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Research Paper: Hemodynamic Charactristics Comparing 2% Lidocaine With Epinephrine and Citanest 3% With Felypressin in Lower Third Molar Surgery

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ABSTRACT

Introduction: Monitoring the patient's status is necessary during the surgical extraction of teeth, especially when the procedure is traumatic or the patient has psychological problems. Stress induced by pain during dental treatments can result in the secretion of endogenous catecholamines which in turn increases hemodynamic changes. The present study aimed to compare hemodynamic changes after using lidocaine-epinephrine and prilocaine-felypressin during the third lower molar surgical extraction.

Materials and Methods: In this prospective randomized clinical trial, 68 patients were selected and allocated into two groups. In group I, two cartridges containing 2% lidocaine, 1.8 mL and adrenaline 1.80000 were used. In group II, the subjects received two cartridges containing 3% prilocaine with 0.03 IU/ mL of felypressin. An anesthetic technique was used for the surgical extraction of teeth. For each subject, systolic and diastolic blood pressures, heart rate, and respiratory rate were measured three times. The mean of these three measurements were compared with that measured at the first visit of the patient. The obtained data were analyzed using SPSS V. 21. The Student t test was applied for comparisons.

Results: Statistically significant differences were observed before and after using lidocaine-epinephrine in both sexes (P<0.0001) regarding the systolic blood pressure, diastolic blood pressure and pulse rate.

Conclusion: The findings of the present study showed that the hemodynamic effects were not significantly different in patients receiving lidocaine with epinephrine and those receiving prilocaine with felypressin.

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1. Introduction

Monitoring patient's status is necessary during the surgical extraction of molars, especially when the procedure is traumatic or the patient has psychological problems; such monitoring allows the surgeon to identify and control the hazardous situations [1]. Stress and anxiety induced by pain during dental surgical interventions can increase the secretion of endogenous catecholamines, which in turn changes hemodynamic parameters like blood pressure and heart rate [1, 2].

An increase in blood pressure during dental surgical procedures may cause some problems in cardiovascular system [2]. Lidocaine with epinephrine is the most common medication used as local anesthetic in dentistry. However, the most common side effect of lidocaine-epinephrine is cardiovascular adverse effects, which may limit its use in some patients. In some countries, such as Japan and European Union, felypressin is used as a safe vasoconstrictor in patients with cardiovascular problems. Felypressin (phe-8-lys vasopressin-2) is a synthetic hormone structurally similar to vasopressin. Since felypressin is not a catecholamine, it has lower cardiovascular effects than epinephrine [3]. Therefore, it is important to find out whether felyperssin is a safer medication than epinephrine in patients with cardiovascular problems.

A significant increase (5 to 12 mm Hg) in systolic blood pressure has been reported in patients who received anesthesia with vasoconstrictor during scaling and root planning [4]. Sung et al. reported that overdose of epinephrine as a vasoconstrictor resulted in increase in cardiac output and oxygen consumption [2]. In another study, no significant difference was reported in blood pressure and pulse rate of patients who received a cartridge of lidocaine with 0.012 mg of epinephrine during dental surgery. Therefore, it can be used in hypertensive patients (blood pressure ≤154.99 mm Hg) [5].

There is no published study on the hemodynamic effects of prilocaine with felypressin in dental treatments. Therefore, in the present study, the experimental model of the bilateral surgical removal of impacted lower third molars was designed to assess the hemodynamic effects (systolic blood pressures and diastolic blood pressure, heart and breathing rate) following the administration of either lidocaine-epinephrine or prilocaine-felypressin in the surgical removal of lower third molars.

2. Materials and Methods

This quasi-experimental randomized clinical trial was performed in patients attending the department of Maxillofacial surgery of Dentistry School of Guilan University of Medical Sciences to undergo the third lower molars surgery from March to October 2016. A demographic questionnaire including age and sex, and the medical and dental history was completed for each patient by the surgeon, who blind to the study groups. The inclusion criteria were the need for osteotomy and minimal to moderate degree of difficulty based on Pell and Gregory and Winter classification [1].

Patients with a history of systemic disorders (such as uncontrolled hypertension), patients using drugs that interact with local anesthetic and those with contraindication were excluded from the study. The surgical interventions lasted between 15 and 45 minutes from the time of incision. A total of 68 patients were selected according to the inclusion and exclusion criteria. The patients were assigned into two 34 patients each, matched with mean age and sex using stratified randomization. An informed consent form was signed by every patient at the beginning of the study. All surgical removals were performed by the same dental surgeon.

At the first visit of the samples, all variables included (blood pressure, heart rate, and breathing rate) were assessed by the surgeon. In group I, two cartridges containing 2% lidocaine, 1.8 mL and adrenaline 1.80000 were used. In group II, the patients received two cartridges containing 3% prilocaine with 0.03 IU/mL of felypressin. Systolic and diastolic blood pressures and heart rate were measured by a digital automatic blood pressure monitor (Beurer, Germany) that was calibrated before using in the study. The breathing rate was measured by counting the number of breaths per minute by the surgeon. After that, an anesthetic technique was used for the surgical extraction of a lower third molar: truncal block of the inferior alveolar nerve with infiltration of the buccal nerve. Thirty-four patients received lidocaine (2 cartridges) and 34 prilocaine (2 cartridges).

On the day of surgery, systolic and diastolic blood pressures, heart rate, and breathing rates of all patient were measured three times. Before anesthetic injection (baseline measurement), after gum removal (intraoperative measurement) and at the end of surgery (postoperative measurement). First of all, the patients were asked to rest for 3-5 min in a sitting position in a quiet room and be silence and still during the measurements. In addition, the patients were instructed to empty their bladders

Table 1. Hemodynamic characteristics before and after the local Anesthetic Administration

Type of Anesthetic Drug		Before Administration		After Administration		P
		Men	Female	Men	Female	
		Mean±SD	Mean±SD	Mean±SD	Mean±SD	
2% Lidocaine, 1.8 mL and adrenaline 1.80000	Systolic blood pressure	130.23±13.0	124.47±9.47	13687±14.66	126.07±11.47	0.000
	Diastolic blood pressure	83.41±7.66	80.55±6.30	85.70±10.13	81.03±8.34	0.000
	Heart rate	90.17±11.62	94.52±10.90	92.52±13.40	94.76±10.64	0.000
	Breathing rate	16.88±1.05	17.05±1.02	17.29±1.30	16.91±0.93	0.000
3% prilocaine with 0.03 IU/ mL of felypressin	Systolic blood pressure	120.70±8.58	117.76±10.98	129.40±9.47	125.35±13.21	0.000
	Diastolic blood pressure	79.54±6.86	77.70±7.58	84.27±5.40	82.70±6.98	0.000
	Heart rate	90.46±10.52	85.58±10.02	89.56±13.98	85.35±11.27	0.000
Breathing rate		18.07±0.53	17.64±0.93	17.66±0.66	17.52±0.94	0.000

before the measurement. Then the patient's systolic and diastolic blood pressures, heart and breathing rate were measured and recorded. After that the anesthetics were injected and the area selected for operation was anesthetized, a flap was raised and the gum was removed.

At this step, systolic and diastolic blood pressures, heart and breathing rate were measured again. At the end of surgery, immediately after extraction of the wisdom teeth and suturing, all variables were measured and recorded for the third time. The mean of these three measurements were calculated and compared with that was measured at the first visit of the patient. Data were analyzed using SPSS version 21.0. The Student t test was performed for comparisons.

3. Results

In the present study, the patient distribution by gender was deliberately balanced (50% males and 50% females), with a mean age of 22 year (range: 18-30 year). The difficulty of surgical extraction of teeth based on Pell and Gregory and Winter classification was minimum to moderate in all cases. The mean duration of surgery was 20 min (range: 15 to 45 min) that was measured from the time of local anesthesia to the end of suturing.

Statistically significant differences were observed before and after the injection of lidocaine-epinephrine in both gender (P<0.0001) regarding the systolic blood pressure, diastolic blood pressure and pulse rate (Table 1). In prilocaine-felypressin group, the changes in all hemody-

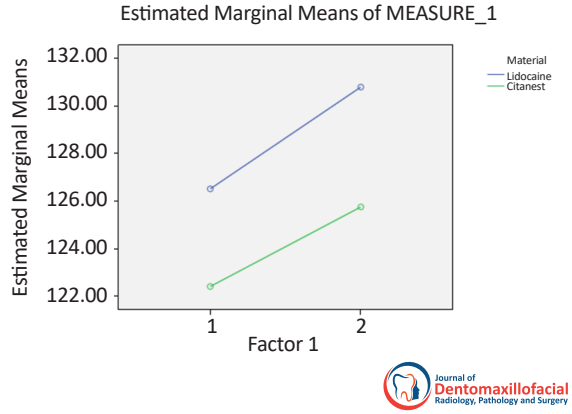

Figure 1. The effect of lidocaine and prilocaine on mean diastolic pressure before and after administration

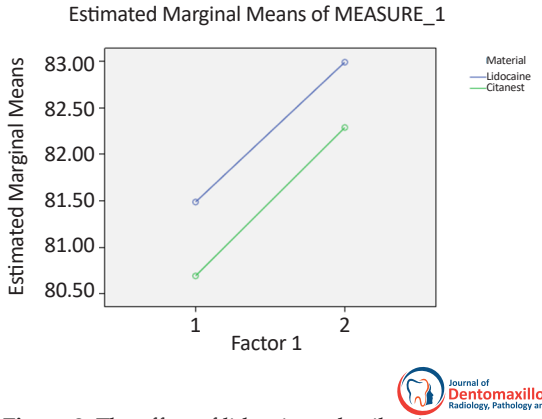

Figure 2. The effect of lidocain and prilocaine on mean diastolic pressure before and after administration

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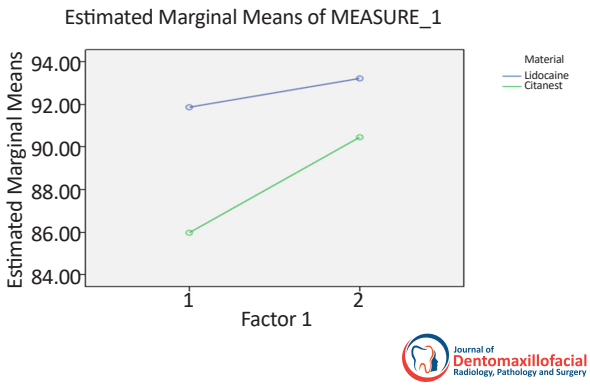

Figure 3. The effect of lidocaine and prilocaine on heart rate before and after administration

namic parameters except breath rate were significant before and after the injection (P<0.0001).

Both groups showed increasing effects on the systolic and diastolic blood pressures (Figures 1 and 2). The increasing effect of prilocaine-felypressin on heart rate was higher than that of lidocaine-epinephrine (Figure 3). Although the injection of lidocaine-epinephrine and prilocaine-felypressin increased the breath rate after injection in comparison with before injection, this difference was not statistically significant.

4. Discussion

Some studies that examined the hemodynamic effects of local anesthetics in healthy individuals have reported no significant changes in heart rate, blood pressure, or other hemodynamic factors. However, this effect may be related to vasoconstrictors and the anesthetic itself. There is no published study that investigated these effects following the application of epinephrine, as a vasoconstrictor, in comparison with felypressin. Thus, in this study, we studied the hemodynamic changes following administration of the two most frequent local anesthetics using an experimental model of double-sided surgery of the mandibular third molars.

Administration of lidocaine with epinephrine results in the bleeding reduction during surgery that is helpful for extending the surgeon's vision during surgery. In addition, it reduces postoperative pain [6]. Some studies investigated the hemodynamic effects of local anesthetics with epinephrine in patients with no history of preexisting systemic diseases and reported that this compound did not significantly change the blood pressure and heart rate [2, 7-10]. However, some researchers recommended that these changes are dependent on the dose of vasoconstrictor [2]. In contrast, some studies reported vasoconstrictor dose-independent changes [1].

In the present study, after the injection of the studied anesthetics (lidocaine-epinephrine and prilocaine -felypressin), the systolic and diastolic blood pressures of the samples increased. This finding is in line with the observations of Montebugnoli et al. [11] and Haghighat et al. [12]. Apparently this increase is related to patient's stress and anxiety that results in the secretion of catecholamines, and in turn increase in heart rate, blood pressure and vasoconstriction. In contrast, Miller et al. reported no association between patients' stress and hemodynamic changes in hypertensive patients following dental surgery [13].

In the study of Holonda et al. no statistically significant changes were observed in diastolic blood pressure of patients before and after prilocaine injection [14]. Silvestre et al. found no association between local anesthetics and the blood pressure of patients with hypertension or those with no systemic diseases [7]. Alemani et al. reported an increase in the systolic and diastolic blood pressures of patients receiving articaine during osteotomy and tooth sectioning. However, at the end of the surgery, the levels of these parameters decreased even lower than that of before the surgery [1].

This inconsistency in Alemani et al. and our studies can be explained, at least in part, by the differences in the time of the measurement of hemodynamic parameters. In this study, the patients' mean heart rate increased after the injection of both anesthetics. In contrast, in the study of Moraes et al., patients' heart rate showed a slight increase immediately after the injection of lidocaine and articaine with epinephrine and then decreased to baseline level [2].

Local anesthetics with epinephrine and the plasma catecholamines have additive effects. This effect is not sufficient to induce hemodynamic effects in younger patients, but it may be problematic in patients with cardiovascular diseases. Therefore, it seems that the systematic control of patients following administration of these drugs is necessary. Besides the administration of local anesthetics, other methods such as conscious sedation may be useful in controlling anxiety and pain and decreasing the resultant cardiovascular responses in both healthy and hypertensive subjects. However, the behavioral control of patients plays an important role in the reduction of stress.

5. Conclusion

The findings of the present study showed that the hemodynamic effects were not significantly different in pa-

tients receiving lidocaine-epinephrine and those receiving prilocaine-felypressin.

Ethical Considerations

Compliance with ethical guidelines

Kinddly clarify the ethical considerations of the research such as ethical code and informed consent.

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Conflict of interest

The authors declared no conflict of interest

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