Orthodontic extractions and the Internet: Quality of online information available to the public

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Introduction: The aim of this study was to evaluate the quality of information available on the Internet for a person interested in orthodontic extractions. **Methods:** The term "orthodontic extractions" was entered into the search engines of both Google and Yahoo, and the first 50 Web links for each were pooled and examined. Exclusion criteria consisted of repetitions, sites requiring registration or login, and those accessing scientific articles. Sites fulfilling the criteria for inclusion were examined by using the LIDA instrument, a validated method of evaluating health care Web sites, based on accessibility, usability, and reliability. The readability of each site was further assessed by using the Flesch reading ease score. **Results:** Of the 100 Web sites identified, 21 were suitable for inclusion and scoring. Overall, the mean total LIDA score was 93 of a possible 144 (65%) (range, 71-116 or 49%-81%). No Web site scored above an arbitrary gold standard of 90%; however, most (20 of 21) scored above 50%. With the LIDA instrument, average accessibility was 70%, average usability was 72%, and average reliability was 41%. The average Flesch reading ease score was 58.3. **Conclusions:** Overall, the quality of information available on the Internet with regard to orthodontic extractions is variable. Although readability is generally good, reliability is a cause for concern, and patients should interpret many of these sites with caution. The top-rated Web sites in a search engine are not necessarily those of the highest quality. (Am J Orthod Dentofacial Orthop 2011;139:e103-e109)

The Internet is a global system of interconnected computer networks that provides a valuable resource for the distribution and gathering of information through the World Wide Web. This medium is now firmly established in the fabric of modern life, with almost 2 billion people worldwide having Internet access in 2009.[1] In medicine alone, there are now a wealth of health-related information Web sites available to anyone with access to the Internet.[2] These range from personal accounts of illness and patient discussion groups, advertising and marketing of medical products or types of treatment, to peer-reviewed open-access journal articles and clinical decision support tools.[3] This access has been recognized for some time as having potentially significant implications with regard to future health care.[4-6]

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However, as an open resource, information on the Internet is not subject to peer review and can be posted by any person, interest group, company, or institution. As a result of this editorial freedom, Web sites can contain erroneous information, caused by either ignorance, bias (deliberate or otherwise), or commercial interest.[7] Moreover, information on a subject can be highly variable and in some cases potentially misleading and harmful.[8] Importantly, consumers who search and appraise health information on the Internet rarely notice or remember the source of the Web sites they have accessed.[9]

The quality of health information available on the Internet has been assessed in relation to many different criteria over a range of medical and (to a lesser extent) dental subject areas in different Web-based information-gathering environments.[2,10-18] However, in most cases, the quality of this information has been regarded as problematic.[19] In an attempt to help users discriminate between sites, a number of organizations have attempted to develop specific methods and tools to evaluate and rate the quality of health information on the Internet, but a universal method is currently lacking.[8,20-22] The LIDA instrument is one such tool; it provides a validated method of evaluating the design and content of health care Web sites and measures 3 key areas: accessibility, usability, and reliability[23] and

has previously been used to assess information quality relating to tonsillectomy.[24]

Successful orthodontic treatment relies on establishing a good relationship between patient and orthodontist, with this process beginning at the consultation and treatment-planning stages. In contemporary practice, both patients and parents are becoming more informed about orthodontics, often having clear ideas about their problems and the potential treatment options. Moreover, as part of the process of informed consent, patients should be offered all alternative treatment plans; this might lead them to seek further information about the available options. In many cases, their primary source will be the Internet, which provides a quick, easy, and extensive resource for further research. The debate over extraction vs nonextraction for orthodontic treatment has provoked controversy since orthodontics began.[25,26] Extractions in orthodontic treatment are primarily prescribed to provide space to accommodate a crowded dentition or to achieve orthodontic camouflage; however, this decision is often subjective. This is reflected in a large range of extraction frequencies between practitioners, with a general trend toward fewer extractions in more recent years.[27-30] It is therefore quite likely that some patients prescribed extractions as part of their orthodontic treatment might seek further information or advice on the Internet. In this study, we aimed to evaluate the health care Web sites that parents or patients might encounter if they search the Internet regarding orthodontic extractions. In particular, 2 validated instruments were used to evaluate the content of each Web site; accessibility, reliability, and usability were rated with the LIDA instrument, and readability was rated by using a score generated from the Flesch reading ease test.

MATERIAL AND METHODS

The World Wide Web was searched in November 2008 by using the Google and Yahoo search engines combined with the term "orthodontic extractions." The default settings for these engines were not altered, and the advanced search facility was not used. These search providers are the most highly ranked and used in the United States, accounting for 65% and 14% of all searches, respectively, in February 2010.[31] The top 50 results from each search engine were saved and pooled to unify repetitions. Exclusion criteria included site duplications, those requiring registration or login, and those providing links to scientific articles. Each Web site was then assessed by using the LIDA instrument and the Flesch reading ease test.

The LIDA instrument is a product of Minervation, a commercial organization based in the United Kindgom that specializes in producing and disseminating accessible, usable, and reliable health care information. It has been developed and validated as an outcome tool for Web-site providers to assess their own sites.[23] It provides a semiautomated tool that requires the URL of each site being assessed to be entered, with drop-down menus to answer questions of content and usability. The rating is automatically calculated and scored between 0% and 100%. The instrument is divided into 3 main domains of accessibility, usability, and reliability, and is constructed as a questionnaire to be applied to each Web site. In each domain, there are 16, 18, and 9 questions, respectively. Each question is scored on a scale of 0 to 3 (0, never; 1, sometimes; 2, mostly; 3, always). There are no formal classifications for total score in the LIDA[23]; however, for this investigation, a gold standard of 90% was set for each Web site.

1. Accessibility: can users access the Web site? The site should conform to legal accessibility standards and reflect best practices in coding and relevant meta-data. Accessibility incorporates page setup, access restrictions, outdated codes, meta-data tags, browser and platform tests (Macintosh and Windows operating systems and 3 browsers, including Internet Explorer, Safari, and Firefox), and registration requirements.
2. Usability: can users find the information that they need? The design and presentation of the site should enable effective use of the information it presents. If this aspect is poor, it might discourage use. Users should be able to engage with the Web site, identify whether it applies to them, and then interact with it—eg, through feedback or active bulletin boards. The other aspect that this part of the instrument investigates is functionality. Usability incorperates clarity, consistency, functionality, and engagability.
3. Reliability: does the site keep up to date with the latest research and reflect best current knowledge? The site should provide comprehensive, relevant, and unbiased information. A concern is the potential harm that can be caused to patients by poor-quality information or advice. The LIDA instrument assesses reliability in terms of currency, conflicts of interest, and content production. Regular updates should be present, so that new evidence is taken into account when giving advice. It should also be clear who runs the site, and there should be a clear method behind content production.

The Flesch reading ease test was also applied to each Web site to assess the level of readability.[32] This test bases its rating on the average number of syllables per word

Table. Web sites evaluated with the LIDA instrument and FRES

Web site	*LIDA score*	*Reliability**	*FRES*	*Highest rank*
www.bos.org.uk	116 (81%)	16	48	4
www.northsydneyorthodontics.com.au	113 (78%)	18	45	23
www.archwired.com	108 (75%)	19	71	2
www.chapelroad.co.uk	108 (75%)	14	60	23
www.orthotropics.com	104 (72%)	8	68	3
www.alpersdental.com.nz	99 (69%)	15	54	32
www.dfuller.com.au	97 (67%)	9	56	25
www.orthodontic-outrage.com	97 (67%)	12	48	1
www.baltimorecosmeticimplantdentist.com	96 (66%)	11	53	18
www.fasttraxortho.com	96 (66%)	13	60	27
www.st-marks.co.uk	96 (66%)	11	59	22
www.yesbraces.com	93 (65%)	8	67	45
www.orthofree.com	92 (64%)	12	71	10
www.smilepage.com	89 (62%)	10	60	5
www.dental-health.com	87 (60%)	12	78	9
www.aacd.com.au	86 (60%)	10	53	33
www.nosebreathe.com	80 (56%)	10	54	19
www.progressiveorthodontics.com	79 (55%)	8	63	35
www.growthorthodontics.com	76 (53%)	7	55	34
www.braces.com.sg	73 (51%)	8	54	43
www.myoresearch.nl	71 (49%)	4	49	21

*Maximum score, 27.

and words per sentence and rates text on a 100-point Flesch reading ease score (FRES), with a higher score relating to a text that is easier to read. A score between 90 and 100 indicates a text that is easily understandable by an average 11-year-old student, a score between 60 and 70 is easily understandable to 13 to 15-year-old students, and a score between 0 and 30 indicates a text that is best understood by a university graduate. For most writing, a score of 60 to 70 is regarded as acceptable. The formula for the FRES is 206.835 – (1.015 × ASL) – (84.6 × ASW), where *ASL* is the average sentence length (number of words divided by the number of sentences) and *ASW* is the average number of syllables per word (number of syllables divided by the number of words).

RESULTS

A total of 100 Web links were identified by the Google and Yahoo searches; 79 of them were not included in the assessment because they were repetitions, required registration or login, or were scientific articles and could be clearly identified as such. The Table shows the Web links identified for assessment and their highest rank in either the Google or Yahoo searches. Among these 21 sites, dentists with specialist orthodontic qualifications produced 9 of them, and 8 were produced by people with no specific orthodontic specialty qualification. Also included were the Web sites of the British Orthodontic Society and the Australian Academy of Cosmetic Dentistry. The British Orthodontic Society is a charity based in the United Kingdom that aims to promote the study and practice of orthodontics, maintain and improve professional standards, and encourage research and education. The focus of the Australian Academy of Cosmetic Dentistry is to advance general dental health by providing information on cosmetic dentistry. Another Web site was produced by a patient who had undergone orthodontic treatment and had started the site to provide information for others going through this process. The remaining 2 Web sites provided no details regarding the origin of their information.

All Web sites were in English, except one that also had the option of a French language version. When we considered the global origin of the identified Web sites, 8 were from the United States, 5 were from the United Kingdom, 5 were from Australia and New Zealand, 2 were from the Far East, and 1 had authors from across the world.

LIDA SCORES

The final LIDA scores for each Web site investigated are shown in the Table. Overall, the mean total LIDA score was 93 of a possible 144 (65%), with a range of 71 to 116 (49% to 81%). Among the 21 Web sites analyzed, none scored above the gold standard of 90% (129 of 144 or more). However, most sites (20 of 21) scored

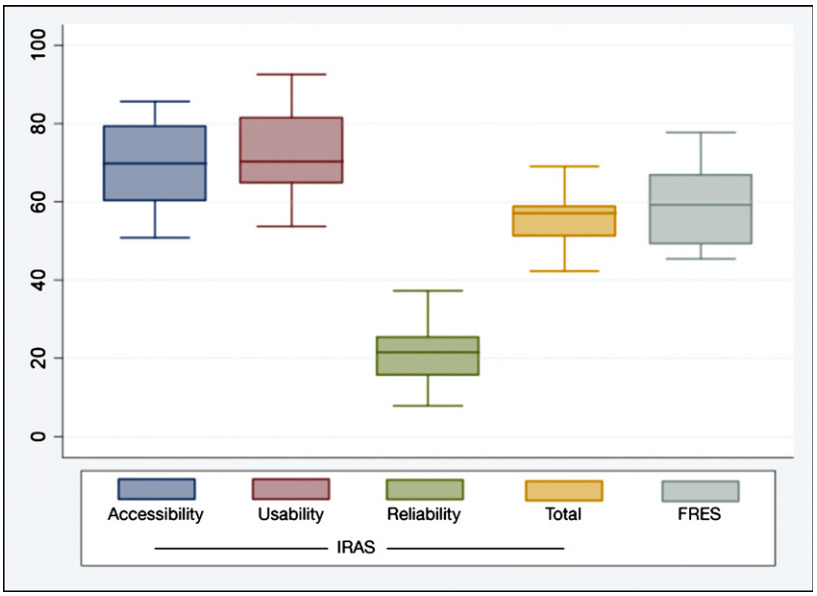

Fig. Distribution of scores for each domain in the LIDA instrument (accessibility, usability, reliability) as well as the total LIDA score (all percentages) and the total FRES.

between 50% and 81%. The distribution of scores in the 3 categories of the LIDA instrument are shown in the Figure.

The average score for accessibility was 44 of a possible 63 (70%). The most accessible Web site was produced by the British Orthodontic Society, achieving a score of 54 (86%). The least accessible sites, with scores of 33 (52%) were the 2 Web sites produced by orthodontic practices in the Far East. All Web sites were operational on both Windows and Macintosh operating systems and on all the Web browsers used (Internet Explorer, Safari, and Firefox). All Web sites were accessible without registration or login.

The average score for usability was 39 of a possible 54 (72%). The highest score of 50 was achieved by a Web site developed by a patient who had undergone orthodontic treatment and wished to share the experience with others. This Web site contained information relating to orthodontic treatment from both patients and specialist orthodontists, with the opportunity to participate in the interactive domains of the site via message boards, forums, and feedback. The Web site was primarily aimed at adults, but several sections could apply to any orthodontic patient. The lowest score of 29 was scored by a Web site aimed at marketing an orthodontic appliance directly to general dental practitioners, specialist orthodontists, and members of the public.

The results for reliability fell substantially below the expected standard. The average score achieved by the Web sites was 11, which represents only 41% of a possible total of 27. Interestingly, the highest score of 19 (70% of the possible total) was attained by the patient-developed Web site. The subsections in this level that favored this particular Web site were primarily related to currency. A significant proportion of the content was open to comment by any user, and the site had gained enough traffic to enable frequent updates in this manner. The other subsection related to conflicts of interest: the original author was clear about his or her motivations to develop the Web site and described clearly how the process started and developed into the Web site that appears today.

FRES

The mean FRES for all the Web sites was 58.3 (SD, 8.6). The highest proportion of Web sites (43%) scored 60 and above, 38% scored between 50 and 60, and 19% scored between 40 and 50. The lowest score of 45.4 was from a Web site developed by a practice in Sydney, Australia. The highest score of 70.7 was scored by a forum-based Web site that contained a panel of dentists, including an orthodontic specialist from the United States, responding to discussions. Large sections of the pages on this Web site are comments and reports from the public about treatment, generally leading to questions involving members of the public and the dental professionals.

Searches were carried out by using the Google and Yahoo search engines, with the results pooled. The highest individual rank in these searches is included in

the Table. It is clear from these data that sites with the highest rankings in the search engines were not necessarily those rated with the highest LIDA score or FRES.

DISCUSSION

One of the most controversial areas in clinical orthodontics is the need for permanent tooth extractions as part of treatment. This controversy exists because the decision is largely subjective and has been an issue of continued debate in the specialty for as long as it has existed.[33] A true consensus is often not achieved, and this can lead to conflicting advice to both patients and parents. In addition, a number of appliance systems are now being marketed specifically on the basis that their use precludes the need for extractions, with this marketing often aimed directly at patients.[34] It is highly likely that a parent or a patient informed of the need for extractions by the orthodontist might seek further information on the subject; this might well be provided by the Internet. Our online search with the key words "orthodontic extractions" yielded a significant number of hits. Moreover, among the Web sites identified, some advocated treatment philosophies that specifically avoided tooth extractions.

The Internet now provides an established third-party portal, which contains a wealth of information for the user. The availability, rapidity, and ease of use associated with this global medium means that, for many people, it is their primary source of information. This is relevant to health care, with up to 60% of American adults using online resources for health information.[35] In theory, this might be regarded as a good thing, empowering people with rapid contemporary information relating to health and disease, and providing a conduit for improved lifestyle choices and early diagnoses. However, there are potential disadvantages, many of which need to be considered in the context of the medium itself. The number of hits relating to a subject can create massive amounts of information; many medical issues are complex, and the user's literacy skills or education can preclude a full understanding, even if the information is accurate.[9] The most important concerns relate to the quality of information that is available, with many sites demonstrating a lack of impartiality or peer-review and often pursuing marginal philosophies or unconventional treatments. Considerable effort is required to produce high-quality and contemporary evidence-based information; in many cases, sites fail to achieve this.[4] A further factor to consider is that highly ranked Web sites in a search engine are not necessarily those of the highest quality, even though they are likely to be the first ones visited by a searcher.[24] This was clear in this investigation, where there was no correlation between ranking in the search engine and either quality or readability of the site. The first and third ranked sites in the Google search were produced by the same proponents of a marginal treatment philosophy, which has no evidence base and aggressively promotes nonextraction orthodontic treatment directly to the public (Table).

Although attempts have been made to provide a framework for quality assessment of health information on the Internet, these are fraught with difficulty. The range and format of information resources varies so much that defining a single quality standard is problematic.[3] In addition, a great problem in regulating quality is the lack of consensus among health professionals regarding current evidence-based practice; in this respect, orthodontics is no exception. There have been a number of tools described for rating the quality of health care Web sites.[22] The LIDA instrument is validated and investigates accessibility, usability, and reliability.[23] In this study, the average scores of Web sites relating to orthodontic extraction compared favorably with those providing information on tonsillectomy: they were higher in all 3 domains.[24] However, the scores were significantly below a gold standard of 90%; this suggests that there is scope for further improvement and development. The highest-scoring Web site was maintained by the British Orthodontic Society, a charity based in the United Kindgom that encourages research and education in orthodontics.[36] Its membership is heterogeneous, consisting of university academics, hospital consultants, specialist practitioners, and general dentists; this is probably reflected in the balanced, consistent, and evidence-based composition of the information in the site. However, 2 other high-scoring Web sites (scoring 67% and 72%, respectively) represented the same unconventional treatment philosophy with no real evidence base.[37,38] These sites are aimed at patients and parents; this is some cause for concern, since they scored quite well with the LIDA instrument. In both this investigation and a previous one concerned with information relating to tonsillectomy, the reliability domain scored the lowest in the LIDA instrument. Because this includes factors such as evidence of updates, conflict of interest disclosure, and checking of original sources, this might explain why some sites in this investigation were ranked relatively highly. It might also reflect the relative impartiality and bias of many sites, particularly when a more controversial subject such as orthodontic extraction is searched.

The FRES also provided a validated tool with a simple measure of how easy a passage of text is to read. This is clearly important in a Web site that provides information

with a scientific basis. In our investigation, the mean FRES score for all Web sites was 58.3, which indicates text that is easily understandable for a 13 to 15-year-old child, and is comparable with previous investigations regarding information on cleft lip and palate and general radiology.[39,40] It was also encouraging that the highest proportion of Web sites scored 60 and above, and even the lowest score of 45.4 was above the threshold regarded as understandable only by a university graduate.

CONCLUSIONS

This investigation has demonstrated that the quality of information available on the Internet in relation to orthodontic extractions is variable. According to the LIDA instrument, no sites achieved a gold standard of 90%; however, there was a large range of scores, with some sites scoring over 70%. In the domains of the LIDA, reliability was generally rated the poorest. The readability of the sites was generally good. There was no correlation between the ranking of a site in the search engine and either quality or readability. Overall, the quality of the information available on the Internet with regard to orthodontic extractions is variable, and patients should interpret many of these sites with caution.

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