LETTER TO THE EDITOR

The Application of Telemedicine in Upper Extremity Surgery

Dear Editor

Telemedicine is a platform of health care delivery involving the use of electronic communication to provide patients with access to health information (1). This includes access to medical staff or to personal or informative health care information. Multiple methods of telemedicine delivery may be employed, including videoconferencing, phone communication, web-based patient portals, text-messaging, and smartphone applications (1, 2). Global crises, including the current Coronavirus pandemic, limit our ability to provide medical care, requiring an alternative means of health care delivery. Though concerns exist regarding the safety and efficacy of telemedicine, its utility in upper extremity orthopedic surgery has been proven (3, 4). Remote management of upper extremity pathology is possible with the use of telemedicine, allowing surgeons to provide care when access is limited. The purpose of this review is to discuss the applications of telemedicine visits (TV) specific to hand and upper extremity surgery.

Logistics of Use

Secure videoconferencing is commonly employed in orthopedic TVs as it allows for both subjective and objective patient assessment, however, this requires patient access to a smart device, phone, or computer (3, 4). Access to such electronics may be limited in older patients or those with minimal technologic experience. However, the effective use of telemedicine in this population and the large percentage of hand-surgery patients with access to a personal computer have been demonstrated in current literature (5, 6).

The choice of device used by patients for remote assessment of upper extremity pathology may have a substantial impact on the quality of evaluation. The use of a smartphone to provide video data requires the patient to hold their cellphone with the contralateral hand, limiting their ability to include the entire portion of the extremity in question within the confines of the camera. Furthermore, bilateral evaluation is difficult with this setup. As a computer provides a static camera, its use allows for patient participation in a "hands-free" manner, likely resulting in less motion artifact and a greater scope of evaluation. On the contrary, for lower extremity visits, hand held devices may offer optimal positioning.

In the authors' experience, the selected method of invitation to participate in videoconferencing may influence the device with which patients choose to participate. Those receiving appointment reminders and TV links via text-message or phone application tend to select the use of a smartphone, whereas those contacted via email often participate via computer. Mitigation of this variability may be aided by pre-visit instructions regarding the preferred method of participation via the scheduling staff. Future investigations are required to evaluate the impact of electronic device selection on the efficacy of orthopedic telemedicine evaluation.

Feasibility of Examination

A major concern regarding the efficacy of telemedicine is the inherent limitation in physical examination. Any portion of the physical exam that requires physician palpation or limb manipulation may be restricted. This may include palpation of the affected region, monitoring of skin temperature, measurement of passive range-of-motion, specific provocative maneuvers, and evaluation of sensation, all of which require physician participation. In times of national health crises, advanced imaging studies including Electromyography and Magnetic Resonance Imaging may only be available on an emergent basis. In spite of these limitations, telemedicine has been proven to provide a satisfactory quality of physical examination, as studies have found providers to rate their remote patient examination as appropriate in comparison to in-office evaluation (7). In the upper extremity specifically, the use of videoconferencing via smartphone has demonstrated adequate determination of extremity motion parameters compared to in-office goniometer use (8). A number of special physical exam tests may be performed via videoconferencing when evaluating the upper extremity. In the shoulder, patients may remotely perform many of the standard tests that do not require tactile feedback (i.e. cross-body adduction evaluation of the AC joint and belly-press testing of the subscapularis muscle). Specialized testing of the hand performed remotely may similarly act to substitute for physician touch (i.e. Finkelstein's testing for DeQuervain's tenosynovitis and Phalen's evaluation of Carpal Tunnel Syndrome). These self-performed

Corresponding Author: Michael Rivlin, The Rothman Institute at Thomas Jefferson University, Philadelphia, PA, USA
Email: Michael.Rivlin@rothmanortho.com

AB&JS THE ONLINE VERSION OF THIS ARTICLE ABJS.MUMS.AC.IR

tests provide highly-specific information regarding patient pathology. In contrast, some tests may not be suitable for patients to self-administer (i.e. Allen's test for circulation, Durkan's, Scaphoid shift test, and other provocative tests for instability). Clinician discretion is advised when selecting or modifying examination and adapting it for TV visits.

Treatment Via Telemedicine

The inability to personally evaluate patients may limit the available treatment options physicians may offer. For example, the ability to provide an injection or perform physical manipulation of an extremity is restricted without in-office evaluation. Despite the spatial disconnect between the physician and patient, effective treatment of many ailments about the upper extremity is possible with telemedicine. Physicians may provide council regarding the natural history of disease and recommend the use of over-the-counter medications. Similarly, prescription medications may be provided electronically and sent directly to the patient's pharmacy. Advanced imaging studies may be remotely ordered and reviewed. Finally, surgeons may prescribe a prefabricated brace from a third-party vendor or recommend a customizable brace fitted by either an orthotist or the patient themselves. Self-measured braces often utilize rudimentary methods of sizing, however, newer technologies are emerging employing smartphone cameras to digitalize the extremity in an effort to make a more accurate personalized brace. Using this technology, the surgeon can remotely prescribe the needed brace and direct patients to the appropriate portal or smartphone application to determine the optimal fit of the orthosis (9). The brace is then shipped to the patient's address with a customized video tutorial or TV fitting by an orthotist.

Telemedicine has already proven effective in both initial consultation and post-operative evaluation of the shoulder, elbow, and wrist (3, 4). As this platform of healthcare delivery continues to demonstrate increased satisfaction and safety, it is likely to see continued utilization. The Coronavirus pandemic has demanded a surge in the use of telemedicine to improve patient outreach and connection. As innovative methods to surpass the spatial disconnect between the patient and the provider are developed, telemedicine appears to be poised for use in health care for many years to come.

Dennis A. DeBernardis DO[1]
Michael Rivlin MD[2]
1 Rowan University School of Osteopathic Medicine, Stratford, NJ, USA
2 The Rothman Institute at Thomas Jefferson University, Philadelphia, PA, USA

References

1. Hailey D, Roine R, Ohinmaa A. Systematic review of evidence for the benefits of telemedicine. J Telemed Telecare. 2002; 8(Suppl 1):1-30.
2. Williams AM, Bhatti UF, Alam HB, Nikolian VC. The role of telemedicine in postoperative care. Mhealth. 2018; 4(3):11.
3. Kane LT, Thakar O, Jamgochian G, Lazarus MD, Abboud JA, Namdari S, et al. The role of telehealth as a platform for postoperative visits following rotator cuff repair: a prospective, randomized controlled trial. J Shoulder and Elbow Surg. 2020; 29(4):775-83.
4. Grandizio LC, Foster BK, Klena JC. Telemedicine in hand and upper-extremity surgery. J Hand Surg. 2020; 45(3):239-42.
5. Lu K, Marino NE, Russell D, Singareddy A, Zhang D, Hardi A, et al. Use of short message service and smartphone applications in the management of surgical patients: a systematic review. Telemed J E Health. 2018; 24(6):406-14.
6. Rozental TD, George TM, Chacko AT. Social networking among upper extremity patients. J Hand Surg Am. 2010; 35(5):819-23.e1.
7. Buvik A, Bugge E, Knutsen G, Småbrekke A, Wilsgaard T. Quality of care for remote orthopaedic consultations using telemedicine: a randomised controlled trial. BMC Health Serv Res. 2016; 16(1):483.
8. Meislin MA, Wagner ER, Shin AY. A comparison of elbow range of motion measurements: smartphone-based digital photography versus goniometric measurements. J Hand Surg Am. 2016; 41(4):510-5.e1.
9. Splint delivery. Dimension Orthotics. Available at: URL: http://www.dimensionorthotics.com/splint-delivery; 2020.