

Internet Resources for Dentistry: Utilization of the Internet to Support Professional Growth, Decision Making, and Patient Care

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Abstract

The use of computers as an information resource in dentistry has grown dramatically over the past ten years. Fueled by the availability of more powerful computers, societal acceptance of computer-based resources, and the development of the Internet, millions of documents now provide a tremendously important repository of information for healthcare providers. Those involved in delivery of dental care need to know how to access and use this information for their professional development and to support clinically related activities. This paper presents issues related to the use of the Internet. It also provides information on the use of search engines to find resources (websites) on the Internet and descriptions of some available resources of interest to those involved in oral healthcare.

Keywords: Internet, dentistry, dental resources, world-wide web

Introduction

Computer use in dental practice has evolved from basic billing systems to incorporation of many aspects of the computer-based oral health record. External forces to dentistry have been driving adoption of technology and computer-based resources, such as the computing power of the desktop computer, societal acceptance of computer-based information resources, and the public implementation of "The Internet" via the World-Wide Web (WWW).

The Internet, initiated by the government for military and research activities, made a major transition and exponential growth with the deployment of "graphical user interface" software (GUI), i.e., browsers, to access standard documents, hypertext markup language (HTML), in the early 1990's. Subsequently, the WWW has become a "defacto" standard for communication in many sectors of the economy and a significant telecommunication infrastructure for developed countries. The number of documents posted on the WWW is estimated at doubling every 20 months and by the year 2000, more than 800 million documents will be online.^{1,2,3,4}



The explosive growth of the number of Internet sites, along with the volume and quality of content in the sites, have provided society with a new level of access to efficient information storage and retrieval. This resource will have an increasing impact on decision-making, communication and entertainment processes in the future. Computer-based information resources will make the Internet as essential as the telephone and television. It should be noted that all of these technologies are migrating to one integrated digital device. With the utilization of standardized Internet protocols, platform independence (the type of computer you use) can be achieved in a cost-effective manner.^{5,6}

The Internet allows distribution, storage, and retrieval of the information (data) "just when you need it." Simultaneously updated data of all types: text, sound, graphics, animation, and video, can now be distributed globally, independent of the type of desktop computer at the end user. The amount of information available on the Internet is impossible to have on an individual personal computer. Another advantage, made possible by standardized information formats used with Internet/WWW technology, is the ability to catalog and search for information in an efficient manner. This can be accomplished using Internet "search engines," such as Alta Vista, Excite and Yahoo. A "search engine" provides the user the ability to query for content on the WWW by entering keywords to locate documents. HTML documents contain "metadata" about the files. Vendors who provide search engines have developed sophisticated catalogues of metadata and hyperlinks to the indexed sites. Dentistry will continue to evolve and increase the utilization of digital multimedia for both the oral healthcare professionals' own acquisition of information, as well as its distribution to our patients and colleagues, and Internet technologies will play a major role in this transformation.

Judging Quality

With the use of the Internet, the end user of the accessed information must scrutinize the validity of the data obtained more than ever. One must recognize that the WWW allows anyone to now be "publisher." Healthcare professionals should apply their understanding of the scientific method, research design, statistical analysis, and critical thinking when analyzing information obtained from Internet resources, just as they would scrutinize paper-based medical literature such as journal articles and product promotions. For biomedical information, assessing quality can first be established by determining if information is substantiated.⁷ This can be determined if the information reported is either "evidence-based," "peer reviewed," or is "reviewed with references" included. Evidence-based information at its highest level is a meta-analysis, an in-depth unbiased review of the current literature. At the other end of the spectrum is a single case report, but both should be backed with references (Table 1).⁸

Table 1. Assessing Quality of Information

One must ask, is the reported information:
a. Evidence based? <ul style="list-style-type: none">• Meta-analysis• Randomized controls• Non-Randomized studies• Case Series• Case Report
b. Peer Reviewed?
c. Reviewed/References included?

Meta-analysis involves an unbiased comprehensive review of the literature and reporting on both sides of issues if controversy exists. An excellent example of this is the Cochrane Reviews (<http://www.update-software.com/ccweb/cochrane/cdsr.htm>). Individuals may have to subscribe for full access, but abstracts are available.⁹

The Cochrane Collaboration

Reports of findings in a “randomized control” study involves one’s understanding of the scientific method. Non-randomized studies, case series, and case reports should provide the reader a background perspective. Those who believe decisions should be informed by the results of research will find the contents of The Cochrane Library helpful. It is the best single source of reliable evidence-based information about outcome effects of healthcare in the world. Content is based on the collaborative meta-analysis of multiple individual studies of similar investigations with a graphical compilation of the statistical analysis.

In a meta-analysis, studies are adjusted for uncommon variables and other bias. The common variables analyzed are enhanced by the corresponding increase in the number of subjects analyzed. Like most other libraries, The Cochrane Library’s Cochrane Systematic Reviews use a process that continuously updates the published information. Important advantages of publishing using electronic media of WWW include providing the publisher the most time and cost efficient mechanism for knowledge dissemination and the user’s instant access to the latest information.

The user of this information must determine if the source is peer reviewed or does not represent

individual opinion. Many Internet sites are now indicating if material is “reviewed.” References should be included to substantiate the content of the information. When accessing information via the WWW and considering quality, one must also consider the type of web-site. Sites that are a directory of WWW resources, in particular those that provide reviews, are much of the time considered more reliable or unbiased such as “Megsites,” Governmental, Educational, or Organizational sites. Therefore, while there are exceptions, consideration to the type of site “.com” vs. “.org” or “.edu,” may need to be taken into account. The user must determine the intent of the content, sales and marketing of products or services, or an unbiased desire to inform the end user. Some other “Practical Guidelines” for evaluating “reliability” of information found on the WWW include: the use of domain name instead of an IP address (every computer on the Internet has a unique assigned number as one can see in the URL address window of the web-browser), the determination if that site is a institutional/corporate site as opposed to a personal web-site, and if others link to the site or document.¹

Evaluation Resources

The sites listed here were included due to their relevancy to “Dentistry” for dentists and staff involved in oral healthcare delivery and support. By no means is this meant to be an exhaustive list, but rather a starting place for “new users” to gain a better understanding of the wealth of information that can be tapped with this tool. The author does not endorse the sites or products mentioned or opinions expressed within referenced documents, but merely provides this reference as a matter of convenience and efficiency in starting or continuing ones cyberspace journey.

To help in the process of evaluating Internet resources, the following sites may be beneficial in furthering ones understanding of evaluation of Internet Information Resources (NLM):

The Health Information Technology Institute's: Criteria for Assessing Quality of Healthcare Information on the Internet.¹⁰ (working draft, 1997)

The project addressed development of criteria for judging the quality of healthcare information on the Internet, supported by Mitretek Systems, Health Information Institute and Agency for Healthcare Policy and Research.

<http://hitiweb.mitretek.org/docs/criteria.html>
Health on the Net Foundation's Code of Conduct (HONcode) for providers of healthcare information on the Net.¹¹

This is a code of ethics for publishers of medical and health information on the Internet. The organization's goal is to provide guidelines so that users of the information will better understand the site's purpose and source.

<http://www.hon.ch/Conduct.html>



Searching the Web for Healthcare Resources: Search Engines, Metasites and Directories

With the explosive growth in the available information on the Internet, mechanisms to find documents and content efficiently needed to be developed. The computer code for programming WWW content, HTML, also can be used to embed information about documents (pages) themselves. This information is referred to as "metadata." Savvy WWW content developers take advantage of the metadata feature to put in

multiple descriptions and keywords related to their homepage and document(s) included in their site. Almost simultaneous to the graphical WWW introduction, were the appearance of "search engines," developed by computer technology vendors. These companies have developed sophisticated mechanisms to review websites, the type of content posted, and the content itself. Now these vendors, each with their own proprietary software, automate the review of millions of documents, categorize and create indexes for end users to query. The end user can enter a keyword or phrase and then view all "HTML" documents the search engine has referenced, and based on the author/web-developer of the content, also see a description of the document (page). HTML searching is two-dimensional at this time, with results of searching indicating the document and the content of the document (if indexed by the search engine). Additionally, web content developers may add their own "search" functionality by indexing their own sites. Typically, an end-user will note a search feature on a website's homepage if incorporated. Many of the vendors who developed the WWW search engines now have marketed proprietary software for webmasters to use to index their own sites. Another mechanism for searching is use of websites that are "directories" of a subject matter, where someone else has compiled lists and links to related web resources.

In the future, the web will allow for more three-dimensional searching (contextual), such as with the capabilities of SGML (standard generic markup language), the grandfather of HTML, as content providers and browsers can be made capable to interpret this format. Presently, when one searches for content using a "search engine," there needs to be a realization that the results returned will be dependent on how authors and search engines have included, referenced, and/or indexed "metadata" about a site or document(s) in a site. A balance between too narrow of search parameters (keywords) and too broad of search must be achieved by the user to acquire meaningful results.

Search Engines

The following is a listing of some common sites with search engines which can assist an Internet user with locating information of interest.

Profusion®

This site provides the ability to do subject and web-site specific searches with multiple search engines simultaneously. The search results returned with the Profusion query tool will display which of the major search engines each resultant URL was obtained from.¹²

<http://www.profusion.com>

Alta Vista®

Alta Vista is a keyword search engine which also searches full text and is very extensive and inclusive. Its strength is literal searching. Incorrect use of the engine will render large numbers of obscure hits. This is the engine to use if you are looking for the obscure!¹³

<http://www.altavista.digital.com>

Excite®

Excite is a keyword and non-coordinated subject search methodology engine. It uses full text search of over 50 million documents. Both literal and concept searches are supported, and the site is easy to use.¹⁴

<http://www.excite.com>

HotBot®

HotBot is another keyword and non-coordinated subject search engine that searches full text for over 54 million documents. Queries are constructed effectively in common language rather than needing to use more complex operators for effective output.

<http://www.hotbot.com>

All major "search engines" provide for general searching as well as categorization for searching of which health related sites are a major subcategory. These sites can be "drilled down" (have direct hyperlink that one "clicks" on) or searched via the company's engine, based on how they have indexed sites and the request of the user. Excite® also has an online health encyclopedia link. HotBot® lists "Dentistry" as a major sub-category of Health Resources.¹⁵

Metasites and Directories

Directories provide a listing (list of lists) of related websites with hyperlinks which are intended to be as comprehensive as possible. There is no standard for categorizing sites, so each directory will organize hyperlinks differently.

Hardin Meta Directory of Health Sources

This site is well maintained and links will be made to specific sections of listed sites to eliminate unnecessary drill-downs (sorting through a site). Many of the lists are developed by experts from the specific field, such as the directories for dentistry listed below.

<http://www.lib.uiowa.edu/hardin/md/index.html>

Directories for Dentistry

Internet Dentistry Resources

The site is maintained by a team at the University of Iowa, School of Dentistry. This list breaks content into educational, commercial, vendors and governmental subcategories including most major dental manufacturers. A comprehensive list of dental journals with links, several of which are "online" journals, is also a component of this directory.¹⁷

<http://indy.radiology.uiowa.edu/Beyond/Dentistry/sites.html>

Dental Related Internet Resources

This site contains a comprehensive list of all dental schools listed by state, international schools listed alphabetically by country, dental training programs, links to the many major dental organizations, a directory of state dental societies and international associations, and oral healthcare products. The site also has links to the educational resources, a number of individual dental offices (listed by state), dental practice management and clinical management software companies, dental labs, equipment and supply vendors, and office designers. Also linked are distributors of office related supplies, including imaging and computer equipment companies, clinical information systems vendors, dental office sales, and several marketing, legal and malpractice groups. Other links include "continuing education," with several links to individual courses, and subscriptions to dental related list-servs (e-mail group) classified by subject area.¹⁸

<http://www.dental-resources.com>



Oral Healthcare Resources on the Net

Academy of General Dentistry

In addition to providing services for members such as online access to AGD Journal articles, chat rooms, online continuing education (CE) and tracking CE, the site also has links to dental specialist academies. The site provides information of interest for dental consumers.¹⁹

<http://www.agd.org>

American Dental Association

Touted as the Association's online service, the homepage has several major paths such as: ADA Publications, including online parts of the Association's Journal; Recent News Updates, now including several online videos; and Dental Practice Issues, which now post standards for "Choosing a Practice Management System" report. An "ADA Members only" section has a warehouse of articles from several publications intended for its members and access to other Association services such as insurance programs. There is another button for the Dental Societies, that allows one to access both state and local societies, and a listing of Dental Schools with addresses (although one might find the links at the American Association of Dental Schools easier to use online for immediate access to dental school's websites).²⁰ The ADA Shopping Mall has access to products and services offered including

links to an online catalog of printed material sold by the ADA, a listing of products with the ADA Seal of Acceptance, and the ADA Library Service. The Consumer Information section provides universal access to ADA statements on topics of public concern such as use of amalgam and fluoride as well as patient education material (bleaching, sealants/caries prevention, practice guidelines, and other accepted dental therapies).²⁰

<http://www.ada.org>

The American Association of Dental Schools

This is an excellent vehicle for finding information about dental schools in the United States and Canada. The site has a wealth of information such as directories, activities of the organization, and admissions procedures for persons interested in a career in dentistry.²¹

<http://www.aads.jhu.edu>

Dental Manufacturers of America

This is a valuable resource for members of this group for activities, meetings and issues impacting manufacturers of dental related products. For the oral healthcare provider, the section for products via a link on the sites homepage may be beneficial when doing product research, making decisions, or contacting vendors about purchases of dental equipment and supplies.²²

<http://www.dmanews.org>

Crest® Dental ResourceNet

This site is dynamically renovated via a Peer Review Board and feedback from users. A library of documents, including patient education information that is one of the most extensive online resources, has been made available to the dental profession.

Dental ResourceNet has made a good start at including a broad-spectrum of content such as: the online dental hygienists publication and abstracts of articles from multiple dental-related journals indexed by subject. These include: computers in dental practice, management, cosmetic dentistry, topics in internal medicine, dental management of medically compromised patients, and abstracts of recently reported P&G oral healthcare research.

There is also a major subcategory for “Useful Sites,” which has links to most major specialty organizations. Another interesting function of this site is an interactive “Calendar” for conferences and events, which can be sorted by city and state or range of dates. The query also provides a short description of the events. It is not an all-inclusive list, but its functionality is novel. The site also has several modular units for continuing education for dentists and hygienist, with about a half dozen courses available for each, and a database of CE requirements for each state. Under the “Practice Management” section, multiple articles related to communications skills can be helpful as a resource to the dental team.²³

<http://www.dentalcare.com>

The American Dental Hygienists’ Association

This is the largest organization representing “dental hygienists.” This Internet site posts career information, oral healthcare instructions and tips (a good resource for patient oral hygiene education), in addition to resources for members such as the Association’s journal and meeting schedules.²⁴

<http://www.adha.org>



What’s Ahead?

The volume of information on the Internet and its use by our society will only continue to grow, with the Internet and a web presence becoming a “defacto” standard for most corporations, businesses, institutions, and associations in the future. Multimedia Internet technology will continue to drive the Internet’s innovativeness. As society moves to the next millennium; television, motion pictures, and music will all be distributed digitally.

The routine use of the Internet at home will further be facilitated by the increased speed of data acquisition through higher speed modems and access points to the Internet. The increased demand will also push the next generation of Internet access, (i.e., Internet2 <http://www.internet2.edu> and <http://www.ngi.gov>) which will make possible a significantly higher speed of data transfer measured in terms of gigabits/second as opposed to present day kilobits/second.

Society will continue to insist on “just in time” information of which healthcare plays a significant role. It is through the unifying technology of Internet standards that make this a reality. Access will grow seamless with more portable devices and the Internet “on-ramp” options such as digital and satellite networks and integration of multiple computer systems and applications through the web browsers. The dental profession and those involved in patient care will only continue to increase their own utilization of this resource as well as provide content for this digital communication process.^{25,26}

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