# ORIGINAL ARTICLE

## Cosmetic

# Sentiment Analysis Surrounding Blepharoplasty in Online Health Forums

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**Background:** Upper and lower blepharoplasty are among the most common procedures in aesthetic surgery and are often emotionally laden due to the subjective nature of outcomes and implications with beauty and self-identity. This article capitalizes on the increasing wealth of patient-provided health information online and is the first to analyze the emotions surrounding blepharoplasty discussions in an open internet health forum, MedHelp.
**Methods:** We used Python to scrape MedHelp for threads that contained "blepharoplasty" and then used IBM Watson Natural Language Understanding to perform sentiment analyses, calculating a general sentiment score (−1 to +1) as well as emotion scores for anger, sadness, joy, fear, and disgust (0 to 1) for posts and keywords contained within the posts. Keywords were then manually grouped into five distinct clinical categories: symptoms, doctor, treatment, medication, and body.
**Results:** We collected 52 threads containing "blepharoplasty," yielding 154 posts and 1365 keywords. The average sentiment score was negative among all posts (−0.15) and keywords (−0.30). Among all posts and keywords, sadness had the highest score and disgust had the lowest score.
**Conclusions:** Fear and sadness are the predominant emotions for blepharoplasty patients online, and the most negative symptoms cited are not ones that surgeons typically expect. *(Plast Reconstr Surg Glob Open 2022;10:e4213; doi: 10.1097/GOX.0000000000004213; Published online 28 March 2022.)*

## INTRODUCTION

Upper and lower eyelid blepharoplasty are among the most common procedures in aesthetic surgery.[1] The cosmetic and functional benefits of the surgery are often highly desirable for patients but difficult to fully understand. Although several studies have examined the functional outcomes of blepharoplasty, subjective indicators of patient satisfaction are often less known to the surgeon.[2,3]

Patient attitudes toward plastic surgery, including blepharoplasty, are widely discussed in online forums such as MedHelp. These forums are publicly accessible and serve as a space for patients to candidly discuss their

expectations, concerns, and results of surgery more freely than they may at the doctor's office. The popularity and engagement with internet health forums has rapidly increased with the tremendous increase in internet usage over the past few decades, with more than half the global population actively online today.[4] Furthermore, in 2012, 72% of American internet users interacted with health information on the web.[5]

To capitalize on the wealth of patient-provided commentary available online surrounding blepharoplasty, we collated online internet posts associated with the term "blepharoplasty" and then used natural language processing (NLP) and sentiment analysis, a subbranch of NLP, to detect and quantify positive, neutral, and negative sentiments in these blepharoplasty-related posts. Sentiment analysis can also assign scores for specific emotions such as anger, disgust, fear, joy, and sadness to the keywords and mined posts. This type of online analysis uncovers patient attitudes surrounding blepharoplasty, identifies potential trends among the topics discussed, and hones in on the relevant issues that elicit the strongest emotions, positive or negative. This article examines all of these elements,

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highlighting the unique insights that can be gained from mining and processing web data to ultimately improve patient care and satisfaction.

## METHODS

We adapted a novel methodology developed by Nguyen et al[6] to mine internet data and analyze the sentiments and emotions contained in that data as described below. The primary paper can be referred for further detail and the source code. Figure 1 summarizes our approach.

### Data Source

MedHelp is the world's largest web-based health community, with more than 15 million visits per month.[7,8] Contained in this platform are 299 official discussion forums, including "Eye Care Community" and "Ask a Doctor—Eye Care Forum," as well as over 1000 user-made groups. MedHelp is publicly accessible and free to use. Each forum consists of multiple threads, which include an initial post containing a question asked by a user, followed by reply posts by one or more users.

### Data Extraction

All relevant threads (including the initial post plus all subsequent reply posts) that contained the search term "blepharoplasty" somewhere within the thread were collected. This was accomplished with a Python script using the package Beautiful Soup, which produced the full text of each post as well as relevant metadata, such as the user ID and overarching forum for each post. Although Nguyen et al[6] used 39 search terms in their initial methodology paper designed to encompass most of the field of oculoplastics, we decided to focus on the very specific single search term "blepharoplasty" with the aim of producing data with a more focused scope and with less noise (eg, posts that contain the search term but are not really relevant to the desired topic).

### NLP and Sentiment Analysis

After extracting the relevant posts, IBM Watson Natural Language Understanding was used to perform sentiment and emotion analyses of the free text of each post. IBM Watson Natural Language Understanding is a machine learning system that uses linguistic models to break free text into important words and phrases, called keywords. The program then calculates a general sentiment score as well as emotion scores for anger, sadness, joy, fear, and disgust for each keyword as well as overall for each post. The sentiment scores ranged from −1 to +1 on a linear scale, with negative scores corresponding to negative sentiments, 0 to neutral sentiments, and positive scores to positive sentiments. The emotion scores ranged from 0 to 1, with a higher score corresponding to a higher likelihood of the presence of that emotion.

### Keyword Processing and Analysis

A Jupyter Notebook script with Python packages Natural Language Toolkit, Pandas, and NumPy was used to group keywords with the same meaning by lowercasing and lemmatizing the keywords as well as removing punctuation and stop words from the keywords. The same script was used to calculate the mean and SD of each processed keyword's associated sentiment and emotion scores (sentiment, sadness, fear, anger, joy, and disgust scores). Keywords were then manually grouped (by T.J.L.) into five distinct clinical categories: symptoms, doctor, treatment, medication, and body. The mean and SD of each of the five keyword groupings were calculated using standard weighted average formulas.

## RESULTS

Searching all 300+ forums on MedHelp using "blepharoplasty" as a search term resulted in 52 threads, yielding 154 posts and 1365 processed keywords. The average sentiment score was negative among all posts (−0.15) and keywords (−0.30). Among all posts and keywords, sadness had the highest score and disgust had the lowest score (Table 1).

### Trends in Sentiment and Emotion Scores by Clinical Grouping

The five clinical categories ordered from most negative to least negative overall sentiment were symptoms, body, medication, treatment, and doctor. Interestingly, the same order applied in terms of average fear score from highest to lowest, as well as for average sadness score from the highest to lowest (Fig. 2). These results suggested that in this dataset, fear and sadness seem to be inversely related to the sentiment score, for example, the more negative the sentiment, the higher the anger and fear. This is statistically quantified in Figure 3, which shows a strong correlation between sentiment and fear, sentiment and sadness, and fear and sadness. In contrast, there was no significant correlation between sentiment and disgust, joy, or anger.

### Looking at the Most Negative Sentiments

Overall and within each clinical keyword grouping, the overall sentiment was negative. This is likely due to the fact that MedHelp is a website designed for patients to ask questions and express concerns, rather than to post positive reviews. The symptoms group was associated with the most negative overall sentiment as well as the highest fear and sadness. Within this group, the top 10 most negative

### Takeaways

**Question**: Using natural language processing, what are the emotions associated with internet discussions related to blepharoplasty?

**Findings**: Fear and sadness are the predominant emotions for blepharoplasty patients online, and the most negative symptoms cited are not ones that surgeons typically expect.

**Meaning**: Sentiment analysis of online forums can uncover novel insights from patient-provided feedback, and is widely applicable to other medical topics and procedures to help practitioners provide more patient-centric care.
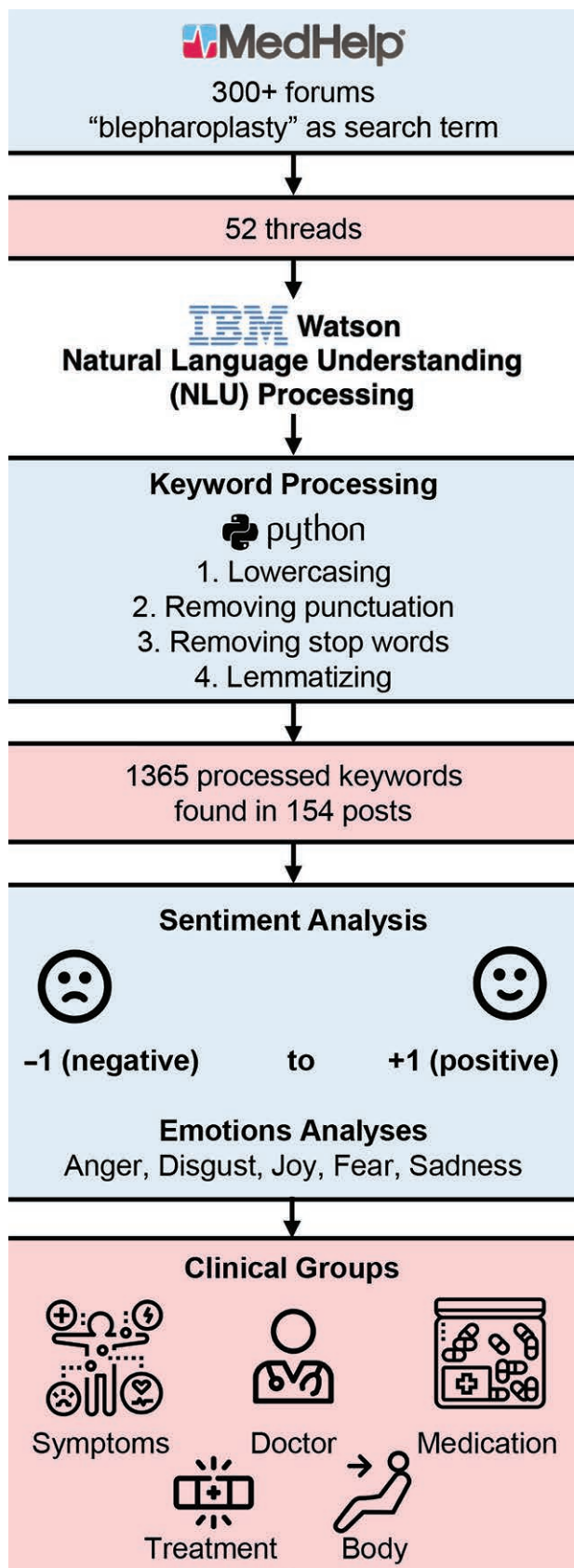
**Fig. 1.** Graphic summarizing the methodology used for sentiment and emotion analysis.

**Table 1. Average Sentiment and Emotion Scores for the 154 Posts and 1365 Keywords Generated from the Search Term "Blepharoplasty"**

|          | Overall Sentiment | Anger | Disgust | Fear | Joy | Sadness |
|----------|-------------------|-------|---------|------|-----|---------|
| Keywords | −0.30             | 0.11  | 0.10    | 0.21 | 0.20 | 0.36   |
| Posts    | −0.15             | 0.11  | 0.09    | 0.25 | 0.31 | 0.40   |

symptoms are shown in Table 2. It is interesting to note that a majority of these symptoms are not ones that are commonly thought to be associated with blepharoplasty complications by the oculoplastics community.

On the posts level, the posts associated with the most negative sentiments are generally questions from patients who are dissatisfied with how their eyelids look naturally and seeking guidance on potential treatments, such as blepharoplasty. The posts with both the highest fear and sadness scores were overwhelmingly related to questions and concerns about blepharoplasty postoperative healing. The posts with the highest anger scores were generally related to postoperative dry eye symptoms and skin tightness. The posts with the highest disgust score were generally related to skepticism on the effectiveness of interventions for treatment of eyelid skin, including blepharoplasty, injections, and skin creams. Finally, the posts with the highest joy scores were related to satisfaction with a blepharoplasty outcome or satisfaction with getting useful answers to questions posted on the forum. (**See appendix, Supplemental Digital Content 1,** which shows the top five posts with the highest and lowest sentiment scores and the top five posts with the highest anger, sadness, fear, disgust, and joy scores, **http://links.lww.com/PRSGO/B989.**)

## DISCUSSION

Plastic surgery procedures often carry a highly emotional component for patients due to the subjective nature of their outcomes as well as their implications with beauty and self-identity.[9] Although there have been a few recent studies looking at emotions in plastic surgery-related Twitter posts, which are brief statements limited to 280 characters each, this is the first article to analyze emotions surrounding discussions in a patient health forum.[10,11] Furthermore, this article aims to focus granularly on blepharoplasties (although not differentiating between upper and lower lids) rather than the plastic surgery field as a whole to demonstrate how emotion analysis can give concrete insights for a specific plastic surgery procedure.

Comparisons across the clinical groups indicate that patients generally feel most negatively about symptoms (either pre or postoperative) and most positively about their interactions with physicians. This finding suggests that physicians play a role in eliciting positive feelings from patients even in the presence of undesirable symptoms. Looking at specific emotions, fear and sadness are the predominant emotions for blepharoplasty patients, as opposed to the other negative emotions of anger and disgust. Therefore, doctors taking the time both pre and postoperatively to sympathetically address sources of fear
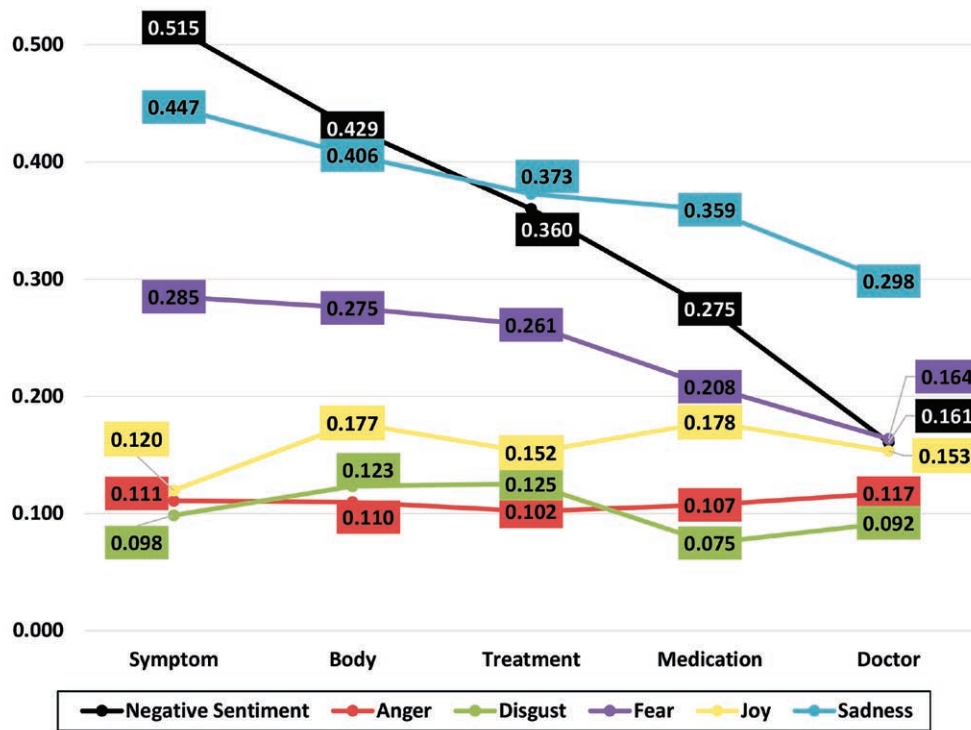
**Fig. 2.** Comparison of the sentiment and emotion scores among clinical groupings show a consistent trend among groups in which sadness and fear are inversely related to overall sentiment (and thus directly related to negative sentiment, as shown here). No significant trends were noted for anger, disgust, or joy.

and sadness can help mitigate negative emotions regardless of functional outcomes.

Notably, of the top 10 symptoms that had the most negative overall sentiment score, the majority of them, such as "cystic acne," "dry skin," and "sinus problems," are not common complications of the blepharoplasty procedure. Although it may be easy to dismiss these concerns, awareness of the

strong emotions these symptoms can elicit can motivate the clinician to take the extra time to address them. The discrepancy between symptoms that patients have the strongest negative emotion to and what are considered typical side effects highlights the idea that patients may not necessarily care about the same outcomes as physicians. Honoring this difference and taking the time to ask a patient about their holistic
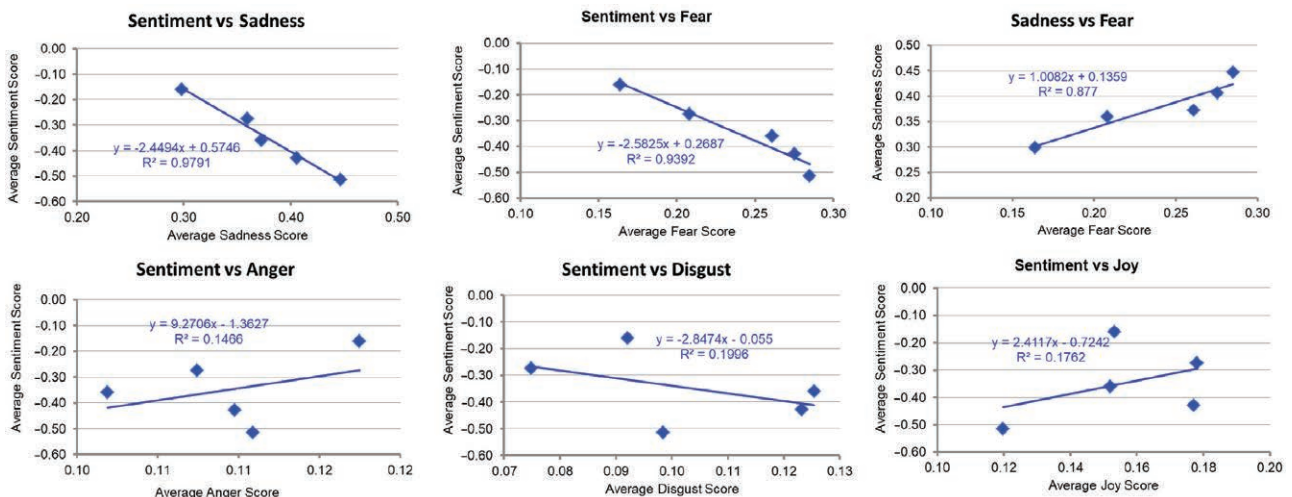


**Fig. 3.** Statistical analysis demonstrates a strong negative correlation between overall sentiment and sadness and between overall sentiment and fear. A positive correlation was found between sadness and fear. There was no significant correlation found between overall sentiment, anger, disgust, and joy.

**Table 2. The Top 10 Keywords in the "Symptom" Clinical Grouping with the Most Negative Sentiment Scores, Ordered from Most to Least Negative**

| Keyword | Sentiment Score |
|---|---|
| Complete cystic acne face | −0.996 |
| Horrible headache | −0.989 |
| Visual snow | −0.987 |
| Left eye pain | −0.980 |
| Red glassy eye | −0.980 |
| Dry skin | −0.978 |
| Fatigue | −0.978 |
| Itchy dry skin | −0.978 |
| Sinus problem | −0.978 |
| Bilateral slk | −0.977 |

symptoms may make a large difference in the patient's overall experience and is a key to patient-centric care.

The biggest limitation to our study is the limited sample size. However, even with a limited sample size, statistically significant trends and novel insights were uncovered. Expanding the number of search terms used by adding terms such as "lid lift," "eyelid surgery," etc. can greatly expand the number of posts and keywords generated but will also require more data filtering to remove irrelevant posts.[6] Gathering data from other internet health forums is another way to expand the dataset. RealSelf is an online healthcare forum where patients research aesthetic procedures and post reviews. The focus on aesthetic surgery and more review-centric nature of the website can both produce more data and help uncover more positive sentiments. Future projects mining larger amounts of data from the web can lead to more robust and quantifiable conclusions.

The novel approach of applying sentiment analysis to text in healthcare forums related to a specific procedure allows for a quick gauge of the general sentiment towards a procedure online and highlights which emotions prevail. It is also an opportunity to examine one of the most honest patient feedback sources available to uncover nuances of what patients care about and value most that may depart from the current standard of care. After initially calibrating the required coding scripts, our methodology can be widely applicable to various procedures and internet forums and mine copious data without significant manual work that would otherwise be required in other forms of data collection, such as chart reviews or surveys. Our paper and the future directions it portends are especially useful for surgeons who are constantly looking to improve their practice and patient satisfaction, including for seemingly straightforward yet high volume and impactful procedures such as blepharoplasty.

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