

Evidence-based Dentistry: Part II. Searching for Answers to Clinical Questions: How to Use MEDLINE

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A b s t r a c t

The ability to conduct efficient literature searches is fundamental to the practice of evidence-based dentistry. In the second part of this series on evidence-based dentistry, strategic literature search techniques are discussed. MEDLINE, because of its breadth, depth and continuous maintenance by the U.S. National Library of Medicine (NLM), is the best source of evidence for health care. Although there are many gateways to MEDLINE, this paper highlights the user-friendly versions of MEDLINE offered free on the Internet by the NLM. The use of well-established search tactics and the unique features of the NLM sites facilitate rapid, effective literature searches.

MeSH Key Words: dentistry; evidence-based medicine; Medline

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In the first paper in this series, the sequence of steps for practising evidence-based dentistry was outlined and the importance of formulating a clear question was discussed. The purpose of this paper is to describe one of the tools to find the evidence — MEDLINE. The general and specific search strategies introduced in this paper can also be applied when searching databases other than MEDLINE.

Strategic Searching Made Easy

A number of excellent and highly specialized databases provide electronic access to medical and scientific literature. By far the most relevant and readily available of these is MEDLINE. This multipurpose database, created and maintained by the United States National Library of Medicine (NLM) of the National Institutes of Health, is an index to the biomedical literature from 1966 onward, covering the disciplines of medicine, dentistry, nursing, veterinary medicine, health care services and the preclinical sciences. At the time of this writing, it contained over 11 million references, about 76% of which include author-written, English-language abstracts from over 4,300 journals, published in more than 70 countries. Over 400,000 new references are added per year, at a rate of nearly 8,000 publications per week. Of the over 700 dental journals currently available worldwide, about 320 are indexed in MEDLINE.

The MEDLINE database belongs to a larger family of more than 40 NLM databases called MEDLARS (Medical Literature Analysis and Retrieval System), which includes specialized databases such as Cancerlit, AIDSLINE and TOXLINE. MEDLINE^{plus} provides consumer health information and encourages consumers to discuss search results with their health care professional. The full MEDLINE database is available publicly to anyone, free of charge, via the Internet. PreMEDLINE, which is updated daily, is the in-process version of MEDLINE. Here, citations, along with abstracts, are available before they are indexed for MEDLINE.

There are many routes to MEDLINE, including those provided by several commercial vendors, such as OVID.¹ The NLM offers free Internet access through 3 Web sites—PubMed,² Internet Grateful Med (IGM)³ and the recently launched NLM Gateway.⁴ Gateway is expected to replace IGM by the summer of 2001. It is targeted to Internet users who are unfamiliar with the vast contents of the NLM and how to access them. It permits simultaneous, seamless searching in multiple retrieval systems at the NLM. In addition to MEDLINE and PubMed, Gateway also accesses OLDMEDLINE (pre-1966 journal citations), LOCATOR^{plus} (books, serial titles and audiovisual resources), meeting abstracts, DIRLINE (a directory of

health organizations, research resources and projects) and a number of other valuable databases. The NLM resources allow users to perform thorough searches that formerly required the expertise of highly trained individuals. The latter statement is not in any way intended to downplay the invaluable role of medical librarians, the real information experts. Indeed, for many scientific endeavours, such as systematic reviews, the expertise of a librarian should be sought.

Some of the basics of searching are discussed below. An understanding of these concepts and techniques facilitates the development of strategic search skills.

The MeSH Vocabulary

MeSH (Medical Subject Headings) is a special vocabulary developed by the NLM to index each reference. The vocabulary contains main headings or index terms, each of which represents a single concept in the biomedical literature. New terms are continuously added and outdated ones removed by subject specialists as new concepts emerge in the scientific literature. When a new citation (the MEDLINE term for information about an article, including its title, authors, source, institution, abstract and more) appears, trained NLM indexers choose the MeSH terms (usually 10 to 12) that best characterize the substance of the article. MeSH terminology provides a consistent way to retrieve information and bypasses the problem of medical jargon and multiple synonyms for the same idea.

In addition to the index terms, MeSH includes numerous "entry terms" (synonyms), which point to the appropriate index term. Currently, MEDLINE has an entry vocabulary of over 300,000 terms linked to its more than 19,000 MeSH terms. The choice of entry terms is important; you should try to focus the term as much as possible. For instance, when the word "post" is entered as a search in MEDLINE, it is linked to the subject heading "stress disorders, post-traumatic" — probably not what you had in mind. When the term "endodontic post" is entered, it is mapped to the index term "post and core technique" and your search is off to a better start.

It can be difficult to decide which terms to enter when starting a new search. A useful strategy is to enter the best term you can think of, scan a few of the abstracts from retrieved articles that seem relevant and then look at the MeSH terms listed in the citation. Repeating this once or twice will help you to develop the list of terms that are most relevant to the subject of interest. When searching MEDLINE in PubMed, IGM or Gateway, a number of sophisticated mapping and matching functions are performed automatically to link the entry terms you have chosen to the appropriate index terms. A very useful feature of these sites is called "details of search." This feature allows you to view the detailed components of the search and facilitates the development of your searching skills.

Searching with Text Words

Besides searching by subject, searching can be done by "text words," which are words or phrases in the title or abstract of the article. These are especially useful for new terminology (e.g., new drugs or procedures). Text words should be used in combination with, rather than instead of, subject terms. The reason is that text words are "uncontrolled" vocabulary — that is, there is no guarantee that the word or phrase as used by the author is either relevant to or specific enough for your search. For example, when the term "mucositis" is searched as a subject, MEDLINE automatically matches it to the MeSH term "stomatitis" and retrieves all citations where oral mucositis is a major concept in that paper. On the other hand, when mucositis is searched as a text word, a citation that does not contain that word in the title or abstract (perhaps the author used the word "stomatitis" or the phrase "oral inflammation") will not be retrieved, but irrelevant citations from the medical literature relating to intestinal mucosal disorders will be.

Search Strategies

A useful feature when searching by subject is called exploding. Exploding causes MEDLINE to gather all the terms that relate to the MeSH term. Although the NLM databases automatically explode terms, some other databases do not. For example, if the subject term "dental restoration" were entered in a database that did not explode the term, only articles dealing with restorations in general would be retrieved. If MEDLINE were instructed to explode the term, papers dealing with amalgams, resins, glass ionomers, temporary restorations and many other topics would be retrieved. This feature leads to a much more inclusive search (with high sensitivity or recall rate), but usually retrieves an impossibly large number of citations, many of which are not relevant. This problem can be overcome by combining searches and by applying limits.

Another useful operation, called truncation, can be employed when doing text word searches. A truncated term (or wild card, in search jargon) is the first part of a word followed by an asterisk. This feature allows all terms beginning with that part of the word to be searched. For example, "dent*" will find all terms that begin with the letters d-e-n-t, including "dental," "dentistry," "dentist" and so on. "Mucosa*" will find terms such as "mucosal," "mucosa" and "mucositis."

Both text words and subject terms can be combined using the Boolean operators AND, OR and NOT to control searches. AND is used when you want to retrieve papers that contain all of the concepts of interest. This feature reduces the number of hits and makes the search more precise. "Head and neck neoplasms AND quality of life" will focus the search to papers in which these 2 concepts are key points. For the years 1995 to 2000, "head

and neck neoplasms” yielded 30,657 hits and “quality of life” yielded 18,468 hits; however, combining the terms with AND limited the retrievals to 480 citations. Adding “AND radiation therapy” reduced the number of hits further to 140 — a more manageable, but still large, number of titles to review.

The operator OR, on the other hand, is used to broaden the search. If you are interested in nonsurgical and nondrug therapy for TMD, you might use “AND temporomandibular dysfunction” with any other terms for therapy (“splint OR bruxism OR exercise OR stress reduction OR acupuncture OR occlusal adjustment,” etc.).

Terms can be excluded by using the term NOT — for example, “bone graft AND allograft NOT autograft” or, in the TMD example, “temporomandibular dysfunction AND [therapy NOT drug therapy] AND [therapy NOT surgery].” Be sure to use uppercase letters for these Boolean operators.

Applying Limits

When looking for information in clinical settings, it is important to apply meaningful limits to reduce the number of irrelevant hits. Twenty-five to 30 titles is a reasonable number to review, although this will vary from person to person and will depend on the nature of the question at hand.

Limits such as human vs. animal research, age groups, year of publication, language, publication types and others can be chosen in most databases. PubMed and IGM have a drop-down menu listing various publication types (e.g., randomized controlled trials, reviews, letters, editorials) which can be used as limits. Limiting by publication type is extremely useful, particularly in a well-researched area, to find the highest level of evidence (or to inform one of the *lack* of good research and invoke the warning, “Reader beware!”). For example, the second search strategy given above for the TMD example yielded 2,050 hits for the years 1966 to 2000. When the same search was limited by publication type, 43 randomized controlled trials and 3 meta-analyses were found. It is important to note that “review” is any type of review and is not confined to systematic reviews, and “practice guidelines” are guidelines developed by any person or organization and may not be evidence-based.⁵

Methodological Filters

Unique to PubMed is a feature called Clinical Queries, which allows the user to access and employ methodological filters. These filters, developed by members of the evidence-based medicine group at McMaster,⁶ sift out articles that do not use specific research methods by applying a combination of tested MeSH terms and text words related to study design and methodology. The searches, which have known sensitivity and specificity, retrieve clinical research from one of 4 study categories — therapy, diagnosis, etiology or prog-

nosis. You can indicate whether you want the search to emphasize sensitivity (a broad search, which will yield the largest number of relevant papers but also many irrelevant ones) or specificity (the irrelevant papers are weeded out, but pertinent ones may be missed). For day-to-day clinical questions, a quick search that emphasizes specificity is usually most helpful.

Getting Help

For members of the Canadian Dental Association, the CDA Resource Centre staff will perform searches at no charge or will assist you by analyzing your search, offering advice ranging from how to get started to more advanced search methods. The Resource Centre staff can be contacted at info.cda-adc.ca.

Most medical, dental and hospital libraries offer regular courses on searching the biomedical literature using a variety of databases. Also, some excellent sites for self-learning are available on the Internet (the subject of the next paper in this series).

The NLM online resources have very well-developed, context-sensitive help text, which not only assists with your search but will help you to develop your search skills as well. For example, IGM has a feature called “analyze search.” Suppose you are interested in the effectiveness of using a fluoride rinse to prevent root surface caries in geriatric patients. You enter “fluoride AND caries AND geriatrics,” press search and get no hits. You see that each term individually has yielded many thousands of hits, so you go back to the search screen and press “Analyze search.” The feature tells you that the term “geriatrics” was a poor choice, because MEDLINE’s MeSH vocabulary understands this term as the professional specialty of geriatrics, rather than a term for elderly patients. The alternative term “aged” is suggested. Substituting this term for “geriatrics” in the search yields 341 hits. You then substitute “root surface caries” for “caries” and narrow the field to 24 articles. Applying the publication type limit, you find that 2 are randomized controlled trials and one⁷ appears to be most related to your original question, so you decide to obtain a hard copy of the paper.

Getting Papers

Reviewing an abstract is insufficient to assess the validity of a clinical study. Simple critical appraisal techniques will help you to decide if the results of the study are believable and if they can be applied to your patient. These decisions cannot usually be made on the basis of the abstract. Dentists practising in hospitals or academic centres have ready access to the biomedical literature. For others, a number of resources are available for accessing documents.

MEDLINE provides links to publishers’ Web sites for approximately 800 journals, where full articles can be

requested or viewed. In some cases, registration, subscription or other types of fees may be required by the publisher.

The NLM sites offer the Loansome Doc service, whereby full-text articles can be ordered electronically through the National Network of Libraries of Medicine. You must make arrangements with a medical library (e.g., at your local hospital) to which the documents will be delivered. Registration is required and variable local fees are applied.

The CDA Resource Centre subscribes to more than 250 dental journals. Its collection is complemented by a collection of core medical journals and access to much of the biomedical literature through interlibrary loans. For members only, photocopies of requested articles are sent by mail or fax at reasonable rates.

Some university dental libraries provide similar services for non-faculty dentists, for which a fee is charged.

Conclusion

A number of forces are coming together to propel the evidence-based paradigm into everyday dental practice. The information explosion, the unprecedented advances in electronic technology and the consumer movement, with increasingly well-informed patients taking part in the clinical decision-making process, all contribute to the need for dentists to meet the challenge and enjoy the opportunities of practising evidence-based dentistry.

In searching for answers to clinical questions, MEDLINE, because of its depth, breadth and continuous maintenance by the NLM, is the best source of evidence for health care. However, other databases and electronic sources are invaluable and offer almost instant access to clinical information. In the next paper in this series, I will discuss the effective use of the Internet to search for evidence. ♦

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C D A R E S O U R C E C E N T R E

The Resource Centre has prepared an information package of recently published articles on evidence-based dentistry. This package is available to CDA members for \$10. Please contact the Resource Centre, tel.: **1-800-267-6354** or **(613) 523-1770**, ext. 2223; fax: **(613) 523-6574**; e-mail: info@cda-adc.ca.