OPEN ACCESS AND ONLINE JOURNALS IN ORTHOPAEDICS: WHAT DOES THE FUTURE HOLD?

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Abstract:

Introduction: Open access journalism has expanded in the last two decades, with increasing titles in all medical specialties, including orthopaedic surgery. No study has evaluated the impact of open access orthopaedic journals or their associated risks and benefits to academic publishing and patient care.

Methods: This study evaluated open access orthopaedic journals utilizing various databases including the Directly of Open Access Journals (www.DOAJ.org), PubMed Central (www.PubMed.org), Google search queries and recent articles, stories, and editorials on the topic of open access journalism. All orthopaedic surgery journals were recorded, as well as associated characteristics including publisher, year of publication, articles and issues per year, impact factor, and potential risk of a "predatory" publisher. Data were summarized and presented.

Results: Our search yielded a total of 42 orthopaedic open access journals in the English language from 30 different publishers. In total, there were nearly 13,000 articles available from these journals available without a license or subscription. Of the 42 journals, 13 (31%) were considered predatory or borderline publishers, and only one had a published impact factor (IF = 0.737). In contrast, 8 of the remaining 29 journals (28%) had a published impact factor with a mean value of 1.788 (range: 0.597-4.302).

Conclusion: Open access publishing is a rising trend in the orthopaedic literature, and allows for free, public and international availability of research findings. Like any new technology, open access is not without its faults, and critics have appropriately raised concerns about academic integrity and profiteering by certain publishers. Researchers and surgeons alike are responsible for maintaining the quality of the orthopaedic literature, by participating in the peer review process and avoiding the temptation to publish quickly.

Case: *An orthopaedic surgeon has just completed a clinical outcomes research project in his area of expertise, and desires publication in a widely read journal so that he may share his findings with the orthopaedic community. After the manuscript was rejected by two widely-read subscription-based orthopaedic journals, he submits the work to a "peer-reviewed open access" orthopaedic journal that he finds online. Within two months he receives a congratulatory acceptance letter stating that the manuscript was accepted without revision and would be published both online and in print with open access. He is required to pay a $1,400 processing fee to publish the work. He is hesitant to proceed due to his unfamiliarity with the journal title he has selected, open access publishing, and the request for a processing fee.*

Introduction

Open access journalism is defined as the "unrestricted online access to articles published in scholarly journals."[1] While the first open access journals did not appear in the biomedical literature until the 1990s, they have assumed an increasingly prominent role in the academic publishing arena over the past two decades. Today, calls for open access continue to grow, based on the central concept that "peer-reviewed research articles, donated for publication by authors with no expectation of compensation, should be available online, free, and with the smallest possible number of usage restrictions."[2] However, the push towards open access has not been announced or formally introduced into the field of orthopaedics, and many surgeons are left puzzled by the vocabulary and options now available for publication.

Within the framework of open access, there exist two models: gold open access, in which publishers make articles freely available to all, and green open access, in which authors upload their manuscripts to the web for distribution, often via manuscript archiving services.[3] While the former is more common in medicine (including orthopaedics) and biology, the latter is more prevalent among disciplines such as mathematics, earth sciences, social sciences, engineering and physics.[4] Other important terms include direct open access (which refers to journals that are fully available without limitations); delayed open access (which denotes free access after a defined period of time); and hybrid open access (whereby authors may choose to pay for open access or proceed with traditional subscription-based publication).[4] Most open access journals utilize a creative commons license, which permits the public to freely share, copy and distribute the work as long as the work is appropriately attributed to the authors, is not altered, and is not used for commercial purposes.[5] Given that open access journals do not generate revenue via subscription fees, they often require authors to pay article processing charges to cover the costs of each publication. A newer designation, termed "platinum open access," has recently been coined to identify journals that do not charge article processing fees for publication.[6]

In many regards, open access journalism has been supported by academicians, whose promotions and professional advancement is often determined, at least in part, by publications. The availability of a wide variety of journals in which to publish can support the ever-increasing pressures to publish novel research. At the same time, many authors have recognized the appearance of "predatory publishers," who create low-impact journals with promises of fast review and publication for a price.

To help clarify the presence, risks, and benefits to this emerging type of journalism, we designed a study is to provide a brief history of open access journals, to review the orthopaedic journals that currently participate in open access, to address the concept of predatory publishers, and to discuss the future implications of adopting this new publication paradigm.

Methodology:

This study was divided into three parts: journal identification, quality assessment, and open access review.

Journal Identification

The first part of this study involved reviewing all available sources to establish a comprehensive list of potential open access orthopaedic journals. This included surveying the Directory of Open Access Journalism (www.DOAJ.org), PubMed Central (www.PubMed.org), known open access publishers (Bentham Open, Springer Open, etc.) and utilizing various web search parameters (www.Google.com). Each site was queried by specialty as well as various search terms such as: orthopedic, orthop(a)edic(s), ortho, surgery, musculoskeletal, arthritis, joint, spine, shoulder, elbow, wrist, hand, hip, knee, ankle, and foot. A complete list was created as well as inclusion of journal details such as title, publisher, international standard serial number (ISSN), electronic ISSN, country of publication, language, first year published, article processing fees, and number of issues and articles published annually. Data were tabulated and presented in graphical form for clarity.

Quality Assessment

The second part of this study involved review journals for quality characteristics. This included identification of impact factor, known reputation of the publisher, and cross-referencing against published list of potential "predatory" or "borderline" publishers as identified by www.ScholarlyOA.com. An analysis was performed to evaluate risk factors for potential predatory publishers.

Open Access Review

The final part of this study included a literature review of current open access articles, editorials, and reviews evaluating the merits, benefit, and risks of open access journalism. Special attention was made to any references to the orthopaedic literature, in particular. The results are summarized below.

Results:

The magnitude of open access journals is expanding for all specialties, including orthopaedic surgery. The DOAJ currently lists nearly 10,000 open access journals with over 1.5 million freely available articles, and recent estimates suggest that in 2011 as much as 17% of published scientific articles were in immediate (12%) or delayed (5%) open access journals.[3] Initial review of the various sources identified above created a list of 301 potential open access orthopaedic journals. After further evaluation of each journal's subject and website, as well as removal of redundant titles, this list was further reduced to 44 journals of which 42 from 30 different publishers were in the English language and focused on orthopaedic topics (see Table 1). In addition, we estimated the cumulative number of articles available in open access orthopaedic journals from 2001 to the present (see Figure 1) with an increasing trend currently at nearly 13,000 articles. We found that the mean article process fee among all journals was $1070 (range: $150-3,000). Importantly, we identified seven of the journals on this list published by predatory publishers Bentham Open and Internet Scientific Publications, LLC. An additional six journals are considered "borderline" and exhibit some characteristics of predatory publishers. We note that only 1 of the 13 (8%) borderline or predatory publishers had a searchable impact

factor compared to 8 of the 29 (28%) remaining open access journals ($p>0.25$). The impact factor of the borderline journal was 0.737, compared to a mean of 1.788 (range: 0.597-4.302) for the other 8 publications.

Discussion and Open Access Review

The transition towards open access has been directed by several forces including technology, finances, ethics, and professional incentives. One of the most important factors in this regard has been the transition to electronic publishing – driven by the growth of the Internet over the past 20 years – which has promoted open access by allowing the low-cost digital distribution of scientific articles.[7] At the same time, traditional subscription prices have continued to rise, often faster than the rate of inflation.[8] While specific prices are often hidden by non-disclosure agreements, estimates suggest that university libraries can sometimes be required to pay up to $20,000 for a single journal title.[9-10] These high costs have forced many libraries to cancel journal subscriptions, thereby confining comprehensive journal collections to large, affluent institutions.[11-12] This "crisis of accessibility" has further engendered support for open access, given that it promises to keep scientific information available to researchers. In fact, proponents of open access argue that making scientific data instantaneously available to all will not only benefit researchers (by reducing the duplication of work), but also the general public (who will reap the benefits of more rapid scientific progress).[13-14]

Proponents of open access have also criticized the traditional model of subscription journals, arguing that it allows scientific journals to profit from the time, effort and funds provided by others. They note that the most demanding aspect of the publication process – peer review – is largely performed by academics who lend their time and energy on a volunteer basis. Research projects may be funded by government agencies, but it is the (privately-owned) scientific journals that reap the profits.[8] The revenue generated by a single article has been estimated at around $5,000, which allowed the scientific publishing industry to generate revenues totaling $9.4 billion in 2011.[8] As a result, the annual profit margins of academic publishers have been estimated to be around 20-50%.[8, 15] Advocates of open access suggest that there is an "obligation of reciprocity," whereby research funded by tax dollars should be freely available to the lay public who has already paid for it, and to the researchers who have created it.[12-13] Similarly, government agencies, charitable foundations and private funders all share the desire to ensure that their research is widely available to the public.[2] It is accepted that peer review has a cost, and it is expected that open access journals will charge article processing fees to cover publishing expenses to allow for free and immediate access to the literature. However, the profit margins of open access journals are often considerably smaller, and overall production costs are typically lower. For example, the most widely known open access journal, *Public Library of Science One*, charges $1350 per article, a figure that is one-third of the publishing cost for the *Proceedings of the National Academy of Sciences*, and $1/25^{th}$ of the estimated cost of publishing an article in *Nature*.[8, 10]

As open access has become more widespread, it has garnered both support and opposition. In the field of orthopaedics, the availability of open access journals has been touted as providing several potential advantages to the worldwide orthopaedic community. For example, advocates contend that open access will result in an increased rate of article citation and, presumably, greater dissemination of knowledge.[13-14, 16-17] While no studies have specifically examined the effect of open access on rates of article citation in orthopaedics, a few studies in other fields have sought to define this relationship.[17-20] In controlled experiments performed in the fields of

physiology, general sciences and social sciences, for example, investigators found that free access increased the frequency of article downloads and citations within the first year after publication, but these rates normalized after three years.[16, 21-22] However, critics argue that these increased rates of citation do not necessarily imply that the articles are actually being read, since citations could presumably occur after review of only the abstract, which is usually publicly available for all journals.[16]

At this point in time, it does appear that the rise of open access has promoted the dissemination of medical research in resource-poor countries. The cost of traditional journal subscriptions is a significant burden on institutions in the developing world, who are often unable to afford the high cost of Western scientific journals.[11] One study compared the reference lists of papers published by researchers in India versus those in Switzerland, and found that the Indian researchers were more likely to cite open access articles, and less likely to cite articles published in expensive journals.[11] Similarly, in a study that specifically examined the effect of open access in the developing world, it was found that open access has had a substantially greater influence in the developing world than in more affluent countries, and that it has resulted in a modest but clearly positive effect on global participation in science.[23]

While some argue that immediate access to the scientific literature has the potential to improve clinical outcomes, these ideas are empiric and are not backed by scientific evidence at the present time. To our knowledge, there has only been one study done to specifically address this question. In this investigation, mental health professionals in the field of clinical psychotherapy were asked to read an article that was distributed under four different conditions: no citation, normal citation, linked citation (at a cost), or free access citation. While those given free access were more likely to read the article, no changes in clinical practice were observed.[24]

In addition to these potential advantages of open access, critics have cited numerous potential pitfalls. For example, there are many who argue that open access will decrease the quality of the scientific literature, without realizing any of the benefits described above. In particular, there are some who have argued that open access journals have the potential to threaten the standard peer review process, and lower quality control standards. For example, when open access first originated in the 1990s, there were doubts about the legitimacy of these new journals.[19] There were concerns that increased article availability would cause subscribers to cancel their journal subscriptions, which threatened to undermine traditional academic publishing and lower the quality of academic peer review.[19] However, this has not proven to be the case. Surveys of researchers have typically found that perceived journal quality is the most important factor for journal selection, regardless of open access or author fees.[25] In a direct comparison of open access and subscription-based journals founded within the past 10 years, there were no differences detected in quality or impact.[19]

Other concerns regarding open access relate to the article processing fees that are charged by most open access journals. From the journal's perspective, processing fees are necessary to cover the costs incurred by the publisher. However, some have suggested that this represents a potential conflict of interest given that payment for publication could, in theory, influence a journal's motivation to accept or reject a manuscript.[25] From our review, the average article processing fee for open access orthopaedic journals is $1070 (range: $150-3000). Others have objected to article processing fees on the grounds that could cause research funds to be diverted towards the payment of publishing fees, instead of performing scientific research.[3] For example, it has been estimated that if open access became the standard, Cornell University would require an additional $1.5 million and Harvard Medical School would need an additional $13.5 million

to cover the publication fees associated with their annual article publication rates.[26] While current open access models do transfer the cost of publication from university libraries to authors (and their research grants), the overall cost is likely to be substantially lower with open access.

Finally, the open access model has been criticized for its potential to spawn "predatory publishers," which are for-profit companies that produce "low impact, low oversight" journals with little impact or visibility.[10] Some have described these publications as counterfeit journals given that they collect publishing fees while exploiting inexperienced authors that are motivated to publish their research. Many of these journals are characterized by marketing techniques which can include "spamming" researchers to solicit manuscripts, promising rapid review and publication.[27] It has since been shown that some of these journals have falsified editorial boards and even plagiarized manuscripts.[15, 27] More recently, an investigator submitted an intentionally flawed sham manuscript to 304 open access journals and found that more than half offered publication without detecting the flaws, and approximately 60% of the decisions were made without any sign of peer review.[28] In response to the presence of these publishers, Jeffrey Beall, an academic librarian at the University of Colorado, Denver, has published a list of potential, possible, or probably predatory publishers (http://scholarlyoa.com/publishers/) and journals (http://scholarlyoa.com/individual-journals/). The scientific community must be aware of these journals, and orthopaedic surgeons should exercise caution when reading, referencing or submitting manuscripts to unfamiliar journals.

Given that orthopaedic treatment can vary widely between countries and regions, our profession stands to benefit from the globalization of research and outcomes. However, established subscription-based journals may have a preference for research performed in North American countries such as the United States and Canada.[29] As surgeons, we should welcome high-quality research from developing nations, to the extent that it is applicable to our practice. Open access provides the platform through which our surgical colleagues in the developing world can publish their own experiences regarding the development of novel techniques, and the treatment of pathologies not otherwise seen in Western countries. This is in addition to the known benefit of increased access to the literature among clinicians practicing in the developing world.

Conclusion

The trend towards open access publishing has been firmly established over the past decade, and shows no sign of reversing. As such, we must be prepared to embrace and integrate open access publishing in a way that supports our science, encourages our researchers, and benefits our patients. Like any new technology, open access is not without its faults, and critics have appropriately raised concerns about academic integrity and profiteering by certain publishers. By understanding these risks and committing to improvement, open access has the potential to advance our field at a rapid pace, and bring it to a wider audience.

As in the scenario used to introduce this article, many orthopaedic surgeons may wonder about the legitimacy of newer open access journals. Before submitting a manuscript to an open access journal for publication, consider evaluating the publication based on the following criteria. First, check the publisher and editorial board for reputable names and colleagues who may be recognized from other publications. Next, search for the journal's title at www.DOAJ.org and determine its impact factor as a secondary representation of overall distribution, recognizing that these benchmarks are not absolute reflections of journal or research quality. We would also recommend visiting PubMed as well as the journal's archives to ensure

that articles are published in a timely fashion, and are actually freely available for download, consistent with open access guidelines. Once an article has been accepted for publication, confirm that the peer-review process has been completed, and request to see the reviewer comments, even if the article was accepted without edits. If a journal meets these requirements and has a reasonable article processing fee (orthopaedic journal average: $1070, range: $150-3,000), an author can feel comfortable proceeding with publication. By adhering to these suggestions, we can improve the quality of the literature while benefitting our colleagues and patients. Instead of simply seeking to publish quickly, we encourage orthopaedic researchers to rather focus on publishing their research in journals that fulfill our moral commitments to wide dissemination and academic integrity.

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Table 1: Orthopaedic Open Access Journals in 2013

Journal Name	Article Processing Charges	First year of publication	2012 Impact Factor*
Acta Orthopaedica	$0	1930	2.736
Acta Orthopaedica et Traumatologica Turcica	$0	1963	0.597
Acta Ortopédica Brasileira	$0	2000	
Advances in Orthopedics‡	$800	2011	
Archives of Orthopaedic and Trauma Surgery	$3000	1903	1.358
Arthritis Research and Therapy	$1500	2003	4.302
Asian journal of Sports Medicine	$0	2010	
BMC Musculoskeletal Disorders	$2000	2000	1.875
BMC Sports Science, Medicine and Rehabilitation	$2000	2013	
Bone & Joint Research	$750	2012	
Case Reports in Orthopedics‡	$300	2011	
Foot and Ankle Online Journal	$0	2008	
Indian Journal of Orthopaedics‡	$0	2007	0.737
International Journal of Shoulder Surgery‡	$0	2007	
ISRN Orthopedics‡	$0	2011	
Journal of Foot and Ankle Research	$1730	2008	1.466
Journal of Orthopaedic Case Reports	$150	2011	
Journal of Orthopaedic Surgery	$0	2005	
Journal of Orthopaedic Surgery and Research	$2285	2006	1.013
Journal of Orthopaedics	$0	2004	
Journal of Orthopaedics and Traumatology	$0	2000	
Journal of Sports Science and Medicine	$475	2000	0.953
Kerala Journal of Orthopaedics	$0	2011	
Open Access Journal of Sports Medicine	$1865	2010	
Open Journal of Orthopedics	$500	2011	
Open Orthopaedics Journal†	$600-900	2007	
Open Spine Journal†	$600-900	2009	
Open Sports Medicine Journal†	$600-900	2007	
Orthopaedic Journal of Sports Medicine	$1000	2013	
Orthopedic Research and Reviews	$1695	2009	
Orthopedic Reviews‡	$550	2009	
SA Orthopaedic Journal	$0	2010	
Scoliosis	$1730	2006	
Sports Medicine, Arthroscopy, Rehabilitation, Therapy and Technology (SMARTT)	$2000	2009	
Strategies in Trauma and Limb Reconstruction	$0	2006	
The Internet Journal of Hand Surgery†	$225	2007	
The Internet Journal of Minimally Invasive Spinal Technology	$225	2007	
The Internet Journal of Orthopedic Surgery†	$225	2001	
The Internet Journal of Spine Surgery†	$225	2005	
The Iowa Orthopaedic Journal	$0	1981	
The Open Bone Journal†	$600-900	2009	
World Journal of Orthopedics	$600	2010	

*If available.
†Potential, possible, or probably predatory publisher.
‡Borderline publisher.

Figure 1: Cumulative Number of Articles Available in Orthopaedic Open Access Journals, 2001-2013