practitioners in determining the complexity of each case called the AAE Case Assessment Difficulty Form. Each version of the form utilizes the same method to systematically access case difficulty. However, the revised version does not evaluate the restorability of the tooth in question. The AAE Case Difficulty Assessment Form was introduced to assist in case selection in an educational setting (Figure 4). The AAE categorized each condition on the AAECDAF a point value. Those conditions present in the minimal difficulty were assigned a value of 1 point, moderate difficulty a value of 2 points. Furthermore, the conditions located in the high difficulty column were given a point value of 5. At the completion of the evaluation of each case, the sum of the point value of all conditions applicable compared to the recommendations given by the AAE. Based on the numerical value, dental students are able to determine whether the case is to be treated or referred. No research of the validity of this point system has been completed.

However, private practitioners were encouraged to utilize this form to assist in case selection and recordkeeping. A practitioner evaluates many criteria from different aspects of

treatment ranging from patient considerations to diagnosis and treatment considerations. Each condition evaluated is determined to have minimal, moderate, or high difficulty. The results of the evaluation allow the practitioner to determine the overall difficulty of the case. Based on the degree of difficulty, the AAE recommends that a practitioner of certain expertise treat the case. The AAE recommends that cases that have minimal difficulty can have a predictable outcome if treated by a practitioner with limited expertise. However, as the difficulty level increases to moderate or high, the AAE states that a practitioner with more clinical experience and expertise should treat the case to ensure a predictable outcome.

Since the advent of these case assessment forms to assist in the determination of complexity of each endodontic case, there has been research that promotes the use of such of a diagnostic tool. In 2003, Ree et al. published an article assessing the usefulness of two endodontic case assessment forms among Dutch general dentists. Two case assessment forms, the Dutch Endodontic Treatment Index (DETI) (Figure 5) and the Endodontic Treatment Classification (ETC) (Figure 6), were utilized and distributed to 83 general dentists. The DETI is utilized to determine whether to initiate root canal treatment or access case difficulty. This form has a list of 15 conditions. If none of the conditions are applicable, one should initiate root canal treatment. However, if one or more of the conditions listed are applicable to the case, the provider is advised to utilize the ETC to determine case difficulty. The ETC is a form that is very similar to the AAECDAF or the Canadian Academy of Endodontics case difficulty assessment form. Conditions present on the list are divided into 3 categories: average risk, high risk, and extreme risk. However, the major difference between the ETC and the forms produced by the AAE and the Canadian Academy of Endodontics is the ETC determines the level of difficulty based on the sum number of units assigned to each case. A unit value is assigned to each condition. Those conditions deemed to be of average risk are awarded a unit value of 1. Those in the high-risk group are deemed to have 2 units and the extreme risk conditions have a unit value of 5. A sum unit value of 15-19 indicates that the endodontic case is of routine complexity, and a predictable outcome is expected. When the sum value of the case falls in the range of 20-25 units, the case is deemed to be Class II. This means that the experienced practitioner will

have a difficult time ensuring a predictable treatment outcome. For all cases whose unit value exceeds 25 units, predictable treatment outcomes are deemed to be difficult for the most highly skilled practitioner. These cases demand advanced knowledge and armamentarium. A survey was formulated and distributed with the two case assessment forms that questioned the clarity, ease of use, and usefulness of each case assessment form. 53% of the sample responded. When using the DETI, the respondents agreed with the authors in determining the degree of complexity in 13 out of 15 cases. Despite the increased complexity of using the ETC, 91% of the participants indicated that the form was helpful. It was concluded that case assessment difficulty forms were useful in determining the complexity of endodontic cases. As a result, these forms could assist in determining the need for referral to the endodontic specialist.

In 2007, Muthukrishnan *et al.* evaluated the reproducibility of grading the complexity of root canal treatment of another case assessment difficulty form, the Restorative Index of Treatment Need (RIOTN). The RIOTN was utilized in all cases referred for a period of one year. The chief investigator, a consultant in restorative dentistry, and a vocational trainee who had been trained for six months analyzed randomly selected teeth. The inter-observer agreements of all examiners were analyzed utilizing weighted Kappa analysis. The reproducibility of grading the complexity of cases utilizing the RIOTN system was found to be moderate to poor. However, the thought that it could be used as a tool in risk management or to select suitable cases of root canal treatment for undergraduates was realized.

Although there appears to be research that determines that the usefulness of a case assessment difficulty form can be beneficial in determining the complexity of each endodontic case, there is little research that evaluates the importance of the criteria evaluated while completing a case assessment difficulty form. Caplan *et al.* in 1999 assessed the effect of patients' presenting conditions on general dentists' self-reported endodontic referral patterns. They also compared the general dentists' perceived indications for referral with those of endodontists. A self-administered, confidential survey was distributed to 79 general dentists and 7 endodontists who provided care to members of a Dental HMO in the Pacific Northwest. The survey was developed by the chief investigator to ascertain the endodontic referral patterns of

general dentists, the thoughts of endodontists as to when general dentists should refer, and if endodontic complications altered the course of routine endodontic treatment. It was formulated to take approximately ten to twenty minutes to complete. A passive consent form was included with the survey. The practitioner was asked to return the questionnaire within two weeks with no identifiable information. The only information requested was the providers' years of experience. 67 questionnaires were returned. It was determined that the level of expertise ranged from 3 to 27 years and the dentists had been employed with the Dental HMO from a span of 0 to 22 years. According to the study, there was a difference regarding the endodontic referral trends of general dentists, and the thoughts of endodontists as to when general dentists should refer. The only condition in which an overwhelming majority of both groups agreed that referral was always necessary was the apicoectomy and retro-fill of multiple roots. The findings of the study revealed that general dentists and endodontists differ with respect to the types of patients they recommend for endodontic referral. Caplan et al. proposed that further studies are needed to determine actual reasons for referral among all groups of practitioners, i.e. pay-for-service dentists, public health dentists, military dentists, etc.

The purpose of this study was to address the effectiveness of the American Association of Endodontists Case Difficulty Assessment Form (AAECDAF) to determine whether a dentist would treat or refer an endodontic case. Specifically, our aims were to a. determine if practicing dentists utilized the AAECDAF to rate the difficulty of each case, and b. determine the practicing dentists' perceived importance of the conditions present on the AAECDAF.

Null Hypotheses: 1. There was no difference in the percentage of dentists who utilized the AAE Case Difficulty Assessment Form and those who utilize the form. 2. There was no difference between the number of conditions present on the AAE Case Difficulty Assessment Form perceived to be important and the number of conditions perceived not to be important.

Materials & Methods

A confidential, electronic survey (Figure 7) was formulated. Each dentist was questioned on field of dentistry, endodontic referral trends, usage of the AAE Case Difficulty Assessment Form, and perceived importance of conditions when determining if a case should be referred to the endodontic specialist. The survey consisted of ten questions, and was designed to take approximately ten minutes to complete. Each question had multiple-choice answers, and answer choices were stratified based on scale. Questions pertaining to referral patterns were stratified with answers that ranged from not likely, somewhat likely, likely, and highly likely when referring to likelihood to refer. When rating the perceived importance of conditions present on the AAECDAF, respondents were supplied with the answer choices of not important, slightly important, important, mostly important, and critically important. QuestionPro (Seattle, WA) was the web-based survey company utilized to conduct the research study. The survey was uploaded on the company's website, and remained in an active state for 3 weeks. QuestionPro inputted the data into databases and ran statistical analysis.

The email addresses of 20,000 practicing dentists representing each of the fifty sates were randomly obtained from the ADA Membership Directory. Each dentist was emailed to solicit voluntary participation in the study. 5,430 electronic invitations were "bounced," which meant either the email address was incorrect, or it was directed to the dentist's spam folder. 147 individuals declined participation via unsubscribing from the email invitations. Therefore, 14,423 practicing dentists were contacted to participate in the study. The participants provided their consent to participate by the completion of the survey. A series of four emails were sent to solicit participation in the research study. The initial email oriented the practicing dentists to the study, provided a link to the self-administered electronic survey, and advised them that two additional reminder emails would be forthcoming. A reminder email was sent one week following the initial email, and another two weeks after. Each email reiterated the details of the study, provided a link to the survey were the participation. At no point during the solicitation, participation, or at the completion of the survey were the participants asked to provide any personal information that

linked them to their responses. As a result, their responses were completely anonymous. Participants were not provided a copy of the AAECDAF as reference material during the completion of the survey. However, at the completion of the study, an electronic copy of the AAECDAF was sent to each participant via electronic mail.

Evaluation

Completed surveys were entered in a database prior to analysis, which was performed using descriptive statistics, ratio analysis, cross-tabulation, and Chi squared tests where appropriate.

Results

1,434 practicing dentists in the US participated in the study; resulting in a 10% response rate. Representation from all 50 states and the District of Columbia were included in the sample size. 92% were general dentists, and the majority of the respondents have been in practice for over 20 years. Approximately75% of the respondents practice within a 10-mile radius from an endodontists. 96.2% of dentists practicing in the United States refer cases to an endodontist for treatment (Figure 8). Of those practitioners who perform treatment, 3% do not refer any cases. Furthermore, 15% reported referring all cases. This left the remainder (82%) of practicing dentist that refer some, many, or most of their endodontic cases. 9.5% of dentists utilized the AAECDAF when determining when to refer and when to treat (Figure 9). 31.3% of the conditions present on the AAECDAF were deemed to be mostly or critically important to dentists when determining whether to treat or refer (Table 1). All 26 of the conditions were conditions that the AAE deemed to be of high difficulty. Of those preceived important conditions, several conditions proved to be of the most importance: previous access with complications, extreme curvature or S-shaped curve, external resorption, canal(s) not visible, and confusion and complex signs and symptoms.

Discussion

Case selection has been a topic of concern. Rosenburg and Goodis highlighted it with their formulation of the UCSF Endodontic Case Selection Form. It was further brought to the forefront when the AAE created the AAE Case Difficulty Assessment Form to assist practitioners in determining the complexity of each case, and determining when to refer and when to treat. Research has determined that the utilization of a systematic means of assessing case difficulty has been very helpful when assessing case complexity (Ree et al. 2003).

In the current study, 1,434 dentists practicing in the United States were surveyed to determine endodontic referral trends, usage of the AAE Case Difficulty Assessment Form, and perceived importance of certain conditions when determining if a case should be referred to the endodontic specialist. 92% of the respondents were general dentists, whom are the primary referral base of endodontists across the country. 57% of these practicing dentists have been in practice for over 20 years, and approximately 75% of the respondents practice within a 10-mile radius from an endodontist. This study does not support the null hypothesis that there is no difference between the in the percentage of dentists who utilized the AAE Case Difficulty Assessment Form and those who utilize the form. The endodontic referral trends witnessed in this research support the finding of Dietz & Dietz, 1992 that demonstrated that approximately 20% of patients refer all cases, another 20% refer no cases, and the remaining 60% of dentists treat and refer.

The AAE divides the country into seven districts (Figure 10). All seven districts had representation in the current study (Table 2). If one examines the US based on geographic districts as the AAE does, one will see that not only does this entire country's proportion of dentists who treat all, refer all, and perform a combination of the two mimic the results of previous studies, but these results are mimicked in each individual district (Figure 11)

The AAE has formulated the AAE Case Difficulty Assessment Form to aid practitioners in determining case complexity. However, only approximately 10% of the participating practitioners

indicated utilizing the AAECDAF. Despite previous studies showing that the utilization of a case difficulty assessment form has been helpful to practitioners, the small percentage of those dentists who utilize the AAECDAF lends one to postulate that the dentists practicing in the United States do not utilize the AAECDAF.

One must speculate as to the reasons for dental practitioners not using the AAECDAF. The AAECDAF has a comprehensive list of 83 conditions that the practitioner must evaluate and determine whether the condition is deemed to be of minimal, moderate, or high difficulty. Based on the number of conditions deemed to be of moderate or extreme difficulty, the AAE recommends that an experienced practitioner complete treatment. The comprehensiveness of the form may be its downfall. The complexity of the form causes it to be time-consuming to complete. As a result, the practitioner may decide to forego the usage of this form. The survey instrument was unable to differentiate those participants who had knowledge of the existence of the AAECDAF. The participants were only questioned on the utilization of the form. As result, we are unable to determine if the 90% of participants who do not utilize the AAECDAF have any knowledge of its existence. It could be that a majority of these dentists have knowledge of the existence and choose not to utilize it. Moreover, it could be that the dentists who do not utilize the AAECDAF have no knowledge of its existence, and would utilize it if they had knowledge of it.

The majority of the dentists in the sample have been practicing for twenty years or longer. At this stage in their career, it can be postulated that these dentists are likely to continue performing dental procedures in the manner in which they are accustom. Dentists of this experience level may think that the methods they have used are the best methods for them, and may be reluctant to utilize new techniques or methods. As a result, these dentists may not be willing to utilize the AAECDAF to help them determine case difficulty.

This study concluded that the vast majority of surveyed practicing dentists in the US do not utilize the AAECDAF. It may be postulated that the under utilization of this form may be due to its convoluted information, the length of time needed to complete the form, the dentists preconceived notion that their method of assessing case difficulty is superior to the AAECDAF, and the lack of knowledge of the existence of the form. However, due to the shortcomings of the

survey instrument, one cannot speculate on the knowledge of existence of the AAECDAF as the survey only questioned utilization of the form.

However, the AAECDAF has been sent to every general practitioner. There are 83 conditions present on the AAECDAF that are to be systematically assessed. Each condition evaluated is determined to have minimal, moderate, or high difficulty. The results of the evaluation allow the practitioner to determine the overall difficulty of the case. Based on the degree of difficulty, the AAE recommends that a practitioner of certain expertise treat the case. The AAE recommends that cases that have minimal difficulty can have a predictable outcome if treated by a practitioner with limited expertise. However, as the difficulty level increases to moderate or high, the AAE states that a practitioner with more clinical experience and expertise should treat the case to ensure a predictable outcome. The results of the current study coincide with the recommendations of the AAE. All conditions perceived to be mostly or critically important were located in the High Difficulty Column of the AAECDAF. These conditions actually constitute 70% of the conditions present In the High Difficulty Column. The majority of the practitioners surveyed perceived 26 conditions on the AAECDAF to be mostly or critically important when determining to treat or refer. As a result, one can imply that these cases need to be treated by a practitioner with experience, as the AAE recommends. While this study does not support the null hypothesis that there is no difference between the number of conditions perceived to be important and the number of conditions perceived not to be important, the conditions perceived to be mostly or critically important may provide practitioners with a better sense of what their colleagues perceive to be important. As a result, they may be able to make a better assessment of case difficulty.

The teeth that were likely to be referred to endodontists were maxillary and mandibular molars (Figures 12 & 13). There was a higher likelihood that 2nd or 3rd molars would be referred as 55.6% of practicing dentists perceived these teeth to be mostly or critically important when determining to refer. The conditions in this study perceived to be mostly or critically important varied greatly. Patients who have experienced traumatic injuries, significant limitations in opening, extreme gag reflex, or history of chronic oral/facial pain were perceived by the surveyed

dentists to be important conditions when determining to refer. However, in this study, the conditions of previous access with complications, extreme curvature or S-shaped curve, external resoption, canal(s) not visible, and confusing and complex signs and symptoms (difficult diagnosis) were deemed to be the most critically important conditions that a patient can present with when assessing case difficulty.

The ultimate goal of all practitioners should be to provide quality, competent endodontic care to all patients. Endodontics does not constitute just the action of performing root canal therapy to the level of a specialist. It also includes determining an accurate endodontic diagnosis and case selection in preventing and/or treating apical periodontitis. In order to provide quality, competent endodontic care, a practitioner must understand their limitations and experience level.

Communication with the potential participants was minimal throughout the course of the study. A total of four emails were sent out to solicit participation. A marked increase in the completion of the survey was seen shortly after each communication was made. As a result, the lack of communication may play a role in the 10% response rate. An electronic survey was used to complete the current study, and was distributed via electronic mail. However, previous studies that focused on case assessment utilized paper surveys and the US Postal Service to deliver surveys to prospective participants. This may be a reason for the marked contrast in response rates. People may be more apt to return hard copy surveys, as opposed to electronic version. However, the utilization of the Internet to complete survey studies appear to be the wave of the future. As more people are becoming dependent on technology, this may lead to a better means of communication. Furthermore, the Internet allows one to have access to a greater number of prospective participants at a much lesser financial burden. The current study was able to contact 14,423 practicing dentists in the US to solicit participation. No previous study related to case difficulty assessment has been able to contact this number of potential participants. As a result, no other study has had the sample size of the current study, and have participation from all 50 states including the District of Columbia.

Due to financial restraints, no financial incentive was available to potential participants. This may have contributed to the lack of participation. With people's busy schedules and the fast-

paced nature of society, there is little to no free time. As a result, this study had to compete with other facets of life for the potential participant's attention during this time. Without any form of compensation or incentive to participate in the current study, many potential respondents opted to forego our invitation to participate. If finances were of no concern, incentives or possible compensation could have been offered to each respondent who completed the self-administered, electronic survey. Consequently, it is postulated that the response rate would have been increased.

The AAECDAF, Canadian Academy of Endodontics case difficulty assessment form, DETI, ETC, and RIOTN are all methods to assess case difficulty. However, each form's method of assessment is slightly different. Each form requires a systematic approach to assessing each endodontic case, and requests that the practitioner evaluate similar conditions when determining case difficulty. All forms, except the DETI, utilize different categories of risk or difficulty for the conditions present. The DETI is merely a list of conditions that are either present or absent from the endodontic case. If any of the conditions located on the DETI are applicable to the potential case, the practitioner is advised to utilize the ETC to determine the degree of difficulty. This form, the DETI, is the only form that advises the use of another case difficulty assessment form to aid in determining whether to treat or refer.

The ETC and the Canadian Academy of Endodontics case difficulty assessment form assign a numerical value to each condition present on the page. The ETC assigns each condition to a category of average risk, high risk, or extreme risk. Each category is assigned a unit value of 1,2, and 5 units respectively. The Canadian Academy of Endodontics case difficulty assessment form divides conditions into three categories as well, and assigns each category a point value of 1,2, and 5. However, instead of the category title of extreme risk, the Canadian Academy of Endodontics categorizes these conditions as very high risk. The AAE advises that those individuals associated with academics utilize a point system when determining case assessment. The AAECDAF 's point value system is the same as the ETC and Canadian Academy of Endodontics case difficulty assessment form. The sum values of all conditions applicable are utilized with each form to see what range of difficulty each potential endodontic

case is. All forms advise that the higher the sum, the less likely an experienced practitioner will be able to ensure a predictable treatment outcome without additional training or specialized armamentarium. The point value system allows for uniform determination of case difficulty. All practitioners are of different educational philosophy, experience level, and confidence. As a result, there will be little similarities between the determination of whether to treat or refer. The point value system will eliminate these differences and allow the form and case difficulty assessment to be similar in all regions of the country.

The current study does not address this point value system. Research is needed to determine whether this is a valuable asset of case difficulty assessment. Furthermore, the assignment of points to each category on each form has been arbitrarily assigned. No research has been completed in the realm of case difficulty assessment to determine if each condition warrants the point value assigned. The present study is unable to address this system, as it was not a part of the study. Retrospectively, the lack of examination of the point value system is a glaring shortcoming of the current study. Further research studies are needed to determine the validity of the point value system and the values assigned to each condition.

Although the present study has marked shortcomings, it shows that electronic means of conducting research studies are feasible. Furthermore, they allow investigators to contact vast numbers of individuals in an economically feasible manner. This study also supplies practicing dentists with a better sense of what their colleagues perceive to be important, and the likelihood that their colleagues are performing a combination of endodontic treatment, as well as referral. As a result, they may be able to make a better assessment of case selection.

TABLES

Table 1

Conditions perceived by dentists practicing in the United States to be mostly or critically important when determining whether to treat or refer an endodontic case.

Conditions Perceived by Dentists Practicing in the United States to be Mostly or Critically Important When Determining Whether to Treat or Refer an Endodontic Case.

- 1. Previous access with complications (e.g., perforation, non-negotiated canal, ledge, separated instrument)
- 2. Extreme curvature (>30°) or S-shaped curve
- 3. External resorption
- 4. Canal(s) not visible
- 5. Confusing and complex signs and symptoms: difficult diagnosis
- 6. Root amputation prior to endodontic treatment
- 7. Extensive apical resorption
- 8. Internal resorption
- 9. Horizontal root fracture
- 10. Significant limitation in opening
- 11. Previous surgical or nonsurgical endodontic treatment completed
- 12. Complicated crown fracture of immature teeth
- 13. Alveolar fracture
- 14. Extreme gag reflex which has compromised past dental care
- 15. Canal divides in the middle or apical third
- 16. Combined endodontic/periodontic lesion
- 17. Significant deviation from normal tooth/root form (e.g., fusion, dens in dente)
- 18. Uncooperative patient
- 19. 2nd or 3rd molar
- 20. Cracked teeth with periodontal complications
- 21. Indistinct canal path
- 22. Extreme difficulty obtaining/interpreting radiographs (e.g., superimposed, anatomical structures)
- 23. Intrusive, extrusive, or lateral luxation
- 24. History of chronic oral/facial pain
- 25. Open apex (>1.5mm in diameter)
- 26. Avulsion

 Table 2

 Number of Respondents Who Refer Endodontic Cases Based on District

	None (0%)	Some (1-25%)	Many (26-50%)	Most (51-99%)	All (100%)	Total
District I	6	70	41	33	31	181
District II	6	51	20	22	9	108
District III	3	72	38	50	29	192
District IV	8	82	39	29	33	191
District V	8	140	69	71	45	333
District VI	14	183	67	73	50	387
District VII	0	8	4	9	6	27

Number of Respondents Who Refer Endodontic Cases Based on District

FIGURES







Figure 2 Canadian Academy of Endodontics Case Classification According to the Degrees of Difficulty and Risk

Criteria and Subcriteria	Average Risk (1 unit / item)	High Risk (2 units / item)	Very High Risk (5 units / item)
A. PATIENT CONSIDERATIO	DNS	(2 anito / itom)	
 Medical history/ anaesthesia / patient management 	No medical problem (ASA Class I)	Special attention: pacemaker / antibiotic allergy (ASA Class II) Vasoconstrictor intolerance Lack of cooperation / fear	Complex medical history/ serious illness / disability (ASA Classes III and IV*) Intolerance to anaesthesia Resistance to anaesthesia
2. Diagnosis	Signs and symptoms straight forward: clear diagnosis	Differential diagnosis of usual signs and symptoms	 Confusing and complex signs and symptoms: difficult diagnosis Indeterminable diagnosis
3. Mouth aperture and physical limitations	Normal mouth aperture (35mm+)	 Reduced aperture (25- 35mm) Difficulty holding film 	 Non-functional aperture (-25mm) Limited reclination
4. Radiographic difficulties	Average conditions	Gagging High floor (lower premolars and canines) Narrow or low palatal yault	 Hard to solve superimposed anatomical structures
B TOOTH CONSIDERATION	I NS		
5. Position in the arch and inclination	□ Anterior or premolar □ Small inclination (-10°) □ Small rotation (-10°)	☐ 1st or 2nd molar ☐ Moderate inclination (10-30°) ☐ Moderate rotation (10-30°)	□ 3rd molar □ Extreme inclination (+30°) □ Extreme rotation (+30°)
 Tooth isolation and access / morphologic aberrations of crown 	Normal original crown morphology or one usable as is No pretreatment required for isolation Stable clamp	Taurodontism / microdens Simple pretreatment required for isolation Unstable clamp (no	Existence of the second s
7. Canal and root shapes	Canal path into / form	retention)	Clamp almost impossible to place Canal path into C or S form
	 Small or no angle (-10°) in the canal Single canal anterior or premolar 	 Moderate angle (10-30°) Molar with 3 canals or less Premolar or anterior with 2 canals Previously initiated endodontic treatment Crown axis different from root axis Canal > 25 mm long 	Extreme angle (+30°) Molar with 4 canals or more Premolar with 3 canals Canal subdivision in the apical or middle thirds C-shape canal system Internal canal wall of a curve < 2 mm thick, on X-Ray films
	□ Closed apex		
8. Canal calcifications	□ Wide and clear canal	 Canal and chamber are visible but quite reduced Pulp stones 	 Almost undistinctive canal path in part or throughout Canal no longer visible*
9. Resorptions		 Internal resorption (without perforation) Apical resorption 	 Internal resorption with perforation* External resorption with* or without perforation
10. Mechanical perforation		Supra-osseous root perforation	Sub-osseous root perforation*
C. ADDITIONAL FACTORS		P	
11. Trauma history	Uncomplicated crown fracture of mature or immature teeth Radicular fracture in apical third History of concussion	Complicated crown fracture of mature teeth Radicular fracture in middle third History of subluxation / alveolar fracture	 Complicated crown fracture of immature teeth Radicular fracture in cervical third Other luxations / avulsion
12. Retreatment			Retreatment
13. Periodontal - endodontic condition			Mobility / pocket / fenestration / dehiscence Furcation involvement Root resection / hemi-section (expected or done)
* ASA Class IV, fusion / den	s in dente, invisible canal, sub-os	sseous / resorptive perforation be	long to Class 3 automatically.
<u>Results:</u>	Total	15 to 17 units: 18 to 25 units:	Class 1 Class 2

CASE CLASSIFICATION ACCORDING TO THE DEGREES OF DIFFICULTY AND RISK

 Kesuits:
 Total
 Class 1

 Total
 18 to 25 units:
 Class 2

 Disposition:
 Accepted or C Referred
 Referred

Figure 3 2006 AAE Case Difficulty Assessment Form



PATIENT INFORMATION	DISPOSITION
Name	Treat in Office: Yes No
Address	Refer Patient to:
City/State/Zip	
Phone	Date:

Guidelines for Using the AAE Endodontic Case Difficulty Assessment Form

The AAE designed the Endodontic Case Difficulty Assessment Form for use in endodontic curricula. The Assessment Form makes case selection more efficient, more consistent and easier to document. Dentists may also choose to use the Assessment Form to help with referral decision making and record keeping.

Conditions listed in this form should be considered potential risk factors that may complicate treatment and adversely affect the outcome. Levels of difficulty are sets of conditions that may not be controllable by the dentist. Risk factors can influence the ability to provide care at a consistently predictable level and impact the appropriate provision of care and quality assurance.

The Assessment Form enables a practitioner to assign a level of difficulty to a particular case.

LEVELS OF DIFFICULTY

MINIMAL DIFFICULTY	Preoperative condition indicates routine complexity (uncomplicated). These types of cases would exhibit only those factors listed in the MINIMAL DIFFICULTY category. Achieving a predictable treatment outcome should be attainable by a competent practitioner with limited experience.
MODERATE DIFFICULTY	Preoperative condition is complicated, exhibiting one or more patient or treatment factors listed in the MODERATE DIFFICULTY category. Achieving a predictable treatment outcome will be challenging for a competent, experienced practitioner.
HIGH DIFFICULTY	Preoperative condition is exceptionally complicated, exhibiting several factors listed in the MODERATE DIFFICULTY category or at least one in the HIGH DIFFICULTY category. Achieving a predictable treatment outcome will be challenging for even the most experienced practitioner with an extensive history of favorable outcomes.

Review your assessment of each case to determine the level of difficulty. If the level of difficulty exceeds your experience and comfort, you might consider referral to an endodontist.

The contribution of the Canadian Academy of Endodontics and others to the development of this form is gratefully acknowledged.

The AAE Endodontic Case Difficulty Assessment Form is designed to aid the practitioner in determining appropriate case disposition. The American Association of Endodontists neither expressly nor implicitly warrants any positive results associated with the use of this form. This form may be reproduced but may not be amended or altered in any way © American Association of Endodontists, 211 E. Chicago Ave., Suite 1100, Chicago, IL 60611-2691; Phone: 800/872-3636 or 312/266-7255; Fax: 866/451-9020 or 312/266-9867;

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AAE Endodontic Case Difficulty Assessment Form

CRITERIA AND SUBCRITERIA	MINIMAL DIFFICULTY		HIGH DIFFICULTY		
Medical history	 No medical problem (ASA Class 1*) 	 One or more medical problems (ASA Class 2*) 	Complex medical history/serious illness/disability (ASA Classes 3-5*)		
ANESTHESIA	No history of anesthesia problems	Vasoconstrictor intolerance	Difficulty achieving anesthesia		
PATIENT DISPOSITION	Cooperative and compliant	Anxious but cooperative	Uncooperative		
ABILITY TO OPEN MOUTH	No limitation	Slight limitation in opening	Significant limitation in opening		
GAG REFLEX	None	Gags occasionally with radiographs/treatment	 Extreme gag reflex which has compromised past dental care 		
EMERGENCY CONDITION	Minimum pain or swelling	Moderate pain or swelling	Severe pain or swelling		
	B. DIAGNOSTIC AND	TREATMENT CONSIDERATION	15		
Diagnosis	Signs and symptoms consistent with recognized pulpal and periapical conditions	Extensive differential diagnosis of usual signs and symptoms required	 Confusing and complex signs and symptoms: difficult diagnosis History of chronic oral/facial pain 		
RADIOGRAPHIC DIFFICULTIES	 Minimal difficulty obtaining/interpreting radiographs 	Moderate difficulty obtaining/interpreting radiographs (e.g., high floor of mouth, narrow or low palatal vault, presence of tori)	 Extreme difficulty obtaining/interpreting radiographs (e.g., superimposed anatomical structures) 		
Position in the arch	 Anterior/premolar Slight inclination (<10°) Slight rotation (<10°) 	 Ist molar Moderate inclination (10-30°) Moderate rotation (10-30°) 	 2nd or 3rd molar Extreme inclination (>30°) Extreme rotation (>30°) 		
TOOTH ISOLATION	Routine rubber dam placement	Simple pretreatment modification required for rubber dam isolation	Extensive pretreatment modification required for rubber dam isolation		
Morphologic Aberrations of crown	Normal original crown morphology	Full coverage restoration Porcelain restoration Bridge abutment Moderate deviation from normal tooth/root form (e.g., taurodontism, microdens) Teeth with extensive coronal destruction	 Restoration does not reflect original anatomy/alignment Significant deviation from normal tooth/root form (e.g., fusion, dens in dente) 		
CANAL AND ROOT MORPHOLOGY	 Slight or no curvature (<10°) Closed apex <1 mm diameter 	 Moderate curvature (10-30°) Crown axis differs moderately from root axis. Apical opening 1-1.5 mm in diameter 	Extreme curvature (>30°) or S-shaped curve Mandibular premolar or anterior with 2 roots Maxillary premolar with 3 roots Canal divides in the middle or apical third Very long tooth (>25 mm) Open apex (>1.5 mm in diameter)		
RADIOGRAPHIC APPEARANCE OF CANAL(S)	Canal(s) visible and not reduced in size	 Canal(s) and chamber visible but reduced in size Pulp stones 	 Indistinct canal path Canal(s) not visible 		
RESORPTION	□ No resorption evident	Minimal apical resorption	Extensive apical resorption Internal resorption External resorption		
	C. ADDITION	AL CONSIDERATIONS			
Trauma history	Uncomplicated crown fracture of mature or immature teeth	 Complicated crown fracture of mature teeth Subluxation 	Complicated crown fracture of immature teeth Horizontal root fracture Alveolar fracture Intrusive, extrusive or lateral luxation Avulsion		

Previous access without complications (e.g., perforation, non-negotiated canal, ledge, separated instrument) ENDODONTIC TREATMENT HISTORY No previous treatment canal, ledge, separated instrument
 Previous surgical or nonsurgical
 endodontic treatment completed
 Concurrent severe periodontal PERIODONTAL-ENDODONTIC
None or mild periodontal disease CONDITION Concurrent moderate periodontal disease disease Cracked teeth with periodontal complications lesion Root amputation prior to endodontic treatment

*American Society of Anesthesiologists (ASA) Classification System

Class 1: No systemic illness. Patient healthy. Class 2: Patient with mild degree of systemic illness, but without functional restrictions, e.g., well-controlled hypertension. Class 3: Patient with severe degree of systemic illness which limits activities, but does not immobilize the patient.

Class 4: Patient with severe systemic illness that immobilizes and is sometimes life threatening. Class 5: Patient will not survive more than 24 hours whether or not surgical intervention takes place.

www.asahq.org/clinical/physicalstatus.htm

Figure 4 2006 AAE Case Difficulty Assessment Form Educator Guide



AAE EDUCATOR GUIDE

To assist educators in teaching predoctoral dental students effective evaluation and decision-making skills in endodontics, the AAE bas prepared the following guidelines. It is the intention that these guidelines provide a more objective evaluation tool for students to use in assessing the difficulty associated with an endodontic patient's case, and assist them in the decision whether to treat or refer. AAE members may photocopy this guide for distribution to other educators.

USE OF ENDODONTIC CASE DIFFICULTY ASSESSMENT FORM

In order to make the *Case Difficulty Assessment Form* a more objective exercise, it is recommended that a point score be assigned to each item within each difficulty category. This point system is offered for educational purposes only and is not recommended for clinical practice.

Those items listed in the Minimal Difficulty category are assigned a point value of 1.

Those items listed in the Moderate Difficulty category are assigned a point value of 2.

Those items listed in the High Difficulty category are assigned a point value of 5.

The following score ranges are recommended in making the decision whether to treat or refer:

- Less than 20 points: Dental student may treat—level of faculty supervision should be tailored to the student's level of experience.
- **20 40 points:** An experienced and skilled dental student may treat with very close supervision by an endodontist, or the case referred to a graduate student or endodontist.
- **Above 40 points:** The case should not be treated by a predoctoral dental student. The patient should be referred to a graduate student or endodontist.

The assignment of an objective "point score" will hopefully assist the dental student in critically evaluating the difficulty associated with treating each patient, assist him/her in making a treatment decision that will be in the patient's best interests, as well as enhance the student's educational experience.

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Figure 5 Dutch Endodontic Treatment Index From Ree et al. 2003

DETI ("Dutch Endodontic Treatment Index")

yes	
0	Medical problems (ASA score ≥ 2)
0	Physical limitations/ cooperation of patient limited to poor
0	Difficult diagnosis
0	Premolar >2 canals
0	Molar >3 canals/ third molar
0	Canal subdivision in middle/ apical third
0	Moderate to extreme rotation and/or inclination of tooth (> 10°)
0	Aberrant crown and/or root morphology/ very long tooth ≥ 30 mm
0	Pretreatment required for isolation with rubber dam
0	Crown, core and/or post present
0	Moderate to extreme canal curvatures (> 10°)
0	Obstructions, resorption, calcification, perforation and/or open apices
0	Retreatment
0	Endodontic-periodontal lesion
0	History of trauma

None of the abovementioned criteria is	\rightarrow	DETI score A	\rightarrow	Initiate root canal treatment
applicable				

One or more of the abovementioned criteria \longrightarrow DETI score B \longrightarrow Assess grade of difficulty with the Treatment Classification form

Figure 6 Endodontic Treatment Classification Form From Ree et al. 2003

criteria	1 unit per item average risk	2 units per item high risk	5 units per item extreme risk
A. Patient consideration	ns		
1. Medical history, anaesthesia and patient management	No medical problems (ASA Class I)	Special attention (ASA class II) Vasoconstrictor intolerance Lock of comparting/ for	Complex medical history: (ASA class III and IV*)
2. Mouth aperture and physical limitations	☐ Normal mouth aperture (≥ 35 mm)	Cooperation rear Reduced mouth aperture (25-35 mm) Difficulty holding radiograph	Allergy to anaesthesia Extremely reduced mouth aperture (≤ 25 mm) Limited reducination
3. Radiographic difficulties	Normal conditions	Strong gagging reflex Narrow or low palatal vault/ high mouth floor	 Hard to solve superimposed anatomical structures
4. Diagnosis	 Signs and symptoms straight forward: clear diagnosis 	 Differential diagnosis of usual signs and symptoms 	 Confusing and complex signs and symptoms: difficult diagnosis
B. Tooth consideration	IS		
5. Position in the arch	Anterior or premolar	1 st or 2 nd molar	3 rd molar
6. Inclination and rotation of tooth	No/small inclination (≤ 10°) No/small rotation (≤ 10°)	 Moderate inclination (10-30°) Moderate rotation(10-30°) 	 □ Extreme inclination (≥30°) □ Extreme rotation (≥30°)
 Morphological aberrations of crown and isolation 	 Normal, original crown morphology No pretreatment required for isolation 	Taurodontism/ microdontism Simple pretreatment required for isolation	Fusion/dens in dente* Extensive pretreatment required for isolation
8. Access to root canal system	Normal access	 Discrepancy between crown and root axis Amalgam build-up in pulp chamber without post 	Porcelain fused to metal, metal or porcelain crown Composite build-up in pulp chamber Post/ cast post and core*
9. Canal and root morphology	 Canal curvature into I form Small or no curvature (< 10°) Anterior tooth or premolar with 1 canal 	 Canal curvature into J form Moderate curvature (10-30°) Anterior tooth or premolar with 2 canals Molar with ≤ 3 canals Previously initiated, but not completed, endodontic treatment 	 Canal curvature into C or S form C-shape canal system Extreme curvature (≥ 30°) Premolar with 3 canals Molar with > 3 canals Canal subdivision in middle or apical third Very long tooth (≥ 30 mm)
10. Apical morphology	Closed (=mature) apex		 Open apex (immature apex/ apex resection without a retrograde filling)
11. Canal calcifications	Canals clearly visible	 Pulp chamber/ canals are visible but quite reduced Pulp stones 	 Almost indistinctive canal path in part or throughout Canals invisible*
12. Resorption		 Internal resorption without perforation Apical resorption 	Internal resorption with perforation* External resorption with* or without perforation
13. Iatrogenic incidents		Supra-osseous perforations	Broken instrument* Ledging* Apical transportations* Sub-osseous perforations *
C. Additional Factors	- 2.9		
 Retreatment of previously completed root canal treatment 			Retreatment of previously completed root canal treatment
15. History of trauma	Uncomplicated crown fracture Root fracture in apical third Concussion	Complicated crown (-root) fracture of mature teeth Root fracture in middle third Subluxation/alveolar fracture	Complicated crown (-root) fracture of immature teeth Root fracture in cervical third Other luxations/ avulsions
16. Endodontic-periodontal lesion			Mobility/ pocket/ fenestration / dehiscence Furcation involvement Root resection/ hemisection expected or completed
Subtotal	□ x1 =	• x 2 =	□ x 5 =
*These criteria belong	to Class III automatically	Total: \rightarrow	□ 15-19 units Class I □ 20-25 units Class II □ >25 units Class III

Figure 7

UNC School of Dentistry Case Assessment Difficulty Survey

Do you perform endodontic treatment in your practice setting?

- Yes
- No

Do you refer patients to an endodontist for endodontic care?

- Yes
- No

What percentage of your endodontic cases do you refer?

- None (0%)
- Some (1-25%)
- Many (26-50%)
- Most (51-99%)
- All (100%)

Do you utilize the American Association of Endodontists Case Assessment Difficulty Form when determining the difficulty of an endodontic case?

- Yes
- No

Please rate each type of tooth on the likelihood you would refer to an endodontist for routine endodontic care.

(Not Likely, Somewhat Likely, Likely, Highly Likely)

- Maxillary Incisor
- Maxillary Canine
- Maxillary Premolar
- Maxillary Molar
- Mandibular Incisor
- Mandibular Canine
- Mandibular Premolar
- Mandibular Molar

Please rate the importance of each of the following conditions when determining whether to refer endodontic cases to an endodontist.

(Not Important, Slightly Important, Important, Mostly Important, Critically Important)

- No medical problems
- One or more medical problems
- Complex medical history/serious illness/disability
- No history of anesthesia problems
- Vasoconstrictor intolerance
- Difficulty achieving anesthesia
- Cooperative and compliant patient
- Anxious but cooperative patient
- Uncooperative patient
- No limitation in opening
- Slight limitation in opening
- Significant limitation in opening
- Gags occasionally with radiographs/treatment
- Extreme gag reflex which has compromised past dental care
- Minimum pain or swelling
- Moderate pain or swelling
- Severe pain or swelling
- Signs and symptoms consistent with recognized pulpal and periapical conditions
- Extensive differential diagnosis of usual signs and symptoms required
- Confusing and complex signs and symptoms: difficult diagnosis
- History of chronic oral/facial pain
- Minimal difficulty obtaining/interpreting radiographs

- Moderate difficulty obtaining/interpreting radiographs (e.g., high floor of mouth, narrow or low palatal vault, presence of tori)
- Extreme difficulty obtaining/interpreting radiographs (e.g., superimposed anatomical structures)
- Anterior/premolar teeth
- 1st molar
- 2nd or 3rd molar
- Slight inclination (<10 degrees)
- Slight rotation (<10 degrees)
- Moderate inclination (10-30 degrees)
- Moderate rotation (10-30 degrees)
- Extreme inclination (>30 degrees)
- Extreme rotation (>30 degrees)
- Routine rubber dam placement
- Simple pretreatment modification required for rubber dam isolation
- Extensive pretreatment modification required for rubber dam isolation
- Normal original crown morphology
- Full coverage restoration
- Porcelain restoration
- Bridge abutment
- Moderate deviation from normal tooth/root form (e.g., taurodontism, microdens)
- Teeth with extensive coronal destruction
- Restoration does not reflect original anatomy/alignment
- Significant deviation from normal tooth/root form (e.g., fusion, dens in dente)
- Slight or no root curvature (<10 degrees)
- Closed apex <1 mm diameter
- Moderate root curvature (10-30 degrees)
- Crown axis differs moderately from root axis. Apical opening 1-1.5 mm in diameter
- Extreme root curvature (>30 degrees) or S-shaped curve
- Mandibular premolar or anterior with 2 roots
- Maxillary premolar with 3 roots
- Canal divides in the middle or apical third
- Very long tooth (>25 mm)
- Open apex (>1.5 mm in diameter)
- Canal(s) visible radiographically and not reduced in size
- Canal(s) and chamber visible radiographically but reduced in size
- Pulp Stones
- Indistinct canal path
- Canal(s) not visible
- No resorption evident
- Minimal apical resorption
- Extensive apical resorption
- Internal resorption
- External resorption
- Uncomplicated crown fracture of mature or immature teeth
- Complicate crown fracture of mature teeth
- Subluxation
- Complicated crown fracture of immature teeth
- Horizontal root fracture
- Alveolar fracture
- Intrusive, extrusive or lateral luxation
- Avulsion
- No previous endodontic treatment
- Previous endodontic access without complications
- Previous endodontic access with complications (e.g., perforation, non-negotiated canal, ledge, separated instrument)

- Previous surgical or nonsurgical endodontic treatment completed
- None or mild periodontal disease
- Concurrent moderate periodontal disease
- · Concurrent severe periodontal disease
- Cracked teeth with periodontal complications
- Combined endodontic/periodontic lesion
- Root amputation prior to endodontic treatment

What field of dentistry do you work?

- Endodontics
- General Dentistry
- Oral & Maxillofacial Surgery
- Orthodontics
- Pediatric Dentistry
- Periodontics
- Prosthodontics

How long have you been practicing dentistry?

- 0-5 years
- 6-10 years
- 11-15 years
- 16-20 years
- >20 years

What is the distance between your office and the closest endodontist?

- 0-10 miles
- 11-25 miles
- 26-50 miles
- 51-75 miles
- 76-100 miles
- >100 miles

In what state do you practice dentistry?

- Alabama
- Alaska
- Arizona
- Arkansas
- California
- Colorado
- Connecticut
- District of Columbia
- Delaware
- Florida
- Georgia
- Hawaii
- Idaho
- Illinois
- Indiana
- lowa
- Kansas
- Kentucky
- Louisiana
- Maine
- Maryland
- Massachusetts
- Michigan
- Minnesota
- MIssissippi
- Missouri
- Montana

- Nebraska ٠
- Nevada •
- New Hampshire •
- New Jersey
- New Mexico •
- ٠ New York
- North Carolina
- North Dakota
- Ohio
- Oklahoma
- •
- Oregon Pennsylvania •
- Rhode Island •
- South Carolina •
- South Dakota
- Tennessee •
- Texas
- Utah
- Vermont
- •
- •
- Virginia Washington West Virginia Wisconsin •
- •
- Wyoming •

Figure 8 Do Dentists Practicing in he United States Refer Patients to an Endodontist for Treatment



Figure 9 Do dentists practicing in the United States utilize the AAE Case Difficulty Assessment Form?





Figure 10 Map of United States based on AAE District Categorization

Figure 11 Percentage of Endodontic Cases Referred by District



Figure 12 The likelihood practicing dentists in the US refer routine maxillary molar cases for treatment



Figure 13 The likelihood practicing dentists in the US refer routing mandibular molar cases for treatment



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