Readability and quality of online resources on prolotherapy

Proloterapi ile ilgili online kaynakların okunabilirliği ve kalitesi

Dilara Ekici Zincirci[1]

[1] Physical Medicine and Rehabilitation, Prof. Dr. Cemil Taşçıoğlu City Hospital, University of Health Sciences

Abstract

Aim: Prolotherapy is one of the regenerative treatments used in the treatment of musculoskeletal pain. This study aims to evaluate the readability, quality, and content of online resources related to prolotherapy.

Methods: The term 'prolotherapy' was searched using the Google search engine, and the first 125 websites were included. The quality of the websites included in the study was assessed using the Journal of the American Medical Association (JAMA) score. The readability of the sources was assessed using Flesch-Kincaid (FK) reading ease, FK level, and Simple Measure of Gobbledygook (SMOG).

Results: Of the 100 websites included, 29% were classified as high quality (JAMA≥3). JAMA scores differed significantly by website typology (p<0.001), with scientific journal and government-supported websites scoring higher than commercial and health professional websites (p≤0.041). The top 10 websites presented by Google had higher JAMA scores than the remaining websites (p=0.002). No significant differences were observed in readability indices between high- and low-quality websites (all p>0.05); however, the Top 10 websites had lower FKG and SMOG grade-level indices (p=0.015 and p=0.029), while the difference in FRE was not significant (p=0.071). Although a definition of prolotherapy was provided on all websites, the rates of reporting composition, indications, and complications did not differ by website typology (all p≥0.243). By quality group, high-quality websites more frequently reported composition (p=0.006) and complications (p=0.002), whereas reporting of indications was similar (p=0.300).

Conclusion: We found that the majority of websites sharing information about prolotherapy were of poor quality and difficult to read. Notably, the first ten websites that were easily accessible to patients were of a higher quality and easier to read. Government-supported websites were found to be of high quality and easy to read. It seems that public institutions need to play a more active role in providing online information resources.

Keywords: Online systems; prolotherapy; quality control; readability

Öz

Amaç: İnternetin kolay ulaşılabilen bir bilgi kaynağı olması, sunduğu içeriklerin kalitesi ve okunabilirliğinin araştırılmasının önemini arttırmıştır. Proloterapi kas iskelet sistemi ağrılarının tedavisinde kullanılan rejeneratif tedavi yöntemlerinden biridir. Bu çalışmanın amacı proloterapi ilgili online kaynakların okunabilirliğini, kalitesini ve içeriğini değerlendirmektir.

Yöntemler: 'Proloterapi' terimi Google arama motoru kullanılarak aranmış ve ilk 125 web sitesi kaydedildi. Çalışmaya dâhil edilen websitelerinin kalitesi Journal of the American Medical Association (JAMA) skoru kullanılarak değerlendirildi. Kaynakların okunabilirliği Flesch-Kincaid (FK) okuma kolaylığı, FK seviyesi ve Simple Measure of Gobbledygook (SMOG) kullanılarak değerlendirildi.

Bulgular: Çalışmaya dâhil edilen 100 web sitesinin %29'u yüksek kalite (JAMA ≥3) olarak sınıflandırıldı. JAMA skorları web sitesi tipolojilerine göre anlamlı farklılık gösterdi (p<0,001) ve bilimsel dergi ile kamu/kurum destekli siteler ticari ve sağlık profesyoneli/klinik kaynaklı sitelerden daha yüksek skorlar aldı (p≤0,041). Google tarafından sunulan ilk 10 web sitesi, diğer sitelere kıyasla daha yüksek JAMA skoruna sahipti (p=0,002). Yüksek ve düşük kaliteli siteler arasında okunabilirlik indeksleri açısından anlamlı fark saptanmadı (tümü p>0,05); ancak ilk 10 web sitesinin FKG ve SMOG eğitim düzeyi indeksleri daha düşüktü (p=0,015 ve p=0,029), FRE farkı anlamlı değildi (p=0,071). Proloterapinin tanımı tüm sitelerde yer alırken, tipolojiye göre kompozisyon, endikasyon ve komplikasyonların belirtilme oranları farklı değildi (tümü p≥0,243). Kaliteye göre ise yüksek kaliteli sitelerde kompozisyon (p=0,006) ve komplikasyon (p=0,002) bilgisi daha sık yer aldı; endikasyonlar benzerdi (p=0,300).

Sonuç: Proloterapi ile ilgili bilgi paylaşan web sitelerinin büyük çoğunluğunun düşük kaliteli ve okunabilirliğinin zor olduğunu bulduk. Hastaların kolaylıkla ulaştığı ilk 10 web sitesinin daha yüksek kalitede ve okunabilirliğinin ise daha kolay olması dikkat çekiciydi. Devlet destekli web sitelerinin yüksek kalitede ve okunabilirliğinin kolay olduğu görüldü. Kamu kurumlarının online bilgilendirme kaynaklarını kullanmada daha aktif olması gerektiği görülmektedir.

Anahtar Sözcükler: Çevrim içi sistemler; kalite kontrolü; okunabilirlik; proloterapi

Received/*Geliş* : 08.06.2024
Accepted/*Kabul*: 12.12.2025

DOI: 10.21673/anadoluklin.1497827

Corresponding author/*Yazışma yazarı*

Dilara Ekici Zincirci

Sağlık Bilimleri Üniversitesi, Prof. Dr. Cemil Taşçıoğlu Şehir Hastanesi, Fiziksel Tıp ve Rehabilitasyon, İstanbul, Türkiye.
E-mail: drdilaraekici@gmail.com

ORCID
Dilara Ekici Zincirci: 0000-0001-7702-0227

INTRODUCTION

Prolotherapy was first developed by surgeon George Hackett, and it is an injection technique for the treatment of chronic musculoskeletal pain (1–3). It is intended to enhance joint and periarticular stability by promoting remodeling in supporting soft tissues such as ligaments, tendons, and joint capsule, most commonly through injection of a proliferant solution (typically hypertonic dextrose) at tendon/ligament entheses and adjacent structures (4). Proposed mechanisms include induction of a localized inflammatory response and subsequent collagen synthesis and maturation, with potential improvement in tissue tensile properties (5,6).

Clinical interest in prolotherapy has increased over the past two decades, and it has been applied across a range of musculoskeletal conditions, including lateral epicondylitis, rotator cuff tendinopathy, knee osteoarthritis, Achilles tendinopathy, plantar fasciitis, low back pain, and joint laxity (7). Overall, prolotherapy is considered relatively safe; adverse events are uncommon and are typically procedure-related (e.g., bleeding, infection, irritation-related nerve injury), with specific risks dependent on anatomical region and technique (8). Post-injection pain exacerbation may occur transiently, and treatment is commonly delivered in multiple sessions, although protocols may vary by condition and patient factors (2,9).

The widespread use of the internet since the beginning of the last century has also increased its use for obtaining information in the field of health (10). More than 80% of users can access health-related information online (11). Google, Bing, Yahoo! are leading online search engines such as are frequently used tools for accessing information (12). Patients commonly use online resources to confirm clinician-provided information, learn about diagnoses, and explore alternative treatment options (13).

Nowadays, patients are eager to consult Dr. Google. In addition to the increase in the number of websites providing information in the field of health, issues such as the accuracy of the content presented, its relevance, references, the reliability of the information and the products or services it recommends, advertising and sponsorship collaborations have become important (14). Insufficient control of these platforms causes the reliability of the information to decrease. Misinformation may harm users or cause their treatment to be incomplete (15). Consequently, studies assessing the readability and quality of online content for various diseases and interventions have become increasingly common (16–18).

Given the growing interest in prolotherapy among clinicians and patients, the reliability of online prolotherapy-related information warrants systematic evaluation. Therefore, the aim of this study was to assess the readability, quality, and content characteristics of websites providing information about prolotherapy and to identify website features associated with higher-quality information. We hypothesized that overall informational quality would be heterogeneous and that higher-quality content would be more frequently observed on professionally affiliated or institutional websites than on commercially oriented platforms.

MATERIAL AND METHODS

Search strategy and website selection

A cross-sectional evaluation of online information was conducted on April 3, 2024. The keyword "prolotherapy" was entered into the Google search engine, as it is the most widely used general web search platform (19). To minimize personalization effects, browser history and cookies were cleared before the search. The uniform resource locators (URLs) of the first 125 results were recorded, consistent with prior approaches, indicating that users primarily engage with early search results.

Websites were excluded if they: (1) were not in English, (2) were inaccessible or required membership/subscription, (3) provided only audio/video content without substantive text, (4) did not allow access to prolotherapy-related information within the three-click rule, or (5) did not contain information about prolotherapy. The three-click rule is not a formal rule; it assumes that when a reader cannot access the information they are looking for within three clicks on a website's homepage, they become frustrated and leave that site (20)

Of the 125 screened URLs, 25 websites were excluded (9 inaccessible, 6 irrelevant/inappropriate content, 4 duplicate URLs, 3 violating the three-click rule, 2 video-only content, and 1 subscription required), leaving 100 websites for analysis.

Types of websites

Included websites were categorized into eight groups based on ownership and purpose: 1) commercial (selling products or providing services for profit), 2) government (sites produced under the responsibility of a government agency), 3) health portals, 4) non-profit (educational or supportive sites), 5) health professionals (university or individuals), 6) scientific journals, and 7) other (unclassified sites).

Outcomes and assessment tools

The Journal of the American Medical Association (JAMA) score

The quality of online resources was assessed using the Journal of American Medical Association (JAMA) criteria defined and used in previous studies. These criteria were defined in 1997 by Silberg et al. It is a streamlined tool for examining reliability and is scored by summing the presence or absence of four key items. The content of these items is as follows:

1. Authorship; information about authors, contributors, and their affiliations should be included.
2. Bibliography; all references and copyrights must be acknowledged.
3. Disclosure; website "ownership", sponsorship, advertising relationships, and potential conflicts of interest must be clearly and fully stated.
4. Reality (Currency); the date the content was published and updated should be stated (21). Each of the criteria is worth 1 point, with the lowest JAMA score calculated as '0' and the highest as '4'. Websites with a JAMA score ≥3 are considered high quality, and those with a JAMA score ≤2 are considered low quality (21).

Readability

Readability was analyzed using an online readability tool (WebFX Readable). The Flesch-Kincaid (FK) readability scale has a score range of 0-100 points. The score is calculated using the formula 206.835- 1.015 x (words/sentences)- 84.6 x (syllables/words) and the higher the score, the easier the text is to read. The Flesch-Kincaid Grade (FKG) is the US education level required to understand the content of the text on a page. (22). The Simple Measure of Gobbledygook (SMOG) score estimates the years of education needed to comprehend health-related written materials (23).

Content analyses

Content characteristics, evaluated for the presence of information on: (i) definition, (ii) composition/solution, (iii) indications, and (iv) complications; additionally, content was reviewed for consistency/accuracy relative to standard descriptions in the medical literature.

Statistical analyses

Descriptive statistics were expressed as the mean ± standard deviation for continuous variables, and as the number of observations (n) for categorical variables. The normality of the data distribution was tested using the Shapiro–Wilk test. Continuous variables following a normal distribution were compared using an independent samples t-test, while those not following a normal distribution were compared using a Mann–Whitney U test. Categorical variables were compared using the chi-squared test or Fisher's exact test. Statistical significance was set at $p<0.05$. Analyses were performed using IBM SPSS Statistics for Windows, version 23.0 (IBM Corp., Armonk, NY, USA).

The sample size was determined by the predefined search strategy and eligibility criteria, yielding 100 websites. Therefore, a sensitivity power analysis was performed for the primary comparison of readability metrics between high-quality (n=29) and low-quality (n=71) websites (two-sided test, $\alpha=0.05$). With these group sizes, the study had 80% power to detect a standardized mean difference of approximately Cohen's $d\approx0.62$ (moderate-to-large effect) between groups. As a secondary analysis, comparisons between the Top 10 results (n=10) and the remaining websites (n=90) should be interpreted cautiously, given the small Top 10 sample, as 80% power would only be achieved for an effect size of approximately $d\approx0.94$ (large effect).

Ethics statement

No human participants or animals were involved, and all data were obtained from publicly accessible websites; therefore, ethics committee approval was not required.

RESULTS

The 100 websites included in the study were categorised by typology as follows: commercial (n = 9, 9%); government-supported (n = 6, 6%); health portals (n = 6, 6%); non-profit (n = 1, 1%); health professional/clinician-affiliated (n = 65, 65%); and scientific journal websites (n = 13, 13%). Given that users predominantly access results listed on the first page of Google search results, the top 10 Google results were also categorised by website type: government-supported (n = 3), health portal (n = 2), health professional/clinician-affiliated (n = 3), and scientific journal websites (n = 2). For inferential analyses, the non-profit category (n = 1) was merged with the health portal category due to low cell counts to improve the robustness of group comparisons (Table 1).

Websites were compared across typologies. JAMA scores differed significantly across website typologies ($p<0.001$), with a large effect size ($\varepsilon^2=0.435$). Bonferroni-adjusted post-hoc comparisons showed that government-supported websites and scientific journal websites had significantly higher JAMA scores than commercial websites (adjusted $p=0.041$ and $p<0.001$, respectively) and health professional websites (adjusted $p=0.037$ and $p<0.001$, respectively). No other pairwise differences remained significant after Bonferroni correction. However, readability indices did not differ significantly by website typology, including FRE ($p = 0.657$), FKG ($p = 0.484$), and SMOG ($p = 0.632$) (Table 2). The top 10 Google results had significantly higher JAMA scores than the remaining websites ($p=0.002$), with a moderate-to-large effect size ($r=0.31$).

The mean JAMA score of the 100 websites included in the study was 1.24 ± 1.74 (median = 0, min = 0, max = 4). Websites with a JAMA score ≥3 were classified as high quality (n=29), while those with a JAMA score ≤2 were classified as low quality (n=71). Readability indices were similar between high-quality and low-quality websites. There were no statistically significant differences in FRE, FKG, or SMOG with negligible effect sizes across comparisons (Table 3).

Across all websites, the mean FRE of the websites was 44.8 ± 19.81 (median = 44.6, min = 10.30 and max = 85.20), the mean FKG was 9.11 ± 3.72 (median = 8.90, min = 2.20 and max = 17.00) and the mean SMOG score was 7.78 ± 3.07 (median = 7.4, min = 3.4 and max = 15.0). Compared with the remaining websites, the Top 10 Google results demonstrated more favorable readability profiles. The Top 10 results showed lower FKG grade levels and lower SMOG grade levels, whereas the difference in FRE did not reach statistical significance (Table 4).

Regarding content completeness by website typology, the definition of prolotherapy was mentioned on all websites (100%); therefore, no inferential comparison was applicable across website typologies. The proportions of websites mentioning composition, indications, and complications did not differ significantly across typologies ($p=0.243$, $p=0.810$, and $p=0.251$, respectively). Overall, the mention rate was highest for composition, intermediate for indications and lowest for complications. Complication information was the least frequently provided, particularly among websites affiliated with health professionals or clinicians (Table 5).

Finally, content completeness differed by website quality for selected items (Table 6). High-quality websites more frequently mentioned composition ($p=0.006$) and complications ($p=0.002$) compared with low-quality websites, whereas mention of indications did not differ significantly between quality groups ($p=0.300$).

DISCUSSION AND CONCLUSION

In recent years, there has been a rapid increase in the use of internet-based health information. Reliable online sources of health information enable patients to make more informed decisions (24). Prolotherapy is a treatment method that has grown in popularity in recent years. It is being used increasingly to treat painful musculoskeletal disorders (7). This study aims to evaluate the quality and readability of online prolotherapy resources and investigate whether these parameters differ according to various factors.

Of all the websites evaluated, 78% were scientific publications or sites created by healthcare professionals. Of the top 10 websites, 50% were scientific publications or sites created by healthcare professionals. Scientific publications had significantly higher JAMA scores than other websites, and the JAMA scores of the top 10 Google-provided websites were also signifi-

Table 1. Website typology distribution in the overall sample and top 10 Google results

Website typology	Overall sample (n=100), n (%)	Top 10 Google results, n (%)
Commercial	9 (9.0)	0 (0.0)
Government	6 (6.0)	3 (30.0)
Health portal	6 (6.0)	2 (20.0)
Non-profit	1 (1.0)	0 (0.0)
Health professional	65 (65.0)	3 (30.0)
Scientific journal websites	13 (13.0)	2 (20.0)
Total	100 (100.0)	10 (100.0)

The typology of the websites was defined according to ownership and primary purpose (commercial; government-supported; health portal; non-profit; health professional/clinician-affiliated; or scientific journal). 'Top 10 Google results' refers to the first ten websites listed on the first page of Google search results for the query term used in this study, as these entries are typically the most visible to users. For inferential analyses involving comparisons across website categories, the non-profit category (n = 1) was merged with the health portal category to reduce sparse cells and improve the robustness of statistical testing. Descriptive counts are presented separately in the table.

Table 2. Comparison of websites according to their typologies

Measure	Commercial (n=9)	Government (n=6)	Health portal + Non-Profit (n=7)	Health professional (n=65)	Scientific journals (n=13)	p-value
JAMA	0.11 ± 0.33	2.83 ± 1.60	1.71 ± 1.89	0.65 ± 1.34	4.00 ± 0.00	**0.001**
FRE	42.53 ± 17.77	41.53 ± 14.08	49.36 ± 7.93	43.84 ± 9.65	50.77 ± 25.76	0.657
FKG	9.36 ± 2.47	8.98 ± 2.13	7.97 ± 1.17	9.22 ± 2.00	9.05 ± 4.68	0.484
SMOG	7.41 ± 1.81	7.35 ± 1.07	7.06 ± 0.89	7.86 ± 1.86	8.21 ± 3.79	0.632

JAMA: Journal of the American Medical Association benchmark criteria; FRE: Flesch Reading Ease; FKG: Flesch–Kincaid Grade; SMOG: Simple Measure of Gobbledygook.

Note: Standard deviation is not applicable for the Non-profit category (n=1). p-values were obtained using the Kruskal–Wallis test.

Table 3. Comparison of websites according to JAMA score.

Measure	High quality (n=29)	Low quality (n=71)	p-value	Effect size
FRE	45.10 ± 19.81	44.29 ± 10.40	0.64	0.009
FKG	8.94 ± 3.72	9.55 ± 1.77	0.76	0.007
SMOG	7.60 ± 3.07	8.26 ± 1.57	0.42	0.042

FRE: Flesch Reading Ease; FKG: Flesch–Kincaid Grade Level; SMOG: Simple Measure of Gobbledygook.

Data are presented as mean ± standard deviation (SD).p-values were obtained using the Mann–Whitney U test.

Table 4. Readability indices for the Top 10 Google results versus other websites

Measure	Top 10	Others	p-value	Effect size
FRE	52.93 ± 13.91	43.98 ± 13.46	0.07	0.180
FKG	7.33 ± 2.17	9.31 ± 2.44	**0.015**	0.244
SMOG	6.56 ± 1.34	7.92 ± 2.14	**0.029**	0.219

FRE: Flesch Reading Ease; FKG: Flesch–Kincaid Grade Level; SMOG: Simple Measure of Gobbledygook.

Data are presented as mean ± standard deviation (SD). p-values were obtained using the Mann–Whitney U test.

cantly higher than those of the remaining sites. However, no statistically significant differences in readability scores were found when website typologies were compared with readability indices, and the readability scores of high- and low-quality websites were similar. Conversely, the top 10 websites exhibited a more favourable readability profile than other sites: the FKG and SMOG educational level indices were significantly lower, though the difference in the FRE score was not statistically significant. Although no differences in content were observed between websites according to typology, it was noted that low-quality sites provided less information about prolotherapy treatment content and complications.

No statistically significant difference was found in terms of any readability index when comparing the typologies of websites with their readability. However, the relatively higher class-level readability indices (e.g.,

Table 5. The rate of mention of definition, composition, indications, and complications according to website typology.

Content		Commercial (n=9)	Government (n=6)	Health portal + Non-profit (n=7)	Health professionals (n=65)	Scientific journals (n=13)	p
Definition	1	9	6	7	65	13	—
	0	0	0	0	0	0	
Composition	1	8	6	6	47	12	0.243
	0	1	0	1	18	1	
Indications	1	5	4	4	31	8	0.810
	0	4	2	3	34	5	
Complications	1	3	3	2	10	3	0.251
	0	6	3	5	55	10	

Values are presented as counts (n). 0 = not mentioned; 1 = mentioned. p-values were obtained using the chi-square test for comparisons across website typologies. The p-value for Definition is not applicable because all websites mentioned the definition (no variability).

Table 6. Mention of definition, composition, indications, and complications according to website quality

Content item	Mentioned	Low-quality websites (n=71)	High-quality websites (n=29)	p
Definition	1	71	29	—
	0	0	0	
Composition	1	52	27	**0.006**
	0	19	2	
Indications	1	36	11	0.300
	0	35	18	
Complications	1	9	13	**0.002**
	0	62	16	

Values are presented as counts (n). 0 = not mentioned; 1 = mentioned. "—" indicates that a statistical test was not applicable because all websites mentioned the definition (no variability). p-values were obtained using Fisher's exact test. Statistically significant at $p < 0.05$.

FKG and SMOG) on scientific journal websites suggest that reading these sites is more challenging than reading other sources. Overall, the readability levels of the websites in our study were higher than the recommended level for seventh-graders (25).

The average JAMA score for all the websites included in our study was 1.24, with only 29% classified as high quality. This suggests that information about prolotherapy available online is generally of low quality. No statistically significant difference was found in any readability index when comparing the readability of high- and low-quality websites. However, our study found that the JAMA score of the top ten websites provided by Google was higher than that of the others and that these sites were easier to read, requiring a lower level of education to understand. While no difference in quality or readability was reported between the top 10 websites and the others in website readability studies on myofascial pain syndrome and ankylosing spondylitis (16,26). Dede et al. demonstrated that the top 10 websites were of a higher quality in their study on piriformis syndrome (24). Considering that prolotherapy is a relatively new and popular treatment, the relatively high quality and readability of these websites, which rank highly in Google searches, is a noteworthy and positive finding for consumers of health information.

Our study revealed statistically significant differences in JAMA scores according to website typology. These differences stem from the fact that websites developed with state support and scientific publications are of a significantly higher quality than those developed by healthcare professionals. Government-supported sites and scientific publications are generally produced within institutional or academic structures and undergo a professional editorial process, so it can be expected that they will demonstrate a higher level of quality in terms of the JAMA criteria. By contrast, only around half of the health portals, and most of the sites created by professional organisations and individuals, were of high quality. These sites often lacked basic information such as author names, references, or update dates. Our study found that commercial websites had the lowest JAMA scores. However, the fact that commercial sites constituted only 9% of our sample sug-

gests that this type of content is underrepresented. Previous studies have also reported that websites created by healthcare professionals can be of low quality (24,27). Furthermore, it has been demonstrated that commercial websites mostly provide incorrect or incomplete information (16).

According to the results of the content analysis, all of the websites included a definition of prolotherapy, followed by information on the composition of the treatment solutions and their intended use. Complications were the least frequently covered topic. No statistically significant difference in the frequency of occurrence of content headings was found when examining the relationship between the typology of websites and their content. However, when examined according to quality classification, it was observed that high-quality websites devoted significantly more space to information about the solutions used in treatment and possible complications than low-quality websites did. In our study, information on prolotherapy complications was markedly less frequently reported than definitions and indications, and was more commonly present on high-quality websites. This aligns with previous evaluations of online health information, which have shown that key risk and adverse-effect information is often underreported and that websites meeting established quality benchmarks tend to provide more comprehensive content (28).

In this study, we found that the vast majority of websites providing information on prolotherapy are of poor quality and difficult to read. Given that patients often turn to the internet before consulting a healthcare professional to research relatively unknown treatment methods, such as prolotherapy, the importance of reliable online health information sources becomes apparent. Our study found that, although scientific websites were of a high quality according to JAMA criteria, the text was difficult to read and required a higher level of education. By contrast, the top 10 Google websites, which were the most easily accessible to patients, were of a higher quality and offered content that was relatively easier to read, requiring a lower level of education. Government-supported websites were also of high quality and relatively easy to read, but there were few of them. It is therefore considered important that managers responsible for the national health system and public institutions use online information platforms more actively and strategically. This would enable patients to access reliable information in a more controlled and standardised manner, reduce the advisory burden on healthcare professionals, and ensure that resources allocated to healthcare services are used more efficiently. Furthermore, to support this process, it is important to raise awareness and disseminate educational programmes aimed at increasing health literacy levels in society.

The internet is a constantly changing and growing platform. This study evaluates written online sources from a specific time period and language. Although a single search engine was used for the study, YouTube.com is the second most visited website and search engine in the world. Screening was performed using the term 'prolotherapy' only. The limitations of this study are that it used a single search engine, searched for a single term, evaluated written texts in a single language, and did not analyse video content. Further research is needed in collaboration with different countries and languages, using different search engines and analysing non-written content, such as video and audio recordings, as well as using alternative search terms for prolotherapy.

Conflict-of-interest and financial disclosure

The author declares that she has no conflict of interest to disclose. The author also declares that she did not receive any financial support for the study.

REFERENCES

1. Hackett GS. Ligament and tendon relaxation. 3rd Edition. Charles C. Thomas. Springfield, IL. 1956
2. Hauser RA, Lackner JB, Steilen-Matias D, Harris DK. A Systematic Review of Dextrose Prolotherapy for Chronic Musculoskeletal Pain. Clin Med Insights Arthritis Musculoskelet Disord. 2016;9:139-59.
3. Rabago D, Nourani B. Prolotherapy for Osteoarthritis and Tendinopathy: a Descriptive Review. Curr Rheumatol Rep. 2017;19(6):34.
4. DeChellis DM, Cortazzo MH. Regenerative medicine in the field of pain medicine: prolotherapy, platelet-rich plasma therapy, and stem cell therapy—theory and evidence. Tech Reg Anesth Pain Manag. 2011;15(2):74-80.
5. Fullerton BD. Prolotherapy for the Thoracolumbar

Myofascial System. Phys Med Rehabil Clin N Am. 2018;29(1):125-38.
6. Mao AS, Mooney DJ. Regenerative medicine: current therapies and future directions. Proc Natl Acad Sci U S A. 2015;112(47):14452-9.
7. Hsu C, Vu K, Borg-Stein J. Prolotherapy: a narrative review of mechanisms, techniques, and protocols, and evidence for common musculoskeletal conditions. Phys Med Rehabil Clin N Am. 2023;34(1):165-80.
8. Dagenais S, Ogunseitan O, Haldeman S, Wooley JR, Newcomb RL. Side effects and adverse events related to intraligamentous injection of sclerosing solutions (prolotherapy) for back and neck pain: a survey of practitioners. Arch Phys Med Rehabil. 2006;87(7):909-13.
9. Rabago D, Slattengren A, Zgierska A. Prolotherapy in primary care practice. Prim Care. 2010;37(1):65-80.
10. Amante DJ, Hogan TP, Pagoto SL, English TM, Lapane KL. Access to care and use of the internet to search for health information: results from the US National Health Interview Survey. J Med Internet Res. 2015;17(4):e106.
11. O'Neill SC, Baker JF, Fitzgerald C, et al. Cauda equina syndrome: assessing the readability and quality of patient information on the Internet. Spine (Phila Pa 1976). 2014;39(10):E645-49.
12. Cassidy JT, Baker JF. Orthopaedic patient information on the World Wide Web: an essential review. J Bone Joint Surg Am. 2016;98(4):325-38.
13. Castleton K, Fong T, Wang-Gillam A, et al. A survey of Internet utilization among patients with cancer. Support Care Cancer. 2011;19(8):1183-90.
14. 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):1244-5.
15. Daraz L, MacDermid JC, Wilkins S, Gibson J, Shaw L. The quality of websites addressing fibromyalgia: an assessment of quality and readability using standardised tools. BMJ Open. 2011;1(1):e000152.
16. Bagcier F, Yurdakul OV, Temel MH. Quality and readability of online information on myofascial pain syndrome. J Bodyw Mov Ther. 2021;25:61-6.
17. Yilmaz R, Karpuz S, Yilmaz H, Solak I. Evaluating the information content, readability, reliability and quality of Turkish websites on osteoporosis. Turk J Osteoporos. 2023;29(2):109-16.
18. Hartnett DA, Philips AP, Daniels AH, Blankenhorn BD. Readability and quality of online information on total ankle arthroplasty. Foot (Edinb). 2023;54:101985.
19. Eysenbach G, Köhler C. How do consumers search for and appraise health information on the World Wide Web? qualitative study using focus groups, usability tests, and in-depth interviews. BMJ. 2002;324(7337):573-7.
20. Zeldman J. Taking Your Talent to the Web: A Guide for the Transitioning Designer. New Riders Publishing; 2001.
21. Meric F, Bernstam EV, Mirza NQ, et al. Breast cancer on the world wide web: cross sectional survey of quality of information and popularity of websites. BMJ. 2002;324(7337):577-81.
22. Kincaid JP, Fishburne RP, Rogers RL, Chissom BS. Derivation of new readability formulas for navy enlisted personnel. Research Branch Report 8-75. Millington (TN): Naval Technical Training Command, U.S. Naval Air Station Memphis. 1975
23. Michielutte R, Bahnson J, Beal P. Readability of the public education literature on cancer prevention and detection. J Cancer Educ. 1990;5(1):55-61.
24. Dede BT, Oğuz M, Aytekin E, Bağcıer F. Quality and readability of online information about piriformis syndrome. J Bodyw Mov Ther. 2024;40:2205-10.
25. Noback PC, Trofa DP, Dziesinski LK, Trupia EP, Galle S, Rosenwasser MP. Kienböck disease: quality, accuracy, and readability of online information. Hand (N Y). 2020;15(4):563-72.
26. Kocyigit BF, Koca TT, Akaltun MS. Quality and readability of online information on ankylosing spondylitis. Clin Rheumatol. 2019;38(11):3269-74.
27. Yurdakul OV, Kilicoglu MS, Bagcier F. Evaluating the reliability and readability of online information on osteoporosis. Arch Endocrinol Metab. 2021;65(1):85-92.
28. Fefer M, Lamb CC, Shen AH, et al. Multilingual Analysis of the Quality and Readability of Online Health Information on the Adverse Effects of Breast Cancer Treatments. JAMA Surg. 2020;155(8):781-4.