

Trends in Patient, Physician, and Public Perception of Ulnar Collateral Ligament Reconstruction Using Social Media Analytics

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Background: Social media posts regarding ulnar collateral ligament (UCL) injuries and reconstruction surgeries have increased in recent years.

Purpose: To analyze posts shared on Instagram and Twitter referencing UCL injuries and reconstruction surgeries to evaluate public perception and any trends in perception over the past 3 years.

Study Design: Cross-sectional study.

Methods: A search of a 3-year period (August 2016 and August 2019) of public Instagram and Twitter posts was performed. We searched for >22 hashtags and search terms, including #TommyJohn, #TommyJohnSurgery, and #tornUCL. A categorical classification system was used to assess the sentiment, media format, perspective, timing, accuracy, and general content of each post. Post popularity was measured by number of likes and comments.

Results: A total of 3119 Instagram posts and 267 Twitter posts were included in the analysis. Of the 3119 Instagram posts analyzed, 34% were from patients, and 28% were from providers. Of the 267 Twitter posts analyzed, 42% were from patients, and 16% were from providers. Although the majority of social media posts were of a positive sentiment, over the past 3 years, there was a major surge in negative sentiment posts (97% increase) versus positive sentiment posts (9% increase). Patients were more likely to focus their posts on rehabilitation, return to play, and activities of daily living. Providers tended to focus their posts on education, rehabilitation, and injury prevention. Patient posts declined over the past 3 years (-28%), whereas provider posts increased substantially (110%). Of posts shared by health care providers, 4% of posts contained inaccurate or misleading information.

Conclusion: The majority of patients who post about their UCL injury and reconstruction on social media have a positive sentiment when discussing their procedure. However, negative sentiment posts have increased significantly over the past 3 years. Patient content revolves around rehabilitation and return to play. Although patient posts have declined over the past 3 years, provider posts have increased substantially with an emphasis on education.

Keywords: ulnar collateral ligament; Tommy John; social media; Instagram; Twitter

Social media offers a powerful platform for both patients and physicians to share their thoughts and experiences. Harnessing this tool to contextualize patient perspectives has the ability to unlock a unique and novel source of insight, including patient-reported outcomes, that can extend beyond the scope of traditional health care paradigms. In the corporate world, >90% of medium and large businesses have used social media for 5 years or longer to engage customers.³⁰ Armed with a deeper understanding of patient attitudes and experiences, providers may be able to align and adjust their own strategies to better serve patients throughout their medical journey. At the same time, these insights may encourage providers to adopt a

more proactive approach in educating and engaging the community directly through social media.

Previous studies have reported on the use of social media, including Instagram and Twitter, to gauge perspectives and perceptions of patients, physicians, and hospitals across a variety of specialties and procedures, including anterior cruciate ligament (ACL) reconstruction, shoulder and elbow surgeries, joint arthroplasty, hip arthroscopy, cellular therapy, and scoliosis.^{||} To date, no study has investigated year-by-year trends in social media for any injury. Furthermore, although previous research has explored ulnar collateral ligament (UCL) reconstruction surgery through social media in the context of broader shoulder and elbow injuries,³² no study has yet to focus exclusively on UCL injuries and reconstruction surgery.

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Although return-to-play rates in UCL reconstruction remain encouraging, with reported rates of 80% to 97%,[¶] complication rates can reach up to 20%, whereas revision reconstructions have increased in recent years with rates reaching up to 15%.[#] Furthermore, the postoperative rehabilitative course can be arduous and time-consuming, ranging from 12 to 18 months postoperatively.^{1,3,11,14,17,22,23,25} Social media provides a unique lens through which to track the patient journey while gathering insight into areas for improvement in both patient experience and education. UCL injuries are especially relevant in social media due to the unique patient population. Given the sports-related nature of the injury in a young patient population (mean age, 21.6 years),²¹ patients with UCL injuries may be more likely to turn to social media platforms because younger demographic groups are the most active on social media.^{6,7,11,13,21,29}

Although social media provides a powerful medium through which to express facts and opinions, it is largely unfiltered, with little to no accountability for accuracy. This can generate misleading public perceptions about topics such as UCL injuries and reconstruction. These perceptions are fueled by the expanse of information available online and compounded by the prevalence of UCL injuries in professional athletes. Subsequently, UCL injuries can often be shrouded in ambiguity and accompanied by inaccurate or misleading information among nonmedical professionals, including the media and fans. This ambiguity can ultimately affect patient perception as well. These misconceptions represent a newfound challenge for physicians in today's modern health care environment and may present obstacles toward achieving high patient satisfaction and administration of optimal health care. To combat false information on social media, many surgeons and hospitals have taken a proactive approach in patient education across social media. Furthermore, in orthopaedic surgery, the high proportion of elective procedures, paired with increased market consolidation and competition, acts as a catalyst for the use of social media in patient engagement and feedback, as surgeons strive to engage more closely with both current patients and potential new patients.

The purpose of this observational study was to analyze public content on Instagram and Twitter across multiple dimensions to explore the perspectives of patients, physicians, hospitals, and the general public (eg, sports fans) on UCL injuries and reconstruction as well as trends in these

attitudes over the past 3 years. We hypothesized that patients would share media with a positive sentiment focused on return to play whereas providers would share media centered on education.

METHODS

Search

On August 1, 2019, we performed a search of public posts from Instagram and Twitter over a 3-year time frame between August 2, 2016, and August 1, 2019. Posts were identified using different combinations of hashtags and keywords depending on the platform. Instagram posts were identified using 26 hashtags, and Twitter posts were identified using 22 hashtags (Appendix Table A1). Only posts related to human elbow UCL injuries and reconstruction surgeries were included; excluded were veterinary and non-human content. All posts referencing elbow UCL injuries or surgeries were included, whereas posts focused on other procedures (eg, injuries and surgeries in the UCL of the thumb) were excluded. Only English-language posts were included.

Categorization

Posts were categorized and scored on 8 major dimensions: (1) sentiment (positive, negative, or neutral); (2) media format (picture, video, text); (3) perspective (patient, family/friend, physician, other health care provider [eg, physical therapist, nurse], provider organization [eg, hospital, physical therapy organization], professional organization, news media, industry, sports fan, and unassociated individual); (4) timing (preoperative, postoperative, nonoperative, perioperative [within 1 week before or after the surgery], and other); (5) content (surgical site, hospital/surgeon, imaging, rehabilitation, activities of daily living, return to work, return to play, advertisement, education, satisfaction, pain, sports fan, surgery, news, other); (6) post popularity (number of likes and comments); (7) informational accuracy; and (8) year segment (year 1, 08/02/2016 to 08/01/2017, categorized as 2017; year 2, 08/02/2017 to 08/01/2018, categorized as 2018; year 3, 08/02/2018 to 08/01/2019, categorized as 2019).

Statistical Analysis

Data were extracted, aggregated, and categorized based on available online data. Media format and post popularity were automatically tagged through web scraping/web data

[¶]References 1, 3, 11, 14, 15, 17, 22, 23, 25, 27, 36.

[#]References 2, 4, 5, 11, 17, 24, 25, 28, 37, 38, 39.

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Ethical approval was not sought for the present study.

extraction, whereas perspective, timing, and content were manually scored by 2 of 5 independent reviewers (J.T., J.K., Z.W., T.K., K.L.). Interreviewer variability was resolved by original media review and discussion to achieve consistency. Sentiment was determined by overall explicit positive, negative, or neutral expression of the post content and accompanying caption, when applicable. Posts with an overall positive mood or message were categorized as positive, and posts with an overall negative mood or message were categorized as negative. Posts with neither a positive nor a negative bent were categorized as neutral.

A preliminary sentiment analysis was conducted using Microsoft Azure Sentiment Analysis Application Programming Interface (API; Microsoft). The Microsoft Azure analysis was based on analysis models pretrained using an extensive body of text and natural language technologies from Microsoft. Given the complexity of gauging tone and context within language, the Microsoft Azure system was used as only a preliminary guide for sentiment analysis. Every original media post was evaluated by 2 of 5 independent reviewers (J.T., J.K., Z.W., T.K., K.L.). Discrepancies in sentiment grading were resolved through reassessment of the post content by the 2 original reviewers along with a third reviewer (J.S.Y.) to determine the final sentiment result. Informational accuracy was reviewed by the senior author (J.B.C.), who is a sports fellowship-trained orthopaedic surgeon. Media containing medical information on UCL injuries or reconstruction (eg, epidemiology, symptoms, treatment, surgical technique, prevention, and rehabilitation) were analyzed for accuracy of content and categorized as accurate, misleading/misconception, or inaccurate. Misleading/misconception media included any posts containing scientifically unproven information. Inaccurate media included any posts containing scientifically incorrect information. All media evaluation for informational accuracy was supported through literature review.

RESULTS

Instagram

A total of 5846 public posts were shared on Instagram with 1 of the 26 key hashtags over the 3-year period. After exclusion of irrelevant posts, 3119 posts were included for analysis. Table 1 summarizes the overall results of the Instagram content along with post popularity measured by median number of likes and comments. Patients made 34% of posts, and physicians and other health care providers made 28%. The remaining posts were from news media (8%), professional organizations (7%), sports fans (7%), family/friends (5%), and other groups (12%). A slight majority of the posts (51%) had a positive sentiment, whereas 17% were negative. In terms of timing, 57% of posts were set in the pre-, peri-, or postoperative phase, with 47% of total posts occurring in the postoperative period. The content of posts focused mainly on return to play (24%), rehabilitation (21%), education (13%), advertisements (9%), and injury prevention (7%). Across the

dimensions of perspective, timing, sentiment, and content, the most popular Instagram posts, gauged by median likes and comments, were patient perspective, perioperative timing, positive sentiment, and return to play, respectively.

Twitter

A total of 298 public posts were shared on Twitter with 1 of the 22 key hashtags over the 3-year period. After exclusion of irrelevant posts, 267 posts were included in the final analysis. Appendix Table A2 summarizes the overall results of the Twitter content along with post popularity measured through median number of likes, retweets, and comments. Patients made 42% of posts while physicians made 10%. A positive sentiment was most frequently used (48%), whereas 11% of posts were negative. In terms of timing, 51% of posts were nonsurgery-related, and 49% of posts were set in the pre-, peri-, or postoperative phase, with 38% of total posts occurring in the postoperative period. The content of posts focused mainly on return to play (24%), surgery (19%), rehabilitation (18%), and education (15%). Across the dimensions of media format, perspective, timing, sentiment, and content, the most popular Instagram posts, gauged by median likes and comments, were video, patient perspective, perioperative timing, positive sentiment, and return to play, respectively.

Social Media Trends

To bolster the descriptive analytics described for both Instagram and Twitter UCL social media posts over the 3-year period, social media data between the 2 platforms were aggregated and subsequently segmented by year to analyze year-by-year trends in social media across key dimensions. Figure 1 depicts the principal trends over the past 3 years in UCL social media posts. By platform (Figure 1A), both Instagram and Twitter exhibited large increases in UCL social media posts, with Instagram increasing by 39% between 2017 and 2019 and Twitter increasing by 96%. For perspective (Figure 1C), patient posts decreased by 28% whereas physician, provider (hospital and physical therapy groups), and other health care provider (physical therapist, nurse) posts increased by 190%, 132%, and 36%, respectively. In terms of timing (Figure 1D), peri- and postoperative posts showed nearly no change over the 3-year time span, whereas nonsurgery timing posts including nonoperative and other posts increased by >120%. For post sentiment, negative sentiment posts increased by 97% whereas positive posts increased by 9%. The largest relative changes in post content (Figure 1F) over the past 3 years were advertisement, education, and injury prevention posts, with increases of 209%, 135%, and 96%, respectively. Return to play and rehabilitation posts increased by 43% and 8%, respectively. Patient social media posts (Table 2) were dominated by content focused on rehabilitation (37%), return to play (34%), and activities of daily living (8%).

TABLE 1
Summary of Instagram Social Media Posts Regarding the Ulnar Collateral Ligament, 2017-2019^a

Dimension	Category	n (%)	Post Popularity Median (25%-75%)		
			Likes	Comments	
Total	Instagram posts	3119 (100)	53 (25-114)	2 (1-6)	
Media	Picture	2272 (73)	49 (23-112)	2 (0-5)	
	Video	847 (27)	63 (34-116)	3 (1-6)	
Perspective	Patient	1059 (34)	83 (41-154)	4 (2-8)	
	Family/friend	142 (5)	50 (23-106)	3 (1-6)	
	Physician	195 (6)	60 (36-106)	2 (1-7)	
	Provider (physical therapist, nurse)	232 (7)	66 (43-176)	3 (1-8)	
	Hospital or physical therapy group	455 (15)	48 (27-88)	1 (0-4)	
	Professional organization	219 (7)	40 (22-78)	1 (0-3)	
	News media	237 (8)	31 (14-88)	1 (0-3)	
	Sports fan	211 (7)	24 (13-59)	1 (0-3)	
	Other	369 (12)	28 (36-283)	1 (1-8)	
	Timing	Preoperative	179 (6)	30 (15-90)	1 (0-4)
Perioperative		140 (4)	92 (32-245)	8 (2-18)	
Postoperative		1451 (47)	69 (36-134)	3 (1-6)	
Nonoperative		710 (23)	39 (19-78)	1 (0-4)	
Other		639 (20)	40 (21-89)	1 (0-4)	
Sentiment	Positive	1604 (51)	65 (34-127)	3 (1-6)	
	Neutral	993 (32)	39 (19-94)	1 (0-4)	
	Negative	522 (17)	43 (20-114)	2 (0-6)	
Content	Return to play	741 (24)	76 (35-154)	3 (1-7)	
	Rehabilitation	648 (21)	65 (36-114)	3 (1-6)	
	Education	402 (13)	45 (23-87)	2 (0-5)	
	Advertisement	284 (9)	28 (18-49)	1 (0-2)	
	Injury prevention	212 (7)	43 (26-99)	2 (0-5)	
	Surgery	142 (5)	60 (23-202)	2 (1-9)	
	Activities of daily living	111 (4)	48 (33-89)	3 (1-6)	
	News	107 (3)	27 (13-76)	1 (0-4)	
	Surgical site (eg, sutures, incision)	97 (3)	57 (29-106)	3 (1-7)	
	Other	375 (12)	51 (26-96)	2 (0-5)	
	Post popularity	Mean No. of likes	150		
		Mean No. of comments	6		

^aBoldface indicates the most popular social media post types by likes within each dimension.

Figure 2 shows the composition of posts by sentiment for perspective types between 2017 and 2019. The frequency distribution of sentiment posts across 2017, 2018, and 2019 for negative, neutral, and positive sentiment posts was statistically significant, with a significant increase in negative posts and decrease in positive posts, $\chi(4, N = 3386) = 49.31$, $P < .001$. For positive sentiment posts (Figure 2A), posts by patients and health care providers (only physical therapists and nurses) decreased by 30% and 28%, respectively, whereas positive sentiment posts by physicians and provider organizations (hospitals and physical therapy groups) increased by >139% and 124%, respectively. For neutral sentiment posts (Figure 2B), health care provider and news media posts increased by >100% with growth rates ranging from 121% to 184%, whereas neutral patient posts decreased by 39%. Negative sentiment posts shared by physicians spiked by 750%, whereas negative patient posts decreased by 4% (Figure 2C). Negative posts by physicians

consisted predominantly of content focused on prevention (35%) and education (29%).

Physician and Health Care Provider Use of Instagram and Twitter

Of the 3386 total social media posts over the 3-year period, 931 (27%) were posted by physicians (including orthopaedic surgeons and non-orthopaedic physicians), physical therapists, nurses, physician assistants, hospitals, and other provider organizations. Provider identities were confirmed by social media profile biographies. Providers tended to post content focused on education (29%), rehabilitation (20%), and injury prevention (14%) (Table 3). Table 4 illustrates the accuracy review of UCL social media posts by providers. Of these posts, 38 (4%) were deemed inaccurate. A total of 14 posts (1.5% of total provider posts) contained factually incorrect information, whereas 24 posts (2.5%)

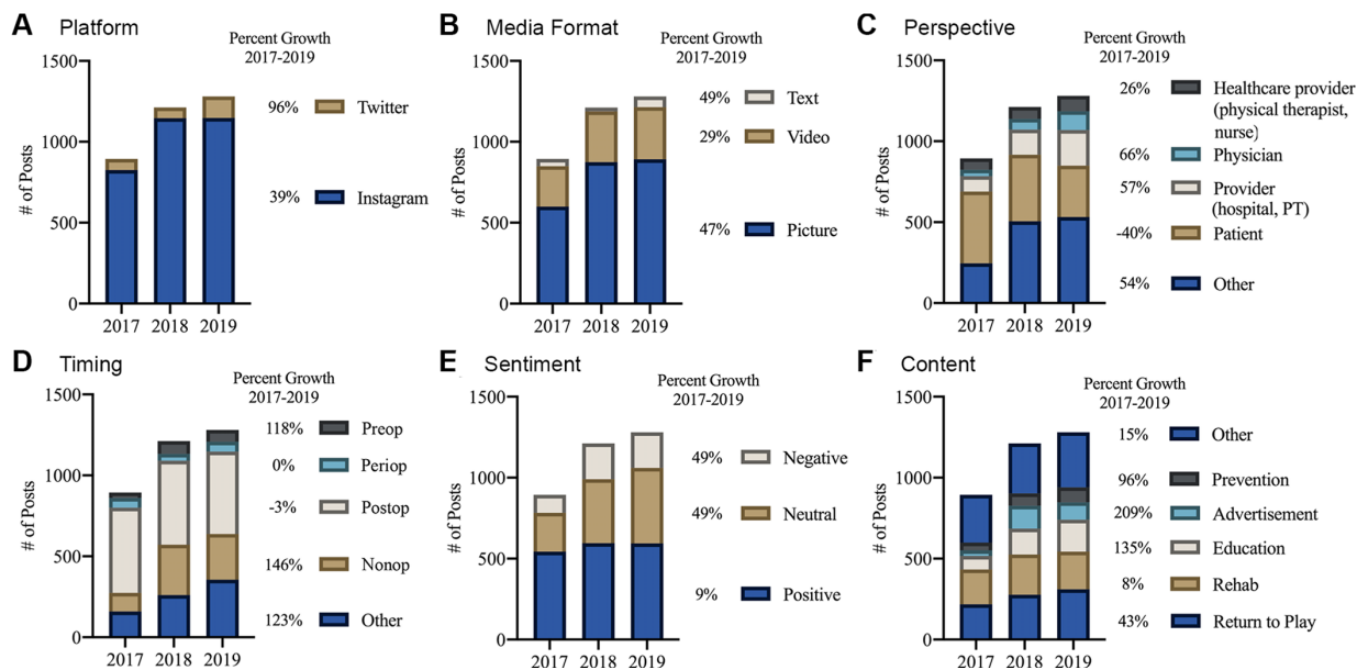


Figure 1. Year-by-year change in social media posts regarding the ulnar collateral ligament, by dimension. Number of posts by year broken down into 6 dimensions: (A) platform, (B) media format, (C) perspective, (D) timing, (E) sentiment, and (F) content. Percentage growth between 2017 and 2019 is reported for each subtype. Periop, perioperatively; Postop, postoperatively; Preop, preoperatively; PT, physical therapist.

TABLE 2
Patient Twitter Social Media Posts Regarding the Ulnar Collateral Ligament, by Content, 2017-2019

Content	n (%)
Total	1172 (100)
Rehabilitation	430 (37)
Return to play	395 (34)
Activities of daily living	91 (8)
Surgery	72 (6)
Surgical site (eg, sutures, incision)	61 (5)
Hospital/surgeon	42 (4)
Pain	20 (2)
Other	61 (5)

were classified as either misleading or a misconception. Figure 3 demonstrates 2 examples of inaccurate posts shared by providers.

DISCUSSION

This is the first study to examine year-by-year trends for any injury on social media. Overall, 4% of posts shared by providers were inaccurate. Patient UCL posts accounted for the largest proportion of total posts, and positive sentiment posts represented the highest proportion by sentiment. With >70% of adults in the United States engaged in some form of social media, social media analytics provides a powerful opportunity to better understand and improve the

patient experience.²⁹ Social media’s pervasiveness and immense potential for information dissemination fuel a need to better understand current usage trends to optimize patient education and administration of optimal care. In recent years, health care trends have seen a distinct shift toward patient-centric care models with an emphasis on understanding how patients perceive their health. Traditional methods for patient insight are derived from standardized assessments, including patient-reported outcomes and patient satisfaction surveys. However, these tools are often categorical in nature and fail to convey patient perspectives beyond specifically solicited metrics. Social media expands these boundaries by delivering a nontraditional and noncategorical examination of patient perspectives.

The current UCL in social media study shows that, overall, across both Instagram and Twitter, the number of total UCL-related posts has increased substantially over the past few years even as inaccurate and misleading posts from providers—including orthopaedic surgeons, nonorthopaedic physicians, physical therapists, nurses, and hospitals—continue to circulate. More specifically, the study demonstrates 3 significant findings.

The first key finding reveals that 4% of provider posts shared on social media platforms are inaccurate. Although total patient posts have declined by 28% since 2017, total posts by physicians and providers, including hospitals and physical therapy groups, continue to surge and have risen by >110%. Saleh et al³⁵ described social media’s role in orthopaedic surgery as both an educational platform and an instrument to promote patient satisfaction. With so much of the US population engaged in social media, social

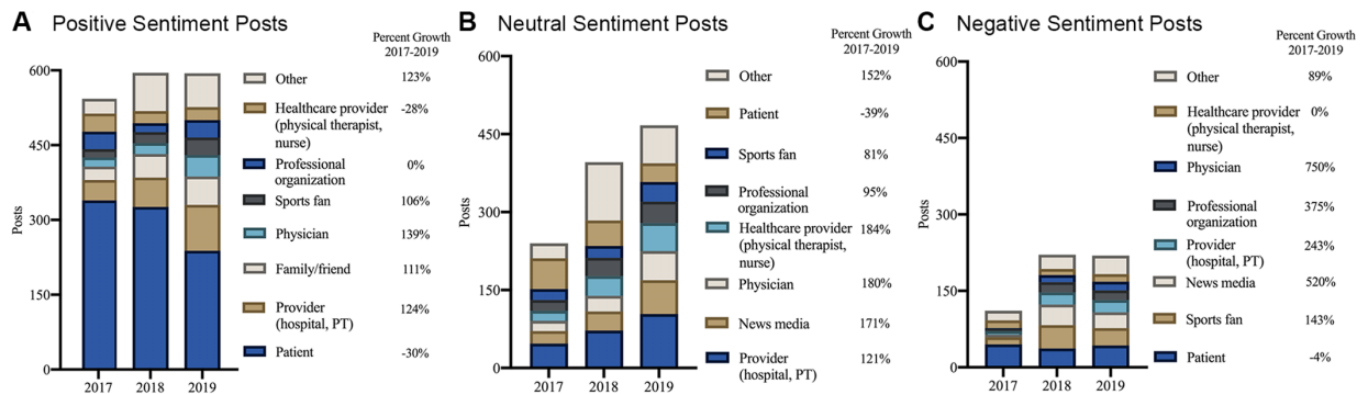


Figure 2. Sentiment posts by perspective. Number of posts broken down by sentiment type—positive, neutral, negative—and perspective type. Percentage growth between 2017 and 2019 is reported for each perspective type. PT, physical therapist.

TABLE 3

Provider Twitter Social Media Posts Regarding the Ulnar Collateral Ligament, by Content, 2017-2019

Content	n (%)
Total	931 (100)
Education	267 (29)
Rehabilitation	182 (20)
Injury prevention	129 (14)
Return to play	100 (11)
Advertisement	96 (10)
Research	56 (6)
Other	101 (11)

TABLE 4

Accuracy Review of Social Media Posts by Providers Regarding the Ulnar Collateral Ligament, 2017-2019^a

Category	Instagram	Twitter	Total
Total posts, n	3119	267	3386
Total provider posts, ^b n (%)	887 (28)	44 (16)	931 (27)
Accurate content (% of provider posts)	855 (96)	38 (86)	893 (96)
Issues (% of provider posts)			
Inaccurate	32 (4)	6 (14)	38 (4)
Misleading/misconception	11 (1.5)	3 (7)	14 (1.5)
Misleading/misconception	21 (2.5)	3 (7)	24 (2.5)

^aBoldface indicates the total provider posts with accuracy issues, including both inaccurate and misleading content.

^bProviders include physicians, hospitals, physical therapists, and nurses.

media analytics provide a powerful tool through which surgeons can not only survey patient perspectives but also interact with and educate patient and general populations on injuries, surgeries, and rehabilitation. However, the increasing pool of provider posts focused on education, rehabilitation, and injury prevention accentuates the importance of sharing accurate content while avoiding the spread of wrong or misleading information, especially if patients believe they are consuming educational material from credible sources. Although the accuracy review of

UCL social media posts flagged only 4% of provider posts as being wrong, misleading, or a misconception, these posts still represent an area for improvement. The concern with these inaccurate provider posts lies in the fact that these providers either may not (but should) understand the current literature or are intentionally reporting false information. In addition to these UCL posts, a sizable number of irrelevant posts (not included in the social media analysis) rely on *Tommy John* and *UCL* keywords in their hashtag usage to target audiences for unrelated advertisements and messages. By associating unrelated products and information with UCL injuries or surgery, these types of social media posts have the potential to severely distort expectations and mislead both patients and the general public. Heightened awareness around the impact and influence of social media, especially in educating patients accurately and responsibly, is critical for providers to understand in order to optimize their ability to connect with and help patients through this nontraditional platform.

The second key finding illustrates that patients comprise the largest proportion of UCL posts. Patients tend to share their own patient experiences revolving around return to play and rehabilitation. Within both of these categories, the overwhelming sentiment is positive (>80%). Unlike physicians, patients rarely post content on education and medical information (<1%). When they do, patients are often resharing material originally posted by a health care provider. Thus, in terms of biased and inaccurate medical information, patients seem to be more likely on the receiving end rather than the initiating end.

The third key finding shows that positive sentiment posts represent the highest proportion of posts by sentiment. However, the proportion of negative sentiment posts versus positive sentiment posts has risen substantially over the past few years. Together, these 3 findings demonstrate the potential of an alternative method to gauge patient satisfaction through understanding how and what patients share within their personal networks. Furthermore, glean- ing how patients as well as the general public perceive and prioritize different aspects of their UCL injuries, surgeries, and rehabilitation process may help surgeons in tailoring

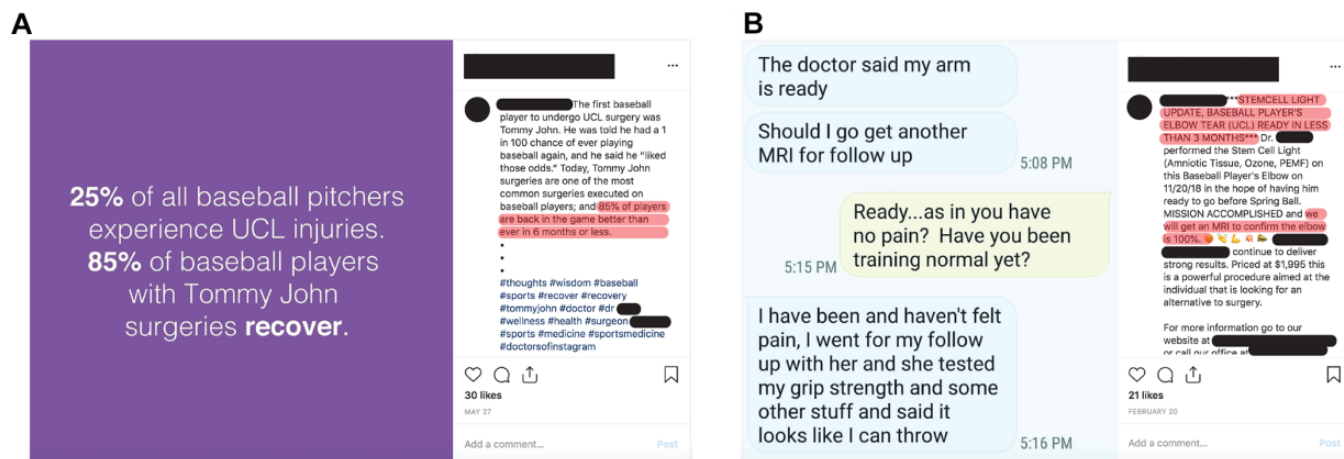


Figure 3. Examples of inaccurate and misleading social media posts by providers. (A) Inaccurate physician post about ulnar collateral ligament (UCL) reconstruction return-to-play timeline and recovery rate; inaccurate content highlighted in red. (B) Misleading integrative medicine clinic post about stem cell therapy recovery and timeline; misleading content highlighted in red. MRI, magnetic resonance imaging; PEMF, pulsed electromagnetic field therapy.

how they interact with patients both clinically and through social media.

Overall, the majority of UCL posts have a positive sentiment, suggesting high overall satisfaction. However, although positive sentiment posts increased by 9%, negative sentiment posts increased by 97% over the same period. This increase in negative sentiment posts between 2017 and 2019 can be traced to negative posts shared by physicians (750% increase), news media (520% increase), professional organizations (375%), provider organizations (hospitals and physical therapy) (243%), and sports fans (143%). Negative sentiment physician posts, composed primarily of content on prevention and education (65% combined), focused on the significance of UCL injury prevention in young athletes with the goal of avoiding UCL reconstruction and the arduous rehabilitation process that follows. Notably, negative patient posts decreased by 4% whereas positive and neutral patient posts decreased by 30% and 39%, respectively. With social media's extensive influence over public perception and expectations, this trend toward more negative sentiment posts regarding UCL injury and surgery is an area to closely monitor in coming years.

Based on the findings of this study, we offer 3 recommendations for orthopaedic clinicians. First, clinicians treating patients with UCL injuries should be aware of the potential for patients to encounter inaccurate or misleading information through social media, even if shared by health care providers. As with many online resources, social media is not peer reviewed. The lack of a review process creates the risk of propagating biased, misleading, and inaccurate information among patients. Consequently, clinicians should try to minimize these detrimental effects by holding candid conversations with patients in the clinic to answer questions or clarify misconceptions. Furthermore, guiding patients toward specific online resources for patient education allows clinicians to better facilitate how and what

patients learn regarding UCL injuries. Second, with the rapid increase in UCL social media posts by health care providers, and as authoritative medical figures, clinicians engaging in social media should recognize the impact and influence their own posts can have on patients and the general public. Accordingly, conscious efforts to share only unbiased and accurate medical information reflecting current literature is critical to optimize education. Third, social media provides clinicians with a unique lens through which to assess patient experience. Patients' posts comprise the largest segment of social media posts, often sharing personal experiences with injury, surgery, and rehabilitation. Although patient satisfaction assessments through social media lack the ability to provide the refined feedback of direct patient surveys, the large sample size offered by social media can give clinicians a broad-strokes perspective of how UCL injuries and UCL reconstruction are perceived by both patients and the general public.

In summary, social media's dissemination of medical information and details of specific surgical procedures such as UCL reconstruction represents a rapidly developing domain. To date, this sphere has been relatively untapped by the medical community despite its wealth of primary, unfiltered patient experiences. Harnessing social media analytics may lead to a deeper understanding of the patient experience, thus potentially guiding more personalized care. At the same time, social media is a powerful tool through which surgeons can engage and educate patients and the general public.

Limitations

There are multiple limitations to the current study. The analysis used to capture UCL injury and surgery posts is based on a keyword search defined by the hashtags included in each social media post. Thus, private posts or posts without a relevant hashtag could not be captured.

This study attempted to address this constraint by widening the scope of keywords used. In assessing the data, interpretation of sentiment is subjective. By using 2 separate sentiment algorithms and rigorously evaluating each post with 2 independent reviewers, the study sought to minimize the variability in this category. Additionally, it is a common phenomenon for social media users to highlight the positive aspects of their lives rather than the negative. As a result, this can create a possible bias for positive outcomes while failing to comprehensively capture negative experiences that patients may face.²⁰ This manipulation bias is inherent in social media and can therefore make a descriptive social media analytics snapshot difficult to interpret. The current study attempted to address this constraint by exploring year-by-year trends to evaluate directional changes that a single snapshot is unable to capture. The social media manipulation bias also prevents generalizing our results to the entire population of patients with UCL injuries because our analysis includes only patients who choose to express their opinions and attitudes on Instagram or Twitter. However, aggregating a large, publicly available pool of subjective patient-reported data through social media is still invaluable in illuminating trends over time.

Because of the nature of this study, no specifics about surgeries, including specific surgical technique, recovery complexities, or patient comorbidities, were taken into account. Furthermore, social media content and sentiment cannot be a substitute for objective, patient-reported outcomes and return-to-play rates. Among social media users, there is also a discrete age bias. Although some form of social media is used by >70% of US adults, only 37% use Instagram and only 22% use Twitter.²⁹ Use of social media, especially Instagram and Twitter, is heavily skewed toward the younger population between 18 and 30.²⁹ Finally, this social media study did not analyze Facebook and Snapchat data despite their popularity, because public data for these platforms are much more restricted and difficult to aggregate.

CONCLUSION

Patients and the general public reported an overall positive experience with UCL reconstruction. However, the past 3 years have seen a relative increase in negative sentiment posts regarding UCL reconstruction. Posts were made most often by patients and tended to focus on return to play, rehabilitation, and activities of daily living. The number of patient posts has declined over the past few years. In contrast, a substantial and rapidly growing portion of social media posts was created by physicians and other health care providers including physical therapists and nurses and tended to focus on education, rehabilitation, and injury prevention. Providers must be careful to produce accurate posts that are helpful in promoting appropriate patient education.

REFERENCES

- Bruce JR, Andrews JR. Ulnar collateral ligament injuries in the throwing athlete. *J Am Acad Orthop Surg*. 2014;22(5):315-325.
- Bruce JR, ElAttrache NS, Andrews JR. Revision ulnar collateral ligament reconstruction. *J Am Acad Orthop Surg*. 2018;26(11):377-385.
- Cain EL, Andrews JR, Dugas JR, et al. Outcome of ulnar collateral ligament reconstruction of the elbow in 1281 athletes: results in 743 athletes with minimum 2-year follow-up. *Am J Sports Med*. 2010;38(12):2426-2434.
- Camp CL, Desai VS, Conte S, et al. Revision ulnar collateral ligament reconstruction in professional baseball: current trends, surgical techniques, and outcomes. *Orthop J Sports Med*. 2019;7(7)(suppl 5):2325967119S0036.
- Clain JB, Vitale MA, Ahmad CS, Ruchelsman DE. Ulnar nerve complications after ulnar collateral ligament reconstruction of the elbow: a systematic review. *Am J Sports Med*. 2019;47(5):1263-1269.
- Conte S, Camp CL, Dines JS. Injury trends in Major League Baseball over 18 seasons: 1998-2015. *Am J Orthop (Belle Mead NJ)*. 2016;45(3):116-123.
- Curry E, Li X, Nguyen J, Matzkin E. Prevalence of internet and social media usage in orthopedic surgery. *Orthop Rev (Pavia)*. 2014;6(3):5483.
- Duymus TM, Karadeniz H, Çağan MA, et al. Internet and social media usage of orthopaedic patients: a questionnaire-based survey. *World J Orthop*. 2017;8(2):178-186.
- Duymuş TM, Karadeniz H, Şükür E, Atiç R, Zehir S, Azboy İ. Social media and internet usage of orthopaedic surgeons. *J Clin Orthop Trauma*. 2017;8(1):25-30.
- Economides JM, Fan KL, Pittman TA. An analysis of plastic surgeons' social media use and perceptions. *Aesthetic Surg J*. 2019;39(7):794-802.
- Erickson BJ, Gupta AK, Harris JD, et al. Rate of return to pitching and performance after Tommy John surgery in Major League Baseball pitchers. *Am J Sports Med*. 2014;42(3):536-543.
- Fidai MS, Tramer JS, Jildeh TR, Stine S, Meta F, Makhni EC. Social media use in the field of orthopedic surgery. In: Makhni EC, Makhni MC, Swart EF, Bush-Joseph CA, eds. *Orthopedic Practice Management*. Springer International Publishing; 2019:61-70.
- Fleisig GS, Andrews JR. Prevention of elbow injuries in youth baseball pitchers. *Sports Health*. 2012;4(5):419-424.
- Ford GM, Genuario J, Kinkartz J, Githens T, Noonan T. Return-to-play outcomes in professional baseball players after medial ulnar collateral ligament injuries. *Am J Sports Med*. 2016;44(3):723-728.
- Fuller JB, Dunn JC, Kusnezov NA, Nesti LJ, Kilcoyne KG. Outcome measures after medial ulnar collateral ligament reconstructions in a military population. *J Shoulder Elbow Surg*. 2019;28(2):317-323.
- Goyal DKC, Galetta MS, Fang T, et al. The impact of social media in orthopaedics. *Curr Orthop Pract*. 2019;30(5):419-422.
- Griffith TB, Ahmad CS, Gorroochurn P, et al. Comparison of outcomes based on graft type and tunnel configuration for primary ulnar collateral ligament reconstruction in professional baseball pitchers. *Am J Sports Med*. 2019;47(5):1103-1110.
- Haeberle HS, Bartschat NI, Navarro SM, et al. Hip arthroscopy: a social media analysis of patient perception. *Orthop J Sports Med*. 2019;7(6):2325967119854188.
- Haeberle HS, Egger AC, Navarro SM, et al. Social media and pediatric scoliosis: an analysis of patient and surgeon use. *Surg Technol Int*. 2017;31:189-196.
- Herron PD. Opportunities and ethical challenges for the practice of medicine in the digital era. *Curr Rev Musculoskelet Med*. 2015;8(2):113-117.
- Hodgins JL, Vitale M, Arons RR, Ahmad CS. Epidemiology of medial ulnar collateral ligament reconstruction. *Am J Sports Med*. 2016;44(3):729-734.
- Jones KJ, Osbahr DC, Schrupf MA, Dines JS, Altchek DW. Ulnar collateral ligament reconstruction in throwing athletes: a review of current concepts. AAOS exhibit selection. *J Bone Joint Surg Am*. 2012;94(8):e49.
- Koh JL, Schafer MF, Keuter G, Hsu JE. Ulnar collateral ligament reconstruction in elite throwing athletes. *Arthroscopy*. 2006;22(11):1187-1191.
- Liu JN, Garcia GH, Conte S, ElAttrache N, Altchek DW, Dines JS. Outcomes in revision Tommy John surgery in Major League Baseball pitchers. *J Shoulder Elbow Surg*. 2016;25(1):90-97.

25. Makhni EC, Lee RW, Morrow ZS, Gualtieri AP, Gorroochurn P, Ahmad CS. Performance, return to competition, and reinjury after Tommy John surgery in Major League Baseball pitchers: a review of 147 cases. *Am J Sports Med.* 2014;42(6):1323-1332.
26. Ng JP, Tarazi N, Byrne DP, Baker JF, McCabe JP. Scoliosis and the social media: Facebook as a means of information exchange. *Spine Deform.* 2017;5(2):102-108.
27. O'Brien DF, O'Hagan T, Stewart R, et al. Outcomes for ulnar collateral ligament reconstruction: a retrospective review using the KJOC assessment score with two-year follow-up in an overhead throwing population. *J Shoulder Elbow Surg.* 2015;24(6):934-940.
28. Osbahr DC, Cain EL, Raines BT, Fortenbaugh D, Dugas JR, Andrews JR. Long-term outcomes after ulnar collateral ligament reconstruction in competitive baseball players: minimum 10-year follow-up. *Am J Sports Med.* 2014;42(6):1333-1342.
29. Perrin A, Anderson M. Share of U.S. adults using social media, including Facebook, is mostly unchanged since 2018. Pew Research Center. Published April 10, 2019. <https://www.pewresearch.org/fact-tank/2019/04/10/share-of-u-s-adults-using-social-media-including-facebook-is-mostly-unchanged-since-2018/>
30. Quesenberry KA. The basic social media mistakes companies still make. *Harvard Business Review.* Published January 2, 2018. <https://hbr.org/2018/01/the-basic-social-media-mistakes-companies-still-make>
31. Ramkumar PN, La T, Fisch E, et al. Integrating social media and anterior cruciate ligament surgery: an analysis of patient, surgeon, and hospital use. *Arthroscopy.* 2017;33(3):579-585.
32. Ramkumar PN, Navarro SM, Cornaghi MM, et al. Social media in shoulder & elbow surgery: an analysis of Twitter and Instagram. *Int J Sports Med.* 2018;39(7):564-570.
33. Ramkumar PN, Navarro SM, Haeberle HS, et al. Cellular therapy injections in today's orthopedic market: a social media analysis. *Cytotherapy.* 2017;19(12):1392-1399.
34. Ramkumar PN, Navarro SM, Haeberle HS, Chughtai M, Flynn ME, Mont MA. Social media and total joint arthroplasty: an analysis of patient utilization on Instagram. *J Arthroplasty.* 2017;32(9):2694-2700.
35. Saleh J, Robinson BS, Kugler NW, Illingworth KD, Patel P, Saleh KJ. Effect of social media in health care and orthopedic surgery. *Orthopedics.* 2012;35(4):294-297.
36. Saper M, Shung J, Pearce S, Bompadre V, Andrews JR. Outcomes and return to sport after ulnar collateral ligament reconstruction in adolescent baseball players. *Orthop J Sports Med.* 2018;6(4):2325967118769328.
37. Somerson JS, Petersen JP, Neradilek MB, Cizik AM, Gee AO. Complications and outcomes after medial ulnar collateral ligament reconstruction: a meta-regression and systematic review. *JBJS Rev.* 2018;6(5):e4.
38. Watson JN, McQueen P, Hutchinson MR. A systematic review of ulnar collateral ligament reconstruction techniques. *Am J Sports Med.* 2014;42(10):2510-2516.
39. Wilson AT, Pidgeon TS, Morrell NT, Dasilva MF. Trends in revision elbow ulnar collateral ligament reconstruction in professional baseball pitchers. *J Hand Surg Am.* 2015;40(11):2249-2254.

APPENDIX

TABLE A1
Instagram and Twitter Hashtag Keywords for Ulnar Collateral Ligament (UCL) Social Media Posts

Instagram Hashtags	Twitter Hashtags
#newUCL	#TommyJohn
#TommyJohn	#TommyJohnComeback
#TommyJohnComeback	#TommyJohnInjury
#TommyJohnInjury	#TommyJohnRecovery
#TommyJohnLigament	#TommyJohnrehab
#TommyJohnRecovery	#TommyJohnRepair
#TommyJohnrehab	#TommyJohnReturn
#TommyJohnRepair	#TommyJohnSurgery
#TommyJohnReturn	#TommyJohnSurgeryRehab
#TommyJohnSurgery	#TommyJohnSurvivor
#TommyJohnSurgeryRecovery	#tornUCL
#TommyJohnSurgeryRehab	#UCLinjury
#TommyJohnSurvivor	#UCLproblems
#tornUCL	#UCLprobs
#UCLinjury	#UCLreconstruction
#UCLreconstruction	#UCLrehab
#UCLrecovery	#UCLrepair
#UCLrehab	#UCLrepairsurgery
#UCLrepair	#UCLsurgery
#UCLrepairsurgery	#UCLtear
#UCLsurgery	#Ulnarcollateralligament
#UCLtear	#Ulnarcollateralligamentreconstruction
#Ulnarcollateralligament	
#Ulnarcollateralligamentreconstruction	
#Ulnarcollateralligamentrepair	
#Ulnarcollateralligamentsurgicalrepair	

TABLE A2
Summary of Ulnar Collateral Ligament Twitter Social Media Posts, 2017-2019^a

Dimension	Category	n (%)	Post Popularity Median (25-75%)		
			Likes	Retweets	Comments
Total	Twitter posts	267 (100)	13 (2-42)	2 (0-5)	0 (0-2)
Media	Text	135 (51)	6 (1-21)	1 (0-3)	0 (0-2)
	Picture	93 (35)	16 (2-38)	2 (0-5)	0 (0-2)
	Video	39 (15)	48 (23-76)	4 (2-8)	1 (0-3)
Perspective	Patient	113 (42)	40 (18-68)	2 (0-4)	1 (0-4)
	Sports fan	39 (15)	3 (0-11)	1 (0-4)	0 (0-1)
	Physician	27 (10)	1 (0-11)	0 (0-3)	0 (0-0)
	Family/friend	25 (9)	11 (1-32)	1 (0-4)	1 (0-1)
	Hospital or physical therapy group	15 (6)	6 (5-17)	4 (2-5)	0 (0-0)
	News media	12 (4)	11 (0-15)	3 (0-4)	0 (0-1)
	Professional organization	9 (3)	0 (6-15)	5 (4-7)	0 (0-1)
	Other	27 (10)	13 (0-8)	0 (0-3)	0 (0-1)
	Timing	Preoperative	5 (2)	13 (8-21)	2 (0-2)
Perioperative		25 (9)	42 (36-67)	2 (0-6)	2 (0-5)
Postoperative		102 (38)	34 (11-67)	2 (0-4)	1 (0-3)
Other		135 (51)	4 (0-12)	1 (0-5)	0 (0-1)
Sentiment	Positive	128 (48)	35 (8-65)	2 (0-5)	1 (0-3)
	Neutral	110 (41)	5 (0-17)	1 (0-4)	0 (0-1)
	Negative	29 (11)	5 (0-15)	1 (0-4)	0 (0-1)
Content	Return to play	65 (24)	32 (8-61)	2 (1-6)	1 (0-3)
	Surgery	51 (19)	15 (4-44)	2 (0-6)	1 (0-2)
	Rehabilitation	47 (18)	32 (13-72)	2 (0-4)	1 (0-4)
	Education	40 (15)	5 (1-19)	2 (0-5)	0 (0-1)
	Sports fan	32 (12)	2 (0-9)	0 (0-3)	0 (0-0)
	Research	15 (6)	2 (0-8)	1 (0-4)	0 (0-0)
	Activities of daily living	5 (2)	1 (1-1)	0 (0-0)	1 (0-1)
	Other	12 (4)	13 (0-22)	2 (0-2)	0 (0-1)
	Post popularity	Mean No. of likes	46		
Mean No. of retweets		5			
Mean No. of comments		2			

^aBoldface indicates the most popular social media post types by median likes within each dimension.