



## Effect of 2% lidocaine and 1:80000 epinephrine on heart rate and blood oxygen saturation during inferior alveolar nerve block and Gow-Gates block: a clinical trial

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### ABSTRACT

**Background and Aim:** The Gow-Gates (GG) block and the inferior alveolar nerve block (IANB) can be used interchangeably for anesthetizing mandibular molars. The aim of this study was to compare these two injections in root canal therapy of mandibular molars with regard to heart rate (HR) and blood oxygen saturation (BOS) changes.

**Materials and Methods:** Thirty patients between the ages of 18-70 years having mandibular molars on both sides of their jaw and in need of root canal therapy were recruited after signing a consent form. The patients' HR and BOS were measured 5 minutes before and immediately, 2, 5, 10, 15, and 20 minutes after injection by using a pulse oximeter. Paired t-test and Friedman test were used for statistical analysis of the data.

**Results:** This study was done on 30 patients (60 teeth). The results of HR and BOS showed no significant differences between the two injection techniques (P=0.6 and 0.7, respectively). Also, HR and BOS in each group were not significantly changed during the follow-ups (P=0.7 and 0.6, respectively).

**Conclusion:** According to the results, IANB and GG block by using 2% lidocaine and 1:80000 epinephrine had no significant different effects on HR and BOS.

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## Introduction:

Local anesthetic drugs are widely used in dentistry.<sup>(1)</sup> One of the side effects of local anesthetics containing vasoconstrictors is that they change the heart rate (HR) and blood pressure (BP).<sup>(2)</sup> Since pain and stress exacerbate these autonomic responses,<sup>(2-4)</sup> there is a need for more attention to controlling this problem in dental clinics.

Some investigators believe that increased HR and BP are not due to the use of drugs, and they are the result of the release of catecholamine from the cortex of the adrenal gland caused by stress and pain,<sup>(4,5)</sup> while others believe that cardiovascular responses are the result of the use of anesthetic drugs in dentistry.<sup>(3,6)</sup>

Generally, vasoconstrictors such as epinephrine decrease the toxic effects of anesthetic drugs and increase the duration of anesthesia.<sup>(7)</sup> However, they increase the peripheral BP and HR.<sup>(6-8)</sup> Some researchers believe that the use of epinephrine in anesthetic drugs increases the duration of anesthesia and therefore, decreases the need for repeating the injection, which results in a decreased catecholamine release due to fear of injection, and its benefits in individuals with arrhythmias outweigh its disadvantages.<sup>(9)</sup>

The inferior alveolar nerve block (IANB) and the Gow-Gates (GG) technique can be used interchangeably. The GG technique is indicated when the patient's mouth opening range is limited because of trismus and when the IANB is unsuccessful. This technique has a lower positive aspiration rate in comparison with the IANB (2% versus 10-15%).<sup>(10)</sup> The injection technique with less systemic effects is preferable.

Considering the increased HR and blood oxygen saturation (BOS) after block injections and their side effects and the lack of information on the effect of these two injection techniques, the aim of this study was to compare the effect of 2% lidocaine and 1:80000 epinephrine on HR and peripheral BOS during the IANB and the GG block.

## Materials and Methods:

The study design of this randomized clinical trial (IRCT2014122220396N1) was split-mouth

and the study population consisted of the patients referring to the dental branch of Islamic Azad University of Tehran. Thirty volunteers who had signed the consent form were entered into the study. Patients with systemic diseases or odontogenic pains in the last few days were excluded from the study. The side of injection (left or right) and the injection technique were randomly selected by using a random number table.

The characteristics of the participants such as age, sex, and the initial (baseline) HR and BOS were recorded by using a pulse oximeter (Jumper Medical Co., Guangdong, China) 5 minutes before injections. Each person was randomly assigned to control (IANB) and case (GG) groups. The technique and the side of injection were recorded. The patients' HR and BOS were measured and recorded immediately and 2, 5, 10, 15, and 20 minutes after injection. After a week, the procedure was repeated by using the other injection technique on the other side of the jaw.

Injections were carried out by the use of an injection syringe (Anthogyr Co., Sallanches, France) with negative aspiration and a 31-mm, 27-gauge needle. For each patient, one cartridge containing 2% lidocaine with 1:80000 epinephrine (Daru Pakhsh Pharmaceutical Mfg. Co., Tehran, Iran) was used for injection on each side of the jaw. Finally, the data were entered into SPSS software program (IBM Co., Chicago, IL, USA), and because of the normal distribution of the data, repeated measures analysis of variance (ANOVA) and paired t-test were used for statistical analysis.

## Results:

Sixty samples (30 patients) were included in this study. 60% of the participants were males and 40% were females with the mean age of  $30 \pm 5$  years (minimum age of 18 and maximum age of 70 years). The HR changes are presented in Table 1 according to follow-up times and the type of injection, which indicates that during the follow-up times, the HRs of the patients were similar and not statistically different ( $P=0.6$ ). Also, the HR changes in each group were not significant during the follow-ups ( $P=0.7$ ).

**Table 1. Heart rate (HR) changes according to follow-up times and the type of injection**

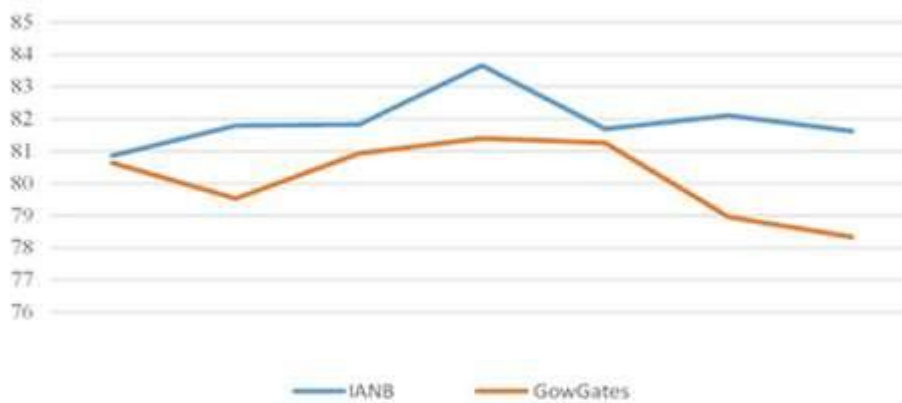
Type of injection	5 minutes before injection	Immediately after injection	2 minutes after injection	5 minutes after injection	10 minutes after injection	15 minutes after injection	20 minutes after injection
IANB	80.86±10.24	81.8±12.01	81.83±10.09	83.66±9.77	81.7±9.45	82.1±9.17	81.63±9.16
GG	80.63±12.26	79.53±13.01	80.93±11.8	81.4±11	81.26±10.36	78.96±10.6	78.33±9.6

IANB=Inferior alveolar nerve block, GG=Gow-Gates

The percentages of BOS are presented in Table 2 and Figures 1 and 2 according to follow-up times and the type of injection. The table shows that the two groups were not significantly different (P=0.7), and the changes in the percentage of BOS during the follow-up periods were not statistically significant (P=0.6).

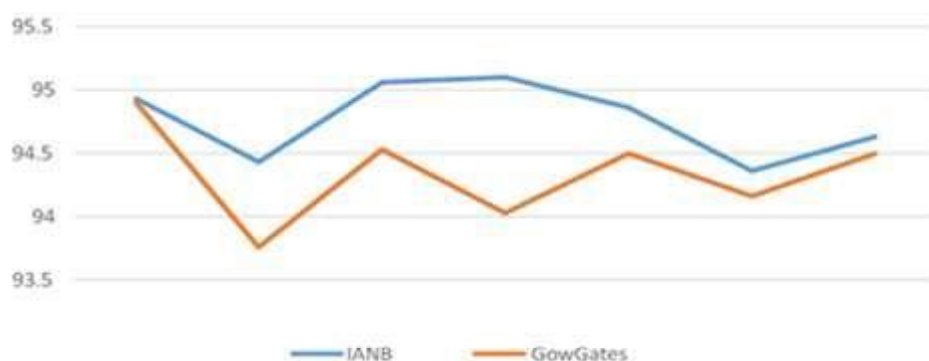
**Table 2. The percentage of blood oxygen saturation (BOS) according to follow-up times and the type of injection**

Type of injection	5 minutes before injection	Immediately after injection	2 minutes after injection	5 minutes after injection	10 minutes after injection	15 minutes after injection	20 minutes after injection
IANB	94.93±2.37	94.43±2.97	95.06±2.7	95.01±2.52	94.86±2.33	94.36±2.98	94.63±2.47
GG	94.9±3.03	93.76±3.09	94.53±2.7	94.03±3.06	94.5±2.14	94.16±2.61	94.6±2.68



**Figure 1- Changes in heart rate (HR) according to the follow-up time and type of injection**

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**Figure 2- The percentage of blood oxygen saturation (BOS) according to the follow-up time and the type of injection**

### Discussion:

The present study was conducted to compare the effect of 2% lidocaine and 1:80000 epinephrine on HR changes and the percentage of BOS following the IANB and the GG block. Statistical analysis of the data showed that there was no significant difference in HR changes and BOS percentages 5 minutes before injection and immediately, 2, 5, 10, 15, and 20 minutes post-injection.

Zarei et al compared the HR changes after periodontal ligament (PDL) and intraosseous injections with different anesthetics by using a pulse oximeter and found no significant difference in HR,<sup>(11)</sup> which is consistent with the findings of the present study. However, in a study by Ketabi et al, BP and HR decreased after infiltration and IANB injections of lidocaine<sup>(12)</sup>, which is not consistent with the results of the present study and with the findings of other studies which found no changes in BP and HR. However, HR changes were not significantly different with regard to the two injection techniques,<sup>(12)</sup> which is similar to our findings.

Wood et al compared the concentration of lidocaine in the blood and the HR changes after infiltration and intraosseous injections and found that the intraosseous injection significantly increased the HR in comparison with the

infiltration technique,<sup>(13)</sup> which is not consistent with the results of our study.

Faraco et al evaluated the effect of 2% lidocaine and 1:80000 epinephrine on BP changes during dental implant surgery and observed significant changes in various cardiovascular parameters including the systolic blood pressure (SBP), the diastolic blood pressure (DBP), and the HR. However, there were no significant changes in the mean arterial BP during dental implant surgery after the injection of 2% lidocaine and 1:80000 epinephrine,<sup>(14)</sup> which is consistent with the results of the current study.

Viana et al evaluated the changes in plasma catecholamine and hemodynamic responses to vasoconstrictors during the conventional block and the GG block with 2% lidocaine and 1:80000 epinephrine in comparison with a control group (conventional block injections with 3% mepivacaine plain).<sup>(15)</sup> Data analysis showed that the plasma level of epinephrine significantly increased after conventional block injections of lidocaine. However, there was no significant difference between the GG group and the control group. Also, there was no correlation between the hemodynamic parameters and the GG injection technique. In all the groups, systolic and diastolic BPs significantly decreased during the first minute and then increased during 5 and 10 minutes after injection and remained almost constant during 15 and 20 minutes after injection. These changes were more common after conventional block injections with lidocaine in comparison with other groups.<sup>(15)</sup> The results of the cited

study are different from our findings.

Several studies have compared the effect of the type of anesthetic solution and the injection technique on HR and the percentage of BOS; however, the present study is the first to compare the IANB and the GG block.

### Conclusions:

According to the results of the present study, it can be concluded that the IANB and the GG technique are not significantly different in terms of their effect on HR and the percentage of BOS.

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