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Original Article *Özgün Araştırma*

CAN YOU TELL ME ABOUT SCOLIOSIS? COMPARISON OF QUALITY, RELIABILITY, AND CONSERVATIVE TREATMENT CONTENTS OF TURKISH WEBSITES AND YOUTUBE VIDEOS ON ADOLESCENT IDIOPATHIC SCOLIOSIS

Bana Skolyozu Anlatır mısın? Adölesan İdiopatik Skolyoz Konulu Türkçe İnternet Sayfaları ve Youtube Videolarının Kalite, Güvenilirlik ve Konservatif Tedavi İçeriklerinin Karşılaştırılması

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ABSTRACT

Objective: The aim of the study was to compare the quality and reliability of Turkish web pages and YouTube videos prepared for adolescent idiopathic scoliosis information. Another aim of the study was to compare whether internet pages and YouTube videos contain some features related to conservative treatment (brace and exercise).

Material and Methods: A total of 46 Turkish digital contents related to adolescent idiopathic scoliosis (23 web pages and 23 YouTube videos) were included in the study. The quality of digital content was measured according to the general quality score and reliability of the Journal of American Medical Association benchmark criteria.

Results: The general quality scores (p=0.540) and Journal of American Medical Association benchmark scores (p=0.591) of the Turkish websites and the YouTube videos related to adolescent idiopathic scoliosis were similar. However, the reliability and educational quality of Turkish websites and videos on adolescent idiopathic scoliosis were insufficient.

Conclusion: Although the Turkish website and YouTube videos on adolescent idiopathic scoliosis contain valuable information, their quality and reliability need to be increased. Video and web pages are not advantageous compared to each other in terms of educational quality. Additionally, videos and websites should include more information about the conservative treatment of adolescent idiopathic scoliosis.

Keywords: *Adolescent, internet, scoliosis, spine*

ÖZ

Amaç: Çalışmanın amacı adölesan idiopatik skolyoz bilgilendirmesi için hazırlanmış Türkçe internet sayfaları ve YouTube videolarının kalite ve güvenilirliğini karşılaştırmaktı. İnternet sayfaları ile Youtube videolarının konservatif tedavi (korse ve egzersiz) içeriklerinin karşılaştırılması çalışmanın bir diğer amacıydı.

Gereç ve Yöntemler: Adölesan idiyopatik skolyoz ile ilgili toplam 46 Türkçe dijital içerik (23 web sayfası ve 23 YouTube videosu) çalışmaya alındı. Dijital içeriklerin kalitesi genel kalite skoru ve güvenilirlikleri Amerikan Tabipler Birliği Dergisi karşılaştırma kriterlerine göre ölçüldü.

Bulgular: Adölesan idiopatik skolyoz ile ilişkili Türkçe internet sayfaları ile Youtube videolarının genel kalite skorları (p=0,540) ve Amerikan Tabipler Birliği karşılaştırma skorları (p=0,591) benzerdi. Bununla birlikte adölesan idiopatik skolyoz ile ilgili Türkçe internet sayfalarının ve videolarnın güvenilirlikleri ve eğitsel kaliteleri yetersizdi.

Sonuç: Adölesan idiopatik skolyoz konulu Türkçe internet sayfa ve YouTube videoları değerli bilgiler içermesine rağmen kalite ve güvenilirliklerinin arttırılması gerekmektedir. Video ve internet sayfaları eğitsel kalite açısından birbirine göre avantajlı değildir. Ayrıca video ve internet sayfalarının adölesan idiopatik skolyozun konservatif tedavisi ile ilgili bilgilere daha çok yer vermesi gerekmektedir.

Anahtar Kelimeler: *Adölesan, internet, skolyoz, omurga*

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INTRODUCTION

Scoliosis is 10° or more frontal plane curvature of the spine that is radiologically confirmed. The etiology of the majority (80%) of cases is unknown and is referred to as idiopathic scoliosis (1,2). Most cases of idiopathic scoliosis (80-90%) occur between the ages of 11-18 and are defined as adolescent idiopathic scoliosis. The worldwide prevalence of adolescent idiopathic scoliosis is 0.47-5.20% (3). In Turkey, this rate is reported to be 2.3% (4). Conservative and surgical treatment options are available in adolescent idiopathic scoliosis (5-8). Treatment is a long process and requires active participation and compliance of the patient and/or caregivers (9). This participation and compliance are directly related to the patients' levels of knowledge about scoliosis (10). Nowadays the internet has become the most important resource that patients and/or caregivers use to get information about scoliosis like other diseases (11,12). It has been reported that adolescent idiopathic scoliosis patients and their caregivers use Internet resources almost twice as much to understand their diagnosis compared to other orthopedic patients (12). Nevertheless, studies on scoliosis have reported that the quality and reliability of Internet-based information is not sufficient (12-15). Additionally, more studies are needed to determine whether Internet-based information can contribute to the management of the deformity, apart from simple education about scoliosis and its treatment (14).

The importance of patient education in scoliosis and the transformation of the internet into a conventional information source in patient education have led to the need for studies on the accuracy and quality of internet content on scoliosis. As far as we know, the quality and reliability of Turkish websites and YouTube videos providing information about adolescent idiopathic scoliosis have not been investigated before. For these reasons, in this study, we aimed to compare the reliability and quality of websites and YouTube videos on adolescent idiopathic scoliosis. Also we aimed to examine whether web pages and YouTube videos contain information about certain features of exercise and brace treatments, which are among the conservative treatment regimens of scoliosis.

MATERIALS AND METHODS

A total of 46 digital content, including 23 web pages and 23 YouTube videos, were included in the study. The inclusion criteria were websites and YouTube videos covering the topic of adolescent idiopathic scoliosis in Turkish. Exclusion criteria; sponsored content, videos provided by sources other than YouTube, similar content from the same source, videos describing patient experiences, those not prepared by healthcare professionals, and a Wikipedia page (12-15). Furthermore, videos shorter than 4 minutes or longer than 20 minutes were excluded as it was assumed that these videos would either not contain enough information for analysis or would be too long to attract the viewer's attention (16,17). Since public internet pages and YouTube videos were used in this study ethical approval and informed consent were not required.

The keyword 'adolescent idiopathic scoliosis' was typed in Turkish into the Google search engine on June 15, 2023. Of the first 39 Turkish web pages scanned 23 of them meeting the inclusion criteria were included in the study. Sponsored content (n=9), Wikipedia page (n=1), and similar content from the same source (n=6) were excluded. However, among the first 47 Turkish YouTube videos, 23 that met the inclusion criteria were included in the study. Similar videos from the same source (n=17), patient experience (n=3), and videos prepared by non-health care professionals (n=4) were excluded.

Outcomes

It was noted whether internet pages and YouTube videos provided information about scoliosis diagnosis, surgical treatment, brace treatment, and exercise therapy (13). In addition, the information provided by the contents about exercise and brace treatment was detailed. It was recorded whether the contents emphasized the importance of exercise therapy, whether there was a warning about the results of incorrect exercise programs, whether they gave information about the type of exercise and specific exercise approaches recommended by The International Society on Scoliosis Orthopedic and Rehabilitation Treatment (SOSORT) (8). It was determined whether the contents contained information about the importance of brace treatment indication for brace treatment, how the brace should be used, and when the brace should be dropped (9).

The quality of web pages and YouTube videos was measured with the general quality score scale and recorded as the GQS. According to the general quality score scale, the content was scored between 1 and 5, and the educational quality of the content, which was not specific to scoliosis, was determined (Table 1). The higher score indicated the better quality (18). Scoring was done by each researcher separately. Researchers examined the different rated contents together and reached a consensus on a common score.

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Table 1: General quality score criteria

Score	Explanation
1	Low quality; extremely improbable to provide any benefit for patients
2	Low quality, however some knowledge is available; very little utilize for patients
3	Suboptimal flow, some knowledge covered however significant issues lacking; slightly helpful for patients
4	Well quality and fluent, the most significant issues are covered; beneficial to patients
5	Superb quality and fluent; extremely helpful for patients

The accuracy and reliability of the source of web pages and YouTube videos were evaluated using the Journal of the American Medical Association (JAMA) benchmarks. These criteria are; authorship, attribution, explanation, and timeliness (Table 2) (19). Web pages and YouTube videos were given 1 point if they contained information about the criterion, and 0 if they did not. The sum of the scores from each criterion was recorded as the JAMA score and the higher the score indicated the better the accuracy and reliability of the source. Scoring was done by each researcher separately. Researchers evaluated websites and YouTube videos with different scores together and reached a consensus on a common score.

Table 2: The Journal of American Medical Association (JAMA) benchmark criteria

Authorship	Creators and contributors, their ties, and related certification should be supplied.
Attribution	References and fountain-heads for whole context should be distinctly noted and all associated copyright knowledge listed.
Disclosure	Internet site "possession", any sponsorship, advertisement, insurance, commercial financing agreements or assist, or potency conflicts of interest must be distinctly and full revealed.
Currency	Uploaded date and updated dates of the context was should be pointed out.

Statistical analysis

The sample size was calculated using G*Power version 3.1.7 for Windows (G*Power, University of Düsseldorf, Düsseldorf, Germany) based on a calculation of the study's power to detect significant changes in GQS. This calculation was performed using the GQS of the surgery technique and exercise training variables for kyphosis reported in a study by Erdem MN and Karaca S. (20). Accordingly, a total of at least 46 items, 23 in each group, had to be included in the study (effect size=0.99, alpha=0.05, 1-beta=0.95; current power=95).

SPSS (SPSS,V20; IBM Corp) was used for data analysis. The conformity of the data to the normal distribution was examined by visual methods (histogram and qq graphs), analytical methods (Shapiro Wilk test), and coefficients of kurtosis and skewness. Continuous variables were expressed as mean ± standard deviation values, categorical variables as numbers (n) and percentages (%). The significance of the difference between two means test was used to compare data that met the parametric test assumptions. Differences between categorical variables were determined by Chi-square analysis.

RESULTS

The occupational distribution of the examined websites and YouTube video creators are given in Figure 1. Among the YouTube videos (n=23) and web pages (n=23) included in the study, the number of videos and web pages providing information about the definition (p=1.00), diagnosis (p=0.381) and surgery (p=0.127) of scoliosis were similar (Table 3). JAMA (p=0.591) and GQS (p=0.540) scores of the YouTube videos and web pages included in the study were similar (Figure 2).

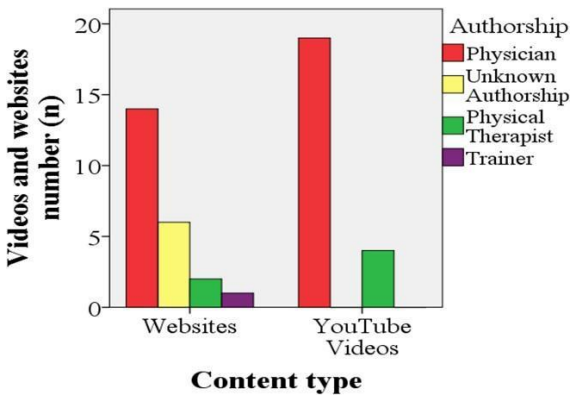

Figure 1: Occupation distribution of content creators

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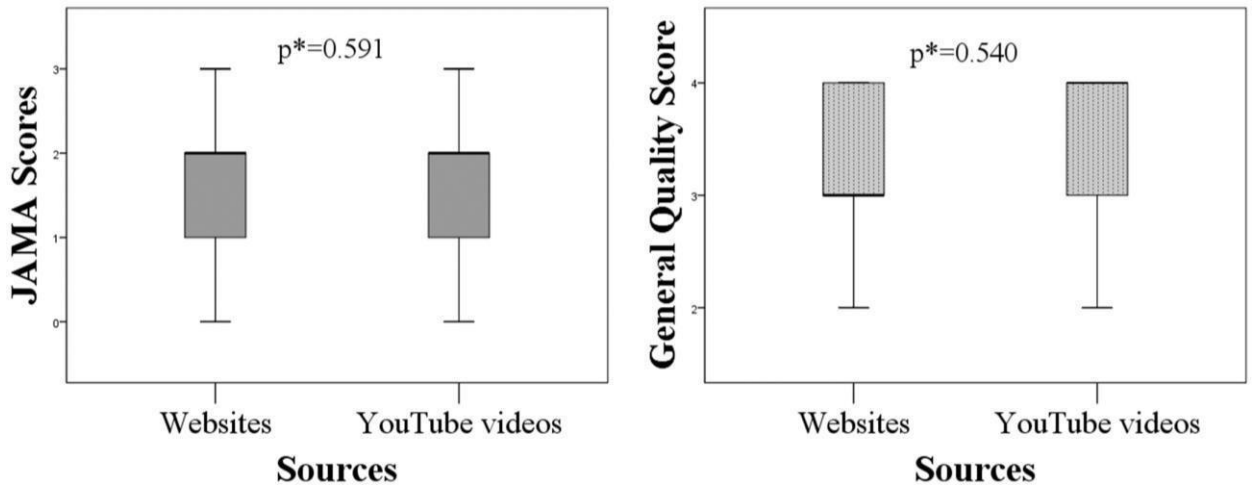

Figure 2: General quality and JAMA scores of content

The number of web pages and YouTube videos emphasizing the role of exercise therapy in adolescent idiopathic scoliosis was similar (p=0.555). The number of YouTube videos explaining the importance of exercise in scoliosis was more than the number of internet pages (p=0.001). However, the number of web pages stating that improperly planned exercise approaches may be harmful was higher than the number of YouTube videos (p=0.020) (Table 3). In addition, while all scoliosis-specific exercise approaches recommended by SOSORT were included in 1 (7.7%) of the web pages, only the Schroth method was mentioned in 8 (61.5%) and none of them were mentioned in 4 (30.8%). While the Schroth method was mentioned in 5 (45.5%) of YouTube videos, none were mentioned in 6 (54.5) (Table 3).

The number of internet pages including information about brace treatment for adolescent idiopathic scoliosis was higher than the number of YouTube videos (p=0.017) (Table 3). However, the importance of the brace was emphasized in all of the YouTube videos including information about the brace, and in 9 (52.9%) of the internet pages (p=0.013) (Table 3).

Table 3: Distribution of the contents according to the information they cover

		YouTube video (n=23)		Web site (n=23)		
		Information available n (%)	No information n (%)	Information available n (%)	No information n (%)	p^x
Definition		23 (100)	0 (0)	23 (100)	0 (0)	1.000
Diagnosis		19 (82.6)	4 (17.4)	21(91.3)	2 (8.7)	0.381
Surgery		12(52.2)	11(47.8)	17 (73.9)	6 (26.1)	0.127
Exercise		11 (47.8)	12 (52.2)	13 (56.5)	10 (43.5)	0.555
	The importance of exercise	10 (90.1)	1(9.1)	3 (23.1)	10 (76.9)	**0.001**
	Exercise attention	1 (9.1)	10 (90.1)	7 (53.8)	6 (46.2)	**0.020**
	Exercise type	3 (27.3)	8 (72.7)	3(23.1)	10(76.9)	0.813
	Specific exercise recommendation	5 (45.5)	6 (54.5)	9 (69.2)	4 (30.8)	0.239
Brace		9 (30.1)	14 (60.9)	17 (73.9)	6 (26.1)	**0.017**
	The importance of the brace	9 (100)	0	9 (52.9)	8 (47.1)	**0.013**
	Brace usage	3 (33.3)	6 (66.7)	9 (52.9)	8 (47.1)	0.340
	When to use a brace	8 (88.9)	1 (11.1)	12 (70.6)	5 (29.4)	0.292
	When to leave the brace	0 (0)	9 (100)	3 (17.6)	14 (82.4)	0.180

p^x: Chi-square test

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DISCUSSION

The aim of the study was to compare the JAMA and GQS scores of websites and YouTube videos on adolescent idiopathic scoliosis. In addition, another aim of the study was to examine whether the contents include certain features of exercise and brace that can be included in the treatment plan for adolescent idiopathic scoliosis. The Turkish YouTube videos and websites included in the study were of low quality and limited reliability. However, the video and web pages did not contain sufficient information about the conservative treatment of scoliosis (exercise and brace).

Studies conducted from the beginning of the 2000s, when the prevalence of internet use began to increase, have reported that the quality of digital content dealing with scoliosis is poor (12-15). Rudisill et al reported that the GQS of pediatric scoliosis YouTube videos uploaded from different sources ranged from 1.3±0.5 to 2.2±1.1 (15). The GQS of the websites and YouTube videos dealing with adolescent idiopathic scoliosis were similar according to the results of this study. However, the GQS scores of both websites and YouTube videos in this study showed that the quality of the scoliosis-related content was low and this result supports the information in the literature that the educational quality of internet resources on scoliosis is low. In addition current study results can make an additional contribution to the literature because it shows that the content of adolescent idiopathic scoliosis of two different digital platforms is not superior to each other in terms of quality.

Reliability and accuracy are the most important concerns about health-themed internet content, and studies show that the reliability and accuracy of internet content describing different health topics are insufficient (20). However, according to the results of the limited number of studies, the reliability of internet content about scoliosis is also weak. Staunton et al reported the mean JAMA score of videos dealing with scoliosis as 1.32±0.467 (14). Rudisill et al reported that the JAMA score of pediatric scoliosis videos from different sources ranged from 0.3±0.5 to 1.8±1.0 (15). In this study, it was seen that the JAMA scores of both the internet pages and YouTube videos prepared for information on adolescent idiopathic scoliosis were low.

Conservative treatment (scoliosis-specific exercise and brace), along with surgery, is one of the two main options for the treatment of adolescent idiopathic scoliosis patients (5-8). There are many studies showing that the progression of the Cobb angle can be stopped or even reduced with conservative treatment (5,7,21). However, our results show that there is not enough information about the conservative treatment of adolescent idiopathic scoliosis in Turkish YouTube videos and websites. Moreover, the differences between videos and web pages in this study also reveal that the information given is presented randomly, without a certain order and flow. This may be due to the professional profiles of those who prepared the videos and websites included in the study, not paying enough attention to the conservative treatment of adolescent idiopathic scoliosis, or neglecting the multidisciplinary team approach (22,23).

It is known that brace treatment is an effective treatment option in patients with adolescent idiopathic scoliosis with brace indication, but to our best knowledge, there is no study investigating whether the information provided by internet content about scoliosis brace is sufficient before (21). In this study; the number of internet pages giving information about the use of braces in adolescent idiopathic scoliosis was higher than the number of YouTube videos. The number of YouTube videos and web pages discussing the brace being an effective treatment option was equal. However, although it contains some information about the brace, the number of internet pages that did not emphasize the importance of brace use was more than the number of YouTube videos. It can be said that the YouTube videos and web pages included in the study lack sufficient information about brace and the existing information does not have a regular flow. In the future, based on this result the creation of more comprehensive content on brace use may contribute to the treatment of scoliosis. Because emphasizing the importance of regular use of the brace in patients with adolescent idiopathic scoliosis, specifying who it is indicated for, explaining how it should be used, and when it should be discontinued may increase patients' compliance with the use of braces (5).

Although the level of evidence is not as strong as bracing and surgical treatment, exercise approaches have both psychological and physiological potential benefits in the treatment of scoliosis (6). The inclusion of three-dimensional exercise methods, especially recommended by SOSORT, in the treatment plan may limit or reduce the increase in the curve degree (7). SOSORT recommends DoboMEd, Schroth, Side Shift, and Scientific Exercise Approach to Scoliosis for the conservative treatment of scoliosis (8). According to the results of this study, about half of both websites and YouTube videos did not include any information about scoliosis exercises. The number of YouTube videos explaining the importance of exercise in the treatment plan was more than the number of internet pages providing information on this subject. However, the number of web pages that mentioned the possible negative consequences of incorrect exercise practices was more than the number of YouTube videos. All of the scoliosis-specific exercise approaches were mentioned in only one of the videos and web pages reviewed. The most emphasized specific exercise approach (in 5 videos and 9 websites) was the Schroth

method. The lack of awareness of health professionals about scoliosis-specific exercise methods and/or their negative perspective on these exercise methods may have caused the content examined to be insufficient in this regard.

The study has some limitations. The dynamic nature of the internet and social media platforms is the most important limitation of the study. The videos uploaded or the web pages prepared after the study limits the interpretation of the study results. Another limitation is that only web pages and YouTube videos are included in the study. However, today, information can be shared not only on internet pages or YouTube but also on many other social media platforms and networks. This situation restricts the results of the study to form a general opinion. Another limitation of the study is that the search was conducted only with the term 'adolescent idiopathic scoliosis'. Data available from videos accessible with other keywords, such as 'curvature of the spine' and 'scoliosis deformity in children', could have influenced the results of the current study.

Although web pages and YouTube videos contain valuable information on adolescent scoliosis, health professionals should be encouraged to increase the quality and reliability of relevant resources. However, it is recommended that the contents provide more information about specific exercise approaches and braces which have evidence of positive effects on the conservative treatment of adolescent idiopathic scoliosis. In addition, a multidisciplinary team should prepare the content to increase the quality of internet pages and YouTube videos and to enrich the information they include.

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REFERENCES

1. Negrini S, Donzelli S, Aulisa AG, et al. 2016 SOSORT guidelines: Orthopaedic and rehabilitation treatment of idiopathic scoliosis during growth. *Scoliosis Spinal Disord*. 2018;13(1):1-48.
2. Labelle H, Richards SB, De Kleuver M, et al. Screening for adolescent idiopathic scoliosis: An information statement by the scoliosis research society international task force. *Scoliosis*. 2013;8(1):1-6.
3. Konieczny MR, Senyurt H, Krauspe R. Epidemiology of adolescent idiopathic scoliosis. *J Child Orthop.* 2013;7(1):3-9.
4. Yılmaz H, Zateri C, Ozkan AK, Kayalar G, Berk H. Prevalence of adolescent idiopathic scoliosis in Turkey: An epidemiological study. *Spine J*. 2020;20(6):947-955.
5. Dolan LA, Donzelli S, Zaina F, Weinstein SL, Negrini S. Adolescent idiopathic scoliosis bracing success is influenced by time in brace: Comparative effectiveness analysis of BrAIST and ISICO cohorts. *Spine.* 2020;45(17):1193-1199.
6. Gámiz-Bermúdez F, Obrero-Gaitán E, Zagalaz-Anula N, Lomas-Vega R. Corrective exercise-based therapy for adolescent idiopathic scoliosis: Systematic review and meta-analysis. *Clin Rehabil*. 2022;36(5):597-608.
7. Schreiber S, Parent EC, Hill DL, Hedden DM, Moreau MJ, Southon SC. Patients with adolescent idiopathic scoliosis perceive positive improvements regardless of change in the Cobb angle–Results from a randomized controlled trial comparing a 6-month Schroth intervention added to standard care and standard care alone. SOSORT 2018 Award winner. *BMC Musculoskelet Disord.* 2019;20(1):319.
8. Negrini S, Aulisa AG, Aulisa L, et al. 2011 SOSORT guidelines: Orthopaedic and rehabilitation treatment of idiopathic scoliosis during growth. *Scoliosis.* 2012;7(1):1-35.
9. Negrini S, Grivas TB, Kotwicki T, Rigo M, Zaina F, international Society on Scoliosis Orthopaedic and Rehabilitation Treatment (SOSORT). Guidelines on "standards of management of idiopathic scoliosis with corrective braces in everyday clinics and in clinical research": SOSORT consensus 2008. *Scoliosis*. 2009;4:2.
10. de Vries U, Hampel P, Petermann F. Patient education programs in child and adolescent rehabilitation. *Die Rehabilitation*. 2017;56(2):103-108.
11. Kanchan S, Gaidhane A. Social media role and its impact on public health: A narrative review. *Cureus.* 2023;15(1): e33737.
12. Lysenko M, Law P, Jarvis J, Wright JG. Improving education and coping of scoliosis patients undergoing surgery, and their families, using e-health. *J Child Orthop*. 2016;10(6):673-683.
13. Mathur S, Shanti N, Brkaric M, et al. Surfing for scoliosis: The quality of information available on the Internet. *Spine*. 2005;30(23):2695-2700.
14. Staunton PF, Baker JF, Green J, Devitt A. Online curves: A quality analysis of scoliosis videos on YouTube. *Spine*. 2015;40(23):1857-1861.
15. Rudisill SS, Saleh NZ, Hornung AL, et al. YouTube as a source of information on pediatric scoliosis: A reliability and educational quality analysis. *Spine Deform*. 2023;11(1):3-9.
16. Shungu N, Haley SP, Berini CR, Foster D, Diaz VA. Quality of YouTube videos on prostate cancer screening for black men. *J Am Board Fam Med*. 2021;34(4):724-731.
17. Cinar C. A Comparison of the quality and reliability of YouTube videos uploaded by healthcare professionals about scoliosis in the past decade. *Cureus*. 2023;15(9):e44830.
18. Singh AG, Singh S, Singh PP. YouTube for information on rheumatoid arthritis—a wakeup call?. *J Rheumatol*. 2012;39(5):899-903.
19. Silberg WM, Lundberg GD, Musacchio RA. Assessing, controlling, and assuring the quality of medical information on the Internet: Caveant lector et viewor—Let the reader and viewer beware. *JAMA*. 1997;277(15):1244-1245.
20. Erdem MN, Karaca S. Evaluating the accuracy and quality of the information in kyphosis videos shared on YouTube. *Spine*. 2018;43(22):E1334-1339.

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Doi: 10.24938/kutfd.1403440

21. El Hawary R, Zaaroor-Regev D, Floman Y, Lonner BS, Alkhalife YI, Betz RR. Brace treatment in adolescent idiopathic scoliosis: Risk factors for failure - A literature review. *Spine J*. 2019;19(12):1917-1925.
22. Ridderbusch K, Spiro AS, Kunkel P, Grolle B, Stücker R, Rupprecht M. Strategies for treating scoliosis in early childhood. *Dtsch Arztebl Int*. 2018;115(22):371-376.
23. Negrini, S. Approach to scoliosis changed due to causes other than evidence: patients call for conservative (rehabilitation) experts to join in team orthopedic surgeons. *Disabil Rehabil*. 2008;30(10):731-741.