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Teledentistry control examination after surgical extraction of third molars

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Abstract

One of the most commonly performed surgical interventions in dentistry is the third molar exatraction. The procedure may be routinely performed or associated with complications. There have been numerous described variations in the postoperative course. The aim of our investigation was to examine the reliability of postoperative control of surgical third molar extraction using the method of teledentistry based on patients' smart phone devices.

We performed an experimental randomized study. The control examination undertaken a day after the surgical procedure consisted of two parts: a virtual one and in-person one. Our digital examination involved photographs taken by patients themselves and an electronic survey. The oral surgeon evaluated first the digital control examination, and afterwards he examined the patient in-person. The results were processed and compared using the Cohen's kappa coefficient, Z test and McNemar's χ^2 test for the statistical significance cut-off value of $p=0.05$.

In total, there were 40 performed control (follow-up) examinations (100%). In 39 (98%) examinations, the results obtained with in-person and virtual approaches were identical. The indications to change their therapy were present in 7 (25%) cases with both methods. The number of actual changes of therapy with in-person approach was 10 (100%), while it was 9 (100%) with teledentistry method. The following agreement values were obtained: sensitivity: 0.9750; specificity: 0.9750; efficiency: 0.9750; and Cohen's Kappa: 0.9500. These values suggested an almost perfect agreement.

The diagnostic differences between patient recovery follow-up using the virtual and in-person approaches after third molar surgical extraction were not statistically significant. In that regard, postoperative course follow-up may rely with a high degree of confidence on contemporary digital communication technologies.

Key words:

Teledentistry, Third Molar, Control Examination, Pericoronitis, Edema

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Telestomatološki kontrolni pregled posle hirurškog vađenja umnjaka

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Abstrakt

Jedna od najzastupljenijih stomatoloških hirurških intervencija je ekstrakcija umnjaka. Može biti rutinska i komplikovana. Opisane su brojne varijacije u postoperativnom toku. Cilj našeg istraživanja je bio ispitati pouzdanost postoperativne kontrole hirurške ekstrakcije umnjaka metodom telestomatologije bazirane na pametnim telefonima pacijenata

Sprovedena je eksperimentalna randomizirana studija. Kontrolni pregled dan posle operativnog zahvata, sastojao se od iz dva dela: virtuelni i in-person. Digitalni kontrolni pregled se sastojao od fotografija pacijenta i elektronskog upitnika. Oralni hirurg je prvo ocenjivao digitalni kontrolni pregled, a potom je in-person pregledao pacijenta. Rezultati su obradjeni i uporedjeni Kohenovim kappa koeficijentom, Z testom i Mc Nemmar-овим χ2 testom za prag značajnosti p=0.05

Urađeno je 40 (100%) kontrolnih pregleda. Kod 39 (98%) pregleda dobijeni su identični rezultati in-person i virtuelnim putem. Indikacija promene terapije postavljena je u 7 (25%) slučajeva kod oba metoda. Broj konkretnih izmena terapije kod metode in-person iznosio je 10 (100%), a kod metode telestomatologije 9 (100%). Dobijene su sledeće vrednosti saglasnosti: sensitivity: 0.9750, specificity: 0.9750, efficiency: 0.9750. Cohen's Kappa: 0.9500. Ove vrednosti ukazuju na skoro perfektnu saglasnost.

Dijagnostičke razlike između praćenja oporavka pacijenata sa hirurškom ekstrakcijom umanjaka, virtuelnim putem i konvencionalnom metodom in-person, nisu statistički značajne. Praćenje postoperativnog toka može se sa visokom pozdanošću osloniti na moderne digitalne komunikacione tehnologije.

INTRODUCTION

Extraction of the third molars is one of the most common surgical interventions in dentistry[0]. The reasons for third molar extraction may be different. They range from dental crowding, then pericoronitis, less and more serious infections caused by these teeth, all the way to complex pathological changes associated with them[2-4]. The course of this surgical intervention may be routine or is accompanied by complications; moreover, numerous complications in the postoperative period have been described as well[3-6]. Nevertheless, most of these interventions have a normal postoperative period and in most cases there is no need to change the planned postoperative therapy[7-9]. In order to monitor the course of recovery and, if required, to change timely the postoperative therapy, the patients are examined 24 h after the surgery[10-12].

On the other hand, the ever increasing presence of digital computerized and telecommunication technologies among the population has made possible the expansion of telemedicine capacities in various areas of medicine. In some of them it has already become the standard, and most of them are currently witnessing expansion in that regard[13-14]. Teledentistry, i.e. telemedicine applied in dentistry, offers numerous advantages reflected above all in the availability of distant dentistry consultations, better patient management and significant savings of both the time and resources[15-16].

Aim

The aim of our study was to examine the reliability of postoperative follow-up control of surgical extraction of third molars using the teledentistry method based on patients' smart phones.

Methods

Our investigation was an experimental randomized study. The study was approved by the Ethics Committee of the Dental Medicine Clinic in Niš and the Ethics Committee of the Faculty of Medicine in Priština – Kosovska Mitrovica. The study took place at the Dental Medicine Clinic in Niš and

the Dentistry Clinic of the Faculty of Medicine in Priština – Kosovska Mitrovica. The study enrolled 37 adult patients of both genders. There were 43 (100%) surgically extracted third molars, 24 (56%) in men and 19 (44%) in women. Out of the total number, 15 teeth (35%) were upper jaw third molars, and 28 teeth (65%) were lower jaw third molars. Altogether, there were 40 (93%) postoperative follow-up controls, 22 (55%) performed in men and 18 (45%) in women. Three (7%) controls could not be performed since the patients did not turn up (Tables 1 and 2).

Table 1 - Number of extractions and controls

	Number of extractions	%	Number of controls	%	Number of missed controls	%
	43	100%	40	93%	3	7%
Men	24	56%	22	55%	2	67%
Women	19	44%	18	45%	1	33%

Table 2 – Third molar distribution according to their anatomical sites

	Left		Right		Total	
Upper jaw	7	47%	8	53%	15	35%
Lower jaw	16	57%	12	43%	28	65%
TOTAL	23	54%	20	46%	43	100%

The control examination consisted of two parts. In the first part, the patient was photographed by any present person, usually a patient's escort. The photographs were taken based on the procedure guidelines, but without any prior training of the person who took the photograph. The guidelines involved three extraoral patient photographs: two profiles and one *en face*, in order to visualize well the extraoral changes (swelling, above all). Then, a couple of photographs were taken of the inside of the mouth, in order to visualize the postoperative area and intraoral tissue in general.

The patients then were asked to fill out the digital survey (Figure 1). Together with the photographs taken, it was uploaded via a local network to the local computer server. The server started an especially created application in support of this study (Figure 2). The server fulfilled all the necessary standards and criteria, including the encryption, authorization and authentication features. In such a way performed digital control examination was then sent to a reviewer (**Figure 3**). The reviewer made the decision as to the local finding assessment, postoperative recovery of the patient and further therapy **(Table 3).** The second part of the examination involved a conventional direct, in-person examination of the patient.

Table 3 - Agreement between two methods (in-person and teledentistry) in relation to prescribed postoperative therapy after control examination

Parameters	In-person n/N (%)	Teledentistry n/N (%)
Analyzed cases	40/43 (93)	40/43 (93)
identical findings	39/40 (98)	39/40 (98)
different findings	1/40 (2)	1/40 (2)
Additional treatments suggested (cases)	7/40 (17)	6/40 (15)
total number of sugestions	10 (100)	9 (100)
removal of one or more sutures	1/10 (10)	1/9 (11)
drain placement or removal	3/10 (30)	3/9 (33)
correction of antibiotic therapy	2/10 (20)	2/9 (22)
correction of antioedematous therapy	4/10 (40)	3/9 (33)

n – number of cases; N – total number.

Figure 1 – Digital questionnaire on patients' smart phones

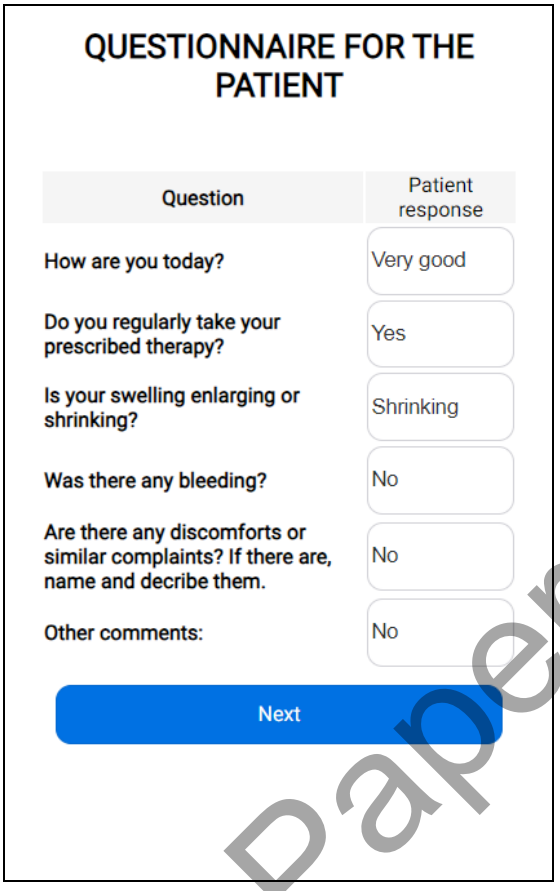


Figure 2 – The upload of photos from smart phones to the local computer server

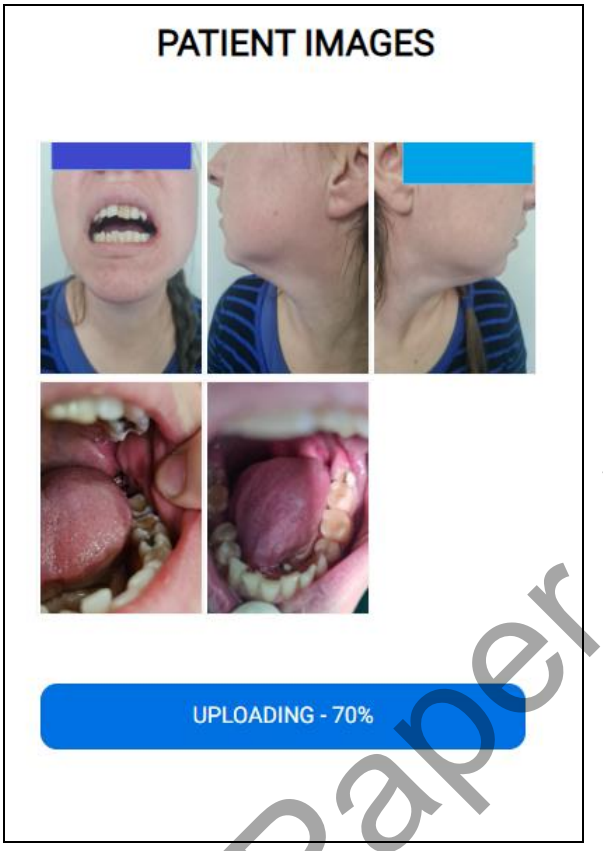
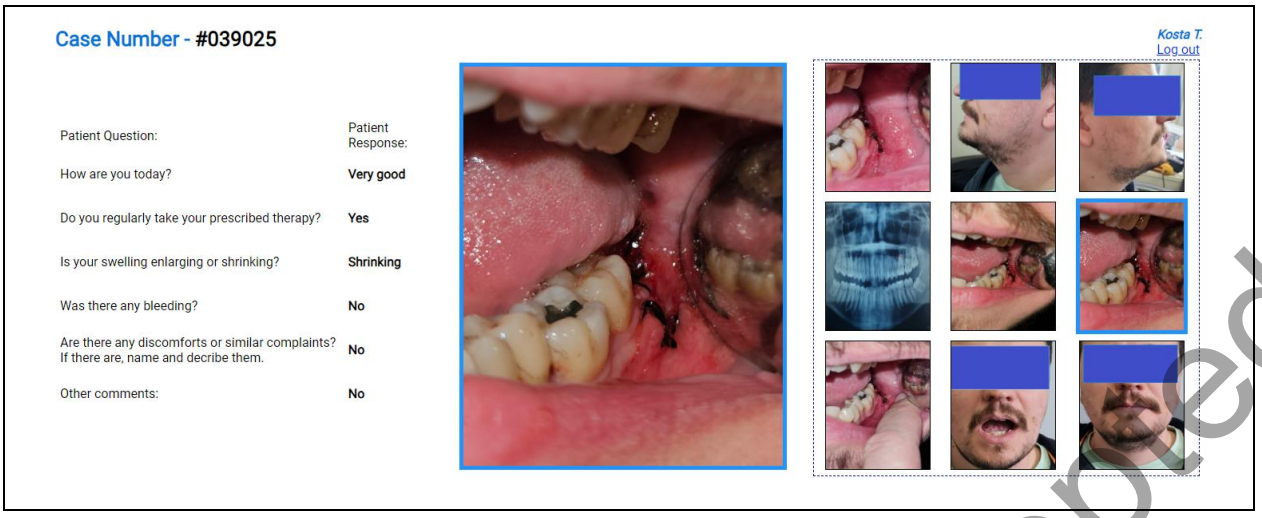


Figure 3 – Digital control examination on a desktop PC of the reviewer



The degree of diagnostic accuracy was determined in accordance with the following scale:

- correct – if the teledentistry postoperative diagnosis was identical to the primary one, or if it was made as an acceptable differential diagnosis;
- incorrect – if the teledentistry postoperative diagnosis was completely different from the primary one, or the diagnosis was not made at all.

Statistical data processing was performed using the *MedCalc* software ver 18.6 for *Windows*. The degree of agreement between the examinations was determined, as well as sensitivity (SE), specificity (SP) and efficacy (EFF). Cohen's kappa coefficient was calculated, Z test comparison was done, as well as the testing with McNemar's χ^2 test for the statistical significance cut-off of p=0.05.

Results

In total, 40 (100%) control examinations were performed. In 39 (98%) examinations the results obtained with digital teledentistry method were identical to in-person patient examination results. In 1 (2%) examination, the results were different. A change or supplementation of therapy at the first control examination was made in 7 (25%) cases with both methods. It should be mentioned that the total number of therapy changes with in-person method was 10 (100%), while with teledentistry method it was 9 (100%). With in-person method the following indications were made: in 1 case (10%), suture removal; in 3 cases (30%), drain placement or removal; in 2 cases (20%),

change of antibiotic therapy; and in 4 cases (40%), change of antiedema therapy. With teledentistry method the following indications were made: in 1 case (11%), suture removal; in 3 cases (33%), drain placement or removal; in 2 cases (22%), change of antibiotic therapy; and in 3 cases (33%), change of antiedema therapy.

Out of 40 (100%) control examinations, an agreement between the in-person method and teledentistry was detected in 39 cases (98%). The following statistical parameters should be reported as well: Sensitivity (SE): 0.9750 (95% CI: 0.8684 - 0.9994), specificity (SP): 0.9750 (95% CI: 0.8684 - 0.9994), efficiency: (Correct classification rate) = 0.9750 (95% CI: 0.9126 - 0.9970). Cohen's Kappa: 0.9500 (95% CI: 0.8816 - 1.0184). Test of Ho: Kappa=0: z=8.50, p =0.0000 t.t.t. Observed agreement: 0.9750 (95% CI: 0.9126 - 0.9970), chance agreement: 0.5000 (95% CI: 0.0000 - 0.0000), positive agreement: 0.9750 (95% CI: 0.9404 - 1.0096), negative agreement: 0.9750 (95% CI: 0.9404 - 1.0096). The obtained agreement values suggested an almost perfect agreement. The diagnostic differences were not statistically significant in our study.

Discussion

The idea that teledentistry can be used in follow-up control examinations in patients who have underwent surgical third molar extraction parallels the advances made in digital and telecommunication technologies. In its essence, it is comfortable for the patients in the sense that visits to their dentistry clinics are avoided, together with everything associated with the visits: traveling, waiting, expenses, additional exposure to the risk of contracting COVID 19 and other diseases[17]. This makes great sense for the patients living at a distance from the place where oral surgery interventions are performed, but also for those who have to travel immediately after the intervention[18-19]. If we take into account the absence of health professionals from work in order to perform in-person control examinations, the savings and other benefits are significantly greater[20].

The control examination a day after the surgical third molar extraction is necessary for a normal postoperative course (without adverse events)[21,22]. In general, examinations using the methods of telemedicine are on the increase, especially after the COVID 19 epidemics[23-25]. In dentoalveolar surgery, control examinations using the method of teledentistry can be successfully

implemented in the follow-up of patient recovery after a dental root resection. Our results agree with the results obtained by Miladinović[26] et al. They established that in-person control examinations a day after the root tip resection can be successfully replaced by distant *„store and forward"* telemedicine examination. Krishna[27] et al., using an *Android* application, were able to monitor successfully patient recovery after routine dental extraction, with an additional ability to give distant instructions, and found a significantly decreased complication rate following dental extractions.

Gangwani [28] et al. reported a successful use of teledentistry consultations in oral and maxillofacial surgery (OMS) procedures, especially in dentoalveolar surgery, in the domains of preoperative patient preparation and postoperative dental care. Kummerow[29] et al. followed the postoperative recovery of patients in general surgery, finding that 68% of doctors and patients thought that it was as good as the visit to a clinic. Further, 24% of them preferred clinical examination, while 8% preferred online examination. Crummey[30] et al. performed a study investigating video-assisted consultations in oral surgery patients. They found that the patients were satisfied with such examinations, but that further standardization of the examinations was required. Jiang[31] et al. established that telemedicine method in patients undergoing total knee arthroplasty was superior to the classical face-to-face rehabilitation method. In contrast to the above mentioned authors, whose results agree with our own results, Walker[32] et al. obtained in their study rather different results. In children with surgically treated clefts, they found that postoperative control examinations could not be successfully performed via electronic ways. As the reason for this, they reported problems essentially technical in nature.

Heimes[33] et al. reported that teledentistry control examinations for minor dental surgery interventions were preferred by 83.3% of patients, while 16.7% preferred to adhere to conventional dental aftercare. They also found that there was no statistically significant difference regarding frequency of symptoms or complication rate. Qari[0] et al. compared the experience of patients at control examinations during the treatment of diseases affecting the temporomandibular joint. They were unable to identify any significant differences in patient experience with virtual and conventional

approach, and thus concluded that control examinations could be performed virtually with a high degree of quality. Difficulties in that regard could be encountered only with older patients, without adequate knowledge in working with virtual platforms.

All these results obtained by reputable authors are in accordance with our own results, except for the study by Walker[32] et al. It is conspicuous that the number of studies dealing with direct comparisons is rather low, which can be explained by still insufficiently developed presence of teledentistry in the practice of dentistry.

However, the benefits of digital communication technologies in everyday practice of dentistry are constantly becoming clearly visible. The COVID 19 pandemics perhaps gave the process a special propulsive force.

Conclusion

The perspectives of teledentistry in the follow-up of dental patients are bright. In particular, in the monitoring of postoperative course after surgical extraction of third molars the method of teledentistry can be used with a high degree of reliability, i.e. there are no statistically significant differences between virtual follow-up approach and conventional in-person patient examination.

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