Original Article

Quality evaluation of the available Internet information regarding pain during orthodontic treatment

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ABSTRACT

Objective: To investigate the quality of the data disseminated via the Internet regarding pain experienced by orthodontic patients.

Materials and Methods: A systematic online search was performed for 'orthodontic pain' and 'braces pain' separately using five search engines. The first 25 results from each search term–engine combination were pooled for analysis. After excluding advertising sites, discussion groups, video feeds, and links to scientific articles, 25 Web pages were evaluated in terms of accuracy, readability, accessibility, usability, and reliability using recommended research methodology; reference textbook material, the Flesch Reading Ease Score; and the LIDA instrument. Author and information details were also recorded.

Results: Overall, the results indicated a variable quality of the available informational material. Although the readability of the Web sites was generally acceptable, the individual LIDA categories were rated of medium or low quality, with average scores ranging from 16.9% to 86.2%. The orthodontic relevance of the Web sites was not accompanied by the highest assessment results, and vice versa.

Conclusions: The quality of the orthodontic pain information cited by Web sources appears to be highly variable. Further structural development of health information technology along with public referral to reliable sources by specialists are recommended. (*Angle Orthod.* 2013;83:500–506.)

KEY WORDS: Orthodontics; Pain; Internet; Information

INTRODUCTION

The Internet is a worldwide provider of health-related information that is increasingly accessed by both health professionals and nonexperts.[1] A large-scale telephone poll in the United States revealed that 74% of adult users searched online in 2011 for medical topics.[2] A similar tendency has been also traced for dental care consultation, as estimated by the Online Health Search 2006,[3] which reports that 17 million Americans have occasionally sought relevant information.

The existing literature implicates a number of therapeutic procedures (ie, separator placement, archwire placement and activations, application of orthopedic forces, and debonding) to instigate a pain response in patients.[4] Incidence of pain symptoms among orthodontically treated samples has been reported[5–9] to vary from 70% to 95%. Furthermore, behavioral research[5] has demonstrated that fear of anticipated pain prevented some patients from seeking orthodontic care. Based on this perspective, it is not surprising that every 10th orthodontic patient may discontinue therapy as a result of pain disturbances during the early stages of treatment.[10]

Given the growing influence of the Internet, it can be expected that persons undergoing or interested in orthodontic treatment will attempt to acquire data online on iatrogenic pain experience. Nevertheless, as a result of the unregulated and diverse nature of the Web, and given the lack of navigation knowledge of laypersons on valid electronic databases and peer-reviewed portals, there is a high likelihood that

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Accepted: August 2012. Submitted: May 2012.
Published Online: October 1, 2012

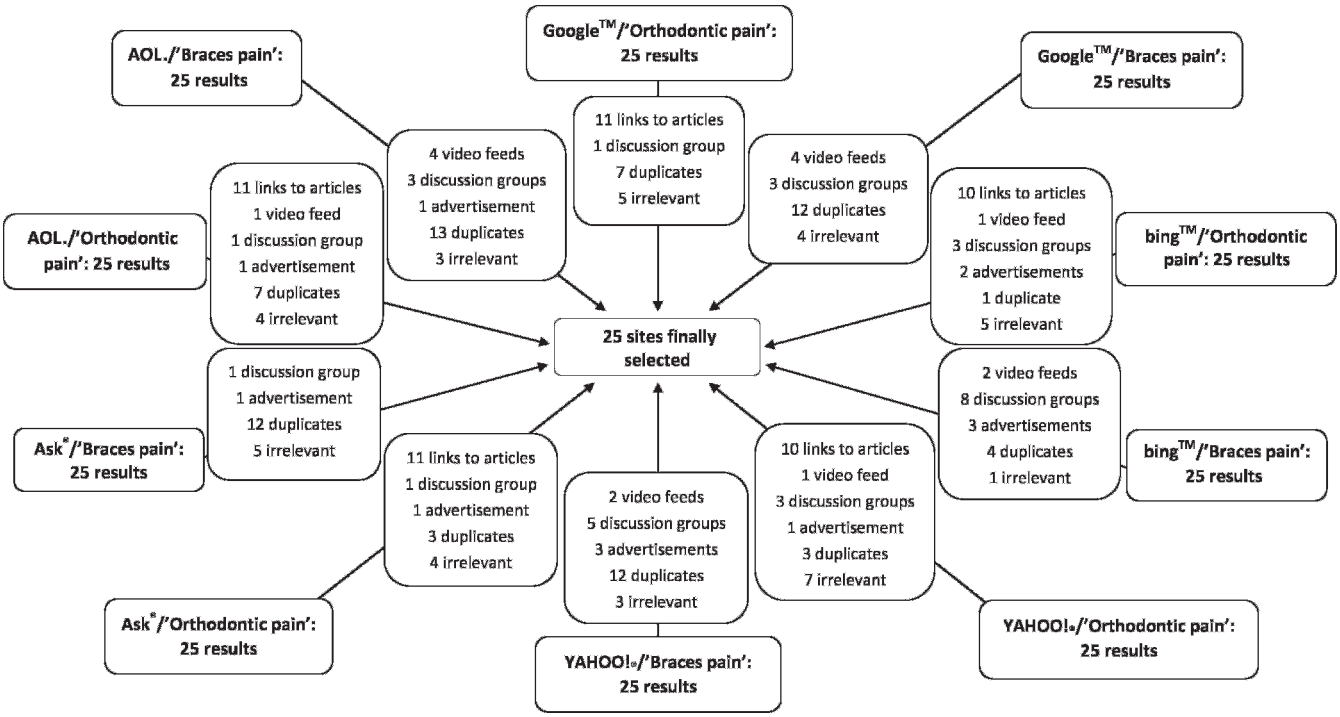

Figure 1. Flowchart diagram of the selection process.

searchers will come across Web information that is of doubtful credibility and accuracy. Hence, the aim of this study was to assess the qualitative characteristics of publicly available e-information on pain associated with orthodontic intervention.

MATERIALS AND METHODS

Search Methods

A search of the Internet was carried out in February 2012 using five popular search engines: Google™ (www.google.com), bing™ (www.bing.com), YAHOO!® (www.yahoo.com), Ask® (www.ask.com), and AOL. (www.aol.com). The terms 'orthodontic pain' and 'braces pain' were entered individually to simulate the typical online search of a common layperson. The top 25 results for each search alternative were compiled for content appraisal. Exclusion criteria included the following: promotional product sites, discussion groups, video feeds, and links to scientific articles (Figure 1). Author name, profession, and type of information of all eligible Internet portals were extracted to contribute to the evaluation process.

Quality Assessment

Accuracy. Accuracy can be defined as the degree of concordance of the information disseminated with the best evidence or with generally accepted clinical practice. The use of textbooks, evidence-based guidelines, and primary literature as reference sources have been methodologically adopted in studies assessing the accuracy of e-health information.[11] In agreement with similar studies,[12,13] we screened Web pages for providing accurate instructions using textbook material[14] as the standard criterion. In particular, two of the authors investigated concurrently whether information regarding duration, etiology, and management of pain was given and, accordingly, scored the sites on a consensus basis, as follows: 0 points = no pain topic was discussed; 1 point = there was a discussion of one topic; 2 points = there was a discussion of two topics; 3 points = all three topics were discussed with major omissions; 4 points = all three topics were discussed with minor omissions; and 5 points = there was a complete discussion. The final ratings were converted to percentage scales to facilitate combined presentation of results.

Readability. Readability of a written text is an objective measure of the reading skills an individual must possess to understand that material.[15] The Flesch Reading Ease Score (FRES)[16] was used to determine the readability of reviewed sources. FRE, average sentence length (ASL), and average number of syllables per word (ASW) are interrelated through the following equation: $FRE = 206.835 - (1.015 \times ASL) - (84.6 \times ASW)$. The outcome is a number ranging from 0 to 100, with higher scores indicating easier text reading. Scores between 90 and 100 are considered easily understandable by an average fifth-grade

Table 1. LIDA Instrument Questions Intended to Evaluate Usability (1–4) and Reliability (5–9) of Web Sites

Question No.	Formulation
1	Is the site design clear and transparent?
2	Is the site design consistent from one page to another?
3	Can users find what they need on the site?
4	Is the format of information clear and appropriate for the audience?
5	Is it clear who has developed the website and what their objectives are?
6	Does the site report a robust quality control procedure?
7	Is the page content checked by an expert?
8	Is the page updated regularly?
9	Does the page cite relevant sources where appropriate?

student. A score range between 60 and 70 can be easily comprehended by eighth- and ninth-grade students. Finally, understanding of up to 30 score texts is considered representative of college- or university-graduate–level reading. For the purposes of the current study, an abstract from each site consisting of 200–500 words was copied and pasted into an online FRES calculator program (http://www.readabilityformulas.com/free-readability-formula-tests.php). Prior comparison[12] of automated and manual calculation has confirmed the accuracy of the online method.

Further qualitative analysis was performed by means of the LIDA instrument (The LIDA Instrument, Version 1.2, Minervation Ltd, Oxford, UK). This validation tool was developed to assess the design and content of health care Web sites. There are three distinct areas measured: accessibility, usability, and reliability. The accessibility score is computed by filling in the Web address of the site on a customized Web platform (http://www.minervation.com/mod product/LIDA). A nine-item questionnaire is applied to evaluate usability and reliability (Table 1). The response alternatives are graded from 0 to 3 (0: never; 1: sometimes; 2: mostly; 3: always). Depending upon the input, this software produces final percentile scores that correspond to high, medium, or low quality. The LIDA score that is the average value of the three subscores indicates the overall rating of the design and structure of the site.

RESULTS

Search Results

The search methodology generated originally 250 sites for relevance analysis. Meticulous screening of the initial selection led to a total of 25 sites that met the requirements of the study. Apparently, 13 advertisements, 29 discussion groups, 15 video feeds, 53 links to scientific articles, 74 duplicates, and 41 Web pages of irrelevant content were excluded from the final rating.

Authorship and Type of Information

In 56% of the sites, the text was not signed by the author (Table 2). A higher proportion of Web platforms, 17 out of 25, did not cite professional details of the contributor. The remainder of the articles were written by two orthodontists, two dentists, and four media professionals. Two of the authors, one from the media group and one of unknown occupation, mentioned personal treatment experience as the motivational factor to initiate writing about orthodontics. With reference to the information specificity, 13 pages claimed to provide exclusive information about aspects of orthodontic therapy. One Web page was found to cover topics of multidisciplinary oral rehabilitation. Tooth and general pain guidance were given in one and two Internet addresses, respectively. Of note, 32% of the reviewed pages had a broader scope of interest, posting information on fields such as nutrition, fitness, entertainment, and lifestyle.

Quality Assessment

The evaluation outcomes and the description statistics of percentile scores are summarized in Tables 3 and 4. A box-and-whisker diagram was constructed to enable schematic representation of the distribution of the data set (Figure 2). It appears that accuracy, usability, and reliability were scattered over a wide range, implying, therefore, the variable quality of these characteristics in the available Internet sources.

Accuracy

Taking into consideration the percentile scores, the mean score for all Web sites was 26.4 (standard deviation [SD]: 21.39). Eighty percent of the sites covered two or fewer topics ($\leq$40%), in accordance with the reference textbook material. Out of these, six sources failed completely to provide valid information about discomfort in orthodontics. The remaining five Web pages reported on all pain topics, but not in detail (60%).

Readability

FRE ratings ranged between 48.6 and 84.7. The total readability level (mean: 68.1) was deemed appropriate for eighth- to ninth-grade students. The top scoring site was designed to consult exclusively those patients experiencing disturbances. Fairly difficult to difficult reading style (FRES: 30–59) was identified for five information sources.

Table 2. Author and Information Details of the Web Sites Analyzed in the Study[a]

No.	Web Sites	Author Details		Information Type
		Name	Profession	
1	archwired.com	n/m	Media professional (former patient)	Orthodontics
2	braces.com	m	Orthodontist	Orthodontics
3	bracesguide.com	m	Orthodontist	Orthodontics
4	bracesinfo.com	n/m	n/m	Orthodontics
5	braces-pain.com	n/m	n/m	Orthodontics
6	bracespain.net	n/m	n/m	Orthodontics
7	bracespain.org	n/m	n/m	Orthodontics
8	bracespain.webs.com	n/m	n/m	Orthodontics
9	bracespain.wordpress.com	n/m	n/m	Orthodontics
10	bracespain34.com	n/m	n/m	General pain
11	bracesprices.net	n/m	n/m	Orthodontics
12	buzzle.com	m	n/m	General
13	canadahealthyliving.com	n/m	n/m	Health and nutrition
14	dental.beautyhill.com	n/m	n/m	Lifestyle
15	ehow.com	m	Media professional	General
16	firstchoicedentistry.com	n/m	n/m	Orthodontics
17	getyourbraces.com	m	Dentist	Orthodontics
18	identalhub.com	n/m	n/m	Dental treatment
19	livestrong.com	m	Media professional	Health and nutrition
20	orthodontics-today.com	m	n/m (former patient)	Orthodontics
21	pain.com	m	Dentist	General pain
22	soyouwanna.com	m	n/m	General
23	toothachesremedies.net	n/m	n/m	Dental pain
24	voices.yahoo.com	m	Media professional	General
25	wikihow.com	m	n/m	General

[a] m indicates mentioned; n/m, not mentioned.

Accessibility

The general accessibility was considered medium (mean: 86.2; SD: 8.25). The maximum achievable score was recorded for a Web platform addressing painful symptoms during orthodontic treatment. High accessibility scores (>90%) were identified for 10 Web pages. The lowest score (72%) was ascribed to three orthodontic pain–specific Internet addresses.

Usability

The mean score of usability was 58.6 (SD: 20.18), which corresponded to medium quality. The highest score of 83 was achieved by five sites for which the information was written by orthodontists, dentists, and a media professional on pain induced by orthodontic interventions. Three Web sites of unknown authorship scored as low as 25.

Reliability

The overall reliability of the Internet portals examined by this study was low (mean: 16.9 ± 19.42). A Web page edited by a Web designer–former orthodontic patient was graded with the highest score of 67. Other than this, we observed that in nine 0-scoring sites the authors were not notified.

LIDA Scores

The mean aggregate validation score for the 25 Web sites was 61.2, which is indicative of a structure of medium quality. LIDA values varied from 45 to 74. The highest grade referred to an orthodontic practice site run by a dentist. The lowest score was obtained from a Web site especially developed for the domain of braces pain.

DISCUSSION

To date studies dealing with orthodontic Web-based information have been rare, with the exception of those that deal directly with orthodontic issues such as extraction treatment[17] or indirectly with the issues of cleft lip and palate[12] and orthognathic surgery.[18] All of these authors reached the conclusion that the quality of related information published on the Internet is variable. Lately, Knösel and Jung[1] perceived a wide variety of orthodontic clips on a video-sharing Internet platform, with the highest proportion of clips uploaded by orthodontic patients.

Our intention was to apply a multievaluative approach to rating ordinary information sources visited by active or prospective orthodontic patients concerned about iatrogenic pain, a clinical issue that affects

Table 3. Evaluation Scores of the Web Sites in Terms of Accuracy, Flesch Reading Ease Score (FRES), Accessibility, Usability, Reliability, and LIDA (in Brackets: the Maximum Achievable Scores; in Parentheses: the Corresponding Percentile Scores)

No.	Web Sites	Accuracy [5]	FRES [100]	Accessibility [54]	Usability [12]	Reliability [30]	LIDA [96]
1	archwired.com	3 (60)	69.3 (69.3)	39 (72)	4 (33)	20 (67)	63 (66)
2	braces.com	2 (40)	78.9 (78.9)	39 (72)	10 (83)	12 (40)	61 (64)
3	bracesguide.com	2 (40)	48.6 (48.6)	45 (83)	10 (83)	14 (47)	69 (72)
4	bracesinfo.com	3 (60)	81 (81)	52 (96)	9 (75)	2 (7)	63 (66)
5	braces-pain.com	1 (20)	84.7 (84.7)	54 (100)	4 (33)	0 (0)	50 (60)
6	bracespain.net	1 (20)	76.8 (76.8)	39 (72)	4 (33)	0 (0)	43 (45)
7	bracespain.org	0 (0)	71.7 (71.7)	51 (94)	3 (25)	0 (0)	54 (56)
8	bracespain.webs.com	1 (20)	71.8 (71.8)	44 (81)	3 (25)	0 (0)	47 (49)
9	bracespain.wordpress.com	1 (20)	73 (73)	47 (87)	3 (25)	0 (0)	50 (52)
10	bracespain34.com	0 (0)	64.8 (64.8)	48 (89)	5 (42)	0 (0)	53 (55)
11	bracesprices.net	1 (20)	64.2 (64.2)	51 (94)	7 (58)	2 (7)	60 (62)
12	buzzle.com	1 (20)	68.9 (68.9)	41 (76)	7 (58)	4 (13)	52 (54)
13	canadahealthyliving.com	1 (20)	72.2 (72.2)	51 (94)	7 (58)	0 (0)	58 (60)
14	dental.beautyhill.com	0 (0)	63.4 (63.4)	44 (81)	7 (58)	2 (7)	53 (55)
15	ehow.com	3 (60)	57.5 (57.5)	49 (91)	10 (83)	8 (27)	67 (70)
16	firstchoicedentistry.com	3 (60)	64.3 (64.3)	53 (98)	9 (75)	0 (0)	62 (65)
17	getyourbraces.com	2 (40)	50.5 (50.5)	49 (91)	10 (83)	12 (40)	71 (74)
18	identalhub.com	0 (0)	79.3 (79.3)	41 (76)	6 (50)	14 (47)	61 (64)
19	livestrong.com	1 (20)	55.7 (55.7)	46 (85)	9 (75)	6 (20)	61 (64)
20	orthodontics-today.com	0 (0)	83 (83)	45 (83)	7 (58)	6 (20)	58 (60)
21	pain.com	3 (60)	50 (50)	45 (83)	10 (83)	8 (27)	63 (66)
22	soyouwanna.com	1 (20)	64.2 (64.2)	46 (85)	8 (67)	0 (0)	54 (56)
23	toothachesremedies.net	2 (40)	67.3 (67.3)	50 (93)	8 (67)	0 (0)	59 (60)
24	voices.yahoo.com	0 (0)	66.3 (66.3)	47 (87)	8 (67)	6 (20)	61 (64)
25	wikihow.com	1 (20)	76.3 (76.3)	49 (91)	8 (67)	10 (33)	67 (70)

patient cooperation and acceptance of appliances.[19] As indicated by the last Harris Poll results,[2] more than two-thirds (69%) of health information queries start at a general search engine. Likewise, we operated five prevalent search programs, namely Google™, bing™, YAHOO!®, Ask®, and AOL, which, according to updated statistical figures,[20] represent 65.9%, 15.1%, 14.5%, 2.9%, and 1.6% of the US search engine market share, respectively. To expand the pool of search results, we explored far beyond the first page of result links, which accounts for the standard retrieval technique in e-health information searches.[21,22]

Dental pain information, including actions taken to relieve pain and the impact on the quality of life, is shared extensively among Twitter users.[23] Therefore, we decided to look into the accuracy of statements about legitimate patient concerns such as cause of pain, duration of pain, and remedies. To measure the data completeness we modified the scoring system used by Rajagopalan and colleagues[13] in a comparative study of electronic scientific databases. A rather poor agreement was found between the broadcast data and reference textbook. Questions on the accuracy and theoretical quality of e-health information have been raised by recent studies[24–26] in multiple medical branches. Several Web pages seemingly focused on orthodontic thematology present incomplete instructions. Another interesting observation was that non-orthodontists were in charge of the sites with the relatively highest scores. Differently stated, a Web site offered by a health professional or health service may not necessarily comprise quality information.[27]

Health domains are frequently produced at a level that is inappropriate for a public of mixed socioeconomic and educational background.[28] Under this condition, readers may fail to broaden their understanding of disease processes or may even misinterpret crucial information on health care decisions. It is imperative for patient education materials to be written at a comprehensive level. Easily understood information can enhance patient's self-esteem and optimize delivery care at home as well as disease self-management.[29] By extracting FRES, one of the oldest textual difficulty measures, we found that the bulk of the Web information was written in understandable language. Health domain administrators should be

Table 4. Mean and Standard Deviation (SD) Values of Evaluated Categories—Percentile Scores (n = 25)[a]

	Accuracy	FRES	Accessibility	Usability	Reliability	LIDA
Mean	26.4	68.1	86.2	58.6	16.9	61.2
SD	21.39	10.17	8.25	20.18	19.42	7.17

[a] FRES indicates Flesch Reading Ease Score.

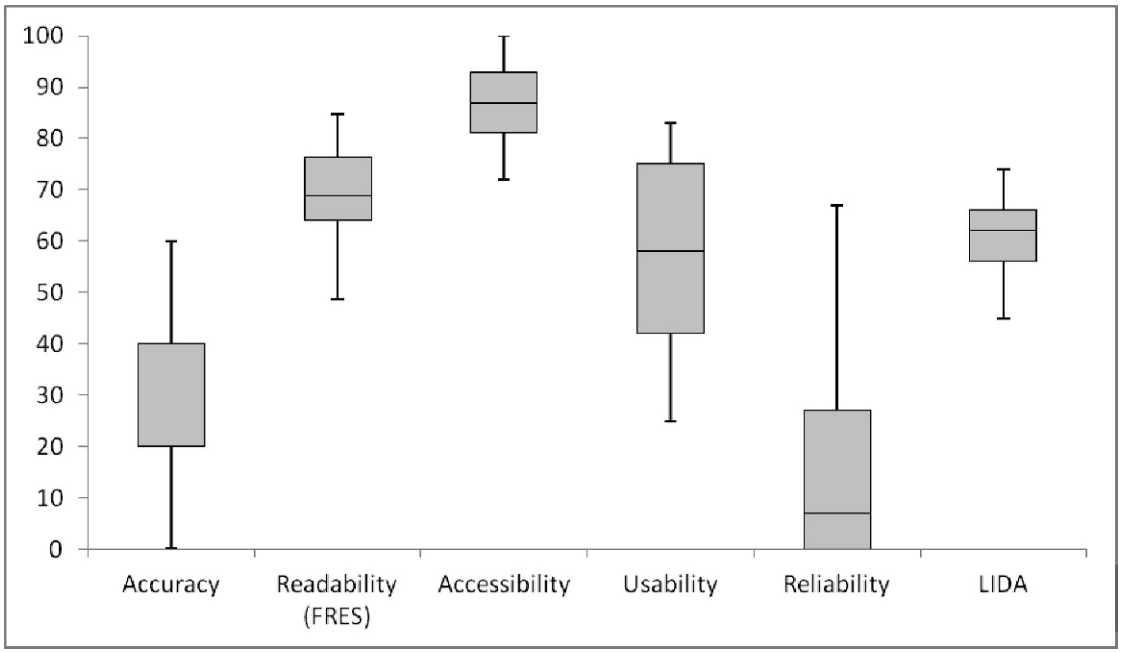

Figure 2. Box-and-whisker diagram illustrating the distribution of evaluation percentile scores.

encouraged to improve reading ease to communicate a broad range of messages to a wide variety of audiences. On the other hand, oversimplifying text may yield the opposite result and render it difficult to convey accurate information.[15]

A wealth of quality rating instruments have emerged over recent years, aimed at reviewing health informative Web sites. Disappointingly, many of them have been identified as incompletely developed and of doubtful utility.[30] Our evaluation tool of choice was the LIDA instrument, a validated set of criteria broadly used in assessment of health care–related material on the Internet.[17,28,31–33] The mean total LIDA score fell within the range described by the aforementioned studies, approximating the outcome of 65% of the orthodontic study of Patel and Cobourne.[17] Looking at the individual categories, the Web pages were rated with medium accessibility, even though they scored higher than all of the previous LIDA studies. Despite the ongoing efforts of Web administrators to secure availability for people with disabilities or with low-end technology,[11] further improvement in this area should be pursued. Usability results exhibited a higher variability than did accessibility results, with the domains supported by specialists displaying the greatest scores. Efficient presentation of the information data is as essential as the information, per se. From this point of view, Internet users may continue the search even after accessing a page containing the desired answer, although the page is poorly organized.[21] Lastly, we discerned a considerably low reliability of the sites under investigation, with direct implications for site transparency, expert authorship, review procedures, and update frequency. Therefore, the average, non–scientifically qualified person may be at risk of being misinformed or manipulated by secondary profit motives.

Access to controlled, user-friendly, and reliable information relating to orthodontic pain may offer numerous benefits to the public. By gaining knowledge over underlying causality, impact on daily activities, and alleviation strategies, patients can become more compliant and at the same time can be more active in a shared consumer-specialist decision-making model, keeping pace with the international trend in health care provision. Continuous development of orthodontic information e-resources and communities will contribute to improvement of quality health care in the near future. In the meantime, orthodontists should temper the existing discrepancy by referring patients to evidence-based education materials on the Internet.

CONCLUSIONS

- In this multiple evaluative study, we realized a variable quality of Internet information about pain experience encountered by orthodontic patients. The Web sites were regarded as disseminating incomplete data that require standard reading skills. LIDA scores for accessibility, usability, and reliability ranged from medium to low, with the last category being rated the least.
- No inferences could be made with regard to the relationship between authorship and quality of

informational content. Internet users should be aware of the limitations when searching for online orthodontic advice and should allow themselves to be guided by specialists to valid Web databases.

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