



ORIGINAL ARTICLE

An influence of adrenaline (1:80,000) containing local anesthesia (2% Xylocaine) on glycemic level of patients undergoing tooth extraction in Riyadh



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KEYWORDS

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Abstract Objective: Aim is to compare the glycemic level among patients before, and after local anesthesia containing adrenaline 1:80,000 among patients who need dental extraction.

Materials and methods: 60 patients were randomly selected including 30 healthy and 30 with a diabetes history for this study in Riyadh city. First the blood glucose level was measured before administering local anesthesia containing adrenaline after taking their history with glucocheck according to instructions, then blood Sugar level was recorded after administering local anesthesia containing adrenaline 1:80,000 concentrations. Blood sugar level was also checked 5 min after the tooth extraction procedure.

Results: There were no significant results found after the administration of local anesthesia containing adrenaline in both healthy and diabetic patients ($p > 0.05$). However, change of significance ($p < 0.05$) was noticed in diabetic patients who had not taken their hypoglycemic medication; there was a rise in their blood glucose level after extraction.

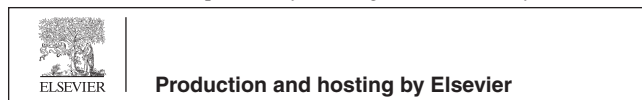
Conclusion: The study concluded no significant effect on the glycemic level of patients after the administration of local anesthesia containing adrenaline 1:80,000 in healthy and diabetic patients whether hypoglycemic medication was taken or not but a rise in blood sugar level was found among diabetic patients who did not take their hypoglycemic medications undergoing tooth extraction.

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1. Introduction

Diabetes is one of the most common diseases which is estimated to affect 200 million worldwide. It affects the metabolic processes of the body, involving many organs that either from a profound or an absolute deficiency of insulin, are related to autoimmune destruction of insulin producing pancreatic beta cells (type 1, insulin dependent diabetes mellitus/juvenile) and from resistance to cellular metabolic effects, related to obesity (type 2 or non-insuline dependent diabetes mellitus) (see [Tables 1 and 2](#)).

It has been known for many years that the inclusion of vasoconstrictors in dental local anesthetic solution offers indisputable advantages ([Meechan et al., 1998](#)). Adrenaline or other catecholamines are used as vasoconstrictors in dental local anesthesia to increase their efficiency by promoting longer lasting anesthesia ([Keesling and Hinds, 1963](#)), reduce the toxic effects by slow absorption due to the vasoconstrictor effect ([Cannel et al., 1975](#)) and make the surgical area less bloody ([Jastak and Yagiela, 1983](#)).

Few studies have been undertaken to show that plasma levels of glucose have been reported to be affected following administration of dental local anesthetic 2% Xylocaine containing adrenaline (1:80,000). The changes in blood sugar level following administration of adrenaline containing local anesthesia have been observed as a subject of controversy in some studies ([Meechan et al., 1998](#); [Meechan, 1991](#); [Boli et al., 1982](#); [Berk et al., 1985](#)). In another study, it was

explained that blood glucose and plasma potassium have been shown to change after administering clinical doses of dental local anesthetics containing epinephrine ([Meechan and Rawlins, 1987](#)). Thus although all studies have been conducted previously with regard to this issue, no conclusive evidence is yet confirmed.

The objective of this study is to compare the blood glucose level among patients before and after administration of local anesthesia containing adrenaline 1:80,000 among healthy and diabetic patients who need dental extraction. Blood glucose was also measured after tooth extraction to assess the difference.

2. Material and methods

60 Patients including 30 healthy and 30 diabetic were randomly selected from three places of the Riyadh city; Collage of Dentistry (King Saud University), Dental Clinic (Iman Hospital) and the King Khalid University Hospital.

First the whole procedure was explained to the patient and after taking the agreement we start to record personal data including age, gender and patient medical history including more particularly whether he was non-diabetic or diabetic under the formatted Performa. We also included a history of hypoglycemic medications, if diabetic, whether taken or not. Moreover, we did not consider the age factor and did not include patients with any other medical problems except diabetic patients.

Table 1 Demographic details of healthy patients.

No.	Age	Gender	1	2	3
1	17	M	113	98	107
2	39	M	123	125	132
3	56	M	100	108	116
4	29	M	110	120	108
5	21	M	80	95	109
6	32	M	97	110	100
7	43	M	109	149	148
8	24	M	97	108	98
9	45	M	94	99	104
10	43	M	119	113	110
11	30	M	79	91	97
12	34	M	95	103	104
13	32	M	96	87	105
14	42	M	130	119	127
15	37	M	90	93	82
16	59	M	136	129	121
17	30	M	140	141	142
18	46	F	157	146	130
19	22	M	118	107	124
20	23	M	84	53	76
21	24	M	190	215	103
22	24	M	90	79	78
23	26	M	107	106	84
24	31	M	109	104	80
25	25	M	90	93	105
26	33	F	88	88	96
27	30	F	97	102	100
28	40	F	90	90	92
29	29	M	82	84	89
30	46	M	102	105	105

1: Denoted for pre-anesthesia. 2: For post-anesthesia. 3: For post-extraction.

Table 2 Demographic details of diabetic patients.

No.	Age	Gender	1	2	3	Comment
1	21	M	126	120	114	
2	50	M	164	208	216	
3	52	M	323	275	346	
4	39	F	255	275	269	
5	40	M	104	108	104	No medication
6	46	F	201	211	246	No medication
7	52	F	209	207	200	
8	42	F	159	166	146	
9	47	F	119	115	131	
10	52	M	173	165	244	No medication
11	33	M	180	180	182	
12	56	M	200	212	187	
13	52	M	165	166	157	
14	63	M	199	182	195	
15	35	M	160	142	160	
16	58	M	194	194	227	No medication
17	51	F	151	150	130	
18	36	M	139	144	132	
19	44	F	233	230	197	
20	55	F	139	141	164	No medication
21	34	M	143	134	140	
22	69	M	190	193	177	
23	64	M	146	155	250	No medication
24	49	M	142	130	204	No medication
25	46	M	126	130	118	
26	40	M	222	231	204	
27	57	M	217	210	259	No medication
28	68	M	210	200	273	
29	50	M	247	225	210	
30	52	F	167	170	188	No medication

1: Denoted for pre-procedure. 2: For post-anesthesia. 3: For post-extraction.

The procedure to check blood glucose level by using Glucocheck is to follow instructions. First we took a drop of blood from the tip of patient finger and placed it over the strip, and measured the blood glucose level before the local anesthesia containing adrenaline (1:80,000) was administered and recorded it, then we checked the second measurement after 5–7 min of local anesthesia. The last one will be after 5 min of the whole procedure of tooth extraction.

All recorded data were entered into a computer “Microsoft Excel” and analyzed using software “Statistical Program for Social Sciences” (SPSS version 15.0).

3. Armamentarium used

1. Glucometer (Bionime with nobel metal electronic strip).
2. Dental local aesthesia (1.8 ml Carpule); 2% Xylocaine containing adrenaline in 1:80,000 concentrations.
3. Sterile gauze & Alcohol swap.

4. Result

In healthy patients mean sugar level was 107.07 (SD 24.50) before and 108.67 (SD 28.44) after administering local anesthesia containing adrenaline (1:80,000) in 30 (100%) patients, whereas 180.10 (SD 47.26) before and 178.67 (SD 44.44) after administering local anesthesia containing adrenaline (1:80,000) in 21 (70%) diabetic patients with hypoglycemic medications and 164.78 (SD 35.70) before and 163.89 (SD 35.75) after LA with adrenaline in 9 (30%) diabetic patients without hypoglycemic medications.

Therefore, the difference in change before and after administering adrenaline containing local anesthesia was slight, showed not significant results in healthy and diabetic patients who had taken or not taken medication (Table 3, Fig. 1).

On the other hand, in healthy patients mean sugar level was 107.07 (SD 24.50) before and 105.67 (SD 18.26) after the tooth extraction procedure in 30 (100%) patients, whereas it was 180.10 (SD 47.26) before and 192.33 (SD 55.98) after tooth extraction in 21 (70%) diabetic patients with hypoglycemic medications and 164.78 (SD 35.70) before and 209.56 (SD 30.82) after tooth extraction in 9 (30%) diabetic patients without hypoglycemic medications.

There was no significant difference before and following tooth extraction in healthy and diabetic patients with medication, whereas significant change was found in diabetic patients without medication (Table 4, Fig. 2).

The end results concluded that in healthy patients and in diabetics who did take their hypoglycemic medications, no significant difference ($p > 0.05$) was seen in both cases after administering local anesthesia containing adrenaline and extraction. The only significant ($p < 0.05$) result was observed with diabetic patients who did not take their hypoglycemic medication undergoing tooth extractions.

5. Discussion

Overall results of this study concluded that in healthy as well as diabetic patients who had taken their hypoglycemic medication, no significant ($p > 0.05$) result was found after LA as well as after extraction. The only significant ($p < 0.05$) result was found in diabetic patients who had not taken their hypoglycemic medication undergoing tooth extractions.

Table 3 Comparison of blood glucose level changes in healthy and diabetic patients after administering local anesthesia.

Type of patient	Healthy		Diabetics (with medication)		Diabetics (without medication)	
	<i>n</i> 30 (100%)		<i>n</i> 21 (70%)		<i>n</i> 9 (30%)s	
	Mean level	S.D	Mean level	S.D	Mean level	S.D
Pre_op Glucose	107.07	24.50	180.10	47.26	164.78	35.70
Post A Glucose	108.67	28.44	178.67	44.44	163.89	35.75
Differences	1.60	13.11	1.43	15.47	0.89	9.25
<i>P</i> -values (paired <i>t</i> -test)	<i>P</i> > 0.05		<i>P</i> > 0.05		<i>P</i> > 0.05	
Interpretation	Not significant		Not significant		Not significant	

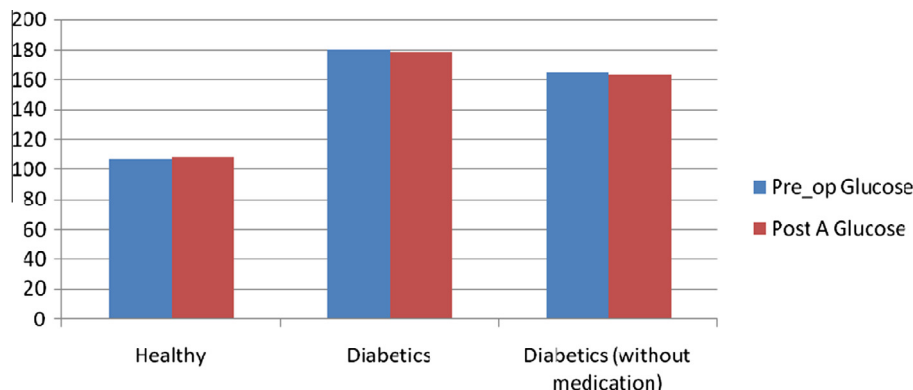
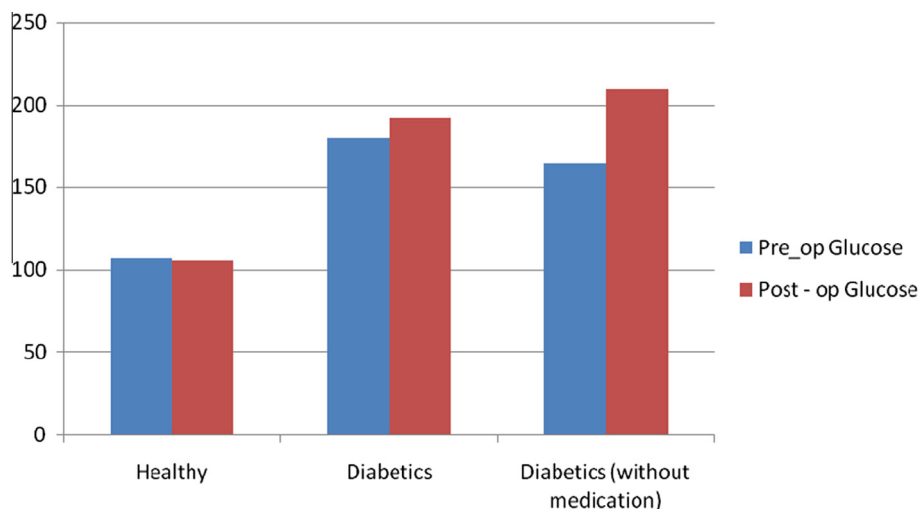


Figure 1 Comparison of pre and post local anesthesia blood glucose means.

Table 4 Comparison of blood glucose level changes in healthy and diabetic patients before and after teeth extraction.

Type of patient	Healthy		Diabetics (with medication)		Diabetics (without medication)	
	n 30 (100%)		n 21 (70%)		n 9 (30%)	
	Mean level	S.D.	Mean level	S.D.	Mean level	S.D.
Pre_op Glucose	107.07	24.50	180.10	47.26	164.78	35.70
Post-op Glucose	105.73	18.26	192.33	55.98	209.56	50.76
Differences	1.3333	21.92	-12.23	33.77	-44.78	30.82
P-values (paired t-test)	$P > 0.05$		$P > 0.05$		$P < 0.05$	
Interpretation	Not significant		Not significant		Very significant	

**Figure 2** Comparison of pre and post teeth extraction blood glucose means.

One recent study (Tily and Thomas, 2007) emphasizes that dental local anesthesia containing adrenaline can be safely used in healthy and diabetic patients as no significant ($p > 0.05$) result was seen pre and post-extraction of the tooth. In this study, significance change was seen in diabetic patients who had not taken their hypoglycemic medication undergoing tooth extraction but no change was found before and after administering local anesthesia containing adrenaline but no significant result was seen after LA with adrenaline and after tooth extraction in diabetic patients taking hypoglycemic drugs.

A study (John and Meehan, 1996) concluded that there was a significant increase in blood glucose following the injection of a solution containing epinephrine at 10 and 20 min when compared to the baseline and to the injection of epinephrine-free solution. The study did not mention the medical status of patients. Therefore this study showed a significant rise of the blood glucose level ($p < 0.05$) in diabetic patients who had not taken their hypoglycemic medication, this showed that the hypoglycemic medication taken by the patient masks the actual effect of adrenaline in the local anesthesia solution on the blood glucose level. This transient rise in blood glucose level might have a major effect on gastrointestinal motor activity (Rayner et al., 2001).

In another similar study (Christensen, 1979), it was observed that an increase in blood glucose levels due to vasoconstrictors used with local anesthetics may be insignificant in normal patients, but can be relevant in diabetic

patients. The metabolic changes also observed in untreated diabetics are, in many aspects, similar to those produced by an infusion of catecholamine.

It has been proved, theoretically, that there was an increase in blood sugar levels in diabetic patients after using local anesthesia containing adrenaline (Sherwin et al., 1980) and on the other hand, catecholamine (epinephrine) released through endogenous (physiologic) and exogenous (external) sources affects suppression of insulin secretion (Cryer, 1984; Ra et al., 1980), stimulates both glycogenolysis and glyconeogenesis (Vernillo, 2003) to produce hyperglycemia. Therefore, the adrenaline (1:80,000) we are using in local anesthesia is present in very small quantities compared to its release from the body. It might be the effect of time period needed to be absorbed in the body and to change the blood sugar level.

In other research comparing between patients taking plain Xylocain injection and others with epinephrine there was a significant increase in blood glucose level following the injection of a solution containing epinephrine (John and Meehan, 1996). Although epinephrine is important in managing the dental procedure, the absence of epinephrine in the local anesthesia will reduce the anesthetic effect and the patient stress will increase leading to the secretion of endogenous epinephrine which will cause blood glucose level to increase. To overcome this we have to use adrenaline containing local anesthesia which will reduce the secretion of endogenous adrenaline (Ad et al., 1984).

The study (Tily and Thomas, 2007) also emphasized the correlation between the number of anesthesia capsules injected and the blood glucose level, the change post operatively was found to be not significant up to a limit of six capsules ($p > 0.05$). However, many other factors have to be considered which can change the blood glucose level, either to increase or decrease it, therefore consideration of this study as a pilot study extends further to analyze the relation of age, gender, psychological factors, measurement of time interval (after injection and tooth extraction), type of hypoglycemic medicine, and nature/extent of surgery to blood glucose level of patients.

6. Conclusion

We conclude from our research that the use of epinephrine containing local anesthesia causes a significant increase in the blood glucose level in diabetic patients who did not take their medications and it is safe to use in healthy and diabetic patients with hypoglycemic medications.

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