Factors Related to Decisions to Extract or Retain At-risk Teeth

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Abstract

Objectives: Decisions to extract a tooth may be among the most critical in dentistry. The aim of this study was to prospectively investigate both clinical and nonclinical factors related to decisions to extract or retain teeth in private general dental practice. Methods: A convenience sample of 196 lowa dentists in private general dental practice reported on 549 cases where decisions were made to extract or retain teeth as they occurred in their practices during a one-month period in May 1997. Bivariate and multivariate analyses were used to identify factors that differentiated between cases where a tooth (or teeth) was extracted and cases where an at-risk tooth was retained. Results: Of the 549 cases, 67 percent involved extraction, while the remainder involved alternatives to extraction. In comparing extraction cases to alternative treatment cases, we excluded 150 extraction cases because dentists reported that no alternative to extraction was available. Using Generalized Estimating Equations (GEE), we identified cost of treatment, presence of tooth mobility, poor prognosis of alternative treatment, and presence of gross caries as significant factors associated with extraction, while previous treatment of the tooth and concerns with patients' health were significantly associated with alternatives to extraction. Conclusions: For teeth at risk for extraction, cost, substantial periodontal disease, and several clinical factors were predictive of extraction. [J Public Health Dent 2000;60(1):39-42]

Key Words: dental health services, tooth extraction, decision making.

The loss of a tooth or teeth can have substantial impact on current oral health and limits future treatment options. Thus, decisions to extract teeth may critically impact the future oral health of dental patients; therefore, it is important to identify factors that contribute to such decisions to extract or retain teeth. Several previous studies have examined dentists' decision making and have found significant variation regarding restorative decisions (1,2). However, such studies may be limited by their simulated approach, which may produce different decisions depending on how the simulation is presented (3). Furthermore, studies of dentist decision making have not focused on decisions to extract or retain teeth, which may have the greatest impact on oral health.

Many studies have attempted to identify reasons for tooth extraction. These studies generally have focused only on oral disease factors and have

found dental caries to be the main reason for extraction, although some have found periodontal disease to be an important reason, especially in older persons (4-7). A few studies examining nonclinical factors and such things as older patient age, lower income, and education levels found new or emergency status in the practice to be associated with extraction (7-9). However, some of these studies were limited to insurance claims data and relatively few were conducted in actual private practice settings. No published studies have reported on factors that distinguish tooth extraction from alternative treatment. That is, previous studies have examined extraction in the context that all teeth are potential candidates for extraction rather than focusing on only those teeth that are truly at risk for extraction.

The purpose of this study was to investigate prospectively both clinical and nonclinical factors related to decisions to extract or retain teeth in private general dental practices.

Methods

We prospectively collected data on clinical and nonclinical factors regarding decisions to extract or retain teeth using pretested dentist questionnaires. We asked participating dentists who were engaged actively in the private practice of general dentistry to complete 25-item, detailed questionnaires when appropriate cases were seen in their offices during a threeweek period in 1997. We asked dentists to choose appropriate cases following brief guidelines and instruction provided to each dentist. We chose not to limit designation of extraction "alternatives" to specific procedures, which may or may not characterize teeth truly at risk for extraction. Instead, we defined cases that dentists were to choose for the study as those where, based on only clinical exam findings, radiographs, and study models, a competent dentist would consider extraction of one or more teeth. We further limited cases to only permanent teeth, and we asked dentists to report on only a single tooth per person. In cases where more than one tooth was extracted or treated alternatively, a single tooth was randomly selected by the dentist following a scheme developed by the study team that utilized a sequence of tooth numbers randomly assigned to each individual questionnaire. We also excluded permanent teeth that were extracted because of space considerations or orthodontics, as well as impacted third molars. Thus, the participating dentists chose the study subjects and teeth "at risk" according to the study team instructions. Lastly, for cases where extractions were performed, we asked dentists to indicate whether the extracted tooth could have been saved. This was done so

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that we could exclude unsalvageable teeth in comparisons between extraction and alternative treatment cases.

In developing our protocol, a pilot study involving 19 volunteer dentists was conducted. The pilot study utilized a lengthy questionnaire that dentists were asked to complete for each appropriate case, as well as a parallel patient questionnaire. For the patient questionnaire, the dentists distributed the questionnaire to the patient, who completed it and returned it directly to the study team. Code numbers linked the dentist and patient questionnaires so that responses could be compared. Usable data on 135 cases were obtained during the pilot study. Participating dentists advised us that the questionnaire was overly burdensome to complete and that distributing a questionnaire to their patients was awkward. We also had concerns that including the patient questionnaire biased dentists' case selection toward more cooperative and "friendly" patients. Based on this input and our concerns, the length of the dentist questionnaire was reduced, the patient questionnaire was eliminated, fewer dentist factors were included, and certain items were modified to improve clarity. In addition, the number of cases per dentist was limited.

Following completion of the pilot study, we invited all active private practice general dentists in Iowa who had not been involved in the pilot study (N=906) to participate by reporting on up to three cases during a threeweek period. Of these, 196 dentists (22%) responded to a single mailing, providing information on 549 cases.

All data were entered and verified using SPSS software (10). Descriptive statistics, bivariate analyses, and multivariate analyses were generated using SAS (11). Bivariate and multivariate analyses were conducted using Generalized Estimating Equations (GEE) (12) to identify factors that differentiated cases where teeth were extracted from cases where an alternative procedure was performed. GEE is a method of regression for correlated data (12). In the present study, the data contain multiple responses (up to three) from the same dentist that are correlated within individual dentists, but treated independently across individual dentists. Because the dependent variable is dichotomous and the

TABLE 1	
Factors Distinguishing Extraction from Alternative Treatment Cases (cont. p. 41	1

Factor	n	Extraction (%)	Alternative (%)	P-value
Patient status			<u> </u>	.002
Regular visits	167	36	49	
Emergency visits	140	43	26	
New to practice	91	22	24	
Method of payment				<.001
Out of pocket	224	66	44	
Private insurance	153	30	48	
Title XIX	21	4	7	
Oral hygiene				<.001
Excellent	27	3	11	
Good	141	25	48	
Fair	153	45	31	
Poor	73	26	10	
Patient's health influenced treat.				.005
No	230	65	50	
Yes	167	35	50	
Tooth condition				.001
Caries	183	44	52	
Periodontal disease	38	14	4	
Other reasons	165	42	44	
Gross caries present				.009
No	220	51	68	
Yes	169	49	32	
Tooth mobility				<.001
No	316	71	94	
Yes	73	29	6	
Periodontal status				<.001
Little or no perio. disease	213	47	65	
<6 mm attach. loss	134	37	31	
6+ mm attach. loss	41	16	3	
Any previous tooth treatment				.007
No	82	26	15	
Yes	397	74	85	
	1.			

data are correlated, the binomial distribution with the logit link is used in the GEE regression model. The GEE regression model tested potential correlates and two-way interactions using the Wald chi-square statistic. In performing the multivariate analyses, we considered all variables as potential correlates, but used a *P*-value of .05 or less based on the Wald chi-square as the inclusion criteria for variables to enter the final model.

Results

Among the 549 cases reported for the study, 368 (67%) involved extraction, while 181 involved alternatives (133 involved endodontic therapy, 95 involved complex restorative treatment, and 12 involved periodontal therapy). For 40 percent of the 549 cases, caries was cited as the primary reason for treatment, while periodontal disease was cited for 19 percent of the cases. Other primary reasons for treatment included nonrestorability (9%), uncertain prognosis (7%), prosthetic considerations (5%), trauma (2%), and other unspecified reasons (18%).

Forty percent of the patients made regular visits to the practice, while 36 percent made only emergency visits, and 24 percent were new to the practice. Of the 549 patients, 308 (56%) paid primarily out-of pocket, 208 (38%) had private dental insurance, and 32 (6%) had Title XIX coverage. Females made

TABLE	TABLE 1 [cont. from p. 40]				
Factor	n	Extraction (%)	Alternative (%)	<i>P</i> -value	
Cost cited as factor				<.001	
No	272	51	91		
Yes	120	49	9		
Questionable prognosis if retained				<.001	
No	283	57	91		
Yes	109	43	9		
Tooth type				.010	
Mandibular incisors	9	4	1		
Maxillary incisors	31	8	9		
Canines	25	7	7		
Premolars	94	26	26		
1st molars	116	26	39		
2nd molars	73	23	17		
3rd molars	13	6	1		
Active coronal caries in remaining				.011	
dentition					
No	286	51	49		
Yes	101	65	35		
Mandibular part. denture present				.011	
No	342	85	93		
Yes	44	15	7		
Sex of patient				.027	
Male	188	42	53		
Female	210	58	47		
Mean age of patient (years)*		51.8	47.4	.008	
Mean # teeth with 6 mm					
attachment loss*		2.2	1.3	.037	
Mean # remaining teeth		25.2	21.5	<.001	

TABLE 1 [cont. from p. 40]

*P-values based on t-test, all others on Wald chi-square statistic (from GEE).

 TABLE 2

 Final Generalized Estimating Equation Regression Model of Factors

 Distinguishing Selection of Extraction from Alternative Treatment

Factor	P-value	Estimated Odds Ratio for Extraction (95% CI)
Cost a factor in decision	<.001	16.7 (7.6, 36.3)
Poor prognosis for alternative	<.001	8.4 (4.1, 17.2)
Tooth mobility present	<.001	8.0 (3.9, 16.8)
Poor oral hygiene*	.001	2.5 (1.4, 4.5)
Gross caries present	.013	2.3 (1.2, 4.5)
Female patient	.038	1.9 (1.1, 3.3)
Any previous treatment of tooth	.011	0.3 (0.1, 0.8)
Patient's health a factor	.003	_
Older patient age	.311	
Patient's health * older patient age (interaction term)	.039	—

*Variable was made dichotomous: good or excellent vs fair or poor.

up 53 percent of this sample, and the mean patient age was 51.3 years.

To make valid comparisons between extraction and alternative treatment cases, we limited the analysis by excluding cases where dentists stated that an extracted tooth could not be saved (i.e., there was no alternative to extraction). Thus, 150 extraction cases were excluded, so that we compared 218 cases where extractions were performed (in spite of feasible, alternative treatment) to 181 cases where treatment considered as alternative to extraction was performed. Cases for these analyses were submitted by 186 of the 196 dentists responding to the questionnaire. As demonstrated in Table 1, significant differences (P < .05) between cases where a tooth was extracted and cases where alternative treatment was performed were found for a number of different factors, including patients' method of payment, oral hygiene and age, and periodontal status of the tooth.

As described previously, we performed GEE to identify factors that differentiated between extraction and alternative treatment cases and to test for interactions. The final regression model is presented in Table 2. Dentist age, number of years in practice, and dentist sex were not statistically significant (P<.05) in differentiating extraction cases from alternative treatment cases, although patient sex (female) was weakly predictive of extraction. Clinical factors that were significant in differentiating between extractions and alternative treatment included tooth mobility, poor oral hygiene, and presence of gross caries. A significant interaction existed between patient's health being a factor in the decision and patient's age. Regardless of the patient's health status factor, older patients were more likely to have a tooth extracted. However, as indicated by the interaction, the age effect is not the same in the patient's health status factor. If a dentist indicated that the patient's health status was NOT a factor in the decision the odds ratio for a one-year increase in age is 1.01 (95% CI=0.99, 1.05) and for a five-year increase it is 1.06 (95% CI=0.94, 1.21). If a dentist indicated that a patient's health status was a factor, the odds ratio for a one-year increase in age is 1.05 (95% CI=1.03, 1.07) and for a fiveyear increase it is 1.27 (95% CI=1.14, 1.41).

Discussion

This study was unique in that we asked private practice general dentists to identify cases where one or more teeth were considered for extraction. Having selected only "at-risk" teeth, we then attempted to identify factors that distinguished whether these teeth were actually extracted or retained. For 40 percent of all cases, caries was the primary reason for treatment-by far the most common factor cited. However, our analyses found that tooth mobility (indicating poor periodontal status) was a significant predictor of tooth extraction. Thus, our findings suggest that while caries may be the most common reason that puts a tooth at risk for extraction, the presence or absence of significant periodontal disease may be the determining factor in whether a tooth is actually extracted. Moreover, when the analysis was restricted to only those for whom cost (another significant predictor of extraction) was not a factor, tooth mobility was a significant predictor of extraction.

As stated above, when cost was a factor in the decision, it also was significantly predictive of extraction, which is not unexpected, as the cost differential between extraction and complex, alternative treatment often is quite substantial. Other predictors of extraction such as poor prognosis for alternative treatment, presence of gross caries, and poor patient oral hygiene reflect the dentists' assessments of the feasibility and likelihood of success for alternative treatment.

Previous treatment of the "at-risk" tooth and concerns with the patient's health were predictive of selection of an alternative to tooth extraction. Perhaps previous treatment of the tooth reflects patients' investment of time and money in maintaining the tooth, such that extraction would be akin to "throwing away" their investment. The association between patients' health and selection of alternatives to extraction suggests that, for these patients, dentists may have been concerned about the potential for complications with extraction, patients' oral function, or patients' ability to adapt to the loss of one or more teeth.

An important limitation of the

study was the relatively low response rate of 22 percent. Because of limited available resources, the response that was generated was entirely the result of a single mailing, and there was no publicity about the study either prior to, or just after, the mailing. Thus, response may have been greater with more effort to publicize the study and one or more follow-up mailings to nonrespondents. However, given that this type of study requires active participation in the selection of cases and reporting of findings, response realistically cannot be expected to approach that of typical questionnaire-based surveys (7).

Because of the relatively low response rate, the sample cannot be considered representative of all Iowa dentists. Comparison of the few dentist characteristics obtained from the sample to all licensed Iowa dentists (13) reveals that the median number of years in practice and median age were the same (18 and 46 years, respectively), although the proportion of females responding to the study (14%) was higher than the proportion of female dentists in Iowa (9%). Thus, one should exercise caution in extrapolating the results of our study to other populations.

Lastly, cases selected for the study were subject to each participating dentist's judgment as to what teeth were truly "at risk" for extraction, and the selection of subjects may have been biased in some way. These potential biases may be considered a weakness of the study, in that what constituted a "case" undoubtedly varied from dentist to dentist; however, we chose this approach in an attempt to obtain a mix of cases from dentists with a variety of treatment philosophies, and different thresholds of trying to salvage "at risk" teeth. Moreover, we did not want to restrict cases artificially to a narrow list of alternative treatments, so as to capture the wide variety of situations that occur in private practice. While this approach likely resulted in considerable variation in the cases included and excluded, we nonetheless were able to identify several factors that distinguished extraction from alternative treatment cases.

In summary, we found that for teeth at risk for extraction, cost issues, substantial periodontal disease, and other clinical factors were significant predictors of extraction. We feel that our approach—of identifying teeth at-risk for extraction and prospectively gathering information about teeth treated with "alternatives" to extraction as well as tooth extraction—allows for a more focused study of dental decision making in actual practice, and allows assessment of factors that distinguish extraction from the various alternatives. However, while this approach is promising, further studies utilizing larger samples in other settings are needed to understand more fully decisions to extract or retain teeth.

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