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# The perceived prognosis of endodontic treatment and implant therapy among dental practitioners

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**Objective.** The aims of this study were to understand if practicing dentists appreciate the difference in criteria for success used in the endodontic and implant literature, to evaluate the perceived outcome of implant therapy compared with endodontic treatment, and to evaluate current and projected utilization of implant and endodontic treatment.

**Study design.** A 16-question survey was distributed to 648 dentists who graduated from the University of Connecticut Dental School over the past 30 years.

**Results.** The response rate was 47%. Forty-nine percent of respondents did not know that different criteria are used in the literature to evaluate implant and root canal treatment. Thirty percent of respondents thought root canal treatment of teeth with necrotic pulp was superior to implants, and only 16% thought retreatment was preferable.

**Conclusion.** A shift in utilization toward implant treatment was not found; however, a perceived superior outcome of implant compared with endodontic treatment does exist among the dental community. (*Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2011;111:e42-e47)

A dentist's personal database of information contributes to his or her judgment of a treatment as being in the best interest of the patient.<sup>1,2</sup> The assimilation of training, discussions, continuing education, and personal values shapes how dentists recommend treatment options. Little is known as to what area is most integral to a dentist's database.<sup>3</sup> Given the advent of a relatively new treatment modality, implants, it is critical that we evaluate the source of information shaping dentists' treatment decisions regarding implant and endodontic treatment.

Dentists must compare the prognosis of each treatment modality published in the literature. Both outcome measures for survival in the endodontic and implant literature are the same: retention of the tooth within the mouth.<sup>4</sup> However, a difference exists in the definition of success between the endodontic and implant literature. Endodontic studies traditionally define success as an asymptomatic tooth with normal periodontal architecture and bone and no infection.<sup>5</sup> Implant studies define success as absence of functional

signs of pain or discomfort, absence of mobility, and an absence of bone loss. However, implants with signs of peri-implant infection maintained by adaptive antimicrobial treatment are considered to be successful.<sup>6</sup> Data do not exist exhibiting if the difference in outcome measures between the implant and the endodontic literature is appreciated by practicing dentists.

A published study of 1.5 million endodontically treated teeth found a 97% survival rate at 8 years,<sup>7</sup> and a prospective clinical study of 635 teeth with an 8-10-year follow-up found root canal treatments with necrotic pulps to have an 86% success rate.<sup>8</sup> Looking at implant literature, a multicenter implant study with 1,022 implants reported a survival rate of 92% and a success rate of 83.4%.<sup>6</sup>

Little literature exists on the current and projected utilization of endodontic treatment compared with implants. The hypothesis of the present study is that utilization patterns are shifting from endodontic treatment and tooth conservation to tooth replacement with implants owing to a perceived superior outcome.

The purpose of this study was threefold: to evaluate dentists' perceptions of endodontic and implant treatment, to review their current and projected utilization, and to assess the sources of information upon which these opinions are based.

## MATERIAL AND METHODS

### Design and distribution of the survey

After obtaining approval from the University of Connecticut Institutional Review Board, we developed a

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16-question survey and informed consent and distributed them to dentists who graduated from the University of Connecticut School of Dental Medicine in the years 1977-85, 1990, and 1995-2003. Questions evaluated both their perceptions of endodontic and implant treatment prognosis and their current and projected utilization of them. The sources of information upon which these opinions are based were also assessed. A pilot questionnaire was sent out to nonsurveyed dentists from the same survey population, and feedback was incorporated into the final questionnaire (Table I).

Graduation rosters were obtained from the dental school, but contact information could not be released; therefore the principal investigator had to independently research this information. Mailing addresses, phone numbers, and occasionally e-mail addresses were located online. Phone calls were made to each dentist to obtain their preferred form of communication: fax, e-mail, or post. The final number of dentists surveyed was 648. A web interface at <http://www.surveymonkey.com> was the central form of distribution, with 527 dentists choosing to be e-mailed; 90 were faxed and 31 posted.

### Collection of survey data

The data were collected during a 1-month period. Two reminder e-mails, after a 2-week interval, were sent to the dentists who chose to be e-mailed. To facilitate collecting unbiased data, respondents were informed that the survey was completely anonymous and that identification of the participant was not linked to the individual responses. The survey was formatted so that participants were allowed to skip questions and to give partial answers. Any e-mails that were returned as undeliverable were resent with amended correct contact information. A message was sent to pediatric dentists and orthodontists indicating that if they did not feel that this was in their realm of dentistry they had the option to not complete the survey and respond citing this reason.

### Data analysis

Raw data were entered into an Excel (Microsoft Corp., Redmond, WA) spreadsheet. Data analysis was performed using SAS version 9.1 software (SAS Institute, Cary, NC). Because most of the orthodontists and pediatric dentists chose not to complete the questionnaire, both of those groups were eliminated from statistical analysis. To analyze the data from question 11 (numbers of various procedures and referrals), the Z test was used, and the level of significance was set at  $P < .05$ . Multinomial logistic regression and linear odds ratios were used to evaluate significant differences among groups at the 95% confidence interval. Frequency distribution analysis was used to analyze the data sets in many of the questions. Dependent variables were implant therapy versus root

canal treatment of a vital pulp, implant therapy versus root canal treatment of a necrotic pulp, implant therapy versus a retreatment, endodontic treatment of a salvageable or restorable tooth versus an extraction and implant, endodontic retreatment of a failing root canal treatment versus extraction and implant. Independent variables were years since graduation, sources of information, and specialist versus general dentist.

### RESULTS

An overall 47% response rate was obtained ( $n = 306$ ); 272 from e-mail, 9 from postal mail, and 25 faxed. Two hundred six (67%) were general dentists and 101 (32.8%) were specialists. Two hundred fifty-four (90.7%) were in private practice. One hundred thirty-three responders (47.8%) were from 1977 to 1985 (senior), 130 (46.8%) from the years 1995-2003 (junior), and 15 (5.4%) from 1990.

### Prognosis

Dentists were asked the question: "Compared with implant therapy, do you feel the prognosis of a vital pulp is much better, better, same, worse, or much worse?" For statistical analysis, the 5 groupings were combined into 3: better, same, and worse (Table II). Frequency analysis revealed that 45% of respondents thought that root canal treatment of a vital pulp had a better prognosis than implant therapy. When asked the question, "Compared with implant therapy, do you feel the prognosis of a necrotic pulp is better, same, or worse?," 36% answered worse. Finally, when asked, "Compared with implant therapy, do you feel the prognosis of a retreatment is better, same, or worse?," 62% answered worse.

Dentists were asked whether they strongly agree, agree, are undecided, disagree, or strongly disagree with the following question: "Does endodontic treatment of a salvageable or restorable tooth provide a better outcome than extraction and a dental implant?" For statistical analysis, the 5 groupings were combined into 3: agree, undecided, and disagree (Table III). Frequency analysis revealed that 65% of respondents agreed with this statement. When asked, "Is endodontic retreatment of a failing root canal in a restorable tooth preferable to extraction and a dental implant?," 47% were undecided. When asked if they thought that in published studies criteria used to determine a successful root canal treatment are the same as criteria used to determine a successful implant, 46% were again undecided.

### Sources of information

Source of information was found to be predictive of survey responses among dentists. The more information dentists obtained from trade journals and dental sales representatives, the less likely they were to answer that the

**Table I.** Final mailed out questionnaire

Please check the box that represents your response or write in the space provided. Your *suggestions are invaluable* for this study. We would appreciate it if you could answer all of the questions; however, you may skip any that you do not want to answer. Please provide your frank opinion and *feel free to give your suggestions* wherever you think appropriate.

1. What best describes your area of specialty?

- 1 General Dentist \_\_\_\_\_ Subspecialty (if applicable)
- 2 Orthodontist
- 3 Endodontist
- 4 Oral Surgeon
- 5 Pedodontist
- 6 Prosthodontist
- 7 Periodontist
- 8 Resident \_\_\_\_\_ (specialty if applicable)
- 9 Other \_\_\_\_\_ (specify)
- 10 Not in practice (skip remaining questionnaire, but please return the questionnaire)

2. At what practice setting do you spend the majority of your time?

- 1 Private practice
- 2 Hospital setting
- 3 Full-time faculty at a dental school
- 4 Part-time faculty at a dental school
- 5 Community health center/clinic

3. At what practice setting do you spend your secondary amount of time?

- 1 Private practice
- 2 Hospital setting
- 3 Full-time faculty at a dental school
- 4 Part-time faculty at a dental school
- 5 Community health center/clinic
- 6 Not applicable; I practice in only 1 clinical setting

4. In what year did you graduate?

- 1 Dental school \_\_\_\_\_
- 2 Most recent specialty program (if applicable) \_\_\_\_\_

Complete the following statements:

|   | Much better                | Better                     | Same                       | Worse                      | Much worse                 |
|---|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 5. Compared with implant therapy, do you feel the prognosis of root canal treatment with a vital pulp is    | <input type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 |
| 6. Compared with implant therapy, do you feel the prognosis of root canal treatment with a necrotic pulp is | <input type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 |
| 7. Compared with implant therapy, do you feel the prognosis of root canal retreatment is                    | <input type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 |

8. Please rank by percentage where you obtain information regarding *implant treatment outcomes*:

- 1 Dental school
- 2 Trade journals
- 3 Peer-reviewed journals
- 4 ADA/AAE/AAOMS/AAP
- 5 CE classes
- 6 Dental Sspecialists
- 7 Dental sales representatives

Total: 100%

9. Please rank by percentage where you obtain information regarding *root canal treatment outcomes*:

- 1 Dental school
- 2 Trade journals
- 3 Peer-reviewed journals
- 4 ADA/AAE/AAOMS/AAP
- 5 CE classes
- 6 Dental Sspecialists
- 7 Dental sales representatives

Total: 100%

**UTILIZATION**

10. If you decided that a patient needed an implant, who would you prefer place the implant? Please choose only 1 response

- 1 General Dentist
- 2 Orthodontist

**Table I.** Continued

|   |                            |                            |
|---|----------------------------|----------------------------|
| <input type="checkbox"/> 3 Endodontist  |                            |                            |
| <input type="checkbox"/> 4 Oral Surgeon   |                            |                            |
| <input type="checkbox"/> 5 Pedodontist  |                            |                            |
| <input type="checkbox"/> 6 Prosthodontist   |                            |                            |
| <input type="checkbox"/> 7 Periodontist   |                            |                            |
| 11. To the best of your ability, please estimate the number of completed procedures per month during the following 2 years  | 2004                       | 2007                       |
| a. The number of root canal procedures you have performed   |                            |                            |
| b. The number of root canal referrals you have made to other providers  |                            |                            |
| c. The number of implant placements you have performed  |                            |                            |
| d. The number of implant referrals you have made to other providers   |                            |                            |
| Indicate the extent to which you agree with the following statements:   |                            |                            |
|   | <i>Strongly agree</i>      | <i>Agree</i>               |
|   | <i>Undecided</i>           | <i>Disagree</i>            |
|   | <i>Strongly disagree</i>   |                            |
| 12. Endodontic treatment of a salvageable or restorable tooth would provide a better outcome than an extraction and a dental implant.                             | <input type="checkbox"/> 1 | <input type="checkbox"/> 2 |
|   | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 |
|   | <input type="checkbox"/> 5 |                            |
| 13. Endodontic retreatment of a failing root canal in a restorable tooth is preferable to extraction and a dental implant.  | <input type="checkbox"/> 1 | <input type="checkbox"/> 2 |
|   | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 |
|   | <input type="checkbox"/> 5 |                            |
| 14. In published studies, criteria used to determine a successful root canal treatment are the same as criteria used to determine a successful implant treatment. | <input type="checkbox"/> 1 | <input type="checkbox"/> 2 |
|   | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 |
|   | <input type="checkbox"/> 5 |                            |
| Complete the following statements:  |                            |                            |
|   | <i>Much less</i>           | <i>Less</i>                |
|   | <i>About the same</i>      | <i>More</i>                |
|   | <i>Much more</i>           |                            |
| 15 Compared to present times, what do you think the importance of the role of endodontics in dentistry will be in the future?                                     | <input type="checkbox"/> 1 | <input type="checkbox"/> 2 |
|   | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 |
|   | <input type="checkbox"/> 5 |                            |
| 16 How does the amount of information you receive on endodontics compare to the amount of information you receive on implants?                                    | <input type="checkbox"/> 1 | <input type="checkbox"/> 2 |
|   | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 |
|   | <input type="checkbox"/> 5 |                            |

**Table II.** Frequency analysis comparing the prognosis of a vital pulp, necrotic pulp, and retreatment to an implant

|            |               | <i>Percentage that thought RCT was better than implants</i> | <i>Percentage that thought RCT was the same as implants</i> | <i>Percentage that thought RCT was worse than implants</i> |
|------------|---------------|---|---|--|
| Question 5 | Vital pulp    | 44.8%   | 41.6%   | 13.6%  |
| Question 6 | Necrotic pulp | 29.0%   | 35.3%   | 35.7%  |
| Question 7 | Retreatment   | 14.5%   | 23.4%   | 62.1%  |

RCT, Root canal treatment.

prognosis of root canal treatment of a necrotic pulp was the same or better than implant therapy. These findings were significant with a *P* value of .0112.

**General dentist versus specialist**

To determine whether there were differences in the responses between general dentists and specialists regarding whether they thought that root canal treatment of a vital pulp was better, the same, or worse than an implant, a multinomial logistic regression was used. Specialists were significantly more likely to think that root canal treatment of a vital pulp had a worse prog-

nosis than implant treatment compared with their general dentist counterparts (*P* = .048). The multinomial logistic regression revealed an odds ratio of 2.45, indicating that general dentists had twice the odds to pick same over worse compared with specialists.

**Criteria for success**

In an effort to understand whether dentists appreciate the difference in criteria used to determine outcome among implant and endodontic prognosis studies, they were asked if they agree or disagree that criteria used to determine success are the same in endodontic and im-

**Table III.** Frequency analysis asking the responders to choose agree, disagree or undecided with the following questions

|             |  | <i>Agree</i> | <i>Undecided</i> | <i>Disagree</i> |
|-------------|--|--------------|------------------|-----------------|
| Question 12 | Endodontic treatment of a salvageable or restorable tooth provides a better outcome than extraction and a dental implant                           | 64.9%        | 16.3%            | 18.8%           |
| Question 13 | Endodontic retreatment of a failing root canal in a restorable tooth is preferable to extraction and a dental implant                              | 31.9%        | 47.3%            | 20.8%           |
| Question 14 | In published studies, criteria used to determine a successful root canal treatment are the same as criteria used to determine a successful implant | 8.8%         | 45.8%            | 45.4%           |

plant studies: 8% agreed, 49% were undecided, and 43% disagreed.

### Years since graduation

When the criteria for success were linked to years since graduation, it was found to have an effect on responses. The odds of agreeing that criteria to determine success are the same increased as years since graduation increased ( $P = .004$ ). Stated another way, older dentists were the least likely to appreciate the difference in criteria.

### Utilization

When looking at their utilization, dentists were asked where they would refer a patient for implant placement. The results of the frequency analysis are outlined in Table IV. Periodontists were chosen 53% of the time, oral surgeons 38% of time, and general dentists and the remaining specialists together 9%.

### Three-year interval evaluation

Evaluating utilization patterns between 2004 and 2007, 4 areas of treatment were surveyed: root canal treatments completed by survey respondents, endodontic referrals, implants placed by survey respondents, and implant referrals. The Z test revealed no significant difference between root canal treatments completed by survey respondents between 2004 and 2007. However, endodontic referral, implants placed by survey respondents, and implant referrals all significantly increased over the 3-year interval.

### Future of endodontics

Looking to the future of endodontics, we asked the survey respondents the following question: "Compared with present times, what do you think that the importance of the role of endodontics in dentistry will be in the future?" Thirty-two percent (85 respondents) answered less, 60% (160) answered the same, and 8% (19) answered more. We also inquired about how the amount of information they received on endodontics compares with the amount of information they receive

**Table IV.** Which type of dentist the responder would choose to have place an implant for their patient (question 10)

|                 | <i>No. of responses</i> | <i>%</i> |
|-----------------|-------------------------|----------|
| General dentist | 14                      | 5.0%     |
| Orthodontist    | 0                       | 0        |
| Endodontist     | 1                       | .3%      |
| Oral surgeon    | 100                     | 38.7%    |
| Pedodontist     | 5                       | 2.0%     |
| Prosthodontist  | 3                       | 1.0%     |
| Periodontist    | 139                     | 53.0%    |

on implants. The majority, 68% (179), answered less, and out of that group 25% (66) had answered much less. Twenty-six percent (68) had found the amount of information to be the same, and 1% (17) thought they received more information about endodontics.

### DISCUSSION

According to this survey, dentists think that the prognosis of root canal therapy of a tooth with a vital pulp is still superior to that of an implant. However, prognosis of implant treatment was thought to be better than root canal treatment of a necrotic pulp or retreatment. This is in contrast to a survey of dentists in Virginia completed in 2007, where respondents preferred endodontic retreatment 66% of the time over implant treatment.<sup>9</sup> These differences might be explained by regional variations in perceptions, because our study was limited to dentists who had their dental training in Connecticut. Additionally, our study surveyed dentists 2 years later than those in Virginia and may represent shifting perceptions.

In the survey of Virginia dentists, it was found that the odds of choosing an implant were higher with practitioners who had placed implants and those with  $\leq 10$  years of experience.<sup>9</sup> Our results showed that 41% of the junior dentists disagreed that retreatment is preferable to extraction and an implant versus 50% of the senior dentists disagreeing. Thus our results contra-

dicted the Virginia findings by reporting that the older dentists choose the implant more frequently.

Survey respondents overwhelmingly chose periodontists as their preferred referral choice for placing dental implants. Endodontists were the least likely (0.3%) to receive referrals for implant placement. This is in contrast to a recent survey by Potter et al., which found that 57% of their respondents supported endodontists placing implants and that currently 5.7% of endodontists place implants.<sup>10</sup> It appears to be clear that endodontists currently represent a small percentage of the specialists placing implants. However, it is unclear whether general dentists would change their referral patterns in the future.

More than one-half of the survey respondents did not appreciate the difference in criteria for measuring outcome between endodontic and implant prognosis studies. In addition, dentists reported receiving less information on endodontics compared with implants. This represents an area for endodontists to educate the dental community.

## CONCLUSIONS

A majority of respondents were unaware that a difference in criteria for success exists between the endodontic and implant literature.

Older dentists were the least likely to appreciate this difference.

Dentists thought that the prognosis of a vital pulp is still superior to implant treatment. However, they viewed implant prognosis to be superior to root canal treatment of necrotic pulps and retreatments.

General dentists have a more positive outlook on the prognosis of root canal treatment of a vital pulp than specialists.

## SUMMARY

In response to the initial hypothesis that utilization patterns are shifting from endodontic treatment and tooth conservation to tooth replacement with implants due to a perceived superior outcome, it was found that root canal treatments completed by respondents did not increase over time; however, root canal treatment referrals, implant placements, and implant referrals all increased over the 3-year interval from 2004 to 2007. Thus, a shift in utilization toward implant treatment

was not found; however, a perceived superior outcome of implant treatment compared with root canal therapy did exist among the sampled dental community.

The results of this study can help to target future educational efforts among referring dentists, especially older dentists. Increasing awareness of the differences in criteria for success in implant and endodontic literature appears to be necessary. Additionally, there is a need to educate dentists on endodontic prognosis. Other possibilities for the future could be a national study or a meta-analysis combining the results of several past studies.

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