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Accuracy of Telemedicine Consultations in Oral and Maxillofacial Surgery During the COVID-19 Pandemic

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Purpose: Telemedicine has been an emerging trend over the past few years and has seen an exponential rise due to the COVID-19 pandemic. The purpose of the present study was to determine the accuracy of planned oral surgery treatment for patients seen initially by telemedicine in the department of oral and maxillofacial surgery during the pandemic.

Methods: This was a retrospective cohort study. Record review of all patients who received telemedicine consultations during the pandemic time frame of March 1, 2020, to March 1, 2021, was performed. The primary outcome was to confirm the accuracy of the planned oral surgery treatment. Accuracy was defined as the ability to conduct the planned surgery with chosen anesthesia (local anesthesia, valium + local anesthesia, intra venous sedation, general anesthesia) at the immediate follow-up appointment without the need for further preoperative testing, evaluation, and consultation. The secondary outcomes were to determine the change in surgical plan, anesthesia plan, and medical plan. Predictor variables included age at the time of telemedicine consultation, gender, race, ethnicity, and the type of consult. Descriptive statistics and logistic regression analysis were executed.

Results: The study sample comprised 286 (64.56%) females and 157 (35.44%) males. The age range of the study population was 9 to 92 years, with a mean age of 33.88 years (standard deviation = 16.29 years). In the cohort of 443 patients who obtained telemedicine consultations, 98.19% were successfully treated at the following appointment. Four hundred thirty-one (97.3%) out of the 443 telemedicine consults were pertaining to dentoalveolar concerns. Logistic regression analysis showed that neither age nor gender has significant effects on the change of surgical and anesthesia plans.

Conclusions: Telemedicine can be effectively utilized in performing consultations for routine oral surgical procedures, especially dentoalveolar surgeries. Besides, a preoperative assessment to determine anesthesia and setting of care can also be determined during telemedicine consultations. However, given the lack of control group and the observational nature of this study, the results must be interpreted with caution.

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The worldwide pandemic caused by the severe acute respiratory syndrome coronavirus 2 has enhanced the use of telemedicine across many disciplines in medicine and dentistry. Virtual consultations have not only helped preserve medical resources including personal protective equipment but have also assisted in reducing the risk of exposure to the patients and health care providers, while maintaining patient's access to care.^{1,2} Additionally, telemedicine has also played a role in caring for patients who reside in rural and underserved areas and in assisted and senior living facilities.^{3,4} Other advantages include saving medical transportation costs and travel time not only for the patient but also for caregivers.⁴ Owing to these benefits, telemedicine has evolved across multiple specialties, including oral and maxillofacial surgery, as a valuable tool for providing patient care.

Telemedicine was already in use by oral and maxillofacial specialists prior to the COVID-19 pandemic; however, it was not as prevalent as it is now.⁵ Several studies have supported the use of telemedicine in oral and maxillofacial surgery during the pandemic. The majority of these studies were clinician and patient satisfaction surveys.⁶⁻⁹

The purpose of this study was to determine the accuracy of a planned oral surgery treatment for patients seen initially by telemedicine in the department of oral and maxillofacial surgery during the COVID-19 pandemic. Accuracy was defined as the ability to conduct a planned surgery with chosen anesthesia (local anesthesia [LA], valium + LA, intravenous [IV] sedation, general anesthesia [GA]) at the immediate follow-up appointment without the need for further preoperative testing, evaluation, and consultation. The investigators hypothesized that the telemedicine consultations are accurate when planning an oral surgery treatment. The specific aims of the study were to measure the accuracy of planned oral surgery treatments with respect to the change in surgical, anesthesia, and medical plans.

Materials and Methods

STUDY DESIGN

To address the research purpose, the investigators designed and implemented a retrospective cohort study. This study was approved by the University of Rochester Research Subject Review Board (STUDY00005871). The study population was composed of all patients who received telemedicine consultations from the department of oral and

maxillofacial surgery during the pandemic time frame of March 1, 2020, to March 1, 2021. The charts of patients were accessed through the hospital's electronic health records. To be included in the study sample, patients had to obtain a telemedicine consultation and finish a postconsultation visit, with completed records. No restrictions on age, gender, race, and ethnicity were placed. Patients were excluded if the telemedicine consultation did not result into a postconsultation visit and if they had incomplete records.

WORKFLOW EMPLOYED FOR THE TELEMEDICINE CONSULTATIONS

The telemedicine consultations were performed by the first-year residents and noncategorical interns under the supervision of the attending in the department of oral and maxillofacial surgery. The consultations in the form of zoom video visits were scheduled for a 30-minute duration anytime from 8:30 AM to 4 PM, Monday through Friday. The visits were scheduled upon receiving appropriate referral and imaging required for the consultation. The residents were initially directly supervised for the entire length of consultation, and when merited to perform consultations properly, they were allowed to progress to perform majority of the consults by themselves with the attending joining in the last 10 minutes to review the imaging, diagnosis, and the treatment plan and to clarify or answer any questions. The order and set of questions asked during the telemedicine consultations were no different from those used in the in-person consultations. Next, the airway exam consisted of the examination of neck mobility, range of motion, and maximal incisal opening. Patients were asked to keep their mouth wide open, with protruded tongue and phonate, to visualize their uvula and faucial pillars. Patients were also asked to show their profile view to assess for the thyromental distance. After history-taking and examination, patient's imaging results sent over by the referring provider was reviewed with the patient utilizing the share screen mode on the zoom platform. The referral, patient's examination, and imaging findings were tallied to form a diagnosis. Based on all the available information, a treatment plan was formulated. The patient was then explained risks, benefits, and alternatives of the procedure. Additional treatment-related instructions were provided. After the completion of the zoom video visit, patients were scheduled for a procedure by our staff members.

Table 1. DESCRIPTIVE STATISTICS: AGE, GENDER, AND RACE DISTRIBUTION OF THE STUDY COHORT

Age					
N	Mean	Standard Deviation	Median	Minimum	Maximum
443	33.88	16.29	29	9	92
Gender		Frequency		Percent	
Female		286		64.56	
Male		157		35.44	
Race		Frequency		Percent	
Asian		5		1.13	
Black		93		20.99	
Native		3		0.68	
Other		18		4.06	
Unknown		90		20.32	
White		234		52.82	

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STUDY VARIABLES

The predictor variables in this study included the age at the time of telemedicine consultation, gender, race, ethnicity, and the type of consult. The primary outcome variable of the present study was to confirm the accuracy of the planned oral surgery treatment for patients seen initially by telemedicine in the department of oral and maxillofacial surgery during the COVID-19 pandemic. Accuracy was defined as the ability to conduct a planned surgery with chosen anesthesia (LA, valium + LA, IV sedation, GA) at the immediate follow-up appointment without the need for further preoperative testing, evaluation, and consultation. The secondary outcome variables were to determine the change in surgical plan, anesthesia plan, and medical plan.

DATA COLLECTION AND DATA ANALYSIS

Information on the variables mentioned above was entered in an Excel data sheet and transferred to SAS for the data analysis (SAS version 9.4; SAS Institute Inc, Cary, NC). Descriptive statistics were obtained to characterize the study variables. Multiple logistic regression with backward model selection was used to study the association between each outcome and some covariates of interest, such as age, gender, race, ethnicity, and type of consult. Statistical significance was set at 0.05.

Results

A total of 443 patients met the inclusion criteria for the retrospective record review and data analysis. As

Table 2. TYPE OF CONSULTS PERFORMED UTILIZING TELEMEDICINE

Type of Consult/Diagnosis		
Type of Consult/Diagnosis	Frequency	Percent
Dentoalveolar	431	97.3
Orthognathic	1	0.23
Pathology	3	0.69
TMJ	6	1.35
Trauma	2	0.45

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presented in [Table 1](#), the study sample comprised 286 (64.56%) females and 157 (35.44%) males. The age range of the study population was 9 to 92 years, with a mean age of 33.88 years (standard deviation = 16.29 years). As shown in [Table 2](#), 431 (97.3%) out of 443 telemedicine consults were pertaining to dentoalveolar concerns. The logistic regression analysis shows that neither age (odds ratio [OR] = 1.013; 95% confidence interval [CI], 0.998-1.029; $P = .0930$) nor gender (OR = 0.647; 95% CI, 0.376-1.113; $P = .1156$) has significant effects on the change of surgical plan ([Table 3](#)). Similarly, neither age (OR = 0.979; 95% CI, 0.950-1.010; $P = .1804$) nor gender (OR = 0.523; 95% CI, 0.221-1.238; $P = .1406$) has significant effects on the change of anesthesia plan ([Table 4](#)).

CHANGE IN SURGICAL PLAN

Change in the surgical plan was noted in 63 (14.22%) out of 443 patients. However, none of these patients' procedures were rescheduled or cancelled on the day of surgery. The changes in the surgical plan were minor. Addition of nonrestorable and impacted teeth was noted in 32 patients. Deletion of teeth that appeared restorable and the patient expressed getting them restored was reported in 10 patients, the nonrestorable teeth were extracted, and patient's visit was completed. Fourteen patients did not want all 4 third molars extracted at the same time, and therefore, phased treatment was performed as per the patient's desire. The reasons for the change in surgical plan are documented in [Table 5](#).

CHANGE IN ANESTHESIA PLAN

Change in the anesthesia plan was noted in 22 (4.97%) of the 443 patients. The reason for a change in anesthesia plan is documented in [Table 6](#). The anesthesia plan of 11 out of 22 patients was changed from IV to LA due to pregnancy, financial restrictions, inability to arrange an escort, several unsuccessful IV attempts, and elevated blood pressure. The anesthesia

Table 3. RESULTS OF THE LOGISTIC REGRESSION ANALYSIS OF CHANGE OF SURGICAL PLAN

Effect	Odds Ratio Estimates			P Value
	Point Estimate	95% Confidence Interval		
Age	1.013	0.998	1.029	.0930
Gender, female vs male	0.647	0.376	1.113	.1156

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plan of 5 out of 22 patients was changed from IV to GA due to several medical reasons and anticipated surgical difficulties of the procedure as described in Table 6.

CHANGE IN MEDICAL PLAN

No change in the medical plan was recorded in the 443 patients.

Discussion

The purpose of this study was to determine the accuracy of planned oral surgery treatment for patients seen initially by telemedicine in the department of oral and maxillofacial surgery during the COVID-19 pandemic. Accuracy was defined as the ability to conduct the planned surgery with chosen anesthesia (LA, valium + LA, IV sedation, GA) at the immediate follow-up appointment without the need for further preoperative testing, evaluation, and consultation. The investigators hypothesized that the telemedicine consultations are accurate when planning oral surgery treatment. The specific aims of the study were to measure the accuracy of planned oral surgery treatments with respect to the change in surgical, anesthesia, and medical plans. The study findings revealed 98.19% (435 of the 443) of patients could undergo their procedure at the immediate appointment following a telemedicine consult.

Results from the current study generated several outcomes. First, a change in the surgical plan was noted in 63 (14.22%) of the 443 patients. Although the percentage was relatively high, the change in the surgical plan was minor, including the addition or deletion of the teeth for extraction, performing phased treatment, addition of a biopsy to the plan, and addition of the laterality for arthrocentesis. It is important to note that none of the procedures of the patients whose treatment plan was changed were rescheduled or cancelled on the day of surgery as described under the results section. Second, a change in the anesthesia plan was noted in 22 (4.97%) of the 443 patients. Out of the 22 patients, only 8 patients were unable to get

Table 4. RESULTS OF THE LOGISTIC REGRESSION ANALYSIS OF CHANGE OF ANESTHESIA PLAN

Effect	Odds Ratio Estimates			P Value
	Point Estimate	95% Confidence Interval		
Age	0.979	0.950	1.010	.1804
Gender, female vs male	0.523	0.221	1.238	.1406

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the procedure on the planned surgery date, and 98.19% (435 of the 443) of patients could undergo their procedure at the immediate appointment following a telemedicine consult. Third, no change in the medical plan was recorded in the 443 patients.

Our results indicate that telemedicine can be very effectively utilized in performing consultations for routine oral and maxillofacial surgery procedures, especially dentoalveolar surgeries. Telemedicine was already in use for oral and maxillofacial surgery prior

Table 5. CHANGE IN SURGICAL PLAN

Number of Patients	Reason for Change in Surgical Plan
32	Addition of nonrestorable and impacted teeth
2	Deletion of alveoloplasty quadrants
1	Bone grafting after the extraction was not performed due to financial concerns
10	Deletion of teeth that appeared restorable and patients expressed getting them restored, the nonrestorable teeth were extracted, and patient's visit was completed
14	Patients did not want all 4 third molars extracted at the same time, and therefore, phased treatment was performed as per patient's desire
2	Underwent biopsy in addition to the planned treatment
1	Bilateral arthrocentesis as opposed to just the right side
1	Underwent maxillary labial frenectomy in addition to the planned treatment

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Table 6. CHANGE IN ANESTHESIA PLAN

Number of Patients	Reason for Change in Anesthesia Plan
11 Patients were changed from IV to LA	3 Patients were pregnant 1 Patient had financial restrictions 1 Patient had elevated blood pressure for IV sedation 1 Patient could not arrange for an escort 1 Patient: We were unsuccessful in placing IV, and after several attempts, the procedure was converted to LA. 4 Patients: The reason was not documented
5 Patients were changed from IV to GA	1 Patient: It was determined that the inferior alveolar nerve was riding higher up in between the roots of #32, and the procedure would be better performed in an operating room. 1 Patient had an esophagogastroduodenoscopy scheduled with the gastroenterology service at our hospital and requested for a combined oral surgery procedure. 1 Patient: After the ASA monitors were placed, we noted bradycardia with heart rate in low 30s. We decided to not proceed with sedation and referred him to a cardiologist for further workup. 1 Patient reported 7 seizures a day prior to the presentation for sedation. 1 Patient was extremely aggressive during IV placement, and due to safety concerns, we rescheduled the procedure to be performed in the operating room.
2 Patients were changed from LA to IV	Reason not documented.
1 Patient was changed from GA to IV	Due to the operating room cancellation during the COVID-19 patient surge at our hospital.
1 Patient was changed from LA to GA	This patient was extremely anxious, could not have tolerated the procedure under LA, and was not a sedation candidate.
1 Patient was changed from GA to Valium	As the patient wanted a sooner appointment.
1 Patient was changed from IV to Valium	The patient's COVID test was old and had to get a new test performed as per the hospital protocol. The patient did not want to remain NPO until the results of the COVID test were final. We accommodated the patient under LA and Valium later in the day.

Abbreviations: GA, general anesthesia; IV, intravenous; LA, local anesthesia.

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to the COVID-19 pandemic to improve access to patients in remote locations. Rollert et al studied 35 patients retrospectively to estimate the effectiveness of telemedicine consultations for preoperative assessments.¹⁰ In their study, efficiency was defined as the capability to complete the surgery with GA at the immediate following appointment without the need for additional preoperative testing, evaluation, or consultation.¹⁰ The authors noted that 33 out of 35 (94%) patients were able to successfully undergo a surgery with GA at the immediate appointment following consultation via telemedicine.¹⁰ In a separate follow-up retrospective study by Wood et al of 335 patients over a 6-year period, authors found telemedicine consultations were successful 92.2% of the time in utilizing the data obtained to formulate a diagnosis and treatment plan.⁵ Furthermore, patients were identified

accurately 99.6% of the time for the clinic or hospital operating room setting.⁵ This result is consistent with the present study that noted 98.19% of the patients could undergo their procedure at the immediate appointment following a telemedicine consult. The present study investigated the accuracy of planned oral surgery treatment for patients seen initially by telemedicine in the department of oral and maxillofacial surgery during the COVID-19 pandemic and is similar to the study performed by Wood et al who measured the efficiency and reliability of telemedicine consultations for preoperative assessment of patients.⁵

A comparative study conducted by Champion et al enrolled a total of 69 patients who were randomized into either an in-person group or a telemedicine group for postoperative care after their third molar surgery.⁸

Following their postoperative visit, patients were administered a satisfaction survey questionnaire. The authors noted no statistically significant difference between the satisfaction scores of the 2 groups. However, patients in the telemedicine group reported statistically significant increased satisfaction pertaining to cost-effectiveness as they did not incur travel expenses and parking costs. Additionally, the telemedicine group did not have to take time off work and was able to save the opportunity costs.⁸

Several studies have supported the use of telemedicine in oral and maxillofacial surgeries during the pandemic. The majority of these studies were clinician and patient satisfaction surveys.^{6,9} A survey study conducted by Al-Izzi et al amid the COVID-19 pandemic to assess clinician and patient desire and willingness for virtual consultations in maxillofacial surgery concluded that teleconsultations were well accepted by all clinicians.⁶ Additionally, they also noted that 149 out of 151 (98.7%) were able to complete a planned treatment based on the working diagnosis established during the virtual consultations. This result is consistent with the present study. However, Al-Izzi et al carried out their study during the pandemic over a short period of time, and their sample size was very small.⁶

Telemedicine has been used in other areas of oral and maxillofacial surgery and has proven successful. Its application in diagnosing maxillofacial fractures through teleradiology has shown promising results. A study performed by Brucoli et al triaged 467 facial trauma patients over 4 years of utilizing the telemedicine system from peripheral hospitals to correctly refer them to a maxillofacial trauma hub center.¹¹ The authors noted teleradiology allowed for an exchange of information between the specialists at the trauma hub center and their colleagues at a local peripheral hospital, thereby providing an effective way of completing remote consultations.¹¹ In the present study, 431 (97.3%) of the 443 telemedicine consults were pertaining to dentoalveolar concerns. Only 2 patients with maxillofacial trauma were seen for a consultation via telemedicine. One patient had a left mandibular angle fracture, and the other patient had bilateral displaced nasal bone fractures. Both patients were appropriately triaged and treated by our service in the operating room.

Telemedicine has been used effectively in the management of the temporomandibular joint disorders. A multicenter, nonrandomized clinical study conducted by Salazar-Fernandez et al included 710 patients with temporomandibular joint disorders in the standard group and 342 in the telemedicine group.¹² From the telemedicine group, only 35 (10%) patients presented with TMJ pathology that required a maxillofacial surgery. The remaining 307 (89.7%) received

nonsurgical treatment in the primary care center via high-resolution consultations.¹² In the present study, only 6 patients with temporomandibular joint dysfunction were seen via telemedicine. All 6 patients were diagnosed correctly, and their magnetic resonance imaging findings were discussed utilizing telemedicine. All 6 patients were surgical candidates and appropriately treated following their telemedicine appointments.

A possible impediment to a broader application of telemedicine is the reimbursement for the providers. To address this concern, Nadella et al performed a study in which the authors reviewed the reimbursement rates of 6,082 submitted claims for the telemedicine and in-person visits in an academic oral and maxillofacial surgery practice.¹³ The authors found the mean reimbursement per insurance payor to be \$98.07 for a telemedicine visit. Their study results suggested that there were no major differences in the financial reimbursement rates between telemedicine and in-person office visits. The average reimbursement for a telemedicine consultation by the insurance payors in our study was \$63.80. A potential reason for this difference could be varying reimbursement policies between states and payors. Future studies can compare the reimbursement rates between diverse insurance providers and among different states across the United States.¹³

The present study has a few limitations. First, a control group that received in-person consultations was not included. Second, the majority of the telemedicine consultations were performed for dentoalveolar concerns. Third, only patients who obtained telemedicine consultations and had finished a postconsultation visit were included in the study. Therefore, this study sample did not include patients who had difficulty utilizing the telemedicine system. Finally, this was a retrospective study, and there was some missing information in the electronic record pertaining to reasons for the change in the anesthesia plan for a few patients. Despite these limitations, this study brings its own significance as it determined the accuracy of planned oral surgery treatment for patients seen initially by telemedicine in the department of oral and maxillofacial surgery during the COVID-19 pandemic. Notwithstanding these limitations, our study included a relatively large cohort of patients who obtained telemedicine consultations, and 98.19% were successfully treated at the following appointment.

In conclusion, the use of telemedicine has become widespread since the onset of the COVID-19 pandemic. The results of this study suggest that telemedicine can be very effectively utilized in performing consultations for routine oral and maxillofacial surgery procedures, especially dentoalveolar surgeries. Besides, a preoperative assessment to determine the

anesthesia plan and the setting of care can also be determined during telemedicine consultations. Future studies should emphasize on utilizing a control group of in-person consults to compare the accuracy between the 2 groups.

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