

# Evaluating the Source and Content of Orthopaedic Information on the Internet

THE CASE OF CARPAL TUNNEL SYNDROME\*

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## Abstract

**Background:** The Internet has become a popular source of medical information for patients. Authors of health-related web pages are not required to adhere to any standard for medical content or accuracy. The goal of the present study was to assess the type, quality, and reliability of information about carpal tunnel syndrome that is available on the Internet.

**Methods:** The search phrase “carpal tunnel syndrome” was entered into five commonly used World Wide Web search engines. The search results then were given as an ordered list of universal resource locators, or web-site addresses. The top (first) fifty web sites from each of the five searches were combined to create a master roster of 250 web-site addresses. These web sites then were evaluated for authorship and content, and an informational value score ranging from 0 to 100 points was assigned to each.

**Results:** Thirty-three percent of the sites sold commercial products for the evaluation or treatment of carpal tunnel syndrome. An additional 30 percent were commercial web sites that did not sell products. Only 23 percent of the sites were authored by a physician or an academic organization. Fewer than half of the sites offered conventional information. Twenty-three percent of the sites offered unconventional or misleading information. The mean informational value of the web sites was 28.4 of a possible 100 points.

**Conclusions:** The information about carpal tunnel syndrome on the Internet is of limited quality and poor informational value. The public and the medical communities need to be aware of these limitations so that the quality of medical information available on the World Wide Web can be improved.

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As of April 2000, seventy-two million Americans had access to the Internet, and that number is expanding daily<sup>3</sup>. More than half of the individuals with Internet access go online to seek health information at least once per month<sup>3</sup>. The Internet, therefore, has become a common source of medical information for patients.

Because of its decentralized structure, information contained within the World Wide Web is not regulated. In addition, there are few mechanisms available for evaluating the quality of this information. For this reason, it has been recently suggested that “myth, bias and deception abound on the information superhighway.”<sup>3</sup> While valid and helpful medical information may be a boon to patients and doctors, invalid and unreliable information can clearly be harmful. The purpose of the present study was to investigate the type and quality of medical information on the topic of carpal tunnel syndrome placed on the World Wide Web.

## Materials and Methods

Carpal tunnel syndrome was chosen as the topic because of its prevalence. In addition, it is a focused topic (unlike, for example, arthritis or wrist fracture) and is thus amenable to computerized keyword searching. The present study was designed to recreate the mechanism by which individuals obtain information from the Internet: namely, by identifying web sites through search engines. By entering the desired phrase into a search engine, a collection of web sites containing relevant information was identified. These web sites then were accessed and evaluated.

### Identification of Web Sites

The search phrase “carpal tunnel syndrome” was entered into the five most commonly utilized World Wide Web search engines. A search engine is a freely available computer program that allows a user to scan the World Wide Web to find web pages that relate to the entered search phrase. Search engines render the results of each inquiry as a list of web-site addresses, or universal resource locators (URLs). Search engines typically arrange URLs in decreasing order of relevance to the search phrase. (Golladay et al.<sup>1</sup> provide an excellent review of the World Wide Web and its use.)

The five search engines that we used were Yahoo (www.yahoo.com), Microsoft Network (www.msn.com), Netscape (www.netscape.com), Go/Infoseek (www.go.com), and Lycos (www.lycos.com). These search engines were selected because they were identified as the most commonly used search engines at the time that this investigation was performed<sup>5</sup>. The top (first) fifty URLs listed by each search engine were evaluated. These were combined to create a master roster of 250 addresses.

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TABLE I  
INFORMATIONAL SCORE BY TYPE OF AUTHOR

Type of Author	Mean Informational Score (points)
Commercial product	19
Commercial site	44
Academic	29
Physician	38
Nonphysician care provider	19
Unidentified	0
Lay	34

### Web-Site Evaluation

Each web site was evaluated according to the medical web-site evaluation guidelines described by Soot et al.<sup>6</sup>. The author, the nature of the web-site content, and the informational value (defined below) of each web site were separately categorized by two hand surgeons, and the results were assessed for reliability. When the subjective characterization of the author or the nature of the content differed between the two evaluators, a third evaluator cast the deciding vote. The informational value of each site was calculated by averaging the score of the two independent evaluators. An aggregate profile of web sources on carpal tunnel syndrome was thus defined.

### Authorship

The author of each web site was assigned to one of seven categories: (1) *academic* indicated that the author or authors had a stated affiliation with a university or research organization; (2) *physician* indicated that the author or authors were individual or group-practice physicians who were not affiliated with a university or research organization or whose affiliation was not stated on the web page; (3) *nonphysician care provider* indicated chiropractors, physical and occupational therapists, acupuncturists, and other alternative medical providers; (4) *commercial site* indicated that the author represented a commercial web site without an interest in a specific commercial product (typically, the stated purpose of these web sites was to provide medical information); (5) *commercial product* indicated an author or authors who were marketing a commercial product for evaluation or treatment of carpal tunnel syndrome; (6) *lay* indicated individuals or organizations who did not belong to any of the previous categories and who maintained a noncommercial web site for providing information about carpal tunnel syndrome; or (7) *unidentified* indicated that the author was not specified.

### Content

The nature of the information regarding evaluation, treatment, pathogenesis, and prevention of carpal tunnel syndrome on each site was described according to one of four categories: (1) *conventional* indicated that the site was dedicated to providing information consistent with conventional knowledge as outlined in textbooks and orthopaedic literature; (2) *unconventional* indicated that the site provided alternative information in addition to conventional knowledge without secondary commercial gains; (3) *misleading* indicated that the site offered unconventional information with secondary commercial gains; or (4) *noninformational* indicated that the site was without patient-related information.

### Informational Value

The informational value of each web site was measured according to a scoring method with a maximum score of 100 points. A maximum of 30 points was given for a complete disease summary; a maximum of 20 points, for a complete review of the treatment options; a maximum

of 20 points, for a complete discussion of the pathogenesis of carpal tunnel syndrome; and a maximum of 15 points each, for a review of the complications and the results of treatment. The points were assigned according to the following standards.

*Disease summary (maximum, 30 points):* Three points each were awarded when any of the following ten factors were mentioned: pain, weakness, numbness, anatomical distribution of the median nerve, anatomy of the carpal tunnel, symptoms occurring at night, decreased strength on physical examination, decreased sensation on physical examination, provocative maneuvers on physical examination (the Tinel sign, the Phalen sign, or the carpal compression test), and diagnosis with nerve-conduction studies.

*Treatment options (maximum, 20 points):* Four points each were awarded when any of the following treatment options were given: splinting, oral anti-inflammatory medications, and corticosteroid injections. Two points each were awarded if open carpal-tunnel release or endoscopic carpal-tunnel release was given as the surgical treatment option. Two points each (to a maximum of 4 points) were awarded for each ergonomic tip (such as taking frequent breaks, modifying the setup of the workstation, or changing body position) that was provided.

*Pathogenesis (maximum, 20 points):* Two points were awarded for each of the following etiologies mentioned: a mass in the carpal canal, an aberrant muscle, a hematoma, a wrist fracture, diabetes mellitus, alcoholic neuropathy, hypothyroidism, rheumatoid arthritis, gout, pregnancy, hemodialysis, obesity, and repetitive stress.

*Complications of treatment (maximum, 15 points):* 7.5 points were awarded for each of the following categories mentioned: complications of nonoperative treatment (such as progression of neuropathy, side effects of oral anti-inflammatory medication, or effects of cortisone injections) and complications of operative treatment (such as pillar pain, infection, or nerve injury). A single mention of a complication in each category was sufficient to earn a full 7.5 points.

*Results of treatment (maximum, 15 points):* 7.5 points were awarded when the results of nonoperative treatment were given, and 7.5 points were awarded when the results of operative treatment were given. Again, a single mention of results in each category was sufficient to earn a full 7.5 points.

## Results

Of the 250 web sites (the first fifty sites identified by five search engines), 175 had a unique URL address and seventy-five were duplications. Not one web site was identified by all five search engines. Only two sites were listed by four of the five search engines.

The 175 unique web sites were analyzed with respect to authorship: fifty-seven (33 percent) were characterized as a commercial product; fifty-two (30 percent), as a commercial site; twenty-two (13 percent), as an academic organization; seventeen (10 percent), as physicians; sixteen (9 percent), as nonphysician care providers; nine (5 percent), as unidentified; and two (1 percent), as laypersons. The two evaluators agreed on the categorization of the authorship for 173 of the 175 sites, for an overall agreement rate of 99 percent.

The content of the web sites was assessed by the two evaluators. They found that eighty sites (46 percent) provided conventional information, fifty-four (31 percent) were noninformational, twenty-five (14 percent) were misleading, and sixteen (9 percent) presented unconventional information. The two evaluators agreed about their content assessments for all 175 sites.

The informational value scores were calculated for

all of the web sites by both evaluators, and the two scores were averaged for each site. The mean score for the 175 unique web sites was 28.4 of a maximum of 100 points, with a standard deviation of 28.3 points. With the fifty-four noninformational sites excluded, the mean informational value score for the remaining 121 sites was 41.1 points. The informational scores for the web sites grouped by type of author are given in Table I.

The intraobserver reliability of the informational score assignment was assessed. The mean difference in scores between the two evaluators was 1.8 points. In 98 percent of the observations the scores assigned by the two observers were within 8 points of each other, and in 87 percent the scores were within 5 points of each other, which represents extremely high reliability.

### Discussion

Our review of the first fifty sites from five prominent search engines returned 175 unique URL addresses. Almost two-thirds of them pointed to a commercial site, and fewer than half of the web sites offered conventional information. The mean informational value score was 28.4 points for the 175 web sites. From these data, we concluded that the quality of information available on the World Wide Web is dubious. When users consult search engines to find web sites and then visit the typical sites identified, they are unlikely to encounter complete, unbiased, and conventional information. Because the Internet has become a common source of information for patients, this finding has practical importance to treating physicians.

The quality of information on the Internet for non-orthopaedic medical conditions has been assessed, but we found no similar assessments for orthopaedic conditions. In a letter published in the *Journal of the American Medical Association*, Rose et al.<sup>4</sup> reported on their study of web sites identified by searching for orthopaedic conditions with use of terms suggested by their patients. They found that only 20 percent of the sites contained patient information and only 7 percent had information that they deemed relevant.

The problem that both patients and physicians encounter is not a lack of information but rather an overload of information, with the valid and valuable information perhaps obscured by the oceans of irrelevant and misleading information. With the increasing role of the Internet as a main source of medical information for patients, it can be assumed that patients are probably misinformed or, at the least, distracted.

We contend that it is not practical — and, indeed, not possible — for physicians to anticipate every piece of information that a patient may have obtained prior to an office visit. This goes beyond the sheer information glut on the web; one cannot even anticipate the so-called top sources of information. In our study, there was little consensus among the most commonly used search engines as to what constituted a top site. Indeed,

there were only seventy-five duplications on the list of 250 sites, and none of the sites were identified by all five search engines. This implies that it is likely that information is gathered from a wide variety of sources. Accordingly, it may not be reasonable to ask physicians to keep abreast of what their patients may or may not know from Internet searches.

There were a few limitations to our study. To start, we based our study on the web sites provided by popular search engines and not on rosters of web sites listed according to overall usage by people interested in carpal tunnel syndrome. It may well be the case that even though 175 web sites were identified by the search engines, most web users interested in carpal tunnel syndrome actually visit only several of these sites. However, we believe that our method of using search-engine results is reasonable as there are few reliable lists of web sites based on usage, and even those would not discern between general visits and visits for the specific purpose of finding information on carpal tunnel syndrome.

The present study was not designed to rate the overall value of the web postings; value, after all, is a subjective quality and includes many features beyond the quality of information. Rather, we aimed to measure objective attributes of popular web sites that provide information about carpal tunnel syndrome. These attributes include the source of information, with specific notation of the presence of a commercial message in the web posting; whether the information was conventional; and the completeness of the information relative to a standard.

Our investigation was limited to the topic of carpal tunnel syndrome. It may well be that other medical topics are covered more completely and with less misleading information. It would not be correct to conclude from this study that all orthopaedic medical information is of the same caliber.

We believe that our measure of informational value is useful, but it is clearly not the only metric for evaluating a web site. This score is a measure of completeness, not accuracy. If a site mentioned all of the factors that we looked for, it received a score of 100 points, even if there was also a sea of extraneous information. A site that had only true statements, but very few of them, received a low score. Thus, informational value does not account for overall accuracy; instead, it measures the contribution of a single web site to the complete education of the user. This measure was chosen because we believe that completeness is an important feature. Visiting a web site requires a substantial investment of time, and a user may visit only a few sites in the course of searching for information.

The potential for the dissemination of inadequate or misleading health-care information on the Internet has been recognized by some individuals and organizations. For example, an Internet-based not-for-profit organization, Health on the Net Foundation, which evaluates

health-related sites, has established guidelines in an attempt to standardize the reliability and credibility of medical information on the World Wide Web<sup>2</sup>. The principles established by this group constitute a code of conduct to which web-site developers should adhere in order to improve the quality of health-care information. However, because the process of posting information on the World Wide Web is unregulated, it remains unclear whether this and similar organizations will have any significant impact on the quality of available medical information.

In summary, our study demonstrated that the Internet offers a wide variety of informational sources on carpal tunnel syndrome. Although we may not have proven the contention that "myth, bias and deception abound on the information superhighway,"<sup>3</sup> we did indeed discover that the quality of information regarding carpal tunnel syndrome is limited. Most sites were not confined to conventional information, and even those

that presented only conventional information did not provide very much of it.

We believe that the Internet poses an interesting challenge to orthopaedic surgeons in that it arms patients with more information than they had in the past. Surgeons must be vigorous in responding to this challenge. To start, physicians must anticipate that patients may have received bad information. Thus, an office visit should include an open-ended question about what the patient thinks that he or she knows, and time should be devoted to disabusing him or her of any myths or errors. It is also reasonable to expect surgeons themselves to become sources of high-quality information either by posting web sites of their own or by publicizing sites known to be of high quality. Finally, physicians must help patients to evaluate the quality of the information that they encounter by educating them with regard to web-site authorship and to potential conflicts of interest associated with the information provided.

### References

1. **Golladay, G. J.; Kirschenbaum, I. H.; Matthews, L. S.; and Biermann, J. S.:** Internet resources for orthopaedic surgeons. *J. Bone and Joint Surg.*, 80-A: 1525-1532, Oct. 1998.
2. **Health on the Net Foundation:** HON code of conduct (HON code) for medical and health websites. *Health on the Net Foundation*. www.hon.ch/HONcode. Sept. 8, 2000.
3. **McCullough, M.:** Virtual medicine: promise and peril. *Philadelphia Inquirer*, p. D1, April 24, 2000. www.phillynews.com/inquirer/2000/Apr/24/magazine/webhealth24.html. April 24, 2000.
4. **Rose, S.; Bruce, J.; and Maffulli, N.:** Accessing the Internet for patient information about orthopedics [letter]. *J. Am. Med. Assn.*, 280: 1309, 1998.
5. *Search Engine Watch*. www.searchenginewatch.com/reports/mediamatrix.html. Feb. 22, 2000.
6. **Soot, L. C.; Moneta, G. L.; and Edwards, J. M.:** Vascular surgery and the Internet: a poor source of patient-oriented information. *J. Vasc. Surg.*, 30: 84-91, 1999.