

The Outcome of a New Teledentistry Initiative in Response to the COVID-19 Pandemic: A Cross-sectional Study

Ankaa Nath¹, Sallen Aoghiz², Chinwendu Nnagbo³, Steven Powell⁴, Eunjoo P Choi⁵, Udochukwu Oyoyo⁶, Heidi Christensen⁷, John Won⁸, So Ran Kwon⁹

ABSTRACT

Aim: The purpose of this study was to assess the overall satisfaction of a new learning experience and evaluate the outcome of LLUSD's educational teledentistry initiative through a survey based on Kirkpatrick's multidimensional model of training evaluation.

Materials and methods: An IRB application was approved (#5210385) for a cross-sectional study that included Loma Linda University School of Dentistry (LLUSD) dental students of the class of 2022 and 2023. The 9-question survey consisted of three sections. The first section included demographic questions on gender and the graduating class. The second section was related to perceived teaching effectiveness, attitude, behavior, and significance. The third section included an open-ended question. The survey was distributed by three student investigators. Descriptive statistics were calculated, and categorical variables were compared using the Chi-squared test (χ^2 test).

Results: The perceived teaching effectiveness of the newly implemented educational initiative was high for increasing the ability to communicate with patients and for screening and identifying the need for referrals. A majority of students believed that teledentistry is an important means to improve patients' access to dental care and that the School has been providing a good educational environment in providing teledentistry sessions to patients. There were no significant differences in the frequencies of positive and negative responses to all questions ($N = 6$) by gender and by class ($p > 0.05$, in all instances).

Conclusions: Teledentistry eVisits allowed the continuation of patient contact and initial assimilation of patient information. There is potential for this educational initiative to be more actively and comprehensively implemented in the future.

Clinical significance: New educational initiatives allow the continuation of patient contact that will ensure that students will graduate as competent oral health care providers despite challenges imposed by the pandemic.

Keywords: COVID-19 pandemic, Educational teledentistry initiative, Kirkpatrick's multidimensional model.

The Journal of Contemporary Dental Practice (2022): 10.5005/jp-journals-10024-3315

INTRODUCTION

Coronavirus disease-19 (COVID-19) was declared a pandemic by the World Health Organization on March 11, 2020. Since then the pandemic has caused a devastating mass casualty, economic instability, unprecedented demands on health care, and heavy challenges to academic dental institutions.¹⁻³ The biggest challenge for all 67 dental schools in the United States was trying to ensure the safety and well-being of students, faculty, staff, and patients while managing the financial burdens caused by a reduction in patient care-related revenues and faculty and staff retention. The challenge also forced many institutions to quickly create curricular modifications to maintain continuity of education for students.³

Nationwide, the requirements to limit dental care to emergency treatments during the pandemic had become a driving force to re-evaluate the use of teledentistry at a more comprehensive level. Medicine had long ago offered telehealth visits as an alternative to in-person appointments to patients who have had access to care issues, such as unreliable transportation, immobility, or far distance to care. It has been identified as a cost-effective method for certain medical services to address the predicted shortage of primary care providers and there are billing codes with comparable reimbursement for telehealth visits.⁴ Teledentistry, on the contrary, had been cautiously slow in its implementation nationally. It is defined by the ADA as "the use of telehealth systems and methodologies in dentistry".⁵ While billing codes for teledentistry were effective on January 1, 2018,⁶ it was the pandemic that necessitated an immediate response with the implementation

¹⁻³Loma Linda University School of Dentistry, Loma Linda, California, United States of America

^{4,5,7-9}Division of General Dentistry, Loma Linda University School of Dentistry, Loma Linda, California, United States of America

⁶Dental Education Services, Loma Linda University School of Dentistry, Loma Linda, California, United States of America

Corresponding Author: So Ran Kwon, Division of General Dentistry, Loma Linda University School of Dentistry, Loma Linda, California, United States of America, Phone: +909 558 5118, e-mail: sorankwon@llu.edu

How to cite this article: Nath A, Aoghiz S, Nnagbo C, et al. The Outcome of a New Teledentistry Initiative in Response to the COVID-19 Pandemic: A Cross-sectional Study. *J Contemp Dent Pract* 2022;23(3):284-288.

Source of support: Nil

Conflict of interest: None

of teledentistry across the nation, with the combined challenges of most states' stay-at-home orders; social distancing and mask mandates; the shortage of personal protective equipment, and concerns over a generation of aerosols and droplets during a large majority of dental procedures, that put dentists and their teams at high risk for contracting the disease and for cross-contaminating and transmitting the disease.⁷

At LLUSD, the dental clinics became the safety net for the community for emergent and urgent dental care. Teledentistry services were offered to start on April 16, 2020. Loma Linda University School of Dentistry had implemented a platform,

an application known as “mydentalchart,” to communicate with patients of record. With the onset of the outbreak, this platform was identified as the technology where information on teledentistry would be disseminated to patients; informed consents secured; eVisits would occur. As COVID-19 targeted the medically compromised and the adult population aged 65 and older, the platform was also anticipated to best serve the vulnerable older adult population that were at high risk for in-person visits. However, the anticipated active use of mydentalchart and the introduction of video visits were hindered by barriers that included technology challenges, limited finances, limited staff, bandwidth shortages, and the limited number of dental services that can be offered as an eVisit. Our school quickly modified teledentistry into an e-visit phone call center provided by third and fourth-year dental students. Calling all patients via phone prior to their in-office visits served several purposes. First, to decrease the amount of contact time between patients and dental school personnel to decrease the likelihood of COVID-19 exposure. Second, to perform a preliminary screening to identify patients who are not suitable for predoctoral student treatment due to serious medical or behavioral conditions, the need for dental treatment to be completed more quickly, inability to afford treatment at the school, or the need to be seen immediately in the urgent care clinic. Third, to decrease the amount of chair time used for the comprehensive oral examinations. Last, to allow more dental students to be productive during non-priority clinic time.

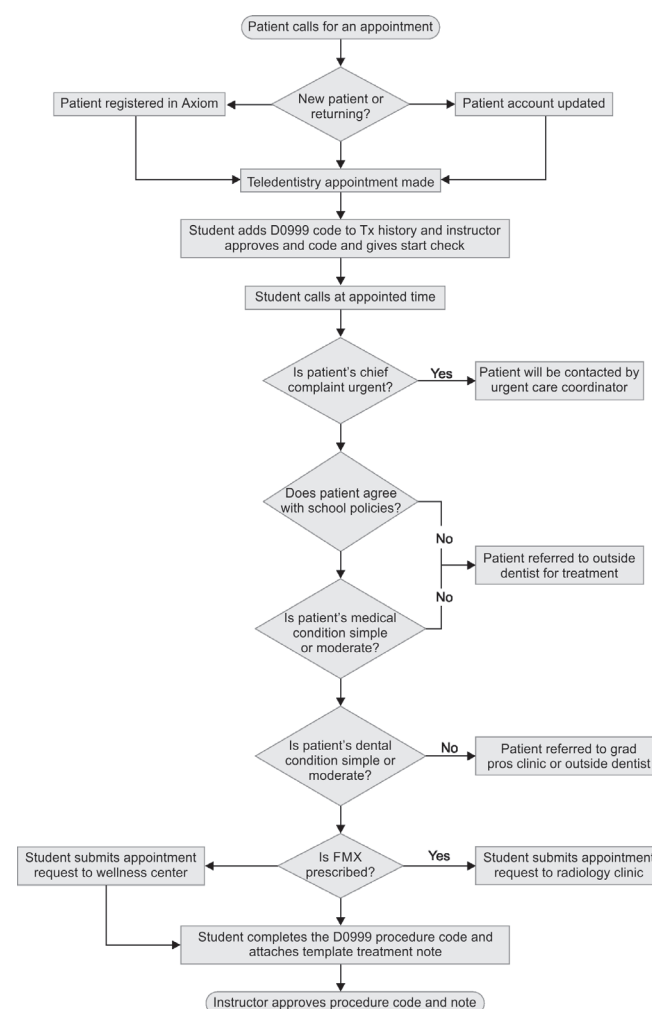
Implementation of a modified way of teledentistry to cope with the COVID-19 pandemic is novel. However, there is scarce information on the educational outcome and students' perspectives on the newly implemented educational initiative. Therefore, the purpose of this study was to evaluate the outcome of LLUSD's educational teledentistry initiative based on Kirkpatrick's multidimensional model of training evaluation which consists of measurement at four levels: (1) participants' satisfaction with the training experience and their attitudes toward the topic; (2) participants' perception and self-report of knowledge and skill acquisition; (3) behavioral change in participants; and (4) institutional outcomes.⁸ We evaluated perceived knowledge acquisition, attitude, and students' satisfaction and hypothesized that the new educational teledentistry initiative would result in positive teaching effectiveness, attitude, and satisfaction.

MATERIALS AND METHODS

The process of the newly implemented teledentistry eVisit initiative is outlined in [Flowchart 1](#).

Patients who called for an appointment at LLUSD main clinics were updated by the call operator if they were patients of record or registered in the Axiom (XTS software, Portland, Oregon, USA) database if they were new patients. A 1-hour eVisit appointment was scheduled and assigned to a third or fourth-year dental student. Teledentistry sessions were held in the conference room and a pod of 8 to 9 students started the calls under the supervision of a faculty. Students were instructed to use the Google Voice app to protect them from using their personal phone numbers allowing them to call anonymously. The main focus and services provided during these eVisits were initial assessment for a comprehensive oral evaluation, a periodic oral evaluation, and a limited oral evaluation. School policies including newly implemented COVID-19 guidelines were explained and patients' commitment to becoming regular patients of record at LLUSD was identified. The patient's chief

Flowchart 1: Workflow of the newly implemented eVisit teledentistry initiative



complaint, missing teeth, and medical history with a complete medication list were entered which patients were instructed to have ready when scheduling the eVisit appointment. If a medical consultation was needed, a form was created and sent to their healthcare provider after the eVisit. Students were required to enter the notes in the Subjective, Objective, Assessment, and Plan (SOAP) form prior to getting their eVisit codes and notes approved by the attending faculty. The eVisit code was “D0999” which was an internal code specific to LLUSD and did not accompany any billing. An appointment request was made for the radiology department with an appropriate radiograph code planned for that particular patient. Each student was given the opportunity to interact with a maximum of 20 patients per quarter. The attending faculties' responsibilities were to approve the codes and notes, give start checks and answer any questions that needed to be addressed during the sessions.

An IRB application was approved by the LLUSD Institutional Review Board (IRB #5210385) for a cross-sectional study that included LLUSD dental students of the Class of 2022 ($N = 134$) and 2023 ($N = 132$). With the approval of the course director, potential participants were contacted by the research team members

5 minutes prior to the beginning of a class. Hard copy surveys were distributed and participants could take their time while filling out the survey. Participation was voluntary and there was no identifier linked to the survey.

The 9-question survey consisted of three sections and is shown in Figure 1. The first section included demographic questions on gender and the graduating class. The second section was related to perceived teaching effectiveness and included questions on the ability to communicate with patients, screen for referrals, and perform comprehensive oral exams (COE), periodic oral exams (POE), and limited oral exams (LOE). Attitude and behavior change was addressed by asking how important teledentistry serves as a means to improve patients' access to dental care and whether participants would actively incorporate teledentistry in their future practice. The impact on the institution was assessed by students' satisfaction with the educational environment in providing teledentistry sessions to patients. Responses were indicated on a 4-point Likert scale with 1 = strongly disagree, 2 = disagree, 3 = agree, and 4 = strongly agree.

The last section included one open-ended question on changes that participants would like to see to improve LLUSD teledentistry sessions.

Descriptive statistics were calculated for all dependent and independent variables. Independent variables were categorized into two domains: (1) gender and (2) graduating class. The findings of descriptive analyses were reported as absolute frequencies of positive and negative responses. Categorical variables were compared using the Chi-squared test (χ^2 test). p -values <0.05 were considered statistically significant. All data were analyzed using SAS version 9.4 (SAS Institute Inc., Cary, North Carolina, USA).



LOMA LINDA UNIVERSITY

Q1. What is your gender identity?

Male ☐ Female ☐ Do not want to disclose ☐

Q2. Which describes your graduating year?

DDS Class of 2022 ☐ DDS Class of 2023 ☐

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	Strongly Agree	Agree	Disagree	Strongly Disagree
Q3. The teledentistry experience at LLUSD has increased my ability to communicate with my patients.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q4. The teledentistry sessions helped me to efficiently screen patients to identify whether they need referrals.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q5. The teledentistry session experience at LLUSD has increased my ability to perform COE/POE/LOE.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q6. Teledentistry is an important means to improve patients' access to dental care.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q7. I plan to actively incorporate teledentistry in my future practice/career.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q8. LLUSD has been providing a good educational environment in providing teledentistry session to patients.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q9. Please suggest changes that you would like to see to improve LLUSD teledentistry sessions.

Fig. 1: Nine item questionnaire

RESULTS

A summary of study participants by graduating class and by gender is listed in Table 1. Out of 266 students, 200 students responded to the survey (Response rate: 75.2%). The Class of 2022 had a higher response rate (87.3%) than the Class of 2023 (62.9%).

The overall response to the six questions in the second section is illustrated in Figure 2. The perceived teaching effectiveness of the newly implemented educational initiative was high for increasing the ability to communicate with patients (positive response: 68.9%) and for screening and identifying the need for referrals (positive response: 62.9%). A majority of students believed that teledentistry is an important means to improve patients' access to dental care (65.3%) and that the school has been providing a good educational environment in providing teledentistry sessions to patients (70.4%). Only half of the students felt that it increased their ability to perform COE/POE/LOE (52.3%) and that they would actively incorporate teledentistry into their future practice (50.8%).

Based on the χ^2 test there were no significant differences in the frequencies of positive and negative responses to all questions ($N = 6$) in the second section by gender and by class ($p > 0.05$, in all instances).

There were 71 students (36%) that responded to the open-ended question on how to improve the educational initiative. The most frequent comments were to move the teledentistry session to the D2 year, make the eVisits available remotely from the student's home, enable a video component so that there is better interaction with the patient, and create a better environment for calling since there was too much background noise making it difficult to listen to the patient, add more training to the students so that students could feel confident in accomplishing the eVisits, and appreciation of a modified teledentistry platform to ensure that education can be continued (Fig. 2).

Table 1: Summary of study participants by graduating class and by gender

	Male	Female	Not disclosed	Total	Response rate
Class of 2022 (N = 134)	60	55	2	117	87.3%
Class of 2023 (N = 132)	41	41	1	83	62.9%

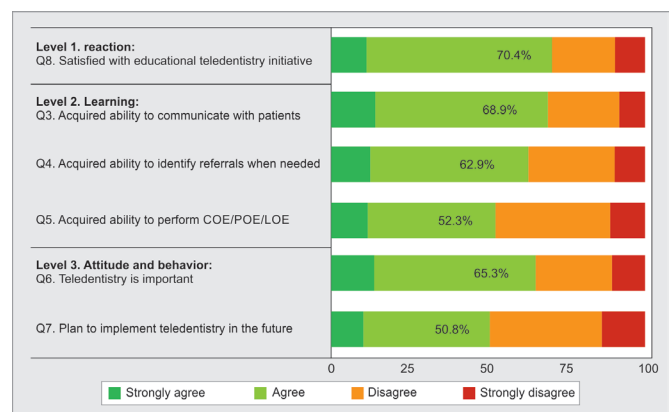


Fig. 2: Responses based on multidimensional Kirkpatrick's model. COE, comprehensive oral exam; POE, periodic oral exam; LOE, limited oral evaluation

DISCUSSION

The disruptions caused by the COVID-19 pandemic affected all aspects of daily life, and dentistry and dental education were not immune to it.^{9,10} The American Dental Education Association (ADEA) listed seven key actions taken by academic dental institutions as a response to the pandemic. First, students were sent home for a period of time with a plan to reassess the time for returning to campus. Second, didactic instruction moved online while the teaching to limited numbers of students was allowed following social distancing guidelines. Third, preclinical instruction continued at some institutions following social distancing guidelines. Fourth, most institutions limited patient care only to urgent or emergency needs, with advanced dental education residents and faculty providing most of this care. Fifth, external rotations and travel were cancelled either by the school or the facility. Sixth, dental licensure examinations were rescheduled. Seventh, graduation events were cancelled or modified to meet COVID-19 restriction guidelines.¹¹ LLUSD had adapted to the crisis following the aforementioned key actions. Furthermore, to maintain continuity of dental education a task force was created to establish a new eVisit teledentistry educational initiative. The task force identified the learning objectives and developed the workflow including a 19-page teledentistry manual listing scripts for students and the required data to be entered into the patient database. As we slowly transition out of the pandemic, it was crucial to reflect on the strengths and the limitations of this new educational initiative for optimization while keeping the well-being of patients, students, and faculty at the center of operations. To fully understand the impact, we evaluated the perceived knowledge acquisition, attitude, and students' satisfaction. Based on the results, we accepted our hypothesis that the new educational initiative would yield positive responses in knowledge acquisition, attitude, and student satisfaction. The responses were not affected by gender or class.

In assessing the learning initiative, we adopted the principles of the Kirkpatrick model that can create a chain of evidence of the value of the learning experience.⁸ The first level of evaluation is the lowest level and addresses learners' satisfaction which is related to question item 8, asking whether the school had provided a good educational environment in providing teledentistry sessions to patients. The positive response (70.4%) was the highest among all questions. The response reflects the success of the initiative as a response to COVID-19-related restrictions and highlights that students appreciated the school's efforts in continuing student-patient interaction and education. The second level assesses the acquired knowledge which was addressed by three questions. Students rated their perceived knowledge acquisition for communication, referral, and different types of examinations. The third level determines whether there have been the behavior or attitude changes on completing the learning. Interestingly, while approximately two-thirds believed that teledentistry is an important means to improve patients' access to dental care only half of the students planned to actively incorporate teledentistry in their future careers. This notion aligns with other studies that reported that dental practitioners consider teledentistry as a useful platform for patients but acknowledge that there are implementation barriers such as practice expenses, equipment setup costs, time, technical incompatibility, and security.^{12–15} A limitation of our study was that it did not evaluate the fourth level—the impact of the learning initiative on the school. Further data collection is required

to address the impact of the new initiative including cost analysis, financial value, quality, and overall outcome.

Teledentistry eVisits allowed the continuation of patient contact and initial assimilation of patient information. Yet it did have some inherent weaknesses that the school felt needed to be addressed. One of the main desires of the teledentistry sessions was to serve as a screening mechanism for the patient population. With the large variety of patient needs with various levels of complexities, it is important to be able to screen patients to determine if their needs can be met at the student clinician skill level. This led to the complication of having patients get further along in the new patient examination process before it would be determined that they were not an appropriate teaching case. This led to significantly more unhappy patients and a less efficient process than anticipated. It was identified that the biggest challenge for this particular system of teledentistry was the inability to visually and manually examine the patients during a teledentistry eVisit session. Thus, the ability to accurately screen the patients' oral health needs was greatly diminished. Thus, as COVID-19 restrictions have lessened and the ability to have additional in-person patient visits has increased, it was decided at the beginning of 2022 to discontinue the teledentistry sessions and to replace them with the new patient screening process. However, we realize that telehealth is here to stay and that there will be a need to optimize teledentistry's utilization for initial examination and data collection of patients' chief complaint, medical history and dental history thus expanding the scope of its utilization globally.

CONCLUSION

Within the limitations of this study, we conclude that teledentistry eVisits allowed the continuation of patient contact and initial assimilation of patient information. By addressing the weaknesses, there is potential for this educational initiative to be more actively and comprehensively implemented in the future.

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