

# Evaluation of Changing Serum Blood Glucose Levels after Local Anesthetic Injection during Tooth Extraction

## Original Article

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## **Abstract**

### **Introduction:**

Injection of local anesthesia during dental procedures can induce metabolic changes. The purpose of this study was to evaluate the changes in the serum blood glucose levels after the injection of lidocaine with a vasoconstrictor during tooth extraction.

### **Materials and methods:**

In this clinical trial study, we enrolled 60 patients. We extracted mandibular teeth by using inferior alveolar nerve block. We took a finger blood sample test from each enrolled patient immediately before and 10 min after local anesthesia administration. The anesthetic solution (1.8 mL carpule) contained lidocaine and 1:80,000 epinephrine. It was injected through the inferior alveolar nerve after negative aspiration. Only one carpule was injected into each patient. This study is approved by the ethics committee of the research center of Azad University of Medical Sciences.

### **Results:**

The mean age of the patients in our study was  $39.54 \pm 15$  years. Thirty-five patients were male, and 25 were female. The serum blood glucose level was  $111.6 \pm 25.47$  mg/dL before local anesthesia and  $115.3 \pm 24.39$  mg/dL after tooth extraction ( $P = 0.418$ ). Eleven female patients and four male patients had a reduction in the blood glucose levels after injection. There was a significant difference between these groups ( $P = 0.01$ ).

### **Conclusion:**

According to our findings and previous reports, using local anesthesia during tooth extraction does not induce hypoglycemia and could increase the serum blood glucose level in individuals.

### **Key words:**

•Anesthesia •Local •Epinephrine •Glucose  
•Lidocaine •Tooth Extraction

## Introduction

Tooth extraction is one of the most common and frequent dental procedures, which is considered a stressful and painful intervention.<sup>(1,2)</sup> If patients' pain can be soothed, therapeutic procedures will be carried out in a more acceptable situation and patients' pain threshold will increase.<sup>(3)</sup>

Lidocaine is the most common local anesthetic material in dentistry. Lidocaine was introduced by Nils Lofgren in 1943 and used for the first time as a local anesthetic material in 1948. One of the most important concerns about local anesthetic injection is its systemic effects.<sup>(4)</sup>

The most common complications after lidocaine injection are vasovagal shock, hyperventilation syndrome, tachycardia, shivering, and the loss of consciousness. Injection procedures cause pain and induce secretion of endogenous catecholamine, which could have a synergism effect with the vasoconstrictors in the local anesthetic material, leading to some side effects.<sup>(5,6)</sup> Using epinephrine along with local anesthesia can also induce metabolic changes.<sup>(7)</sup>

During anesthetic material injection, some individuals experience some unpleasant situations, such as paleness and losing consciousness, and one of the supportive medications in these cases is using glucose.<sup>(8)</sup> Activation of the sympathetic system by stress and epinephrine injection can increase the blood glucose level in patients who undergo dental procedures, such as tooth extraction. Dental surgery with local anesthetic injection can increase catecholamine release, blood glucose, and insulin.<sup>(9)</sup>

The aim of this study is to evaluate the serum blood glucose level changes after local anesthesia by using local anesthetic in tooth extractions.

## Materials and Methods

In this clinical trial study, we evaluated the effect of local anesthetic, by using lidocaine and epinephrine, on the blood glucose concentration in patients who underwent teeth extractions. This study was conducted at the Department of Oral and Maxillofacial Surgery in the dental college, and it was approved by the ethics committee of the research center of Azad University of Medical Sciences. This trial is registered with RCT ID: AEARCTR-0000445.

This study was performed between February and May 2014.

We used a convenient, time-based sequential sampling method. Informed consent was given by all patients. We included all adult individuals who were referred to our department for mandibular tooth extractions, and we excluded patients who underwent tooth extractions both in mandible and maxilla or had known histories of diabetes, infection, or any contraindications for using epinephrine.

Our local anesthesia solution (1.8 mL carpule) contained lidocaine and 1:80,000 epinephrine. It was injected in 1 min through the inferior alveolar nerve after negative aspiration. Only one carpule was injected in each patient.

We took a finger blood samples immediately before and 10 min after the administration of local anesthesia. We used a glucometer (Accu Check Active, model GC, Germany) to measure blood glucose in our samples.

Statistical analyses were performed by using Statistical Program for Social Sciences software (SPSS) version 18. Paired t-test and chi-square test were used for data analyses. The significance level (P) was set at 0.05.

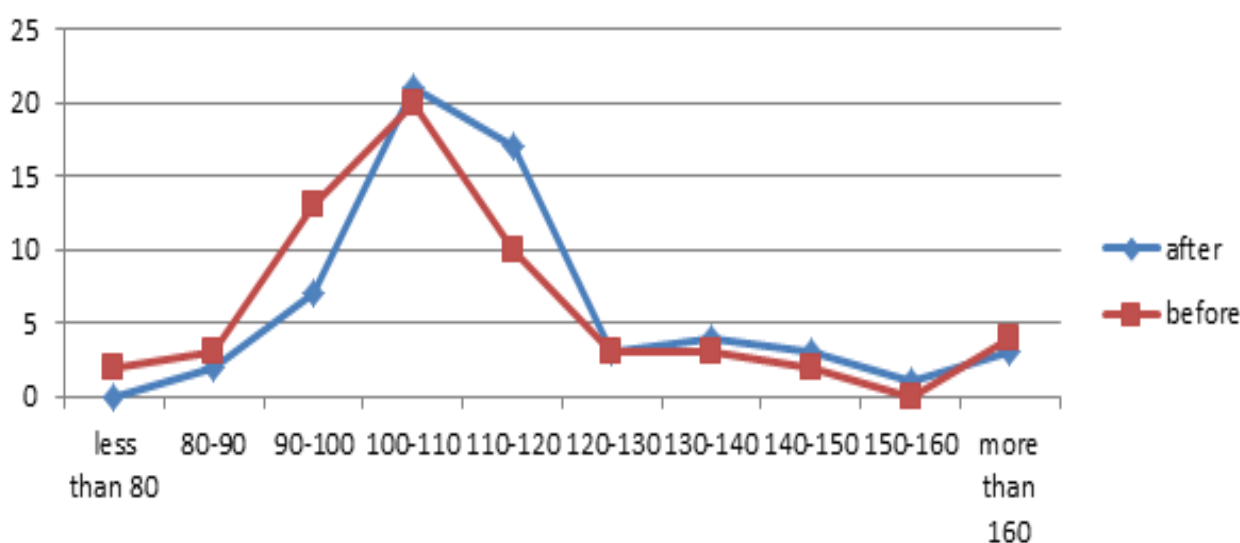
## Results

In this study, we had evaluated 60 individuals. Thirty-five (58.3%) were male, and 25 (41.7%) were female. The mean age in our study was  $39.54 \pm 15$  years. Most patients underwent molar tooth extraction. In two patients (3.3%), we extracted their first tooth; only in one participant tooth number four was extracted, and in nine patients (15%), we extracted tooth number five. Forty-eight patients underwent molar tooth extraction (16 patient for each tooth). Before injection, the mean blood glucose level in patients was  $111.6 \pm 25.47$  mg/dL, and 10 min after lidocaine injection, the mean blood glucose was  $115.3 \pm 24.39$  mg/dL. Paired t-test showed that there was no significant difference in blood glucose levels in patients before and after injection ( $P = 0.418$ ). Before local anesthesia, in 42 patients, the blood glucose level was higher than 100 mg/dL, and after lidocaine injection, in 51 participants, the blood glucose level was higher than 100 mg/dL. Chi-square test showed that there was a significant change in the number of patients who had

blood glucose levels higher than 100 mg/dL after lidocaine injection ( $P = 0.03$ ). Nine patients had blood glucose levels lower than 100 mg/dL, and 41 participants had blood glucose levels higher than 100 mg/dL both before and after tooth extraction. After anesthesia injection, in 45 patients (75%), blood glucose levels were increased, and in 15 patients (25%), it was decreased. Among female participants, in 11 patients, blood glucose levels were decreased; in contrast, among male participants, in only four patients, blood glucose levels were decreased. Chi-square tests showed there was a significant difference between groups ( $P = 0.01$ ).

We also divide patients in to two groups: molar and non-molar tooth extraction. Forty-eight patients underwent molar and 12 underwent non-molar tooth extraction. The blood glucose level of 13 patients in the molar group and two patients in the non-molar group was decreased. Figure 1 summarizes the distribution of blood glucose levels in patients before and after local anesthesia administration.

During our study, vasovagal shock occurred in one patient. The blood glucose level was 94 mg/dL before and 98 mg/dL during his shock, and it was 102 mg/dL when he was stabilized.



**Figure 1.** Distribution of 60 patients before and after local anesthesia based on their blood glucose levels.

## Discussion

In this clinical trial study, we evaluated glucose levels in 60 patients before and after tooth extraction. There was no significant difference before and after our procedure in patients' blood glucose levels. Between male and female participants, blood glucose level in female patients was significantly reduced after injection ( $P = 0.01$ ). Only in one individual was vasovagal shock observed. No hypoglycemic state was detected in this patient. This could be due to catecholamine release and cortisol secretion following anxiety, fear, and pain during injection in this case.

Tily et al. evaluated 30 diabetic and 30 healthy individuals in 2007. They used local dental anesthesia (1.8 mL carpule each) containing 1:80,000 epinephrine and evaluated patients be-

fore and 10 min post-extraction. They showed that there was no significant difference in blood glucose concentrations before injection and 10 min after extraction in healthy people compared with diabetic patients. There was no correlation between blood glucose changes and the number of carpules injected, number of teeth extracted, and the gender of the patients; however, there was a significant difference between their diabetic patients who used and who did not use their medications.<sup>(10)</sup> Our results agree with their findings.

In some other studies, it has been shown that local anesthetic administration can increase norepinephrine in plasma but there is a subtle increase related to the severity and extension of the dental procedure. The blood glucose concentration is related to the epinephrine plasma

concentration and is different from norepinephrine secreted by the sympathetic system.<sup>(11-13)</sup> An increased blood glucose level is observed in the presence of epinephrine in local anesthetic materials. Epinephrine has gluconeogenic hormonal activity. After epinephrine infusion, blood glucose concentration increased rapidly during 15 min and returned to the baseline after 2 h.<sup>(14, 15)</sup> Bortoluzzi et al. included 37 Brazilian individuals in their study to evaluate hemodynamic and glucose measurement changes in patients who received a local anesthetic and a vasoconstrictor (LAVA; 2% mepivacaine with adrenaline 1100,000). They reported that their evaluated parameters, including systolic blood pressure, diastolic blood pressure, heart rate, and glucose levels, have no significant changes in healthy individuals.<sup>(16)</sup> Our results are consistent with their report. In both studies, there was no significant difference before and after dental procedures in glucose levels.

In local anesthetic materials, epinephrine can penetrate to blood circulation and lead to glucose level increase after injection. This change happens after injection and before dental extraction. It is important to know changes in the hemodynamic state and blood glucose after local

anesthetic injection to manage some emergent conditions that may occur immediately after injection.

As it was mentioned in the results section, there was a patient with vasovagal shock in our study. According to his different blood glucose levels, there was no hypoglycemic state in this patient. This situation can be explained by catecholamine release and cortisol secretion following anxiety, fear, and pain during injection in this patient.

## Conclusion

In many situations during dental procedures, after anesthetic injection, the clinicians encounter emergencies, such as dizziness or loss of consciousness. In these situations, many clinicians begin to administer intravenous fluids with glucose to treat hypoglycemia; however, according to our results and previous studies, blood glucose levels not only decrease after local anesthetic injection but also increase due to injection, pain, and emotional stress.

## Acknowledgments

Authors declare that they have no conflicts of interest.

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