Osteoarthritis and Cartilage

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Impact of changes in clinical practice guidelines for intra-articular injection treatments for knee osteoarthritis on public interest and social media

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SUMMARY

Objective: To summarize changes in recommendations for injection treatments for knee osteoarthritis (OA) in current clinical practice guidelines (CPGs) and to assess whether these changes have affected public interest according to Google data and content in YouTube videos.
Design: A literature search to identify CPGs revised since 2019 that provide recommendations regarding the five intra-articular injection treatments for knee OA (corticosteroid [CS], hyaluronic acid [HA], stem cell [SC], platelet-rich plasma [PRP], and botulinum toxin [BT]) was conducted to assess perspective changes for each treatment. Data from Google Trends were examined to identify changes in search volume from 2004 to 2021 using a join-point regression model. Relevant YouTube videos were divided into those uploaded before and after changes in CPGs and compared according to degrees of recommendation for each treatment to identify the effect of changes in CPGs on video production.
Results: All eight identified CPGs released after 2019 recommended HA and CS use. Most CPGs were the first to state a neutral or opposing stance concerning the use of SC, PRP, or BT. Interestingly, relative searches on Google for SC, PRP, and BT has increased greater than those for CS and HA. YouTube videos produced after CPGs changed continue to recommend SC, PRP, and BT as much as those produced before CPGs were revised.
Conclusions: Although knee OA CPGs have changed, public interest and healthcare information providers on YouTube have not reacted to this shift. Improved methods to propagate updates to CPGs warrant consideration.

Introduction

Osteoarthritis (OA) is a debilitating, degenerative, and progressive joint disease that is one of the most prevalent chronic conditions[1,2]. To date, there is no cure for knee OA, with most treatments focusing on reducing pain and improving quality of life. Depending on the condition of the patient and the severity of the disease, treatment options for knee OA can vary greatly, from non-pharmacological treatment to pharmacological and surgical treatments[3,4]. Knee injection therapy is an one pharmacological therapeutic option for knee osteoarthritis. In addition to corticosteroids and hyaluronic acid (HA), studies on the effectiveness of stem cell (SC)[5], platelet-rich plasma (PRP)[6], and botulinum toxin (BT)[7] injections for knee intra-articular (IA) have been undertaken

since the middle of the 2000s. However, the efficacy of IA therapies using various medications is still controversial, making it difficult to decide when and which drug to use. To help with this decision-making process, the clinical practice guidelines (CPGs) have been developed by relying on expert opinions to help direct physicians toward proper decision-making. Although CPGs are not meant to require uniformity and provide the same treatment for all patients, using CPGs has a positive effect on evidence-based treatments.[8]

Various international health care groups have developed evidence-based CPGs that provide treatment recommendations and are continually updated. In particular, updates to CPGs were made in 2019 by organizations with significant global influence, such as the OA Research Society International (OARSI), the American College of Rheumatology (ACR), and European Society for Clinical and Economic Aspects of Osteoporosis, Osteoarthritis and Musculoskeletal Diseases (ESCEO). Despite major changes in these recommendations, little is known of the impact of these revised CPGs on the use of these injections.

Although it would be nearly impossible to directly verify changes in public interest and clinician perspectives, we sought to indirectly identify these using Google Trends, a tool that allows researchers to study anonymous and aggregate search data. Google trends has already been used to analyze a range of social and behavioral outcomes, as well as user interests, in social science[9]. Furthermore, we recognized that YouTube, a dominant video-sharing platform, serves as a new source of providing information.

The usage of YouTube as a source of information is constantly expanding and healthcare practitioners are increasingly using YouTube to disseminate information to the public in the medical area[10]. Thus, we could identify the impact of the revision of knee OA CPGs in 2019 on both public interest and clinician's perspectives regarding certain treatment options by combining data from Google trends and YouTube.

This study aimed to assess public interest in injection treatments of knee OA as determined by Google Trends data and to evaluate the content and reliability of YouTube videos in this field in comparison with current evidence-based CPGs.

Materials and methods

Guideline screening and analysis of power of CPG influence using the number of citations

A comprehensive search of all CPGs relevant to the non-operative management of knee OA was conducted using the PubMed database. The flowchart of CPG selection is shown in Fig. 1. We reviewed selected CPGs in detail and checked when they were last updated.

Although different associations publish CPGs, their influence may different. We noted 2019 because a revised version of the CPGs was released in that year by three rather influential associations: OARSI, ACR, and ESCEO. Using Web of Science and Google Scholar

Fig. 1

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PubMed search (n = 282)

Search terms
((knee) AND (osteoarthritis)) AND ((guidelines[title]) OR (recommendations[title]) OR (statement[title]))

Number of references identified through other sources (n = 9)

(Identification)

Included for screening (n = 291)

(Screening)

Title/abstract excluded (n = 224)
-Not Guideline or Recommendations: 150
-Not Knee or Intra-articular Injections: 63
-Not related to most recent version: 10
-Duplicate: 1

Full text analysis (n = 67)

(Eligibility)

Full text excluded (n = 51)
-Not Knee or Intra-articular Injections: 32
-Not related to most recent version: 14
-Only for a single injection material: 3
-Duplicate: 1
-Not English: 1

Final analysis (n = 16)

(Inclusion)

Flowchart of the selection of eligible clinical practice guidelines based on preferred reporting items for systematic reviews and meta-analysis statement.
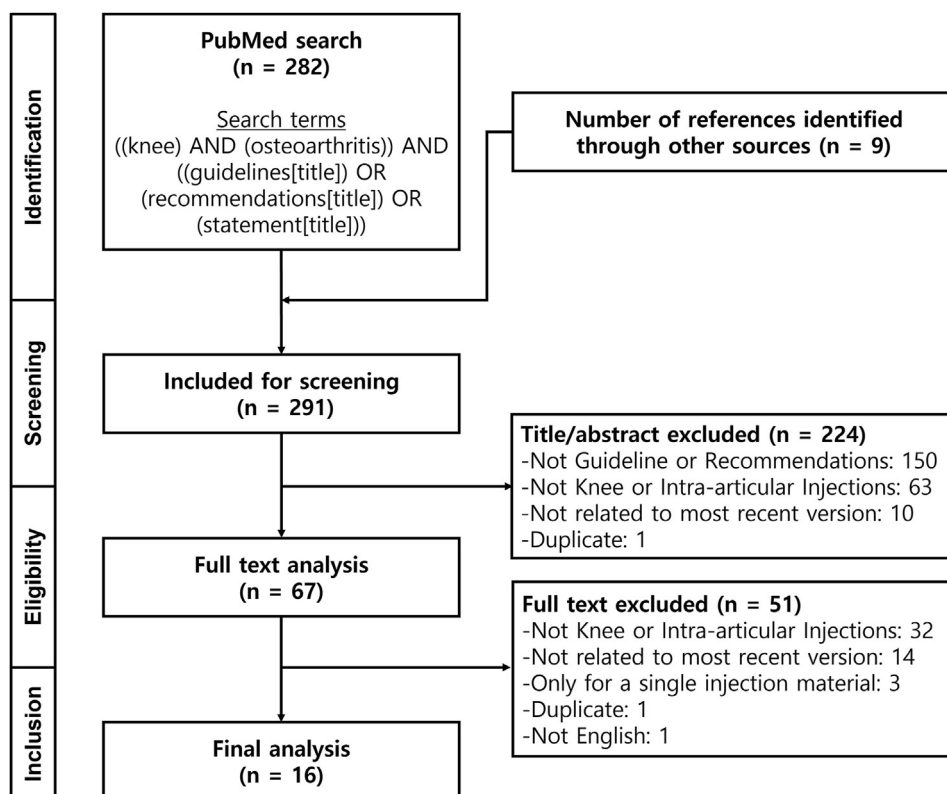
data, we confirmed the number of citations of each CPG and based on it, we determine whether 2019 would be a good year to cut off. Then, we finally analyzed CPGs that were revised after 2019.

In-depth analysis of CPGs

Afterwards, we checked whether recommendations for each injection material were positive or negative and how recommendations may have been changed in the CPGs released as of 2019, compared to previous CPGs. Recommendations regarding the materials used for IA injections (corticosteroids [CS], HA, PRP, SC, and BT) for knee OA from each guideline were summarized according to the strength of the recommendations reported. The Grading of Recommendations Assessment, Development, and Evaluation (GRADE) approach to developing the recommendations was used to generalize the categories of CPG recommendations: strong, weak, uncertain or neutral, weak against, and strong against[11]. A recommendation was considered weak if it was reliant on particular therapies failing first or if specific clinical characteristics were satisfied. Each CPG was reviewed independently by two reviewers (H.E.C. and C.W.J.), and any disagreements were resolved by consensus. A third reviewer was consulted if no agreement could be reached.

Survey of interest in knee OA injection materials using Google Trends analysis

Google Trends (http://trends.google.com) offers worldwide search volume data on a monthly basis for specific entered terms[12]. The retrieved data are provided in the form of line graphs showing trends, along with relative search volume (RSV; %) values. RSV is not an absolute search volume number, but a normalized value calculated by dividing the search volume at each time point by the total searches of the geography and time range for a specific entered term and is scaled from 0 to 100. For example, a normalized value of 10 indicates that the volume at that specific time on specific geography for that particular term is 10% of the maximal search volume of that term over a given period.[13]

The keywords were selected according to the checklist for the documentation of Google Trends use[12]. On May 1, 2022, we queried Google Trends and downloaded the search volume data for injection treatment options for knee OA using the following terms: "knee injection," "cortisone knee," "HA knee," "SC knee," "PRP knee," and "botox knee." These combinations were determined through several trials to identify phrases that were sufficiently inclusive such that search results best reflected the most commonly used terms by the public and their search volume. We searched within "worldwide" from January 1, 2004 to December 31, 2021 using the "global" query category. We created a website (https://googletrend.wixsite.com/kneeinjection) where readers can check these trends in real time.

The impact of CPGs on YouTube content

On May 1, 2022, after removing the web browser's history and cookies, a YouTube video search for injection treatment options regarding knee OA was performed. Because the purpose of this study was to determine whether changes in CPGs influenced the provision of medical information, only medications on which had changed were checked on YouTube. The search keywords for each drug were the same as those used in Google Trends analysis, and the search results were displayed using the relevance filter, which is the default setting of YouTube. Two authors (H.E.C. and J.H.P.) extracted the 50 most highly relevant videos for each treatment option after excluding duplicate or irrelevant videos based on the titles and descriptions of the videos[14–16]. English videos, including the contents of the IA injection treatment in the knee OA, were included in the final review. Baseline characteristics were extracted as follows: title, uniform resource locator, video uploader, date of upload, posting days, number of views, viewing index, number of likes, number of comments, and duration (seconds). The viewing index was calculated for each video as the number of days divided by the posting days after uploading to YouTube and multiplied by 100 to obtain percentage values.[17]

All the videos were categorized into two groups according to the type of uploader: healthcare professionals and non-healthcare professionals based on the WHO classification[18]. The "About" section of YouTube, which includes a self-introduction of the uploader and, if available, additional information, including the uploader's website link, was used to categorize the type of uploaders.

Then, without being aware of the basic characteristics of each video, two independent reviewers (C.W.J. and M.B.), who were certified specialists in physical medicine and rehabilitation, viewed and analyzed videos based on the GRADE approach[11]. When different grading was obtained for the same video, the discrepancy was resolved through discussion until the two reviewers reached an agreement. Finally, to identify the effect of the release of CPGs on video production, we compared videos by dividing them into those uploaded before 2020 group and those uploaded thereafter. The standard date for classifying videos was set to 2020 based on the upload date to account for the time it takes for CPG changes to propagate.

Statistical analysis

For Google Trends analysis, we estimated the mean annual RSV (ARSV) by averaging the monthly RSV over the period of one year. A join-point regression model was used to identify significant changes in mean ARSV values for each knee OA IA injection treatment option during the study period. When a significant join-point was confirmed, linear regression analysis was used to identify changes in the trend between the join-point and the specific time point. As a result, changes in mean ARSV, or changes in the trend, during that period were calculated as an annual percentage change (APC). Average APC (AAPC) and the respective 95% confidence intervals were calculated to show linear trends in mean ARSV during the entire study period from 2004 to 2021[19]. Using a natural log-linear model, the rate of AAPC was analyzed over time. The Join Point Trend Analysis Software version 4.9.0.1 (Statistical Research and Applications Branch, National Cancer Institute, Bethesda, MD, USA) was used for all of the statistical analyses in the Google Trends analysis. Supplementary details provide statistical analytical methods for a join-point regression in detail.

For YouTube analysis, descriptive data are presented as percentages (%) and median (interquartile range [IQR]) for continuous variables. The Wilcoxon rank-sum test was used to investigate associations between groups. The proportion of videos according to the degree of recommendation for each group was compared using the Cochrane Armitage Trend test. All data were analyzed using the R statistical package version 4.1.2 (R Foundation for Statistical Computing). Statistical significance was set at $P < 0.05$.

Results

CPGs search results and an indirect analysis of CPG influence based on citations

A total of 16 CPGs were identified. Information of the writing associations, the year of publication, the number of citations in Web of Science and Google Scholar for each CPG are provided in Table I.

Number	Association	Year	Country	Number of citations from	
				Web of science	Google scholar
1	American Academy of Orthopaedic Surgeons (AAOS)[‡]	2021	US	3 (367)[*]	18 (573)[*]
2	French Society of Rheumatology (SFR)	2020	France	13	23
3	Veterans Affairs/Department of Defense (Va/DoD)	2020	US	5	9
4	American College of Rheumatology (ACR)[‡]	2019	US	719	1343
5	European Society for Clinical and Economic Aspects of Osteoarthritis (ESCEO)[‡]	2019	Europe	144	413
6	Osteoarthritis Research Society International (OARSI)[‡]	2019	US	868	1475
7	Arthroscopy Association of Canada (AAC)	2019	Canada	7	11
8	Italian Society of Rheumatology (SIR)	2019	Italy	18	32
9	American Academy of Family Physicians (AAFP)	2018	US	1	2
10	Royal Australian College of General Practitioners (RACGP)	2018	Australia	NA[†]	9
11	Agency for Healthcare Research and Quality (AHRQ)	2017	US	NA[†]	63
12	Turkish league against Rheumatism (TLAR)	2017	Turkey	11	22
13	Pan-American League of Rheumatology Associations (PANLAR)	2016	South America	34	59
14	National Collaborating Centre for Chronic Conditions (NCC-CC)	2014	UK	NA[†]	5
15	National Institute for Health and Care Excellence (NICE)	2014	UK	NA[†]	139
16	European League Against Rheumatism (EULAR)[‡]	2013	Europe	751	1403

[*] Undervalued due to short publication periods. Citation number of the previous version is in parentheses.
[†] Cannot be traced as it has not been published as a research article.
[‡] Top five popular citation sources.

Table I

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Lists of included clinical practice guidelines

The top five popular citation sources are OARSI, the European Alliance of Associations for Rheumatology (EULAR), ACR, the American Academy of Orthopaedic Surgeons (AAOS), and ESCEO. Of these, three CPGs (OARSI, ACR, ESCEO) released new versions in 2019.

Changes in knee IA injection material recommendations in each CPG after 2019

Based on the aforementioned findings, we established year 2019 as a benchmark for changes. Eight CPGs were revised or newly created after 2019, focusing on IA injection for the management of knee OA[20–27]. Of these CPGs, four were published in the United States, three in Europe, and one in Canada.

Fig. 2 depicts changes in CPGs between previous and current versions for each injection material. Previous versions of the CPGs provided a statement on CS (8/8, 100%), HA (7/8, 87.5%), and PRP (1/8, 12.5%). No CPGs provided a statement on SC or BT. In contrast, all (100%) of the latest versions of the CPGs provided a statement on CS and HA use, seven (87.5%) provided a statement on PRP, five (62.5%) provided a statement on SC, and one (12.5%) provided a statement on BT use. Supplementary Table 1 provides a summary of CPGs and their recommendations in detail.

All recent CPGs have recommended CS injections. AAOS noted uncertainties about CS in 2013, but turned in favor of CS, which can provide short-term relief, in 2021. In 2012, ACR conditionally recommended CS IA injection only when other treatments failed, but it was strongly recommended in 2019 due to short-term efficacy.

In the case of HA, six CPGs provided strong, weak or conditional recommendation opinions. HA was strongly recommended by the AAOS in 2013, but it revised its stance to a weak recommendation with the caveat that a specific subset of patients may benefit from treatment in 2021. OARSI and the Veterans Affairs and Department of Defense (VA/DoD) reported uncertain recommendations in 2014, but weak recommendations were made in the latest version. On the other hand, the ACR conditionally recommended HA in 2012, but changed its stance to conditional against in 2019.

The CPGs of the previous edition did not address SC therapy. However, in the most recent version, two CPGs gave a strong recommendation against (ACR, OARSI), two gave a weak recommendation against (Arthroscopy Association of Canada (AAC), VA/DoD), and one showed an uncertain or neutral (Italian Society of Rheumatology [SIR]) position.

There were seven opinions regarding PRP in the latest CPGs. PRP was strongly opposed by ACR, AAC, and OARSI, whereas VA/DoD, SIR, and the French Society of Rheumatology was neutral on its use. Only AAOS, which had a neutral opinion in the previous version, weakly recommended PRP. For BT use, only ACR provided a position with conditional recommendations against.

Google Trends analysis

The monthly RSV for "knee injection" is shown in Fig. 3(A). The mean ARSV values were 36.30 in 2004 and 22.30 in 2007; during this period, the search volume decreased by 14.0% ($P = 0.061$). Since 2007, the search volume constantly increased by 9.8% (95% confidential intervals: 8.2, 11.4; $P < 0.001$) by 2022.

For "cortisone knee", the mean ARSV was 21.60 in 2004, and the search volume continued to increase during the study period, up 7.6% (95% confidential intervals: 5.4, 10.0; $P < 0.001$) from 2004. No join points were identified [Fig. 3(B)].

For "HA knee", the search volume had increased by 1.4% during the study period globally, but the difference was not statistically significant ($P = 1.0$). The mean ARSV for HA was 14.33 in 2004, which then dropped by 3.83 in 2006, a total of −43.6%. (95% CI: −71.2, 10.3; $P = 0.088$). An inconsistent but statistically significant upward trend to 2021 was shown in the search volume (+9.7%; 95% confidential intervals: 6.6, 12.8; $P < 0.001$) [Fig. 3(C)].

For "SC knee", the trend showed an inconsistent increase of 38.0% ($P < 0.05$). The search volume was 0 in 2004 and increased
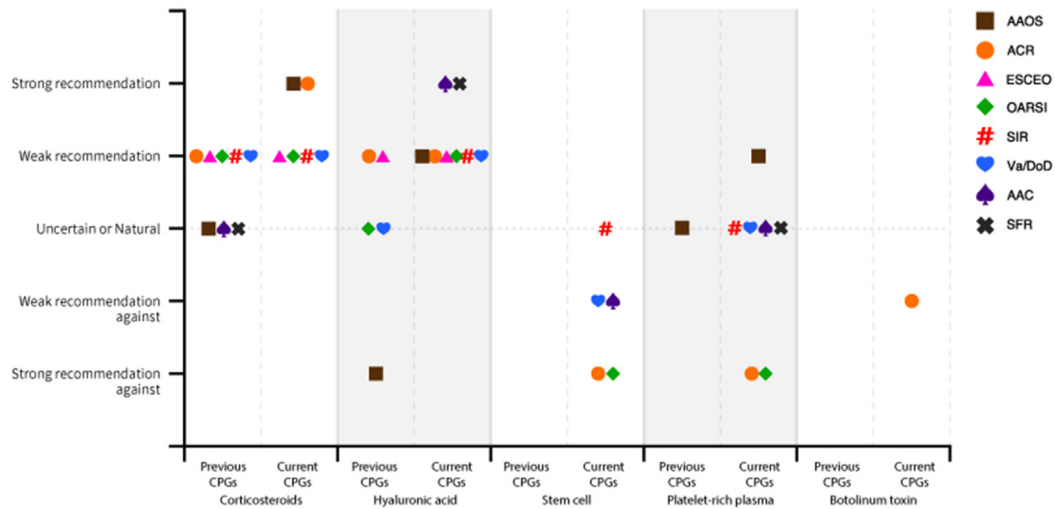
Fig. 2   *Osteoarthritis and Cartilage*

Difference in CPG views between the previous and current versions for each injection material. The current version refers to the last updated version of each CPG, and the previous version means the last version just before the last update. AAOS, American Academy of Orthopaedic Surgeons; ACR, American College of Rheumatology; ESCEO, European Society for Clinical and Economic Aspects of Osteoporosis, Osteoarthritis and Musculoskeletal Diseases; OARSI, Osteoarthritis Research Society International; SIR, Italian Society of Rheumatology; Va/DoD, Veterans Affairs/Department of Defense; AAC, Arthroscopy Association of Canada; SFR, French Society of Rheumatology.

until 2012 (+78.0%; 95% confidential intervals: 42.0, 123.2; $P < 0.001$), followed by an increasing trend smaller than before until 2021 (+10.0%; 95% confidential intervals: −9.0, 32.0; $P = 0.298$) [Fig. 3(D)].

For "PRP knee", the trend revealed an inconsistent increase of 38.3% ($P < 0.05$). In 2004, there was no search volume, but since 2015, it has increased by 56.0% (95% confidential intervals: 38.6, 75.7; $P < 0.001$). Following that, a statistically insignificant increasing trend in searches was observed through 2021 (+10.8%; 95% confidential intervals: −17.6, 49.1; $P = 0.468$) [Fig. 3(E)].

For "botox knee", a non-significant increasing trend was observed with the increasing search volume of 21.5% during the study period ($P < 0.05$). The mean ARSV was 0 in 2004, which then increased up to 2006 (+29.6%; 95% confidential intervals: −23.3, 1980.7; $P = 0.093$), followed by a plateau (+3.7%; 95% confidential intervals: −3.3, 11.2; $P = 0.285$) [Fig. 3(F)].

Fig. 4 presents the RSV of Google Trends for all knee OA IA injection treatment options by month from January 2004 to December 2021. The patterns remained unchanged from 2019.

YouTube analysis

The use of CS and HA was recommended in both previous and current versions, while a new trend emerged that recommended against the use of SC, PRP, and BT. YouTube analysis was conducted only for SC, PRP, and BT where shifting views of CPGs were identified.

A total of 102 videos were included (42 videos of SC and 44 videos of PRP). Only two eligible videos were found for BT. Of the included videos, a total of 63 videos (74.1%) were from the "before 2020" group, and 22 videos (25.9%) were from the "after 2020" group (Table II). The videos of the "after 2020" group had a smaller number of posting days ($P < 0.001$), but their viewing index was significantly higher than those of the "before 2020" group ($P = 0.001$). There were no significant differences between the two groups in terms of the uploader type ($P = 0.229$).

Most CPGs did not oppose or recommend using SC, PRP, and BT injections, which appeared around 2019 for knee OA. When we analyzed YouTube videos uploaded before and after 2020 based on recommended, neutral, or not-recommended opinions on these three treatments, a total of 52 videos (61.2%) presented recommended opinions, 27 (31.8%) were neutral, and six (7.1%) presented not-recommended opinions. A comparison of the proportion of videos according to the degree of recommendation did not show any difference between the two groups ($P = 0.121$).

Discussion

This study provides a comprehensive overview of and recent changes in guideline recommendations for knee HA, CS, PRP, SC, and BT IA injections for knee OA. There were general trends in the guidance provided on HA, CS, PRP, SC, and BT IA injections; almost all guidelines favor CS and HA, whereas PRP, SC, and BT IA injections are not recommended because of the risk involved and lack of evidence. However, the public was far more interested in SC, PRP, and BT IA injections, which CPGs oppose, than CS or HA, which CPGs recommend. Furthermore, the percentage of YouTube videos that advocated SC, PRP, and BT IA injections without basing their recommendations on CPGs did not decline even after the CPGs were updated.

For the management of knee OA, several CPGs recommend the use of pharmacological treatments, such as acetaminophen and nonsteroidal anti-inflammatory drugs, in conjunction with weight loss and exercise[20,23]. However, patients often require additional
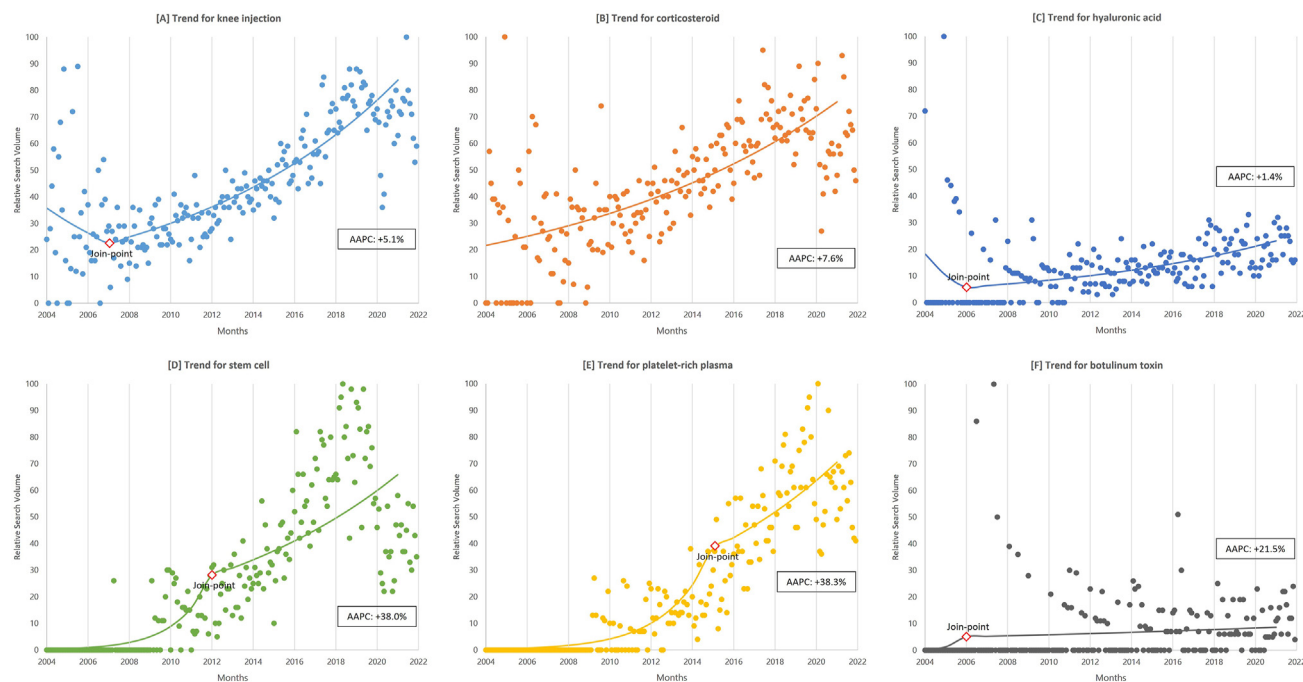
Fig. 3

Osteoarthritis and Cartilage

Google Trends relative search volume for (A) knee injection, (B) corticosteroid, (C) hyaluronic acid, (D) stem cell, (E) platelet-rich plasma, and (F) botulinum toxin by month, January 2004 to December 2021. Dots indicate monthly relative search volume for each keyword. The red square indicates the join point, which means the timing for a statistically significant change in the trend. The solid line represents the segmented regression model including the join point. AAPC, average annual percentage change.

treatment. Patients with knee OA often take several medications due to comorbidities, which raise concerns about the use of additional oral medications. Also, oral medication and exercise frequently fails to sufficiently reduce pain and discomfort of patients. Another reason might be the lack of effective disease-modifying antirheumatic drugs for knee OA[28]. Even in patients whose symptoms are severe enough to require surgery, there may be significant barriers to considering surgery. Knee IA injection may
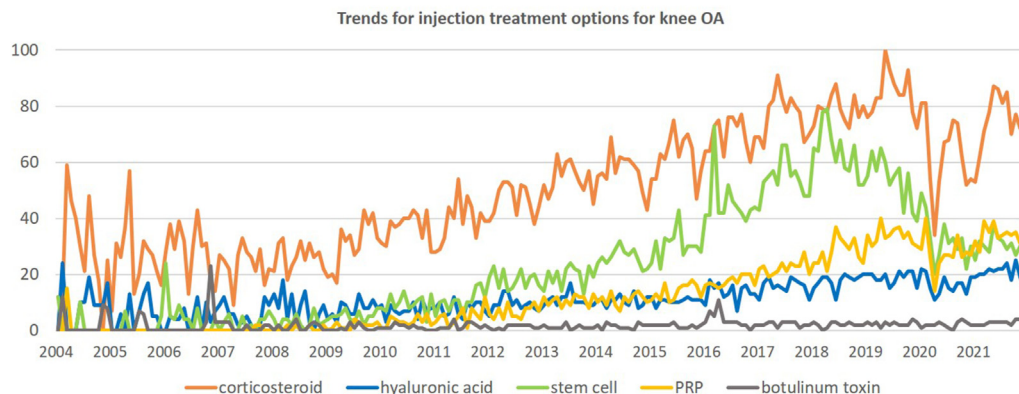

Fig. 4

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Google Trends relative search volume for all injection treatment options for knee osteoarthritis by month, from January 2004 to December 2021. PRP, platelet-rich plasma.

Variables, median (IQR)	Overall (N = 85)	Before 2020 (N = 63, 74.1%)	After 2020 (N = 22, 25.9%)	P-value
Viewing index	6.68 (2.08–24.99)	4.21 (1.73–17.71)	15.57 (8.35–41.55)	0.001
Posting days	1505 (2522–870)	2010 (1442–2932.5)	490 (252.75–643.75)	<0.001
Number of views	6266 (3124–29,949)	7699 (3179.5–41,497)	5467 (2828.5–14699.5)	0.338
Number of likes	57 (11–212)	44 (11–181)	102 (33.5–233.8)	0.172
Number of comments	3 (0–22)	2 (0–13.5)	16 (3–37.25)	0.025
Duration (seconds)	204 (171–368)	191 (142–338.5)	292 (196.5–570.5)	0.013
Uploader type, n (%)				0.229
Healthcare professionals	76 (89.4%)	58 (92.1%)	18 (81.8%)	
Non-healthcare professionals	9 (10.6%)	5 (7.9%)	4 (18.2%)	
Degree of recommendation, n (%)				0.121
Recommended	52 (61.2%)	41 (65.1%)	11 (50.0%)	
Neutral	27 (31.8%)	19 (30.2%)	8 (36.4%)	
Not recommended	6 (7.1%)	3 (4.8%)	3 (13.6%)	

PRP: platelet-rich plasma, IA: intra-articular; IQR, interquartile range; SD, standard deviation; The viewing index was calculated for each video as the number of days divided by the posting days after uploading to YouTube and multiplied by 100 to obtain percentage values. The P-values shows the significance of the differences between group "Before 2020" and group "After 2020."

Table II

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Characteristics of videos addressing stem cell, PRP, and botulinum toxin knee IA injections by upload date as of 2020

be a suitable and safe alternative in these circumstances, and CPGs have provided guidance for knee IA injection.

In this study, we attempted to identify shifting views of CPGs on knee OA IA injection treatments. There are many options for injection treatment of knee OA. CS and HA are two major materials for knee IA injections, which have long been used and proven to help in the short-term and long-term relief of symptoms, respectively[29]. In recent decades, along with a better understanding of the pathophysiology of knee OA, new therapies, including SC, PRP, and BT, have emerged as possible IA injection treatment options for knee OA[30–32]. However, the lack of consistency in previous studies examining the effectiveness and safety of these materials emphasizes the limitations of drawing conclusions from existing data on their use for OA. Recent CPGs reflect this by adopting views that are nearly identical, recommending against these treatments or only conditionally recommending them.[20,22,23]

However, this shift in expert opinion had little to do with public interest. The observed increase in search activity for "knee injection" since January 2004 is consistent with the rising number of knee OA cases due to an accelerated obesity epidemic and aging populations[33]. This increasing number of knee OA cases may contribute to the increased use of pharmacological treatments[34]. This trend would lead to a growing interest in these treatment options in patients with knee OA. Similar trends in search volume were observed for proven treatments, such as CS and HA. Searching for unsupported treatments, such as PRP, SC, and BT, on the other hand, followed a much higher upward trend than searching for supported treatments[35,36]. Furthermore, even after CPG revisions, this trend did not change. This indicates that the general public is more interested in novel and unproven treatments. The disparity between scientific evidence and patient expectations can place a significant burden on physicians when making optimal decisions at the point of care.

Owing to advantages of easy accessibility and great influence, social media platforms are expected to facilitate communication about health issues between the general public, patients, and healthcare professionals[37]. However, YouTube, the most popular social media platform, has been found to provide misinformation on several medical topics[10]. Our results are consistent with those of previous studies[38–40]. Most YouTube videos regarding IA injection materials for knee OA conveyed information not based on CPGs, although medical professionals participated in the production of 83% of the included videos. This suggests, consistent with a prior study[41], that medical advice given on YouTube by medical professionals may not be adherent to evidence-based guidelines.

Unfortunately, the public watched videos that did not follow CPGs just as much as they did videos that did. The lower reliability scores of the videos did not follow CPG than those of the CPG-based videos, especially in the areas of uncertainty, suggest that these videos were not enough to address the gaps in knowledge or differences in expert opinion concerning treatment options[42]. Viewers and perhaps patients most likely watch videos with insufficient and incomplete information regarding knee OA IA injection treatments. This finding suggests that physicians should give serious consideration to how to increase public awareness of CPGs in the Internet age.

Prior to the widespread use of the Internet, patients could only get reliable medical information through their doctors. Nowadays, there is an increase in the number of people finding health information online[43]. Unfortunately, a majority of medical videos in YouTube have been shown to disseminate misinformation rather than providing evidence-based medical advice[10,44]. Patients are exposed to this information without any screening due to the lack of peer review system; nevertheless, we cannot forbid patients from using the Internet. Considering the difficulty with selecting useful information about injection materials and the rising public interest, there is a need for high-quality evidence-based videos to be produced and managed. In addition, we think that a study on a variety of alternative methodologies is necessary to stay up with the developments in the Internet era. Researchers have already suggested some clues. Some use HONcode to increase website credibility[45], others have tried to check CPG transmission through social media[46], and some others have been working on patient influencers[47]. Research on how to deliver knee OA CPGs to the public should be conducted in various ways in the future.

Although informative, our study had several limitations. Regarding Google Trends analysis, the selection of search terms could be limited by the characteristics of Google Trends to only provide data about search trends for terms with sufficient search volume to report[13]. To overcome this, we tried several combinations of words and phrases as a test and were careful in selecting the final search terms. Second, Google Trends provides RSV rather than absolute values of search volumes for each entered term; therefore, it is difficult to identify how many unique users are reflected in the data. Third, since there was a period when the RSV value was 0%, we added 0.5 for the period of RSV = 0 when calculating AAPC. This value may have a small computational impact, but not enough to influence the overall trend. Regarding YouTube analysis, we did not analyze all videos related to injection treatments for knee OA. However, previous study showed more than 90% of Internet users clicked on the first three pages of search results[48], so our study could be considered to have examined a decent number of videos. Finally, our study was limited to the search results exclusively in English. However, English is the language that is most frequently used to create content on the Internet including Google and YouTube. Therefore, our study could be considered as well representing Internet searches.

Conclusions

A clear increase in public interest in knee OA IA injection treatment options was identified; however, the effects of evidence-based CPGs were minimal. The public showed a higher interest in treatments opposed by CPGs than treatments supported by them. Healthcare information about knee OA IA injections provided through YouTube also hardly reflected changes in the CPG. This suggests the need to think about how to disseminate CPGs to the general public and healthcare professionals, in addition to creating unbiased, evidence-based, high-quality CPGs.

Author contributions

Conception and design, analysis and interpretation of data: C.W.J., M.B., and H.E.C.; drafting of the article and collection and assembly of data: C.W.J.; critical revision of the article for important intellectual content: H.E.C. and J.H.P.; and final approval of the article: H.E.C.

Conflict of interest

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None.

Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.joca.2022.12.013.

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