What Do Patients Encounter When Searching Online About Meniscal Surgery?

An Analysis of Internet Trends

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Background: Many patients use the internet to learn about their orthopaedic conditions and find answers to their common questions. However, the sources and quality of information available to patients regarding meniscal surgery have not been fully evaluated.

Purpose: To determine the most frequently searched questions associated with meniscal surgery based on question type and topic, as well as to assess the website source type and quality.

Study Design: Cross-sectional study.

Methods: The following search terms were entered into a web search (www.google.com) using a clean-install browser: ''meniscal tear,'' ''meniscus repair,'' ''meniscectomy,'' ''knee scope,'' ''meniscus surgery,'' and ''knee arthroscopy.'' The Rothwell classification system was used to categorize questions and sort them into 1 of 13 topics relevant to meniscal surgery. Websites were also categorized by source into groups. The *Journal of the American Medical Association* (*JAMA*) benchmark criteria (medians and interquartile ranges [IQRs]) were used to measure website quality.

Results: A total of 337 unique questions associated with 234 websites were extracted and categorized. The most popular questions were ''What is the fastest way to recover from meniscus surgery?'' and ''What happens if a meniscus tear is left untreated?'' Academic websites were associated more commonly with diagnosis questions (41.9%, $P < .01$). Commercial websites were associated more commonly with cost (71.4%, $P = .03$) and management (47.6%, $P = .02$). Government websites addressed a higher proportion of questions regarding timeline of recovery (22.2%, $P < .01$). Websites associated with medical practices were associated more commonly with risks/complications (43.8%, $P = .01$) while websites associated with single surgeons were associated more commonly with pain (19.4%, $P = .03$). Commercial and academic websites had the highest median *JAMA* benchmark scores (4 [IQR, 3-4] and 3 [IQR, 2-4], respectively) while websites associated with a single surgeon or categorized as ''other'' had the lowest scores (1 [IQR 1-2] and 1 [IQR 1-1.5], respectively).

Conclusion: Our study found that the most common questions regarding meniscal surgery were associated with diagnosis of meniscal injury, followed by activities and restrictions after meniscal surgery. Academic websites were associated significantly with diagnosis questions. The highest quality websites were commercial and academic websites.

Keywords: internet search; meniscal repair; meniscectomy; meniscus

Educating patients about the nature of their condition and available treatment options is a critical aspect of informed decision making between the orthopaedic surgeon and the patient. Outside of the orthopaedic clinic, patients increasingly seek information from the internet, which provides an overwhelming abundance of resources with varying quality and accuracy. Of patients undergoing orthopaedic outpatient procedures, 65% researched their condition, and almost 30% of these patients asked their surgeon

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questions based on their research.[8] Orthopaedic patients frequently consult the internet to research their conditions[5] and rely on internet search engines, such as Google, which aggregates information in a streamlined fashion to facilitate patient self-education about their medical conditions. Google utilizes RankBrain and Bidirectional Encoder Representations from Transformers,[17] which employs machine-learning algorithms to understand the intent of a person's search and provides content that best matches the user's desired search.[6] This feature enhances a Google search by providing relevant content related to their initial search. These machine-learning algorithms play a significant role in patient education.

Although the internet is a convenient tool, Koenig et al[11] found that only about one-third of patients trust online orthopaedic information. Evaluating information on meniscal surgery, among the top 10 most common orthopaedic procedures according to a 2021 meta-analysis,[3] can be quite difficult. Unfortunately, 74% of patient education materials for common arthroscopic surgeries such as meniscal repair exceeds the readability recommendations of the American Medical Association and the National Institutes of Health.[1] In addition, YouTube videos related to meniscal surgery were found to be unreliable and contained low-quality information, as determined by Kunze et al[13] using the *Journal of the American Medical Association* (*JAMA*) benchmark criteria, the Global Quality Score, and the meniscus-specific score. Aside from discussions with their surgeon, these readily available resources are often the first, and sometimes only, supplemental materials patients use to educate themselves and potentially make decisions about their care.

While research investigating Google search engine machine learning has been published on total knee and hip arthroplasty,[26] there have been no such studies on meniscal surgery. The purpose of this study was to analyze the most frequently searched questions associated with meniscal surgery based on question type and topic as well as to assess the source type availability and quality. These data could serve as a valuable tool to allow physicians to gain a better understanding of possible patient concerns before their visits for meniscal surgery.

METHODS

Using a clean-install Google Chrome incognito browser window, the following search terms were entered into Google Web Search (www.google.com): "meniscal tear," "meniscus repair," "meniscectomy," "knee scope," "meniscus surgery," and "knee arthroscopy." A clean-installed browser was used to minimize the effect of personalized search algorithms. For each of the search terms, the list of frequently associated questions as determined by Google's algorithms refreshed until approximately 100 questions were generated, which is consistent with previously published methodology.[4,23] A freely available data mining extension (Scraper, Version 1.7; dvhtn) was used to extract each question and its associated webpage to a database in Microsoft Excel.

The questions were categorized according to the Rothwell classification system, which categorizes question types as either fact, policy, or value questions.[10,20] The classification system is summarized in Table 1. Questions were then further classified into 1 of 13 topics relevant to meniscal surgery: specific activities/restrictions, timeline of recovery, technical details, cost, anatomy/function, diagnosis, indications/management, risks/complications, pain, longevity, evaluation of surgery, injury comparison, and other. Descriptions for each of these topics can also be found in Table 1. As previously reported in the literature,[23] websites were categorized by source into the following groups: commercial, academic, medical practice, single surgeon personal, government, social media, and other. Definitions and examples are listed in Table 1. Two reviewers (E.L.H. and A.A.) categorized the questions and associated websites. After each categorization, discrepancies between the 2 reviewers were resolved by a third party (A.M.).

Website quality was assessed using the *JAMA* benchmark criteria, which rates websites based on authorship, attribution, currency, and disclosure. One point is assigned for the presence of each component and totaled for a final *JAMA* benchmark score (Table 2).[24] This instrument has been used in multiple previous studies to investigate the quality of online health information.[4,13,16,21] Two reviewers (E.L.H. and A.A.) assessed website quality, and a third reviewer (A.M.) was utilized to resolve discrepancies.

Statistical Analysis

Descriptive statistics were recorded as counts and percentages in Microsoft Excel (Version 16.66). Analysis of question type, question topic, and website source and quality was performed with the Pearson chi-square test. Statistical significance was determined as $P < .05$.

RESULTS

A total of 662 questions were generated from the initial search. After duplicates were removed, 337 unique questions associated with 234 websites were extracted and

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Ethical approval was not sought for the present study.

TABLE 1
Rothwell Classifications of Questions, Question Classification by Topic, and Website Categorization[a]

Category	Description
Rothwell Classification of Questions	
Fact	Asks whether something is true and to what extent, objective information (example: "Is knee arthroscopy covered by insurance?")
Policy	Asks whether a specific course of action should be taken to solve a problem (example: "What exercise is good for a torn meniscus?")
Value	Asks for evaluation of an idea, object, or event (example: "How painful is meniscectomy recovery?")
Question Classification by Meniscal Surgery Topic	
Fact	
Activities/restrictions	Ability to perform a specific activity or action after meniscectomy or any restrictions to activity or lifestyle during recovery or indefinitely
Timeline of recovery	Specific questions regarding length of time for recovery milestones
Technical details	Surgical procedure, includes specific questions about implants
Cost	Cost of surgery and/or rehabilitation postoperatively
Anatomy/function	Specific questions regarding the structure and function of the meniscus
Diagnosis	Questions regarding how one knows they have a meniscal injury
Policy	
Indications/management	Surgical indications and timing of surgery
Risks/complications	Management of risks/complications during and after surgery
Value	
Pain	Pertains to duration, severity, and management of pain
Longevity	Specific questions regarding longevity of a meniscal repair
Evaluation of surgery	Evaluation of the successfulness or invasiveness of a meniscal repair/knee arthroscopy
Injury comparison	Comparison between meniscal and other injuries with regard to severity, etc
Website Categorization	
Academic	Institution with a clear academic mandate, including universities, academic medical centers, academic societies (example: AAOS, Henry Ford Health)
Commercial	Commercial organization that positions itself as a source of health information, includes medical device and pharmaceutical companies (example: WebMD, Everyday Health)
Government	Websites ending in ".gov" or maintained by a national government (example: Medline, PubMed)
Medical practice	Local hospital or orthopedic practice without an academic affiliation (example: Michigan Orthopedic Surgeons)
Single surgeon personal	Website built and maintained by individual surgeon. Excludes biography pages on institutional websites (example: www.ericmakhnimd.com)
Social media	Websites maintained by nonmedical organizations designed primarily for information sharing between internet users. Includes health blogs, internet forums, and support groups (example: www.fitpro.com, www.silversneakers.com)

[a]AAOS, *American Academy of Orthopaedic Surgeons.*

categorized. The top 11 most frequently asked questions for meniscectomy are presented in Table 3.

Most of the questions fell into the fact-type Rothwell classification (65.0%) (Figure 1A). The most popular question topics were diagnosis (18.4%), activities/restrictions (14.2%), technical details (12.5%), and indications/management (12.5%) (Figure 1B). The most frequent websites searched were commercial (32.3%) followed by academic (27.3%), medical practice (19.9%), single surgeon personal (8.6%), and government (8.6%) (Figure 2A).

The distribution of website sources by category and stratified by question topic is summarized in Figure 2. When examining all websites sources according to Rothwell classification, government websites (11.1%, $P = .036$) and social media websites (3.7%, $P = .036$) were associated more commonly with fact-type questions, and commercial websites were associated with policy questions (43.3%, $P = .045$). Of the 3 websites classified as "other," 1 was a site maintained by an anesthesiologist aimed at providing accurate information for patients and medical

TABLE 2
JAMA Benchmark Criteria[a]

Criteria	Description
Authorship	Clearly identifiable author and contributors with affiliations and relevant credentials present
Attribution	References and sources clearly listed with any copyright information disclosed
Currency	Clearly identifiable posting date of any content as well as date of any revisions
Disclosure	Website ownership clearly disclosed along with any sponsorship, advertising, underwriting, and financial support

[a]*JAMA*, *Journal of the American Medical Association*.

TABLE 3
Top 11 Most Common Questions for Meniscal Surgery per Google Results

1. What is the fastest way to recover from meniscus surgery?
2. What happens if a meniscus tear is left untreated?
3. Are you awake during knee surgery?
4. What should you avoid with a torn meniscus?
5. Are you intubated during knee surgery?
6. Can a cortisone shot help a torn meniscus?
7. Can a meniscus tear get worse?
8. Will my knee ever be the same after meniscus surgery?
9. Do you have to wear a brace after meniscus surgery/with torn meniscus?
10. How do you sleep after meniscus surgery?
11. What are the long term effects of a torn meniscus?

students interested in the field, another was a website for a nonprofit organization, and the third was the online version of the *Merriam-Webster Dictionary*. The site maintained by the anesthesiologist and the online version of the *Merriam-Webster Dictionary* were categorized as fact type, and the nonprofit organization website was categorized as policy type.

Regarding the question topics, academic websites were associated significantly more frequently with diagnosis (41.9%, $P < .01$) and commercial websites were associated significantly more with cost (71.4%, $P = .03$) and indications/management (47.6%, $P = .024$) compared with the other website types (Figure 2B). Both academic and commercial websites were associated significantly less often with questions regarding timeline of recovery when compared with the other website types (13.9%, $P = .01$). Of

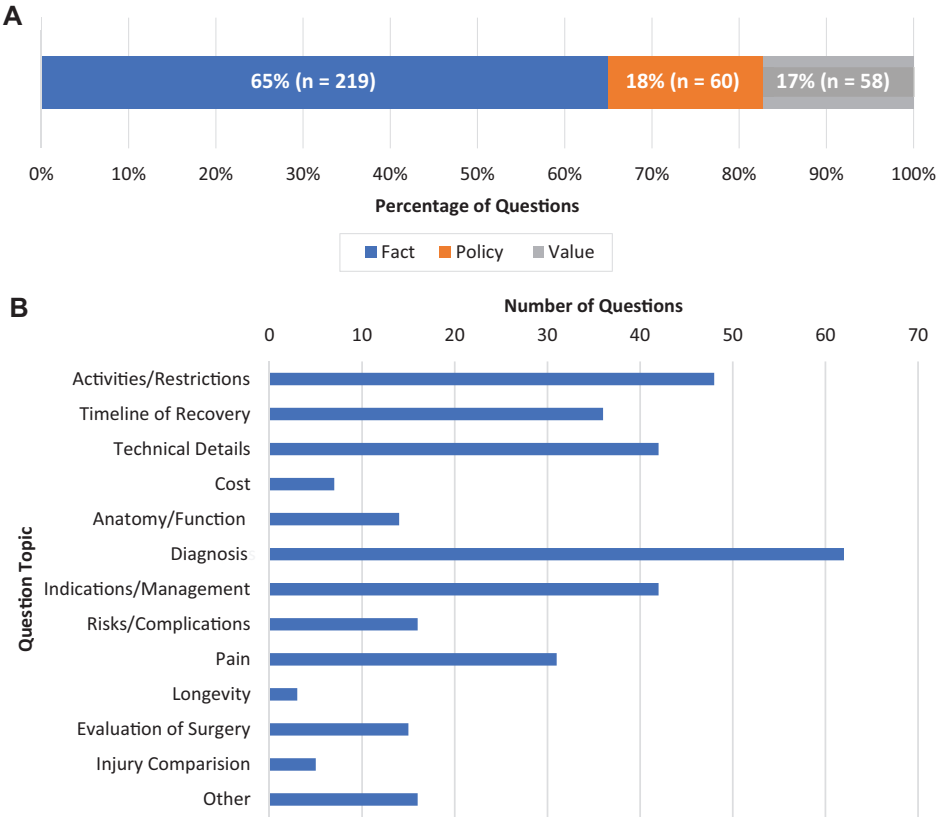

Figure 1. Relative distribution of questions by (A) Rothwell classification and (B) meniscal surgery topic.

Figure 2. (A) Relative distribution of websites by category. (B) The percentage of questions in each website category. Statistically significant difference compared with the other categories: *$P < .05$, **$P < .01$, ***$P < .001$ (Pearson chi-square test).

TABLE 4
JAMA Benchmark Score for Each Website Category[a]

Category	*JAMA* Score, median (IQR)
Total websites	3 (1-4)
Commercial	4 (3-4)
Government	3 (2-4)
Academic	3 (2-4)
Medical practice	1 (1-2)
Single surgeon	1 (1-2)
Social media	2 (1-2.25)
Other[b]	1 (1-1.5)

[a]IQR, interquartile range; *JAMA*, *Journal of the American Medical Association*.

[b]Sources in this category were websites maintained by an anesthesiologist, a nonprofit organization, and the *Merriam-Webster Dictionary*.

all website types, government websites had a significantly higher proportion of questions regarding timeline of recovery (22.2%, $P < .01$) and a lower proportion of questions about diagnosis (1.6%, $P = .03$) and indications/management (0%, $P = .03$). Overall, websites associated with medical practice were associated significantly more commonly with risks/complications (43.8%, $P = .01$) while single-surgeon websites were associated significantly more commonly with pain (19.4%, $P = .03$). Finally, social media was associated significantly more frequently with activities/restrictions (10.4%, $P < .01$) when compared with the other website categories.

The results of the quality assessment of the websites are shown in Table 4. The median *JAMA* benchmark score for the different website types was 3 (IQR 1-4). Commercial and academic websites had the highest median *JAMA* benchmark scores (4 [IQR 3-4] and 3 [IQR 2-4], respectively), whereas websites associated with a single surgeon or categorized as "other" had the lowest scores (1 [IQR 1-2] and 1 [IQR 1-1.5], respectively).

DISCUSSION

The results of the present study indicated that the most common questions associated with meniscal surgery were associated with diagnosis of the injury, followed by activities and restrictions after surgery. The top 2 questions

were "What is the fastest way to recover from meniscus surgery?" and "What happens if a meniscus tear is left untreated?" Commercial websites were used predominantly to answer policy questions regarding courses of action that should be taken. Academic websites were associated significantly with diagnosis questions. The highest quality websites were commercial sites followed by academic, government, and social media, whereas the lowest quality resources were from medical practice and single surgeon websites.

Meniscal injuries are challenging for patients to diagnose themselves as they can have similar symptoms to knee osteoarthritis, and a large portion of tears can be found in those without knee pain or stiffness, highlighting how the injury can be subtle and confusing for patients.[2,12,15] This largely explains why most questions identified via Google answer objective information regarding meniscal surgery (65%) and were related to diagnosis of tears (18.4%). In addition, there are various meniscal surgery techniques (repair, meniscectomy, transplantation, and so on) and, in some cases, nonoperative management is recommended. Therefore, it is understandable why the second most common question was "What happens if a meniscus tear is left untreated?" The next most common group of questions was related to activities/restrictions (14.2%) as there is significant variation in rehabilitation protocol between meniscectomy and meniscal repair, which can confuse patients trying to understand their postoperative restrictions.[7,14,18,22] The most common question presented by Google's machine-learning algorithm was "What is the fastest way to recover from meniscus surgery?" indicating that is probably a topic most patients will encounter if they search online. We believe that by identifying the most common questions gathered from online sources, our study can potentially improve patients' appointments by helping providers focus their limited appointment time on the most common and high-yield questions that were identified in our study. This can help surgeons provide the most educational and informative visit for the patient.

Patients utilize websites authored by a variety of sources; however, this could be problematic for receiving accurate information about meniscal injuries and surgeries. Our study found that these sources were derived most often from commercial websites (43.3%, $P = .045$). Commercial websites presented the largest volume (32.3%) of websites associated with questions. Despite their prevalence, commercial websites can potentially provide discordant and/or inaccurate information. Painter et al[19] found that commercial websites had the highest percentage of information (35.7%) that went against widely supported medical advice when compared with athletic organization and educational websites. Turning patients to academic websites instead may not be a successful alternative as concern exists over their readability. Academic websites (https://my.clevelandclinic.org/, https://www.mayoclinic.org/) writing about meniscal tears were found to have lower average readability scores when compared with public sources (https://www.webmd.com/, https://www.knee-pain-explained.com/).[9] As a result, academic websites may not be as helpful in conveying information to patients of varying education levels despite their availability online. Given the issues with relying on online sources, providers should attempt to improve communication and availability to patients to ensure accurate and understandable information is provided and direct patients to appropriate sources to learn about meniscal injuries and surgeries.

Interestingly, we found medical practice and single surgeon websites had the lowest quality of evidence scores, which identifies an area of improvement for surgeons and practices. Commercial and academic websites, which make up most website sources available for meniscal surgery, were of relatively high evidence quality. Shen et al[23] found a similar trend in their study looking at internet search trends in total hip arthroplasty and total knee arthroplasty, with commercial and academic websites scoring higher than surgeon websites via *JAMA* benchmark scores. As seen in a recent study by Cassidy et al,[4] orthopaedic patient information available online between 2000 and 2015 was found to be of generally poor quality. Information provided in single surgeon and medical practice websites are not subject to the collaborative process that commercial or academic websites utilize, thus providing information subject to error. Given overall most information available online is of poor quality, more attention should be placed on improving the quality of information and sources on surgeon-controlled websites. Surgeons should work to improve their institutional and personal websites to provide higher quality information so patients can be directed there as a resource.

Limitations

This study is not without limitations. First, given that Google search terms are in constant flux as people across the world search about meniscal injuries, there may be variability over time in the types of questions asked, which limits the reproducibility of this study. As a result, the present data likely represent a snapshot of questions from the time of the study that would change with repetition over time. In addition, while this methodology has been previously published, questions may fall into multiple categories of source types, thus creating overlap and difficulty with categorization. We attempted to mitigate discrepancies in classification with a third-party reviewer to resolve any disagreement. Lastly, the *JAMA* benchmark score is an imperfect assessment of website quality and that must be considered when making conclusions regarding quality of evidence. Other similar studies have shown that the *JAMA* benchmark scores better measure source transparency than quality.[23,24] The modern website has information distributed across multiple pages rather than 1 page, which can result in an artificially low rating for some websites.

CONCLUSION

Our study found the most common questions regarding meniscal surgery were associated with diagnosis of

meniscal injury followed by activities and restrictions after meniscal surgery. Commercial websites were associated predominantly with policy-type questions. Academic websites were associated significantly with diagnosis questions. The highest quality websites were commercial and academic websites.

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