

Computer and Internet Usage by Canadian Dentists

Carlos Flores-Mir, DDS, Cert Ortho, MSc, DSc; Neal G. Palmer, DDS, MSc, FRCD(C); Herbert C. Northcott, PhD; Carolyn Huston, BSc; Paul W. Major, DDS, MSc, FRCD(C)

Contact Author

Dr. Flores-Mir
Email: carlosflores@ualberta.ca



ABSTRACT

Objectives: To determine the frequency of computers in Canadian dental offices and to assess their use; to evaluate Internet access and use in Canadian dental offices; and to compare use of computers and the Internet by Canadian dentists, by the general public and by other dental groups.

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 general 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%. Of the 312 respondents, 4 (1%) were in full-time academic positions, 15 (5%) were not practising, and 9 (3%) provided incomplete data. Therefore, 284 survey responses were available for descriptive analysis. Two hundred and fifty-seven (90%) of the respondents had a computer in their primary practice. Computers were used mainly for administrative tasks (accounting, bookkeeping and scheduling) rather than clinical tasks. Internet access was common (185/250 or 74%), and high-speed Internet access (93/250 or 37%) was increasingly common, judging from the results of previous studies on computer use. The main reasons given for not having in-office Internet access were security or privacy concerns and no reported need for or interest in the service.

Conclusions: Computer use was high in this sample of Canadian dentists, but a small proportion of dental offices remained without computers. Canadian dentists' use of the Internet was greater than that of American dentists, private enterprise and the North American public in general.

MeSH Key Words: Canada; dental practice management; dentists; internet/utilization

© *J Can Dent Assoc* 2006; 72(3):145
This article has been peer reviewed.

Computers have made their presence felt in almost every facet of the modern world. By the year 2000, computers were present in approximately half of all homes in Canada and the United States.^{1,2} The use of computers in the business setting is even greater: a 1999 survey of Canadian enterprises revealed that 82% used computers.³

An increase in the use of computers in private dental practices has been reported in the

past 2 decades. The first comprehensive survey in the United States by the American Dental Association (ADA) was published in 1984. At that time, about 11% of American dentists used computers in their practices.⁴ A steady increase has been reported since then: 27% (1987), 37% (1990), 67% (1994), 80% (1997) and 85% (2000).⁵ Other sources reported 48% in 1992⁴ and 85% in 1998.⁶ In Australia the first report on this topic was published in 1984, when about 9% of the dentists surveyed

reported using a computer.⁷ Seven years later the proportion had increased to 37%.⁸ Only 6% of Scottish dentists reported using computers in their practices in 1989.⁹ By 2003, 77% of the dental practices in a small area in England reported the use of computers.¹⁰

As far back as 1984, computers were regarded as useful tools for accounting, administration and education in dental practices.^{7,11,12} In 1992 an increase in the use of computers in dental practices was predicted for digital radiography, computer charting, video imaging, intraoral cameras and CAD/CAM (computer-aided design and manufacture) applications.⁴ Nevertheless, the 2000 survey conducted by ADA⁵ indicated that administrative functions continued to be the main tasks for which computers were used.

No previous reports of the use of computers and the Internet by Canadian dentists have been identified. The objectives of the present study were to determine the frequency of computers in Canadian dental offices and to assess their use; to evaluate Internet access and use in Canadian dental offices; and to compare computer and Internet use by Canadian dentists, by the general public and by other dental groups.

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.¹³ The survey used in the present study collected demographic data and information about type of computer, dentistry-related applications (imaging software, charting methods, digital photography and radiography capabilities) and Internet connection. The survey also asked respondents to list their reasons for using the Internet in the previous 3 months.

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 another dentist was chosen, until the total number of dentists required was 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 computer and Internet

Table 1 Demographic characteristics of 284 Canadian dentists responding to a survey about computer use

Characteristic	No. (%) or mean (SD)	
Age (years) (n = 278) ^a	46.8	(10.1)
Years in practice (n = 284)	20.4	(10.3)
Province of primary practice	284	
British Columbia	47	(17)
Alberta	37	(13)
Saskatchewan	9	(3)
Manitoba	5	(2)
Ontario	118	(42)
Quebec	41	(14)
New Brunswick	6	(2)
Prince Edward Island	1	(<1)
Nova Scotia	8	(3)
Newfoundland	0	(0)
Province not stated	12	(4)
Primary type of practice	284	
Solo practice	157	(55)
Associateship	49	(17)
Partnership	33	(12)
Group practice	37	(13)
Other	5	(2)
Not stated	1	(<1)

^aSix respondents did not state age.

usage between Canadian dentists and a similar sample of Canadian orthodontists.¹³

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. Three 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 considered low enough to consider the remaining data accurate and to forgo further manual confirmation.

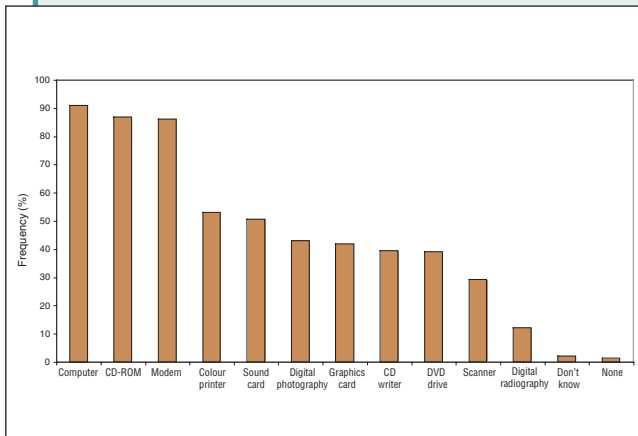


Figure 1: Computer equipment present in the dental offices of a sample of 250 Canadian dentists.

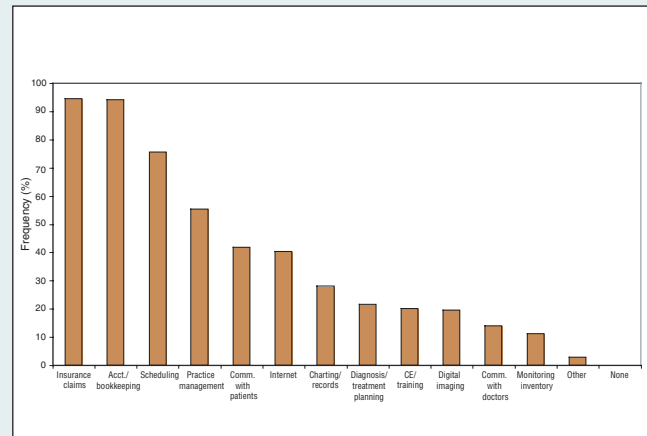


Figure 2: Computer applications performed by a sample of 250 dentists who had a computer. Acct. = accounting, CE = continuing education.

The data were analyzed by descriptive statistical methods using Excel (Microsoft Corporation, Seattle, Wash.) and SPSS for Windows (SPSS Inc., Chicago, Ill.) software. Percentages for each variable were based on the number of respondents for the corresponding question. Previously published research^{4-6,8-10,13-15} reported descriptive statistics, such as frequency and range, with no attempt to make statistical inferences.

Results

Of the 1,096 surveys mailed, 312 were returned by participants (response rate of 28%). Another 31 (3%) of the packets were returned by the postal system because of incorrect addresses. Of the 312 respondents, 4 (1%) were in full-time academic positions, 15 (5%) were not practising, and 9 (3%) provided incomplete data. Therefore, 284 (91%) survey responses were available for analysis.

Demographic Characteristics

More than half of the respondents had a solo practice (Table 1). 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 responses came from the remaining provinces (4% of respondents did not state their location).

The response rate was variable across the country. The mean response rate was 29%, ranging from 0% in the Northwest Territories to 57% in New Brunswick.

Computer Usage

Among the 284 respondents, 257 (90%) had a computer in the primary practice; of the 35 dentists who had a secondary practice, 23 (66%) also had a computer in the secondary practice. Dentists with and without computers

in their practices were of similar age ($p = 0.066$; Mann-Whitney U test) and had been practising dentistry for a similar number of years ($p = 0.094$; Mann-Whitney U test). The number of working hours was also similar ($p = 0.717$; Mann-Whitney U test). Only average practice income was associated with the presence of computers ($p < 0.001$; Mann-Whitney U test).

Most of the respondents had a CD-ROM reader and a modem (Fig. 1). About half had a colour printer, digital photography capability, graphics card, sound card and DVD/CD writer.

Respondents reported that computers were used primarily for accounting, billing, bookkeeping and processing insurance claims (Fig. 2). In many offices, computers were also used for scheduling and practice management.

Internet Usage

Among the 250 respondents with valid responses for the section on computer equipment in the practice, 216 (86%) had a modem, and 185 (74%) had Internet access in the office, 93 (37%) with a high-speed (broadband) connection, 86 (34%) with dial-up connection, and 6 (2%) who did not know what type of connection they had. One in 6 of the respondents (17/86) who currently had a dial-up connection reported that they would be upgrading to a broadband connection in the next 12 months, and 5 (8%) of the 65 who had no Internet access at the time of the survey planned to get Internet access within the next 12 months.

One-quarter of the dentists reported not having Internet access at work, for various reasons (Fig. 3). Slightly more than half reported that they accessed the Internet from a different location. Almost one-third reported having security or privacy concerns related to the

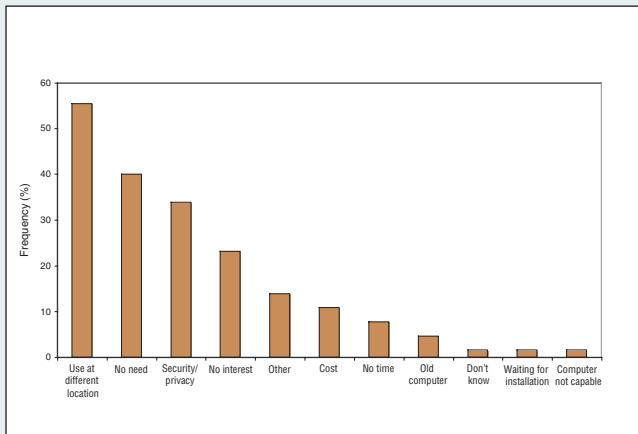


Figure 3: Dentists' reasons for not having Internet access ($n = 65$ dentists without Internet access).

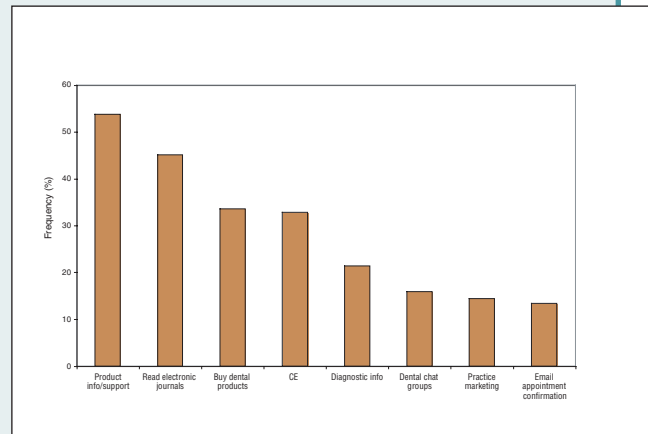


Figure 4: Dentists' reasons for using the Internet in the past 3 months ($n = 243-249$). CE = continuing education.

Internet. Other significant reasons for not having Internet access were no need (27/65 or 42%) and no interest (15/65 or 23%).

Respondents primarily used the Internet to obtain product support or information (134/249 or 54%) and to read electronic journals (109/243 or 45%). Other important uses were to buy dental products (83/247 or 34%) and to participate in continuing education (CE) (81/247 or 33%) (Fig. 4).

Discussion

Research about computer usage by dentists has been done in England,¹⁰ Australia,^{8,14} Scotland⁹ and the United States.⁴ All of these studies used mail surveys, and most used check box type questions, although some included a few open-ended questions to be filled in by the respondents. Use of email for such surveys did not improve response rates over surveys by conventional mail.¹⁵ On the basis of the available literature, there is no indication that conventional mail surveys are inadequate to survey computer usage. No studies were found in which telephone-based surveys were used to assess computer and Internet use by dentists.

The response rate for this survey was 28%. Response rates for previous surveys were 88% among general dental practitioners in a small area in England,¹⁰ 53% among Scottish dentists practising in Glasgow⁹ and 70% for Australian dentists.⁸ Therefore, it seems that Canadian dentists were less likely than dentists in other countries to respond to a mail survey. A similar survey¹³ sent to Canadian orthodontists yielded a response rate of almost 50%. The current survey was translated into French, which permitted a response rate of 12% in Quebec, lower than the overall response rate of 28%. Because of the large

variance (64%) in response rates between the provinces, caution must be exercised in interpreting the findings of this study.

Surveys of computer use by dentists around the world have yielded similar results to those reported here. For example, a 1993 study from Australia reported that the most important uses of computer were for accounting (84%), patient billing (80%) and word processing (80%).⁸ In the United States at about the same time, accounting, processing of insurance forms and other bookkeeping functions were the most common uses for office computers.⁴ In a confined area of England, where dentists were surveyed in 2003, insurance claims (79%), accounting (66%), scheduling (60%) and record storage (59%) were the main reasons for using computers.¹⁰ As reported here, insurance claims (92%), accounting and bookkeeping (92%), and patient scheduling (75%) were the main reasons for using computers in Canadian dental practices. These findings are similar to those of the 2000 survey by ADA, which found that 96% of dentists used computers for accounting and billing, 93% for processing insurance claims and 74% for patient scheduling.⁵ Accounting tasks have been an important and increasing use of computers since the early 1990s.

The proportion of Canadian dentists in this sample who had in-office computers was 90%, more than for other Canadian enterprises surveyed in 1999 (82%).³ However, it is to be expected that the frequency of computer use in the private sector would have increased over the past 5 years. ADA reported that 85% of dentists had computers in their offices in 2000, a substantial increase since 1984, when 11% of dental offices had computers.⁵

Eighty-six percent of Canadian dentists had a modem at work in 2004, the same proportion as reported in the

2000 ADA survey.⁵ Seventy-four percent of the Canadian dentists reported having Internet access at work whereas just over half of the U.S. dentists reported having Internet access.⁵ Only 53% of Canadian enterprises³ used the Internet in 2000. By comparison with these 2 studies, Canadian dental offices are high consumers of Internet services, although the difference of 3–4 years in the timing of these surveys must be taken into account (it is to be expected that use of the Internet would increase during this time frame). Dentists' Internet use was also greater than that of the general public.^{1,16}

High-speed or broadband Internet has increasingly changed the way many of us live, and it has probably also changed dental practices. The dental community appears to have accepted high-speed service as the acceptable form of Internet service, given that 37% of those with Internet access had a broadband connection and an additional 8% indicated that they would be upgrading to broadband in the next 12 months. The ADA survey⁵ in 2000 found substantially different data regarding broadband use. Only 10% of dentists reported having broadband access, although an additional 31% planned on getting the service within the next 12 months; 55% reported that they had no plans to get high-speed Internet access. Canadians' access to broadband Internet connection is reportedly among the greatest in the world, more than double that of their North American counterparts.¹⁷ However, the data from the ADA survey may no longer be pertinent, as broadband service became more generally available around the time the ADA survey was conducted in 2000.

One-quarter (26%) of the respondents to the current survey reported having no in-office Internet access, although half (36/65 or 55%) of these respondents had Internet access at another location. This seems consistent with ADA results,⁵ which showed slightly greater Internet access at home than at work. The main reasons given by Canadian dentists for not having access to the Internet were lack of need (41%), security or privacy concerns (33%) and lack of interest (23%). In a confined area of England, lack of need (56%), reluctance of the staff (24%) and cost (19%) were the main reasons for not having Internet access.¹⁰ These results indicate that inaccessibility, high cost or lack of computer skills are not major impediments to using the Internet.

Canadian dentists tended to use Internet resources to get product information and support (54%), to read electronic journals (45%), to buy dental products (34%) and to obtain CE credits (33%). In the Thames region of England, reading electronic journals (61%) and obtaining CE credits (49%) were the main reasons for in-office Internet use.¹⁰ Buying dental products online does not appear to be a common practice in England.

Knowledge of Canadian dentists' computer and Internet usage would permit commercial suppliers of

dental products and services to know what proportion of their market is likely to use computer-related services (e.g., digital radiography and photography, scheduling and reminder systems, intraoral cameras). Professional bodies and dentists themselves might use this information to determine the feasibility of communicating with members or peers through the Internet (email correspondence, patient consultations).

The current emphasis on evidence-based health care may increase the need for computer use and Internet connections in dental practices. Online databases (e.g., PubMed, Cochrane, MEDLINE) are key tools in the search for the best evidence, and their use depends on Internet access. Also, an increasing number of journals offer online access and online CE evaluations. These are important reasons for dental practices to have computers and Internet access.

Conclusions

A high proportion of the Canadian dentists surveyed used computers in their offices, primarily for administrative tasks (accounting, bookkeeping and scheduling) rather than clinical tasks. Internet access was common and there is significant use of high-speed access among Canadian dentists. The main reasons for not having in-office Internet access included security and privacy concerns and lack of need for or interest in the service. Canadian dentists' Internet use was greater than that of American dentists, private enterprise, and the North American public in general. ♦

THE AUTHORS

Acknowledgement: Financial support for this research was provided by the McIntyre Memorial Research Fund.



Dr. Flores-Mir is a clinical associate professor and director of the cranio-facial and oral health evidence-based practice group in the orthodontic graduate program, department of dentistry, University of Alberta, Edmonton, Alberta.



Dr. Palmer is a clinical assistant professor and director of undergraduate orthodontics, department of dentistry, University of Alberta, Edmonton, Alberta.



Dr. Northcott is a professor in the department of sociology, University of Alberta, Edmonton, Alberta.

Ms. Huston is an MSc student in the department of statistics, University of Alberta, Edmonton, Alberta.



Dr. Major is a professor and director of the orthodontic graduate program, department of dentistry, University of Alberta, Edmonton, Alberta.

Acknowledgement: Financial support for this research was provided by the McIntyre Memorial Research Fund.

Correspondence to: Dr. Carlos Flores-Mir, Faculty of Medicine and Dentistry, Room 4051A Dentistry/Pharmacy Centre, University of Alberta, Edmonton, AB T6G 2N8.

The authors have no declared financial interests.

References

1. Newburger EC. U.S. Census Bureau. Home computers and internet use in the United States: August 2000. September 2001. Available from: URL: <http://www.census.gov/prod/2001pubs/p23-207.pdf> (accessed January 2006).
2. Sciadas G. The digital divide in Canada. Statistics Canada. Science, Innovation and Electronic Information Division. Statistics Canada. October 2002. Available from: URL: <http://www.statcan.ca/english/research/56F0009XIE/56F0009XIE.pdf> (accessed January 2006).
3. Bakker C. Information and communications technologies and electronic commerce in Canadian industry. Science, Innovation and Electronic Information Division. Statistics Canada. November 2000; Available from: URL: <http://statcan.gc.ca/english/research/88F0006XIE/88F0006XIB2000004.pdf> (accessed January 2006).
4. Kiser A, Nash K. Computers in dentistry on the rise. *J Am Dent Assoc* 1992; 123(2):106–7.
5. American Dental Association: 2000 survey of current issues in dentistry. Dentists' computer use. Chicago: American Dental Association; 2001.
6. Schleyer TK, Spallek H, Torres-Urquidy MH. A profile of current Internet users in dentistry. *J Am Dent Assoc* 1998; 129(12):1748–53.
7. Barnard PD. Dental practice survey — more details of practice. *Aust Dent Assoc News Bulletin* 1989; 112:6–7.
8. Hou AY, Barnard PD. Computer use in private dental practice in Australia, 1991. *Aust Dent J* 1993; 38(3):191–5.
9. Shoolbread JW, Wohlgemuth B. A survey of the use of micro-computers in general dental practice in Scotland. *Br Dent J* 1989; 166(7):267–8.
10. John JH, Thomas D, Richards D. Questionnaire survey on the use of computerisation in dental practices across the Thames Valley Region. *Br Dent J* 2003; 195(10):585–90.
11. Rens RD, Wolter CA. Are in-office computers for you? *CDA J* 1984; 12:71–3.
12. O'Connor JT. The computer craze and dental data. *Compend Contin Educ Dent* 1985; 6(4):310, 312–3.
13. Palmer N. Computer and Internet usage among Canadian orthodontists [master's thesis]. Edmonton (Alberta): University of Alberta; 2004.
14. Barnard PD. Facts and figures. Australian dentistry — 1988. Sydney: Australian Dental Association; 1989.
15. Muhumuza R, Moles DR, Bedi R. A survey of dental practitioners on their use of electronic mail. *Br Dent J* 1999; 186(3):131–4.
16. Statistics Canada. Overview: access to and use of information communication technology. March 2001. Available from: URL: <http://www.statcan.ca/english/freepub/56-505-XIE/0000156-505-XIE.pdf> (accessed January 2006).
17. Ipsos-Reid. Broadband goes mainstream. Half of home internet subscribers now using a broadband connection in Canada. April 2002. Available from: URL: <http://www.ipsos-reid.com/search/pdf/media/mr020425%2D2.pdf> (accessed January 2006).