

Original Research Article

Analysis of blood pressure during tooth extraction

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Abstract

Introduction: Surgical procedures have a history of dental pain, apprehension and fear reported by patients. Because of these reasons, they trigger a series of modifications that lead to changes in blood pressure and stress occurrences. **Objective:** This study aimed to monitor changes in blood pressure pre-, trans-, and postoperatively and assess whether the differences would be significant. **Material and methods:** One hundred and ninety-four patients, both genders, aged between 14 and 65 who were undergoing surgery for tooth extraction were selected. They had their systolic and diastolic blood pressures measured at four different times: preoperative (M1), post-anesthesia (M2), post-extraction (M3) and at the end, after the suture (M4), with the aid of a digital tensiometer. **Results:** There were statistically significant differences between systolic blood pressure changes among all times, except between M1 and M4. Concerning the diastolic blood pressure measurement, there were statistical differences among all times except between M1xM4 and M2xM3. **Conclusion:** There were changes in blood pressure between different moments of extractions.

Introduction

Blood pressure (BP) is understood as that within arteries with communication to the walls. It can be calculated by multiplying the total peripheral resistance by the cardiac output and it can vary from a maximum value during systoles and a minimum value during diastoles [23]. These measurements can undergo alterations because of systemic, behavioral, and physiological modifications when one faces stimuli caused by oral surgery, for example [8].

The current dental surgeries have a close relationship with blood pressure changes, since patients potentially correlate dental treatment with pain [4], resulting in fear [24], anxiety and stress, which is a body response to negative [27] and/or stress [19, 22, 26] stimuli many times imperceptible to the dentist. Consequently, one of the most evident effects in modifying the physiologic balance is the blood pressure change, resulting from the stress due to dental procedure [9]. In Brazil, there has been found a prevalence of 15% of patients with dental anxiety [10], which can reach to 95% when tooth extraction is mentioned [11].

Heart diseases are a great risk for world population health [15] reaching from 22% to 41% of Brazilian population [2, 6], and it has been an extremely prevalent condition particularly in patients who will be submitted to surgeries [25]. The disease is currently explained by several genes interacting with many factors, among them, inheritance, obesity, and food [12, 13]. The dentists must pay attention to any symptom and they play an important role in diagnosing the disease [16]. There exists also a relationship between bacterial endocarditis and oral surgery, which can result in heart alterations [30].

It is also possible to cite "white coat hypertension", a condition of blood pressure change only noted in clinical practice, where the patient is anxious and stressed waiting to be seen by either the dentist or the doctor, but it is within normal range during other daily situations [16].

Another relationship extremely important in dental clinics and mainly during oral surgeries is the use of anesthetic solutions associated with vasoconstrictor drugs because the following are the most used ones in dental practice [14]: epinephrine, felypressin, phenylephrine and noradrenaline. These vasoconstrictor drugs have been associated with anesthetic salts and have directly acted on the system of blood vessels of the area anesthetized, resulting in the vasoconstriction as main effect, but exerting a side effect on blood pressure and/or

heart rate [3], in addition to the pain and anxiety during anesthetic application [18].

According to Trento *et al.* [28] and Tucci *et al.* [29], these drugs inside the circulatory system can cause alterations. Adrenaline raises the systolic pressure and the heart rate, causing excitatory movements in the myocardium, palpitations and tachycardia, but these symptoms are transitory and not serious [29]. On the other hand, phenylephrine and noradrenaline can significantly raise both systolic (SP) and diastolic (DP) pressure. Felypressin does not affect directly the myocardium, but it is a powerful vasoconstrictor of the heart, which can lead to angina attacks with myocardial ischemia in patients with some heart circulation deficiency [17]. With the advent of vasoconstrictor drugs, it has been noted that most of the heart complications occur during or after the surgical procedure [21]. Generally, these acts and symptoms cause blood pressure alterations. The dentist should control and pay special attention mainly in hypertensive and elderly patients and those with any heart alteration [1].

This study aimed to measure and analyze the result of systolic and diastolic blood pressure values at four moments of possible significant alterations during tooth extractions.

Material and methods

This study was submitted and approved by the Ethical Committee in Research of the Center of Higher Education of Campos Gerais (Cescage), under protocol no. 976/CEP. The study randomly selected 194 volunteers, both genders (91 male and 103 female), aged between 14 and 65 years-old, who were referred to tooth extraction in the Discipline of Oral Surgery of the School of Dentistry of the Center of Higher Education of Campos Gerais, Ponta Grossa, Paraná, Brazil.

All patients participating in the study were carefully evaluated by anamnesis, physical and radiographic examination, and when necessary by complementary laboratorial tests. Inclusion criteria comprised the referral for at least one tooth extraction and good general health to be submitted to the procedure. Patients who were not within the parameters to be submitted to tooth extraction; continuously using anticoagulant and/or antiplatelet drugs for the last six months; pregnant women; presenting pericoronitis, hepatic dysfunction, uncontrolled diabetes mellitus, and hypertension; and using substances capable of altering blood pressure were excluded from the

study. All measurements were executed by a single examiner previously trained after the signing of a Free and Clarified Consent Form by all patients who were willing to participate in the study.

The measurements were carried out with the aid of a digital tensiometer (G-Tech Model GS100® – Genexel Medical Instruments, South Korea), previously calibrated, verified and approved by Inmetro. The systolic and diastolic blood pressure were measured (in mmHg), at four different moments: waiting room, ten minutes prior to the patient was sat on dental chair (M1), five minutes after the application of the first anesthetic tube (1.8 ml of 2% mepivacaine with epinephrine 1:100.000) (M2), after tooth extraction (M3) and after suture (M4).

After the analysis of the data, the following statistical tests were applied: Analysis of Variance for Repeated Measures Tukey-Kramer Multiple Comparisons, with level of significance of 5%.

Results

By evaluating the data of systolic measurements, the highest mean was at M1 followed by M4, M3 and M2. Comparing the systolic measurements between two different moments, only at M1xM4 there were no statistically significant differences ($p > 0.05$). At the other measurements, there were statistically significant differences between M1xM2 ($p < 0.001$), M1xM3 ($p < 0.001$), M2xM3 ($p < 0.01$), M2xM4 ($p < 0.001$) and M3xM4 ($p < 0.001$) (table I). The value of $p < 0.0001$ is considered as extremely significant.

Table I - Mean and standard deviation of systolic blood pressure for different moments

Group	N. of patients	Mean	Standard deviation	*
Systolic M1	194	119.2	15.982	A
Systolic M2	194	112.2	14.315	B
Systolic M3	194	115.1	15.141	C
Systolic M4	194	118.5	14.693	A

* Equal letters mean that there were no statistically significant differences; different letters mean significant differences

Concerning to the diastolic measurement, the highest mean was seen at M4, followed by M1, M3 and M2. Comparing these moments, at two comparisons there were no statistically significant differences: M1xM4 ($p > 0.05$) and M2xM3 ($p > 0.05$). At the other comparisons, there were statistically significant differences between M1xM2 ($p < 0.001$), M1xM3 ($p < 0.001$), M2xM4 ($p < 0.001$) and M3xM4 ($p < 0.001$) (table II).

Table II - Mean and standard deviation of diastolic blood pressure for different moments

Group	N. of patients	Mean	Standard deviation	*
Diastolic M1	194	77.3	14.532	A
Diastolic M2	194	71.3	12.099	B
Diastolic M3	194	73.6	12.189	B
Diastolic M4	194	77.8	11.848	A

* Equal letters mean that there were no statistically significant differences; different letters mean significant differences

Discussion

The knowledge of the patient's general health is of extreme importance for dentists, since systemic alterations can influence on dental treatment. Heart diseases play an important role in this context, mainly hypertension, which is the most common diseases in adults [8, 15] and a growing condition in Brazil, affecting 30% of the population [2, 6, 10].

In this study, it could be observed that during a dental surgical procedure existed a significant alteration of blood pressure, because the peak of SP occurred at the first moment, that is, at the pre-operative time and before the anesthetic solution injection, characterizing the “white coat hypertension” [16], in addition to the anxiety generated by the effects of oral surgery can cause to patients, for example, pain, fear, and stress [4, 11, 19, 22, 24, 26].

Salles *et al.* [20], by studying the influence of vasoconstrictor drugs on blood pressure, affirmed that there were not significant alterations after the application of 2% lidocaine with noradrenaline, 3% prilocaine with felypressin and 2% mepivacaine with epinephrine. According to Dantas *et al.* [7], who evaluated the effect of mepivacaine with epinephrine on blood pressure, only the diastolic pressure slightly increased about 1.5 mmHg, which is within the patterns of normal measurements: 120 for SP and 80 for DP. In this present study, the mean and standard deviation of both systolic and diastolic blood pressure measurements were within the patterns of physiologic normality. Santello *et al.* [21] affirmed that most of the cardiac risks for patients submitted to dental surgeries occur after the ending of the procedure. In this present study, the DP peak was just after the ending of the procedure.

Conclusion

Within the results of this study, it can be concluded:

- There were alterations in blood pressure between different moments of tooth extraction;
- The highest mean of systolic pressure measurements was during the pre-operative moment;
- The highest mean of diastolic pressure measurements was after the ending of the procedure;
- There were significant differences in systolic pressure measurements between M1xM2, M1xM3, M2xM3, M2xM4 and M3xM4, when compared between each other;
- There were significant differences in systolic pressure measurements between M1xM2, M1xM3, M2xM4 and M3xM4, when compared between each other.

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