INTRODUCTION

The spread of the novel coronavirus SARS-CoV2 (COVID-19) into a global pandemic impacted many aspects of our lives and community. Education, business, and healthcare required the adoption of virtual interactions to serve our community and to practice physical distancing as recommended by the Centers for Disease Control and Prevent (CDC) and World Health Organization (WHO). These were uncharted waters for many practicing physicians, who sought alternative methods to continue providing patient care through the pandemic. Legal policies were rapidly modified to promote safer virtual access to healthcare; the Coronavirus Appropriations Act and Section 1135 of the Social Security Act allowed Medicare, Medicaid, and private insurers to provide reimbursement for virtual patient encounters.¹ It became clear that surgeons must also embrace telemedicine, and thus began a shift in patient evaluation from primarily physical encounters to virtual appointments.

The literature describes many different uses for telemedicine. Rural areas use telemedicine for patient evaluation and postoperative monitoring.² From a surgical perspective, previous studies demonstrate that live-streaming procedures could be an educational tool for surgeons. After watching these live procedures, the surgeons' self-reported confidence in their ability to operate increased.³ Telemedicine has been utilized by burn and trauma surgeons by wound image sharing, which optimized care referrals and screening for urgent patient evaluation.⁴ Researchers postulate

Summary: Physicians attempted to continue providing patient care through the SARS-CoV2 (COVID-19) pandemic. Surgeons embraced telemedicine as patient evaluation transitioned from physical encounters to virtual appointments. However, there is a paucity in the literature on the utility of telemedicine within plastic surgery or how it can meet patients’ needs. A survey study was created to assess surgeons’ involvement and experience with telemedicine. Subjective experience was assessed on a five-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree). This survey was distributed to the members of the American Society of Plastic Surgeons. Data were collected and analyzed via RedCap. Of the total 177 plastic surgeons who responded, 139 (78.5%) surgeons reported the implementation of telemedicine during the pandemic. Plastic surgeons felt that they were able to establish rapport (3.9 ± 0.9), meet the goals of the encounter (3.6 ± 1.0), and efficiently evaluate patients (3.5 ± 1.2). Plastic surgeons reported their overall experience was between helpful and neutral (3.2 ± 1.3). Most plastic surgeons have implemented telemedicine in their practice. The majority of telemedicine use was for breast, cosmetic, and reconstructive patient care. Telemedicine was most frequently used for initial patient screening and routine postoperative visits. Surgeons plan to continue using telemedicine when appropriate for patient screening and routine or unexpected postoperative visits in the future. Many have found utility of telemedicine in providing patient care and it is likely that telemedicine will be a part of routine practice moving forward.

Plastic Surgeons Nationwide Share Experience Regarding Telemedicine in Initial Patient Screening and Routine Postoperative Visits

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that the incorporation of telemedicine may benefit surgeons in the reduction of patient bias, as they no longer are influenced by the facility, the staff, and wait times to be seen.\textsuperscript{2} Another study describes the limitations of telemedicine including technical errors, over-diagnosis, and inability to perform a standard physical examination.\textsuperscript{6}

There is a paucity within the literature on the utility of telemedicine within plastic surgery or how telemedicine can be used by plastic surgeons to meet patients’ needs. The purpose of this study is to explore plastic surgeons’ implementation of telemedicine during the COVID-19 pandemic, reporting trends in surgeon experience and identifying the future role and applicability of telemedicine within plastic surgery.

**METHODS**

**Study Design and Data Collection**

A survey was developed to assess the telemedicine experiences of plastic surgeons. A questionnaire consisting of dichotomous questions, scaling questions, Likert scale statements, multiple-choice, and free-text questions was formulated to assess the use, opinion, and future role of telemedicine for a practicing plastic surgeon. The survey contained a minimum of six questions and a maximum of 23 questions based on surgeon responses.

Scaling questions were used to assess the percentage of each surgeon’s practice that is telemedicine. Likert scale statements addressing sentiments about the utility of telemedicine are scaled in a traditional fashion (1= strongly disagree, 2= disagree, 3= neutral, 4= agree, 5= strongly agree). Multi-choice questions assessed which plastic subspecialties utilized telemedicine, what tools have been utilized to optimize patient care, and what tools would be helpful in future practice. Free text provided responders with the opportunity to comment on positive and negative experiences with the implementation of telemedicine. Free text was assessed by all authors and grouped by common themes.

Members of the American Society of Plastic Surgeons were invited to participate in our survey. Members received an initial invitation, a 1-month reminder, and a 2-month reminder. REDCap Database Collection software was used to distribute the survey and record results. Data collection included surgeon subspecialty, practice type, and variables of telemedicine use: use before and during the pandemic, time of implementation, indications for not using telemedicine, phase of utilization, tools used, future plans, and overall experience of telemedicine. This study was approved by the university’s institutional review board.

**Statistical Analysis**

Statistical analysis was performed using Excel Data Analysis Software and R. Descriptive statistics (mean, frequency, range, or SD) were analyzed for the variables collected.

**RESULTS**

**Surgeon Demographics**

Of the 874 plastic surgeons who received full invitations, 177 (20.3%) responded. Surgeons self-reported their practice type, including 42.2% solo-practitioners, 24.3% hospital employed, 22.2% private group, 8.6% hospital-affiliated group, and 2.7% selected another style of practice. Survey responders were dispersed across the South (33.7%), the Northeast (28.6%), the Midwest (26.3%), and the West (11.4%).

In regard to plastic surgical subspecialties, many respondents utilized telemedicine in their practice of cosmetic (61.6%), breast (58.7%), and general reconstructive surgery (50.0%). There were fewer respondents using telemedicine to evaluate patients in hand/peripheral nerve (16.7%), craniofacial/pediatric (15.2%), gender affirmation (10.1%), and burn surgery (8.0%). A surgeon demographic summary is displayed in Table 1.

**Trends of Telemedicine Implementation**

Most surgeons (81.4%) indicated that they had never used telemedicine before the COVID-19 pandemic. The 33 surgeons who had prior telemedicine experience report that 12.4% (SD = 17.3) of patient encounters were performed virtually. Between March 16, 2020, and March 31, 2020, 47 (26.6%) providers implemented telemedicine in their practice. The second-highest rate of telemedicine implementation was between April 1 and April 15, 2020, with 33 (18.6%) providers. Full-time points of telemedicine implementation are summarized in Figure 1. Following the first wave of COVID-19, there was a surge in the incorporation of telemedicine among plastic surgeons; 78.5% reported use of telemedicine in 23.9% (SD = 27.3) of patient encounters. Thirty-eight (21.5%) surgeons did not incorporate telemedicine into their practice.

Plastic surgeons who never embraced telemedicine most commonly reported feeling uncomfortable using telemedicine to provide patient care (65.8% of nonusers). Thirteen percent of surgeons felt that telemedicine visits were unnecessary and they closed their practice if
they could not perform traditional patient visits. Another four surgeons indicated they did not have equipment or support to perform telemedicine visits in their practice. Three surgeons did not use telemedicine because they required a physical examination for every patient encounter, and three surgeons reported they never used telemedicine because patients refused. Contributing factors for not using telemedicine are summarized in Table 2.

**Table 2. Summary of Telemedicine Nonuser Rationale**

| Rationale                                      | Count (%) |
|------------------------------------------------|-----------|
| I did not feel comfortable using telemedicine  | 22 (57.9) |
| to provide patient care                        |           |
| My department/practice did not support the use | 4 (10.5)  |
| of telemedicine                                 |           |
| My patients declined to participate in telemedicine | 3 (7.9)  |
| Other                                          | 1 (2.6)   |
| Unnecessary                                     | 5 (13.2)  |
| Inadequate for examination                      | 3 (7.9)   |

Category percentages are calculated within the 38 respondents who never used telemedicine.

**Telemedicine Experiences of the Plastic Surgeon**

When asked to rate statements on a five-point scale (1 = strongly disagree to 5 = strongly agree) regarding their experiences with telemedicine, plastic surgeons agreed that they could establish rapport via telemedicine (3.9 ± 0.9, Mode = 4). Surgeons were inclined to agree that the goals of the telemedicine encounter were met (3.6 ± 1.0, Mode = 4), telemedicine was an efficient way to see patients (3.5 ± 1.2, Mode = 4), telemedicine was necessary (3.5 ± 1.2, Mode = 4), and surgeons could provide adequate patient care through telemedicine (3.5 ± 1.1, Mode = 4). However, most surgeons felt that they were unable to perform a sufficient physical examination (2.3 ± 1.1, Mode = 2). Overall, surgeons felt that patient satisfaction with the encounter was positive (3.9 ± 0.9, Mode = 4). Surgeon sentiments can be seen in Table 3.

Plastic surgeons reported that their overall experience with telemedicine was between helpful and neutral (3.2 ± 1.3, mode = 4) with surgeons reporting telemedicine as extremely helpful (15.2%), helpful (37.2%), or neutral (14.5%) experience. Interestingly, 33.1% of surgeons had a negative overall experience, reporting telemedicine visits as difficult (17.2%) or inadequate (15.9%) for patient evaluation.

**Figure 1.** Percentage of plastic surgeons utilizing telemedicine over time. Spanning from before March 2020, when the virus hit the United States, to August 2020.

**Table 3. Surgeon Impressions after Using Telemedicine**

| Perception Statements                          | Response* | Response* |
|------------------------------------------------|-----------|-----------|
| Average ± SD                                   | Mode      |           |
| I was able to establish good patient rapport  | 3.9 ± 0.9 | 4         |
| via telemedicine                               |           |           |
| Overall impression of patient satisfaction     | 3.9 ± 0.9 | 4         |
| with telemedicine                              |           |           |
| Telemedicine visits are an efficient way to    | 3.5 ± 1.2 | 4         |
| see patients                                   |           |           |
| Goals of the encounter were met via telemedicine| 3.6 ± 1.0 | 4         |
| Telemedicine visits are necessary               | 3.5 ± 1.2 | 4         |
| I was able to provide an adequate visit        | 3.5 ± 1.1 | 4         |
| I was able to perform a sufficient             | 2.3 ± 1.1 | 2         |
| physical examination                           |           |           |

Category percentages are calculated within the 38 respondents who never used telemedicine.

Responses reference the 1–5 Likert scale: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree. Response average, SD, and mode are reported above.
Telemedicine Encounter Types and Payment

Most surgeons reported using telemedicine for their initial screening (87.1%) and routine postoperative visits (77.7%). Less than half of telemedicine users performed virtual preoperative appointments (44.6%), evaluation in the immediate postoperative period (25.2%), or unscheduled postoperative visits (47.5%).

In terms of insurance reimbursement, 27.0% of surgeons reported that they were reimbursed equally as an in-person visit, 18.3% reported less reimbursement, and 54.7% did not know how much reimbursement they were receiving.

The Future of Telemedicine in Plastic Surgery

Plastic surgeons reported that in the future, they would primarily use telemedicine for initial screening visits (67.6%), routine postoperative visits (69.0%), and unscheduled postoperative visits (53.2%). Less favorable is the use of telemedicine for preoperative visits (38.1%) and immediate postoperative visits (25.2%). Surgeons estimated an average 17.0% (SD = 17) of their practice to be replaced by telemedicine moving forward (Table 4).

Most surgeons (59.0%) used digital photographs to aid in patient evaluation. Less commonly used tools for patient evaluation include a scale (10.0%), thermometer (5.0%), blood pressure cuff (2.2%), and heart rate monitor (1.4%). Surgeons reported they would continue or start using digital photographs (52.5%), scales (30.2%), thermometers (11.5%), blood pressure cuffs (15.8%), and heart rate monitors (10.8%) in future encounters. Additionally, some surgeons plan to start using a pulse oximeter (10.1%), incentive spirometer (2.9%), and pedometer/activity monitor (3.6%) as adjunctive tools to evaluate patients in telemedicine encounters. A comparison of current and future instrument utilization is displayed in Table 5.

**DISCUSSION**

Virtual platforms have become a mainstay for socialization, education, business, and medicine during the COVID-19 pandemic. Patient care was not immune to these changes and many plastic surgeons were compelled to start telemedicine during this exceptional time. The shift in patient care was faced with challenges for all users, such as learning new software, ensuring patient privacy, and adjustments to patient physical examination. Nevertheless, most plastic surgeons have implemented telemedicine in their practice. The majority of telemedicine use was for breast, cosmetic, and reconstructive patient care. Telemedicine was most frequently used for initial patient screening and routine postoperative visits during the pandemic. Additionally, surgeons plan to continue using telemedicine when appropriate for patient screening and routine or unexpected postoperative visits in the future. Furthermore, surgeons agreed that they were able to establish a good rapport with their patients via telemedicine and either agreed or were neutral that the goals of their encounter were met and that telemedicine was an efficient way to see patients.

As with any survey study, there is potential for bias. Our study is limited by the response rate (20.3%), which is lower than desired; however, surgeons may have been less responsive to surveys during this unprecedented time. After all, the pandemic has presented challenges to all aspects of our lives in addition to our mission to care for patients. Although attempts were made to contact surgeons from all types of practice in various states across the country, the survey may be vulnerable to sampling bias. Lastly, these findings are limited to surgeons in the United States; thus, results may not be generalized globally.

Notably, the survey did not separate surgeon experiences from video and telephone visits. In our practice, we noticed that patients often decline video encounters but are more accepting of phone calls. We found that telephone calls are especially challenging because nonverbal reactions are imperceptible and the overall tone from the patient can be difficult to assess. This was particularly memorable from interactions with our breast reconstruction patient population, reminding us that nonverbal communication often conveys more than spoken words.

The authors suggest that telemedicine has utility within the practice of plastic surgery. Remote visits are optimal for initial screening visits to rule out poor surgical candidates and identify patients who require further evaluation by a standard consultation. Telemedicine is effective for routine postoperative visits, and has been employed by many plastic surgery centers for patients living in rural areas. Obvious benefits of telemedicine are increased flexibility and convenience to the patient, yet the challenge of telemedicine continues to be the ability to perform an adequate physical examination. The incorporation of tools (photography, scale, monitors) to provide objective information to the surgeon may address some of that void. Future technological advances in biometric tools may improve haptic feedback to the surgeon, allowing tissue quality, color, and temperature to be evaluated similarly to a standard examination. It is not outside the realm of possibility that practicing surgeons today may experience a different reality; imagine a future where artificial intelligence coupled with video chat may become the norm of patient evaluation. Even with today's

**Table 4. Telemedicine Use in Different Phases of Patient Care Varying by Visit Type**

| Visit Type                   | Current Use | Planned Future Use |
|-----------------------------|-------------|--------------------|
|                             | n (%)       | n (%)              |
| Initial or screening visit   | 121 (87.1)  | 94 (67.6)          |
| Preoperative visit           | 62 (44.6)   | 53 (38.1)          |
| Immediate postoperative visit| 35 (25.2)   | 35 (25.2)          |
| Routine postoperative visit  | 108 (77.7)  | 96 (69.0)          |
| Unscheduled postoperative visit| 66 (47.5)  | 74 (55.2)          |

Data reported for current use and planned future use.

**Table 5. Adjunctive Instruments to Consider for Telemedicine Patient Evaluation by Instrument Type**

| Instrument                                | Current Use | Planned Future Use |
|-------------------------------------------|-------------|--------------------|
| Digital photographs                       | 82 (59.0)   | 73 (52.5)          |
| Scale                                     | 14 (10.0)   | 42 (30.2)          |
| Thermometer                               | 7 (5.0)     | 16 (11.5)          |
| Blood pressure cuff                       | 3 (2.2)     | 22 (15.8)          |
| Heart rate monitor                        | 2 (1.4)     | 15 (10.8)          |
| Pulse oximeter                            | 0 (0.0)     | 14 (10.1)          |
| Activity monitor/pedometer                | 0 (0.0)     | 5 (3.6)            |
| Incentive spirometer                      | 0 (0.0)     | 4 (2.9)            |

Data reported for current use and planned future use.
limited physical examination in telemedicine, many surgeons found that the goals of the encounter could be achieved. The ease and accessibility of telemedicine visits seem to leave both surgeons and patients with a positive experience.

Despite our survey’s limitations, this is the first study to describe the timeline of telemedicine’s implementation among plastic surgeons, its sentiments in clinical practice, tool utilization, and future roles. Plastic surgeons have been confronted with challenges during the COVID-19 pandemic. Many have found utility of telemedicine in providing patient care and it is likely that telemedicine will be a part of routine practice in the future, refined by the lessons learned from our experiences.

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