

caused elevations in circulating epinephrine levels and cardiac output. In this study, the shortening of PEP, prolongation of LVET, and decrease of Q, which suggested a positive inotropic action, were observed in the local anesthesia group. Therefore, teeth removal has a positive inotropic effect. In the diazepam group, there were no significant changes in PEP and Q, and prolongation of LVET was less than that in the local anesthesia group. We have shown that diazepam minimized the effects of minor oral surgery on myocardial function. And it has been reported by Dionne and his associates that cardiac output tended to increase during oral surgery in unsedated patients, whereas output decreased during surgery in the group premedicated with diazepam. Their results support our hypothesis.

In preliminary studies,<sup>3,4</sup> it was demonstrated that there were no significant differences between the epinephrine groups with or without diazepam. This suggests that the effects on myocardial function produced by local anesthetics for dental procedures were not affected by diazepam.

In this study, diazepam minimized the effects of minor oral surgery, a stress-evoking situation. Diazepam does

not have a direct effect on cardiac function and does not modify the cardiac effects of local anesthetics. Thus it is suggested that diazepam attenuated the stress-induced responses, and that diazepam is very useful for minor dental surgery, especially for patients with dental phobia. These findings are supported by the evaluation of cardiac function by measuring STIs.

## REFERENCES

1. Wexler LF et al: Hemodynamic monitoring: Noninvasive techniques. *Anesthesiology* 1976;45(2):156-183.
2. Dionne RA et al: Effects of diazepam premedication and epinephrine-containing local anesthetic on cardiovascular and plasma catecholamine responses to oral surgery. *Anesth Analg* 1984;63:640-646.
3. Kamekura N et al: Effects of local anesthetics for dental procedures on systolic time intervals. *J Jpn Dent Soc Anesthesiol* 1985;13(2):201-210.
4. Kamekura N et al: Effect of local anesthetics for dental procedures on systolic time intervals under intravenous sedation with diazepam, *J Jpn Dent Soc Anesthesiol* 1986;14(2):210-217.

# Changes in Heart Rate and Blood Pressure During Dental Procedures with Local Anesthesia

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**T**he injection of local anesthesia, and certain dental treatments that constitute painful stimuli, may entail cardiovascular changes such as hypertension, hypotension, tachycardia, or bradycardia in some patients. Although such changes have been studied previously, there have been no reports on the changes in blood pressure and heart rate observed in a large group of patients. The objective of this study was to evaluate the changes in these parameters during local anesthesia for dental treatment in a large sample of patients.

## METHODS

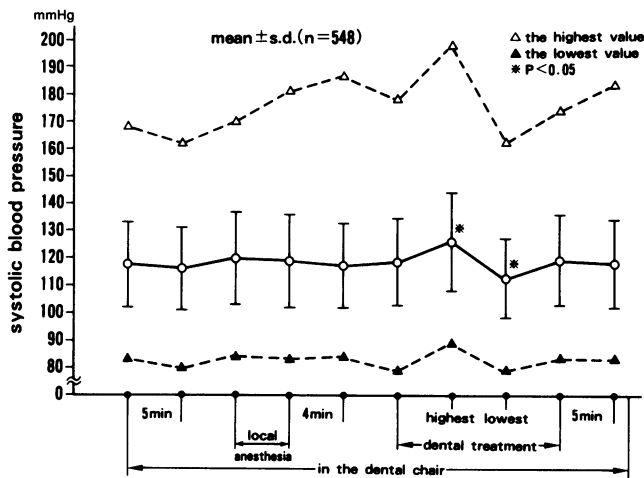
Five hundred forty-eight patients with ages ranging from 9 to 87, who underwent dental treatment as out-patients at Nishibori Dental Clinic in Tokyo, were evaluated for this study; 298 were male and 250 female. The majority (473) of the patients were between 20 and 59 years of age, and 49 were over 60 years old. We measured the systolic and diastolic blood pressures and the heart rate using the automatic digital sphygmomanometer (Nippon Colin, BP-103N) and the teleprinter (Nippon Colin). The patients were supine on the dental chair, and we usually wrapped the cuff around the left upper arm.

Blood pressure and heart rate were recorded (1) immediately after the patients had sat down on the dental chair; (2) 5 minutes later; (3) at the start of local anesthesia; (4)

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**Figure 1.** Changes in systolic blood pressure.

at its completion; (5) 4 minutes later; (6) at the start of the dental treatment; (7) at 2- to 5-minute intervals during the treatment; (8) upon completion of the dental treatment; and (9) 5 minutes later.

The values recorded immediately after the patient had sat down in the dental chair were paired with each subsequently recorded value, and possible statistical differences between patients were calculated by Student's *t*-test.

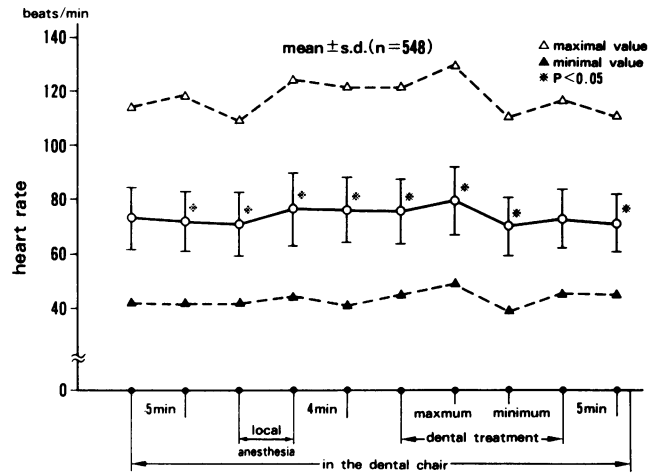
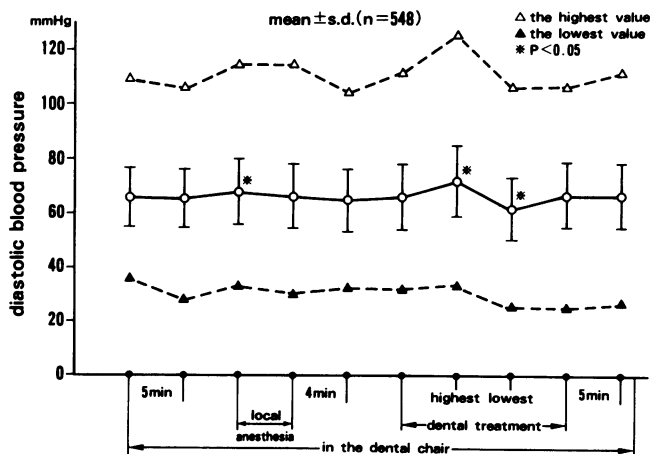
A 2% lidocaine-1/80,000 epinephrine solution was used for infiltration anesthesia.

**RESULTS**

Dental treatment mostly consisted of operative dentistry and tooth extraction, but also included endodontic and periodontal therapy. In most cases treatment was completed within 30 minutes.

The control systolic blood pressure, measured immediately after the patients had sat down in the dental chair,

**Figure 2.** Changes in diastolic blood pressure.



**Figure 3.** Changes in blood pressure.

was  $117.6 \pm 15.5$  mm Hg (mean  $\pm$  SD) with maximal and minimal values of 168 mm Hg and 83 mm Hg, respectively (Figure 1). The maximal elevation recorded during local anesthesia for any one patient was 41 mm Hg and the maximal fall 44 mm Hg; maximal elevation (60 mm Hg) and maximal decrease (44 mm Hg) were similar during the dental treatment.

The control diastolic blood pressure, which ranged from 36 mm Hg to 109 mm Hg, had a mean of  $65.9 \pm 11.2$  mm Hg. It rose significantly immediately after the beginning of local anesthesia and during the dental treatment, where it peaked. It then dropped significantly during the dental treatment, where it dropped to a low (Figure 2). The maximal elevation recorded during local anesthesia was 31 mm Hg and the maximal drop 27 mm Hg, whereas these were 46 mm Hg and 35 mm Hg, respectively, during dental treatment.

The heart rate recorded immediately after the patient had sat down in the dental chair showed a mean of  $73.2 \pm 11.5$  beats/min, with a maximum of 114 beats/min and a minimum of 42 beats/min. It decreased at the start of local anesthesia and increased at its completion. During dental treatment, it peaked to a high and dropped to a low (Figure 3). The maximal increase recorded during local anesthesia was 46 beats/min and the maximal decrease 29 beats/min, whereas these were 54 beats/min and 47 beats/min, respectively, during the dental treatment.

**DISCUSSION**

Significant changes in blood pressure and heart rate were observed in some of our 548 patients during dental treatment under local anesthesia. We would like to recommend blood pressure and heart rate monitoring of dental patients as means of preventing cardiovascular accidents.