Endodontic Treatment Outcome: Survey of Oral Health Care Professionals

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Abstract

This study assessed the opinion of oral health care professionals regarding the predictability of initial endodontic treatment, expected long-term outcome and the importance of placing a coronal coverage after completion of treatment. An eight-item questionnaire was distributed among oral health care professionals. There were 49% of participants who responded that the expected retention rate of teeth 5 to 10 yr after endodontic treatment was more than 90%, whereas 44% responded that such retention rate was between 70 to 80%. The majority of the participants also responded that the need for additional treatment, such as retreatment, apical surgery or extraction, was expected to occur within the first 3 yr after endodontic treatment if initial treatment has failed. About 87% of participants responded that placing coronal coverage after completion of endodontic treatment in premolars and molars was very important for long-term tooth retention and 92% responded that overall, endodontic treatment was a predictable procedure with long-term tooth retention rate. Statistically significant associations were found between years of experience and expected rate of retention for both the total group of respondents ($p < 0.001$) and for general practitioners when examined separately ($p < 0.002$). Statistically significant associations were only found for general practitioners between years of experience and their responses regarding the need for additional treatment ($p < 0.05$) and overall predictability of endodontic treatment ($p < 0.02$). A trend was found between the professionals' years of experience and their opinion regarding the importance of coronal coverage. Of the group who had more than 20 yr of experience, about 87% considered coronal coverage to be very important for long-term tooth retention. In conclusion, it appears that most clinicians participating in this study consider endodontic therapy to be a predictable procedure with long-term tooth retention rate. Their opinions also reflect the variations that currently exist in the literature regarding the reported outcome of endodontic treatment. *(J Endod 2006; 32:399–403)*

Key Words

Endodontic success, endodontic treatment outcome, initial endodontic treatment, opinion survey, tooth retention

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Endodontic treatment outcome is related to treatment expectations of the operator and can influence case selection and choice of treatment (1). Knowledge and assessment of endodontic treatment outcome by the clinician play an important role in a rational evidence-based case selection and endodontic treatment decision-making. In certain clinical situations, this may determine whether patients will retain their natural dentition or the affected tooth be replaced by an implant.

Follow-up clinical studies have shown that root canal treatment applying modern principles of practice can yield favorable outcome with healing rates well above 90% (2). It appears that patients also sense improved quality of life and satisfaction with their decision to have endodontic treatment rather than extraction (3). Furthermore, when assessing the retention rate of endodontically treated teeth, it has been found that nonsurgical endodontic treatment is a predictable procedure with excellent long-term prognosis (4, 5). Lazarski et al. (4) studied cohorts of patient populations in Washington State and assessed the outcome of initial treatment in 44,613 patients. They found that about 94% of the teeth remained functional after 3.5 yr (4). Salehrabi and Rotstein (5) assessed the prognosis and outcome of initial endodontic treatment in 1,462,936 teeth of 1,126,288 patients from 50 states across the United States. It was found that 97% of teeth were retained in the oral cavity at least 8 yr after initial nonsurgical endodontic treatment. The combined incidence of untoward events such as retreatments, apical surgeries, and extraction was 3% and occurred mostly within 3 yr from completion of treatment. In addition, analysis of the extracted teeth revealed that 85% had no full coronal coverage and a significant difference was found between covered and noncovered teeth (5).

Several investigations assessing the opinions of dentists regarding the restoration of endodontically treated teeth have been published (6-8). However, information regarding clinicians' opinions regarding endodontic treatment outcome and tooth retention rate is still lacking. The purpose of this study was to assess the opinion of oral health care professionals regarding the predictability of initial endodontic treatment, expected long-term outcome and the importance of placing a coronal coverage after completion of treatment.

Materials and Methods

An eight-item questionnaire was distributed among a convenience sample of oral health care professionals attending Continuing Education courses at the University of Southern California, School of Dentistry between March through May, 2005. The questionnaire included four items on practice profile and demographics and four multiple-choice questions regarding participants' opinions on endodontic treatment outcome (Fig. 1). Course participants included general dentists, specialists, dental hygienists and dental assistants. Over a period of 3 months, 1,000 survey questionnaires were distributed. Attendees received the surveys in their course registration materials and completion of the survey signified the individuals' voluntary consent to participate in the study. Participants also received instructions to complete the surveys and return them to a designated area. Survey questionnaires were anonymous and participants were not required to give their names or any other identifying information.

Data obtained from the returned questionnaires were entered and analyzed using SPSS version 13.0 statistical software. Associations between years of experience and (a) expected rate of retention, (b) the need for additional treatment, (c) placing coronal coverage, and (d) the overall predictability of endodontic treatment were analyzed. Nonparametric statistics were run to detect significant differences among nominal and ordinal data and the strength of those relationships where ordinal data were available for both variables. Differences among the groups were statistically analyzed using the Pearson Chi-Square test and Spearman rho tests at the $p < 0.05$ level of confidence. Differences among mean ranks for

1. Please indicate your profession. If you are a specialist, indicate your specialty:

a. Dentist- General Practitioner
b. Endodontist
c. Oral Surgeon
d. Orthodontist
e. Pedodontist
f. Periodontist
g. Prosthodontist
h. Other, please specify: _____

2. Please specify your age:

a. Less than 35
b. 35 – 44
c. 45 – 54
d. 55 – 64
e. 65 +

3. Years of professional experience:

a. 0 – 5 years
b. 6 – 10 years
c. 11 – 15 years
d. 16 – 20 years
e. More than 20 years

4. Practiced hours per week:

a. Less than 10 hours
b. 10 – 20 hours
c. 21 – 30 hours
d. 31 – 40 hours
e. More than 40 hours

5. In your opinion, the expected retention rate of teeth 5 - 10 years after endodontic treatment (excluding retreatments and apical surgeries) is:

a. More than 90%
b. 70% - 80%
c. Less than 60%

6. If initial endodontic treatment did not solve the condition and the tooth required additional treatment such as retreatment, apical surgery or extraction, when would you expect it to occur more frequently?

a. Within the first 3 years after endodontic treatment
b. 4 - 6 years after endodontic treatment
c. More than 6 years after endodontic treatment

7. Placing coronal coverage after completion of endodontic treatment in premolars and molars is:

a. Not important for long-term tooth retention
b. Somewhat important for long-term tooth retention
c. Very important for long-term tooth retention

8. Overall, is endodontic treatment a predictable procedure with long-term tooth retention rate?

a. Yes
b. No
c. I don't have an opinion

Figure 1. Questions used in the survey questionnaire.

responses were analyzed using the Kruskal-Wallis test and the differences between two responses were analyzed using the Mann-Whitney test at the $p < 0.05$ level of confidence as well.

Results

Frequency of responses is reported as a percentage of the total number of respondents for each question. Of the 1000 questionnaires distributed, 445 were returned, yielding a response rate of 44.5%. The majority of participants were general practitioners (88.3%) and the rest were specialists (7.7%) and other allied oral health professionals (4%) (Table 1). The majority (83.6%) were between 35 to 64 yr old (Fig. 2*A*), had more than 10 yr of professional experience (83%) (Fig. 2*B*) and practiced more than 20 h per week (93%) (Fig. 2*C*).

Almost half of the participants (49%) responded that the expected retention rate of teeth 5 to 10 yr after endodontic treatment was more than 90%, whereas 44% responded that such retention rate was between 70 to 80%, and 7% indicated it was less than 60% (Fig. 2*D*). The majority of the participants (67.9%) also responded that the need for additional treatment, such as retreatment, apical surgery or extraction, was expected to occur within the first 3 yr after endodontic treatment if initial treatment has failed (Fig. 2*E*). The majority of participants (87.6%) responded that placing coronal coverage after completion of endodontic treatment in premolars and molars was very important for long-term tooth retention (Fig. 2*F*), while 92.1% responded that overall, endodontic treatment was a predictable procedure with long-term tooth retention rate (Fig. 2*G*).

TABLE 1. Distribution of oral health care professionals completing the questionnaires.

Profession	No. of Participants	%
Generalists	393	88.3
Endodontists	15	3.4
Oral Surgeons	1	.2
Orthodontists	2	.45
Pedodontists	3	.7
Periodontists	7	1.6
Prosthodontists	6	1.35
Other	18	4.0
Total	445	100.0

Respondents with more experience indicated the expected retention rate of teeth was more than 90% (Table 2). Statistically significant associations were found between years of experience and expected rate of retention for both the total group of respondents (X^2 (8) = 27.059, $p < 0.001$), and for general practitioners when examined separately (X^2 (8) = 24.018, $p < 0.002$). Also, there were significant differences among the responses (H (2) = 19.747, $p < 0.001$).

Respondents with more experience indicated that if the tooth required additional treatment it would occur within the first 3 yr (Table 3). Here, the only statistically significant association was found for general practitioners, (X^2 (8) = 17.184, $p < 0.05$). Again, there were significant differences among the responses (H (2) = 11.321, $p < 0.01$). Similar results were found for the association between years of experience and the overall predictability of endodontic treatment in that the only statistically significant association was found for general practitioners, (X^2 (8) = 8.228, $p < 0.02$) (Table 4). Also here there were significant differences among the responses (H (2) = 8.749, $p < 0.02$).

Although there was no statistically significant relationship between years of experience and placing coronal coverage after completion of endodontic treatment in premolars and molars, a trend was found between the professionals' years of experience and their opinion regarding the importance of coronal coverage. Of the group who had more than 20 yr of experience, 87.14% considered coronal coverage to be very important (Table 5).

In addition, statistically significant correlations were found between years of experience and expected rate of retention and the need for additional treatment. The Spearman's rho correlation coefficient was calculated and resulted in an extremely weak positive correlation between years of experience and expected rate of retention (rho (443) = −0.117, $p = 0.014$) indicating a significant relationship between the two variables. In addition, an extremely weak positive correlation was found between years of experience and the need for additional treatment (rho (443) = 0.128, $p = 0.007$) indicating a significant relationship between the two variables.

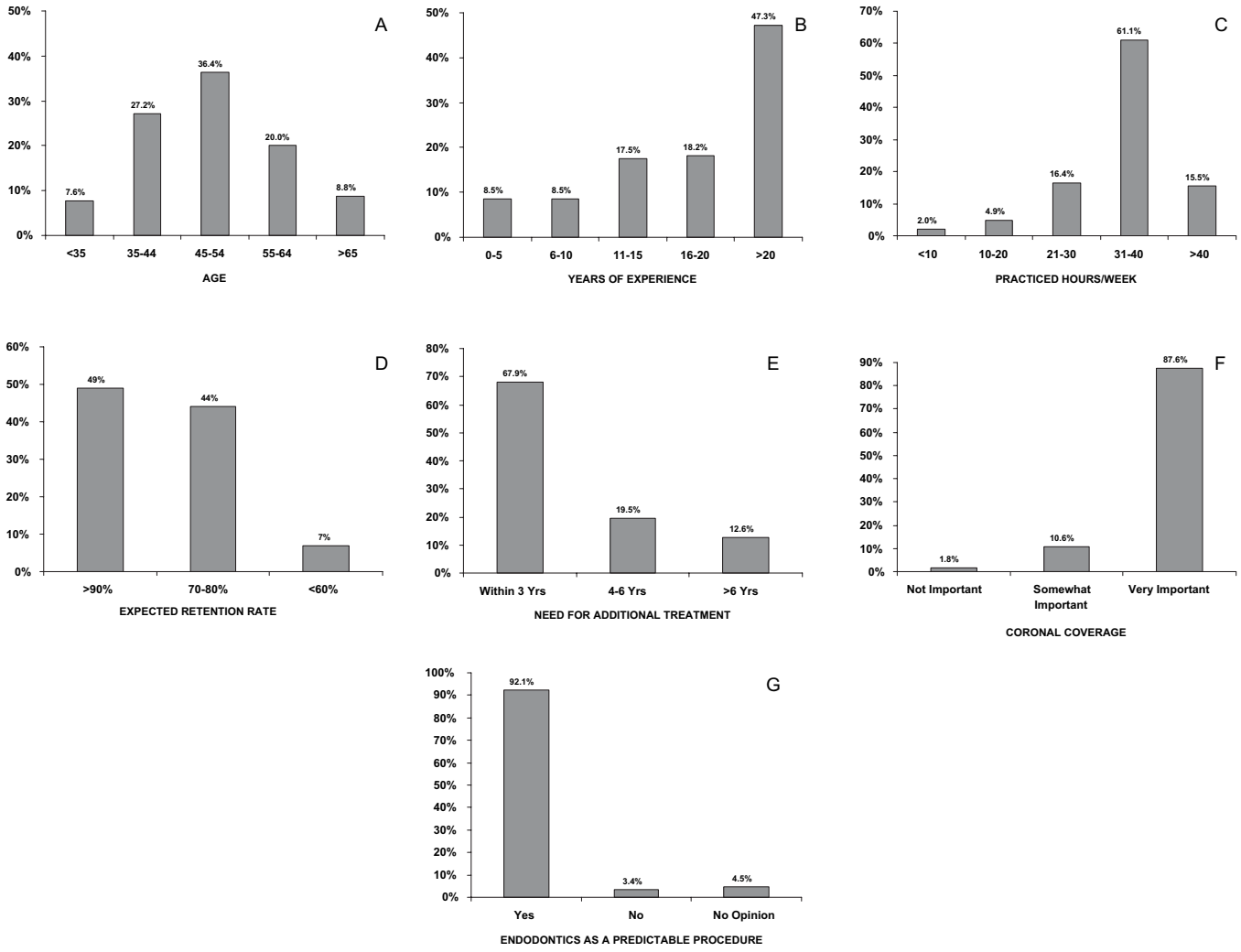

Figure 2. Percent distribution of age (*A*), years of experience (*B*), and weekly practice hours (*C*) of the oral health care professionals included in the study as well as percent distribution of their responses regarding expected retention rate of teeth 5-10 yr after endodontic treatment (*D*), expected time of need for additional treatment after endodontic treatment (*E*), importance of placement of coronal coverage in premolars and molars after endodontic treatment (*F*), and overall predictability of endodontic treatment as a procedure providing long-term tooth retention rate (*G*).

Discussion

The results of this study revealed several interesting patterns of knowledge and opinions among the participating oral health care professionals regarding the predictability of initial endodontic treatment, expected long-term outcome, and the importance of placing a coronal coverage after completion of treatment. The majority of participants expected untoward events such as retreatment, apical surgery or extraction to occur within the first 3 yr after initial endodontic treatment. This expectation is in alignment with data reported in the literature (5, 9). In an 8-yr. epidemiologic study of a large patient population in the US, it was found that most endodontic clinical failures requiring additional intervention were recognized within the first 3 yr (5). Additionally, tooth retention rates as related to such untoward events were not expected to change considerably thereafter (5). Another study found that the majority of apical surgeries were performed within the first 2 yr following completion of orthograde endodontic treatment (9).

The majority of the survey participants, about 87%, responded that placing coronal coverage after completion of endodontic treatment in

TABLE 2. Association between years of experience of participants and their responses regarding expected retention rate of teeth 5–10 years after endodontic treatment. Data show actual number of responses and numbers in brackets refer to general practitioners only.

Years of Experience	Retention Rate			Total
	>90%	70–80%	<60%	
0–5	16 (16)	21 (19)	1 (1)	38 (36)
6–10	12 (10)	24 (21)	2 (2)	38 (33)
11–15	27 (25)	46 (37)	5 (4)	78 (66)
16–20	47 (43)	31 (24)	3 (3)	81(70)
>20	116 (106)	74 (63)	20 (19)	210 (188)
Total	218 (200)	196 (164)	31 (29)	445 (393)

TABLE 3. Association between years of experience of participants and their responses regarding expected time of need for additional treatment after endodontic treatment. Data show actual number of responses and numbers in brackets refer to general practitioners only.

Years of Experience	Need for Additional Treatment			Total
	Within 3 Yrs	4–6 Yrs	>6 Yrs	
0–5	32 (31)	5 (4)	1 (1)	38 (36)
6–10	28 (25)	8 (7)	2 (1)	38 (33)
11–15	52 (43)	19 (18)	7 (5)	78 (66)
16–20	57 (50)	15 (13)	9 (7)	81 (70)
>20	133 (118)	40 (37)	37 (33)	210 (188)
Total	302 (267)	87 (79)	56 (47)	445 (393)

premolars and molars was very important for long-term tooth retention. This agrees with the data reported in several studies (4, 5, 10, 11). Lazarski et al. (4) found that unrestored teeth were a significant factor in failures following endodontic treatment. Salehrabi and Roststin (5) found that more than 83% of teeth extracted after initial endodontic treatment had no full coronal coverage. The number of extracted teeth without full coronal coverage was 5 to 6 times greater than fully covered teeth (5). Similar results were found by Aquilino and Caplan (10) who reported that endodontically treated teeth without full coronal coverage were lost at a rate six times greater than fully covered teeth. In addition, Vire (11) reported that about 60% of extractions of endodontically treated teeth occurred because of either restorative or prosthetic failure and coronal fractures. Although diverse opinions exist regarding the significance of the association between the quality of coronal restoration and outcome of endodontic treatment, it has been well established that the quality of both the root canal treatment and the restoration plays an important role in long-term treatment outcomes (10, 12–15).

The opinions of the participants regarding the expected retention rate of teeth 5 to 10 yr after endodontic treatment were divided. The majority (49%) responded that the expected retention rate was more than 90%, while many others (44%) expected it to be between 70 to 80%. This may reflect the controversy and confusing data that exist in the endodontic literature. Although a substantial number of studies attempted to assess the outcome of endodontic treatment, their reports varied considerably (1). Treatment outcome was assessed either by radiographic changes, evidence for healing or nonhealing of the tissues as determined by the specific investigators, functionality of the tooth involved and/or by presence of signs and symptoms. Because of lack of standardization, these studies varied considerably in design, treatment protocols and methodology as well as in recall rates and duration of the observation periods (1). Such variations in the published data may have created inconsistencies and lack of standardization for oral health care professionals attempting to determine long-term endodontic success or failure and make rational and effective case selection. Different criteria such as healing, functionality and tooth retention were also used and added to the existing confusion. It seems that measurement of loss of an endodontically treated tooth over time may be more informative and consistent rather than using the ambiguous terms "success" or "failure" that require, for comparison purposes, precise definitions agreed by all investigators (5, 16). In this regard, studies analyzing large cohorts of patient populations as well as multiple treatment variables can provide the oral health care professionals with more comprehensive data allowing better assessment of long-term tooth retention prognosis (4, 5).

From our study it appears that participants who expected the long-term tooth retention rate to be more than 90% were in alignment with the findings of Lazarski et al. (4) and Salehrabi and Rotstein (5) who analyzed large cohorts of patient populations and reported 94% and 97% retention rates, respectively. However, the fact that many professionals expected the retention rate to be less than 80% calls for better educational strategies and more consistency in criteria used to report long-term endodontic treatment outcome. It has been suggested that to form a reliable evidence base for the outcome and prognosis of initial endodontic treatment, studies need to comply with four methodology parameters: cohort, intervention, outcome assessment, and analysis

TABLE 4. Association between years of experience of participants and their responses regarding the overall predictability of endodontic treatment as a procedure providing long-term tooth retention rate. Data show actual number of responses and numbers in brackets refer to general practitioners only.

Years of Experience	Treatment is Predictable			Total
	Yes	No	No Opinion	
0–5	34 (32)	1 (1)	3 (3)	38 (36)
6–10	32 (28)	4 (4)	2 (1)	38 (33)
11–15	68 (57)	3 (3)	7 (6)	78 (66)
16–20	75 (64)	2 (2)	4 (4)	81 (70)
>20	201 (181)	5 (5)	4 (2)	210 (188)
Total	410 (362)	15 (15)	20 (16)	445 (393)

TABLE 5. Association between years of experience of participants and their responses regarding importance of placement of coronal coverage in premolars and molars after endodontic treatment. Data show actual number of responses and numbers in brackets refer to general practitioners only.

Years of Experience	Coronal Coverage			Total
	Not Important	Somewhat Important	Very Important	
0–5	0 (0)	3 (3)	35 (33)	38 (36)
6–10	1 (1)	5 (5)	32 (27)	38 (33)
11–15	2 (2)	6 (5)	70 (59)	78 (66)
16–20	1 (1)	10 (6)	70 (63)	81 (70)
>20	4 (4)	23 (21)	183 (163)	210 (188)
Total	8 (8)	47 (40)	390 (345)	445 (393)

(17). However, when more than 60 published observational cohort studies were analyzed, only 12 conformed to at least three of the four parameters (17, 18). These studies form the core of our current evidence for endodontic treatment outcome, however, some of them assessed relatively small populations and for short follow-up periods. Of these studies, only four studies also used tooth functionality as an endodontic treatment outcome criteria reporting retention rates of 88 to 94% (19–22). Out of these 12 core studies, only three studies conformed to all four-methodology parameters (23–25) out of which only one also reported tooth functionality as outcome criteria, yielding retention rate of 97% (25).

One of the most significant finding in our study was that the vast majority of oral health professionals (92%) expressed the opinion that, overall, endodontic treatment was a predictable procedure with long-term tooth retention rate. This finding may reflect the notion that exist among professionals that endodontic treatment can provide excellent service to patients by preserving the natural dentition for prolonged periods of time. This is also well supported by evidence documented in the literature (1–5, 15–25). Therefore, it is of utmost importance to use uniform criteria and provide supporting evidence to aid the clinician in his clinical-decision making process. From the results of this study as well as from data presented in the modern literature, most clinicians should prefer, whenever feasible, to preserve the natural dentition rather than replacing it with an artificial device.

Extrapolation of the results of this study to other oral health care professionals either in California, the United States or in other countries should be done with caution. Firstly, the return rate of the completed questionnaires was just below 50%. Secondly, our participants comprised a specific group of professionals, those who attended continuing education courses. More studies using samples from larger populations are required to further assess the opinions of oral health care professionals regarding the predictability of endodontic treatment and long-term treatment outcome.

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