

THE EVALUATION OF CHANGES IN BLOOD GLUCOSE LEVEL BY THE EFFECT OF DENTAL LOCAL ANAESTHETICS DURING ORAL SURGERY

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ABSTRACT

Purpose : The aim of this study was to investigate the effects of five different types of dental local anaesthetics with or without a vasoconstrictor on blood glucose level, heart rate and blood pressure in otherwise healthy volunteers undergoing third molar operation. **Methods :** Sixty healthy volunteers divided into five groups took part and five different dental local anaesthetics, such as prilocaine 3%, lidocaine 2%, articain HCl 20 mg, articain HCl 40 mg or mepivacaine with vasoconstrictors were used. Heart rate and blood pressure were recorded 5 min before, and 5, 20 and 120 min after the injection of dental local anaesthetic. Blood glucose levels were measured concomitantly with heart rate and blood pressure records. **Results :** Blood glucose level, heart rate and blood pressure were stable and in significant changes were noted by the use of dental local anaesthetics during third molar operation. **Conclusion :** It is concluded that dental local anaesthetics can be used confidently in patients who are under stressful surgery up to a dosage of 2 ml in dental practice.

Key Words: Local Dental Anaesthetics, Blood Glucose Level, Heart Rate, Blood Pressure, Impacted Third Molar.

INTRODUCTION

Local anaesthetics improve patient acceptance in dental treatment and as a result, it contributes significantly to oral health. Dental practitioners use local anaesthetics very frequently in their daily practice. Therefore, the toxicity and efficacy of these agents are of particular interest. The effect of dental local anaesthetics containing adrenaline was previously investigated both in healthy and medically compromised individuals (1-4). Significant changes in blood glucose level may cause different medical problems in individuals

who are under stress. Third molar operations are considered as one of the most stressful operations in dentistry. Previous studies suggested that the quantity of adrenaline in dental local anaesthetics injected routinely during oral surgery procedures can produce biochemical changes in healthy volunteers and in patients undergoing third molar surgery (5,6). These changes may be hypoglycemia or hyperglycemia. The alterations in blood glucose level during oral surgery and contributing factors that cause these alterations, such as stress and dosage of adrenaline within dental local anaesthetics were investigated in this study.

The purpose of the study was to investigate the effect of adrenaline within prilocaine 3% (Citanest), lidocaine 2% (Jetocaine), articain HCl 20 mg (Ultracaine DS), articain HCl 40 mg (Ultracaine Fort) and mepivacaine (Mepicaine), on blood glucose level, heart rate and blood pressure in otherwise healthy volunteers undergoing third molar operation. We considered that this would be a useful model to demonstrate the effects of exogenous adrenaline in individuals who were undergoing a controlled stressful procedure.

MATERIALS AND METHODS

Patients were provided with a patient information sheet explaining the purpose of the study. A verbal explanation was given and the patient signed a consent form. This was carried out to conform with the Ethical Committee of the

Table 1: The amount of adrenaline given as mg/ml for each anaesthetic solution used in this study.

Anaesthetic solution	mg/ml
Prilocaine 3 %	20
Lidocaine 2 %	40
Articain HCl 20 mg	20
Articain HCl 40 mg	40
Mepivacaine	30

Table 2 : The mean values for all the measurements.

	Articaine 40 mg	Articaine 20 mg	Mepivacaine	Lidocaine 2 %	Prilocaine 3 %
Blood glucose level					
5 min before	57.5	68.1	76.0	78.5	62.3
5 min after	64.4	74.7	80.4	88.4	63.3
20 min after	62.7	73.7	80.5	80.7	64.7
120 min after	64.8	74.7	81.4	80.2	66.2
Heart rate					
5 min before	75.3	72.0	79.3	77.3	78.3
5 min after	75.3	77.3	74.3	76.2	75.6
20 min after	77.6	74.0	72.6	74.2	73.6
120 min after	70.3	74.6	72.0	72.5	71.1
Diastolic blood pressure					
5 min before	78.7	69.1	72.5	75.8	71.6
5 min after	77.9	69.1	72.9	70.8	72.0
20 min after	75.4	72.5	71.2	75.0	72.9
120 min after	77.9	75.8	71.6	76.6	72.0
Systolic blood pressure					
5 min before	117.9	107.5	113.7	110.4	112.5
5 min after	120.0	109.1	112.9	109.1	111.6
20 min after	112.5	110.0	110.4	109.5	115.0
120 min after	113.7	126.2	112.9	112.0	107.5

Gazi University, Faculty of Dentistry. A total of 60 otherwise healthy volunteers participated in this study and divided into five different groups (n=12 for each group). Each volunteer required the removal of a lower third molar tooth under local anaesthesia. The mean age of these patients was 25 and 35 of them were female. The dental local anaesthetics with or without a vasoconstrictor used for this study were prilocaine 3%, lidocaine 2%, articain HCl 20 mg, articain HCl 40 mg and mepivacaine. The maximum dosage of these anaesthetic solutions applied in this study was 2 ml, and the amount of adrenaline for each anaesthetic solution was shown in Table 1.

Each patient was treated in the morning and advised not to take breakfast. A 21-gauge cannula was introduced into a vein in the right antecubital fossa and blood pressure was measured with a standard sphygmomanometer which was attached to the left arm. Five minutes before the local anaesthetic injection, 5 ml blood was taken for glucose measurement. Five minutes after the baseline sampling, the patient was administered 2 ml of one of the local anaesthetics listed above. Five minutes after local anaesthetic injection, 5 ml blood was again taken for glucose measurement. Further blood

samples were taken at 20 and 120 min after local anaesthetic administration. Heart rate and blood pressure measurements were recorded concomitantly with each blood sample. Blood samples were collected by careful aspiration into a plastic syringe, transferred to chilled test tubes containing EDTA, and transported in ice to the laboratory where they were centrifuged and stored at -70°C immediately. All injections, surgery and measurements were performed by the same operator. Duration of the surgery was recorded for each patient.

Blood glucose levels were measured by a Technicon RA-XT auto analyser using Menarini diagnostic mood kits at the Gazi University Department of Biochemistry.

In this study, "analysis of variance with repeated measures on one factor" was used for the statistical evaluation of the data because the blood glucose levels, heart rates and blood pressures were recorded on different time intervals for each volunteer. The mean values for all the measurements were given in Table 2.

RESULTS

A. Blood glucose level

Blood glucose levels were almost same before and after the injection of local anaesthetics. There was a slight increase only lidocaine 2% group at 5 min after the injection ($p>0.05$) (Fig. 1).

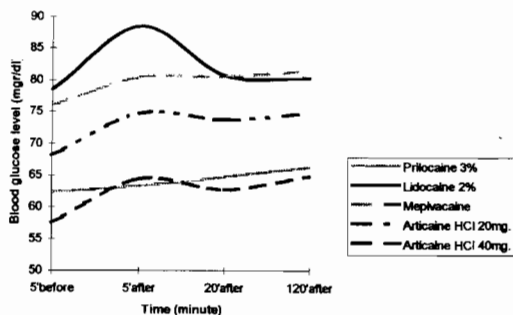


Fig. 1: The mean blood glucose levels obtained when five different dental local anaesthetics were used.

B. Heart rate

There was no statistically significant difference in any group. However, there was a decrease in heart rate when prilocaine 3%, lidocaine 2% or mepivacaine was used and an increase at 5 min after articaine HCl 20 mg injection, and 20 min after articaine HCl 40 mg injection ($p>0.05$) (Fig. 2).

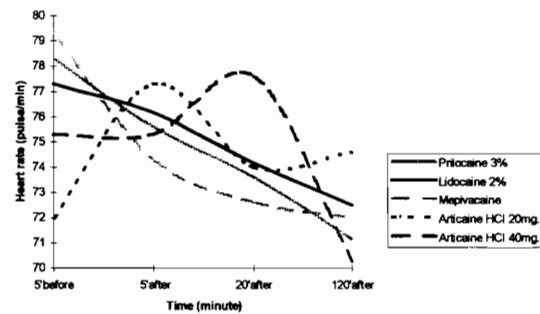


Fig. 2 : The mean values of heart rate.

C. Blood Pressure

There was no statistically significant change in diastolic blood pressure. However, a slight decrease at 5 min after and an increase at 20 and 120 min after the injection of lidocaine 2% was observed. Furthermore, there was a slight

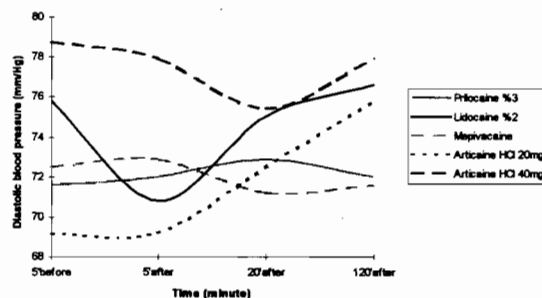


Fig. 3 : The mean values of diastolic blood pressure.

decrease with mepivacaine and a slight increase with articaine HCl 20 mg. A constant increase was noted when articaine HCl 40 mg was used ($p>0.05$) (Fig. 3).

Systolic blood pressure records showed a slight increase with articaine HCl 20 mg at 120 min after injection. There was a slight decrease at 20 and 120 min after the injection of articaine HCl 40 mg ($p>0.05$) (Fig. 4).

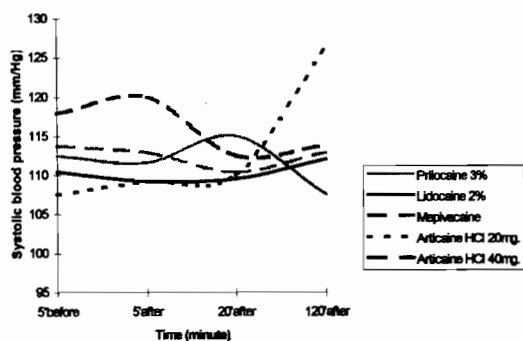


Fig. 4 : The mean values of systolic blood pressure.

DISCUSSION

Adrenaline is one of the hormones that influences blood glucose level. Dental surgeons usually use adrenaline containing local anaesthetic solutions to control local bleeding and prolong the action of the local anaesthetic (7, 8). It was previously reported that adrenaline containing local anaesthetic solutions raise blood glucose level during major anaesthesia (9, 10). However, Roberts and Sowray (11) reported that the administration of adrenaline does not influence blood glucose level during dental anaesthesia. Meechan (9) also pointed out the possible effect of the stress factors on blood glucose levels when various anaesthetics are used. He reported that the cause of the small and harmless changes in blood glucose levels that he observed in his study was stress. He suggested that both metabolic and haemodynamic responses should be investigated while assessing the generalised effects of dental local anaesthetics.

Syncope is a common complication of stressful situations such as dental surgery (12). The clinical picture of syncope is usually dominated by the circulatory effects but the possibility of hypoglycemia as a contributing factor must be considered as glucose is crucial for cerebral metabolism (13). Salins et al (14) estimated the glucose level in capillary blood of 16 patients, who had vasovagal syncope during exodontia with local anaesthesia. One consistent finding in their study was the low blood glucose levels in all patients during syncope, compared with the levels one hour after recovery.

The autoregulation of the cerebral circulation normally prevents cerebral ischemia unless the systemic arterial pressure falls to extremely low levels such as 40 mmHg (12). It is well known that hypotension induced cerebral hypoxia can cause loss of consciousness. Another sign of syncope is arrhythmia. Sinus tachycardia and sinus bradycardia is said to be present if the heart rate is above 120 beats/min and below 60 beats/min, respectively (15). The significance of cardiac dysrhythmias during oral surgical procedures remains unclear. In general, dysrhythmias should be interpreted as warning signs of distress. Previous studies have demonstrated that dysrhythmias can occur when oral surgery is performed under local anaesthesia. Williams et al (16), Ryder (17) and Barkin and Middleton (18) reported an incidence of cardiac dysrhythmias as 26.2%, 9.2% and 16%, respectively. However, in a study of Meechan (9), no significant change in heart rate and systolic blood pressure attributable to the injection of 50 µg adrenaline was reported.

In the present study, all measurements were within normal limits for blood glucose level, heart rate and blood pressure (Fig. 1, 2, 3, and 4). However, there was a slight increase in blood glucose level at 5 min after lidocaine 2% injection (Fig. 1). There was also a decrease in heart rate and diastolic blood pressure in the same group when the slight increase in blood glucose level occurred. These changes may be due to stress, as third molar operations are very stressful operations for patients. Thus it is concluded that dental local anaesthetics can be used confidently in patients who are under stressful surgery up to a dosage of 2 ml in dental practice.

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