The continued growth and development of information technology has placed vast potential resources at the fingertips of any orthopaedic surgeon with an Internet-connected computer. Keeping abreast of the latest developments and of evidence-based surgery is an essential part of modern orthopaedic practice and an integral part of clinical governance. Much of the up-to-date knowledge is available on the Internet but is frequently hidden among the huge amounts of other data and information, making the access to accurate information difficult for the inexperienced or unwary. Information overload can be difficult to cope with. In addition, access to certain sites is restricted by passwords or requires the payment of a subscription. What strategies can a busy orthopaedic surgeon employ to find current knowledge in a quick and efficient manner?

The ideal orthopaedic search engine

In an ideal world an orthopaedic surgeon could use one search engine to find all required orthopaedic knowledge. This engine would have to possess the capacity to search the entire Internet, update itself continually as new information was posted and filter out knowledge of little relevance or of poor quality. Portals which are available currently to access accurate knowledge, such as Orthopaedic Web Links (OWL) and Orthogate, have amassed many thousands of peer-reviewed links, but their lists are by no means comprehensive. Their continual update relies upon the goodwill and enthusiasm of their editors, often with minimal financial backing. They do not have the resources to keep up with the huge volumes of new data added to the Internet each day and, unless there is a fundamental change to their infrastructure, they will continue to fall behind the rapidly advancing pace of new developments.

The problem of sifting through the large amounts of knowledge on the Internet is addressed by general search engines, such as Google, Yahoo or Alta Vista, some of which are currently searching up to 4.28 billion pages at a time. Search engines keep up to date with the many new pages added to the Internet with programmes called ‘web crawlers’, which inspect the contents and title of a web page and index it according to a set of criteria. These criteria are subtly different between individual search engines and hence identical searches can yield different results (Table I). Knowledge of the indexing system for a major search engine can allow a good web page designer to influence the position of the page when it is ranked during a search. An unscrupulous designer can therefore achieve a highly ranked search hit with a page even when topics unrelated to the main content of the site are searched for. For those of us who are familiar with the use of general search engines there is little doubt that their effectiveness in delivering accurate information has improved greatly over the last few years. Frequently we can find what we require in the first 20 links but the danger of heading down a blind alley still exists. In terms of orthopaedic literature these engines are becoming increasingly useful, especially with the employment of the advanced search functions which each provides based on the principles of Boolean logic (Table II). They will, however, always have the problem of quality control and many subject searches will still continue to yield an excess of information which will be too much to evaluate. Quality criteria are needed but must be simple and easy to use (Table III).

National electronic Library for Health

In March 2001, the United Kingdom Government began the creation of a virtual electronic library for health. The foundations of this library were put in place with the National electronic Library for Health (NeLH) which went online in early 2003. The musculoskeletal section commenced in October 2003. The NeLH website provides a wide variety of quality knowledge accessible to both patients and
health professionals. In addition, using a password, healthcare staff can access 200 major on-line textbooks, 20 major databases and four thousand full-text journals via Ovid Fulltext. While the journals have only been put online as far back as the early nineties this clearly represents a very powerful facility for rapidly retrieving full up-to-date articles. The current selection includes some of the highest impact journals in orthopaedics and trauma. Trawling through dusty library recesses with a worn out photocopy card should become a thing of the past. Provided that such a hub is called BIOME and encompasses all those databases it serves as a good starting point from which to develop further searches.

Table I. Comparison of search results yielded from different general Internet search engines. The more specialist health gateway site BIOME is also included for contrast. Keywords entered are shown in the first column. Site search performed February 2004

<table>
<thead>
<tr>
<th>Keyword</th>
<th>Google15</th>
<th>Alta Vista16</th>
<th>Yahoo17</th>
<th>BIOME18</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orthopaedics</td>
<td>498 000</td>
<td>27 352</td>
<td>756 000</td>
<td>147</td>
</tr>
<tr>
<td>Fracture radius</td>
<td>64 800</td>
<td>1700</td>
<td>223 000</td>
<td>1</td>
</tr>
<tr>
<td>Fracture femur</td>
<td>52 800</td>
<td>1959</td>
<td>113 000</td>
<td>3</td>
</tr>
<tr>
<td>Knee replacement</td>
<td>783 000</td>
<td>11 473</td>
<td>760 000</td>
<td>7</td>
</tr>
</tbody>
</table>

Future developments

Computer technology continues to advance rapidly. The apocryphal Moore’s law predicts a doubling of the power of computer processing every 18 to 24 months. The development of broadband has allowed information to be transferred and downloaded faster. The increased speed of delivery will make it easier to use multimedia resources such as video clips of patient clinical examination, radiographs or live webcast operating. With an estimated 7% of the population of the United Kingdom currently using broadband its potential is clearly underexploited. The development of other devices such as personal digital assistants will allow this technology to be increasingly portable and used with wireless technology at the bedside.

Table II. Boolean search logic using three logical operators

<table>
<thead>
<tr>
<th>Operator</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>OR</td>
<td>The more concepts or terms used the greater the number of records retrieved</td>
</tr>
<tr>
<td>AND</td>
<td>The more terms combined the fewer records retrieved</td>
</tr>
<tr>
<td>NOT</td>
<td>Retrieves records where only one of the terms is present and effectively excludes other records from a search</td>
</tr>
</tbody>
</table>

Table III. Silberg’s Quality Website Criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Authorship</td>
<td>Authors and contributors, their affiliations, and relevant credentials should be provided</td>
</tr>
<tr>
<td>Attribution</td>
<td>References and sources for all content should be listed clearly, and all relevant copyright information noted</td>
</tr>
<tr>
<td>Disclosure</td>
<td>Web site “ownership” should be prominently and fully disclosed, as should any sponsorship, advertising, underwriting, commercial funding arrangements or support, or potential conflicts of interest</td>
</tr>
<tr>
<td>Currency</td>
<td>Dates that content was posted and updated should be indicated</td>
</tr>
</tbody>
</table>

Useful resources

No single search will yield all the orthopaedic knowledge available on a particular subject. The strategy used will depend very much on the type of information sought and to a certain extent on the seniority of the orthopaedic surgeon. For many trainees the Orthoteers site is a valuable, quick and extensive source of information. It was originally created by three British orthopaedic postgraduate trainees who were preparing for the FRCS (Tr & Orth) examination. It contains extensive background reading, also frequently reviews seminal or controversial papers on a variety of topics. Other similar resources originally written by orthopaedic trainees revising for exams are Wheeless Orthopaedic Textbook, and Orthonet. Like OWL and Orthogate the information in these resources is by no means comprehensive and is not absolutely up to date, but it serves as a good starting point from which to develop further searches.

For those surgeons wishing to take a look at the current orthopaedic literature more familiar databases such as Medline or Pubmed can be searched although they only provide abstracts. For employees of The National Health Service in the UK, obtaining a network password from Athens allows access to the full complement of facilities provided by the National Electronic Library for Health with its full text journals. It also directs the user to other providers such as The Resource Discovery Network. This is a collaboration of many education and resource organisations called hubs. For the health, medicine and the life sciences this hub is called BIOME and encompasses Organising Medical Networked Information (OMNI) and Nursing, Midwifery and Allied health Professions (NMAP). BIOME rapidly links one to OWL, Orthogate and Orthoteers when the title ‘orthopaedics’ is typed in its search engine. The International Cochrane Collaboration provides a basis for well-informed decisions based on systematic reviews of the effects of interventions. The United Kingdom’s National Institute of Clinical Evidence (NICE) makes strategic decisions on the development of clinical guidelines for the use of both patients and professionals. BestBets were developed to provide rapid evidence-based answers to clinical questions and to take into account the shortcomings of much current evidence, allowing physicians to make better judgements. Although BestBets was initially focussed on emergency medicine, there are a significant number of topics concerning orthopaedic trauma. Clinical Evidence is a source of some of the best available evidence on the effects of common clinical interventions in musculoskeletal medicine.
Internet search engines will continue to evolve. Exciting new types are appearing. Metasearch, clustering and intelligent engines refine the searching power in subtle but useful ways and join together searches from several sources.\textsuperscript{30-32} The power of these engines will not improve until the internal data in web pages, metadata, is improved. The Dublin Core Group\textsuperscript{33} is attempting to improve metadata\textsuperscript{34} but this has been poor in orthopaedics. Search engines have such significant indexing and ranking effects that they will ultimately affect decision making in the economics of orthopaedics and scientific research. Delay in the indexing of orthopaedic scientific research by search engines can lead to the duplication of work, and might affect the economic viability of a research institution.

It is clearly not possible for the vast majority of doctors to manage the huge volumes of electronic knowledge available to help them in the practice of evidence-based surgery. It seems essential that a central agency, with government support, should take responsibility for the maintenance of a structure of knowledge management that provides accuracy, currency and quality assurance. Implicit in such a structure is appropriate and continual training of medical professionals in information technology. The technology is here now, failure to embrace it is not an option.

References