EDITOR'S CHOICE

Evaluation of a Comprehensive Telemedicine Pathway for Carpal Tunnel Syndrome: A Comparison of Virtual and In-Person Assessments

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Purpose We evaluated a comprehensive telemedicine pathway for carpal tunnel syndrome (CTS). Our primary aim was to compare telemedicine and in-person administration of the six item CTS-6 instrument (CTS-6) in patients undergoing carpal tunnel release (CTR) and to determine whether surgical plans determined via telemedicine were altered by in-person assessments. We additionally aimed to assess agreement between telemedicine and in-person examinations.

Methods In this prospective investigation, patients referred to a hand surgeon for evaluation of CTS were offered a telemedicine pathway. A modified, virtual CTS-6 was administered during the telemedicine consultation and a virtual exam was performed. Patients indicated for CTR were evaluated in person on the day of surgery. Agreement between the telemedicine and in-person CTS-6 and exam findings was determined. Patients were evaluated via telemedicine postoperatively to determine satisfaction with the program and assess surgical complications.

Results A total of 32 cases were included. The mean CTS-6 score administered via telemedicine was 17.7, compared with 16.8 in person; this difference was not statistically significant. There were no cases indicated for CTR during the telemedicine visit that had a subsequent change in management based on the in-person evaluation. Agreement was lowest for the sensory assessment (63%). The Phalen and Durkan compression tests demonstrated high levels of agreement (97% and 94%, respectively). Satisfaction was high for patients in the telemedicine CTS pathway.

Conclusions Overall agreement between telemedicine and in-person administration of the CTS-6 is high for patients with CTS. In patients indicated for CTR via telemedicine, an in-person examination does not appear to alter management. The telemedicine examination of hand sensation demonstrates lower levels of agreement with the in-person assessment. Telemedicine can serve as an alternative to conventional, in-person clinic visits for the diagnosis and postoperative management of uncomplicated, primary CTS. *(J Hand Surg Am. 2022;47(2):111–119. Copyright © 2022 by the American Society for Surgery of the Hand. All rights reserved.)*

Type of study/level of evidence Diagnostic II.

Key words Carpal tunnel release, carpal tunnel syndrome, CTS-6, physical examination, telemedicine.

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Received for publication April 2, 2021; accepted in revised form August 31, 2021.

No benefits in any form have been received or will be received related directly or indirectly to the subject of this article.

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0363-5023/22/4702-0001$36.00/0
https://doi.org/10.1016/j.jhsa.2021.08.024

Telemedicine utilization for upper-extremity care has been increasing.[1] While interest in telemedicine programs has expanded in recent years, the coronavirus disease 2019 (COVID-19) pandemic resulted in a rapid increase in utilization of video-based medical services.[1–3] Within hand and upper-extremity surgery, telemedicine programs have focused on emergency department evaluations, follow-up fracture care, and routine postoperative visits.[4–6] The proposed benefits of telemedicine encounters include a decreased travel burden, enhanced convenience, and cost reductions for both health-care systems and patients.[6–8] Recent investigations have raised concerns related to decreased revenues, because telemedicine visits appear to generate lesser total visit charges compared to in-person visits.[9]

Despite the trend toward increased telemedicine utilization within upper-extremity surgery, there remain both real and potential concerns regarding its use as an alternative to conventional, in-person visits. Criticisms of this technology have often focused on its limitations with respect to the physical examination. While it appears that video examinations are adequate for lower-complexity postoperative care, the inability to directly examine the patient may limit the evaluation of more complex conditions.[6,10] Prior authors have suggested that certain provocative maneuvers and tests for the evaluation of CTS are poor candidates for telemedicine exams and cannot be consistently performed.[11] Even with the recent increase in telemedicine-related publications, there are a paucity of studies specifically comparing the accuracy of the virtual hand examination to the conventional, in-person examination. Furthermore, it remains uncertain whether management plans created during a telemedicine encounter are altered by a subsequent in-person assessment.

The purpose of this investigation was to evaluate the implementation of a comprehensive telemedicine pathway for patients with CTS. This study had 2 aims. Our primary aim was to analyze the use of a modified CTS-6 instrument as part of telemedicine screening for patients being evaluated for CTS and compare it to in-person administration of the conventional CTS-6 instrument.[12] Second, we aimed to analyze agreement between telemedicine and in-person physical examination tests and maneuvers. We hypothesized that the telemedicine and in-person administration of the CTS-6 would demonstrate high levels of agreement.

MATERIALS AND METHODS

Geisinger Health System institutional review board approval was obtained from the Geisinger Musculoskeletal Institute for this prospective study, which began as an institutional quality improvement initiative. Our upper-extremity surgery division is part of a rural, academic, level I trauma center that functions as a tertiary referral center. We designed a comprehensive CTS pathway that would allow for both initial consultations and postoperative care after CTR to be performed via telemedicine.

Telemedicine screening and scheduling

All referrals placed to schedule a consultation with an upper-extremity surgeon within our division are divided into 2 categories: urgent (which includes both 3-day referrals and "same-day" referrals) and routine (10-day or 30-day referrals). Referrals were screened for inclusion if the patient was sent with a diagnosis of CTS or if the referral specifically mentioned CTS. All patients with a routine referral to a single upper-extremity surgeon (L.C.G.) for suspected CTS were eligible to participate if they: were 18 years of age or older; owned a smartphone, computer, tablet, or laptop with video-calling capability; had access to reliable Wi-Fi internet; were in state during the telemedicine encounter; and had a valid e-mail address.

Patients who met the inclusion criteria and had a routine (10- or 30-day) referral were contacted by our dedicated upper-extremity schedulers and offered the option of obtaining an earlier telemedicine appointment date. These telemedicine visits were typically 1 to 3 weeks earlier than the in-clinic visits. Patients were asked whether they had undergone prior CTR on the involved extremity, which served as the only exclusion criteria. Screening began in September 2020 and patients screened prior to March 1, 2021, were analyzed.

Patients who elected for a telemedicine visit were then contacted by the hospital via e-mail and/or text message. This electronic message contained a link to the telemedicine application, which utilized a web-based video conferencing program. Patients could access the program using any internet-connected device with video capability. The telemedicine platform utilized was designed by InTouch Health (Santa Barbara, CA), and has been customized for our institution. Patients received automated appointment reminders both 1 day and 1 hour before their telemedicine visit.

TABLE 1. Description and Scoring of the Modified Telemedicine CTS-6 and the Conventional In-Person CTS-6*

CTS-6 Components	Telemedicine Examination	In-Person Examination	Points
1. Numbness predominantly or exclusively in median nerve distribution	Verbally asked	Verbally asked	3.5
2. Nocturnal numbness	Verbally asked	Verbally asked	4
3. Thenar atrophy or weakness	Visible thenar atrophy on video	Thenar atrophy or muscle strength less than grade 5	5
4. Positive Phalen's test	Patient performs with maximum passive wrist flexion for up to 1 minute.	Same as telemedicine examination	5
5. Loss of 2PD	Abnormal sensation with light touch in median distribution compared to a region on the hand/arm with normal sensation (Ten Test).	Failure to discriminate 2 points held 5 mm or less apart from each another in median innervated digits (static 2PD)	4.5
6. Positive Tinel sign	Patient performs test using contralateral digits to tap median nerve at level of the carpal tunnel	Physician performs test	4

*A CTS-6 score of >12 (80% probability of CTS), was considered diagnostic for carpal tunnel syndrome.

Initial telemedicine consultation

During the telemedicine encounter, a detailed patient history was obtained, and the surgeon had access to the electronic medical record system both prior to and during the visit. This was a single-surgeon (L.C.G.) investigation. Electrodiagnostic studies and prior imaging studies could be reviewed if they had been obtained by the referring provider, but neither of these were ordered by the treating surgeon after the initial consultation. While there is no accepted gold standard for the diagnosis of CTS, changes to the American Academy of Orthopaedic Surgeons Clinical Practice Guidelines no longer require electrodiagnostic studies in all cases.[13] Additionally, for patients with a diagnosis of CTS based on symptoms and physical examination, electrodiagnostic studies rarely alter the diagnosis.[14] In our practice, electrodiagnostic studies are infrequently utilized for patients with primary CTS in the absence of atypical features or diagnostic uncertainty.[15]

As part of the visit, we administered a modified, virtual CTS-6, adapted from the description by Graham et al.[12] Questions in the symptoms and history component of the CTS-6 were asked directly to the patient to determine whether the numbness was predominately in the median nerve distribution and whether the patient had experienced night symptoms. Table 1 includes descriptions of how the telemedicine CTS-6 was modified and administered. For the sensory assessment on the telemedicine application of the CTS-6, we utilized a modification of the Ten Test as described by Strauch et al.[16] Rather than having the patient rate sensation on a scale of 1 to 10 as originally described for the Ten Test, we had the patient make a binary assessment (normal vs abnormal) to correspond with the binary scoring of the CTS-6 question.[12] A CTS-6 score > 12 (80% probability of CTS) was considered diagnostic for CTS.

Additional telemedicine physical examination tests and maneuvers that are not components of the CTS-6 but are frequently utilized as part of the assessment of peripheral compressive neuropathy were also performed. Before having the patient perform these components of the examination, the surgeon would describe the test and then demonstrate it to the patient. Patients performed a carpal tunnel compression test (Durkan) by applying pressure from the contralateral thumb directly over the involved carpal tunnel while placing the fingers on the dorsum of the hand. Determination of a positive Tinel sign (percussion test) over the ulnar nerve at the elbow was also made. The surgeon would demonstrate how to palpate the olecranon and medial epicondyle prior to having the patient tap over the ulnar nerve at the elbow.[17] An elbow flexion test was also performed by having the

patient maximally flex the elbow for 60 seconds with both the wrist and shoulder in neutral rotation.[17] Paresthesia in the ring and small finger was again indicative of a positive test. The Tinel sign for the ulnar nerve at the elbow, as well as the elbow flexion test, can be positive in approximately one-fifth of asymptomatic elbows, and were not considered diagnostic for cubital tunnel syndrome in the absence of other clinical findings.[18] Additionally, we noted any associated diagnoses and discussed management of these with the patient on a case-by-case basis. If the patient was being evaluated for bilateral CTS, details regarding each limb were recorded as a separate case.

If the history, physical examination, and CTS-6 were consistent with a clinical diagnosis of CTS (CTS-6 score $>$ 12), we discussed both nonoperative treatment with a night splint and operative treatment with a CTR. In our integrated health-care system, many patients referred to a hand surgeon have been previously treated by a primary care or nonoperative musculoskeletal physician with a trial of night bracing or corticosteroid injection. Operative intervention was considered for patients with persistent CTS symptoms despite nonoperative treatment. Patients who elected for CTR were directly scheduled for surgery without a separate in-person clinic visit or additional testing. In situations where patients were indicated for bilateral CTR, these were performed in a staged manner and no simultaneous bilateral CTRs were performed on the same day.

Preoperative examination and carpal tunnel release

Patients that elected for CTR were examined in person by the senior author (L.C.G.) in the preoperative area on the day of surgery. The CTS-6 was administered in-person (Table 1). The additional examination tests and maneuvers that were performed via telemedicine were repeated in the preoperative area. Patients completed a Numeric Pain Rating Scale (NPRS), Single Assessment Numeric Evaluation, and Patient-Reported Outcomes Measurement Information System Upper Extremity Short-Form 7a, as well as a *Quick*DASH.

After informed consent was obtained, endoscopic CTR was then performed in the operating room. Postoperatively, patients had a small adhesive bandage dressing and were encouraged to begin digital range-of-motion exercises immediately after surgery. Over-the-counter analgesia was used for pain control, and no opioid medications were prescribed.

Postoperative telemedicine evaluation

A postoperative telemedicine follow-up visit was scheduled around 10 to 14 days after surgery. The NPRS was recorded. For the physical examination, we inspected the incisions, which were all closed with absorbable suture to eliminate the need for suture removal in the clinic. Any observed surgical complications were recorded.

Similar to a prior investigation for postoperative telemedicine utilization, we had the patient rate their experience with the program and with the technology.[6] At the conclusion of the telemedicine visit, patients were asked to rate the telemedicine program with respect to ease of use on an 11-point Likert scale, with 0 indicating "very difficult" and 10 indicating "very easy." Patients then completed an 11-point Likert scale to rate their satisfaction with both the result of the procedure and the overall program, with 0 indicating "very unsatisfied" and 10 indicating "very satisfied." Patients were also asked the following question during the postoperative visit: "if you had CTS again and had to choose between a telemedicine pathway or in-person clinic visits, which would you choose?" Both the patient and the surgeon rated the audio and video quality they experienced during the pre- and postoperative visits on a 3-point scale, with 1 indicating no audio or visual availability, 2 indicating reduced audio or visual feed quality, and 3 indicating a well-functioning, clear audio or visual feed.

Statistics and sample size calculation

Operatively treated patients who attended their follow-up visit were included in the final analysis. An analysis and comparisons were performed with respect to cases as opposed to patients to account for the staged bilateral CTRs. For our primary aim, we compared the telemedicine administration of the CTS-6 to the in-person administration. We assessed telemedicine and in-person agreement for each of the components of the CTS-6, as well as the additional examination tests/maneuvers performed. In addition, a kappa statistic was calculated to account for agreement by chance: (observed agreement − agreement expected by chance) / (100% − agreement expected by chance).

Descriptive statistics were used for baseline demographics. We used Student *t* testing to compare the mean CTS-6 scores for the telemedicine and in-person evaluations. Differences with *P* values $<$.05 were considered statistically significant.

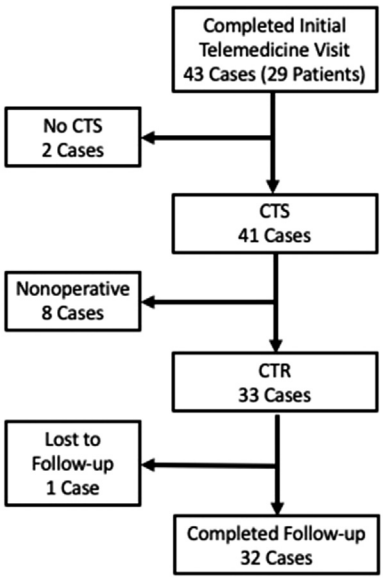

FIGURE 1: Flowchart depicting patient participation for this investigation.

Prior to the initiation of the investigation, we performed an *a priori* sample size calculation. Our primary comparison was between the telemedicine and in-person CTS-6 scores. Based on the study by Fowler et al,[19] we estimated that the mean CTS-6 score for patients with CTS would be 15.8 ± 3.4. These values were consistent with institutional pilot data for CTS cases with CTS-6 scores in both a telemedicine and in-person setting. We wanted to detect a mean paired difference of 2 for the CTS-6 score between the 2 settings. We selected a difference of 2 because this value was smaller than the lowest point value assigned to a single question on the CTS-6 (3.5). In addition, with an assumed mean of 15.8 on the CTS-6, a difference of 2 would still result in a score above 12, which we utilized as a diagnostic cutoff for CTS (>80% probability). Using an SD of 3, alpha of 0.05, and 80% power, it was determined that a sample size of 20 cases would be required.

RESULTS

Figure 1 represents a flowchart of patient participation. Overall, we screened a total of 47 patients for possible inclusion. Of these, 18 patients (38%) did not meet the inclusion criteria, had a prior CTR, or refused to participate. The remaining 29 patients (43 cases) elected for an initial telemedicine evaluation. There were 2 cases (5%) that did not have a diagnosis of CTS based on the telemedicine visit (CTS-6 scores of 3.5 and 7.5). In both cases there was concern for cervical spine pathology and, after subsequent evaluation with our physical medicine and rehabilitation team, both were found to have cervical spondylosis with cervical radiculopathy.

TABLE 2. Baseline Demographics and Preoperative PROMs for the 32 Included Cases That Underwent CTR*

Characteristic	Value
Cases, N	32
Age, years	
Mean (SD)	46(12)
Range	24–72
Male, n (%)	8 (25%)
Right hand involved, n (%)	18 (56%)
Dominant hand involved, n (%)	18 (56%)
Prior contralateral CTR, n (%)	2 (6%)
Diabetes, n (%)	4 (12%)
Rheumatoid arthritis, n (%)	0 (0%)
Associated diagnoses, n (%)	4 (13%)
Lateral epicondylosis	1
Cubital tunnel syndrome	1
Thumb carpometacarpal arthritis	1
Trigger digit release	1
Associated surgical procedures, n (%)	2 (6%)
Endoscopic cubital tunnel release	1
Trigger digit release	1
PROMs, mean (SD)	
NPRS	2.8 (2.1)
Patient-Reported Outcomes Measurement Information System upper extremity	39.4 (5.6)
Single Assessment Numeric Evaluation	60.7 (22.1)
*Quick*DASH	41.9 (11.1)

*PROM, patient-reported outcome measure.

There were 41 cases of CTS; of these, 33 elected for operative treatment (CTR). Eight patients with CTS elected to continue with nonoperative management, and these patients had a mean telemedicine CTS-6 score of 14.4. One case was lost to follow-up after surgery, leaving a total of 32 cases available for the final analysis. Table 2 contains baseline demographics for all included cases. Of the 32 included cases, 2 (6%) underwent an additional associated procedure at the same time as the CTR, as noted in Table 2.

Table 3 represents a comparison between the telemedicine and in-person administration of the CTS-6 and other examination tests. When administered via

TABLE 3. Comparison of Telemedicine Versus In-Person History and Examination Components for the 32 Included Cases

History and Examination Components	Telemedicine Evaluation (+) Finding, n (%)	In-Person Evaluation (+) Finding, n (%)	% Agreement	Kappa Statistic
CTS-6 components				
1. Median nerve numbness	30 (94%)	30 (94%)	100%	1.00
2. Nocturnal numbness	31 (97%)	31 (97%)	100%	1.00
3. Thenar atrophy or weakness	3 (9%)	3 (9%)	94%	0.88
4. Positive Phalen's test	32 (100%)	31 (97%)	97%	0.94
5. Median nerve sensory changes	22 (69%)	16 (50%)	63%	0.26
6. Positive Tinel sign	16 (50%)	17 (53%)	78%	0.56
Additional tests and maneuvers				
Median nerve compression test (Durkan)	31 (97%)	31 (97%)	94%	0.88
Tinel sign (ulnar nerve at elbow)	6 (19%)	5 (16%)	84%	0.68
Elbow flexion test	5 (16%)	4 (13%)	97%	0.94

telemedicine, the mean CTS-6 score for included cases was 17.7 (SD, 3.5), compared to 16.8 (SD, 3.8) with the in-person administration ($P = .34$). For the CTS-6, agreement was lowest for the assessment of median nerve sensation (63%). There were no cases indicated for CTR during the telemedicine visit that had a subsequent change in plan (cancellation of surgery) as a result of the in-person evaluation in the preoperative area. All 32 included cases that underwent CTR had a telemedicine CTS-6 score of >12, and the in-person CTS-6 was also >12 in all cases.

Table 4 contains information from the postoperative telemedicine visit. There was 1 surgical complication (allergic reaction to bandage adhesive). One postoperative visit had an audio-visual complication in which the surgeon had poor video quality and was unable to hear the patient. The visit was rescheduled for later the same day and was completed without complication. Overall, 97% noted they would choose a telemedicine pathway for CTS again over a conventional in-clinic pathway.

DISCUSSION

In this prospective evaluation of a telemedicine pathway for CTS management, we found overall high levels of agreement between telemedicine and in-person administration of the CTS-6. Our primary aim was to analyze the use of the CTS-6 instrument as part of a telemedicine screening examination for patients with suspected CTS. Recognizing that CTS lacks a diagnostic gold standard, the CTS-6 was developed, in part, to aid in creating standardized clinical diagnostic criteria.[12] Additionally, the CTS-6, as described by Graham et al,[12] allows for clinicians without specific expertise in hand surgery to diagnose CTS clinically, in a similar manner to hand surgeons. Although this investigation was not a true assessment of inter-rater reliability, we did compare overall CTS-6 scores when administered by a hand surgeon (L.C.G.) and by a patient without any clinical expertise (under the remote supervision of the hand surgeon). In these 2 settings, the results of the CTS-6 were essentially equivalent. This aim (and study design) was somewhat pragmatic, in that the goal was to determine whether a telemedicine consultation was sufficiently reliable to create a management plan that would be unchanged by an in-person evaluation on the day of surgery. This study period coincided with a period of time where our institution limited outpatient clinic access for elective visits due to COVID-19. Our results demonstrated that the surgical plan for CTR was unchanged in cases where patients were diagnosed with CTS based on a telemedicine examination and elected for surgery. While we could find no similar studies relative to hand and upper-extremity surgery, similar comparative investigations have been performed in other orthopedic subspecialties. In evaluating 33 spine patients who had both preoperative telemedicine and in-person examinations, Lightsey et al[20] noted the surgical plan determined during telemedicine was unchanged by a subsequent in-person examination in 31 cases

TABLE 4. Technological and Clinical Results From the Telemedicine Postoperative Visits for the 32 Included Cases

Characteristic	Value
Video quality for patient, n (%)	
1: None	0 (0%)
2: Reduced/poor	0 (0%)
3: Good	32 (100%)
Audio quality for patient, n (%)	
1: None	0 (0%)
2: Reduced / Poor	0 (0%)
3: Good	32 (100%)
Video quality for surgeon, n (%)	
1: None	0 (0%)
2: Reduced/poor	1 (3%)
3: Good	31 (97%)
Audio quality for surgeon, n (%)	
1: None	1 (3%)
2: Reduced/poor	0 (0%)
3: Good	31 (97%)
NPRS, mean (SD)	1.7 (2.1)
Clinical complications, n (%)	1 (3%)
Allergic reaction to bandage adhesive	
Satisfaction with telemedicine program, 0−10 Likert scale	
Mean, SD	9.7 (0.6)
Range	8−10
Ease of use of telemedicine program, 0−10 Likert scale	
Mean, SD	9.7 (0.7)
Range	8−10
Satisfaction with procedure, 0−10 Likert scale	
Mean, SD	9.6 (0.6)
Range	8−10
Prefer telemedicine for future care, n (%)	31 (97%)

(94%). For patients presenting with a concern for primary CTS, a telemedicine examination can be used as an alternative to an in-person examination, as CTS-6 scores in both settings are essentially equivalent.

Prior authors have suggested that certain provocative maneuvers and tests for the evaluation of CTS are poorly adaptable for telemedicine exams and cannot be consistently performed.[11] Generally, discussions of telemedicine within hand and upper-extremity surgery acknowledge the limitations inherent to any virtual examination: the inability to examine the patient.[8,21] However, with the exception of range of motion, the telemedicine examination for hand surgery has been largely unstudied, and comparisons of telemedicine and in-person examinations have been infrequent in other orthopedic subspecialities. In comparing telemedicine and conventional examinations for patients with and without spine pathology, Goyal et al[22] found no difference for sensory, motor, and special tests between the 2 modalities. Our findings were more mixed, as we noted high levels of virtual and in-person agreement for some physical examination components of the CTS-6 (Phalen test and thenar atrophy assessment), whereas agreement was low for sensory assessment and Tinel sign. Additionally, some special tests and provocative maneuvers for peripheral compressive neuropathy that are not part of the CTS-6 (Durkan compression test and the elbow flexion test), demonstrated >90% agreement between the 2 settings.

In comparing the telemedicine and in-person examinations, examination agreement was lowest for the assessment of median nerve sensation. Telemedicine encounters utilized the Ten Test, similar to that describe by Strauch et al,[16] and we assessed conventional static two-point discrimination (2PD) for the in-person examination, noting 63% agreement. Differences in our findings with regards to sensation may be attributable to the way that our modification of the Ten Test was performed (patients performing it on themselves as opposed to an examiner performing the test) and suggest poor reliability for this sensory assessment. Despite the limitations of the sensory exam, in practice we have found it rare to rely on static 2PD to make a decision to proceed with CTR and, despite the low percentage of agreement with respect to sensory findings, our management did not change in cases with discordant sensory exams. A positive Phalen test coupled with positive symptom components of the CTS-6 results in a score >12, and these 3 elements of the CTS-6 all demonstrate high levels of virtual and in-person agreement. Future investigations should endeavor to determine a more reliable telemedicine sensory assessment, particularly if virtual consultations involve more complex initial presentations.

Patients in our series noted high levels of satisfaction with the telemedicine pathway. These

findings are similar to prior investigations in noting that satisfaction with telemedicine visits is similar to satisfaction with in-clinic visits for orthopedic encounters.[3] In a study of postoperative upper-extremity patients, we previously found that telemedicine decreased travel burdens and resulted in similar visit satisfaction compared to in-clinic appointments.[6] The percentage of patients that would choose telemedicine again for further visits (97%) was similar to the percentage that preferred telemedicine for postoperative care after upper-extremity surgery in our prior investigation.[6] While high patient satisfaction with telemedicine is not a particularly novel finding, it is worth noting that satisfaction remained high despite the patients meeting the surgeon in person for the first time just prior to elective surgery.

Our study has a number of limitations which should be considered. Despite a prospective design, our methodology was subject to selection bias (particularly for patient satisfaction), as all patients chose to participate in a telemedicine program. Additionally, the majority of this study was conducted during the "second wave" of COVID-19 at our institution, which also likely had an impact on satisfaction data because telemedicine patients were offered earlier visits (typically around 1 to 3 weeks sooner). The patients screened for this study had a high likelihood of having CTS given our inclusion criteria. Thus, the low number of patients without a diagnosis of CTS limited the ability to determine sensitivity/specificity for the telemedicine CTS-6. Considering the discordance of our sensory exam between the 2 settings, it may have been useful to repeat the Ten Test (in addition to static 2PD) during the in-person evaluation. Given that we excluded patients with prior CTRs, these visits were lower-complexity initial consultations, and it is uncertain whether our results are generalizable to more complex clinical presentations or to more complex conditions in general. Since comparisons were only available for patients who underwent CTR, it is unclear whether the results would differ for patients with CTS undergoing nonoperative treatment. Further limiting the generalization of these findings is the fact that this study was conducted by a single upper-extremity surgeon, which introduces potential selection and confirmation bias. The surgeon was not blinded to the results of the telemedicine CTS-6 during the in-person examination. Additionally, no separate, blinded observer performed the in-person examination in the preoperative area, and it is possible the treating surgeon would have been less likely to change the plan on the day of surgery compared to a blinded observer.

A comprehensive telemedicine pathway for patients with CTS results in high levels of patient satisfaction. Overall agreement between telemedicine and in-person administration of the CTS-6 is high for patients with CTS. In all cases where CTR was planned after a telemedicine visit, the plan remained unchanged based on the results of the in-person assessment. Telemedicine examination of hand sensation has some limitations when compared to conventional sensory examination. With essentially equivalent overall CTS-6 results when administered virtually or in person, telemedicine can serve as an alternative to conventional, in-person clinic visits for the diagnosis and postoperative management of uncomplicated, primary CTS.

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