Pilot Concordance Study to Evaluate the Accuracy of Teledentistry Compared to Direct Clinical Assessment for Diagnosis of Non-Emergent Soft Tissue Oral Pathologic Conditions in the Oral Medicine Graduate Clinic at the University of Alberta

by

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Abstract

Background: Teledentistry uses telecommunication and information technologies to provide dental care remotely. This can include real-time consultations with a dentist or dental specialist and transmitting diagnostic information such as x-rays and images to other health care providers for consultation. Teledentistry has been used in various forms for several decades but has seen increased adoption recently due to technological advancements and the need for remote healthcare options. It is beneficial in rural areas where access to dental care can be limited and can help reduce costs and improve patient outcomes. It has been proposed that teledentistry can be used for various oral medicine needs such as diagnosis and treatment planning, patient education and monitoring, and follow-up care. Despite having existed since the 1990s, teledentistry was rapidly and widely adopted during the COVID-19 pandemic.

Objectives: This study aims to determine the accuracy and reliability of teledentistry for diagnosing non-emergent oral soft tissue lesions using conventional examination as a gold standard.

Methods: Patients referred to the Oral Medicine Graduate Clinic at the University of Alberta and who have access to electronic devices, such as a computer, laptop, or tablet, were given the option to be entered into the study. Those who met the inclusion criteria and consented to participate in the study were contacted by a treatment coordinator who further discussed the next steps of both visits (virtual and in-person visits).

Results: We examined 48 participants in our study, and our study's results revealed a high degree of concordance between the virtual and in-person diagnoses of oral lesions made by the student. There was an almost perfect agreement when the instructors provided a diagnosis. During virtual and in-person patient visits, there was substantial agreement between the student and instructor regarding the diagnosis. There was evidence of homogeneity variances among

intra- and inter-observer variability. This further supports the use of teledentistry to diagnose non-emergent soft tissue oral pathologic conditions. The results of the inter-method reliability between two students' ratings (virtual vs clinical) were 0.951 - statistically significant. While the inter-method reliability results between two different instructors' ratings (virtual vs clinical) were also 0.951 - statistically significant. On the other hand, the results of the inter-method reliability between the student and Instructor A ratings (virtual only) were 0.731 - substantial agreement, and the results of the inter-method reliability between the student and Instructor B ratings (clinical only) was 0.707 - statistically substantially significant. Patients were satisfied with both virtual and conventional examinations.

Conclusions: According to the findings, teledentistry is potentially an accurate method for diagnosing non-emergent soft tissue oral pathologic conditions. It also provides graduate oral medicine students with adequate learning opportunities. In addition, patients were satisfied with both virtual and conventional examinations. The results obtained have been encouraging. However, additional prospective multicenter trials with many participants must confirm our findings.

Preface

This thesis is an original work of Ahammad Kandari. The research project of which this thesis is a part received research ethics approval from the University of Alberta Research Ethics Board under the project named: “Human Study: Pilot concordance study to evaluate the accuracy of teledentistry compared to direct clinical assessment for diagnosis of non-emergent soft tissue oral pathologic conditions in the Oral Medicine Graduate Clinic”, No. Pro00103655, February 2021.

Dedication

To my late father, who showed me the power of life mastery; to my late mother, whose prayers always surrounded me until I became what I am now; to my late sister Fatima who taught me the value of hard work.

To my beloved supportive brother, my beautiful sisters and my friends who were always with me through the journey of struggles and the moments of success.

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1 Chapter One: Introduction and Literature Review

This chapter will discuss the introduction and definition of teledentistry, the methods of teleconsultation, and the role of teledentistry in various dental specialties, the impact of COVID-19 on dental education, the significance of teledentistry by conducting a literature review that explains its definition, history, methods of delivery, requirements, how it works, applications in various fields of dentistry, as well as its advantages and disadvantages, will be further discussed. It will end with the problem statement and thesis objectives.

1.1 Teledentistry

1.1.1 Definition

A continually evolving science, telemedicine or telehealth, which refers to "healing at a distance," has been around for over 100 years and dates to the early 20th century[1]. The World Health Organization describes Telemedicine as "the delivery of health care services, where distance is a critical factor, by all health care professionals using information and communication technologies for the exchange of valid information for the diagnosis, treatment, and prevention of disease and injuries, research and evaluation, and for the continuing education of health care providers, all in the interests of advancing the health of individuals and their communities"[2]. Subsequently, synonymous terms such as teledermatology, teledentistry, etc., have been used, which refer to the same concept of using information technology for interactions between physically separated patients and healthcare providers in specific medical specialties[3].

One of the most significant challenges of the 21st century is to provide high-quality healthcare to all people[4]. However, with the increase in the world population and disparity in socioeconomic backgrounds, it is nearly impossible to accomplish this vision[5]. Furthermore, access to healthcare can only be achieved if the provider and recipient are present at the same

place and time[5]. With the advances in information and communication technologies, medicine and dentistry have seen significant improvement in the delivery of healthcare[6]. The exponential growth of the internet and its use has also transformed the way medicine and dentistry are practiced[7]. Telemedicine refers to the use of information and communication technologies in healthcare to diagnose, plan treatment, prevent diseases, and conduct research activities in difficult-to-reach communities[8]–[10]. Similarly, teledentistry has been developed in dentistry, which involves the use of communication technologies to provide clinical care, oral screening, and health information, and promote education in difficult-to-reach communities[8]–[10]. Initially, teledentistry involved exchanging data through telephone lines, fax machines, and the exchange of computer-based documents. However, the deployment of the internet and high-speed broadband connections have become the cornerstones of modern teledentistry[11]. The term "Teledentistry" was used in 1997 by Cook, who defined it as "the practice of using videoconferencing technologies to diagnose and to provide advice about the treatment over a distance"[12].

1.1.2 Origin and History of Teledentistry

Teledentistry, a subset of telemedicine, is a recently introduced technological innovation in dentistry. It includes combining telecommunications about dentistry to exchange clinical information and digital images to diagnose and provide clinical care over a distance[13].Teledentistry has evolved over the years. In early 1959, Alberta Jutra used the communication cable to communicate videotaped telefluoroscopy examinations between two hospitals in Montreal[14],[15].In the 1960s, dental continuing courses were first distributed via video telecommunications via satellite transmissions[9]. The concept of teledentistry was first introduced at the 1989 conference as a part of the discussion on the topic "how to apply dental informatics in dental practice." Later, in 1989, a conference funded by the Westinghouse Electronic Systems Group in Baltimore drafted the blueprint of dental informatics, introducing

the initial concept of teledentistry[16]. In 1994, teledentistry was taken up as a project by the U.S. Army to help the troops and their dependents worldwide improve their oral health and awareness about oral health through continuing dental education programs[11],[17]. Later, in 1997, the term teledentistry was first used. This term originated after the U.S. Army, through its Total Dental Access (TDA) project in 1994, made the effective and early use of teledentistry to serve the army personnel and their dependents[18]. This project reduced treatment costs and delivery of oral care even to remote areas. During that time, the U.S. Army used a traditional Plain Old Telephone System (POTS) with two communication methods— Real-time and store-and-forward[19]. Since POTS went through the telephone company with low-speed and interrupted connections, it severely delayed the video and audio signals. This impacted the quality of the communication[19]. Later, in 1995, a pilot study was conducted by Haiti, connecting a general dentist to a dental specialist in Washington, DC, through a satellite system[19]. However, the video quality of the teleconsultation was inadequate to diagnose several pathological conditions. After two years, Germany, Belgium, and Italy tested Integrated Services Digital Network (ISDN)– based teledentistry. ISDN offers higher speed and allows information to travel in both directions simultaneously. But the high cost involved in setting up an ISDN network has made it more suitable for city and suburban clinics[20]. Meanwhile, countries such as Scotland, Japan, England, and Taiwan have also conducted studies on ISDN-based teledentistry[20],[21]. Slowly, teledentistry is expanding worldwide and has evolved even in developing countries. The next generation of web-based teledentistry practice uses an amalgamation of the World Wide Web for videoconferencing and POTS for sharing patient records. This web-based teledentistry is cost-effective as it doesn't require a unique network like ISDN. However, web-based networks may pose a threat to privacy and security, unlike the ISDN network, which is connected from one point to another without network sharing[11],[13]. Later, in 2004, The University of Minnesota collaborated with Hibbing Community College

and included teledentistry for consultations and referrals to facilitate healthcare services to the underserved population[22].

1.2 How Does Teledentistry Work

Data availability has played a significant role in the evolution of teledentistry, allowing dental professionals to provide better patient care and improve communication and collaboration among healthcare professionals[11],[23]. Special video conference equipment and video internet connection are established at both the hub and remote sites for a teledentistry visit. As soon as the patient checks in at the clinic at remote sites, they are asked to fill out questions online or on paper. These questions are related to the chief complaint, medical history, and dental history. The dentist, hygienist, or dental assistant at a remote dental site performs the patient's essential examination and records hands-on examination. All the dental records, documents, questionnaires, imaging, etc., are transferred to the hub through the online electronic patient record system. The dentist or the specialist on the other end receives the information and reviews it, and later starts with a live video consultation. The specialist interviews the patient, asks questions, discusses the diagnosis and treatment plan, and educates the patient about routine oral hygiene maintenance. In some situations, the dentist or the specialist may ask the patient to open their mouth for an assessment over the virtual consultation or just review the records and imaging over the teleconsultation. In most teleconsultations, the patient feels that the dentist is standing next to them[23].

Teledentistry is also used to improve dental education and access to quality dental care, even in areas where access to a specialist is limited[23]. For instance, the Teledentistry project developed by the Children’s Hospital Los Angeles, in association with the University of Southern California’s mobile dental clinic, provides quality care to children living in rural areas of California who have no access to specialists[24]. Another study on teledentistry was conducted in two general dental practices in remote areas of Scotland. These two dental

practices were connected to a restorative specialist at a central hospital with the help of a personal computer (P.C.)-based videoconferencing link connected by an Integrated Services Digital Network (ISDN). Twenty-five patients were selected for the trial for 12 months. In this study, the cost of teledentistry with two different consultation methods was compared. The other two different consultation methods include either specialist visits to remote communities or patient travel to hospitals from remote areas. The study concluded that teledentistry is a cost-effective method compared to other methods[21]–[23].

1.3 Methods of Teleconsultation

Teleconsultation can be conducted mainly in the following ways — "Real-time consultation" and "Store and forward." Real-time consultation involves direct online communication between a dentist or a dental specialist and a patient in a different location. Meanwhile, in the "store and forward" method, the dentist gathers clinical information through clinical records, images, x-rays, lab test reports, or videos later shared with other dentists or specialists to gather opinions. In this modality, the patient isn't involved during such information interchange[23]. Teledentistry aids in the management of patient records, diagnosis of diseases, and evidence-based clinical decision-making. It offers oral healthcare services to underserved patients residing in remote locations, ensuring equity in oral healthcare delivery. This advanced technology allows the seamless transfer of clinical records, images, and documents and greater accessibility to dental practitioners and specialists[25],[26]. Overall, teledentistry helps prioritize high-risk populations and allows easy referral of patients to a specialist[26]. This reduces the hospital waiting list and saves patients' effort and travel time compared to conventional appointments[27]. In addition, teledentistry also serves as an alternative to traditional learning methods, benefitting dental students and faculty[11]. A study reported that teleconsultations in a Swiss telemedical center were helpful in cases related to dental trauma and provided

additional support in the absence of a dental specialist[28]. Another study found that teledentistry facilitated rural Australians with cost-effective dental specialist consultations[29].

1.4 Methods of Delivering Teledentistry

Teledentistry utilizes telecommunication technology, electronic health records, digital imaging, and the Internet to arrange teleconsultation with specialists, supervise hygienists in remote areas, and provide long-distance clinical training and continuing dental education. Teleconsultation through teledentistry is conducted mainly in the following ways— Real-time consultation, Store-and-Forward method, Near-Real-Time consultation, and Remote Monitoring Method[30].

- **Real-time consultation**: Real-time consultation is also known as synchronous consultation. This type includes audio-visual tools for the users to see and interact with each other[30]. For instance, it involves videoconference wherein dental professionals and patients from different locations can visualize and communicate with each other[31]. It can also be used for application sharing, where software can be run and controlled by two different users[23]. Real-time consultation also allows detailed discussion by personal contact or clarification of queries as they arise. However, faster internet connections and expensive and sophisticated equipment are prerequisites for real-time consultations[9].
- **Store and forward method**: The store and forward method is known as asynchronous or a pre-recorded consultation. It involves collecting all the required information (clinical information, photos, and x-rays) by a dentist that is stored in a file and shared with a consultant via email or any other means[32]. Later, the consultant retrieves and analyzes the file's contents. Based on the information received, necessary diagnosis and treatment planning are shared back with the dentist in the same manner[23],[32],[33]. This

type is less expensive and more acceptable as it does not require fixing a feasible time for real-time contact[9].

- **Near-Real-Time consultation**: It is a variant of real-time consultation. In this type, data sent ranges from low-resolution, low-frame-rate images that look like jittery television [28,35,36]. This mode is mainly used in regions where network connection is poor, communication costs are high, or in situations where real-time communication with a specialist is important, but the quality of data is not so critical. Through this mode, a dentist can share patient information, radiographs, lab test results, remarks, graphical representations of hard tissues, and other information through multiple platforms [35,36].
- **Remote monitoring method**: Remote monitoring method includes the monitoring of patients remotely. The patient may be located in a hospital or at home [35,36].

1.5 Requirements for a Teledentistry Set-Up

Besides the presence of essential clinical staff and relevant coordinators at the dental facility, equipment required for teledentistry can be divided into two types[34]:

1. Hardware equipment
2. Software applications

1. **Hardware equipment**: Hardware equipment includes intraoral cameras, extra-oral digital cameras, video cameras, digital radiographic equipment (X-ray, RVG, CBCT, MRI, etc.), computer set-ups, fax, scanner, and Integrated Services for Digital Networks, Internet or Intranet system to transfer the information.
2. **Software applications**: Several computerized systems mainly rely on telemedical methods such as the OralCDX system for imaging and analysis of oral lesions, CAD/CAM, Decision support systems and dental practice management, standalone I.P. (Internet Protocol)/ ISDN videoconferencing solution or install a PCI (Peripheral

Component Interconnect) codec board for videoconferencing. With the introduction of smartphones, several apps such as Practo, Poc clinic-health enablr, Modasta health, and websites such as Denteractive, DentalEMR, and Mouthwatch are available. These apps and websites can be used on smartphones and tablets by patients to connect with their dentists and by the clinician to manage their practice better[35].

1.6 Applications of Teledentistry in Various Fields of Dentistry

The use of teledentistry technologies has been documented in various branches of dentistry[24],[26],[36],[37]. For instance, in 2008, the use of teledentistry, specifically in implant dentistry, was evaluated to investigate the indications and prosthetic objectives. Smartphone technology in telemedicine for oral and maxillofacial surgeons was also used to assess the CT scans shared between the resident and attending physician or on-call surgeon. This study concluded that smartphones could be successfully used in teledentistry and aid in consultation, communication, and treatment planning[35],[36],[38]. Another study reported that teledentistry could be used as a tool by dental hygienists to provide oral healthcare to underserved populations[39]. The role of teledentistry in diagnosing early childhood caries was investigated. It was concluded that teledentistry could be an efficient means of screening schoolchildren with early childhood caries[40]. Teledentistry was also an effective tool for easy referral in orthodontics cases[41],[42]. Meanwhile, in the field of endodontics, studies highlighted the role of teledentistry in diagnosing periapical lesions and the easy transfer of intraoral images and radiographs for expert opinion[43]. As noted, several attempts to use teledentistry have been reported with apparent success[43].

1.6.1 Teledentistry in Orthodontics

In Orthodontics, teledentistry can be used to share the details of the 3D scans of the jaw with peers or specialists. Teleconsultants may help in the treatment planning using the digital models of the patient. They also assist in applying preventive and interceptive orthodontic practices in

remote areas where there are no specialists. Berndt *et al*. analyzed the feasibility of a general dentist in providing interceptive orthodontic services under the supervision of an orthodontist to underprivileged children[44],[45]. In this study, 30 pre-treatment and post-treatment orthodontic study models of children treated by a dentist with the help of teledentistry were compared with 96 children treated by orthodontic residents under the direct supervision of orthodontic faculty. These groups were scored with the peer assessment rating index. The authors found no significant difference between the groups, which signified that teledentistry could be used as a viable approach to reducing the severity of malocclusions in underprivileged children when referral to an orthodontist was not feasible. Stephans *et al*., in their review on orthodontic referrals, concluded that teledentistry enabled dentists to offer better services in remote areas[45]. Another author, Mandall *et al*., evaluated the general dental practitioner's opinion about a teledentistry system to screen new patient orthodontic referrals[46]. The study results concluded that ~71% of the general dental practitioners considered the use of teledentistry as a good option for orthodontic referrals[46].

1.6.2 Teledentistry in Endodontics

The use of teledentistry in Endodontics is an ideal solution for seeking timely expert help in diagnosing and suggesting a treatment plan. In this regard, several studies have proven the application of teledentistry in conservative dentistry and endodontics. For instance, Brullman *et al*., in their study on the remote recognition of root canal orifices, tested 50 images of endodontically accessed teeth that were acquired with an intraoral camera[47]. These images were saved on the laptop and presented to 20 observers who marked orifices of the visible canal using software that stored the canal locations in standard files. These locations were later verified with histological analysis. In 87% of cases, canal orifices were correctly identified. This indicated that remote recognition of root canals by experienced dentists could help inexperienced colleagues detect root canal orifices. Another study by Baker *et al*. compared

the interpretation of conventional radiographs transferred by a video teleconferencing system to conventional view box interpretation for both in vivo and periapical bone lesions. Results of the study showed no significant difference between the ability of the evaluator to identify periapical bone lesions using a video teleconferencing system or a conventional view box[48].

1.6.3 Teledentistry in Pediatric and Preventive Dentistry

Teledentistry in Pediatric dentistry can help in the early detection of caries and the diagnosis of other pediatric problems. In this regard, Kedzierawski and Billings assessed the prevalence of dental caries and dental care utilization in preschool children[39]. During the study, potential children were randomized into two groups- one that received a traditional visual/tactile oral examination for caries detection, and another received a teledentistry examination. The authors concluded that teledentistry was as good as visual/tactile examination of dental caries screening in children. Another study by Kedzierawski *et al*. evaluated caries prevalence using teledentistry in children between 12-60 months of age in childcare centers. Telehealth assistants collected the images of the primary dentition using an intraoral camera. These images were stored in web-based storage and were sent to a qualified pediatric dentist. The study showed that teledentistry offered potential means of screening high-risk preschool children for the signs of early childhood caries[49].

1.6.4 Teledentistry in Prosthodontics

In Prosthodontics, teledentistry aids in the teleconsultation with the specialist for model analysis, projection of the shape of the restoration, of its height, and inter-jaw relationships using virtual articulators. These files are usually shared via email[12]. Along similar lines, Ignatius *et al*. conducted a study investigating videoconferencing for the diagnosis and treatment planning for patients who require full mouth rehabilitation. The results of the study concluded that video consultation in dentistry aids in facilitating specialist services in sparsely populated regions of Finland[50].

1.6.5 Teledentistry in Oral and Maxillofacial Surgery

Teledentistry in Oral and Maxillofacial surgery helps establish an appropriate diagnosis of oral lesions and tumors and establish a treatment plan for third molar extraction, minor surgical procedures, and other conservative treatment[12],[51]. Duka *et al*. conducted a study investigating the practical usability of teledentistry in managing oral surgery patients in establishing surgical treatment of third molars[52]. The authors concluded that teleconsultation in the diagnostic assessment of impacted or semi-impacted third molars was similar to the clinical diagnosis's real-time assessment. Authors Aziz and Ziccardi described the use of Smartphone telemedicine as an efficient and effective way for communication, diagnosis, and treatment planning[37]. Overall, teledentistry in oral surgery improved the efficiency of specialty consultation and triaging and enhanced quality care to the patients[30],[52].

1.6.6 Teledentistry in Oral Medicine, Oral Pathology and Oral Radiology

Several orofacial disorders, including oral cancers, temporomandibular disorders, oral mucosal diseases, salivary gland disorders, oral neurosensory disturbances, bruxism, burning mouth syndrome, malodor, and dental sleep medicine, require consultation with a specialist. Timely recognition and early intervention limit the spread of the disease and have a better prognosis. However, many dentists feel inadequately trained to identify and manage such conditions, increasing the need for consultation with adequately trained specialists. Teledentistry helps bring the specialists on board and allows rural dentists or hygienists to use the specialist's expertise to diagnose the disease and plan the treatment[12]. The knowledge of teledentistry in oral medicine and radio-diagnosis was applied by Bradley *et al*. in a community dental treatment in Northern Ireland[53]. In this study, dentists referred several patients with oral diseases from areas of Northern Ireland for specialists' services (the Regional Oral Medicine Consultant at the School of Dentistry, Belfast). The authors proved that teledentistry could be successfully used for consultations. Pereira *et al*. assessed the feasibility of remote diagnosis

of oral diseases by broadcasting images through emails[54],[55]. The study included images of 25 cases of oral lesions captured over a year at a primary care public health clinic in Parana in, Brazil. The authors concluded that emails are helpful in clinics in remote areas where there are no oral medicine specialists. Summerfelt *et al*. described the oral health workforce model on teledentistry that provided training to the midlevel practitioner to work for the underserved communities in the U.S[38]. In response to this, the Northern Arizona University Dental Hygiene Department developed a teledentistry-assisted practice that considered dental hygienist in the role of the mid-level practitioner. The authors concluded that these mid-level practitioners could provide comprehensive preventive oral health care and diagnostic services to people of the underserved population in both urban and rural areas. These practitioners are digitally linked as members of an oral health team with the help of teledentistry methodology. In another study, Torres-Pereira *et al*. captured pictures of oral lesions using a professional digital camera and sent images attached as emails to two distant consultants. According to this study, in 80% of cases, at least one of the consultants provided the correct diagnosis[54].

The discipline of Oral Medicine and Oral Pathology in dentistry relates to diagnosing and managing oral lesions. The direct visualization of these oral lesions is the first step toward the diagnosis. However, the limited availability of Oral Medicine specialists globally delays the specialized attention required, affecting the prognosis of oral disease. Hence, it would be worth exploring how teledentistry can be considered to triage referrals, facilitate early diagnosis, and contribute to the management of oral lesions[25].

In this regard, the possibility of distant diagnosis in oral medicine was previously investigated. It was reported that remote diagnosis using digital images via email is an effective alternative in diagnosing some oral lesions[53]. In another study, the authors used a prototype teledentistry system and found that teledentistry may be considered an alternative approach to managing referral cases in oral medicine[56]. Patient and clinicians' acceptability in recording and

transmitting clinical images of some common oral lesions has been assessed. It was concluded that the patient and clinician had good acceptability of recording and transmitting clinical images of common oral lesions and hence aimed to develop this methodology further[55]. In another study, oral lesions were captured using a professional digital camera, and the images were sent as attachments in emails to two distant consultants. At least one of the distant consultants provided the correct diagnosis to 80% of the cases evaluate[25]. This led to the conclusion that the use of oral lesions pictures sent via email could have an acceptable diagnostic accuracy rate.

Overall, teledentistry seems to be an effective tool for early diagnosis and timely intervention of oral lesions, including malignant cancers[25]. It also seems to improve oral health in remote areas where dental specialists are unavailable. Teledentistry is a method of diagnosing oral soft tissue lesions that have not been investigated in all scopes, such as live-platform examination, to reach a tentative diagnosis[57].

1.7 Impact of COVID-19 on Dental Education

The COVID-19 pandemic has significantly affected dental education, particularly clinical education. As a result of the provincial and governmental recommendations to address the initial stage of the COVID-19 pandemic, in-person learning in dental schools across North America was abruptly suspended for a few months. While virtual platforms were implemented to deliver didactic courses successfully, courses requiring hands-on learning and clinical education were negatively impacted. Teledentistry consultations were infrequently used to triage emergencies, and routine and elective appointments for patients were canceled. This led to significant disruption of clinical education as dental students could not follow up with their existing patients and could not acquire the experiences required for achieving competency[58],[59]. With the uncertainty of the future trajectory of the pandemic, reliable

alternative learning tools would need to be identified so that clinical education can continue seamlessly[11],[59].

Although several studies have reported data in clinical oral medicine and pathology setting, none have discussed the role of teledentistry in the oral medicine educational environment[60], [61]. There is an agreement that non-conventional, remote diagnosis may be a valuable substitute for diagnosing oral lesions[62]. Teledentistry is a viable resource with high acceptance amongst patients and dentists, but limited information is available on the acceptance by a dental graduate student[62],[63].

1.8 Role of Teledentistry in Dental Education

The advent of the COVID-19 pandemic has affected dental education significantly, resulting in the suspension of in-person learning in dental schools for a few months[64]. Since then, courses requiring hands-on training and clinical education have been disrupted, affecting dental students' clinical knowledge and experience to acquire competency. To resolve this, several alternative learning approaches would need to be identified. Among all possible strategies, the application of teledentistry to help oral medicine graduate students gain clinical experience must be validated and compared with the traditional in-person examination, which is considered the gold standard for assessment. During the pandemic, teledentistry in Oral Medicine programs has emerged as crucial tool or managing oral health. COVID-19 has affected teledentistry and oral medicine programs in the following ways:

COVID-19 has increased the demand for teledentistry services, as people have been reluctant to visit dental clinics out of fear of infection. Teledentistry has allowed patients to receive dental care from the security and convenience of their homes. A study published in the Journal of Telemedicine and Telecare in 2020 found that teledentistry and synchronous video consultations increased significantly during the pandemic[64]. COVID-19 has also contributed to the expansion of Oral Medicine programs, as dentists have been called upon to diagnose and

treat oral symptoms of the virus, such as oral ulcers and lesions. Oral Medicine clinics played a crucial role in managing oral manifestations of COVID-19, according to a 2021 study published in Oral Diseases[64],[65]. The pandemic has also led to the adoption of new technologies in teledentistry, such as intraoral cameras and 3D scanning devices. These technologies have enhanced the quality of teledentistry consultations and enabled dentists to diagnose and treat oral conditions remotely[65]. Teledentistry could also help deliver clinical training and continuing education over long distances. Videoconferencing and internet technologies enable two-way communication between the instructor and the trainees. This results in low-cost, affordable, and real-time interactive sessions[11]. Teledentistry can also be used to train dentists and dental students to conduct clinical examinations. Moreover, using this technology, dental assistants and other supporting staff can also be trained to schedule patients' appointments and manage billing and insurance-related issues[11]. Teledentistry facilitates faculty and dental students at different universities to collaborate in research and exchange their views or experiences on given topics. This technology also helps to provide hands-on training to the dentist, dental students, and other supporting staff at remote sites to review patients' medical and dental history, perform disease-specific clinical examinations, and diagnose and manage the disease in the orofacial region. If required, specialists can be consulted for their opinion[23].

Despite the benefits and wide range of applications in dentistry, the adoption of Teledentistry in routine oral healthcare and dental education has been low[2]. This could be due to several factors, such as variation in the licensure requirements from state to state, technical errors that result in misdiagnosis, privacy issues, and the risk of losing data during transmission. Besides, the need for updated course material, lack of uniform charting and diagnostic codes, an experienced instructor who is comfortable with online communication, and the accurate type of network connection during sessions further hinder its use in dental education[11]. The

ongoing COVID-19 pandemic has made it necessary for healthcare providers to effectively manage patient concerns using these technologies primarily because of "social distancing" and limited access to care[58].

1.9 Teledentistry in Canada

Teledentistry is gaining popularity in Canada to improve access to oral health care services, especially in remote and underserved areas, for consultation and diagnosis when oral health is at risk[66]. Teledentistry is also used to provide remote consultations with specialists, especially in areas where there are few or no dentists. Teledentistry is used in Canada to provide dental professionals with continuing education opportunities, especially in remote and underserved areas where access to in-person education may be limited[59],[66]. Teledentistry is being utilized in research projects to examine the efficacy of remote diagnosis and treatment for oral health conditions and investigate methods for enhancing access to oral health care services in underserved areas[22],[66].

1.10 Teledentistry Dental Codes

Depending on the circumstances and the specific insurance plan, teledentistry can be billed to either the patient or the insurance company. Here are some examples of billing for teledentistry: Direct payment by the patient, reimbursement by insurance, or copayments and deductibles. Notably, teledentistry billing practices are still evolving, and dental providers and insurance companies may have varying policies and requirements. Dentists should check with their state's dental board and insurance companies to ensure compliance with all applicable regulations and guidelines[67],[68].

Dentists and dental insurance companies use dental codes to bill for services rendered during teledentistry consultations. The American Dental Association (ADA) has developed several teledentistry codes that are recognized by the majority of U.S. insurance companies[67],[69].

The following are some of the most frequently used dental codes for teledentistry:

- D9995: This code is used for synchronous (real-time) teledentistry consultations, in which the patient and dentist communicate using videoconferencing technology in real-time.
- D9996: This code is used for asynchronous (store-and-forward) teledentistry consultations in which the patient sends information (such as images or video) to the dentist, who later reviews it.
- D0140: This code is used for a limited oral evaluation that can be performed via teledentistry.
- D0170: This code is used for a reevaluation of a patient's oral health status after a teledentistry consultation.

It is important to note that the application of teledentistry codes may vary based on the specific services rendered and the insurance company's requirements. Dentists and dental insurance companies should check with their state's dental board and insurance commissioner to ensure they are using the correct codes and adhering to all applicable regulations. It is important to note that CDT code D9430 should not be billed for conversations with office staff regarding appointment scheduling or modification[68]–[70].

1.11 Benefits of Teledentistry

Some of the benefits of teledentistry are[27],[35]:

- Teledentistry benefits oral health care by facilitating early diagnosis and timely treatment of oral diseases.
- Teledentistry facilitates the communication of remote site clinicians with peers and specialists at different locations. This reduces the isolation of the clinician and improves access to care.

- It facilitates access to quality oral care in areas with a lack of oral healthcare providers due to challenging geographical locations and limited resources.
- It enables rural communities to seek help from specialists in urban areas, which they could not achieve due to a lack of proper clinical settings or finances.
- It is affordable and saves patients' traveling time and expenses since they don’t have to travel to seek specialists’ opinions in urban areas.
- It aids in allowing accessible communication with the insurance industry.
- It is helpful in emergency and critical conditions where it may not be feasible to shift the patient immediately to a well-equipped facility.
- It can help provide health care to people, especially the elderly with home-bound chronic illnesses.
- It plays an essential role in facilitating healthcare facilities for the victims of natural disasters such as earthquakes, tornados, tsunamis, or man-made disasters such as wars and riots.

1.12 Shortcomings of Teledentistry

The teledentistry area is expanding rapidly and makes it possible to provide dental care at a distance through the utilization of various technologies. Although it has many advantages, it also has a lot of rather substantial drawbacks. The difficulty of carrying out specific operations, such as physical examinations and specific diagnostic tests, remotely is one of the primary obstacles that must be overcome. In addition, there may be restrictions on the quality of the photographs and information that may be conveyed, and patients may feel more comfortable receiving treatment if they have the opportunity to contact personally with a dentist. The cost involved in arranging telemedicine setup and equipment is high. It requires a proper internet connection, a backup communication system, and a technical support group. Furthermore, legal and regulatory hurdles will limit the range of practice that teledentistry providers can engage

in, as well as the financial reimbursement for telehealth services is not facilitated by much healthcare/insurance plans. Finally, the presence of any technical glitch during data transmission may lead to misdiagnosis. As the industry continues to develop and advance, finding solutions to these deficiencies will be necessary[10],[35].

1.13 Statement of the Problem

With uncertainties stemming from the pandemic and other factors that may further impact the dental schools and conventional delivery of clinical education, an important goal is to identify alternative tools that can help provide Oral Medicine graduate students with the clinical experience and, in turn, improve oral health in the general population, using all possible strategies, including teledentistry. To be successfully used, this application must be validated to assess clinical oral pathologic conditions and compared with traditional/conventional in-person oral examinations that are deemed the gold standard for screening[71],[72].

In terms of the previous studies conducted on the same topic, many studies relied on sharing previously taken pictures of the patient's mouth, whether via phone or dentist's camera, followed by sharing them with a specialist to reach a proper diagnosis[59],[71],[72]. However, attempts have yet to be made to obtain a diagnosis using a virtual, live, and 3D teledentistry platform. Therefore, our objective is to compare the accuracy of teledentistry to the gold standard clinical examination to determine the dependability of using this method to evaluate the non-emergent soft oral tissue pathology lesions referred to the oral medicine graduate clinic at University of Alberta, which will be determined in the upcoming chapters.

1.14 Objectives

The objectives of this study are:

1. This study aims to determine the accuracy and reliability of teledentistry as part of the process for diagnosing non-emergent oral soft tissue lesions as compared to conventional direct clinical examinations.

2. Determine if teledentistry could be utilized for Oral Medicine graduate dental education.

2 Chapter Two: Materials and Methods

The methods include the study population and specific clinical criteria (inclusion and exclusion criteria), specific procedures, sample size, methodology in detail, clinical evaluation, and efficacy endpoints. In addition, the classification of pathologic conditions, their codification, the determination of data analysis methods, and the statistical tests utilized will be discussed.

2.1 Ethics Approval

This research project is part of a thesis which received research ethics approval from the University of Alberta Research Ethics Board under the project named: “Human Study: Pilot concordance study to evaluate the accuracy of teledentistry compared to direct clinical assessment for diagnosis of non-emergent soft tissue oral pathologic conditions in the Oral Medicine Graduate Clinic”, No. Pro00103655, February 2021 (Appendix A).

2.2 Study Design and Setting

This pilot study was conducted in the Oral Medicine Graduate Clinic at the University of Alberta's Faculty of Dentistry in Canada. The study population consisted of individuals referred to the Oral Medicine Clinic. The Oral Medicine treatment coordinator contacted 48 participants (fit for the inclusion criteria); they were offered the chance to participate in the study and asked to sign the consent to participate (Appendix B & Appendix C). A virtual appointment using a secure FoMD-approved telehealth platform was scheduled with the participant, the instructor, and the Oral Medicine graduate student. Details of appointments were provided to all participants in advance.

The participants were provided with a written and pictorial document that guided self-manipulating their oral mucosa to conform to the virtual visits (Appendix D).

The oral medicine graduate student and the instructor conducted a standardized interview and examination of the patient during the virtual appointment. The oral medicine graduate student and the instructor independently established a clinical/working diagnosis at the end of the virtual visit. Both examiners (student and instructor) were unable to exchange and discuss their diagnoses with one another or provide their opinion to the patient.

Following the virtual examination, the participants were scheduled for an in-person appointment within three weeks after the virtual examination. Scheduling the two visits three weeks apart eliminated the possible progression of the oral mucosal condition. The participants were examined again in person by a team of oral medicine graduate student (same student) and a different instructor. The participants signed the general consent provided by the School of Dentistry (Appendix E) and filled out the medical history form (Appendix F). Before performing the in-person examination, these steps are mandated by the School of Dentistry for all patients, not only those enrolled in our study.

A clinical/working diagnosis was established according to the same criteria used during the virtual examination. A clinical photograph of the affected mucosa was retaken. The diagnoses were compared to those established via virtual appointments. All the diagnoses provided by the examiners (instructors and graduate student) were separately maintained in all settings (virtual and in-person). The oral medicine graduate student and instructors retained separate Google sheets for each de-identified case to prevent sharing of diagnoses. After the study was completed, these Google Sheets were shared with the oral medicine graduate student for data analysis. These Google Sheets contain the date the patient was examined virtually and clinically, the unique chart number provided by the School of Dentistry for each patient, and the diagnosis from each examiner (Student and Instructor A/B).

The oral medicine graduate student's ability to evaluate and diagnose the oral condition was assessed based on the diagnoses made during the two examinations. Keeping the same oral medicine graduate student and changing the principal investigator (instructor) team removed the possibility of interobserver variability and replicated the clinical learning environment. Increased variability in inter-observer agreements as compared to intra-observer agreements has been frequently reported in the literature[72],[73].

2.3 Study Participants

The study population comprised patients referred to the Oral Medicine Graduate clinic between 2020 and 2022, who had access to electronic devices, such as a computer, laptop, or tablet, and were given the option to be entered into the study.

2.3.1 Inclusion Criteria

To be enrolled in the study, participants must be:

- Aged 18 years or over.
- Referred for evaluation of a non-emergent oral mucosal soft tissue condition.
- Capable and willing to give informed consent for participation in the study.
- Had access and capability of using electronic devices such as a cell phone, computer, laptop, or tablet and internet access.
- Had a regular household-grade LED flashlight or a flashlight on the cellular phone.

2.3.2 Exclusion Criteria

The following exclusion criteria applied:

- Patients who were unable or unwilling to give consent.
- Any known significant systemic or oral disease or disorder that, in the treating clinician's opinion was a contraindication for participation in the study.

- Required a translator to facilitate the interview.

2.4 Sample Size Estimates

Participants that met the inclusion criteria were recruited for evaluation using teledentistry and a conventional in-person oral clinical examination. Assuming a power of 80%, an alpha of 0.05, and the use of Cohen's Kappa for measuring rater agreement with an expected Kappa of 0.4, a total of 48 participants were needed to be recruited for our pilot study.

2.5 Sampling and Recruitment

Patients referred to the Oral Medicine Graduate clinic (Oral Diagnosis/Pathology) at the University of Alberta were informed about this study. The patients were contacted by the clinic staff appointed in the Oral Medicine Graduate Clinic. These patients who were willing to participate and who met the inclusion criteria were given the option to participate in the study. If they consented (Appendix C), the study protocol was discussed in detail, focusing on compliance in keeping their appointments.

2.6 Study Protocol

2.6.1 Teledentistry Intervention

After signing consent (Appendix C) to participate in our study, participants were scheduled for a virtual appointment via a secure FoMD-approved telehealth platform, which in our case, was a Zoom-link live meeting. The participant, the instructor and the oral medicine graduate student were present during the meeting. All members activated their video cameras and unmuted themselves during the zoom-live assessment. Before the examination began, the instructor and student introduced themselves. The first step was to ascertain that the participant could see and hear clearly. Additionally, the instructor and student ensured that the patient consented to participate in the research before starting the examination. Details of appointments were provided to all patients in advance. The patients

were provided with a written and pictorial document that guided self-manipulating their oral mucosa to conform to the virtual visits (Appendix D). The oral medicine graduate student and the principal investigator conducted a standardized interview and examination of the patient during the virtual appointment. A clinical/working diagnosis was established at the end of the virtual visit by the oral medicine graduate student and the instructor without sharing their opinion with the patient. In addition, both examiners (the instructor and the student) made their virtual diagnoses separately and did not share or discuss their opinions regarding the participant's diagnoses. At that point, both examiners filled out a Google sheet with the diagnosis that they had made. A virtual photograph of the affected mucosa was taken. Up to 4 virtual participants' appointments were scheduled on the same day.

2.6.2 In-Person Evaluation

Within three weeks after the virtual examination, the patient was examined again in person by the same oral medicine graduate student but a different instructor from the study team. The participants needed to sign the general consent provided by the School of Dentistry (Appendix E) and fill out the medical history form (Appendix F) before performing the in-person examination. This step was mandated by the School of Dentistry for all patients, not only those enrolled in our study. A clinical/ working diagnosis was established according to the same criteria used during the virtual examination. A clinical photograph of the affected mucosa was retaken. In addition, both examiners (the instructor and the student) established their diagnoses separately and did not share or discuss their opinions regarding the participant's diagnoses with each other. After documenting their diagnosis separately and filling out their Google sheets, the oral medicine graduate student and the instructor discussed the case and shared their opinion with the patient.

2.7 Data Collection

2.7.1 Coding the Variables and Data Entry

- According to the latest available International Classification of Diseases and related health problems (Third edition, ICD-10) provided and used by the World Health Organization[74].
- ICD serves a broad range of uses globally and provides critical knowledge on the extent, causes, and consequences of human disease and death worldwide via data that is reported and coded with the ICD. Clinical terms coded with ICD are the main basis for health recording and statistics on disease in primary, secondary, and tertiary care, as well as on cause of death certificates. These data and statistics support payment systems, service planning, administration of quality and safety, and health services research. Diagnostic guidance linked to categories of ICD also standardizes data collection and enables large-scale research[74].
- Using the ICD codes for oral disorders, specifically benign non-urgent soft tissue pathologies, allowed us to categorize the virtual and clinical diagnoses. This assisted in measuring the degree of agreement between the two assessments[75].
- A sample of the codes used in this study is attached in the table below. The codes were taken from the ICD-10 website for specific oral pathologic conditions (Table 2-1).

2.7.2 Survey Instrument

The participants were asked to complete a satisfaction questionnaire sent electronically at the end of the first visit (virtual) and the conventional in-person visit (Appendix G1 and Appendix G2). The Oral Medicine graduate student completed an assessment and satisfaction questionnaire at the end of the first visit (virtual) and the conventional visit (Appendix H1 and Appendix H2). Endpoints assessed diagnostic accuracy by comparing the diagnosis at the end of the virtual and conventional clinical visits, and satisfaction

feedback between the appointments was analyzed. Both survey questions stated before (Appendix G and Appendix H) were derived from previously performed research with a similar telehealth focus[63],[76].

At the end of the study, the instructors shared their Google sheets with the student, who took the lead in assigning the ICD codes to the specific diagnosis in both examinations (virtual and in-person) to assess the intra-observer and inter-observer reliability using the specific testing tool.

Table 2-1

International Classification of Common Oral Pathologies in Third Edition ICD-10

ICD-10: Non-Emergent Soft Tissue Oral Pathologic conditions			
Diagnosis	Code	Diagnosis	Code
Amalgam tattoo	L81.8	Lymphoepithelial cyst	K09.9
Benign neoplasm of lip	D10.0	Lymphoid hyperplasia	R59.9
Benign neoplasm of tongue	D10.1	Lupus	L93.2
Benign neoplasm of parotid	D11.0	Lipoma – oral	D17.79
Benign neoplasm of another major salivary	D11.7	Median rhomboid glossitis	K14.2
gland	D11.9	Melanotic macule	L81.8
Benign neoplasm of major salivary gland,	D10.2	Morsicatio	K13.21
unspecified	D10.30	Mucocele – oral	K11.6
Benign neoplasm floor of mouth	D10.39	Mucositis NOS	K12.2
Benign neoplasm, unspecified mouth	D10.4	Nicotine stomatitis	K13.24
Benign neoplasm, other parts of mouth	I77.9	Nonspecific ulcer	K12.39
Benign neoplasm of tonsil	B37.9	Papilloma	D10.0
Caliber persistent artery	K13.70	Pemphigoid	L12.1
Candidiasis	K14.1	Pemphigus	L10.0
Epulis fissuratum	L51.8	Peripheral giant cell	K13.79
Erythema migrans	M27.8	granuloma	K13.79
Erythema multiforme	K13.29	Peripheral ossifying fibroma	K13.4
Exostosis	K13.4	Pyogenic granuloma	K12.33
Focal epithelial hyperplasia (Heck's)	K13.4	Radiation changes	K11.6
Foreign body granuloma	K14.1	Ranula	K13.79
Foreign body reaction	K09.0	Retrocuspid papilla	K13.70
Geographic tongue	K14.0	Scar	K13.4
Gingival cyst	K14.3	Suture granuloma	I86.0
Glossitis	D18.09	Thrombosed varix	I77.9
Hairy tongue	D18.01	Tortuous labial artery	K13.70
Hemangioma oral	K13.21	Traumatic neuroma – mouth	K13.70
Hemangioma lip/skin	K13.79	Traumatic granuloma	K12.30
Hyperkeratosis	D48.5	Ulcer NOS	I99.8
Inflammatory papillary hyperplasia	L43.9	Vascular anomaly	B07.9
Keratoacanthoma	K13.21	Verruca vulgaris	K13.70
Lichen planus	L43.8	Verruciform xanthoma	K13.4
Lichenoid drug reaction	L43.2		

2.8 Data Analysis

After retrieving the data, grouping was done to conduct statistical analysis. For objective one, Cohen's kappa was calculated to determine consistency and accuracy of teledentistry between visits (virtual and in-person). All analyses were performed using SPSS 22 software.

For objective two, survey results were analyzed using descriptive analysis to determine differences between examination methods from the participants' and the oral medicine graduate student's points of view.

3 Chapter Three: Results

In this chapter, findings with supporting Tables and Figures are presented. In addition, the conducted statistical analysis is discussed to determine the p-value significance of the results. SPSS-22 software is used to assess the inter-rater and intra-rater reliability between two examiners in different settings (virtual and in-person examinations). Finally, the participants' voluntary surveys after the virtual and in-person visits are evaluated, as well as the student's responses for the same visits.

3.1 Coding the Variables and Statistical Tests

As we were aiming for Diagnosis of Non-Emergent Soft Tissue Oral Pathologic conditions in the Oral Medicine Graduate Clinic, specific codes describing these lesions were taken into consideration based on ICD-10 codes. After identifying the lesion in both virtual and clinical contexts, a unique ICD-10 code was assigned. To ascertain student and instructor agreement, a personal codifying approach was used, and the codes were assigned randomly. We assigned numbers from 1-10 based on our diagnoses. (Table 3-1)

Table 3-1

Demonstration of the Codes We Used from ICD-10 and Our Coding Approach

Diagnosis	ICD-10 code	Our code
Glossitis	K14.0	1
Hyperkeratosis	K13.21	2
Hairy tongue, Geographic, and fissured tongue	K14.3	3
Lichen planus/Lichenoid mucositis/immune-mediated	L43.9	4
Leukoplakia and other disturbances of oral epithelium including tongue	K13.2	5
Vascular anomaly	I99.8	6
Ulcer NOS	K12.30	7
Melanotic macule	L81.8	8
Papilloma/Fibrous hyperplasia/Lymphoepithelial cysts	D10.0	9
No pathology detected	0	0

The reliability results between raters (Student vs Student, Student vs Instructor A, Student vs Instructor B and Instructor A vs Instructor B in both virtual vs in-person). The number of the

participants in all of our examinations was 48. Inter-method agreements are reported in the following section (Table 3-2)

1. **Assessing student vs student (virtual vs clinical):**
    - The results of the inter-method reliability between two students' raters (virtual vs clinical) are Kappa = 0.951 with p <0.05. The level of agreement between the examiners was almost perfect.
2. **Assessing instructor vs instructor (virtual vs clinical):**
    - The results of the inter-method reliability between two different instructors' raters (virtual vs clinical) are Kappa = 0.951 with p <0.05. The level of agreement between the examiners was excellent.
3. **Assessing student vs instructor (virtual only):**
    - The results of the inter-method reliability between the student and Instructor A raters (virtual only) are Kappa = 0.731 with p <0.05. The level of agreement between the examiners was substantial.
4. **Assessing student vs instructor (clinical only):**
    - The results of the inter-method reliability between the student and Instructor A raters (clinical only) are Kappa = 0.707 with p <0.05. The level of agreement between the examiners was substantial.

Table 3-2

Assessing the Reliability in Different settings

Assessment	Inter method reliability	Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Student vs student (virtual vs clinical)	Measures of Kappa Agreement	0.951	0.34	16.236	.000
Instructor vs instructor (virtual vs clinical)		0.951	0.34	16.435	
Student vs instructor (virtual only)		0.731	.070	12.821	
Student vs instructor (clinical only)		0.707	.072	12.496	

3.2 Participants Demographics

Our treatment coordinator invited 48 participants who consented to participate in this study between February 2021 and April 2022. 65% of those 48 participants were men, while 35% percent were women. In addition, the largest proportion of participants was within the age range of 60 to 69 years old. On the other hand, those aged 70 to 79 had the lowest incidence. Most participants, 37%, opted to use their laptops, while only 13% used their tablets. (Figure 3.1 and Figure 3.2)

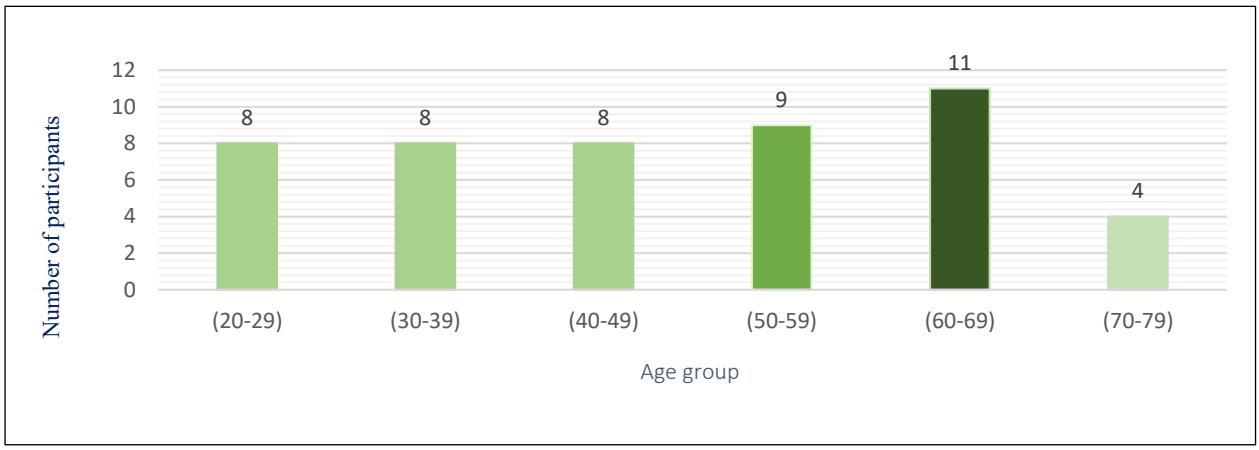

Figure 3-1: Number of participants based on the age group

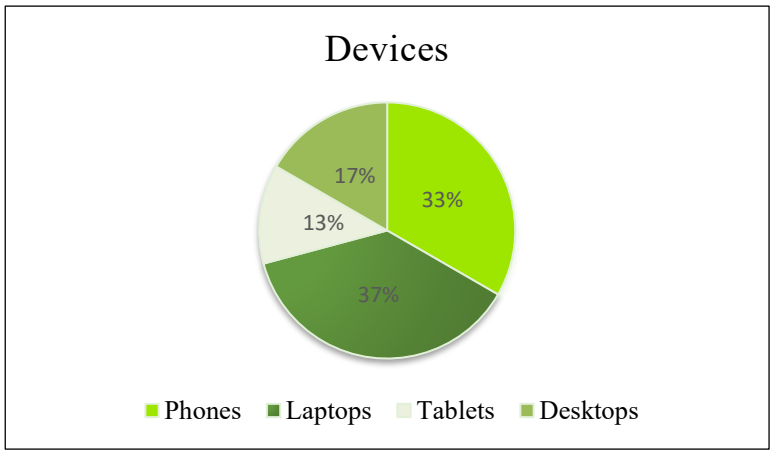

Figure 3-2: Percentage of participants based on the device used during the virtual examination

3.3 Participants Feedback Surveys

Following the virtual and in person examination visits, we chose to send our participants an optional survey to get their views. The participants' feedback surveys were sent out by our treatment coordinator, and both were voluntary. The anonymized results of the surveys were shared with the student after the participant's had completed the assessments.

3.3.1 Participants' Feedback Survey (Virtual Visit)

After the virtual visit, a feedback survey with several questions and answers to learn what the participants thought about various areas using a Likert scale. (Table 3-3). Considering that this survey is voluntary, the response rate to the survey was high - nearly 69%, with 45 surveys sent out and 31 participants responding. The statement, "I would use the virtual clinic again," was utilized as the primary inquiry to determine whether or not the participants will be comfortable using the virtual visits option during subsequent dental appointments. The majority of participants (around 55%) responded definitely agree to use the virtual visit option again, giving a total rating of 4.3 out of 5. The use of this alternative was agreed upon by all the participants.

3.3.2 Participants Feedback Survey (In-person Visit)

Following the in-person visit, a feedback survey with several questions and answers to learn what the participants rate various aspects on a Likert scale. (Table 3-4). Considering that this survey is voluntary, the response rate to the survey was high - nearly 66%, with 41 surveys sent out and 27 participants responding. To ascertain whether the participants may take these aspects into account when making future decisions,the statement, "The in-person clinic was convenient for me in terms of time commitment (travel, work, or other commitments)." This option obtained a final score of 3.8 out of 5 because one-fourth of the participants disapproved of utilising it in the future.

Table 3-3

Survey Questions and Participants' Responses After the Virtual Visit

#	Questions	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Average Score
1	In light of the coronavirus pandemic, I would consider future consultations via a virtual clinic	41.9%	45.2%	6.5%	3.2%	3.2%	4/5
2	The virtual clinic saved me time (travel, work, or other commitments)	54.8%	25.8%	9.7%	9.7%	0%	4.1/5
3	I was able to easily access the virtual clinic	77.4%	22.6%	0%	0%	0%	4.7/5
4	I did not have any connection issues	64.5%	29%	3.2%	3.2%	0%	4.4/5
5	I could talk to the clinician as well if we met in person	61.3%	29%	9.7%	0%	0%	4.4/5
6	I was able to express myself effectively	58.1%	32.3%	9.7%	0%	0%	4.4/5
7	I could easily hear and talk to the clinician	71%	22.6%	3.2%	3.2%	0%	4.5/5
8	The system was easy to use	64.5%	32.3%	3.2%	0%	0%	4.5/5
9	The virtual clinic met my needs	45.2%	32.3%	22.6%	0%	0%	4/5
10	I would use the virtual clinic again	54.8%	35.5%	9.7%	0%	0%	4.3/5

Table 3-4

Survey Questions and Participants' Responses After the In-person Visit

#	Questions	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Average Score
1	In light of the coronavirus pandemic, I would consider future consultations in person	57.7%	34.6%	7.7%	0%	0%	4.4/5
2	The in-person clinic was convenient for me in terms of time commitment (travel, work, or other commitments)	50%	23.1%	7.7%	15.4%	3.8%	3.8/5
3	I was able to arrive at the clinic easily	57.7%	38.5%	3.8%	0%	0%	4.4/5
4	I did not have any travel issues	61.5%	26.9%	7.7%	3.8%	0%	4.3/5
5	I could talk to the clinician effectively	80.8%	15.4%	0%	3.8%	0%	4.7/5
6	I was able to express myself effectively	80.8%	19.2%	0%	0%	0%	4.8/5
7	I could easily follow and understand the clinician	73.1%	23.1%	0%	3.8%	0%	4.6/5
8	The in-person appointment process was easy to follow	80.8%	19.2%	0%	0%	0%	4.8/5
9	The in-person clinic met my needs	80.8%	15.4%	0%	3.8%	0%	4.7/5
10	I would schedule an in-person clinic appointment again	80.8%	15.4%	3.8%	0%	0%	4.7/5

3.4 Student's Feedback Surveys

Following both the virtual and in-person examinations, the student answered a survey question. In each setting, 48 participants were assessed, and after each exam, Google Forms were used to record student replies. (Table 3-5 and Table 3-6)

3.4.1 Student's Feedback (Virtual Examination) Survey

For our study's questions of interest, we asked the student six questions. Our primary objective is to evaluate teledentistry as a learning tool and the student's capacity to diagnose oral lesions via teledentistry. Our primary concentration was on the following issues:

1) "Did the ability to use teledentistry with the patient meet your learning experience"
    - In almost 98% of the visits, the student was satisfied with teledentistry as a learning tool, and just 2% of the time, the student was unable to decide.
2) "Were you able to examine the patient properly to meet your goals for the visit."
    - For almost 87% of the visits, the student was able to evaluate the patient and fulfill the virtual exam. However, the student was unable to decide in 10% of cases and were dissatisfied with 2% of examinations.

Table 3-5

Survey Questions and the Student Responses After the Virtual Examination Visit

#	Questions	Responses			
		Very Satisfied	Satisfied	Undecided	Dissatisfied
1	Did the ability to use teledentistry with the patient meet your learning expectations?	81.25%	16.67%	2.1%	0%
2	Were you able to examine the patient properly to meet your goals for the visit?	66.67%	20.83%	10.42%	2.1%
3	Were you able to see and speak to the patient clearly during the examination?	91.67%	2.1%	4.12%	2.1%
4	Rate the quality of the visual image?	54.17%	22.9%	16.67%	6.25%
5	Rate the quality of the audio sound?	91.67%	4.12%	0%	4.12%
6	Overall, the quality of care you provided?	83.33%	14.6%	2.1%	0%

3.3.2 Student Feedback (In-person Examination) Survey

- On the other hand, during the in-person examination, student feedback was positive in approximately 98% of visits, while the student was unable to decide in 2% of instances.

Table 3-6

Survey Questions and the Student Responses After the In-person Examination Visit

#	Questions	Responses	
		Very satisfied	Undecided
1	Did the in-person examination with the patient meet your learning expectations?	98%	2%
2	Were you able to examine the patient properly to meet your goals for the visit?	98%	2%
3	Overall, the quality of care you provided?	98%	2%

4 Chapter Four: Discussion

4.1 Discussion

Teledentistry is an innovative tool to deliver virtual dental care and education services [88,89]. It was first used in 1994 by the US Army to serve the army personnel and their dependents. Since then, several studies have been conducted in the area of teledentistry, but none have compared its accuracy with that of conventional clinical examination, which is considered a gold standard[22].

This is the first study of its kind to compare the accuracy of presumptive diagnoses of oral lesions at the conclusion of virtual versus traditional (in-person) clinical visits. We conducted our study at the University of Alberta - Oral Medicine Clinic, in which all the examiners and the participants were double-blinded as the participants were contacted based on the referral, which was assigned to be the treatment coordinator job. Those who met our inclusion criteria were given the chance to participate. And if they consent, then they will be provided with the virtual examination information sheets. We started our study after obtaining ethical approval. Once we started, we aimed not only to compare the accuracy. Also, our participants were allowed to provide us with their feedback regarding this technology. In addition, patient satisfaction feedback and the learning experience of the Oral Medicine graduate student between appointments were analyzed.

The results of our study revealed a high degree of concordance between the virtual and in-person diagnoses made by the student. When the instructors provided a diagnosis, there was also a high degree of consensus. During virtual and in-person patient visits, there was substantial agreement between the student and instructor regarding the diagnosis. This statistically insignificant difference between intra- and inter-observer variability validates the use of teledentistry to diagnose oral mucosal benign lesions.

Through the use of teledentistry with the participants, the student's learning expectations were met in more than 98% of cases, according to the virtual examination student satisfaction survey. Over 80% of the time, the student felt capable of examining patients and achieving his visit objectives. In only 2% of instances was, the student unable to make a diagnosis due to his inability to properly examine the patient and evaluate the offending lesion. This suggests teledentistry can be used as a tool in imparting dental education and training.

Moreover, despite being able to speak and being satisfied with the audio sound quality, the student expressed dissatisfaction in three cases. The student presumed it was due to the participant's unstable WIFI connection or the use of low-quality headphones. Regarding the virtual assessment of oral lesions, the student was unable to commit to a diagnosis as they were unable to visualize the abnormality in eight cases. Since high-quality photographs are essential for the remote diagnosis of oral lesions, enhancing image acquisition via smartphones, advanced software, and internet technologies, as well as patients' photography skills, can benefit teledentistry programs. Overall, the student was pleased with the care provided via the virtual examination.

In contrast, during the student feedback survey for the in-person examination, the majority (98%) of responses reported that the in-person examination with the patient met their learning expectations. In nearly 98% of cases, the student felt they were able to examine patients and achieve the visit's objectives. In approximately 98% of cases, the student was extremely satisfied with the overall quality of patient care.

The results of the student feedback survey indicate that teledentistry has a promising future as an effective tool for imparting clinical education to Oral Medicine graduate students and improving the quality of patient care. Al Mohaya *et al*. conducted a survey to examine oral

medicine practitioners' utilization of telemedicine[77]. According to the study's findings, telemedicine could be useful for remote diagnosis, consultation, training, and education[77].

Furthermore, to learn about participants' experiences both in the clinic and during virtual appointments, feedback forms were sent to the patients. For virtual visits, 45 virtual feedback survey forms were sent out to participants, of whom 31 responded. In the virtual consultation feedback survey, more than 85 % of patients were satisfied with the virtual consultation and would also consider future online consultations especially during a coronavirus pandemic. During the COVID-19 pandemic, a large proportion of patients had positive experiences with virtual consultations, as observed in a study by Murthy *et al*.[78]. This suggests that teledentistry is a viable option for expanding patients' access to healthcare services. In addition, it can improve resource management and limit the spread of the highly contagious COVID-19 virus (at the time of the study). According to a study by Flores *et al*., patients with oral mucosal conditions are referred to an oral medicine clinic by multiple clinicians. This requires patients to travel twice as far and endure a lengthy wait to see an oral medicine specialist. This inevitably increases the cost as well as the duration of their treatment. Teledentistry provides patients with access to Oral Medicine specialists who are typically unavailable in their geographic area[79].

Consequently, approximately 80% of patients believed that virtual consultation was simple to access and saved their travel time. In some developing nations, the availability of uninterrupted internet service can pose a challenge when implementing teledentistry. However, in our study, over 90% of participants did not experience internet connection issues and felt they were meeting the dentist in person. They could even communicate effectively with the dentists and follow their instructions precisely. The majority of patients readily accepted the new teledentistry system, as the process was smooth, and their problems were resolved entirely. In light of the coronavirus pandemic, nearly 90 % of all participants expressed their desire to use

this consultation method in the future. This is due to the fact that virtual examination, particularly during the COVID-19 pandemic, reduced the number of unnecessary urgent care visits, emergency room overcrowding, and contact between people and exposure to the COVID-19 virus[63],[79],[80].

Similarly, 41 feedback forms were distributed to the study participants who had visited the clinic in person, and 27 patients responded. Even during the pandemic, more than 90% of survey respondents indicated a preference for future consultations in person. This may be due to the fact that teledentistry is a relatively new idea that requires the use of devices such as smartphones, laptops, desktops, and smart media. Further, in our study, we had to schedule the participants in our clinic for the in-person visit, which may have caused them to be biased towards the clinical settings due to their past dental experience of visiting the dental office[63]. Also, participants with conditions requiring a physical exam prefer to visit the dentist in person for prompt diagnosis and treatment. Typically, conventional in-person appointments cannot replace these circumstances[77].

Accordingly, although participants were required to visit the clinic in person, almost 90% of them had no concerns with the distance or travel time. More than 80 % of participants indicated that they would prefer to meet the dentist in person for improved communication. Approximately 95% of patients believed they could follow the dentists' directions, and 96% were pleased with in-person appointments. Additionally, over 90% of patients were very comfortable with in-person sessions and preferred to meet the dentist in person. However, more than 70% of participants considered it convenient to attend a clinic in person, while 20% found it inconvenient because it is time-consuming and may need individuals to take time from work. The findings of patient satisfaction surveys indicate that the majority of participants are satisfied with both virtual and conventional appointments.

The results of our study were comparable to the multicenter study by Flores *et al*. that evaluated the diagnostic accuracy of a telediagnosis service for oral mucosal disorders. The study concluded that teledentistry could be considered a promising alternative for the clinical support of health professionals[79]. Another study by Amtha *et a*l. demonstrated a high level of satisfaction with teledentistry among Oral Medicine patients similar to our study[80]. However, the participation of a small number of subjects with no prior knowledge of the teledentistry services is some of its limitations.

Blomstrand *et al*. and other writers favoured the use of teledentistry since it might lower dental care expenses for a larger population, improve quality access, and reduce the increased morbidity of oral disorders whose treatment was delayed owing to fears about COVID-19's spread[81],[82]. However, high equipment costs, lack of digital literacy among patients and healthcare providers, resistance to learning the technology, and concerns about the data privacy and security of healthcare records are some challenges to incorporating teledentistry across clinical practice and dental education institutions[78],[83].

4.2 Study Limitations and Future Directions

4.2.1 Study Limitations

This study contends that teledentistry is an accurate method for identifying benign oral soft tissue mucosal lesions, comparable to conventional clinical evaluation.

However, its limitations include a small sample size. Additional prospective multicenter studies with a large sample size may be required to validate the findings of this study.

Using an unstable WiFi connection or headphones of inferior quality can also negatively impact the virtual visit exam. In addition to a stable WIFI, a light source to evaluate the oral lesions, a device with a camera to be able to assess the lesion and the participants ability to use the technology are important potential barriers. In addition, because this study included both

types of visits (Virtual and In-person), approximately 10% of participants disagreed that teledentistry saved them time because they had to visit our clinic for the in-person examination.

Further, in the field of Oral Medicine, diagnosing lesions can prove to be a challenging task for the Oral Medicine students. The reliance on participant feedback to describe the consistency of the oral lesions (soft, firm, bony hard) can often be inadequate. One potential resolution to address this issue could be to provide the participants with thorough descriptions of the lesions to facilitate their evaluation. Furthermore, students may encounter difficulties when examining oral lesions situated in hard-to-reach areas towards the back of the oral cavity. These challenges must be acknowledged in order to ensure accurate and effective diagnosis in this field.

Overall, the future of teledentistry looks bright. With the potential to improve access to care, reduce costs, and increase patient satisfaction, it is a promising field that is likely to continue to grow and evolve in the coming years. Additionally, the future of teledentistry will be shaped by the growing focus on patient-centred care. Teledentistry can provide patients with greater control over their dental care, allowing them to receive treatment on their own terms and in the comfort of their own homes. This can improve patient satisfaction and lead to better outcomes.

In conclusion, teledentistry has the potential to revolutionize the way dental care is delivered by making it more convenient and accessible for patients. This technology allows for remote consultations and treatments, which can save time and money for both patients and providers. Further, teledentistry can be especially beneficial for people living in rural or underserved areas, where access to dental care may be limited. However, it is important to note that teledentistry is not a replacement for in-person care, and certain procedures may still require an in-person visit. As technology continues to advance and more dentists adopt teledentistry, it will likely play an increasingly important role in the future of dental care.

4.2.2 Future Directions

People are more comfortable with virtual consultations after the pandemic. To expand the scope of teledentistry, innovations should seek new technologies and solutions that make the teledentistry platform less cumbersome and more inexpensive for both patients and dentists.

Additionally, several policy modifications are also necessary for the widespread implementation of teledentistry-enabled preventive treatments worldwide.

Regarding education, teledentistry can help dental education by facilitating access to routine consultations via postgraduate dental education programs and continuing dental education programs. Also, modifying the existing dental curriculum by offering dental courses to educate undergraduate and postgraduate students about the importance and how to conduct a virtual examination is a crucial step in providing a future alternative to the clinical exam. In addition, a collaboration between dental boards and insurance companies to offer special codes for this technology should be explored.

Another future direction of teledentistry is the use of artificial intelligence (AI) and machine learning (ML) to improve the accuracy and efficiency of diagnosis and treatment planning. AI and ML can be used to analyze images and data from teledentistry consultations, helping to identify patterns and make predictions about treatment outcomes. It may be advantageous to investigate the potential of incorporating intraoral scanners in the screening process for oral lesions and implementing teledentistry services as part of the dental practice. The resolution, color representation and soft tissue depiction of oral soft tissues by intraoral scanners has improved significantly. Such measures could offer significant opportunities for further research and development in the field.

The increased use of mobile devices and the internet will also play a major role in the future of teledentistry. As more people gain access to smartphones and internet connectivity, the ability

to provide dental care remotely will become increasingly accessible. Teledentistry can be improved by enhancing image acquisition via smartphones, advanced software, and Internet technologies, as well as patients' photography skills. This will be particularly important for people living in rural or remote areas, as well as for those who are unable to travel to a dental office due to mobility issues.

4.3 Conclusion

Overall, teledentistry has the potential to be a reliable method as part of the process for diagnosing non-emergent soft tissue oral pathologic conditions. Nevertheless, obtaining a biopsy is essential for the most precise oral pathology diagnosis. This crucial step ensures patients receive the best possible care and accurate results.

Teledentistry could also provide graduate oral medicine students with adequate learning opportunities. In addition, the Oral Medicine graduate student were satisfied with both virtual and conventional examinations. Moreover, patients exhibited a high degree of satisfaction during both virtual and conventional examinations.

Despite the fact that teledentistry has existed since the 1990s, it was swiftly and widely adopted during the COVID-19 pandemic. The results obtained thus far are promising. To corroborate our findings, however, additional multicenter prospective trials with a high number of individuals are required.

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Appendices

Appendix A: Ethics Approval and Renewal

RESEARCH ETHICS OFFICE
Health Research Ethics Board

2-01 North Power Plant (NPP)
11312 - 89 Ave NW
Edmonton, Alberta, Canada T6G 2N2
Tel: 780.492.0459
www.uab.ca/reo

Notification of Approval (Renewal)

Date:	January 28, 2022
Amendment ID:	Pro00103655_REN1
Principal Investigator:	Pallavi Parashar
Study ID:	MS1_Pro00103655
Study Title:	Pilot concordance study to evaluate the accuracy of teledentistry compared to direct clinical assessment for diagnosis of non-emergent soft tissue oral pathologic conditions in the Oral Medicine Graduate Clinic
Sponsor/Funding Agency:	Start-up
Approval Expiry Date:	Friday, January 27, 2023

RESEARCH ETHICS OFFICE
Health Research Ethics Board

2-01 North Power Plant (NPP)
11312 - 89 Ave NW
Edmonton, Alberta, Canada T6G 2N2
Tel: 780.492.0459
www.uab.ca/reo

Notification of Approval (Renewal)

Date:	January 11, 2023
Renewal ID:	Pro00103655_REN2
Principal Investigator:	Pallavi Parashar
Study ID:	Pro00103655
Study Title:	Pilot concordance study to evaluate the accuracy of teledentistry compared to direct clinical assessment for diagnosis of non-emergent soft tissue oral pathologic conditions in the Oral Medicine Graduate Clinic
Sponsor/Funding Agency:	Start-up

RSO-Managed Funding:

	Project ID	Title	Grant Status	Sponsor	Project Start Date	Project End Date	Purpose	Other Information
View	RES0060206	Pilot Concordance Study to Evaluate the Accuracy of Teledentistry for Diagnosis of Non-Emergent Soft Tissue Oral Pathologic Conditions in the Oral Medicine Graduate Clinic	Submitted		3/1/2021	3/31/2024	Grant	

Approval Expiry Date:	Wednesday, January 10, 2024

Appendix B - Participant's information sheet

Dentistry and Dental Hygiene
Excellence in Dental Health

Pilot concordance study to evaluate the accuracy of tele-dentistry for diagnosis of non-emergent soft tissue oral pathological conditions in the Oral Medicine graduate clinic

Principal Investigator and Co-Investigators :
Dr.Pallavi Parashar
Dr. Carlos Flores-Mir
Dr. Hollis Lai
Oral Medicine Graduate Student/ Co-Investigator:
Dr. Ahammad Kandari

Why am I being asked to take part in this research study?

You have been asked to take part in this study because you have been referred for assessment of an oral lesion/condition that is considered non-urgent. You will be eligible to have your initial assessment done virtually, followed by an in-person examination as part of this study.

What is the reason for doing this study?

This study is exploring the use of tele-dentistry as an alternative to in-person oral assessments. The goals are to assess:

- Improved accessibility to a specialist
- Convenience of having an appointment from the comfort of your home

Where will the study occur?

The study in divided into two steps:

- Step 1: Virtual examination – at your home, scheduled via a video consultation. We will provide detailed step-by-step instructions.
- Step 2: In-person examination – University of Alberta Oral Health Clinic, Oral Medicine Graduate program clinic [Kaye Clinic, 8th floor, Edmonton AB]

What will I be asked to do?

You will be scheduled for two assessments of the oral lesion/condition (virtual and in-person). Each visit will be approximately 45 minutes. This is done to confirm that a tele-dentistry assessment is a viable option to be used in the future to assess similar non-urgent oral lesions. At the completion of each visit, you will be sent a questionnaire/survey by *Intiveo,* our patient communication *portal.* The questionnaire will need to be completed and would take approximately five (5) minutes.

What are the risks and discomforts?

- Some level of emotional stress could be felt by participants when they share their details online, even though a secure delivery set up is utilized. Every effort will be made to put the patient at ease and the virtual appointments will be attempted to replicate in-person appointments.
- Given that the patients will be entering a health care facility, there is a risk of exposure to COVID as a result of the increased exposure to other people since there is an increased time in travel and increase time in the health care facility. Measures undertaken to reduce this risk include screenings of people entering the Kaye Edmonton Health Clinic, usage and provision of PPE (masks and gloves), use and provision of hand sanitizers and applying of physical distancing measures where possible inside the clinic. COVID screening questions will additionally be asked chair side. The information about COVID risk and mitigation efforts are included in the participant consent form.

What are the benefits for me?

- Participating in this study will not alter the quality of your treatment. There may not be any direct benefits. Information gained from this study will help us understand differences in the outcomes between both examination approaches, which may help us treat other patients with similar conditions in the future.
- If virtual assessments/tele-dentistry can provide a comparable level of care, there is great potential to minimize the burden of visits for future patients that require consult in rural areas or have other limitations (mobility, travel, etc.) for non-urgent pathological lesions.

What will be done while I am in the study?

- You will be interviewed and examined in two settings (virtual and in-person) and we will collect similar data twice. For both examinations, you will be contacted for scheduling the appointments.

What happens if I become injured because of this research?

- There is a minimal risk for participating in this study, mostly related to the stress/embarrassment aspect of being examined at home and sharing personal details via video call and entering a healthcare facility during COVID. Significant efforts will be made to mitigate any risk.
- By signing this consent form you are not releasing the investigator(s), institution(s) and/or sponsor(s) from their legal and professional responsibilities.

Do I have to participate in the study?

- You do not have to participate. This participation is optional and will not affect the quality of examination that you will receive if you decide to be seen as part of our regular clinic.

Can I terminate my participation in the study early?

- Even if the decision was made to participate, you are free to withdraw from the research study at any time. Your patient status and continuation of care will not be compromised in any way because of your withdrawal from the study. Should you choose to withdraw from the study, you may not qualify to receive the $15 gift card.

Are there other choices to being in this research study?

You do not have to participate in this study in order to receive care in the Oral Medicine graduate clinic.

What will it cost for me to participate?

You do not have to pay anything additional for taking part in this study. However, the examination and assessment cost will be the normal cost for similar assessments at our Oral Medicine Graduate Clinic for in-person assessments. The cost for both options is the same.

Will I be paid to be in the research?

- To thank you for your time, a $15 gift card will be given to you upon completion of study.

Will my information be kept private?

During the study we will be collecting health data about your case. We will do everything we can to make sure that your health information is kept private. No data relating to this study that includes your name will be released outside of the study doctor's office or published by the researchers. Sometimes, by law, we may have to release your information with your name so we cannot guarantee absolute privacy. However, we will make every legal effort to make sure that your health information is kept private.

The study doctor/study staff may need to look at your personal health records held at the study doctor's office, and/or kept by other health care providers that you may have seen in the past (i.e.: family doctor). Any personal health information that we get from these records will be only what is needed for the study.

During research studies, it is important that the data we get is accurate. For this reason, your health data, including his/her name maybe looked at by people from the Research Ethics Board at the University of Alberta and/or the University of Alberta auditors.

By signing this consent form you are saying it is okay for the study doctor/staff to collect, use and disclose information about you from their personal health records as described above.

After the study is done, we will still need to securely store the health data that was collected as part of the study. At the University of Alberta, we keep data stored for 5 years after the end of the study.

What if I have additional questions?

If you have any questions about the study or study-related injury, you may contact Dr. Kandari at 780 297-6072 or Dr. Parashar at 780-248-1119. If you have any concerns about your rights as a study participant, you may contact the Research Ethics Office, at (780) 492-2615. This office has no affiliation with the study investigators

UofA Ethics ID: Pro00103655

Version: January 17, 2021

Appendix C - Participant's Consent form

Participant's Consent form

Pilot concordance study to evaluate the accuracy of tele-dentistry for diagnosis of non-emergent soft tissue oral pathological conditions in the Oral Medicine graduate clinic

Principal Investigator and Co-Investigator: **Dr.Pallavi Parashar**
Dr. Carlos Flores-Mir
Dr. Hollis Lai

Oral Medicine Graduate student and Co-Investigator: **Dr.Ahammad Kandari**

	Yes	No
Do you understand that you have been asked to be in a research study?	☐	☐
Have you read and received a copy of the attached Information Sheet?	☐	☐
Do you understand the benefits and risks involved in taking part in this research study?	☐	☐
Have you had an opportunity to ask questions and discuss this study?	☐	☐
Do you understand that you are free to leave the study at any time, without having to give a reason and without affecting your future oral medicine care.	☐	☐
Has the issue of confidentiality been explained to you?	☐	☐
Do you understand who will have access to your study records, including personally identifiable health information?	☐	☐
Do you want the investigator(s) to inform your family doctor that you are	☐	☐

participating in this research study? If so, give his/her name _____

	Yes	No
Future Contact		
Do you agree to be contacted for follow-up or to facilitate future research?	☐	☐
Use of my research information beyond this study		
Do you agree for your information to be securely stored at Oral Health Clinic to facilitate future reuse?	☐	☐

Who explained this study to you?

_____

I agree to take part in this study: Yes / No

Signature of Research Participant _____ Printed Name _____

Date: _____

Signature of Witness _____

I believe that the person signing this form understands what is involved in this study and voluntarily agrees to participate.

Signature of the investigator or Designee _____

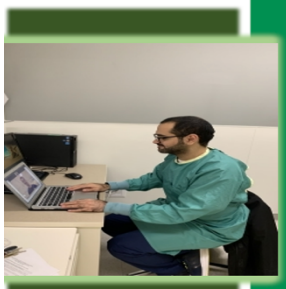
Date _____

UofA Ethics ID: Pro00103655.

Version: January 17, 2021

Appendix D - Teledentistry online examination patient information

Patient information



What is tele-dentistry?

Tele-dentistry is a dental assessment conducted by a video chat application or phone call, between the patient and a dentist. In our study, the Oral Medicine graduate student with facilitate the virtual consultation appointment with the help of the attending specialist using a video conference call.

What are the proposed benefits of tele-dentistry consultations for the patient?

- Improved accessibility to a specialist
- Convenience of having an appointment from the comforts of your home

What do I need for a tele-dentistry consultation?

- A device (laptop, desktop, iPad or smart-phone) with working camera, speaker and microphone.
- A stable internet connection
- Video communication tool (Zoom)
- A flashlight

Who will be present for the video consultation call?

- Only you and the specialist-dental team.

How do I prepare for my consultation?

- Prepare a list of questions that you would like to ask
- Find a quiet, well-lit space with proper light
- Ensure your device is working and check all the required inputs

Will the consultation be recorded?

- No, it will not be recorded. Photographs of the oral findings during the virtual examination may be taken.

What if I don't want to continue with the consultation?

This may probably be the first time you may be experiencing an assessment via a digital platform. As a result, you may feel nervous during the first tele-dentistry examination. Rest assured we will try to make it as easy as possible. However, please inform the dental team if you wish to discontinue the video consultation.

How It Works ?

1st step: Schedule an appointment

2nd step: Prepare for the virtual visit

3rd step: Tele-dentistry examination
- Fill the survey

4th step: We will schedule for an in-person examination within **21 days**

5th step: In-person examination
- Fill the survey

Photo guide

- ❑ The photos here will serve as a reference of what we will ask you to do during your virtual visit
- ❑ Make sure that you are at the same level of your camera with a proper angulation with the light
- ❑ We may ask you to use your cell-phone light or flashlight, so keep it handy.
- ❑ We may ask you to take a step forward or backward when you're being examined as we need to see your face and mouth properly.

Cont.

Photo 1: Lower face , Just smile.

Cont.

Photo 2: Neck area – rotate your neck to the sides (right and left). Try to relax your neck and lower your chin so that your neck muscles will be visible.

Cont.


Photo 3: Inside surface of your lips and gums around your front teeth. Use your clean fingers to reflect your upper and lower lip. Gently hold your lip on either corner using your fingers, then turn the upper and lower lip outwards. We will be able to assess your gums in the front region too.

Cont.


Photo 4: Gums around your back teeth. Similar to the previous instructions, use your clean fingers to hold the upper and lower corner of the mouth on the same side, and gently pull your cheek outwards. Keep your teeth touching together when doing this action. Try and relax your cheeks so that you are able to show the gums around your back teeth

---

Cont.


Photo 5: Inner-cheeks: With your clean fingers, hold the upper and lower lip by the corners on the same side. Relax your cheeks and pull them away from your back teeth. The pinch grasp is most effective.

Cont.




Photo 6: Tongue surfaces. Pull your tongue out. Then extend your tongue out and sideways. Lastly, place your tongue behind your front upper teeth (touching the roof of your mouth).

Cont.

Photo 7: Roof and floor of the mouth. Lift your tongue up and touch the gums behind your upper front teeth and lower your chin for assessing the floor of the mouth. Now, open your mouth and lift your chin up, for assessment of the roof of the mouth.

Tips

- ✓ Check your devices properly before the examination
- ✓ Prepare two devices if possible; if one doesn't work, use the second immediately
- ✓ Fill the surveys so that you can help us improve our practice approach
- ✓ Don't stress out
- ✓ Make sure you have an appointment for an in-person examination within 21 days after completing your tele-dentistry appointment

Thank you for your participation!

Appendix E - Consent to diagnosis and treatment planning

THE GOVERNORS OF THE UNIVERSITY OF ALBERTA
FACULTY OF MEDICINE AND DENTISTRY
ORAL HEALTH CLINIC

CONSENT TO DIAGNOSIS AND TREATMENT PLANNING

PLEASE READ THIS DOCUMENT CAREFULLY!

I understand that The Governors of the University of Alberta and the Faculty of Medicine and Dentistry, their officers, board members, agents, employees, students, volunteers, servants and representatives (the "University") operate the Oral Health Clinic as part of teaching and research and that treatment may be provided by one or more faculty, students, contractors, residents or graduate students at the Oral Health Clinic.

I understand that my acceptance as a dental patient at the Oral Health Clinic is a privilege and not a right and is based upon my dental needs corresponding to the educational needs of the University's School of Dentistry students, graduate students and residents.

I understand that my status as a patient of the Oral Health Clinic may be terminated if:

- my treatment needs no longer correspond to the educational needs of the students, graduate students and residents, or
- my treatment needs are treated and resolved and my condition is stable, or
- my treatment needs are determined to be beyond what can be reliably treated at the Oral Health Clinic (See TERMINATION OF TREATMENT section below for further details).

I understand that my status as a patient of the Oral Health Clinic may be terminated if:

- I am determined to be noncompliant with treatment recommendations made in my best interests, or
- I regularly fail to attend my appointments on time, or
- I am behaving in an upsetting or combative manner that places others in an uncomfortable or stressful environment (as determined at the discretion of the University).

I understand that my status as a patient of the Oral Health Clinic may be terminated or that a specific appointment may be cancelled if:

- I am intoxicated, impaired, ill or otherwise not fit for treatment.

I understand that once my status as a patient at the Oral Health Clinic has been terminated, I will not be allowed to continue as a patient at the Oral Health Clinic unless new oral health issues appear. If this happens, I understand that I may apply to re-enter as a patient by going through the normal screening process for all new patients, and that this screening will help the University determine whether my new oral health needs satisfy the acceptance educational criteria for the University's School of Dentistry students, graduate students and residents.

I understand that the undergraduate students performing work on me or my child of whom I am the parent or legal guardian are not licensed or practicing dentists/dental hygienists but are registered University students under the supervision of the appropriate licensed practitioner. All other faculty, contractors, residents and graduate students performing dental treatments have the necessary registration, licensing or certification, as applicable in Alberta.

I am aware there are risks associated with or related to dental treatments. These risks are described in this Consent to Diagnosis and Treatment Planning form and have been fully explained to me. I understand that I will be advised of additional specific risks associated with a given treatment and that I will have the opportunity to ask questions about the risks to treatment.

I hereby consent to and authorize the University to perform diagnostic services, administrate anesthetics and medications as deemed necessary and dental treatment that may be required by me or my child.

I hereby consent to and authorize the dental treatment required by me or my child as has been fully explained to me, or any other procedures deemed necessary or advisable. If any unforeseen condition should arise in the course of the treatment that calls for judgment on the part of those providing treatment, or for procedures in addition to or different from those contemplated prior to commencing the then current treatment, I authorize those providing treatment to do whatever he or she may deem advisable, including ceasing treatment.

DEVELOPMENT OF TREATMENT PLANS AND FINANCIAL COSTS

I acknowledge that I will be required to sign (for myself or my child) a "Consent to Treatment & Financial Agreement" form prior to the commencement of any of these treatments acknowledging which treatment plan I have chosen for myself or my child and the anticipated financial cost of the plan to me. I understand that the anticipated financial cost of the treatment is an estimate only and the actual financial cost may differ if the treatment becomes more complex or has to be altered during the course of the treatment.

CONSENT TO PUBLICATION OF PHOTOGRAPHS AND OTHER RECORDS

The University may deem all or any portion of my dental records (or my child's), including charts, casts, radiographs, and photographs, to be of benefit in dental education and science. For research involving human subjects, full approval will be received through the appropriate Human Ethical Board prior to the start of the research study. The individual identification of human subjects used for research or educational purposes will be kept in strictest confidence and not identifiable from material used.

I hereby consent, for myself or my child, to the publication or republication of such dental records and information, either separately or in connection with each other, in professional journals or dental books or to their use for any other purpose, which the University may deem proper in the interest of dental education.

I acknowledge and understand that in any such publication or use, I or my child, will not be identified by name as the patient with the exception that I or my child may be identified to any accreditation body as required by, and only to the limited extent required by, such accreditation body or by law.

RISKS

I acknowledge that I am aware there are risks associated with or related to the dental treatment to be received by me or my child and these risks include, but are not limited to:

- reactions to anesthetics and medications given during treatment (including paresthesia);
- dangers associated with radiation from x-rays;
- sore, irritated and bleeding gums due to dental procedures used in cleaning teeth;
- injuries, irritations, sensitivity or damages to the mouth, gums, jaw, muscles, bone and teeth due to dental procedures used during treatments including inconvenience or the requirement for further treatment due to any of these reasons;
- Infections occurring during and after dental treatment;
- discomfort resulting from dentures and sore, irritated and bleeding gums;
- unmet or unresolved aesthetics expectations.

CONSENT TO TEST

In the event of inadvertent possible transmission of infectious material to a person rendering treatment to me or my child, I understand and agree to comply to testing of my, or my child's, blood for determination of transmissible diseases.

TERMINATION OF TREATMENT

The University reserves the right, in its sole discretion, to terminate treatment of any patient for any reason whatsoever. In the event the treatment becomes more complex than originally anticipated the University may terminate treatment and refer me or my child to an appropriate licensed practitioner to continue and/or complete treatment. I hereby accept and acknowledge that the University has the right to terminate treatment. In the event treatment is terminated, I agree to pay the fees associated with the treatments received by me or my child up to and including the date of termination.

YOUR HEALTH INFORMATION

The health information that we are collecting is needed to determine your eligibility for the School of Dentistry, to provide you with diagnostic, treatment and care services, or for the training of students, or for research purposes, under section 27 of the Health Information Act. It is collected under the authority of the 20(b) of the Health Information Act - directly related to and necessary to carry out an authorized purpose under section 27. The confidentiality of this health information and your privacy are protected by the provisions of the Health Information Act. If you have any questions about this collection and use of your health information, please contact the Associate Chair, Clinical Operations at (780) 407-5572.

Protection of Privacy – The personal information requested on this form is collected under the authority of Section 33(c) of the Alberta *Freedom of Information and Protection of Privacy Act* and will be protected under Part 2 of that Act. It will be used for the purpose of implementing this Consent to Diagnosis and Treatment Planning Form. Direct any questions about this collection to:

Associate Chair, Clinical Operations
8B.105Y Kaye Edmonton Clinic
11400 University Avenue
Edmonton, AB T6G 1Z1
(780) 407-5572

DISCLAIMER

I am aware that the University does not warrant or guarantee the results of dental treatment and I acknowledge that the University is not responsible for any injury, loss or damage of any kind sustained by me or my child as the result of dental treatment or the failure of the University to treat me or my child, including such injury, loss or damage caused by the negligence of the University.

ACKNOWLEDGMENT

I acknowledge that I have read and understood this Agreement that I appreciate and accept the risks associated with dental treatment and that I have executed this Agreement voluntarily. If my child is to receive the dental treatment, I am executing this Agreement as the parent or legal guardian of this child.

Electronic signature will be obtained in the clinic. No signature is required on this paper copy.

Appendix F - Oral Medicine program medical history form

ORAL MEDICINE PROGRAM
MEDICAL HISTORY FORM

Name:_____**Alberta Heath No.**_____
Last **First** **MI**

Date of Birth: _____ **Height**_____ **Weight**_____

PLEASE CIRCLE YOUR RESPONSES (*YES, NO, DK (DON'T KNOW)* TO INDICATE IF YOU HAVE, HAVE NOT OR DO NOT KNOW IF YOU HAVE HAD ANY OF THE FOLLOWING DISEASES OR PROBLEMS.

Do you have any of the following diseases or problems?
YES NO DK Active Tuberculosis
YES NO DK Persistent cough greater than 3 weeks in duration
YES NO DK Cough that produces blood
YES NO DK Been exposed to anyone with Tuberculosis
If you answered yes to any of the 4 items above please stop. Talk to your student dentist or someone at the reception desk.

GENERAL MEDICAL INFORMATION:

YES NO DK Are you now, or have you been in the past year, under the care of a physician?

YES NO DK Have you had any serious illness, operation, or been hospitalized in the past 5 years? If yes, how long ago?
_____

YES NO DK Have you had an organ transplant? If yes, please specify: **HEART KIDNEY LIVER LUNG OTHER (Specify):**_____

YES NO DK Have you had open heart surgery? If yes, please specify: **VALVE BYPASS (CABG) OTHER (Specify):**_____

YES NO DK Have you had an orthopedic total joint (e.g. hip, knee, elbow, finger) replacement?

YES NO DK Have you ever had any radiation therapy or chemotherapy for a growth, tumor or other condition?
- ☐ Radiation: Explain:_____
- ☐ Chemotherapy: Explain:_____

YES NO DK In the last 2 years, have you taken or are you now taking steroids (e.g. Cortisone)? Please specify:

Steroid Medication	**Dosage/Frequency**	**Length of Period Taken** *(Days, Weeks, Months, Years)*	**If no longer taking, when was the medication discontinued?**

Have you taken, are you taking or are you scheduled to begin taking?

YES NO DK -Oral bisphosphonates (Alendronate (Fosamax, Fosamax Plus D), Etidronate (Didronel), Ibandronate (Boniva), Risedronate (Actonel), Tiludronate (Skelid))?

YES NO DK -Intravenous bisphosphonates (Clodronate (Bonefos), Pamidronate (Aredia) or Zoledronic Acid (Reclast, Zometa))?

YES NO DK Do you use or have you used tobacco (smoking, snuff, chew, bidis)? (Specify):
- ☐ **PAST (Specify type): SMOKING SNUFF CHEW BIDIS**
- ☐ **CURRENTLY (Specify type): SMOKING SNUFF CHEW BIDIS**

Specify amount per day: _____ For how many years: _____

How interested are you in stopping? **VERY SOMEWHAT NOT INTERESTED**

YES NO DK Do you drink alcoholic beverages?
If yes, are you alcohol dependent? **YES NO DK**

YES NO DK Do you use or have you used prescription or street drugs or other substances for recreational purposes? (Specify):

- ☐ **PAST**
  (Specify type): COCAINE ECSTASY HEROIN MARIJUANA METHAMPHETAMINE OXYCONTIN OTHER (Specify)_____
- ☐ **CURRENTLY**
  (Specify type): COCAINE ECSTASY HEROIN MARIJUANA METHAMPHETAMINE OXYCONTIN
  OTHER (Specify)_____
  Are you drug dependent? **YES NO DK**

FEMALES ONLY:

YES NO DK Are you pregnant? If yes, number of weeks: _____
YES NO DK Are you nursing?
YES NO DK Are you taking birth control pills, fertility drugs or hormonal replacement?
(Specify): **BIRTH CONTROL FERTILITY DRUGS HORMONAL REPLACEMENT**

MEDICATIONS:

YES NO DK Are you taking, have you recently (within the last month) taken, or are you supposed to be taking any medications (prescription, over the counter, diet supplements, vitamins, natural or herbal)? If yes, please specify medication(s), dosage and frequency:

Medication *Prescription or Over the Counter*	**Dosage/Frequency**	**Supplements** *Diet supplements, vitamins(natural or herbal)*	**Dosage/Frequency**

ALLERGIES:

YES NO DK Are you allergic to or have you had a reaction to any of the following? Please specify type of reaction:

- ☐ Local anesthetics (Novocaine/Epinephrine) **Reaction:** _____
- ☐ Penicillin **Reaction:** _____
- ☐ Sulfa drugs **Reaction:** _____
- ☐ Other antibiotics (Specify): _____ **Reaction:** _____
- ☐ Codeine or other narcotics **Reaction:** _____
- ☐ Aspirin **Reaction:** _____
- ☐ Hay fever/seasonal (allergic rhinitis) **Reaction:** _____
- ☐ Metals/Jewelry (nickel/chrome) **Reaction:** _____
- ☐ Food (Specify): _____ **Reaction:** _____
- ☐ Iodine **Reaction:** _____
- ☐ Latex (rubber) **Reaction:** _____
- ☐ Other/Other Medication(s) (Specify): _____ **Reaction:** _____

MEDICAL CONDITIONS: Do you have or have you had any of the following diseases, problems, or symptoms?

YES NO DK *Heart/Blood Pressure problem*
If yes, please specify:
- ☐ Rheumatic fever/Rheumatic heart disease
- ☐ Infective endocarditis
- ☐ Artificial heart valves
- ☐ Congenital heart defect
- ☐ Heart murmur
- ☐ Mitral valve prolapse
- ☐ Angina (chest pain)
- ☐ Heart attack
- ☐ Heart failure
- ☐ Coronary heart disease
- ☐ High blood pressure
- ☐ Low blood pressure
- ☐ Palpitations
- ☐ Arrhythmia (irregular heart beat)
- ☐ Shortness of breath
- ☐ Swelling of the ankles
- ☐ Pacemaker
- ☐ Implantable defibrillator
- ☐ Other (Specify): _____

YES NO DK *Respiratory/Lung problem*
If yes, please specify:
- ☐ Asthma
- ☐ Emphysema/COPD
- ☐ Tuberculosis
- ☐ Sinusitis
- ☐ Bronchitis
- ☐ Persistent cough
- ☐ Sleep apnea
- ☐ Snoring
- ☐ Other (Specify): _____

YES NO DK *Diabetes/Endocrine disorder*
If yes, please specify:
- ☐ Diabetes
  - ☐ Type 1
  - ☐ Type 2
- ☐ Thyroid problems
  - ☐ Hypothyroidism
  - ☐ Hyperthyroidism
- ☐ Other (Specify): _____

YES NO DK *Kidney/Urinary disorder*
If yes, please specify:
- ☐ Renal failure/insufficiency
- ☐ Dialysis
- ☐ Frequent urination
- ☐ Other (Specify): _____

YES NO DK *Cancer or Tumors*
If yes, please specify:
- ☐ Malignant
  Location: _____
- ☐ Benign

YES NO DK *Neurologic/Nerve problem*
If yes, please specify:
- ☐ Stroke
- ☐ TIA (transient ischemic attack)
- ☐ Seizures/Epilepsy
- ☐ Multiple sclerosis
- ☐ Parkinson's disease
- ☐ Neuropathies
- ☐ Dementia/Alzheimer's (memory loss)
- ☐ Headache
- ☐ Fainting or dizzy spells
- ☐ Feeling of tingling or numbness
- ☐ Psychiatric disease/Mental health disorder
  - ☐ Bipolar/Manic depression
  - ☐ Schizophrenia
  - ☐ Depression
- ☐ ADD/ADHD (attention deficit disorder)
- ☐ Feelings of anxiety
- ☐ Feelings of depression
- ☐ Other (Specify): _____

YES NO DK *Blood/Hematologic disorder*
If yes, please specify:
- ☐ Anemia
- ☐ Sickle cell disease
- ☐ Sickle cell trait
- ☐ Bruise easily
- ☐ Leukemia
- ☐ Lymphoma
- ☐ Bleeding disorders
  - ☐ Hemophilia
  - ☐ Other (Specify): _____
- ☐ Other (Specify): _____

YES NO DK *Stomach/Intestine/Liver disorder*
If yes, please specify:
- ☐ Cirrhosis/Chronic hepatitis
- ☐ Jaundice (skin/eyes turn yellow)
- ☐ Hepatitis
  - ☐ A
  - ☐ B
  - ☐ C
  - ☐ D
  - ☐ Other (Specify): _____
- ☐ Heartburn
- ☐ Acid reflux (GERDS)
- ☐ Ulcers
- ☐ Crohn's disease
- ☐ Other (Specify): _____

YES NO DK *Muscle/Bone/Connective Tissue disorder*
If yes, please specify:
- ☐ Arthritis
  - ☐ Rheumatoid
  - ☐ Osteoarthritis
  - ☐ Other (specify): _____
- ☐ Osteoporosis
- ☐ Gout
- ☐ Temporomandibular joint disorder
- ☐ Lupus
- ☐ Fibromyalgia
- ☐ Other (Specify): _____

YES NO DK *Infectious disease*
If yes, please specify:
- ☐ HIV
- ☐ AIDS
- ☐ STD (sexually transmitted disease)
  - ☐ Syphilis
  - ☐ Gonorrhea
  - ☐ Chlamydia
  - ☐ Genital herpes
  - ☐ Human papillomavirus
- ☐ Cold sores
- ☐ Other (Specify): _____

YES NO DK *Head/Eye/Ear/Nose/Throat problem*
If yes, please specify:
- ☐ Vision problems
- ☐ Glaucoma
- ☐ Hearing impairment
- ☐ Other (Specify): _____

YES NO DK *Dermatologic/Skin problem*
If yes, please specify: _____

YES NO DK *Eating disorder*
If yes, please specify:
- ☐ Bulimia
- ☐ Anorexia
- ☐ Other (Specify): _____

YES NO DK *Do you have any other problem, disease or condition not listed above?*
If yes, please specify:
_____

Appendix G - Participant's survey feedback (virtual and in-person visit)

Appendix G.1 Participant's feedback survey (Virtual visit)

#	Questions	Responses				
1	In light of the coronavirus pandemic, I would consider future consultations via virtual clinic	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
2	The virtual clinic saved me time (travel, work, or other commitments)	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
3	I was able to easily access the virtual clinic	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
4	I did not have any connection issues	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
5	I could talk to the clinician as well as if we met in person	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
6	I was able to express myself effectively	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
7	I could easily hear and talk to the clinician	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
8	The system was easy to use	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
9	The virtual clinic met my needs	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
10	I would use the virtual clinic again	Strongly agree	Agree	Neutral	Disagree	Strongly disagree

Appendix G.2 Participant's feedback survey (In-person visit)

#	Questions	Responses				
1	In light of the coronavirus pandemic, I would consider future consultations in-person	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
2	The in-person clinic was convenient for me in terms of time commitment (travel, work, or other commitments)	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
3	I was able to arrive at the clinic easily	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
4	I did not have any travel issues	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
5	I could talk to the clinician effectively	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
6	I was able to express myself effectively	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
7	I could easily follow and understand the clinician	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
8	The in-person appointment process was easy to follow	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
9	The in-person clinic met my needs	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
10	I would schedule an in-person clinic appointment again	Strongly agree	Agree	Neutral	Disagree	Strongly disagree

Appendix H - Oral Medicine Graduate student survey (Virtual and in-person visit)

Appendix H.1 Oral Medicine Graduate student survey (Virtual visit)

#	Questions	Responses				
1	Did the ability to use teledentistry with the patient meet your learning expectations?	Very satisfied	Satisfied	Undecided	Dissatisfied	Very dissatisfied
2	Were you able to examine the patient properly to meet your goals for the visit?	Very satisfied	Satisfied	Undecided	Dissatisfied	Very dissatisfied
3	Were you able to see and speak to the patient clearly during the examination?	Very satisfied	Satisfied	Undecided	Dissatisfied	Very dissatisfied
4	Rate the quality of the visual image?	Very satisfied	Satisfied	Undecided	Dissatisfied	Very dissatisfied
5	Rate the quality of the audio sound?	Very satisfied	Satisfied	Undecided	Dissatisfied	Very dissatisfied
6	Overall, the quality of care you provided?	Very satisfied	Satisfied	Undecided	Dissatisfied	Very dissatisfied

Appendix H.2 Oral Medicine Graduate student survey (In-person visit)

#	Questions	Responses				
1	Did the in-person examination with the patient meet your learning expectations?	Very satisfied	Satisfied	Undecided	Dissatisfied	Very dissatisfied
2	Were you able to examine the patient properly to meet your goals for the visit?	Very satisfied	Satisfied	Undecided	Dissatisfied	Very dissatisfied
3	Overall, the quality of care you provided.	Very satisfied	Satisfied	Undecided	Dissatisfied	Very dissatisfied