Restorative Treatment Strategies Reported by French University Teachers

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Abstract: Disparities among dental schools concerning the teaching and practice of cariology and operative dentistry can lead to variations in students’ treatment modalities that can have health and economic consequences for patients and third party providers. The purpose of this study was to assess caries management strategies taught in French dental schools employing a questionnaire used in a previous study involving private dentists. The study population consisted of 180 teachers of operative dentistry. Each teacher received a questionnaire and a reply-paid envelope. The questionnaire assessed their treatment strategies, knowledge and beliefs about selected aspects of diagnosis, and treatment of dental caries. After one reminder, the response rate was 49.1 percent. The results illustrate a wide disparity among French teachers concerning restorative treatment thresholds for approximal surfaces, opinions about the rate of caries progression, and the need to monitor lesions near the DEJ. The teachers’ attitudes differed from those of private practitioners: they tended to intervene surgically at a later stage, but they would intervene earlier in the treatment of the carious process than would Scandinavian dentists. This study may help in encouraging dental faculties to develop a consensus on issues related to diagnosis and management of dental caries.

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The restorative treatment strategies used by dentists in clinical practice in Norway, Sweden, Denmark, Western Australia, and Scotland have been analyzed with the aid of a questionnaire.1-8 These studies have revealed wide variations in restorative treatment thresholds among dentists in these different countries. Espelid et al. developed a questionnaire, used in Norway and Sweden on two nationally representative samples of dentists, to assess practitioners’ restorative treatment strategies.2,3,7,8 More recently, a similar study was conducted in France in a random sample of (n=2003) general dental practitioners.9 The results of this study showed a tendency towards early restorative intervention and large variability among dentists’ treatment decisions. Black’s cavity preparation principles have long guided dentists’ restorative strategies, but in recent years better understanding of the carious process has changed operative treatment philosophies: now, preventive strategies involving fluoride and remineralization are preferred, and operative treatments are undesirable unless the carious lesion has reached an advanced stage of cavitation.10 Our earlier findings9 would suggest that many French dentists have not modified their operative treatment practices in the light of modern philosophies. This reluctance probably has several explanations, but an important factor may be the content of the cariology curriculum during undergraduate training.

The purpose of this study was to assess the caries management strategies taught in French dental schools using the questionnaire developed by Espelid et al. in order to allow comparisons. Some variables concerning the knowledge and beliefs of the dentists about selected aspects of diagnosis and treatment of dental caries were added to the questionnaire.

Material and Methods

In France, there are sixteen dental schools, which graduate approximately 800 dentists each year. Each dental school is divided into two parts: a uni-
versity section where the educational process consists of lectures and tutorials, and a hospital section where students and teachers are engaged in clinical activities. Thus, the target population consisted of all the teachers of operative dentistry affiliated with the sixteen hospital sections. The list of these practitioners (n=180) was available in the 2002 directory of dental schools’ hospital centers. The questionnaire was mailed in February 2003 with anonymous reply-paid envelopes. A reminder was sent two months later to all the original practitioners. Five dentists were excluded because they had ceased university practice; consequently, there were eighty-six teachers who responded (49.1 percent).

To preserve the anonymity of the respondents, very few personal characteristics were included. The respondents matched the target population with respect to the proportion of men and women. In the target population, there was a mean of eleven teachers per faculty (minimum three, maximum twenty-eight). Since the responses were anonymous, it was not possible to determine the faculty of origin of the respondents. Our previous experience with administering surveys to dental educators in France indicates that many were reluctant to answer questions that may allow investigators to identify respondents, such as answering a question that requests the name of their dental school. Thus, we chose respondent anonymity to improve the participation rate, and we asked no questions that would reveal respondents’ school location.

Age and private practice of the target population were unknown. More than 25 percent of the respondents were fifty-one years or older, 51.2 percent were thirty-five to fifty years, and 23 percent were less than thirty-five years of age. Sixty percent of the respondents had a private practice in addition to their teaching activity.

The questionnaire had two sections. The first section was a French translation of the questionnaire developed by Espelid et al. and used in several previous surveys. The second section, described below, added some questions about the knowledge and beliefs of respondents about caries.

The first section of the questionnaire used diagrams of different stages of caries to explore dentists’ treatment thresholds for approximal and occlusal caries as well as their preferred operative techniques and restorative materials for hypothetical lesions. Questions 1 and 2 determined the stages of caries.

Figure 1. The earliest stage of approximal carious development, judged on radiograph, at which the different respondents (n=87) would intervene with operative treatment.
in the progression of the lesion at which the respondent considered restorative treatment was appropriate and his or her choice of cavity design (options were tunnel, saucer-shaped, Black Class II) and of dental material (amalgam, GIC, composite, GIC plus composite, other) (Figures 1 and 2). Questions 3 and 4 concerned the diagnosis and treatment alternatives for minor or questionable occlusal caries (Figure 3). All questions pertained to a hypothetical patient aged twenty years, who visited a dentist annually, had low caries activity, and had good oral hygiene.

The questions in this section were:
Question 1, Figure 1 (approximal), Item 1: “The figure illustrates different radiographic stages of caries progression. The question pertains to the distal surface of an upper second premolar. Which lesion(s) do you think require(s) immediate restorative treatment?”

Question 1, Item 2: “What preparation technique would you choose for the smallest lesion that you would restore?”

Question 1, Item 3: “What restorative material would you choose for the smallest lesion that you would restore?”

Question 2, Figure 2 (occlusal), Item 1: “The figure illustrates different clinical appearances of caries...
in a lower second molar. Which lesion(s) do you think require(s) immediate operative treatment?"
Question 2, Item 2: “What preparation technique would you choose for the smallest lesion that you would restore?"
Question 2, Item 3: “What restorative material would you choose for the smallest lesion that you would restore?"

Question 3, Figure 3 (tooth A), Item 1: “Do you think that, from its clinical and radiographic appearance, tooth A has occlusal (enamel or dentin) caries?"
Question 3, Item 2: “How would you treat this occlusal surface?"
Question 3, Item 3: “If you would restore the tooth, what material would you use?"
Question 4, Figure 3 (tooth B), Item 1: “Do you think that, from its clinical and radiographic appearance, tooth B has occlusal (enamel or dentin) caries?"
Question 4, Item 2: “How would you treat this occlusal surface?"
Question 4, Item 3: “If you would restore the tooth, what material would you use?"

Figure 3. Respondents’ diagnoses (pie charts) and treatment suggestions (bar charts) for tooth A and tooth B (1=Prepare carious part + fissure seal; 2=Prepare carious part; 3=Fissure sealant; 4=Prepare whole fissure; 5=No treatment; 6=Fluoride treatment; number of respondents=87)
The second section included the following items:

Question 5, Item 1: “Do you think that the radiographic appearance of proximal caries, compared with clinical observations, usually indicates: (a) underestimation of depth? (b) the true depth? (c) overestimation of depth?”

Question 5, Item 2: “What is your estimate of the average time it would take for a proximal lesion to progress from outer enamel to dentin (in the permanent dentition)?”

Question 5, Item 3: “If a proximal lesion is radiographically detected near the enamel-dentin junction (EDJ), it must be left unrestored for the least six months in order to determine if it is an active lesion and to evaluate its progression rate. Do you agree or disagree, or are you uncertain, with respect to this statement?”

Question 5, Item 4: “Cavitation of a proximal lesion is usually not visible to the naked eye even if the lesion has reached the EDJ. Do you agree or disagree, or are you uncertain, with respect to this statement?”

Question 5, Item 5: “What is for you the most important? It is (a) more important to fill all carious teeth (accepting the risk of some unnecessary restorations), or (b) it is more important not to fill sound teeth unnecessarily (accepting the risk of not restoring some carious lesions), or (c) these risks of error are of equal importance?”

In this descriptive study, all the variables were qualitative. Data are thus presented using graphs and proportions. The chi-squared test was used to test the relationship between the teachers’ restorative treatment thresholds and their age, gender, and knowledge and beliefs about the carious process. The level of significance was set at 5 percent. Dentists were grouped depending on the stage of lesion progression at which they would intervene. For approximal (Figure 1) and occlusal (Figure 2) surfaces, the groups were respectively defined as: enamel (grades 1 and 2), EDJ (grade 3), and all deeper lesions (grades 4-6) or enamel (grades 1 and 2), external dentinal (grade 3), and all deeper lesions (grades 4-5).

Results

The vast majority of the respondents (88.3 percent) believed that radiographs underestimate the depth of a lesion compared with clinical findings. There was considerable variability in the responses with regard to the time it would take for an approximal lesion to progress from outer enamel to dentin. Approximately one in ten teachers thought it would take less than six months; one third, seven to twelve months; one third, thirteen to twenty-three months; and one quarter, more than two years. Half of the teachers would monitor a lesion detected radiographically near the EDJ for six months in order to determine whether it was active and to evaluate its rate of progression. The other respondents disagreed (40.7 percent) with this statement or were uncertain (9.3 percent). Almost half the respondents (53.6 percent) did not believe that an approximal lesion at the EDJ had a visible cavity, while 35.7 percent were of the opposite opinion and 10.7 percent were uncertain. Fifty-five percent of the teachers felt it was important to avoid all types of error such as “not to fill all carious teeth” or “fill sound teeth unnecessarily.” Nineteen percent thought it was very important to fill all carious lesions, and 26.2 percent thought it important never to fill sound teeth.

A carious lesion confined to enamel would have been operatively restored by 21.9 percent of the respondents; 39.1 percent would have prepared a cavity for a lesion at the enamel-dentin junction, and 39.1 percent would have waited until the lesion was in dentin (Figure 1). Sixty-one percent of respondents preferred the tunnel preparation, while 36.9 percent preferred saucer-shaped preparations and 2.4 percent traditional class II preparations. The majority of the respondents (78.6 percent) suggested composite or composite plus glass ionomer cement (GIC) for restoring the approximal surface, while 8.3 percent would use amalgam and 11.9 percent GIC (conventional or resin modified).

The restorative treatment threshold for approximal lesions (enamel, EDJ, and deeper) depended on the dentists’ opinions about the carious process. The threshold was at the deep level: 67.4 percent of the practitioners would monitor a lesion to assess its rate of progression as opposed to 8.6 percent who would not do so and to 24 percent who were uncertain (p<0.001). All the dentists who thought it was more important to fill all carious teeth would intervene operatively for lesions confined to enamel (grades 1-3), as opposed to 50 percent of those who thought it more important never to fill sound teeth (p<0.01). The age and sex of the respondents and their opinions concerning progression, cavitation, and radiological appearance of carious
lesion had no influence on restorative treatment threshold (NS).

About one fifth (20.7 percent) of the teachers would restore an occlusal lesion confined to enamel, and 79.3 percent would wait until the lesion had progressed to dentin (Figure 2). Eighty-nine percent of the respondents preferred to limit the preparation to the carious lesion, while 8 percent preferred a preparation that included all of the occlusal fissures. The majority of the respondents (92 percent) opted to use composites for restoring the occlusal surface, while 8 percent would have used amalgam.

The restorative treatment threshold for occlusal lesions (enamel, outer third of the dentin and deeper) varied according to sex and to the importance given by the dentists to the risk of over- or undertreatment. Twenty-five percent of the male dentists would restore an occlusal lesion confined to enamel, while only 8.7 percent of women teachers would do so (p<0.05). Half the dentists who thought that it was more important to fill all carious teeth would intervene surgically for lesions confined to enamel, as opposed to 14 percent who thought it more important never to fill sound teeth and 15 percent who answered that these risks of error were of equal importance (p<0.05). The age of the respondents and their opinions concerning monitoring, progression, cavitation, and radiological appearance of carious lesions had no influence on restorative treatment threshold (NS).

The results relating to Teeth A and B are given in Figure 3. The teachers did not vary markedly when diagnosing occlusal caries. Eighty-three percent of the respondents diagnosed a dentinal lesion in tooth A, and 37 percent and 43 percent found no lesion or an enamel lesion, respectively, in Tooth B. The treatment alternatives proposed for those teeth are presented in Figure 3. Concerning Tooth A, the most (83 percent) frequently proposed solution was a restoration limited to the carious part with or without a fissure sealant, 53 percent and 30 percent, respectively, of the answers. For Tooth B, 66 percent of the teachers preferred fissure sealing.

**Discussion**

Before commenting on the implications of these findings, several limitations of the analyses should be noted. First, in this study, we used the 2002 directory of dental schools’ hospital centers. This includes a list of all the practitioners working in operative dentistry. Because of staff turnover in dental hospital centers, it is unlikely the list was complete. Second, the low response rate (~50 percent) limits the validity of the results. It compares poorly with surveys on restorative dentistry conducted in dental schools in the United States, Canada, Brazil, Japan, and northern European countries where response rates ranging from 66 percent to 93 percent have been reported. This level of response seems typical of questionnaire surveys of teachers in central and southern Europe. Third, it was not possible to compare all the demographic characteristics of the respondents in order to verify the degree to which our sample represented the overall population of operative dentistry faculty in French dental schools. We did not ask questions about demographic variables or the name of the respondent’s dental school to ensure anonymity so as not to discourage participation. Fourth, questions related to restorative treatment threshold were based on a twenty-year-old hypothetical patient in the hope of limiting response variance. The results reported in this article thus apply only to the type of patient described. For a given carious lesion, a dentist’s diagnosis and restorative treatment decision will vary depending on patient characteristics, age, dental status, and regularity of attendance. Notwithstanding the limitations of the findings, the data generated provide a useful insight into the beliefs and attitudes of French university teachers in operative dentistry.

The results illustrate a wide disparity among French university teachers, particularly concerning the restorative treatment threshold for approximal surfaces, opinions about the rate of approximal lesion progression from outer enamel to dentine, and the opportunity to monitor approximal lesions near the DEJ. It also appeared that these three variables were interrelated as has been demonstrated in previous surveys. For example, for a given stage of carious progression, one dentist might surgically treat a carious lesion that is cavitated, while another dentist who believes that caries progresses rapidly might prefer to intervene operatively. It can be hypothesized that these opinions illustrate the dentist’s understanding of the carious process and his or her level of confidence about remineralization.

Several studies conducted among dental schools in North America, Europe, and Japan have reported large disparities in the teaching of cariology and restorative dentistry in terms of content or quantity of hours. Moreover, an evaluation of clinical attitudes of uni-
versity teachers indicates a wide variability in diagnosis of carious lesions, assessment of restorations, and treatment decisions. This teacher variability can lead to variation in their students’ treatment modalities that can have health and economic consequences for patients and third party providers. Since so much of dental treatment is irreversible, patients risk needless or inappropriate interventions. Thus, dental schools should develop evidence-based teaching in dental cariology and favor the use of standardized criteria for treatment decisions in operative dentistry.

The attitudes of university teachers differed from those of private practitioners. University teachers tended to intervene operatively at a later stage than did private dentists. For an approximal lesion at the EDJ, 88 percent of the private practitioners but only 61 percent of the teachers would have intervened operatively. The teachers rarely would have used traditional class II preparations, nor would they have extended the preparation to involve all of the occlusal fissures. There was good agreement between teachers and practitioners concerning the diagnosis of questionable carious lesion on occlusal surfaces (Questions 3 and 4). They were more familiar with the use of fissure sealants, and they were more inclined to substitute preventive care for restorative treatment. University teachers seemed to have a better knowledge of the new concepts of caries management, probably because they have easier access to the scientific literature than do private practitioners. Paradigm change has been shown to be slow among dentists, so perhaps it is not surprising that teachers are more aware of current concepts than are practitioners.

The present findings suggest that French dental teachers would intervene earlier in the carious process than would Scandinavian dentists. The reasons of this tendency are unknown, but one might speculate. First, in populations with high caries activity, dentists may be keen to place restorations before lesions progress. In France, caries incidence has diminished in recent decades, but many dentists may not have modified their treatment practices accordingly. Secondly, the remuneration system focuses on acts of restorative care. Patients pay the dentist according to the item of treatment provided and then seek reimbursement from an insurance fund. To qualify for reimbursement, the treatment must be on a list of approved procedures. Restorative treatments are listed. Professionally provided preventive care does not generally qualify for reimbursement, a limitation that discourages prevention and encourages operative care. This may influence the curriculum and dental school treatment plans.

As the first French study of its kind, this project will allow future changes to be monitored and comparisons to be made with similar studies elsewhere. The findings may also help sensitize university teachers regarding variability in restorative treatment modalities. A challenge for the future will be to encourage teachers and dental faculties to develop a consensus on issues related to diagnosis and treatment of dental caries. Collaboration among teaching institutions could lead to consistent and modern management of the carious process, which could be advantageous to patients and reduce the cost of health care.

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REFERENCES