

Analysis of Reasons for Extraction of Endodontically Treated Teeth: A Prospective Study

Babacar Touré, DDS, PhD,* Babacar Faye, DDS, PhD,* Abdoul W. Kane, DDS, PhD,*
Cheikh M. Lo, DDS,[†] Bassirou Niang, DDS,* and Yves Boucher, DDS, PhD[‡]

Abstract

Introduction: The purpose of this prospective study was to analyze the factors related to extraction of endodontically treated teeth. **Methods:** One hundred nineteen cases of extraction of endodontically treated teeth were consecutively reviewed, and the following items were recorded: type of tooth; presence and type of coronal restoration; motive of consultation; reasons for extraction; patient's age, gender, level of education; smoking status. Association between factors was investigated with χ^2 analysis. **Results:** Dental pain was the main motive for consultation (68.9%). The teeth most extracted were mandibular molars (51.3%), followed by maxillary molars (16.1%). First molars were the most frequently extracted (29.4%). Ninety-one teeth (76.5%) were restored coronally with or without post, and crowned teeth represented 5.9% of the sample. The reasons for extraction were periodontal disease (40.3%), endodontic failure (19.3%), vertical root fracture (13.4%), nonrestorable cuspid and crown fracture (15.1%), nonrestorable caries (5.2%), iatrogenic perforations and stripping (4.2%), and prosthetic (0.8%). Analysis between gender, smoking status, and education level showed no significant difference for reasons of extraction ($P = .33$ and $.34$). **Conclusions:** The mandibular first molar without crown was the most frequently extracted tooth. The main reasons for extractions were periodontal disease, endodontic failure, and nonrestorable tooth damage caused by fracture or caries. (*J Endod* 2011;37:1512–1515)

Key Words

Endodontically treated teeth, extraction, factors

From *Conservative Dentistry and Endodontics, University Cheikh Anta Diop, Dakar, Sénégal; [†]Dental Public Health, University Cheikh Anta Diop, Dakar, Sénégal; and [‡]Conservative Dentistry and Endodontics, University Paris VII, Paris, France.

Address requests for reprints to Dr Babacar Touré, Maître de Conférences Agrégé Conservative Dentistry and Endodontics, PO Box 12465, Colobane Dakar, Faculty of Medicine Pharmacy and Odontology, University Cheikh Anta Diop, Dakar, Sénégal. E-mail address: babacar.toure@ucad.edu.sn 0099-2399/\$ - see front matter

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Despite progress in prevention and operative techniques, teeth extraction remains an important part of therapeutics. Several studies investigating the reasons for teeth extraction report predominance of carious and periodontal diseases (1–9). Because endodontic treatment is performed mainly to prevent tooth extraction, it is important to evaluate the fate of endodontically treated teeth. Two longitudinal studies carried out in the United States with a long follow-up period reported retention for endodontically treated teeth in oral cavity of 94% and 97% (10, 11). A study in Taiwan followed 1,557,547 teeth during a 5-year period after nonsurgical endodontic treatment and found a retention rate in oral cavity of more than 92.3% (12). These studies have not specified the reasons for the extractions of the missing teeth. In fact, studies reporting the factors accounting for the extraction of endodontically treated teeth are scant. For instance, after chart examination of 147 extracted teeth after endodontic treatment, Fuss et al (13) found that the reasons were related to the quality of the crown restoration (43.5%), the endodontic treatment (40.2%), a vertical root fracture (10.9%), and periodontal diseases (5.5%). Vire (14) noted in a study of 116 endodontically treated teeth that in 59% of the cases, prosthodontics reasons motivated the extraction, followed by periodontal disease (32%) and endodontic treatment failure (9%). In another study, Zadik et al (15) found the following reasons: nonrestorable caries 61.4%, endodontic treatment failure 12.1%, vertical root fracture 8.8%, iatrogenic perforations and stripping 8.8%, periodontal diseases 4.6%, cusp fractures 2.4%, orthodontic factors 1.3%, prosthetic factors 0.2%, and trauma 0.5%. When studying the associated factors, they noted that the periodontal causes were more prevalent among smokers than in nonsmokers, which corroborates the results of Johnson and Guthmiller (16) on the impact of cigarette smoking on periodontal diseases. It is worthy of note that all these investigations were of retrospective design.

The purpose in this study was to prospectively investigate the reasons for the extraction of permanent endodontically treated teeth.

Materials and Methods

Data were collected consecutively during a 2-month period extending from April 15–June 15, 2010. The information was obtained from 120 practitioners randomly selected from a list provided by the National Order of Dental Surgeons of Senegal. Practitioners who had an exclusive and specialized practice were removed from this list. Questionnaires were sent to the included practitioners by mail with a stamped envelope. They were due to return at the end of the study. The questionnaire included information about the practitioner (age, gender, seniority); the patient (age, gender, level of education, and smoking status); the motive for consultation (pain, mobility, esthetics, trauma, other reasons to be specified); the tooth or teeth extracted (type, the preexisting coronal restoration); and the reason for extraction (endodontic failure, caries, periodontal disease, prosthetic, fractures, perforations, orthodontic, esthetic, or other reasons to be specified). The endodontic treatment was confirmed by a radiographic appearance of some permanent root canal filling. Teeth that were extracted before the completion of the endodontic treatment were not included in this study.

Confidentiality and anonymity were respected throughout.

The aforementioned variables related to the practitioners, the patients, and the teeth extracted were computed. The different quantitative variables are expressed in

TABLE 1. Distribution of the Sample According to Motive for Consultation

Motive for consultation (n = 119)	n	%
Pain	82	68.9
Dental mobility	13	10.9
Trauma	10	8.5
Esthetics	3	2.5
Other	11	9.2

terms of their mean and standard deviation, whereas the qualitative variables are given as their absolute value and the percentage.

The association between qualitative variables was tested by using χ^2 . The level of significance was fixed at $P \leq .05$. The statistical analysis was performed with the SPSS software (Statistical Package for Social Sciences version 11.5; SPSS Inc, Chicago, IL).

Results

Of the 120 dental surgeons asked to participate in this study, 33 responded to the questionnaires, providing a response rate of 27.5%. The mean age was 43.85 ± 7.96 years; 72.7% were male. The mean professional practice was 14.06 ± 7.68 years.

One hundred nineteen patients had a permanent tooth extracted after an endodontic treatment during the study period. The mean age of the patients was 37.5 ± 13.22 years, with 50.9% women. The level of education was as follows: university 25.2%, secondary 24.4%, middle school 17.6%, and elementary school 32.8%. Nonsmokers represented 76% of the sample.

Dental pain was the main motive for consultation (68.9%), followed by dental mobility (10.9%), trauma (8.5%), and esthetics (2.5%). The other reasons for consultation (coronal fracture, loss of restoration, periodontal abscess, total crown destruction, gingival bleeding, prosthetic treatment, and halitosis) represented 9.2% of the

sample (Table 1). There was no significant difference for these reasons according to gender and education levels of the patients ($P = .67$ and $.28$, respectively).

The teeth that were the most often involved in the emergency consultation were the first mandibular molars (29.4%), the second and third mandibular molars (21.9%), the maxillary premolars (11.7%), the incisors and maxillary canines (10.9%), the first maxillary molars (10.1%), the mandibular premolars (6.7%), the second and third maxillary molars (6%), and the mandibular incisors and canines (3.2%) (Fig. 1).

Ninety-one teeth (76.5%) were previously coronally restored. Restorations without post represented 67.2% including amalgam (58%), composite (6.7%), and glass ionomer cement (2.5%), whereas those with post accounted for 3.4%. Seven teeth (5.9%) were crowned with or without post and core.

The reasons on which the decisions to extract a tooth were based are presented in Figure 2; periodontal disease (40.3%) was the most frequent. Other reasons included endodontic treatment failure (19.3%), vertical root fracture (13.4%), nonrestorable cuspid and crown fracture (15.1%), nonrestorable caries 5.2%, iatrogenic perforations and stripping 4.2%, prosthetic 0.8%, and total crown destruction (1.7%). Statistical analysis that looked at influence of gender and educational levels on these variables showed no significant differences ($P = .33$ and $.34$, respectively).

Discussion

In the present study, 33 of 120 dental surgeons with a mean professional practice of 14.06 ± 7.68 years responded to the questionnaires. In view of the high number of participants in the study, no calibration was performed. This is therefore a limitation for this study because clinicians might have a different analysis of cases and take different therapeutic decisions despite their important clinical experience (17). One hundred nineteen endodontically treated teeth were

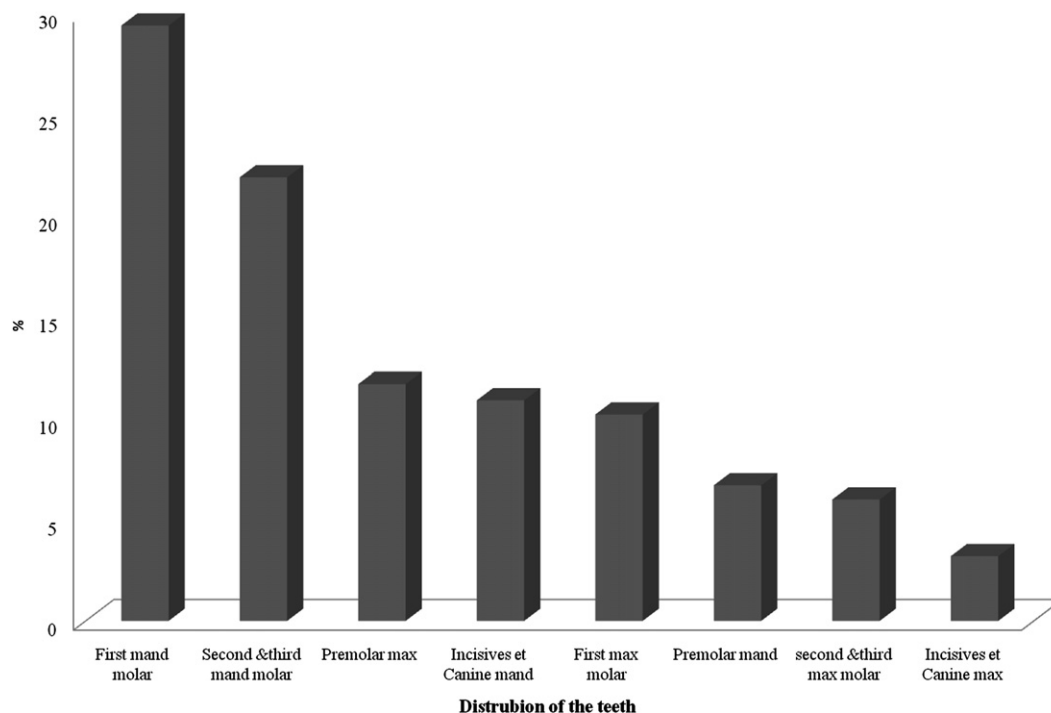


Figure 1. Distribution of the extracted endodontically treated permanent teeth. mand, mandibular; max, maxillary.

extracted during the study period. In this study, pain was the main motive for consultation (68.9%), as already observed in a prior study related to emergencies (18). Mandibular molars were the most extracted teeth (51.3%), followed by maxillary molars (16.6%) and maxillary premolars (11.7%). The predominance of mandibular molars was also noted by Zadik et al (15), in which they represented 44.6% of the sample. No mandibular incisor or canine was extracted in their study, as opposed to the present study in which these teeth represented 3.2% of the sample. Among the molars, the first mandibular molars represented 29.4% of the extracted teeth. This great prevalence was noted in almost all of the studies and is associated, above all, to its susceptibility to caries and the frequency of treatments.

In the present study, periodontal diseases were the primary reason for extraction (40.3%). This high rate is a peculiarity, because it rarely exceeded 5% in the other studies (13–15), except for those performed by Chen et al (12) and Vire (14), who noted that 26.8% and 32%, respectively, were periodontal causes. Despite the high rate of periodontal causes noted in this study and the causes related to the impossibility of restoration of the teeth, the results of this study are not very different from those found in the literature. Fuss et al (19) noted a low frequency of periodontal reasons (5.5%) and a predominance of reasons related to the impossibility of restoring the tooth and to endodontic failures (63%). Reasons related to nonrestorable caries were the primary causes of extraction in the study by Zadik et al (15). Other reasons mentioned are endodontic failures (12.1%), iatrogenic fractures and perforations (17.6%), and periodontal diseases (4.6%).

In this study, an analysis of factors related to gender, educational level, or smoking status did not show any differences when compared with reasons for extraction, in contrast to the findings of Zadik et al (15), who noted that the reasons related to periodontal diseases were 5.8 times more important with smokers than with nonsmokers. The reasons related to endodontics represented 36.9% and were composed of endodontic failures (19.3%), vertical fractures (13.4%), and iatrogenic perforations and stripping (4.2%). Fuss et al (13) found endodontic reasons in 51%, Vire (14) noted 59% for the same reasons, and 19% were found in the study conducted by Zadik et al (15).

Sjogren et al (20) reported a prevalence of 31% of vertical fractures in teeth after endodontic treatment. This contrasts with the results obtained in the present study, which are similar to those of Vire (14) with 13%. Zadik et al (15) and Tamse et al (21) noted a higher prevalence of fractures in the mandibular molars, but this tendency was not found in the present study, in which the maxillary premolars were the teeth that were the most subject to fracture. With 19.3% of endodontically treated teeth extracted because of endodontic treatment failure and 4.2% for technical endodontic problems, ie, iatrogenic perforations and stripping, this study points out the need for advanced endodontic treatment in Senegal where there are very few specialists in endodontics. Although no indication related to the status of the endodontically treated teeth was available, ie, initial endodontic treatment or retreatment, we can speculate that an endodontic retreatment or a surgical endodontic treatment could have been attempted before extraction.

Coronal restoration was presented on 70.6% of the teeth. The relation between apical periodontitis and coronal restoration has been explored in several retrospective clinical studies suggesting that coronal restoration is a factor associated with the presence of apical periodontitis (22–25). A recent meta-analysis highlighted the difficulty when evaluating the relative contribution of coronal and endodontic seal and emphasized their synergy for periapical health (26).

Coronal restorations were dominated by direct core build-up techniques (amalgam, composite resins, and glass ionomer cement) without post in 67.2% of the cases. Only 5.9% of teeth with root canal treatment were restored by crowns; this finding corroborates the results of Touré et al (27), who noted a prevalence of 0.95% of crowns in Senegal. This low prevalence of crowns might be explained by several factors including the cost, the low refund by insurance, and lack of motivation from the patient.

Several studies have investigated the relation between the type of coronal reconstruction and the survival rate of teeth after endodontic treatment (10, 14, 28, 29). They concluded that teeth without full cuspal coverage were lost at a rate that was 5 or 6 times higher than fully covered teeth. Sorensen and Martinoff (30) further investigated

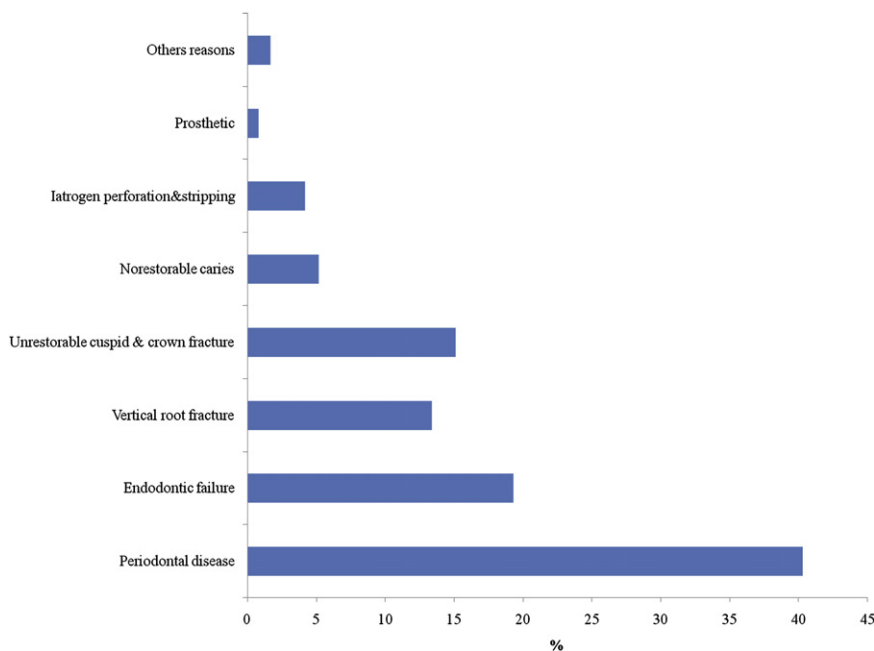


Figure 2. Reasons for extraction of the 119 extracted endodontically treated teeth.

the survival rate according to the group of teeth and found that the rate of clinical success was significantly improved with coronal coverage of posterior teeth but not for anterior.

In the present study, 94% of the extracted teeth never had a final restoration with full cuspal coverage. This finding is similar to that of Zadik et al (15), who noted that 85% of the extracted endodontically treated teeth were without full cuspal coverage. This high percentage of extraction of teeth without full cuspal coverage might be explained by several factors such as changes in tooth architecture resulting from the cumulative loss of tooth structure (31) and therapeutic procedures (32), the loss of pulpal sensitivity (33), or the forces exerted by certain materials onto the dental residual tissues.

Conclusion

Despite its limitations, this study provides data related to reasons for extraction of endodontically treated teeth. The mandibular first molar without a crown was the most frequently extracted tooth. The main reasons for extractions were periodontal disease, endodontic failure, and nonrestorable tooth damage caused by fracture or caries. Further research with calibrated clinicians in either the dental school or in a network of private practitioners would provide additional information.

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The authors deny any conflicts of interest related to this study.

References

- Aida J, Morita M, Akhter R, Aoyama H, Masui M, Ando Y. Relationships between patient characteristics and reasons for tooth extraction in Japan. *Community Dent Health* 2009;26:104–9.
- Al-Shammari KF, Al-Ansari JM, Al-Melh MA, Al-Khabbaz AK. Reasons for tooth extraction in Kuwait. *Med Princ Pract* 2006;15:417–22.
- Chestnut G, Binnie VI, Taylor MM. Reasons for tooth extraction in Scotland. *J Dent* 2000;28:295–7.
- Corbete F, Davies WI. Reasons given for tooth extraction in Hong Kong. *Community Dent Health* 1991;8:121–30.
- Da'ameh D. Reasons for permanent tooth extraction in the North of Afghanistan. *J Dent* 2006;34:48–51.
- Jovino-Silveira RC, Caldas Ade F Jr, de Souza EH, Gusmão ES. Primary reason for tooth extraction in a Brazilian adult population. *Oral Health Prev Dent* 2005;3:151–7.
- Molven O. Tooth mortality and endodontic status of a selected population group: observations before and after treatment. *Acta Odontol Scand* 1976;34:107–16.
- Morita M, Kimura T, Kanegae M, Ishikawa A, Watanabe T. Reasons for extraction of permanent teeth in Japan. *Community Dent Oral Epidemiol* 1994;22:303–6.
- Trovik TA, Klock KS, Haugejorden O. Trends in reasons for tooth extractions in Norway from 1968 to 1998. *Acta Odontol Scand* 2000;58:89–96.
- Salehrabi R, Rotstein I. Endodontic treatment outcomes in a large patient population in the USA: an epidemiological study. *J Endod* 2004;30:846–50.
- Lazarski MP, Walker WA 3rd, Flores CM, Schindler WG, Hargreaves KM. Epidemiological evaluation of the outcomes of nonsurgical root canal treatment in a large cohort of insured dental patients. *J Endod* 2001;27:791–6.
- Chen SC, Chueh LH, Wu HP, Hsiao CK. Five-year follow-up study of tooth extraction after nonsurgical endodontic treatment in a large population in Taiwan. *J Formos Med Assoc* 2008;107:686–92.
- Fuss Z, Lustig J, Tamse A. Prevalence of vertical root fractures in extracted endodontically treated teeth. *Int Endod J* 1999;32:283–6.
- Vire DE. Failure of endodontically treated teeth: classification and evaluation. *J Endod* 1991;17:338–42.
- Zadik Y, Sandler V, Bechor R, Salehrabi R. Analysis of factors related to extraction of endodontically treated teeth. *Oral Surg Oral Med Oral Pathol Endod* 2008;106:31–5.
- Johnson GK, Guthmiller JM. The impact of cigarette smoking on periodontal disease and treatment. *Periodontol* 2000 2007;44:178–94.
- Kvist T. Endodontic retreatment: aspects of decision making and clinical outcome. *Swed Dent J* 2001;144:1–57.
- Touré B, Kane AW, Diouf A, Faye B, Boucher Y. Preoperative pain and medication used in emergency patients with irreversible pulpitis or acute periodontitis: a prospective comparative study. *J Orofac Pain* 2007;21:303–8.
- Fuss Z, Lustig J, Katz A, Tamse A. An evaluation of endodontically treated vertical root fractured teeth: impact of operative procedures. *J Endod* 2001;27:46–8.
- Sjogren U, Hagglund B, Sundqvist G, Wing K. Factors affecting the long-term results of endodontic treatment. *J Endod* 1990;16:498–504.
- Tamse A, Fuss Z, Lustig J, Kaplavi J. An evaluation of endodontically treated, vertically fractured teeth. *J Endod* 1999;25:506–8.
- Ray HA, Trope M. Periapical status of endodontically treated teeth in relation to the technical quality of the root filling and the coronal restoration. *Int Endod J* 1995;28:12–8.
- Tronstad L, Asbjørnsen K, Døving L, Pedersen I, Eriksen HM. Influence of coronal restorations on the periapical health of endodontically treated teeth. *Endod Dent Traumatol* 2000;16:218–21.
- Hommez GM, Coppens CR, De Moor RJ. Periapical health related to the quality of coronal restorations and root fillings. *Int Endod J* 2002;35:680–9.
- Kirkevang LL, Ørstavik D, Hörsted-Bindslev P, Wenzel A. Periapical status and quality of root fillings and coronal restorations in a Danish population. *Int Endod J* 2000;33:509–15.
- Gillen BM, Looney SW, Gu LS, et al. Impact of the quality of coronal restoration versus the quality of root canal fillings on success of root canal treatment: a systematic review and meta-analysis. *J Endod* 2011;37:895–902.
- Touré B, Kane AW, Sarr M, Ngom CTH, Boucher Y. Prevalence and technical quality of root fillings in Dakar, Sénégal. *Int Endod J* 2008;41:41–9.
- Aquilino SA, Caplan DJ. Relationship between crown placement and the survival of endodontically treated teeth. *J Prosthet Dent* 2002;87:256–63.
- Trope M, Maltz DO, Tronstad L. Resistance to fracture of restored endodontically treated teeth. *Quint Int* 1985;16:357–60.
- Sorensen JA, Martinoff JT. Intracoronal reinforcement and coronal coverage: a study of endodontically treated teeth. *J Prosthet Dent* 1984;51:780–4.
- Reeh ES, Messer HH, Douglas WH. Reduction in tooth stiffness as a result of endodontic and restorative procedures. *J Endod* 1989;15:512–6.
- Gutmann JL. The dentin-root complex: anatomic and biologic considerations in restoring endodontically treated teeth. *J Prosthet Dent* 1992;67:458–67.
- Randow K, Glantz PO. On cantilever loading of vital and non-vital teeth: an experimental clinical study. *Acta Odontol Scand* 1986;44:271–7.