# CLINICAL ARTICLE

## The Internet: Selecting relevant orthopaedic knowledge and managing it on your personal computer

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### Introduction

The rapid expansion of the Internet and ubiquity of broadband connections is vastly improving our access to knowledge and how we search for orthopaedic information. Not only are a significant proportion of articles online as text, but a few minutes' browsing will also locate videos of operative technique. Podcast lectures and blogs are available at the click of the mouse.

Until recently if you did not personally subscribe to a variety of journals, a trip to the medical library was usually necessary to find an article, or verify a fact for research. As a Web-enabled doctor today, you are able to download most of this information from the comfort of your office or study.

This article will guide you as to the most effective way to search for and download an article using your web browser and an Internet connection. There is a plethora of information online so the searcher will have to be savvy to avoid frustrations such as password-protected sites, pay sites and references of dubious authenticity.

### Characteristics of a quality orthopaedic website

Many orthopaedic sites are of poor quality. Besides sloppy presentation, there may be untruths or bias towards a product or technique. This may be due to conflicts of interest, the site commercially driven towards selling a product, or to advertise a practice. Others sites exist for patient education rather than for the orthopaedic surgeon. How does the orthopaedic surgeon recognise a quality site with reliable information?

Silberg[1] notes the following criteria for assessing a quality website (*Table I*).

Quality orthopaedic sites should be controlled by a webmaster who is at least an orthopaedic surgeon, andpreferably also known as an author of peer-reviewed journal articles. Popular sites of value to the academic are often large and have appreciable running costs; do not begrudge the fact that you may have to pay to gain access. As with paper journals the cost of running a large website, of several thousand pages, may have to be offset by sponsorship or subscriptions by the users.

Of the many orthopaedic websites the following are comprehensive, of a good standard, and particularly useful to the postgraduate who is studying orthopaedics.

| Table I: Silberg's quality web criteria | |
| --- | --- |
| **Criteria** | **Reason** |
| Authorship | The affiliations and relevant credentials of authors and contributors should be provided. |
| Attribution | References and sources for all content should be listed clearly, and all relevant copyright information noted. |
| Disclosure | Website 'ownership' should be prominently and fully disclosed, as should any sponsorship or advertising. |
| Currency | The dates on which content was posted and updated should be indicated. |

## Popular academic orthopaedic sites

Of the thousands of orthopaedic websites available, only a few are dedicated to academic orthopaedic surgery. The rest are either commercial or are for patient education.

1. **Orthogate**[2] is a site dedicated to providing verified and approved web references and also has a search facility. The site was begun in 1995 by Dr Myles Clough,[3] an orthopaedic surgeon in Kamloops, Canada.

2. **Orthoteers**:[4] This site was started by three registrars – Jonathan Borill, Lennard Frank and Susan Deakin. It has now developed into a major site containing a significant portion of the knowledge an orthopaedic registrar needs to acquire. It has a large advisory board to vet the content. Unfortunately it requires an annual subscription if the user wants more than a cursory glimpse of its content.

3. **Wheeless Textbook**.[5] This site, at Duke University, is edited by Clifford Wheeless, and has 11 000 pages of orthopaedic information. Most information is didactic, being given in a bulleted list of points.

4. **Intute**:[6] This is a UK-based organisation with similar ideals of providing a search facility to approved quality sites and references. It does not deal exclusively with orthopaedic material but medical articles can be specified.

5. **Book and journal publishers**. Major publishers, including such sites as the *Journal of Bone and Joint Surgery*[7] use software that allows the user to search not only their site material but other relevant medical and basic science journals.

## Passive methods:
## Receiving new knowledge by mail

It is not always necessary to actively search for information. If you know what type of orthopaedic information interests you, the patient orthopaedic surgeon can have it sent to his mailbox or his mail aggregator program. There are two methods to arrange this: joining a mailing list, or subscribing to a feed.

### Mailing lists

Subscribing to a mailing list allows orthopaedic surgeons to keep abreast of their topics of interest. They will receive regular emails on their chosen fields of interest and can also become active by replying to the thread thus making themselves a member of a discussion group. The downside of a mailing list is that all mail, not just the headlines, is sent to your mailbox. This can result in a large volume of post to sift through.

The quality of the mailing list is even more difficult to assess than that of a webpage. McLauchlan,[8] in his assessment of the Orthopod[9] mailing list, felt that a mailing list could be a medium of good quality orthopaedic information.

### RSS feeds

Another method of receiving mail or blogs is through subscribing to an RSS feed. RSS stands for 'really simple syndication' and overcomes the biggest problem of mail lists, which is the volume of unwanted information and its concomitant waste of bandwidth.

By joining a feed, the subscriber may selectively download the articles he is interested in. The feed initially sends headlines only to the subscriber. This is done on a regular basis (hourly for news feeds, but weekly or monthly for most orthopaedic feeds). These are selected by clicking on the headline which will download the full text (blog), or audio talk (podcast). Most modern web browsers allow the user to join a feed, but, in addition, there are many specialised RSS aggregator programs such as FeedReader[10] and SharpReader.[11] Many of these software programs are freeware.

### Advantages of an RSS feed over a website[12]

- Users can be notified of new content without having to actively check for it.
- Content updates can be sourced from many modalities (news, journals, portals and PubMed) can be tracked and easily managed in one central location.
- No time is wasted navigating complex sites.

There are many excellent text-based and podcast feeds available on orthopaedic topics. Orthopaedic Web Links[13] maintains a list of feeds of orthopaedic interest.

Video podcasts or vodcasts have an important role in the education of a practical profession such as ours. Many excellent videos of operative technique on the Internet, including the video library maintained by the *Journal of Bone and Joint Surgery*[14] exist. Video files are large, and a broadband connection is recommended for shortened download times.

## Reference linking

Once you have found useful information, it is useful to keep a link to it on your computer. Commonly this is done by adding a 'bookmark' in your favourite web browser or other program linking descriptive text to the web address. URLs (Uniform Resource Locator – the 'link' in a hypertext document), as a method of accessing articles, suffer from a number of disadvantages.

### Problems with URLs

•    They are often not persistent, i.e. the target document can be deleted or moved to another site.[15]
•    The linked copy may be in another format, e.g. the user may be looking for a print or PDF format while the linked version is HTML (Hypertext Markup Language).

The International DOI Foundation (IDF) has developed a form of reference linking that aims to overcome some of these difficulties. The Digital Object Identifier (DOI) identifies a digital object. It is a number or series of symbols that uniquely identifies a particular publication and will link the user to the document's current location on the Web. The DOI website[16] maintains links to the document and the International DOI Foundation (the supervisors of the DOI system) strive to keep valid links to the numbered document, wherever it may be moved to. The aim is to prevent link obsolescence ('link rot'), which tends to occur over time whenever links are deleted or moved.

Using DOI names as identifiers makes managing intellectual property in a networked environment much easier and more convenient.

These days many electronic journals and even web 'reprints', downloadable from the publishers, include the document's DOI number. This array of letters and digits can be entered into the search box at www.doi.org and it will link to the source document at the publisher's site.

The user thus does not have to know the address of the institution that hosts this document. This may not be much of a problem with a well-known journal publishing house but (the DOI System) is a major advantage when looking for a thesis or other paper without a known publisher. Over time even previously financially sound publishers may disappear, or cease to have a web address by either selling copyright to a rival publisher or other party. This third party will now host the electronic archives of the defunct journal. An identifier persistently refers to a content item regardless of its physical location or ownership, even if either is transferred to another publisher.[17]

The DOI is becoming ubiquitous. In recent years many popular magazines such as the *New Scientist* have begun to quote the DOI number in parentheses as a reference rather than the classical formal listing of title, author and journal as a footnote to the article. An interested reader can thus easily consult the relevant online source with minimal effort.

Another use for DOI numbers is in hypertext web documents. A link can be made using the DOI rather than (directly) to a website. The link is more likely to survive changes and deletions to the site or address you intend to quote if it links via doi.org whose professionals are dedicated to maintaining valid links. To make a link, use the format http://dx.doi.org/[doi-number]; once you click on this hyperlink you will be directed to the correct document, usually at the journal publisher's site.

## Archive sites

A reliable way to find scholarly articles is to visit an archive site. These respected sites such as PubMed and Medline[18] do not publish themselves but invite other publishers to deposit either hard copy or digital versions of their publications with them. They do not own copyright over the articles they store. PubMed Central[19] serves such a function. Besides peer-reviewed journal articles they also store unpublished articles and data, considered of value in the opinion of publishers and researchers they trust.

PubMed is an archive of biomedical and life sciences journal literature at the US National Institutes of Health. PubMed is well supported by all major publishers. A search from the PubMed website will link the user to most of the orthopaedic (and other biomedical) literature ever published. Currently most journals have an online presence, and will be referenced by PubMed. In many cases only the abstract of an article and not the full text will be available. PubMed maintains links to the actual publisher's site where the full version of the article can be read, albeit often - only after paying a fee.

## Cost considerations

Many publishers now have digitalised their entire paper archives and these can be accessed online. *The Journal of Bone and Joint Surgery*, for example has PDF (Portable Document Format file) copies available from the date of first publication in 1948.[20]

These articles need to be paid for; publishers are often for profit commercial organisations and will expect to extract a fee for these. After searching for and finding the article, the user typically will be allowed to read the abstract for free, but is then required to pay $30 or more to download the PDF or full text version of the article.

There are more cost-effective ways of legitimately obtaining these articles. Journals you personally subscribe to will allow you to login on their website and download whatever is available, after signing up using your subscription number.

If you are a member of an academic library they probably already have subscriptions to many popular orthopaedic journals. This right of access to the full text versions is also transferred to you as a member. It is not necessary visit the library in order to exercise this right; all that is necessary is access to the Internet from a university computer. Many publisher's sites take note of the referrer's unique IP (**I**nternet **P**rotocol address, a field in the HTM header sent with every packet of online communication from your computer), and if this packet comes from a subscribing academic institution, the remote host computer will sign the user in automatically and honour him or her with the privileges of a paid subscriber.

Many universities also allow students and staff to log on to their library site from outside the university. After verifying the user via login passwords, he or she is then allowed to log into publishers' sites to which the university has subscription rights. Licence agreements pay a role here: some publishers do not allow **away from campus access**, but most do.

A university also has finite means and, most likely, does not have subscriptions to all orthopaedic journals. If you still cannot get the full text of your reference free online, consider asking the librarian for an inter-library loan. In many cases all that will have to be paid for is the cost of photocopying the article. Ironically, because of licence agreements, the paper version may be more freely available for inter-lending than a digital copy. This is because libraries are bound by treaties on inter-library loans. The conference on fair use (CONFU)[21] agreement determines fair use; its main aim is to allow fair academic use, and also to prevent the borrowing library from being able to redistribute it again as if they had a subscription. This agreement was more biased towards photocopied (paper) copies, but recently digital copies are becoming regarded as an equivalent.

If you need the copy for teaching purposes, for example to distribute to a class, your university may already own a blanket copyright agreement. For example, Stellenbosch University pays a levy to the Dynamic Artistic and Literary Rights Organisation (DALRO[22]) to allow unlimited copies (with certain provisos, such as only one article per journal) to your class. The university requires to be notified retrospectively of your use of the article.

## Free journal sites/ open access repositories

Many are concerned by the fact that commercial publishers make their profit from selling articles generated from research funded by public money. To counter this commercialisation, many **O**pen **A**ccess (OA) electronic resources have been established. There is an advantage to the author too in using OA journals. Alma Swan[23] has shown that a publication is more likely to be cited from an OA journal than from a subscription equivalent. The reason is that the OA journal is easier to find and retrieve on the Internet.

Below is a selection of the better-known OA sites.
- **BioMed Central**[24] is an independent online publishing house committed to providing free access to the peer-reviewed biological and medical research it publishes.
- **Directory of Open Access Journals**[25] where the reader can find eight journals in the field of orthopaedic surgery. These journals include *Acta Orthopaedica* and *Orthopaedic Research and Reviews*.
- **Free Medical Journals.com**[26] links to many OA medical journals. The site allows the user to download (**full text**) copies of articles from 18 orthopaedic journals.

## Reference manager software

The personal computer (PC) will generate many useful links and downloads from your academic quest for knowledge. Reference managers allow the user to create order with this data.

These handy programs allow the user to compile a reference of articles read, even if the user does not wish to become an author. The software allows a user to download a citation with a few clicks of the mouse, and keep a database of the downloaded reference. Links to a copy of the PDF (or any other file) you download to your own PC can be added including a field for graphics. There is a field allowing the user to add his or her notes and annotations. Many citation managers interface with popular word processors such as MS Word, and can automatically add and maintain a list of references as a footnote to the article. The program will correctly order the articles and keep the style of the references uniform and in accordance with that wanted from a selection of well-known journals. Alternatively the writer's own style can be formatted.

There are many commercial reference manager programs such as EndNote[27] and Procite.[28] In addition there are public domain (freeware) alternatives such as JabRef[29] distributed under the GNU[30] (general public licence). Most of these public domain managers make use of the BibTex notation. This is a simple text-based format that can easily be handwritten.

**Example:**

```
Reference 15 in BibTex format:
@article{
 author = {Priscilla Caplan, William Arms},
 title = {Reference linking for journal articles},
journal = {D-Lib Magazine},
 volume = {5},
 number = {7/8},
 year = {1999}
 }
```

This formatted paragraph of text needs to be copied from the host site and merely pasted into your BibTex-compatible browser.

The commercial reference managers are even more automatic. The host site's software will allow the user to 'download to citation manager'. Once the manager type is selected, the reference is downloaded in a format such as RIS[31] (a standardised tag format developed by **R**esearch **I**nformation **S**ystems ). This file can either be saved to disk on the user's machine or will activate your citation manager automatically to include the reference in its library – as 'RIS' will be a file type associated by your operating system with your favourite citation manager. The whole process is thus semi-automatic and you can, with minimal effort, build up a large and ordered library of the articles you have read. Most reference managers also allow you to link to a local, on disk, copy you might have saved from your web search.

## Search engines

Popular search engines such as Google[32], Bing[33] and Yahoo[34] give too many non-academic references to be of much use if an academic peer-reviewed citation is sought.

Wootton[35] has pointed out that Boolean searches using (AND, NOT and OR) are easy to do and one does not need to be a skilled librarian to yield very accurate and specific search results.

Another distraction is spam and illegal advertising from pharmaceutical vendors.[36] Specialised services such as Google Scholar,[37] a version of Google optimised for scholarly articles and patients, are an improvement for literature searches.

What distinguishes a good from a bad search engine? Simpson[38] considers a good search engine to have the capacity to search the whole Internet and regularly update itself as new or altered pages appear. He considers that there should also be an ability to filter out poor quality material. At present the user gets all results yielded. This selection must be done by the user, as leaving anything out of the search results would amount to censorship. The way around this is search engines dedicated to academic publications.

In addition there are many specialised medical search sites, such as:

• **Intute**[6] – a collection of gateways from the site which is maintained by a consortium of respected British universities. The site links to quality resources in the health and life sciences.
• **Scirius**[39] – a dedicated scientific research site which claims to have 370 million scientific articles indexed.
• **Google Scholar** – a selective search engine dedicated to academic articles.

> A good search engine has the capacity
> to search the whole Internet and regularly
> update itself as new or altered pages appear

With this service, the full text is weighed, as is the author and the publication in which the article appears. It is ranked according to how often the article has been cited. Although the list is often old, the article is more likely to be peer reviewed. It may also come from libraries, theses and other academic sources such as conference proceedings. Scholar often leads the user to sites requiring 'paid for' subscriptions. Although there is a feature linking you to your local library site for a full test version, Google Scholar does not know whether your library is subscribed or not.

## Conclusion

The Internet has changed the way we deal with and acquire knowledge. Not only is more information available, but you can effectively store and reference on your own PC. Search engines that can index the entire Internet and produce a search results in microseconds are both a boon and a curse as they have difficulty in distinguishing pearls of wisdom from pornography. The advent of search engines dedicated to scholarly work and archival sites such as PubMed has helped to improve the quality of their results for the academic.

It is still up to the individual to verify the quality of the information returned from such searches. All these sophisticated searches do is filter out some of the dirt. Spam producers and unscrupulous businesspeople will always be able to keep ahead of these efforts.

A practical knowledge of how to obtain copies of references not available directly through your web connection to your Internet provider is necessary. Use your local medical libraries' online service and if this fails ask for an old-fashioned inter-library loan on paper!

Online information is growing in quantity but is much shorter-lived than the paper documents it replaces. The life span of information on a hard disk is unknown,[30] but it is probably only slightly longer than flash disks and non-gold-plated CD-ROM disks. Joe Iraci[40] has demonstrated in accelerated ageing tests that they store information reliably for less than 10 years. In addition to the concern about degradation of the data itself there are other concerns online as a result of the basic building blocks of webpages – the HTML (**H**yper**t**ext **M**arkup **L**anguage); the hyperlinks themselves. Online references are liable to 'link rot', and vendor obsolescence. Services such as PubMed and other archival sites are helping keep references pointing towards viable sites. The DOI initiative promises to grow and provide a system of valid links to much more scholarly output than just formal journal articles.

The Internet will continue to evolve. Orthopaedic websites will proliferate and search engines will become more attuned to the needs of the academic searcher. On the other hand spam producers and con artists will continue to keep abreast of these developments. While the future of publishing will undoubtedly be more web-based, the orthopaedic surgeon will always have to exercise judgment before accepting all online information as gospel truth.

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## Note from the Editor:

The Internet has changed every aspect of modern life. The development of the personal computer followed by the Internet can be likened to the internal combustion engine as an age-defining technological achievement. In the same way that the internal combustion engine transformed transport from a slow methodical journey into fast-paced commuting, so the Internet has revolutionised the transference of knowledge from individual communication into a world wide hub. Unfortunately, in the same manner that a fast-paced life can leave the individual dazed at times, so the wealth of journals, publications and websites on the Internet can numb the academic endeavour to seek out good information. Nowhere is this more evident than in the field of medicine. With the industry, academic institutions, individuals and many more 'publishing' literally every second, it can sometimes be impossible to find accredited information. Often a researcher or clinician becomes paralysed after hours of searching without anything of value to show for the effort. The problem is that there is just too much information out there.

This article attempts to bring some order to the chaos. By following some easy principles the author guides the reader to some accredited websites and also furnishes the average surgeon with some basic skills to navigate the Internet 'superhighway'. With these skills it is hoped that the clinician should be able to obtain relevant information, organise this information in a reasonable manner and become more comfortable with the use of the Internet in order to untangle the confusion that is the World Wide Web.