Blood Pressure, Heart Rate and Temperature Variability during Periodontal Surgery

RG Gedik, I Marakoğlu, S Demirer

ABSTRACT

The aim of the present study is to investigate changes in blood pressure, pulse rate and temperature before and after periodontal surgery. The study included 127 normal healthy patients (43 males, 84 females) with age range 9 to 65 years (mean age: 26 ± 12 years) who underwent periodontal surgery. After administration of a local anaesthetic agent (Ultracain DS®) containing 0.06 mg adrenaline, the blood pressure, pulse rate, and temperature were measured. Based on the type of operation, the patients were divided into four groups. Statistically significant changes (as decreasing) in all parameters were observed (blood pressure : systolic 111.3 ± 20.1, diastolic 67.7 ± 13.1, pulse rate: 87.8 ± 14.9, temperature: 36.3 ± 0.3) but these changes were significantly decreased after operations (blood pressure: systolic 105.9 ± 19.7, diastolic 62.6 ± 11.3, pulse rate: 84.01 ± 13.1, temperature: 36.2 ± 0.3). And without age group differentiation in all parameters, statistically significant decreases were found among females ($p \leq 0.05$).

INTRODUCTION

Most dental treatments are conducted under local anaesthesia and it is well known that dental surgery causes increase in blood pressure, even in normotensive patients (1). The factors influencing this increase are not yet fully understood. It is important to determine factors causing the blood pressure response during dental surgery because fatal subarachnoid haemorrhage and massive bleeding related to dental surgery and high blood pressure have been reported (1). Previous studies have demonstrated that increases in blood pressure during tooth extraction are related to difficulties in tooth extraction and the volume of local anaesthetic used (1–5). The role of the autonomic nervous system in the blood pressure response induced by dental surgery has not yet been resolved. Studies have shown that an increase in blood pressure during dental surgery seems to be mediated primarily by an activation of the sympathetic nervous system (6–11).

METHODS

The study included 127 patients (43 males, 84 females), 9 to 65 years of age (mean age 26 ± 12) who underwent periodontal surgery at the Faculty of Dentistry, Cumhuriyet University, Turkey. The details of the procedure and clinical trials were explained to all patients and written informed consent was obtained from each. All patients were asked to complete a questionnaire on medical history and current medical therapy. According to the type of operation, the patients were divided into four groups (gingivectomy, periodontal flap, surgery, frenectomy and curettage). After administration of local anaesthetic (Ultracain DS®) containing 0.06 mg of adrenaline, baseline blood pressure, pulse rate and temperature were measured and recorded before and after periodontal operation. Also, the patients were divided into subgroups according to their education, age and gender. Statistical analysis (impaired t-test) was applied.

From: Cumhuriyet University, Faculty of Dentistry, Departments of Oral Diagnosis and Radiology, and Periodontology; Sivas, Turkey.

Correspondence: Dr R Gedik, Cumhuriyet University, Faculty of Dentistry, Oral Diagnosis and Radiology Department, 58 140 Sivas, Turkey.
Fax: 90 3462191237, e-mail: rgedik@cumhuriyet.edu.tr.

RESULTS

The changes in blood pressure, pulse rate and temperature during periodontal surgery under local anaesthesia were analyzed. The blood pressure (systolic and diastolic), pulse rate and temperature of the first group were decreased after operation ($p \leq 0.05$). The blood pressure (systolic and diastolic), pulse rate of the second group were decreased ($p > 0.05$) but the temperature did not change ($p > 0.05$) (Table 1). In the third and fourth groups, the blood pressure and pulse rate did not change ($p > 0.05$), but the temperature was significantly decreased ($p \leq 0.05$) after operation (Table 1).

According to the level of education, the patients were studied in four categories (Ignorant = 0, Basic education = 1, High school = 2, University = 3). Statistically all parameters were found to have significantly decreased among the patients who had basic and high school education after operation. There was no significant change observed in temperature ($p > 0.05$) among the patients who had university degrees; other parameters were significantly decreased ($p \leq 0.05$) (Table 2).

Regardless of age group differentiation, there was statistically significant decrease in all parameters among females ($p \leq 0.05$). Excluding systolic blood pressure, the other parameters were decreased in males ($p \leq 0.05$) (Table 3).

According to gender and age, the patients were subdivided into four groups (1 = 9-19, 2 = 20-29, 3 = 30-39, 4 = 40-60). In the first age group, statistically significant changes in pulse rate and temperature were observed ($p \leq 0.05$) but no such significant change in blood pressure (systolic and diastolic) was observed among females. In all parameters, no significant changes were observed among

Tables 1 & 2

Tables 3 & 4

males ($p > 0.05$). In the second age-group, excluding temperature, the other parameters were significantly decreased among females. Excluding temperature and pulse rate, the other parameters were decreased ($p \leq 0.05$) among males. In the third group, the only significant decrease was observed in pulse rate among females but no significant decreases were observed among males in all parameters. In the fourth group, statistical changes were observed among females in systolic blood pressure. No statistically significant changes were observed among males in all parameters (Table 4).

DISCUSSION

It is well known that blood pressure and pulse rate increase during tooth extraction. The contribution of the sympathetic nervous system in this increase is not well understood (2–5). Because the administration of local anaesthetics without dental treatment fails to increase plasma noradrenaline concentrations, the blood pressure response seem to be dependent on the dental treatment itself (2). Recent study observed that peak plasma adrenaline concentrations are reached just after the administration of local anaesthetics with adrenaline, while the peak plasma noradrenaline concentrations are obtained during tooth extraction. This difference in time-course of plasma catecholamines suggests that the adrenaline present in the local anaesthetic leaks into the systemic circulation instead of an activation of the sympathetic nervous system being the primary factor affecting the increase in blood pressure during tooth extraction (2–6).

In this study, the blood pressure, pulse rate and temperature were significantly decreased after gingivectomy operation ($p \leq 0.05$). The blood pressure and pulse rate were significantly decreased ($p \leq 0.05$) but the temperature did not change after flap operation ($p > 0.05$) The blood pressure and pulse rate did not change ($p > 0.05$), but the temperature was significantly increased ($p > 0.05$) after frenectomy and curettage operation.

Some studies revealed that the systolic blood pressure significantly increased above the preoperative control, throughout surgery, but diastolic pressure did not change significantly throughout surgery when compared with the preoperative control. The pulse rate increased just after the local anaesthesia and lowered afterward (2, 12). Increases in systolic blood pressure induced by tooth extraction correlated significantly with the age of the patient.

In this study, according to the level of education, the systolic blood pressure did not show any statistically significant changes ($p > 0.05$) but in the other parameters changes were found to be statistically significant in the patients who had basic education. Statistically important changes were found in all parameters among the patients who had high school education and significant changes were found only in temperature among the patients who had a university degree.

Many studies, in different age groups, showed that middle-aged and older patients have greater increases in blood pressure during dental surgery than younger patients (4). Another study suggests that the maximum blood pressure changes were more intense during surgery in boys than in girls (6).

In this study, important changes in pulse rate and temperature were observed between 9 and 19 years of age in female patients but these changes were not observed among males. In another group (aged 4 – 40 years) the only important change was observed in temperature. A change in systolic blood pressure was observed among females but no such change was observed among males of this group.

CONCLUSION

Many factors such as patient age, gender, education, the volume of local anaesthetic, the length of the treatment and the difficulty of the procedure may be strong determinants of the extent of the increase in blood pressure. All the parameters that showed statistically significant changes may only increase more in medically compromised patients and such patients may warrant more precaution and routine monitoring during periodontal and implant surgery.

ACKNOWLEDGEMENT

We would like to thank Nurse Nevin Acar for her assistance in this study.

REFERENCES

1. Matsumura K, Miura K, Kurokawa H, Abe I, Takata Y. Lack of association between QT dispersion and blood pressure response during dental surgery. Clin Exp Pharmacol Physiol 2001; **28**: 748–51.
2. Nakamura Y, Matsumura K, Miura K, Kurokawa H, Abe I, Takata Y. Cardiovascular and sympathetic responses to dental surgery with local anesthesia. Hypertens Res 2001; **24**: 209–14.
3. Miura K, Matsumura K, Nakamura Y, Kurokawa H, Kajiyama M, Takata Y. Suppression of cardiac sympathetic nervous system during dental surgery in hypertensive patients. Hypertens Res 2000; **23**: 207–12.
4. Matsumura K, Miura K, Takata Y, Kurokawa H, Kajiyama M, Abe I, et al. Changes in blood pressure and heart rate variability during dental surgery. Am J Hypertens 1998; **11**: 1376–80.
5. Tsuchihashi T, Takata Y, Kurokawa H, Miura K, Maruoka Y, Kajiyama M et al. Blood pressure response during dental surgery. Hypertens Res 1996; **19**: 189–94.
6. Satou T, Mukaida T, Abe E, Nozaka K, Amari E. Blood pressure changes in children during minor oral surgery. Shoni Shikagaku Zasshi 1990; **28**: 761–9.
7. Clayton DG, Allt-Graham J. Intravenous lignocaine in dental anaesthesia. The effect of pretreatment on the incidence of dysrhythmias. Anaesthesia 1983; **38**: 1066–70.
8. Niebergall C, Giglio JA, Campbell RL. Evaluation and management of the cardiac patient for office oral surgery. Anesth Prog 1983; **30**: 67–71.
9. Passler L, Benkert P. Cardiovascular behavior after local anesthesia in the jaw region with added vasoconstrictor agents. Stomatol DDR 1978; **28**: 415–20.
10. Elliott GD, Stein E. Oral surgery in patients with atherosclerotic heart disease. Benign effect of epinephrine in local anesthesia. JAMA 1974; **227**: 1403–4.
11. Nordenram A. Vasoconstrictor agents as local anesthetics in dental practice. Nor Tannlaegeforen Tid 1969; **79**: 608–17.

12. Nagao H, Munakata M, Tachikawa N, Shiota M, Kasugai S. Clinical study of risk management for dental implant treatment – changes of blood pressure and pulse rate during implant surgery under local anesthesia. Kokubyo Gakkai Zasshi 2002; **69**: 27–33.