

Blood Glucose Changes Following Third Molar Surgery

Reza Sharifi ^a, Mahboube Hasheminasab ^a, Farzaneh Bolandparva ^a, Zahra Aboutalebi ^b, Tayebah Ghasemi ^{a*}

^a Craniomaxillofacial Research Center, Department of Oral and Maxillofacial Surgery, School of Dentistry, Tehran University of Medical Sciences, Tehran, Iran; ^b Department of Oral and Maxillofacial Surgery, School of Dentistry, Tehran University of Medical Sciences, Tehran, Iran.

***Corresponding authors:** Tayebah Ghasemi, Craniomaxillofacial Research Center, Department of Oral and Maxillofacial Surgery, School of Dentistry, Tehran University of Medical Sciences, Tehran, Iran. **E-mail:** t.ghasemi90@gmail.com; **Tel:** +98-912 4196305

Submitted: 2020-09-20; **Accepted:** 2020-11-25; **Published Online:** 2020-12-01; **DOI:** 10.22037/rrr.v5i1.33138

Introduction: Surgical removal of third molars has been well-known for causing stressful situation for the majority of the patients. Increasing serum glucose level is expected following acute rise in epinephrine level or probably local anesthetic injection. This study was designed to compare blood glucose levels before and after third molar surgery. **Materials and Methods:** In this prospective clinical trial study, candidates for third molar removal surgery were enrolled. Blood glucose level was measured by glucometer before and 10 minutes after surgery in each patient and the result were compared. **Results:** The mean blood glucose in 92 patients before the procedure were 110.82 ± 15.38 mg/dl and after surgery, it increased significantly to 123.95 ± 16.87 mg/dl ($P < 0.001$). The only variable that effects the blood glucose level in this study was the type of local anesthetic ($P = 0.019$). **Conclusion:** The current study showed that there is a significant increase in blood glucose level in patients undergoing surgical removal of impacted third molar teeth.

Keywords: Local Anesthesia; Epinephrine; Blood Glucose, Dental Surgery

Introduction

Third molar surgery is one of the most common procedures in dental outpatient setting. The procedure has been well-known for causing stressful situation for patients in different age groups (1) that causes follow-up withdrawal in some cases and eventually poses a threat to oral and dental health. The anxiety may be managed with a short face to face interview or prescribing some medications (2). During dental procedures, hemodynamic changes, especially in blood pressure, serum glucose level, pulse and respiratory rate are expected following acute rise in epinephrine level or probably local anesthetic injection. Both autonomic nervous system and endocrine productions are extremely involved in these circumstances and there might be serious consequences in patients with underlying cardiac or endocrine diseases. Glycolysis is one of the main physiologic effects of catecholamine release which results in increased serum glucose level (3).

During dental procedures local anesthetic drugs containing vasoconstrictor are usually used safely. The local vasoconstrictor agents induce sympathetic effects and increase blood glucose levels especially when injected in highly vascularized area or into a vessel inadvertently (4). This study was designed to compare blood glucose levels before and after third molar surgery.

Materials and Methods

Patients

This was a prospective clinical trial study performed from February 2017 to February 2018. Patients were selected of all who underwent surgical removal of unilateral or bilateral third molar teeth in Department of Oral and Maxillofacial Surgery of Tehran University of Medical Sciences, Tehran, Iran. Ethics committee of Tehran University of Medical Sciences approved the study design. The aim of the study was explained to all patients as well as and the risk and benefits of the procedure. Each patient signed the written consent form if an agreement

was reached.

Past medical history, drug history, local anesthetic drug and its dosage, the number of the impacted teeth and their locations were asked and entered in a previously designed checklist. The last meal in each patient was half an hour before surgery. Blood glucose level was measured for each patient before and 10 minutes after the procedure by glucometer. For third molar surgery, local anesthesia was performed by inferior alveolar, long buccal and lingual nerve block injection. Type of local anesthesia is mentioned in table 1 and the surgery was performed by the same method for all patients.

Table 1. Type of local anesthetics and patients

Drug	Patient number
Lidocaine 2% + 1:80,000 epinephrine	50 (54.3%)
Articaine 4% + 1:200,000 epinephrine	41 (44.6%)
Etidocaine 1.5% + 1:200,000 epinephrine	1 (1.1%)

Data analysis

Data analysis was performed using SPSS software version 21. Glucometer results before and after the procedure were compared by Paired T- test if parametric situations were met. If normality assumption was not met, non-parametric alternatives were used. Linear regression was used to predict the effects of different variables on blood glucose levels and to reduce the possible confounding effect of each variable on Paired t test results. Significance level was defined below 0.05.

Results

Finally, 10 out of 102 patients who underwent a procedure longer than one hour were excluded from the study to decrease the confounding effect of long-standing procedures. The mean age of the included patients was 23.87 ± 3.79 and 55 patients

(59.8%) were male and 37(40.2%) were female. Of 92 patients, 11(12%) were visited by a physician regularly for medical reasons and 6 (6.5%) consumed medications. The prevalence of different medical problems among patients was as follows: 2 (2.2%) cardiac disease, one (1.1%) thyroid disease, 3 (3.3%) renal problem, 4 (4.3%) gastrointestinal problems, one (1.1%) history of cancer, 6 (6.5%) history of allergy to foods and 3 (3.3%) hematologic diseases. The diabetic patients and patients with endocrine disorders were excluded from the study. In case of having bilateral impacted third molars, one of the teeth was selected randomly. Local anesthetic was administrated according to the Table 1 and Table 2. The number of extracted teeth was one in 45 (48.9%) and two in 47 (51.1%) patients.

Table 2. Number of used cartridges in patients

Anesthetic cartridges number	Patient number
1	2 (2.2%)
2	27 (29.3%)
3	36 (39.1%)
4	24 (26.1%)
5	3 (3.3%)

The mean surgical time was 32.61 ± 12.37 minutes, with range of 10-60 mins. The average blood glucose level before and 10 minutes after the procedure were 110.82 ± 15.38 mg/dl and 123.95 ± 16.87 mg/dl, respectively. According to the Paired t-test there was a significant difference in blood glucose levels before and after third molar surgery (average increase in blood sugar is 13.13 mg/dl) in this study ($P < 0.001$). In other words, blood glucose level increased significantly following third molar surgery.

Regression analysis showed that only the type of local anesthetic had a significant effect on the blood glucose level and other variables such as gender, age, the number of local anesthetic cartridges used, number of extracted teeth and operation time were not effective (Table 3).

Table 3. The study variables effect on the level of blood glucose changes using regression test

Operation time	Number of extracted teeth	Number of local anesthesia cartridges	Type of local anesthesia	Age	Gender	Constant coefficient	
0.264	0.4	0.448	0.019	0.087	0.149	0.195	P value



Discussion

Different factors such as diabetes mellitus, stress, surgical trauma, epinephrine in combination with local anesthetic agents and some potential medications used by patients can increase blood glucose level (5). Hyperglycemia is a major metabolic response to stress and trauma that is associated with increased serum level of epinephrine and glucagon and elevated production of hepatic glucose (6). Most changes in serum glucose level during dental procedures are expected to occur after vasoconstrictor injection along with local anesthetic agents especially when injected into the vessels inadvertently. Epinephrine, as a vasoconstrictor, has been used with local anesthetic agents to expand the depth and duration of anesthesia. Biochemical changes related to exogenous adrenaline administration occur 10 minutes after intraoral injection in adults. Its influence on both alpha and beta adrenergic receptors and consequent hemodynamic effects are the main subjects involved in increasing systolic blood pressure, heart rates and serum glucose level (7, 8).

In a study by Haghighat *et al.*, (9), it was demonstrated that blood glucose level increased following surgical extraction of third molars under local anesthesia using two cartridges of Lidocaine 2% and epinephrine 1:80,000. No symptoms of hypo or hyperglycemia were observed in any patients and there was no increase in glucose level more than 110 mg/dl. However in our study the mean level of blood glucose was 123.95 mg/dl. In another study, Kaviani *et al.*, (10) found a significant increase in blood glucose with the maximum serum level of 108.56 mg/dl after dental implant placement in which propofol and midazolam were used as anesthetic induction agents. In 2007, the effect of epinephrine injection with local anesthetic agents on blood glucose levels during dental surgical procedures was investigated in diabetic and healthy patients (11). According to that study, no significant changes in blood glucose level occurred postoperatively. In 2001, a study investigated probable changes in blood pressure, glucose and insulin level in 11 patients who received local anesthetics for dental extraction. It was shown that as a result of sympathoadrenal activation, heart rates, glucose and epinephrine level increased post operatively. In 2010, a study reported no significant changes in blood glucose level in patients who were referred for routine dental examinations regardless of receiving anesthetic agents (12). The current study showed a statistically significant increase in blood glucose level in patients undergoing surgical removal of impacted third molar (13.13 mg/dl increase on average) regardless of the maximum

dose of anesthetic agent (number of cartridges), number of extracted teeth or other possible confounding factors except type of local anesthetic which effects the blood glucose level.

Compared to the laboratory method of measuring blood glucose level, the use of glucometer is convenient, non-invasive, cheaper and faster, therefore in this study, glucometers were used to measure blood glucose levels of patients.

To evaluate hemodynamic changes in patients undergoing third molar surgery, the intervening variables should be neutralized. In addition, the surgical technique, experience of the surgeons and surgical difficulty should be the same in all patients and the patient should be selected based on specific inclusion criteria that it was performed in this study. However, in most studies, including the present study, because of insufficient number of samples, it was not possible to use a split-mouth design to exclude all interfering variables.

Conclusion

Compared to preoperative status, blood glucose level is increased after impacted third molar surgery and only the type of local anesthetic changes blood glucose levels statistically. Therefore, the dentist should pay attention to this issue in order to prevent dental emergencies and this might cause some problems in diabetic patient.

Acknowledgment

This study was part of a thesis supported by Department of Oral and Maxillofacial Surgery Tehran University of medical sciences.

Conflict of Interest: 'None declared'.

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Please cite this paper as: Sharifi R, Hasheminasab M, Bolandparva F, Aboutalebi Z, Ghasemi T. Blood Glucose Changes Following Third Molar Surgery . *Regen Reconstr Restor*. 2020;5 (1): e28. Doi: 10.22037/rrr.v5i1.31138.

