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Research Article

Evaluating Glycemic Response to Lidocaine with Two Different Vasoconstrictors in Diabetic Patients Undergoing Tooth Extraction: Crossover Randomized Clinical Study

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ABSTRACT

Objective: This study aimed to evaluate the epinephrine-containing and norepinephrine-containing local anesthetic solutions on blood glucose levels of type II diabetic patients undergoing dental extractions.

Materials and Methods: A total of 60 simple extractions (n=60), performed on teeth of 30 patients with type II diabetes mellitus, were included in the study. The sample was divided according to the used anesthetic solutions into two groups: Group A (lidocaine with epinephrine group; n=30) and Group B (lidocaine with norepinephrine group; n=30). A vasoconstrictor concentration of 1:100,000 was applied in both groups. Consistently with each extraction, blood glucose levels measurements, using portable glucometer, were done three times: immediately before local anesthesia administration, 5 minutes after local anesthesia, and 5 minutes after tooth extraction.

Results: The change in blood glucose concentration following the administration of local anesthesia was not statistically significant in both Group A and Group B (P>0.05). No significant change in this parameter was found after teeth extractions in both groups (P>0.05). There were also no significant differences in the glycemic response between Group A and B (P>0.05).

Conclusion: Administration of 4 ml of 2% lidocaine with epinephrine 1:100,000 or 2% lidocaine with norepinephrine 1:100,000 in the context of simple dental extraction did not strikingly increase nor decrease the blood glucose levels in patients with type II diabetes. According to the results of this study, both local anesthetics may be used safely in type II diabetics, with no preference for one over the other.

Keywords: Blood Glucose, Local Anesthesia, Epinephrine, Norepinephrine, Diabetes Mellitus, Exodontia.

INTRODUCTION

Diabetes is one of the most common serious chronic diseases (1). The prevalence of Type II diabetes has reached alarming levels in many countries around the world (2). The prevalence of diabetes mellitus in the developing countries was estimated to increase by 69%, to affect 439 million adults by 2030 (2). In Syria, it was estimated that, after only two years from now, approximately 20% of Syrian adults, aged 25 years and older, will have Type II diabetes (3).

Local anesthetics are the most common drugs used by dentists in clinical practice. Vasoconstrictors are usually added to local anesthetic solutions to oppose the potential vasodilating actions of the local anesthetics (4). Vasoconstrictor is highly important addition to a local anesthetic solution as it enhances local anesthesia in quality and duration, assists in hemostasis, and may increase local anesthetic safety (4).

By reviewing the literature, one can find that the use of vasoconstrictors (i.e. epinephrine) with type II diabetics is a controversial issue (5-10). Some authors suggested avoiding epinephrine with these patients because it may produce a significant rise in blood glucose levels (5, 6). On the other hand, some publications reported that it

is safe and not contraindicated to use epinephrine in patients with type II diabetes (7-9). Hereby, the present study aimed to evaluate glycemic levels in type II diabetic patients before, during and after exodontia using 2% lidocaine with 1:100,000 epinephrine and 2% lidocaine with 1:100,000 norepinephrine.

MATERIALS AND METHODS

This crossover randomized clinical study was conducted to evaluate changes in glycemic levels in diabetic patients undergoing two anesthetic protocols during simple tooth extractions. Study participants were patients who sought multiple teeth extraction from Clinics of Department of Oral and Maxillofacial Surgery (Faculty of Dental Medicine, Damascus University). Ethical clearance was obtained after study protocol was reviewed and approved by Research Ethics Committee of Damascus University (registration no. 1213; research ID: 18600802). All patients who participated in the study provided informed consent statement.

Inclusion criteria were type II diabetic patients, with no any other health issue except for the diabetes, age between 40 – 60 years, patients with two teeth in the same jaw indicated for extraction, and pre-operative blood glucose level of less than 200 mg/dl. Exclusion criteria were the presence of significant medical problem (besides diabetes), alcoholism, patients who reported pregnancy, lactation or allergy to local anesthetics.

The sample (n=60) was divided into two groups: Group A and Group B. Two separate early dental simple extraction appointments were set for each participant so that he/she would be included in both study groups. Simple randomization was used to determine which group to start with. One week interval was between the two appointments. Patients were instructed to have normal breakfast, but identical in content and quality on both appointments. Group A (n=30) were anesthetized with 2% lidocaine with 1:100,000 epinephrine, and Group B (n=30) were anesthetized with 2% lidocaine with 1:100,000 norepinephrine.

Glycemic levels by capillarity were evaluated for each patient three times on each appointment: before local anesthetic administration, 5 minutes after administration of local anesthesia, 5 minutes after dental extraction. Blood glucose levels were measured by using a glucometer (GlucoLab, Infopia Co. Ltd., Anyang, Kyunggi, Korea). Local anesthesia and dental extraction were always done by one fixed operator. The same volume of anesthetic solution (4 ml) was applied using fixed technique in both study groups. After each simple dental extraction, the difficulty of extraction was immediately reported by the operator on 10-cm visual analogue scale. All dental extraction data, patient demographic information, blood sugar concentrations were recorded on a case-specific form.

The collected data were processed and analyzed using Statistical Package for the Social Sciences for Windows V19 (SPSS Inc, Chicago, IL, USA). Analysis included descriptive statistics of each variable. Paired t test was conducted to examine the significance of the difference between the means of each group at different points of time. Further, mixed model ANOVA was used to measure the differences between the two groups over different time points. The level of significance was set as $P<0.05$ with confidence intervals of 95%.

RESULTS

After 51 extraction patients were screened, 30 patients were eligible and included in all phases of this randomized clinical trial. Flow diagram of the progress through phases of this study (i.e. enrollment, allocation, follow-up, and data analysis phases) is shown in (Figure 1). Depending on the nature of the crossover design of this study, each patient participated twice and included in both study groups (n=60). The age of the participants ranged from 41-57 years with an average of 49.7 (±4.7) years. The percentage of males was 53.3%. The demographic information for the study sample is summarized in (Table 1). There were no statistically significant differences between the two study groups with regard to demographic characteristics ($P>0.05$; Table 1).

Table 2 shows the glycemic responses to the anesthetic solutions and the subsequent dental extractions in both Group A and Group B. It also presents the differences in the glycemic change between groups (Table 2). Although there was a slight increase in blood glucose levels in Group A versus a slight decrease in blood glucose levels in Group B after administration of local anesthesia and after dental extraction, these changes were not significant ($P>0.05$; Table 2).

DISSCUSSION

In dentistry, local anesthetics containing epinephrine are widely used because of the multiple benefits that accrue from adding epinephrine as a vasoconstrictor to the local anesthetic solution (4). Epinephrine was known to cause rise in blood glucose concentrations, and some authors concluded that it should be used with caution in diabetic patients (10). Hereby, this study was conducted to evaluate the significance of epinephrine-containing local anesthetics' effect on glycemic levels in diabetic patients undergoing

simple dental extractions. Further, the present study investigated the glycemic response in those patients to local anesthetic with another vasoconstrictor, i.e. norepinephrine, and compared between the two cases (Group A and Group B) to find which is preferable.

This study was crossover randomized clinical trial. As for split-mouth study designs, the nature of this case-crossover design, where each patient serves as his/her own matched control, eliminates between-subject variability (11, 12). Age, gender, ethnicity, host response, and many other personal confounders were effectless by dint of this study design, and so this improved the study power.

In Group A where 2% lidocaine with 1:100,000 epinephrine was used as local anesthetic solution, mean blood glucose levels was found to be slightly increased after both local anesthesia and exodontia. This elevation in blood sugar was found to be insignificant ($P>0.05$; Table 2). The opposite was observed when this variable was studied in Group B. It was found that the mean glycemic change after administration of 2% lidocaine with 1:100,000 norepinephrine and the following extractions was negative. However, this decrease in blood glucose levels in Group B was not significant ($P>0.05$; Table 2). This means that neither epinephrine-containing nor norepinephrine-containing local anesthetics had a significant effect on blood glucose levels in patients with type II diabetes. This result is in line with the findings of Santos-Paul et al. (7). They conducted a case-control randomized study on 70 participants and found that the use of 2% lidocaine with 1:100,000 epinephrine as a local anesthetic was safe and did not interfere with blood glucose concentrations of diabetic patients undergoing oral surgery (7).

Epinephrine is known to be more preferred than norepinephrine when it comes to its effects on the cardiovascular system (13). Conversely, a common general idea can be found among dentists that norepinephrine is better than epinephrine as a vasoconstrictor with diabetes mellitus. But by considering the results of the current study and the comparison between the two study groups, one can find that there was no statistically significant difference regarding the glycemic response ($P>0.05$; Table 2), whether epinephrine or norepinephrine was used as vasoconstricting additives to local anesthetic. This may indicate that there is no preference given to norepinephrine as a vasoconstrictor in type II diabetic patients.

CONCLUSION

Administration of 2% lidocaine with epinephrine 1:100,000 or 2% lidocaine with norepinephrine 1:100,000 at the assessed volume (4 ml) in the context of simple dental extraction did not strikingly increase nor decrease the blood glucose levels in patients with type II diabetes. Both local anesthetics may be used safely in type II diabetics, with no preference for one over the other.

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CONFLICT OF INTEREST

Each named author has no conflict of interest, financial or otherwise.

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TABLES

Table 1: General clinical characteristics of the two study groups.

Variable		Group A (n=30)	Group B (n=30)		P-Value
Age (mean ± SD)		49.67 ±4.66	49.67 ±4.66		1.000*
Gender					
	Male	16	16		1.000**
	Female	14	14		
Extracted Tooth					
	Central Incisor	5	11		0.298**
	Lateral Incisor	10	5		
	Canine	9	7		
	First Premolar	4	6		
	Second Premolar	2	1		
Jaw					
	Maxillary	20	20		1.000**
	Mandibular	10	10		
Side					
	Right	14	13		0.795**
	Left	16	17		
Indication of Extraction					
	Wide Destruction	14	14		1.000**
	Mobility	16	16		
Extraction Difficulty (mean ± SD)		1.6 ±0.72	1.9 ±0.80		0.134*

*Analyzed by t tests; ** Analyzed by Chi-Square tests; SD= Standard Deviation

Table 2: Changes in Blood Glucose Levels after administration of local anesthetics and teeth extraction from participants of study groups.

Study Group		Blood Glucose Level (mg/dl)*					
		Baseline (SD)	Post- LA (SD)	Change (SD)		P-Value**	P-Value***
Group A (n=30)		164.37 (± 13.15)	166.43 (± 15.52)	2.06 (± 12.05)		0.355	0.448
Group B (n=30)		163.03 (± 14.97)	161.93 (± 19.48)	-1.10 (± 11.76)		0.612	
		Baseline (SD)	Post- Ex (SD)	Change (SD)		P-Value**	P-Value***
Group A (n=30)		164.37 (± 13.15)	164.57 (± 19.66)	0.20 (± 16.61)		0.948	0.345
Group B (n=30)		163.03 ± 14.97	158.40 (± 19.76)	-4.63 (±14.49)		0.091	

*Values are presented as means ± SD; **Analyzed by paired t test; *** Analyzed by linear mixed model (differences between groups); SD= Standard Deviation; Post- LA= 5 minutes after Local Anesthesia; Post- Ex= 5 minutes after exodontia.

FIGURES

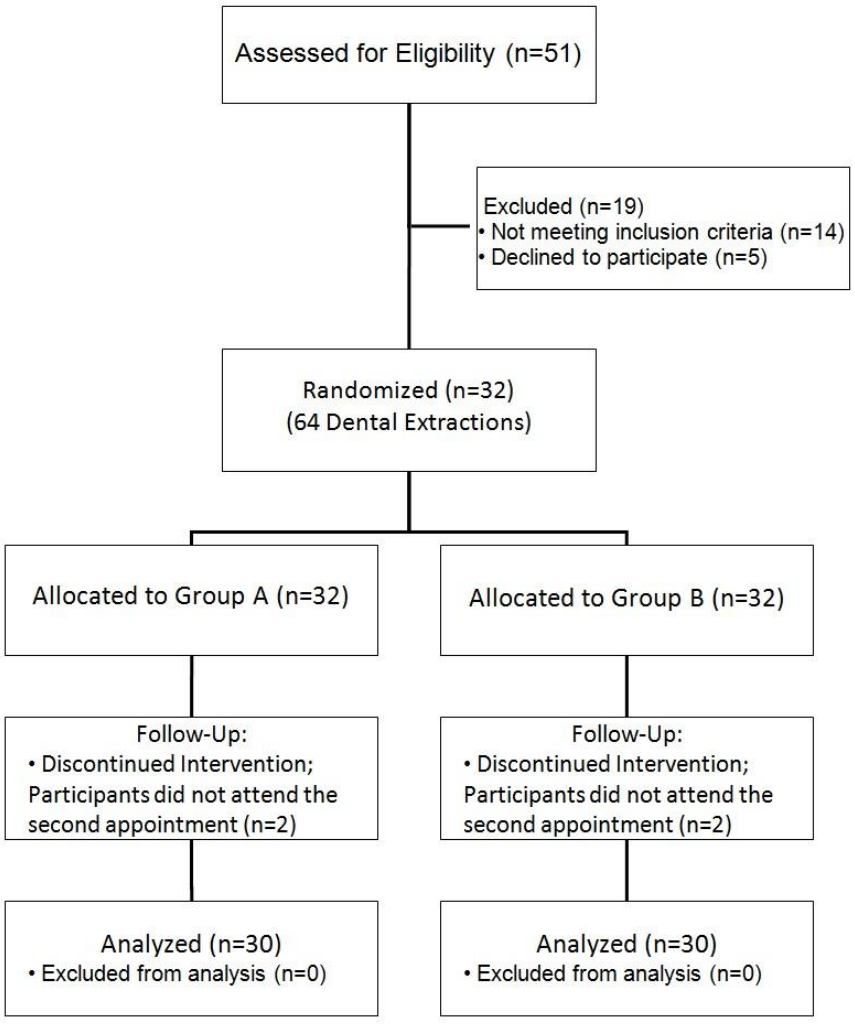

Fig.1: Study flow chart illustrating the flow of participants through different phases of this trial.