# Telemedicine for Otolaryngology: Challenges, Opportunities, Limitations, and the Impact of COVID-19

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Funding: None

Competing interests: None declared

Ethical approval: Not required

Acknowledgements: We thank Valerie Gramling, PhD for the critical reading of this manuscript.

Keywords: telemedicine, otolaryngology, COVID-19, SARS-CoV-2, virtual healthcare

Running Title: Telemedicine during COVID-19 in Otolaryngology

 doi:10.20944/preprints202204.0243.v1


## Abstract

**Objectives:** As institutions modified medical practices to mitigate the spread of the SARS-CoV-2 virus, providers were forced to modify care through the implementation of telemedicine. The objective of this article is to review the current practices of otolaryngology during the COVID-19 pandemic and the limitations of telemedicine in current practice.

**Methods:** A thorough review of the PubMed and MEDLINE databases was performed for publications between 2020 and 2021. Studies discussing telemedicine in otolaryngology during COVID-19 pandemic were selected.

**Results:** As worldwide cases of COVID-19 continue to oscillate, we must continue to be vigilant in our clinical practice, implementing safe techniques to mitigate the spread of the SARS-CoV-2 virus through the continual use of telemedicine in all specialties of otolaryngology. Trends of increased patient acceptance of the use of telemedicine have been seen across subspecialities, including otolaryngology.

**Conclusion:** Currently there are challenges associated with the implementation of telemedicine in the field of otolaryngology that rely heavily on adjunct physical examination, imaging studies, and specialty procedures. However, telemedicine has tremendous potential and can be adapted to include in the otolaryngologist's toolbelt during public health emergencies such as the COVID-19 pandemic.

 doi:10.20944/preprints202204.0243.v1

**Public Interest Summary**

The impact of COVID-19 was widespread in healthcare, especially in otolaryngology that relies heavily on physical examination, procedures, and imaging studies. Although telemedicine acceptance is increasing in acceptance among patients, there are challenges and limitations to its implementation in the practice of otolaryngology. As telemedicine becomes an essential tool in the safety and health of patients, it is important to continue to refine our techniques of virtual visits to ensure complete and adequate healthcare to patients.

 doi:10.20944/preprints202204.0243.v1

## Introduction

As institutions modified medical practices to mitigate the spread of SARS-CoV-2, providers were forced to modify in-person care through the implementation of telemedicine(1, 2). In otolaryngology (ENT) specifically, telemedicine seemed nearly inapplicable due to the large number of surgical procedures, imaging studies, and physical examinations required for diagnosis and treatment(3).

While technology has improved over the decades since the introduction of telemedicine, the COVID-19 pandemic was the propelling factor to remove the final financial and insurance barriers preventing the widespread implementation of the technology(4). Despite initial apprehension, telemedicine has become an essential tool and is expected to become a mainstay in ENT clinical practice and academic medicine(2, 5). The elimination of all in-person encounters and procedures within otolaryngology in lieu of telemedicine is not possible which resulted in practice modification to ensure patient and provider safety(6-8).

The objective of this article is to review the current practices of ENT during the COVID-19 pandemic and the limitations of telemedicine in current practice. We aim to comprehensively cover the use of telemedicine in otolaryngology subspecialties and provide a foundation regarding incorporation of telemedicine into otolaryngology. As a future direction, we examine how we can use the knowledge we have gathered from this pandemic to advance our practice with modern technology. The objective of this paper is not to equate in-person visits with virtual ones, but rather to discuss where technology can assist vulnerable communities and understand the current “successes” and failures of telemedicine in otolaryngology.

 doi:10.20944/preprints202204.0243.v1

## Methods

References were compiled from PubMed and MEDLINE databases between January 10th 2021 – May 1st, 2021 and included publications from March 2020 to May 2021. A wide array of keywords and their abbreviations were used discussing medical education, virtual learning, otolaryngology (ENT), otolaryngology (ENT) training, otolaryngology head and neck surgery residency, telemedicine, telehealth, COVID-19, and SARS-CoV-2. 280 peer-reviewed articles were reviewed; selected articles emphasized tailoring otolaryngology practice to the COVID-19 pandemic and provider and patient adaptation in subspecialties of otolaryngology to limit spread of SARS-CoV-2.

## Results

### *Implementation of Telemedicine in Otolaryngology by Subspecialty*

Throughout the pandemic, otolaryngologists have been required to adapt many of their in-office screening procedures and exams to telemedicine techniques. A recent meta-analysis found that roughly 50% of ENT medical consultations could successfully be carried out through telemedicine(1). Importantly, the study showed that neither image quality nor the handling of technology by the physician or patient were obstacles to a diagnosis(1). By further implementing telemedicine into our practice for follow up appointments and medical care, we can direct medical staff and equipment to departments overwhelmed by patients with COVID-19.

All subspecialties of ENT had high rates of procedure cancellations during early 2020 and at subsequent peaks throughout the ongoing pandemic(9). Implementation of telemedicine by subspecialties of ENT is reviewed in **Table 1**. Telemedicine implementation was found to be more common in subspecialties that had not recovered to 80% of their pre-COVID patient load including

 doi:10.20944/preprints202204.0243.v1

the subspecialties of laryngology, pediatric otolaryngology, and rhinology. Telemedicine visits were effective in the establishment of new patients, routine follow-up with established patients, pre-operative consultations, and post-operative care(4).

**Table 1: Recommendations for changes in otolaryngology by subspecialty during the COVID-19 pandemic.**

| **Facial Plastic and Reconstructive Surgical Practice** | **Reference** |
|---|---|
| For minor craniofacial trauma in which clinical decisions will be made based on history and imaging studies, telemedicine is adequate for initial treatment and triage. | (50) |
| Telemedicine allows for multidisciplinary consultations in burn units, cleft palate consultations with dentistry, and acute trauma in the emergency room. | (12-14) |
| Telemedicine should be implemented for noncomplicated, post-discharge surgical follow-up. | |
| **Head and Neck Surgical Oncology and Endocrine Surgical Practice** | **Reference** |
| The head and neck cancer population are largely immunocompromised and therefore, telemedicine can reduce SARS-CoV-2 infection risk. | (20, 50) |
| For the follow up of malignancies and procedures, telemedicine can be utilized to address patient concerns. | (18, 21) |
| Group visits for head and neck survivorship can be created, allowing for members to address shared concerns, strategies, and insights. | (10) |
| **Otology and Neurotology** | **Reference** |
| Most middle and inner ear complaints could be evaluated and diagnosed over telemedicine. | (3) |
| Patients with chronic ear disease are suggested to utilize telemedicine paired with commercially available otologic endoscope and smartphone apps. | (10, 50) |
| Cochlear implants can be rehabilitated and successfully activated remotely. | (25, 26) |
| Preexisting algorithms can be implemented through telemedicine platforms that stratify patients and reduce the number of in-person examinations for dizziness. | (29) |
| If patients rely on lip reading in the otology clinic, telemedicine visits can mitigate masks being a barrier to communication. | (51) |
| **Pediatric Otolaryngology** | **Reference** |
| Aerosolization via crying or coughing is common during examination, therefore, telemedicine allows patients to be being more comfortable and cooperative in their home. | (41, 52, 53) |
| Telemedicine offers a means for follow-up in pediatric patients who have difficulties in getting to a hospital or have chronic conditions that require minimal follow-up. | (34) |
| Telemedicine allows several households to attend visits remotely, thus facilitating care for patients with separated and divorced families. | (37) |
| **Rhinology, Sinus, and Anterior Endoscopic Skull Based Surgical Practice** | **Reference** |

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|---|---|
| During triage of rhinologic symptoms, telemedicine may be utilized to better understand the patient's history and treatment, especially in the context of anosmia and COVID-19. | (54) |
| After rhinologic procedures, removal of nasal packing can be done at home with assistance over telemedicine by a nurse or medical professional. | (55) |
| Treatment modification for allergic rhinitis or chronic sinusitis can be evaluated over telemedicine. | (41) |
| **Laryngology** | **Reference** |
| Remote sharing of laryngeal pathology can limit the number of laryngoscopies performed in patients seeking second opinions. | (23) |
| For patients who require voice therapy sessions, telemedicine has been shown to be successful. | (24) |
| For dysphagia, providers can implement remote swallowing therapy including video education. | (26, 27) |
| **Sleep Surgery** | **Reference** |
| To limit usage of polysomnograms to diagnose obstructive sleep apnea, a thorough history can be done via telemedicine to guide diagnosis. | (56) |
| Telemedicine should be incorporated for the diagnosis and management of sleep apnea and CPAP therapy through home sleep testing, monitoring, and treatment adjustment. | (57) |
| If a patient is in a remote setting, having the oral examination performed via telemedicine in a local physician's office may help with positioning of the patient for Drug Induced Sleep Endoscopy. | (57) |

Beyond pre-operative and post-operative care, discussions of laboratory and imaging results can be addressed entirely via video telemedicine visits (10). Increased efficiency of visits can be achieved by having a nurse and scribe prepare the patients, so they are ready for provider consultation. Initial telemedicine visits can solve most elective and many urgent issues; however, providers can have subsequent in-person visits if needed(11).

### *Facial Plastic and Reconstructive Surgery*

In facial plastic and reconstructive surgery, telemedicine offers the advantage of multidisciplinary consultation in burn units, dermatology consultations, cleft palate consultations with dentistry, and acute trauma consultation in the emergency room(12-16). Minor burn and

 doi:10.20944/preprints202204.0243.v1

cutaneous wound consultations and follow up care can be achieved over telemedicine(17). In these cases, telemedicine has applications in triaging trauma safely and efficiently and evaluating digital images provided by patients(18).

Jones et al. looked at the establishment of a diagnosis using digital images in acute plastic surgery consultations and concluded that digital images were sufficient to make the diagnosis. This method was preferred over physical images provided by patients due to magnification ability(14). Having technicians send example photographs and attend virtual visits to coach patients on how to take photographs can greatly assist in pre-operative planning, initial consultations, and can substitute some in office imaging(19).

A thorough review of facial plastic surgery telemedicine consultations found great applicability for initial consultation and for non-complicated, post-operative follow up(5). Synchronous telemedicine consults are similar to in-person consults with the increased benefit of decreased transportation costs and waiting time for specialist care in rural settings. The utilization of telemedicine in facial plastic consultations can be an effective way to mitigate in-person exposure while reducing cost to individuals already socioeconomically strained by the pandemic(17).

***Head and Neck Endocrine and Oncologic Surgery***

The MD Anderson Head and Neck Surgery Center has emphasized telemedicine's use to mitigate risks and provide substantial care to the vulnerable and immunocompromised head and neck cancer population(20). Telemedicine permitted consistent follow up of new symptoms and simultaneously addressed patient's concerns regarding prognosis, treatment, and management while mitigating risk of SARS-CoV-2 contraction(18, 21).

 doi:10.20944/preprints202204.0243.v1

Continuous communication between the patient and the provider via telemedicine reduced the burden placed on patients as they go through their cancer journey. Head and neck oncology surveillance and survivorship visits can be moved to a telemedicine platform to continue to provide support(10). Survivorship group visits matched based on the same trajectory of recovery and disease can be created, allowing for members to address shared concerns, strategies, and insights(10).

For post-operative care, smartphone apps were developed to aid in management of free flap surgeries to ensure adequate perfusion. In initial trials of the application, a study reported 98% sensitivity and 94% specificity in detection of abnormal perfusion(22). This could serve as a supplement to in-person examination. Patients should still have regular, in-person follow up appointments as free flaps commonly fail due to incomplete perfusion of the newly implanted tissue(18).

***Laryngology***

Intraoral, pharyngeal, and laryngeal examination currently require in-person examination(18). Remote sharing of laryngeal pathology, however, can curb the number of laryngoscopies performed in patients seeking second opinions, limiting excessive discomfort and cost(23).

For patients with chronic pathology who require voice therapy, telemedicine sessions were successful, allowing patients to safely make improvements in vocal cord and laryngeal pathologies without clinical exposure(24). For individuals suffering from laryngomalacia, providers can provide mediation techniques, reassurance, and schedule follow up laryngoscopy if needed(25). For dysphagia, providers have had success implementing remote swallowing therapy.

 doi:10.20944/preprints202204.0243.v1

For patients with a tracheostomy, video education can be implemented on stromal hygiene. Supplies can also be delivered directly to the house to prevent in office changes. If required, in-person follow up care can address breathing difficulties due to aspiration and mucus plugging(26, 27).

***Otology and Neurotology***

Otologic evaluation of patients has been expedited through telemedicine, helping improve efficiency of the practice due to the large volume of patients seen in otology. One study showed a decrease from 47% of patients waiting greater than 5 months for an audiology consultation to less than 3% following telemedicine implementation(28). A retrospective study determined over 80% of middle ear complaints and 90% of inner ear complaints could be evaluated and diagnosed over telemedicine due to the decreased necessity of examination for diagnosis(3).

When a patient complains of dizziness, preexisting algorithms can be implemented through telemedicine platforms to stratify patients with life threating complications, those requiring medical intervention, and those who can be treated virtually(29). As the patient history is the primary component of diagnosis for dizziness, virtual consultation could reduce the amount of patients in the clinic(30).

Delayed treatment for hearing loss significantly affects patient's ability to work and further contributes to social isolation(26). For patients who have had their cochlear implant surgery delayed, calling the patient and providing resources to alleviate low mood, depression, or hopelessness have helped patients cope(31). Telemedicine visits are ideal for cochlear implant candidates as most visits are spent on surgical counseling(25). Following implantation, implants can be rehabilitated and activated remotely.

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For patients who are hard of hearing, masks can act as a barrier. To overcome this obstacle, providers can implement telemedicine visits to allow for effective communication and lip reading(26). Additionally, patients can maximize the volume and utilize the chat function during telemedicine visits, further facilitating conversation.

The continued use of telemedicine in otology will depend on the advancement and implementation of telemedicine instruments. Smartphone-enabled otoscopes have been found to have 96% specificity in identifying normal tympanic membranes and 100% sensitivity in identifying pathology(32). These scopes have been successfully used at Weill Cornell Medicine and cost roughly $20-$30(4). If cost is a limitation, patients can visit their nearest primary care office who will be able to obtain images using an otoscope and forward these images to an otolaryngologist for evaluation(33). The future implementation of affordable image acquisition devices will allow for increased applicability of telemedicine in the field of otology(34).

***Pediatric Otolaryngology***

Pediatric otolaryngologists were initially concerned by the limited physical exam during telemedicine visits, specifically during otoscopy and nasolaryngoscopy. However, after 1 month of use of telemedicine, most providers felt it would be a valuable platform to increase patient outreach post-pandemic and were able to stratify patients that needed in-person evaluation(35).

The most common procedures seen in a pediatric otolaryngology clinic include post-operative follow up, chronic otitis media, acute hearing loss, and dysphagia. For pediatric patients with chronic otitis media, it is imperative to not delay treatment as this may lead to impairment of speech development(26). Delaying care for tonsillitis leads to an increased risk of possible

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peritonsillar abscesses(26). To assist in treatment of these conditions, imaging studies, procedures, and laboratory orders were able to be placed based on the history and limited physical exam allowed via telemedicine.

For pediatric patients with health or social conditions that make hospital visits challenging, telemedicine offers patients the ability to receive care at a centralized tertiary center without the burden of traveling to a large academic institution(34, 36). Often these patients require active medical management, but do not require an in-person visit for treatment; thus, telemedicine offers to bridge this gap while providing excellent follow up management(37). This method was proven to be effective in one study, finding that 99% of telemedicine cases had congruency in diagnosis when compared to follow up in-person appointments(38).

Pediatric otolaryngologists noted that patients tend to be more at ease in a home environment versus the clinical environment and thus, were more likely to follow physician instructions. This includes opening their mouth to allow for more comprehensive oral examinations via video telemedicine(37). As children are often not willing to participate in the in-office examination process, a basic examination of the oral cavity or anterior nose can turn into an aerosol generating procedure through coughing, screaming, and spitting(39). Therefore, virtual outpatient consultations show clear benefits for post-operative follow ups, discussions regarding results, and continued discussion to proceed with surgical intervention. Importantly, telemedicine has been shown to reduce the number of missed school days, in pediatric settings, and workdays for parents having to attend their child's appointments(40).

Pediatric care often requires having a caregiver present, creating greater exposure risk to both the patient and provider(39). Telemedicine allows several family members located in different households to attend visits. This allows separated and divorced families to be involved in the care

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of their children and allows parents to easily schedule appointments around their work schedules(37).

***Rhinology***

The practice of rhinology during COVID-19 has relied heavily on the history and limited physical examination rather than modern imaging, evidenced by a decrease in CT utilization(41). By narrowing the indications for nasal endoscopy and the ability for limited examination of the anterior nares over telemedicine, the rhinologist facilitates resource stewardship and patient safety. As anosmia is a common symptom of COVID-19, providers can utilize telemedicine to stratify patients that have developed COVID-19 or determine those that require in-person examination.

According to a survey sent to members of the American Rhinologic Society, 96.2% of respondents had begun using telemedicine, showing one of the highest utilization rates among ENT subspecialties(42). A common presentation to a rhinologist is allergic rhinitis. Treatment modification for allergic rhinitis or chronic sinusitis can be evaluated over telemedicine, and after failed treatment, in-person evaluation can be used(41). For patients that are deemed to need more invasive examination, grouping patients into procedure days can limit the personnel needed in the hospital(10).

***Overall Limitations of Telemedicine in the Otolaryngology Practice***

As telemedicine has rapidly expanded, many previous problems including doctor-patient familiarity, the selection of technology platforms, virtual physical examination, and insurance reimbursement have been resolved. Although there may be decreased reimbursement rates for

 doi:10.20944/preprints202204.0243.v1

virtual visits, an increase in time between consults for academic or administrative purposes may outweigh the decreased compensation(43).

Despite the array of applications, telemedicine has fallen short in equating to in-person ENT office visits. ENT is a field that heavily depends upon physical exam findings for decision making and requires physicians to visualize areas of the body that cannot be appreciated without certain instruments(37). Improper visualization of the tympanic membrane and oropharynx make treatment recommendations more difficult and less accurate. Patients are untrained to use at-home otoscopes, so most telemedicine examinations are limited to the pinna(35, 44).

Increased implementation and expansion of teleotoscopy can mediate these challenges through easily purchased, direct-to-consumer products(35). Some institutions provided telemedicine otoscopes with a prepaid return label, increasing access to care for patients who are not able to afford a telemedicine otoscope(44). However, many institutions have not invested in the technology or infrastructure to support this technology and therefore, still rely on in-person examination(45). The most frequent complaint of telemedicine among pediatric otolaryngologists was ear-related due to lack of an otoscope and no audiologic examination to narrow in on the diagnosis(35). Providing well-lit images of the child's oropharynx, ears, and oral cavity prior to the telemedicine encounter can help a pediatric otolaryngologist provide a directed treatment plan to the patient.

Another area of difficulty to diagnose included stridor and breathing difficulties due to the lack of flexible nasolaryngoscopy(35). Providers, therefore, largely must make a presumptive diagnosis based on physical examination signs rather than direct visualization(25).

Head and neck oncology patients may not greatly benefit from telehealth. As these patients require a high level of multidisciplinary care, patients often need to come into the academic center

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for another appointment. During ENT visits, these patients require in-person examination and therefore, telemedicine has limited application in clinical care of head and neck surgery. Safety should focus on mitigation techniques instead.

In evaluating patient satisfaction of telehealth, it is vital to understand that many studies(45-47) excluded patients without access to a personal computer, internet, or were unable to answer emails. Patients unfamiliar with telemedicine technology, including the elderly and disabled, may not have the means to perform a successful telemedicine visit(26, 48). This can skew our understanding of how willing patients are to utilize telehealth. Therefore, there is a need to continually evaluate our implementation of telemedicine and increase outreach to vulnerable populations. **Table 2** highlights common limitations to care in otolaryngology and future directions to overcome them.

**Table 2: Limitations of telemedicine and future directions to overcome the limitations.**

| Limitation of Telemedicine | Future Direction to Overcome the Limitation | Reference |
|---|---|---|
| Image quality and the availability of platforms limited the applicability of telemedicine. | Since the pandemic, the rise of various telemedicine platforms and technology increased availability of telemedicine consults. | (1, 14) |
| Many insurance companies refused to reimburse telemedicine consultations in lieu of in person-visits. | With expansion of state and national laws, payment models have adjusted to telemedicine consults. | (58) |
| Free flaps can be difficult to examine to ensure adequate healing as they have to be conducted very frequently. | Smartphone apps have been developed to aid in postoperative management of free flap surgeries to ensure taking of the flap. | (22) |
| Patient's requiring examination requiring an otoscope must travel to an otolaryngologist for evaluation. | Patients can utilize a smartphone-enabled otoscope to obtain images to send to their otologist and have a virtual consult. | (4, 32) |

| | | |
|---|---|---|
| Insurance companies are reducing compensation of telemedicine visits compared to in-person visits. | The increase in work efficiency has provided increased time between consults for academic or administrative purposes for otolaryngologists. | (43) |
| 25% of Americans do not have access to internet enabled devices to perform a telehealth visit. | Increased allocation of funding to reduce healthcare disparities by implementing telemedicine in socioeconomically disadvantaged communities will reduce strain on the healthcare system and prepare us for future pandemics. | (26, 59) |

The most significant limitation of our review is its risk of bias with many of the cited studies being published during the height of the pandemic. Many reported "good results" based in situations where no better option was available and, therefore, cannot be directly validated or compared to a "normal" setting. Without proper control groups or cohorts, is not possible to directly evaluate if these measures are (1) better or worse than direct consultations; or (2) if they should use them routinely.

In addition, our study is a narrative review and not a systematic review. Our goal for this paper was to conglomerate the large amount of information on this topic and give readers a resource to understand the strengths and pitfalls of telemedicine in otolaryngology. We are not concluding that telemedicine is equivalent to in-person visitation, but that it is a helpful tool that can help in critical circumstances such as a pandemic, and in normal settings to increase efficiency and outreach. Currently, telemedicine is not a replacement but rather a means to help mitigate the spread of infection and reduce unnecessary emergency room visits.

 doi:10.20944/preprints202204.0243.v1

## Conclusions

Telemedicine usage prior to the pandemic was limited, especially in surgical subspecialties including otolaryngology. However, since the necessity for physical distancing, otolaryngologists have successfully adapted their practices and examinations to a virtual setting. In situations of emergent care, proper resource allocation and safety management have facilitated care. For necessary and timely office visits, otolaryngologists have adapted techniques to mitigate the spread of SARS-CoV-2.

The general benefits of telemedicine include reducing transportation costs for patients and providers, saving both parties time and thereby increasing efficiency, and reducing unnecessary referrals to specialists. In the context of the pandemic, telemedicine allowed for a reduction in personal protective equipment (PPE) usage, allowing greater allocation to emergent cases(7, 49). Telemedicine holds great potential in ENT, especially in providing care to underserved, rural, and remote communities that have sparse access to specialist care.

As this was one of the first large scale pandemics in the modern era since the rise of technology, we have been able to learn how to adapt our medical practice to the virtual setting. We have been able to critically examine our in-person practice and have learned ways to mitigate the spread of the virus. This review suggests that telemedicine may provide the adequate level of care in some cases and can be advantageous to increase outreach. However, further research is warranted before telemedicine becomes a routine technique in the field of otolaryngology to be beneficial for the patients.

 doi:10.20944/preprints202204.0243.v1

**Acknowledgements**

We are grateful to Dr. Valerie Gramling for the critical reading of the manuscript.

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