ORIGINAL RESEARCH ARTICLE

How Qualified is Online Information Regarding Space Maintainers? A Content-quality and Readability Analysis

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Abstract

Purpose: To evaluate the reliability, quality, and readability of information regarding space maintainers on English websites using different scales.

Materials and Methods: The selected search terms, which were "space maintainer", "band and loop", "distal shoe space maintainer", "nance appliance", and "lingual arch" were searched by four search engines (Yahoo, Bing, Yandex, and Google), and 992 websites were recorded. The websites were evaluated using the Journal of American Medical Association (JAMA), Quality Criteria for Consumer Health Information (DISCERN), Flesch-Kincaid Grade Level (FKGL), and Flesch Reading Ease Score (FRES) instruments.

Results: Among the 90 websites included in the study, Professional Health Organization (PHO) websites had significantly higher DISCERN quality index scores in all sections and total (p<0.05) compared to other websites. There were no significant differences between websites regarding FKGL and FRES readability scale scores (p>0.05). Only 3 (3.3%) met all JAMA criteria and PHO websites scored significantly higher than the others in almost all categories (p<0.05).

Conclusions: Within the limitation of this study, the quality and readability of web-based information regarding pediatric space maintainers was low level and scientcally imperfect. It would be beneficial for health professionals to publish quality websites that are reliable, contain quality information, and are easy to understand by the patient.

Key words: Information; Internet; Quality; Space maintainers; Websites

Introduction

The Internet has recently become a preferred source of information for healthcare professionals and patients. [1,2] In the United States (US), web-based healthcare information is one of the most common sources of information for patients, following the recommendations of doctors. [3] Similarly, in a study, 71% of Internet users obtain information on health-related issues via Internet in seven European countries. [4] This increased demand for online health information has led to the development of numerous websites. [5] Many health-related websites include personal blog accounts of diseases, forums where patients share information, and articles from scientific journals. [6] The information on the Internet should be equivalent to or higher than that provided by health professionals. [7] Therefore, patients must have access to accurate, reliable, and quality information. [1] Low-quality information creates a trust problem between doctors and patients. Health professionals should direct patients who want to learn more about quality Internet-based resources in every aspect. [8]

The Internet, which provides large-scale data in the health field, has powerful potential to raise awareness of patients. [9] However, while patients increase their knowledge of dentistry with the information they obtain over the Internet, the possibility of inaccurate information continues to pose a major problem. [10] The greatest disadvantage of Internet-based health-related data is that a controller cannot audit it. Any desired information can be published online without questioning the quality and reliability of any person or organization. [11]

Early loss of primary teeth often occurs as a result of dentoalveolar abscesses, trauma, internal/external resorptions, and caries that cause excessive material loss. [12] This may cause problems such as decreased arch length, crowding, ectopic eruption, impaction of permanent teeth, crossbite, and midline deviation. [13] Space maintainers are fixed or movable appliances used to preserve arch length, aesthetics, function and phonation following the premature loss of a tooth or teeth.

This is the first study evaluating the information on websites regarding space maintainers, which is important in pediatric dentistry. This study aims to evaluate the reliability, quality, and readability of web-based information on English websites for space maintainers using different scales.

Material and Methods

Search Strategy

The most popular searched terms about 'space maintainers' by internet users in English were determined for the last 12 months (May 2022-May 2023) via Google Trends application. According to the evaluation, it was determined that the most searched words in English were 'space maintainer', 'band and loop', 'distal shoe space maintainer', 'nance appliance', and 'lingual arch'.

A researcher in the US performed a website search using a virtual private network (VPN). User history was cleared before the searches and between entries for each search term. The search engine was not logged in to avoid being affected by previous search history. The related websites were searched using Google, Yandex, Bing, and Yahoo Internet search engines using the five most searched word groups. Based on the previous studies using search engines, it was found that users did not continue searching after the first five pages [12] or rarely searched after the first ten results [13]. For this reason, the results of the first five pages of the relevant search engines were evaluated. Microsoft Excel saved websites as uniform resource locator (URL) files for each search term.

Inclusion/Exclusion Criteria

In this study, 990 websites in English were researched. Before the analysis, links to scientific articles, duplicate websites, advertisements, social media/video sites, information/presentation sites, dental store/laboratory sites, forums/blogs, and irrelevant websites were excluded (Figure 1). The study was designed with 90 websites. To determine the researcher's internal reliability, 2 weeks after 90 websites were scored, 10 websites were randomly selected from the website links and re-evaluated. To group the data, the websites were divided into Dental Professionals (DP), Dental Clinics (DC), and Professional Health Organizations (PHO).

Evaluation of Reliability, Quality, and Readability

Journal of American Medical Association (JAMA) and Quality Criteria for Consumer Health Information (DISCERN) criteria were applied to evaluate the information quality of the websites. DISCERN is the first standardized quality criteria of consumer health information to evaluate written information about treatment options. [14] The DISCERN includes a questionnaire with 16 questions, each scored from 1 to 5 on a Likert scale. The questions in the DISCERN consist of three parts: The first part (questions 1-8) was used to determine the reliability of the website, and the second part (questions 9-15) was used to evaluate the information quality about treatment options. The third part (Question 16) provides a general quality evaluation of the website. In the DISCERN quality index, websites with a score of 16-26 are very poor, 27-38 are poor, 39-50 are moderate, 51-62 are very good, and websites with a score higher than 63 are evaluated as excellent. [14] The presence of the Health on the Net (HON) code was investigated. HONCode is the most commonly used certification for the quality of healthcare information online. It was established to promote quality health information to facilitate access to the most relevant and latest from the Internet. [15] According to high-quality, transparent information standards, this institution evaluates applications for health-related websites using eight criteria (privacy, complementarity, authoritativeness, justi-
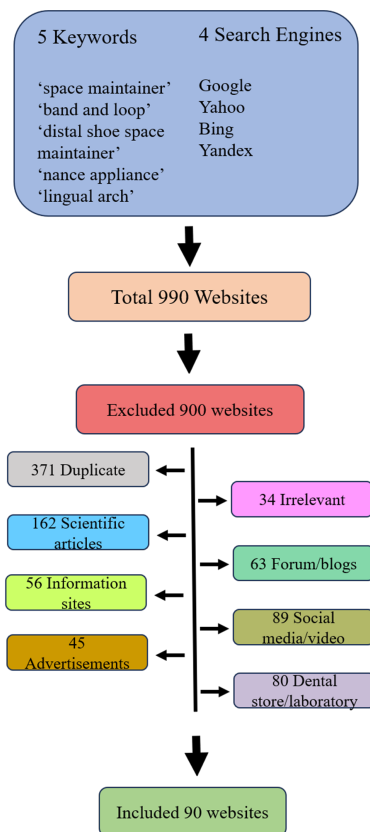

Figure 1. Flow chart

fiability, attribution, transparency, disclosure, and variations of advertisements). If the website contains these standards, a one-year valid HONCode certificate is issued, and the certificate expires at the end of the year. [15] The JAMA evaluate the justification and reliability of medical information for healthcare information resources on the Internet. [16,17] It consists of four parts: authorship, attribution, disclosure, and currency to evaluate the basic information presented on websites. [17] Each item provided in the JAMA criteria was evaluated as 1 point.

The readability of websites was evaluated using the Flesch-Kincaid Grade Level (FKGL) and Flesch Reading Ease Score (FRES) scores. All relevant article content on the relevant website was included and calculated automatically via a FRES/FKGL calculator to accurately calculate scoring. Among the most appropriate readability formulas used to analyze health information on the Internet are FRES and FKGL, developed by the United States Department of Defense. [18] These tools are highly reliable for assessing health-related websites. [19] The FRES uses the length of a sentence and the number of syllables to determine a score between 0 and 100; the higher the score, the easier the readability of the website. [20] According to the FRES analysis, the score should be 65 to reach basic English. [21] FKGL provides a readability score considering the US education level and represents the number of years of schooling required to figure out the context of the text.

Statistical Analysis

Jamovi software (v2.3.26) was used to perform statistical analysis. The Shapiro-Wilk test was used to determine normality. The data had a non-normal distribution and ordinal variables; therefore, the Kruskal-Wallis test was used to compare websites based on scores. For pairwise comparison, the Dwass-Steel-Critchlow-Fligner test was conducted. The Fisher-Exact Test was also used for categorical
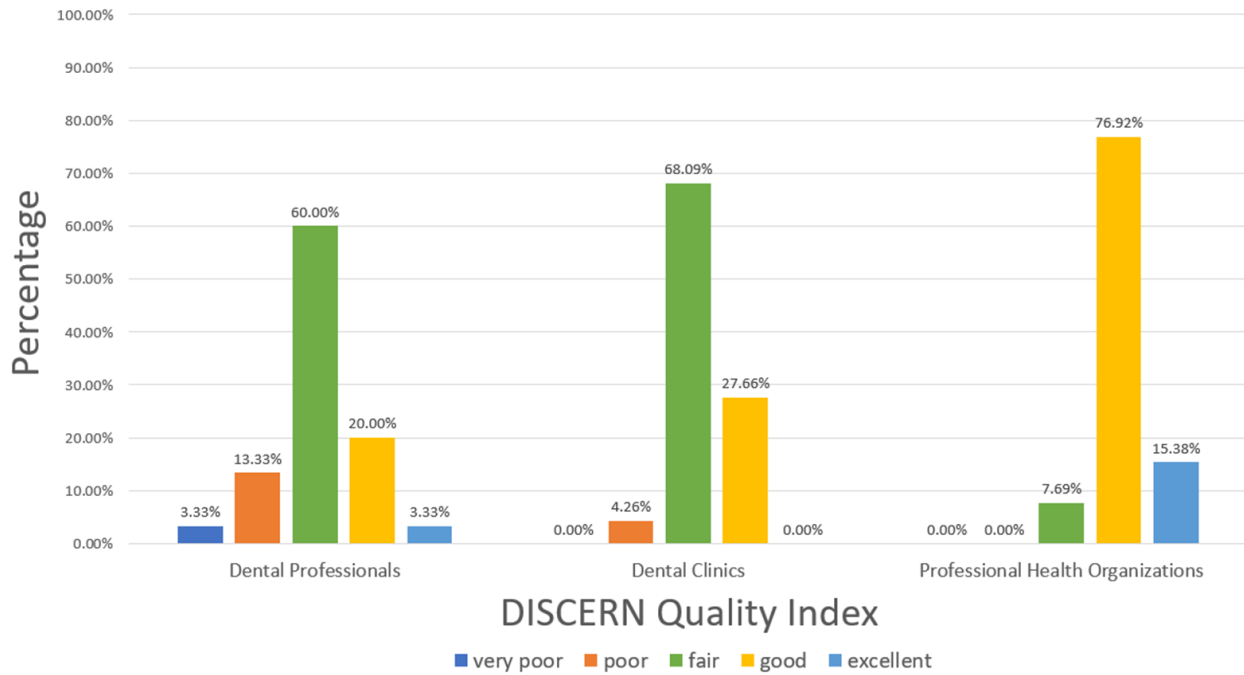
Figure 2. DISCERN Quality Scores of the Websites (%)

variables on the JAMA benchmark scale. Spearman's Correlation analysis was performed to compare the scales. Correlation coefficients with an absolute value lower than 0.40 were considered low, between 0.40 and 0.60 moderate, and above 0.60 high strength.[22] Intra-rater agreement was assessed by Cohen's Kappa coefficient. The data was summarized by median (min-max) or N(%). The level of significance was set at p<0.05.

Results

A total of 992 websites in English worldwide were detected on the Internet. Following the exclusion criteria, we planned to work on 90 websites. Of these websites, 30 (33.3%) belonged to the DP group, 47 (52.2%) to the DC group, and 13 (14.4%) to the PHO group. As a result of kappa analysis, a high level of intraobserver agreement was determined for DISCERN (k = 0.853), JAMA (k = 0.814), FKGL (k = 0.825), and FRES (k = 0.843).

DISCERN, HONCode, and JAMA Results of the Websites

The median scores for DISCERN in Sections 1, 2, and 3 were 24 (range 13-40), 25 (range 7-35), and 3 (range 1-5), respectively. The total DISCERN score was 48 (range 24-75). PHO websites had statistically higher DISCERN scores in all sections and total (p<0.05) compared to other websites (Table 1). The DISCERN quality index for the websites are shown in Figure 2. There were no websites with HONCode certificates among the researched ones.

Only three (3.3%) websites met all the JAMA criteria and belonged to the PHO group. Among all the sites, Disclosure was the most complied criterion among the JAMA criteria (61.1%), whereas Attribution was the least (4.4%). Ten websites (33.3%) did not provide none of all JAMA criteria in the DP group, and 18 websites (38.2%) were found in the DC group.

According to the JAMA benchmark, there were significant differences between groups in in almost all categories (p<0.05), but no significant difference in Disclosure criteria (p>0.05). In all categories, PHO websites exhibited higher scores than the other websites. The total quality score of PHO websites was also significantly higher than that of the others (p<0.05), with a median score of 2 (range 1-4). Overall websites' total quality scores were 1 (range 0-4) (Table 2). The JAMA benchmark for the study groups are shown in Figure 3.

There was a significant positive correlation between the FRES and JAMA scores and DISCERN (p<0.05). But the positive correlation between JAMA and DISCERN had medium strength (p<0.05). In contrast, FKGL scores showed a significant high strength negative correlation with the FRES scores (p<0.05), and low strength negative correlation with DISCERN. However, no significant correlation was between JAMA and FKGL scores (p>0.05), as shown in Figure 4.

FRES and FKGL Results of the Websites

The median scores for FRES and FKGL were 62.15 (range 33.1-75.2) and 9.1 (range 5.2-17.5), respectively. There was no significant difference between the groups in FRES and FKGL scores (p>0.05) (Table 1).

Discussion

In this study, PHO websites had statistically higher DISCERN scores in all sections and total. There were no websites with HONCode certificates among the researched ones. Only 3 websites met all the JAMA criteria which were in the PHO group. According to the JAMA benchmark, PHO websites scored significantly higher than the others in almost all categories. There were no significant differences between groups in FRES and FKGL scores.

With the development of technology, the Internet has become the primary source of information that patients commonly use to obtain information about health services.[23] However, even though the increasing amount of information on the Internet, no research has been conducted on the readability, reliability, and quality of the data on websites containing information about pediatric space maintainers frequently used in pediatric dentistry. In this study,

Table 1. Comparison of DISCERN, FRES, and FKGL scores among Dental Professionals, Dental Clinics, and Professional Health Organizations groups

	Dental Professionals	Dental Clinics	Professional Health Organizations	Total	P-value
DISCERN Scores					
Section 1	23 (13-30) a	23 (16-28) a	28 (22-40) b	24 (13-40)	<.001
Section 2	25 (7-34) a	25 (15-34) a	29 (17-35) b	25 (7-35)	0.030
Total	46.5 (24-63) a	47 (31-60) a	56 (49-75) b	48 (24-75)	<.001
Section 3	2 (1-4) a	2 (1-4) a	3 (2-5) b	3 (1-5)	0.005
FRES	62.05 (44-75.2)	62 (33.1-73.9)	64.7 (37.5-70.3)	62.15 (33.1-75.2)	0.934
FKGL	9 (5.2-14.2)	9.2 (6.1-17.5)	9 (7.2-13.9)	9.1 (5.2-17.5)	0.744

Quality Criteria for Consumer Health Information (DISCERN), Flesch-Kincaid Grade Level (FKGL), Flesch Reading Ease Score (FRES). Median (Min-Max), Kruskal Wallis Test and Dwass-Steel-Critchlow-Fligner pairwise comparisons. Different uppercase letters indicate significant differences in the row.

Table 2. Comparison of JAMA benchmarks among Dental Professionals, Dental Clinics, and Professional Health Organizations groups

|	Dental Professionals	Dental Clinics	Professional Health Organizations	Total	P-value
Authorship[1]					<0.001†
No	27 (90.0%)	43 (91.5%)	5 (38.5%)	75 (83.3%)	
Yes	3 (10.0%)	4 (8.5%)	8 (61.5%)	15 (16.7%)	
Attribution[1]					0.002†
No	29 (96.7%)	47 (100.0%)	10 (76.9%)	86 (95.6%)	
Yes	1 (3.3%)	0 (0.0%)	3 (23.1%)	4 (4.4%)	
Disclosure[1]					0.115†
No	11 (36.7%)	22 (46.8%)	2 (15.4%)	35 (38.9%)	
Yes	19 (63.3%)	25 (53.2%)	11 (84.6%)	55 (61.1%)	
Currency[1]					<0.001†
No	26 (86.7%)	42 (89.4%)	3 (23.1%)	71 (78.9%)	
Yes	4 (13.3%)	5 (10.6%)	10 (76.9%)	19 (21.1%)	
Total Quality[2] Score	1 (0-3)a	1 (0-3)a	2 (1-4)b	1 (0-4)	<0.001‡

[1]n (%), [2]Median (min-max), †Fisher-Exact Test, ‡Kruskal Wallis Test and Dwass-Steel-Critchlow-Fligner pairwise comparisons. Different uppercase letters indicate significant differences in the row.
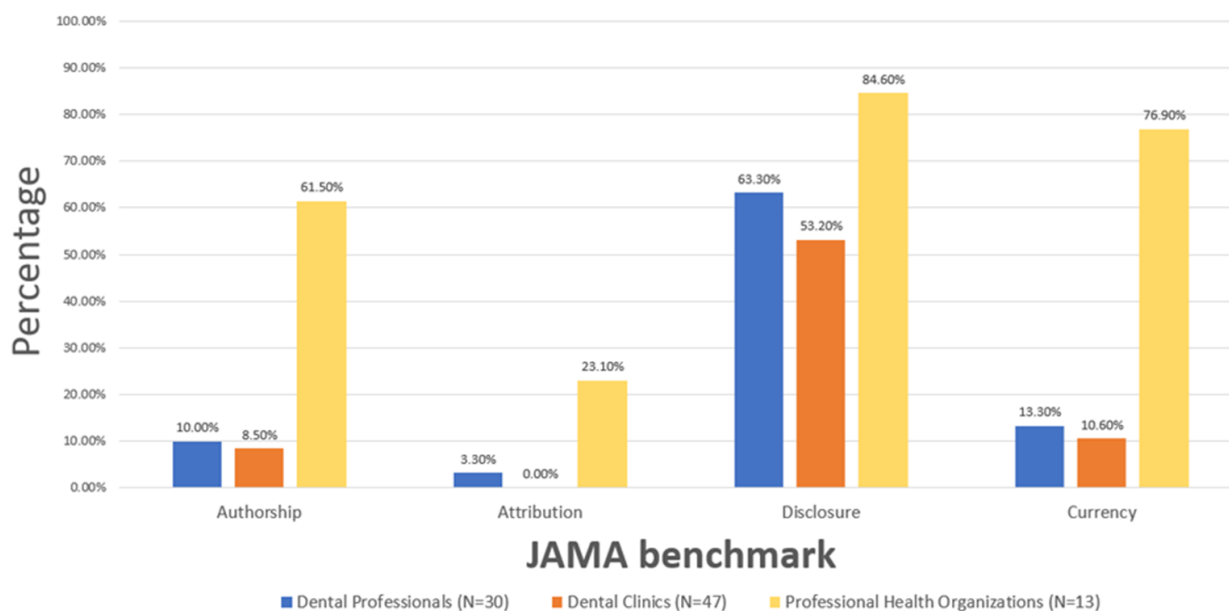
Figure 3. JAMA Benchmarks of the Websites (%)

for the first time, using Google, Yahoo, Bing, and Yandex search engines, worldwide English websites related to space maintainers were extensively evaluated using the DISCERN quality index, JAMA criteria, HONCode certification, FRES, and FKGL readability scale.

Different search engines have been used to evaluate the quality of Internet-based information.[24] Yahoo, Bing, Yandex, and Google search engines were used to expand the scope of the study. According to the algorithm used in search engines, websites related to the searched terms are in the top ranks. When DISCERN quality index scores were examined, the total score of all sites (Sections 1 and 2) was found to be 48 (moderate score). In the comparison between groups, PHO had the highest score in all sections and the highest total score compared to the DP and DC groups. Similarly, it has been reported that health sites show the highest DISCERN scores in
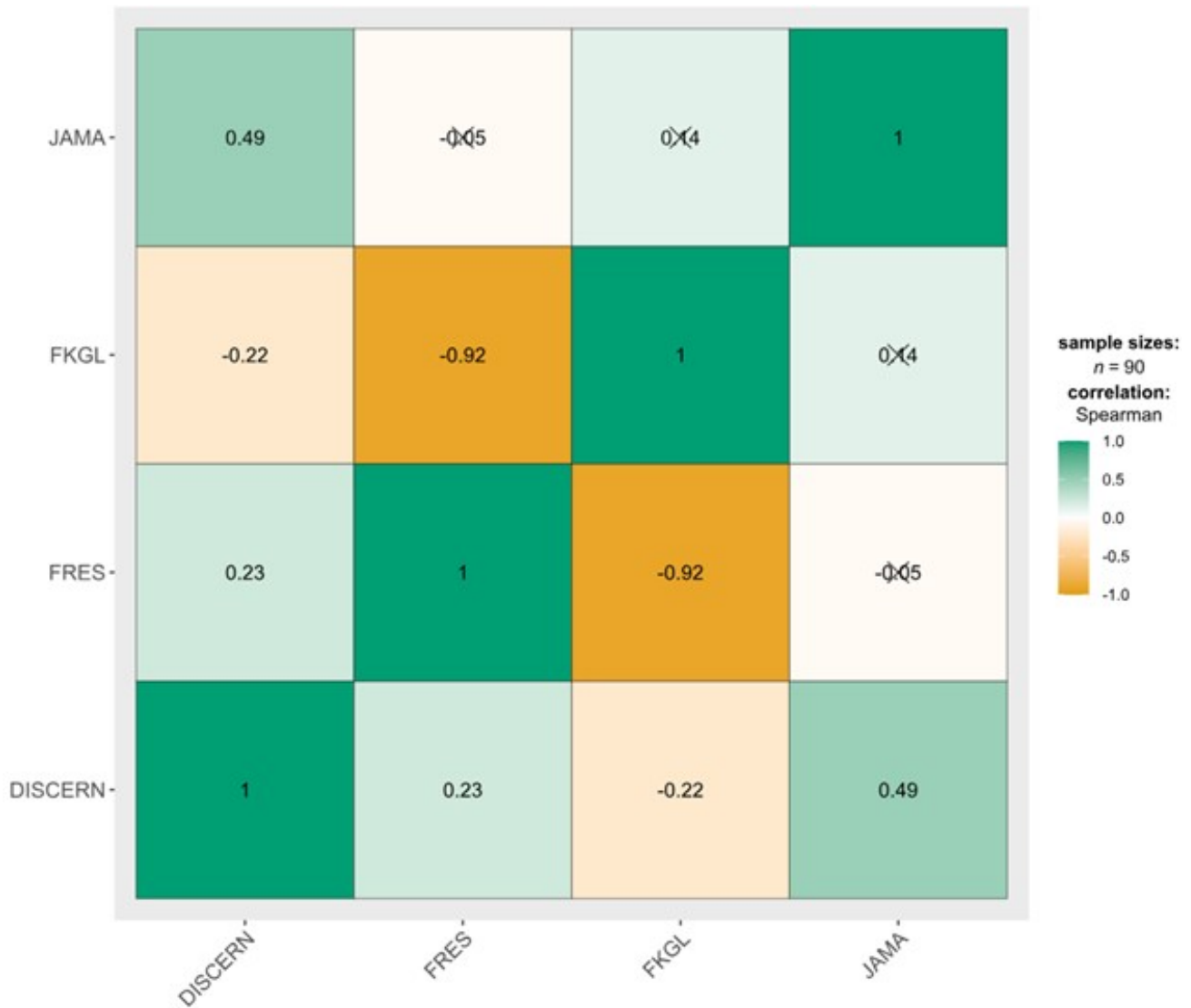
Figure 4. Correlation matrix boxes: green and orange boxes indicate positive and negative correlations, respectively (Colour tones indicate the strength of the correlation). Boxes without "X" indicate significance (p<0.05). The numbers on the boxes are Spearman's correlation coefficients.

Demirsoy et al.[25] and the study by Meade and Dreyer[26]. This may be because the PHO group had lower commercial concerns, was less biased, and received professional help in organizing websites.

In this study, the PHO websites had the highest scores among the JAMA criteria. Among the evaluated criteria, the highest scores were determined for the Disclosure criterion. In a study by Haque et al.[27], evaluated the quality of web-based information, the Disclosure criterion was high, with a score of 88%. In their study on adult orthodontics, McMorrow and Millett[28] found that the Disclosure criterion had the lowest score of 31%. The different scores of the JAMA criteria in the studies may be due to the variability in the quality of the websites that shared information on various subjects. In the Attribution criterion, low scores were obtained, in line with data in the literature. Olkun et al.[23] reported that the Attribution criterion had the lowest score (7%) in their study on lingual orthodontics. Similarly, Meade and Dreyer[26] reported that, among the JAMA criteria, the citation criterion received the lowest score of 14%. This indicates that websites lack resources. Information shared without acknowledging the source causes uncertainty regarding website reliability. For this reason, health professionals should indicate the sources of the articles on these websites.

The mean FRES score for all websites was 62.15, and the FKGL score was 9.1. This study's results showed that the readability of the content was moderate. While showing that approximately ten years of school education in the US is required to correctly understand the information given in the current study, most patient-oriented studies emphasize that a 6th-grade reading level is required.[26,29]

This study has some limitations. While browsing websites, the study universe can be expanded by researching various languages. There may be differences in the contents and rankings of websites at different times. Being as in other studies evaluating the reliability of web-based information, this study discusses current conditions over a period of time. However, because the essence of the Internet is variable, the level and quality of information can constantly change.

Conclusion

This study showed that the quality and redability of web-based information on pediatric space maintainers was low level. To increase the readability level, health professionals should include content consisting of short and understandable sentences in their written texts. It is helpful to publish quality websites that contain reliable and high-quality information about pediatric space maintainers that are both free of commercial interests and easy for the patient to understand.

Author Contributions

S.E.A: Conceptualization, Methodology, Investigation, Data Curation, Writing Original Draft, Review&Editing

Conflict of Interest

The authors declare that they have no conflict of interest.

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