Perceptions and Attitudes of Canadian Dentists toward Digital and Electronic Technologies

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ABSTRACT

Objectives: To determine dentists' perceptions of the usefulness of digital technologies in improving dental practice and resolving practice issues; to determine dentists' willingness to use digital and electronic technologies; to determine perceived obstacles to the use of digital and electronic technologies in dental offices; and to determine dentists' attitudes toward Internet privacy issues.

Methods: An anonymous, self-administered survey of Canadian dentists was conducted by mail. A potential mailing list of 14,052 active Canadian dentists was compiled from the 2003 records of provincial regulatory bodies. For each province, 7.8% of the dentists were randomly selected with the help of computer software. The surveys were mailed to this stratified random sample of 1,096 dentists.

Results: The response rate was 28% (312/1,096). Of the 312 respondents, 4 (1%) were in full-time academic positions, 16 (5%) were not practising, and 9 (3%) provided incomplete data. Therefore, 283 survey responses were available for analysis. More than 60% of the dentists indicated that computer technology was quite capable or very capable of improving their current practice by increasing patient satisfaction, decreasing office expenses, increasing practice efficiency, increasing practice production, improving record quality and improving case diagnosis and treatment planning. More than 50% of respondents reported that digital photography and digital radiography were quite useful or very useful. About 70% of the dentists agreed or strongly agreed with using digital and electronic technologies to consult with dental specialists. Cost of equipment and lack of comfort with technology were regarded as significant or insurmountable obstacles by substantial proportions of respondents.

Conclusions: Respondents generally viewed digital and electronic technologies as useful to the profession. Increased office efficiency and production were perceived as positive effects of digital and electronic technologies. These technologies are more often used for consulting with colleagues rather than for consulting with patients. The major obstacles to the general use of these technologies were related to cost, lack of comfort with technology and differences in legislation between provinces and countries. Privacy issues were not perceived as a significant barrier.

MeSH Key Words: attitude of health personnel; computer systems/utilization; dentists; practice management, dental/organization & administration

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Dentists have been using computers for various applications in the dental office for many years. Computerized appointment systems,[1] dental practice management software[2] and programs for recording patient data and for financial management[3] have been presented as tools to increase productivity in dental practice. There is also increasing interest in teledentistry[4,5] and videoconferencing.[6,7] The availability of digital and electronic technologies is a key factor in these changes.

Many obstacles need to be overcome if digital and electronic technologies are to be fully integrated in the operation of dental offices. These obstacles may be physical, technical or psychosocial barriers in the form of perceptions and attitudes related to software incompatibilities, patient privacy, unclear association and government regulations, interference with the patient–practitioner relationship, unclear fee-for-service or remuneration guidelines, and rejection of claim reimbursements by insurance providers.[8,9]

If dentists perceive that digital and electronic technologies are valuable for practice management or practice efficiency, there will be a greater chance of their more general acceptance. However, if the new technologies are perceived as cumbersome, if learning the technologies is perceived to take time away from the practice and if practice systems are already running adequately, dentists may be unconvinced of the need for any change.

In a recent survey, Canadian dentists did not perceive digital and electronic technologies as a high research priority relative to treatment techniques and dental materials.[10] Nevertheless, recent research among Canadian orthodontists has shown that the areas of practice causing the most stress for orthodontists are related to time management and patient cooperation.[11] Similar research has not been conducted for Canadian dentists. By establishing the current perceptions and attitudes of dentists toward electronic and digital technologies, the dental profession and the industry more generally will be able to plan for future acceptance and implementation of the technologies. No previous reports have been found regarding the perceptions and attitudes of Canadian dentists to digital and electronic technologies.

The objectives of this study were to determine dentists' perceptions of the usefulness of digital technologies in improving dental practice and resolving practice issues; to determine dentists' willingness to use digital and electronic technologies; to determine the perceived obstacles to the use of digital and electronic technologies in dental offices; and to determine dentists' attitudes toward Internet privacy issues.

Methods

The study was approved by the Health Research Ethics Board at the University of Alberta.

Survey Instrument

A mail survey was developed to obtain information about use of computers and the Internet by Canadian dentists. The survey was adapted from a questionnaire originally developed to evaluate computer and Internet use among Canadian orthodontists.[12] The survey used in the present study collected demographic data and information about actual computer and Internet usage, which were reported previously,[13] and information about perceptions and attitudes toward computer and Internet use in dental practices, which are reported here. The survey also included questions about the ability of technology to resolve practice-related issues, dentists' motivation for using the technologies, their willingness to use the technologies and potential obstacles to doing so.

Survey Distribution

A mailing list of Canadian dentists was compiled from the 2003 records of provincial regulatory bodies. A total of 14,052 dentists were registered as active in that year. For each province, 7.8% of the dentists were randomly selected with the help of computer software. If the selected dentist was also registered as a specialist, he or she was eliminated, and the next dentist was chosen, until the total number of dentists required had been attained. The surveys were mailed to this stratified random sample of 1,096 dentists. A response rate between 20% and 30% was expected to produce a final sample size of 250 to 300. This sample would allow for comparisons of attitudes toward computer and Internet usage between Canadian dentists and a similar sample of Canadian orthodontists.[12]

The survey questionnaire was distributed in a packet that included a self-addressed, stamped return envelope and an introduction letter explaining the research and seeking informed consent from participants. At 1 and 2 weeks after the initial mailing, reminder cards were mailed thanking respondents who had returned their surveys or reminding those who had not responded to complete and return the questionnaire.

Data Analysis

Completed surveys were coded, and spreadsheets were created for data entry. The survey results were manually entered into a personal computer by a research assistant who was not aware of the study objectives. The data were "cleaned" by checking for entries outside of legitimate ranges and for inconsistent codes; the necessary corrections were made by manually rechecking the surveys. A random number generator was used to select 20% of the surveys for hand-checking by a third party to determine the rate of data entry errors. The error rate was 0.2% (19 of 9,918 points), which was deemed low enough to consider the remaining data accurate and to forgo further manual confirmation.

The data were analyzed by descriptive statistical methods using Excel (Microsoft Corporation, Seattle, Wash.) and SPSS for Windows (SPSS Inc., Chicago, Ill.). Descriptive statistics such as the frequency and range were reported.

Results

Of the 1,096 surveys mailed, 312 were returned (response rate of 28%). Another 31 packets (3%) were returned because of incorrect addresses. Of the 312 respondents, 4 (1%) were in full-time academic positions, 16 (5%)

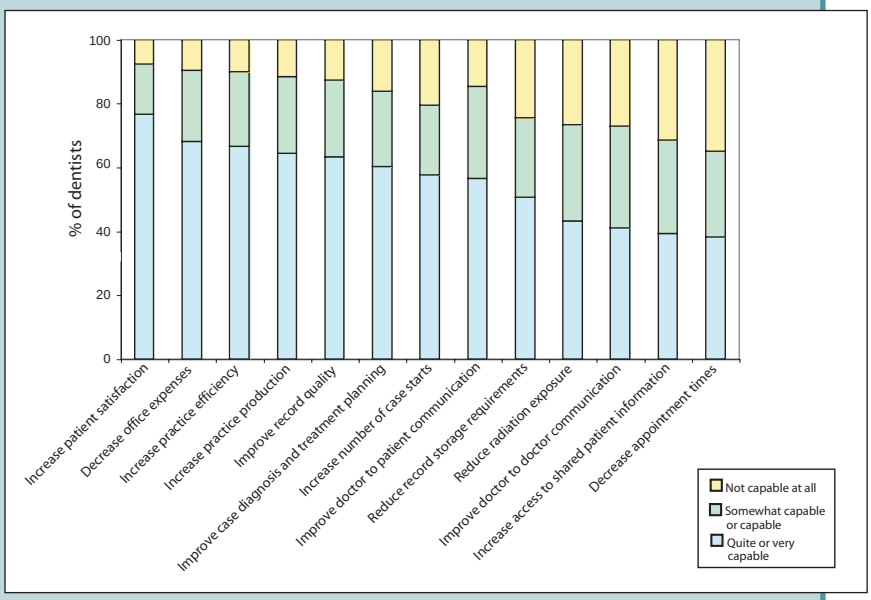

Figure 1: Perception of the capability of various technologies to improve aspects of current practice.

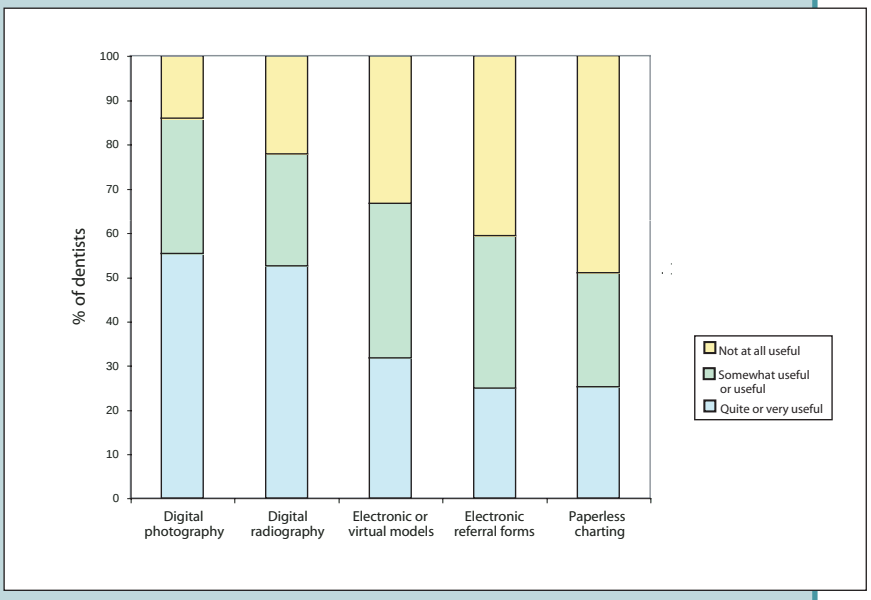

Figure 2: Perception of usefulness of various information technologies.

reported not currently practising, and 9 (3%) provided incomplete data, which left 283 surveys (91%) for analysis. Of these, 21 (7%) had incomplete responses in the section on perceptions and attitudes. Therefore, for the data analysis reported here, only 262 surveys were fully available.

Demographic Characteristics of the Responders

As reported previously,[13] more than half of the 283 respondents had an individual practice. Their mean age was 46.8 years (standard deviation [SD] 10.1), and they had a mean of 20.4 years of experience (SD 10.3). As expected, a large percentage of respondents (42%) were from Ontario. Quebec, British Columbia and Alberta accounted for 44% of the replies, and 10% of the responses came from the remaining provinces, which had the smallest number of practising dentists. The remaining 4% of respondents did not identify their province of practice.

Capabilities of Technology

More than 60% of the dentists indicated that computer technology was quite capable or very capable of improving their current practice by increasing patient satisfaction, decreasing office expenses, increasing practice efficiency, increasing practice production, improving the quality of office records, or improving case diagnosis and treatment planning (**Fig. 1**). Between 40% and 60% felt that computer technology was quite capable or very capable of increasing the number of case starts, improving doctor-to-patient communication, reducing the requirements for record storage, reducing radiation exposure or improving doctor-to-doctor communication. Less than 40% thought that computer technology was quite capable or very capable of increasing access to shared patient information or decreasing appointment times.

Usefulness of Technology

More than 50% of respondents reported that digital photography and digital radiography were quite useful or very useful (**Fig. 2**). More than 30% thought that electronic or virtual models were quite useful or very useful. About one-quarter of the respondents suggested that electronic referral forms and paperless charting were quite useful or very useful.

Willingness to Use Technology

Respondents were asked to report their willingness to use digital and electronic technologies in various communication settings. About 70% of the dentists agreed or strongly agreed with using digital and electronic technologies to consult with dental specialists (**Fig. 3**). Just over 50% agreed or strongly agreed with using these

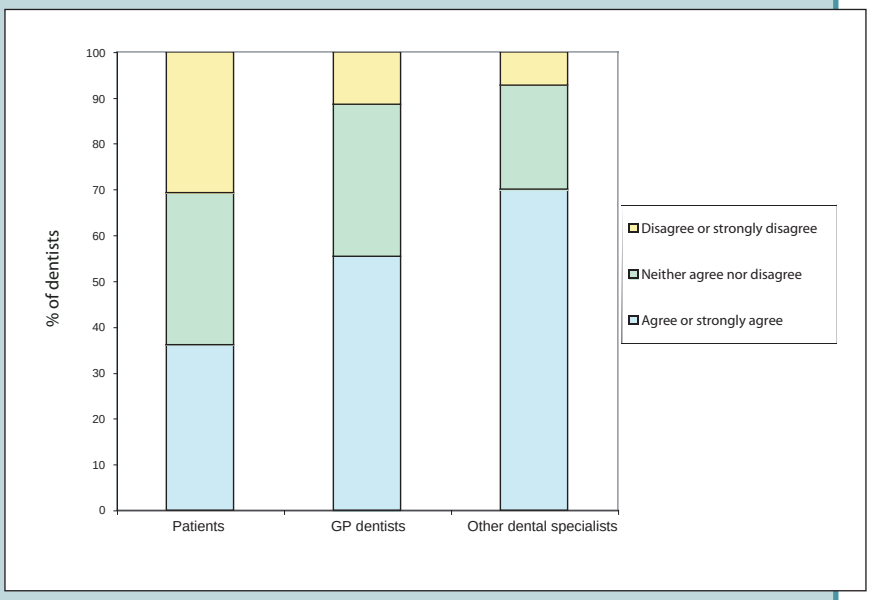

Figure 3: Willingness to use information technologies for consultations with patients and colleagues.

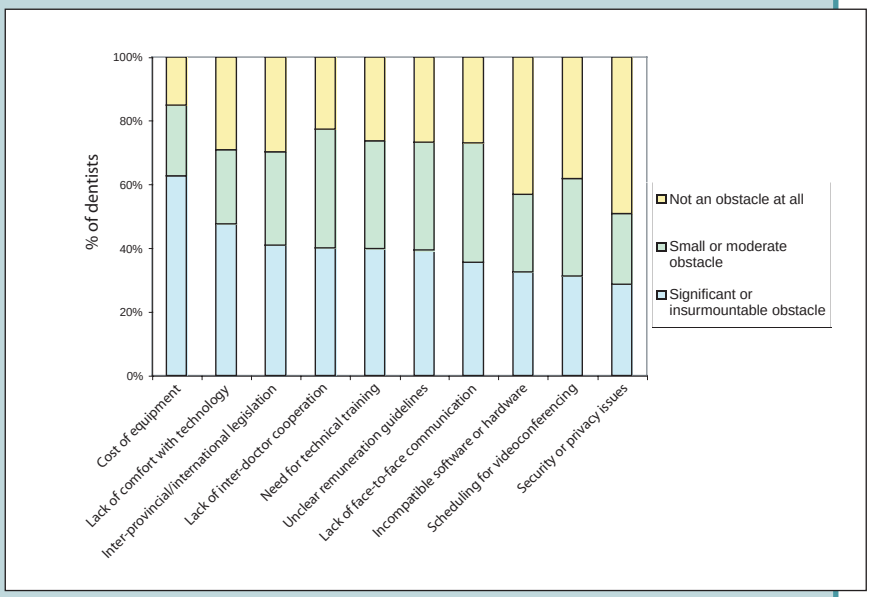

Figure 4: Obstacles to the use of information technologies.

technologies to consult with other general practitioners. Less than 40% agreed or strongly agreed with using digital and electronic technologies for consultations with patients.

Obstacles

Figure 4 shows how dentists rated various obstacles to the general use of electronic and digital technologies in their own practices. Cost of equipment (63%) and lack of comfort with technology (47%) were the most important obstacles regarded as significant or insurmountable. About 40% of the respondents indicated that differences in legislation between provinces and countries, lack of cooperation among dentists, need for technical training and unclear remuneration guidelines for consultations were significant or insurmountable obstacles. Finally, lack of face-to-face communication, incompatible software or hardware, problems with scheduling for videoconferencing, and security or privacy issues were significant or insurmountable obstacles for less than 40% of the dentists.

Discussion

It seems that if new technologies are to gain general acceptance into a professional community, there must be a strong perception that they will offer improvements over current practices. The Internet, the World Wide Web and other technological developments have and will continue to redefine patient care, referral relationships, practice management, service quality, professional organizations and competition.[14–16]

In the survey reported here, the respondents felt that digital and electronic technologies were useful for most aspects of dental practice. For certain aspects (increased sharing of patient information and reduction in duration of appointments) the perception of usefulness was lower, but about 40% of respondents still perceived the technologies as quite capable or very capable of improving practice. These results are similar to perceptions of the capabilities of technology among Canadian orthodontists.[12] Most of the aspects evaluated in the survey of orthodontists pertained to the greatest sources of stress and concern among practitioners in that field,[11] including office expenses, appointment times, case starts, diagnosis and treatment planning, and patient satisfaction. These are related to broader issues of time management (and lack of personal time), patient cooperation and practice management, all of which relate to orthodontists' stress and personal satisfaction. It has been assumed that determinants of stress and personal

satisfaction are similar among Canadian orthodontists and dentists, but no previous evaluation for dentists could be found.

In the current study of Canadian dentists, digital photography and digital radiology were considered more useful than electronic models, electronic referral forms and paperless charting. Greater proportions of Canadian dentists than Canadian orthodontists[12] perceived various technologies as quite or very useful: 52% and 42%, respectively, for digital radiology; 25% and 18% for electronic referral forms; and 32% and 15% for electronic models. In contrast, smaller proportions of Canadian dentists perceived digital photography (56% and 77%) and paperless charting (25% and 34%) as quite or very useful. These differences could be explained by the more diverse uses that dentists have for each of these information technologies.

Dentists appear more open to communicating electronically with specialists than with patients; results were similar for Canadian orthodontists.[12] These findings are consistent with other research showing that practitioners are leery of using digital and electronic technologies to communicate with the public, but are willing to use such technologies to communicate with colleagues.[17,18]

Obstacles that impede the acceptance of digital and electronic technologies in the international dental community include cost, lack of comfort with technology, privacy, time, software incompatibility, unclear guidelines, interference with patient–practitioner relationships and lack of remuneration guidelines.[8,9,19] Similarly, cost of equipment, lack of comfort with technology, differences in legislation between provinces and countries and lack of communication among practitioners were the major obstacles to the general acceptance of digital and electronic technologies among Canadian dentists.

Finally, Canadian dentists did not consider security or privacy issues as a significant obstacle. This finding contrasts with those of previous studies,[8,9,12] which have considered security and privacy issues as important obstacles to the use of information technologies. Apparently Canadian dentists feel that information transmitted over the Internet is secure.

Electronic transmission of claims is one compelling reason for dental practices to have at least one computer with Internet access.[20] The current drive among health care professionals to practise evidence-based health care, which is specially strong in the United Kingdom, is an extra incentive to computerize dental practices, since this allows access to electronic databases and accredited online continuing education (CE).[19] In Australia[21] about 65% of surveyed dentists considered using computers to obtain CE credits. Although evidence-based practice concepts are not as strongly established in Canadian dental practices as in those in the United Kingdom, it is likely that this situation will soon change. Accordingly this could be an additional driving force to computerize dental practices.

Recent surveys revealed that more than 64% of the households in the United Kingdom[22] and about 40% of those in the United States[23] and Canada[24] had Internet access. This means that there is tremendous potential for promoting dental practices to patients. Many adult patients find information about goods and services through the Internet. No other medium offers the same degree of flexibility and the potential to reach as many people. Once dentists in general practice realize this potential, they will probably increase their marketing efforts through the Internet, which will increase the use of digital and electronic technologies among Canadian practices.

Dentists are sensitive to some of the potential obstacles associated with using electronic technologies, but they are willing to meet these challenges and incorporate these new approaches into their dental practices. Specific research regarding how information technology might benefit specific aspects of practice such as increasing case starts, reducing appointment times and reducing office expenses would likely motivate dentists to increase their adoption of new technologies.

Conclusions

The dentists who responded to this survey generally viewed digital and electronic technologies as useful to the profession. Increased office efficiency and production were perceived as positive effects of digital and electronic technologies. There seemed to be a greater trend toward consulting electronically with colleagues than with patients. The major obstacles to the general use of these technologies were related to cost, lack of comfort with technology and differences in legislation between provinces and countries. Privacy issues were not perceived to represent a significant barrier.

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