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*Endodontology*

# A comparison of survival of teeth following endodontic treatment performed by general dentists or by specialists

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## Abstract

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**Objective** A chart review was performed at 3 private general practices in different regions of Alabama to compare success of endodontic treatment provided by specialists versus generalists.

**Study design** To qualify for the study the general dentists had to perform some endodontic treatment and to refer some to endodontists. Success was defined as the treated tooth being present at 5 years after the date of treatment initiation. This criterion, was chosen because of its unequivocal categorization of results. Calibrated dentists reviewed over 3,000 charts.

**Results** 350 met the inclusion criteria. 195 teeth were treated by generalists, with an 89.7% success rate. 155 teeth were treated by endodontists, with a 98.1% success rate.



**Conclusion** In this limited survey, endodontic treatment by specialists was significantly more successful.

The success of endodontics is of interest to dental professionals, patients, and third-party payers. Not only are predictive factors important, but also past experience of specialists and generalists may influence their selection by health-care providers or patients. Many authors have studied success; however, few studies compare endodontic treatment provided by generalists to care provided by specialists.

Many studies show greater than 90% success. In a recent study Lazarski et al found only a 5% loss of endodontically treated teeth to extraction.<sup>1</sup> They found no difference with training of practitioners and an overall success rate of 94% at 3-5 years posttreatment.<sup>1</sup> The cases treated by specialists were found to be more difficult technically. They also found that unrestored teeth were a significant factor in failure. Although the retreatment groups were small, there was a difference in surgical retreatment success, with endodontist success superior at 90.2% of 491 cases versus generalist success in only 71% success in 262 cases surgically retreated.

A recent study by Cheung suggests that nearly half of endodontic procedures fail, with a median survival time of just less than 2 years.<sup>2</sup> He reports the experience of a teaching facility in Hong Kong. Very stringent criteria were used. Many of the treatments deemed failures were ultimately successful following retreatment.

Caplan and Weintraub presented a study of a dental maintenance organization in Oregon.<sup>3</sup> They investigated associated conditions in an effort to better predict a successful outcome. They found that missing adjacent teeth, more plaque, history of trauma to the treated tooth, no posttreatment restoration, and older patients showed statistical probability of lower success. Training of the practitioner was not a factor in their rather small study of 96 cases with matched controls.

While outcomes were not considered, a recent study by Hull et al found that generalists provided treatment for half of the nearly 25,000 molar endodontic claims submitted to the Washington Dental Service in 1999.<sup>4</sup> Generalists treated nearly three quarters of the anterior teeth and premolars receiving nonsurgical endodontic therapy.

In a meta-analysis by Friedman, treatment of teeth with periapical inflammation as evidenced by periapical radiolucency has also been shown to diminish success.<sup>5</sup> He quoted 34 studies with success rates resulting in a nonweighted average of 90.7% if apical periodontitis were absent. In the presence of apical inflammation, studies were noted to show from 10% to 25% lower success.

The purpose of this study was to compare 5-year survival rates of teeth endodontically treated by endodontists versus generalists.

## Methods

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The University Human Studies Committee approved the protocol for the surveys. Informed consent was obtained from 3 general practitioners in different large cities in Alabama. Two were solo general practices and 1 was a group general dental practice. Three recent dental school graduates reviewed the charts after calibration to the following criteria.

Teeth were included or excluded on the basis of chart evidence indicating a root canal had been performed by a generalist or a specialist at least 5 years prior. Treatments were categorized as failures if a chart note or radiograph prior to the exact 5-year mark evidenced extraction of the subject tooth. Success was categorized as presence of the tooth on a radiograph or a restorative chart notation at or beyond the exact 5-year mark. Patients were excluded if there were no definite evidence of extraction prior to the exact 5-year mark or of continued presence of the tooth at or beyond the exact 5-year mark.

A form was used for data collection. It included patient initials, patient age in whole years at the time of initiation of treatment, tooth number using the 1-32 system, classification of the practitioner as a generalist or endodontist, the year treatment was performed, and whether the tooth was present at the exact 5-year mark. The exact date of treatment initiation plus 5 years was used.



Further calibrated data included measurement of the length of fill relative to the radiographic vertex of the root end. Five categories were included: overfill greater than 2 mm, overfill 0-2 mm, flush fill, underfill 0-2 mm from the radiographic vertex, and underfill greater than 2 mm. Preoperative calcification was recorded as present if the canal was not visible for its entire length or if a pulp stone was present radiographically. Preoperative periapical radiolucency was recorded as positive if the periodontal ligament at the apex was at least double the normal width. A curve was defined as a difference in canal path at least 20 degrees from the main canal direction. The presence of adjacent teeth was noted as 0, 1, or 2, based on the condition at the time of treatment. Restoration was defined as crown, post and crown, or intracoronal restoration, if noted on the chart or visible on a radiograph at any time between endodontic therapy and the exact 5-year mark. The category "No Restoration" was defined as absence of chart record or radiographic evidence of restoration anytime during the 5 years following endodontic treatment. The use of the subject tooth as an abutment for either fixed or removable prosthesis was noted using the 5-year radiographic or chart records. Immunocompromised status, as defined by the ADA Guidelines for prosthetic joint antibiotic prophylaxis, was recorded.<sup>6</sup> Finally, any management problem during the endodontic treatment that was noted on the chart was recorded.

In practice 1, review of approximately 900 charts yielded 128 endodontically treated teeth that met the qualifications for inclusion. Practice 2 provided 168 teeth for analysis from about 1400 charts inspected. Practice 3 gave 58 qualified teeth from approximately 700 chart reviews.

A chi-square analysis was performed where patterns seemed present. We used this test because data were not the type expected to be distributed in a bell-shaped pattern.

## Results

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Approximately 3500 charts were reviewed, and 350 charts met the inclusion criteria. The findings are presented in the [Table I](#) . Insufficient numbers existed in many categories to establish statistical significance. The data were interpreted as follows.

**Table I.** Raw data recorded by categories for each practice

	Practice 1 (800 Charts)			Practice 2 (1,600 Charts)			Practice 3 (700 Charts)			Total (3,100 Charts)		
	GP	Endo	Failures	GP	Endo	Failures	GP	Endo	Failures	GP	Endo	Failures
n	88	40	12	62	102	6	45	13	5	195	155	23
Mean age	51.4	53.9	46.7	47.1	49.6	55.0	46.8	51.2	55.8	49.0	50.8	50.8
3rd molars	1	0	0	0	1	0	1	0	0	2	1	0
2nd molars	15	22	4	3	22	1	10	3	1	28	47	6
1st molars	22	16	3	13	39	1	14	5	1	49	60	5
Pre molars	28	1	3	30	30	3	15	2	2	73	33	8
Anteriors	22	1	2	16	9	1	5	3	1	43	13	4
Primary T.					1						1	
Failures	11	1		4	2		5	0		20 (10.3%)	3 (1.9%)	23 (6.6%)
Fill												
>2 Short	37	8	6	19	15	4	16	0	2	72	23	12 (12.6%)
0-2 Short	40	22	6	34	67	1	24	8	3	98	97	10 (5.1%)
Flush	8	6	0	7	17	1	4	5	0	19	28	1 (2.1%)
0-2 Long	3	4	0	2	3	0	1	0	0	6	7	0
>2 Long	0	0	0	0	0	0	0	0	0	0	0	0



Calcification	10	4	1	14	57	1	14	8	2	38	69	4
Preop area	57	26	9	40	56	5	26	6	5	123	88	19 (9%)
Curve >20°	19	13	2	3	24	2	3	9	1	25	46	5
Adjacent t.												
2	55	16	6	49	67	2	32	5	3	136	88	11 (4.9%)
1	29	19	5	12	31	3	10	8	0	52	57	8 (7.3%)
0	4	5	1	1	4	1	3	0	2	8	0	4
Restoration												
Crown	65	38	9	49	94	4	38	13	3	152	145	16 (5.4%)
Post/CR	12	1	1	7	2	1	2	0	0	21	3	2 (8.3%)
Intracoronals	4	0	0	4	6	0	3	0	0	11	6	0
None	7	1	2	2	0	1	2	0	2	11	1	5 (20.8%)
Abutment												
None	63	34	9	54	86	2	47	6	4	164	126	15 (5.1%)
Fixed	24	6	3	6	12	3	3	0	1	33	18	7 (13.7%)
Removable	1	0	0	2	4	1	0	2	0	3	6	1 (3.8%)
Immuno comp Management	1	0	0	2	4	1	0	2	0	3	6	0
Management	1	0	0	1	0	0	2	0	2	4	0	2

The mean ages of all groups were essentially equal. The success rate of endodontists at 98.1% was statistically significantly better than the rate for generalists at 89.7% ( $P < .01$ ). Endodontists treated predominately molars, yet the generalists treated many molars, even third molars. Endodontists treated 62% of second molars and 55% of first molars. Endodontists treated half of the premolars and a third of the anteriors. These data generally agree with Hull et al.<sup>4</sup>

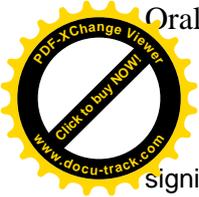
Almost all root fillings were generally confined to the canal, with no overfills greater than 2 mm. Of the 350 total, only 13 were cataloged as overfilled; 47 were flush with the radiographic apex. Most obturations terminated within the apical 2 mm of the canal ( $n = 195$ ). Underfills greater than 2 mm occurred in 94 cases. When the group of short fills greater than 2 mm was compared with the fills 0-2 mm from the radiographic vertex, a chi-square test found a statistically significant difference, with  $P < .025$ .

Generalists were willing to undertake treatment of teeth with periapical radiolucencies. They treated 58% of all teeth with periapical inflammation sufficient to minimally double the periodontal ligament width. They treated fewer teeth with calcified canals (36%) and curves (35%).

Adjacent teeth were present mesially and distally to the endodontically treated tooth in 224 cases. Only 1 adjacent tooth was present in 109 patients. Eight cases were found where the treated tooth had no adjacent teeth. Of these 8, 4 were failures. Although this lone-tooth group is very small, it concurs with the conclusions of Caplan and Weintraub.<sup>3</sup>

Crowns were the most frequent restoration, at 296. Crowns with posts totaled 24, making the total for crowns 320 of 350. Intracoronals occurred in 18 cases, and they were placed in 8 anterior teeth, 3 premolars, 3 first molars, and 4 second molars. Twelve teeth were not restored. Five failures (42% of the 12 unrestored teeth, 21% of all failures) occurred in the unrestored group, but again the number is too small to draw a firm conclusion but concurs with findings by Caplan and Weintraub.<sup>3</sup>

Comparison of abutments showed a higher percentage of failures with the group that served as fixed bridge anchors versus removable prosthesis abutments or no abutment. However, this difference was not statistically



significant.

Review of data in [Table 1](#) showed an interesting trend. Practice 2 had a referral rate more than double the others. The failure rate in this practice was less than half its peers. This practice also had a much higher rate of crown placement. Further, the number of treated teeth that were not used for prosthetic abutments was much higher. These data are insufficient, however, to show statistical difference.

## Discussion

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A chart review format was chosen for this study because of the potential difficulty in contacting patients. Also we considered that practitioners might be reluctant to participate if they thought that direct patient contact could lead a disgruntled patient to take legal action. The 5-year time was chosen because that interval is frequently used in survival studies, including those for implants. Presence or absence of the tooth is not subject to interpretation as would be subjective measurement of radiographic change, clinical signs and symptoms, patient history, etc.

Tooth loss could be due to restorative failure, fracture, or other nonendodontic reason. The chart review format was not considered a satisfactory means to gather such data.

The fact that generalists did not have as much success may relate to training, as suggested by Cheung.<sup>2</sup> One who has engaged in study at the residency level has considerably more didactic and clinical instruction compared to the generalist's experience during their dental school curriculum. Further, practicing endodontists would be expected to have more clinical experience than generalists.

Certainly many factors enter into the decision to refer a patient for specialist care. These include technical difficulty, patient management, and tooth position, among others. One should be cautious in extrapolating data from only 3 practices, yet comparison of the 3 practices shows widely different referral patterns. Few trends were identified to determine criteria generalists use to make referrals. Sixty-nine percent of referred teeth were molars. Calcified and curved canals also were referred at a greater rate.

Another interesting finding was that obturations more than 2 mm short of the apex resulted in a higher, but not statistically significantly different, failure rate. A larger sample may show statistically significant differences. Another factor associated with higher failure was lack of coronal restoration.

The high long term survival rate for teeth treated by endodontic specialists is equal or better than the long term outcome of implants. A recent meta-analysis of implants by Berglundh et al evaluated 51 longitudinal studies of at least 5 years, reporting 2.5% failure prior to loading and an equal rate of failure for implants restored with fixed prostheses.<sup>7</sup> If the final restoration were a removable prosthesis, the failure rate was greater than 5 per cent. Another implant survival study followed over 1022 ITI® implants (Straumann, Waldenburg, Germany) in 10 different practices in France<sup>8</sup>: 1.4% were lost before loading, 4.6% were lost at 5 years, and the failure rate reached 7.8% at 7 years.

The failure groups were so small that statistical analysis was not feasible. The notable trend was that pretreatment radiographic apical rarefactions had a negative effect on success. This confirms the findings of Friedman.<sup>5</sup>

The high failure rate associated with lack of restoration lends credibility to the philosophy of the importance of the coronal restoration, as demonstrated by Ray and Trope.<sup>9</sup> Even though the sample in this study was too small to achieve statistical significance, the suspicion is that higher failure should be expected when no restoration follows the endodontic therapy. The overall high rate of crowns and other restorations may partly explain the very good success rate of endodontic therapy in this study.

In summary, endodontically treated teeth have a high rate of survival, especially when treated by specialists. This survival rate is as high or better than the survival rate reported for dental implants.

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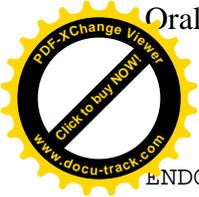
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## Publishing and Reprint Information

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