Previsit Patient Instructional Video for the Virtual Orthopedic Foot and Ankle Examination

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Level of Evidence: Level V, clinical tips.

Keywords: telemedicine, telehealth, virtual, examination

Introduction
Telemedicine use has become increasingly prevalent over the past year as a result of the COVID-19 pandemic. To conserve resources and comply with social distancing regulations, in-person clinical visits have been limited in many regions of the country to only the most urgent issues. This shift in care delivery has forced orthopedic surgeons to integrate telemedicine into their practices, a technological evolution that might otherwise have taken decades. Previous studies have demonstrated that telemedicine can be an economical, safe, and effective alternative to in-person care. Advantages include decreased costs to the patient, reduced commute times, and improved access for impaired patients or those who live in rural areas. Barriers to telemedicine implementation include technical challenges and resistance to change by both physicians and patients.

During the urgent adoption of telemedicine in the early COVID-19 pandemic, a technical challenge that orthopedic surgeons faced was guiding patients through an effective physical examination. Within months, orthopedic telemedicine guides were published for patient education and facilitating the musculoskeletal examination. These publications, however, included only a short video clip to explain to the patient how to participate in the examination during a telemedicine visit.

In the foot and ankle subspecialty, the closely adjacent complex anatomy compared to other areas of the body presents unique challenges for physical examination. We sought to address this difficulty by creating a standardized means for patients to share the most comprehensive necessary information to assist in evaluation. Here we report on a previsit technique video we have developed and implemented specific to the foot and ankle at a single busy academic tertiary care institution to augment the virtual examination and mitigate some of these challenges.

Preliminary Preparation Steps
Before the virtual visit, patients receive a consent form detailing the visit structure, associated limitations, and payment. The physician’s office sends new patients the routine paperwork via e-mail, which includes instructions for returning by regular mail or uploading securely into their electronic medical record (EMR). If patients have radiographs completed at an outside imaging center, they are requested to mail the disc to the physician’s office at least 2 weeks prior to their visit so that it can be uploaded into their chart.

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Preparing for the Virtual Visit and Video Exam

To optimize the efficiency and efficacy of the examination portion of the visit for both patients and providers, we designed and recorded an instructional video that is sent to all patients by e-mail a minimum of 1 week prior to their appointment. This video consists of a step-by-step guide on how to take suitable photos and videos of their feet and ankles for the physical examination portion of their visit. These media files are then directly uploaded by the patients into their EMR or e-mailed to the physician’s office to be uploaded for access by the provider before and during the virtual visit. Along with the video, patients are given a link to test their microphone and camera in advance of the visit to ensure adequate functionality and positioning.

Previsit Instructional Video Steps

Our instructional video is sent to patients as an mp4 file (Video 1). It begins by having the patient prepare by removing their shoes and socks and rolling up their pants to expose the areas of concern (Figure 1). The patient is next asked to request assistance from another person to take photos of their feet and ankles using a smartphone. The video demonstrates...
**Figure 4.** Photographs show coronal ankle, hindfoot, midfoot, and forefoot alignment from (A) front and (B) behind.

**Figure 5.** Photograph shows dynamic coronal alignment assessment by single-leg stance.

**Figure 6.** Photograph showing arch reconstitution and heel alignment assessment by single-leg heel rise.
ideal examples of such photos being taken for reference. First, the assistant photographs from above to show axial forefoot, midfoot, and hindfoot alignment (Figure 2). Deformity such as metatarsus adductus, forefoot abduction, pes planus, and hindfoot varus or valgus can be easily noted in these images.

Sequential photos of the bottom of each foot are taken to evaluate for the presence of callus or ulcers that could indicate uneven load distribution from pathologic alignment (Figure 3).

Front and back views of the feet and ankles are then taken to show weightbearing coronal ankle, hindfoot, midfoot, and forefoot to help evaluate varus or valgus deformity (Figure 4). This process is repeated while the patient stands on one foot sequentially to assess the flexibility or rigidity of deformity (Figure 5). To evaluate posterior tibialis muscle function and ability to achieve heel varus and arch reconstitution, the assistant takes photos from behind while the patient performs sequential single leg heel rises (Figure 6).

Next, to gauge weightbearing sagittal alignment, the assistant takes a photo of the lateral and medial aspect of each foot and ankle while the patient stands upright. This allows inspection for subfibular impingement, arch collapse, and greater and lesser toe deformities including claw,
Figure 10. Screenshot of video for dynamic gait assessment from the (A) front and (B) back.

Figure 11. Screenshot of video for dynamic toe walking gait assessment from the (A) front and (B) back.
hammer, mallet, and cock-up toes (Figure 7). To assess for ankle range of motion, photos are then taken of the medial side of each foot and ankle while the patient maximally dorsiflexes the ankle with the knee flexed (Figure 8). Similarly, photos are taken of the medial foot and ankle with active great toe plantarflexion and dorsiflexion to allow evaluation of metatarsophalangeal joint range of motion, important in hallux rigidus and hallux valgus assessment (Figure 9). This also allows for assessment of the contributions of the extrinsic tendons on hallux metatarsophalangeal joint range of motion.

A dynamic gait assessment is then performed by having the assistant take a video from the front and back of the patient walking (Figure 10) and again from the front and back with the patient toe walking (Figure 11). This provides an assessment of motor function with the presence of anti-gravity ankle and toe dorsiflexion and plantarflexion, as well as posterior tibialis muscle function through arch maintenance. The flexibility of planovalgus and cavovarus deformity can be studied through these images, and balance and proprioception are also appreciated.

A video is then taken from the lateral side with the patient doing double leg squats to assess ankle range of motion, particularly dorsiflexion (Figure 12).

To simulate gastrocnemius soleus, posterior tibialis, and peroneus brevis strength assessment, the patient is next instructed to roll up a towel and wrap it around the junction of the midfoot and forefoot. A video is taken of the patient plantarflexing, inverting, and evert ing each foot against the resistance from pulling the towel while in a seated position (Figure 13).

Finally, to evaluate wear pattern, which has implications for foot load distribution related to deformity, photos are obtained from behind and on the bottom of their most commonly worn shoes.

Patients record this documentation using a cell phone, producing JPEG files for the photos and MP4 files for the videos. Patients are also instructed to take a picture of any recent radiographs to ensure they are available for physician review in the EMR, in the event the patient is unable to mail an imaging disc prior to the visit.

**Preliminary Experience With the Previsit Instructional Video**

Our preappointment instructional video has been effective to methodically replicate the most important aspects of an in-person foot and ankle evaluation. Both physicians and patients appear to benefit from the tutorial video by having more time during the telemedicine visit to focus on history, assessment, and plan. Patients are more actively involved in the clinical data collection process because they are educated on what to expect and how to best prepare and participate in telemedicine visits. Moreover, having a set of systematic and detailed photos and recordings of the patient’s foot and ankle beforehand better focuses interaction and discussion with the patient during the telemedicine encounter.

With 7 months and 28 patients of experience integrating this previsit video into each telemedicine visit, several important benefits have been noted. Valuable clinical time is conserved by not spending the start of each visit teaching the patient or a family member on how to set up and optimize image capture. Instead, by having documentation of the relevant, important physical examination features available for review in advance, the visit is more focused on discussing the differential diagnoses and treatment options in greater detail. The patient photos and recordings are also conveniently saved as part of the patient’s EMR for later review and reference during subsequent medical record documentation.

This tutorial video, however, does not fully compensate for the inherent disadvantages of telemedicine for musculoskeletal examination in orthopedic surgery. This includes the inability to accurately evaluate motor strength, sensation, vascular status via pulses, and range of motion or to precisely localize painful areas. We do routinely supplement this video by asking the patient to perform additional
maneuvers during the virtual visit as needed based on individual presentation and specific pathology.

**Future Directions**

It is likely there will continue to be a role for telemedicine beyond the pandemic. Advantages of telemedicine as an alternative to in-person visits have already been shown for patients with decreased mobility due to lower extremity pathology, those with long commutes to clinic, and those in lower socioeconomic levels. Development of standardized protocols for both the patient and provider to prepare before and during the actual telemedicine encounter is necessary to optimize visit efficiency and accuracy. Future directions include comparison of physician and patient satisfaction and outcomes incorporating previsit physical examination instructional videos such as this one into telemedicine visits with standard in-person visits.

**Summary**

Physical examination plays a critical role in diagnosis and treatment in the orthopedic foot and ankle subspecialty. More research is needed to discern how best to utilize virtual modalities as they become more commonplace, not just from the imposition from the COVID pandemic but also from the standpoint of patient convenience and time efficiency. Here we have described our creation of a previsit educational video to guide and engage patients on acquiring invaluable physical examination information for the orthopedic foot and ankle telemedicine encounter.

**Acknowledgment**

We thank Lyn Camire, MA, ELS, of MedStar Union Memorial Hospital for editorial assistance.

**Ethics Approval**

Per IRB regulations, the brief oral survey mentioned in this manuscript is deemed as quality improvement but not research. Therefore, it doesn’t require IRB approval.

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**Declaration of Conflicting Interests**

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article. ICMJE forms for all authors are available online.

**Funding**

The author(s) received no financial support for the research, authorship, and/or publication of this article.

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**Supplemental Material**

There is a supplemental video for this article available online.

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