



## Blood Pressure Variations in the Perioperative and Postoperative Period after Tooth Extractions: An Evaluative Study

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### Abstract

**Introduction:** Tooth extraction generates a certain level of stress and anxiety; furthermore, these factors can produce a sudden variation in blood pressure even in normotensive patients. This study aimed to determine the variation in blood pressure values and its relationship with the level of anxiety in patients undergoing dental extractions.

**Methods:** In total 110 adult patients, requiring simple dental extractions were selected and treated at the Surgery outpatient Clinic. Thus, the modified Corah questionnaire was applied to determine the level of anxiety and blood pressure control was performed by the auscultatory method, using a Riester © Duplex® 2.0 Stethoscope. The Riester exacta® aneroid sphygmomanometer, complying with the European standard EN1060, was used in the preoperative period, 5 minutes after the application of the local anesthetic and in the immediate postoperative period. Data were analyzed at a statistical confidence level of 95%.

**Results:** 98.2% (n = 108) showed a variation in blood pressure values between the pre- and postoperative time intervals, however, a significant variation occurred in the systolic pressure; the highest values were recorded in the immediate postoperative period. There was greater variability of blood pressure in patients with moderate to severe anxiety than in patients with mild anxiety. Patients from 50 - 60 years of age showed a higher variation in blood pressure values during the procedure.

**Discussion:** There was a significant variation in blood pressure during dental extractions in normotensive patients, and the level of anxiety shown by patients was related to the blood pressure values measured in this study.

**Keywords:** Arterial Pressure; Tooth Extraction; Dental Anxiety; Sphygmomanometers; Oral Surgical Procedures

### Introduction

A sudden rise in blood pressure is a form of adaptation that can occur in both hypertensive and normotensive patients and is manifested by external factors such as pain, anxiety, distress. The procedures performed in Dentistry and especially in Oral Surgery, generate stress and anxiety in patients [1], and play an important role in the variation of blood pressure [2].

The rapid and temporary variation in blood pressure levels can reach levels that are harmless to those in a healthy condition, but could lead to complications in patients at risk [3]. The ability to regulate these variations depends on the blood flow in the organs with the highest flow, the speed of ascent and the values reached.

The three main reasons for recording blood pressure values in patients are: firstly, to obtain the baseline data on the patient's

current condition, thus enabling decisions to be made about their treatment; secondly, to record relevant data for their medical records, control follow up and decide whether care has been provided; and lastly, to provide medical legal support [4].

Therefore, identifying a patient with a high level of anxiety could help to minimize these concomitant effects by providing adequate perioperative management. The aims of this research were twofold: firstly to determine the variation in blood pressure values and their relationship with the level of anxiety in patients who underwent simple dental extraction procedures in the Surgery Division outpatient clinic of the UCE School of Dentistry; secondly, to prevent clinical decompensation in the patients treated, and evaluate the data obtained to enable allow monitoring of conditions that could lead to more serious problems.

## Materials and Methods

### Study design and ethical considerations

An evaluative study was conducted in patients who arrived at the Oral Surgery outpatient clinic of the Dental School, to undergo tooth extraction procedures under local anesthesia during August 2019 to December 2019. The Group of patients selected agreed to participate and signed the term of free and informed consent as indicated by the Subcommittee on Ethics and Research in Human Beings of the Central University of Ecuador. (No. MSP-VGVS-2017-0955-0/11-21-2017). This cross-sectional study is reported according to the STROBE statement.

### Participants and treatment protocol

Participants in the study were selected by using a non-probabilistic convenience sampling method, according to the established inclusion and exclusion criteria. The variables considered were blood pressure, anxiety level, age, gender, and operative time required to perform simple extraction. We included 110 normotensive patients in the age-range from 18-60 years, both genders, who needed oral surgery. Surgery was performed under local anesthesia; however, no patient received more than three vials of local anesthetic.

### Clinical measurements

In fact, to determine the level of anxiety of the patients, the modified Corah's Dental Anxiety Scale (DAS) [5], a validated questionnaire in the Spanish language was applied. This consisted of five questions regarding dental care, according to which the patients were classified as having mild anxiety if the sum of their answers totaled < 9; moderate anxiety 9 - 12; high anxiety 13 - 14 and severe anxiety > 15. Blood pressure was measured using the auscultatory method, using a Riester © Duplex® 2.0 Stethoscope. The sphygmomanometer used was the Riester exacta® aneroid type, complying with the European standard EN1060, and supplementary ANSI/AAMI/ISO 2007 specifications for sphygmomanometers.

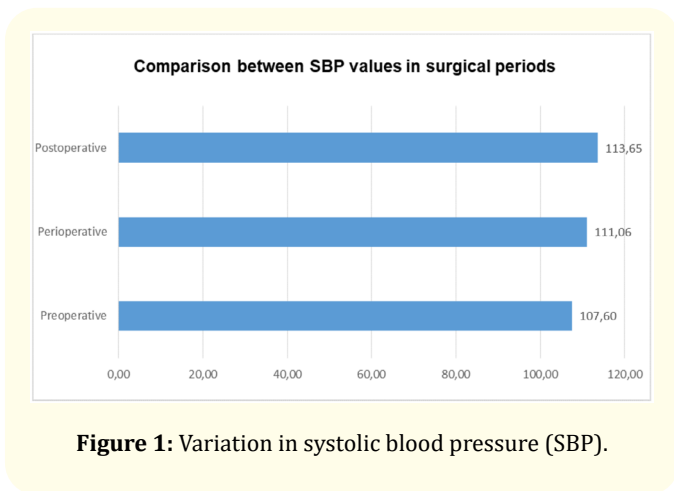
Prior to tooth extraction, the Corah questionnaire was applied to determine the level of anxiety. Thus, an initial basal pressure measurement was made, by which the values were found to be in normal range according to the 2017 AHA classification. Moreover, after performing the anesthesia technique with Lidocaine 2% 1.8 ml with epinephrine 1: 80000 Xylestesin™ of the 3M brand, the time of five minutes was allowed to elapse before taking the blood pressure again. On conclusion of the procedure, the blood pressure was measured once more to record last pressure after the patients had undergone tooth extraction.

### Statistical analysis

The level of significance was 5%. Statistical analyses were performed using SPSS software version 25 and with free software R version 3.5.1. The Kruskal Wallis, Mann-Whitney and Friedman tests were applied for data analysis.

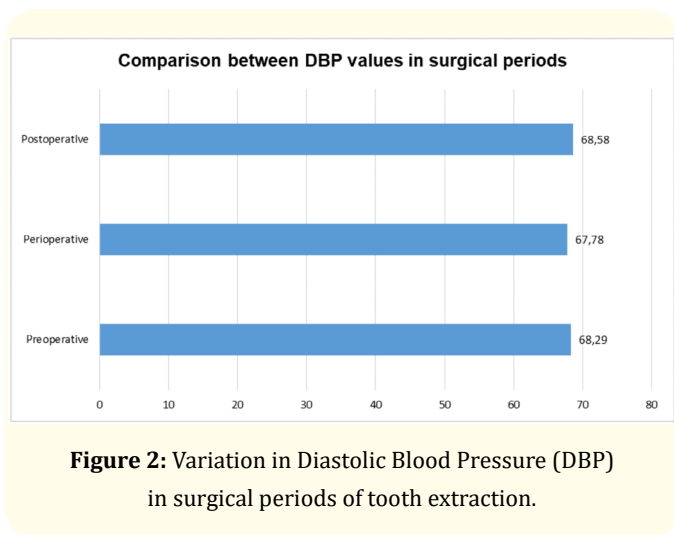
## Results

Relative to distribution of the population of 110 patients included in the study, 54.5% (n = 60) were male and 45.5% (n = 50) were female patients. The age-range was between 18 - 28 years in 43.6% (n = 48). The first results are shown in figure 1, presenting the mean value of systolic pressures measured, which tended to rise as the surgical procedure progressed. Therefore, there was significant variation in systolic blood pressure during the simple tooth extraction procedure (p = 0.000) according Friedman test.



**Figure 1:** Variation in systolic blood pressure (SBP).

In figure 2, the mean diastolic pressure values were compared, and a slight variation in these was observed during the simple extraction procedure ( $p = 0.249$ ). There were no significant differences in mean diastolic pressure values during different stages of the procedure.



**Figure 2:** Variation in Diastolic Blood Pressure (DBP) in surgical periods of tooth extraction.

Table 1 shows each blood pressure behavior during the entire procedure. In the perioperative period, a complete variation was recorded in 96.4% of patients ( $n = 106$ ). The predominant variation in blood pressure behavior that could be seen was an increase and decrease in values of the systolic and diastolic stages, respectively, which occurred in 30.9% of patients.

Blood pressure behaviour	Between Preoperative - Perioperative Periods	%	Between Perioperative - Postoperative Periods	%
Increase (SBP) Y (DBP)	24	21.8%	41	37.3%
Decrease SBP and DBP	5	4.5%	20	18.2%
Increase SBP and Decrease DBP	34	30.9%	22	20.0%
Decrease SBP and Increase DBP	23	20.9%	4	3.6%
Only increase in SBP	11	10.0%	11	10.0%
Only decrease in SBP	5	4.5%	2	1.8%
Only increase in DBP	3	2.7%	4	3.6%
Only decrease in DBP	1	0.9%	4	3.6%
DBP and SBP are maintained	4	3.6%	2	1.8%
Total	110	100.0%	110	100.0%

**Table 1:** Blood pressure behavior according to the surgical period.

Abbreviations: Systolic Blood Pressure (SBP); Diastolic Blood Pressure (DBP).

At the time interval in the middle of the preoperative and postoperative periods, 98.2% of total number of patients ( $n = 108$ ) showed variation in the values. Moreover, in this period 37.3% of patients showed increase in their SBP and DBP condition, when compared with their baseline condition.

Figure 3 shows that there were statistically significant differences in the level of anxiety and blood pressure values in the postoperative period. Thus, the mean values between different levels of anxiety were not similar ( $p = 0.003$ ).

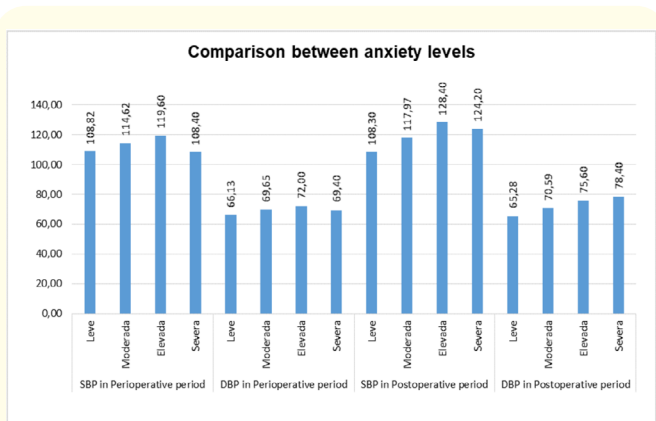


Figure 3: Relationship of blood pressure variation with anxiety levels.

Table 2 shows the range variations in blood pressure values recorded in normotensive patients during the surgical procedure; values between 89 - 150 mmHg for systolic and 42 - 100 mmHg for diastolic pressure. Thus, the higher values were relative to the hypertensive condition. Whereas, the highest rate in systolic pressure occurred in postoperative period with a final value for the male group = 113.62 mmHg; and for the female group = 113.68 mmHg. Finally, maximum rate for diastolic pressure was recorded in the postoperative period with values of 68.30 and 68.92 for male and female groups, respectively.

Therefore, the highest blood pressure values occurred in the immediate postoperative period. Whereas, there were no statistically significant differences in blood pressure measurements between

		Preoperative				Perioperative				Postoperative			
Systolic blood pressure													
Gender	N	Mean	SD	Range		Mean	SD	Range		Mean	SD	Range	
M	60	108.60	10.869	88	128	111.62	12.814	89	148	113.62	11.921	90	140
F	50	106.40	11.393	82	128	110.40	13.744	90	140	113.68	16.305	90	150
Diastolic blood pressure													
M	60	67.40	8.310	50	78	65.93	10.697	42	96	68.30	10.190	50	90
F	50	69.36	9.253	50	78	68.00	10.887	52	100	68.92	10.776	46	100

Table 2: Systolic and diastolic pressure values according to gender and surgical stage during tooth extraction.

male and female patients during any stages of the simple tooth extraction procedure.

Relative to age, higher blood pressure values were recorded in patients aged 50 - 60 years, while for systolic and diastolic pressure, between the ages of 39 - 49 years, 18 - 28 years and 29 - 38 years, the results were similar. Finally, no significant differences were found between the variation in blood pressure, anesthetic technique, and the number of vials of anesthetic (1-3 vials) used in simple tooth extractions as shown in table 2.

Discussion

In dental practice, the most common pathological systemic condition detected in patients who seek care is high blood pres-

sure (HTA, also referred to as HBP or hypertension), which ultimately requires special care, so the registration of vital signs, such as arterial pressure becomes an essential requirement for making decisions about the proper management, and therefore, ensuring that it follows a normal course. Blood pressure is a vital sign that is continually changing due to the circadian rhythm and different factors such as stress and anxiety. In fact, during tooth extraction procedures, patients are imminently affected by these factors [1].

In the present study, blood pressure and anxiety levels were analyzed in normotensive patients, considered ASA I, by the American Association of Anesthesiology (AAA), during simple tooth extraction. This was based on previous studies [1,4] that also analyzed variables such as pulse, frequency heart rate, respiratory rate and oxygen saturation. Other authors [4] performed BP measurements in other surgical procedures, or during implant surgery [3].

Some of these studies [1,4,6], showed that there was no significant difference in the relations between blood pressure values and gender data, similar to the findings of the present study. Moreover, no differences were found between gender data and anxiety levels of the patients in this study, in contrast with results found in a study conducted recently [7].

The results shown in our study indicated that when compared with the group of patients aged between 18-60 years, patients aged between 50 - 60 years were in the Group that showed the highest variation in their blood pressure values. However, in study conducted by Mendieta, *et al.* [1] they found no statistically significant differences between the ages, because they analyzed patients between 18 and 67 years, but the groups were divided into those over 35 and under 35 years. Therefore, we consider that this division was slightly too wide to make it possible to find differences between the groups.

Relative to the results of blood pressure values, the changes found differed widely. In the present study, variation in blood pressure was obtained in 98.2% of patients between the pre- and postoperative periods, results similar to those of a previously described study [1] that found a variation in 95.9% of patients. In addition, statistical differences were found in our study, when the variation in systolic blood pressure was compared. However, for the values referring to the diastolic stage, there were no statistically significant results, in agreement with other studies described [6,7]. Whereas, in recent studies, statistical differences were found in both types of pressure [2,4,8,9].

As regards variation in BP values according to the surgical stage, our results showed a higher value recorded in the postoperative period, and this could be associated with duration of the surgical procedure. Considering that this was performed in the outpatient clinic by students undergoing training, the procedure could possibly have been extended, in addition to other associated factors such the surgery itself, and the tooth to be extracted. Similar results have been described in the literature [7].

The type of anesthetic and the number of vials used to perform the surgery were considered contributory variables. Thus, 2% 1.8 ml lidocaine was used with epinephrine 1: 80000, with the maximum number of three vials for each patient. No significant data

were found relative to variation in BP according to the number of anesthetic vials used, results that were similar to those previously found in recent studies [6,10].

Bajrami Z., *et al.* [2], used 2 ml of lidocaine 2% with 1: 100,000 adrenaline, and 2% lidocaine without adrenaline, and found no significant variations in blood pressure irrespective of the type of anesthetic, as has also previously been shown by Mestre, *et al.* 2001, [11]. Moreover, Dantas M., *et al.* [4], used mepivacaine 2% (36 mg) with epinephrine 1: 100,000 and articaine 4% (72 mg) with epinephrine 1: 100,000, and concluded that both anesthetics generated variations in vital signs. Their results, however, demonstrated that articaine had a smaller residual effect when compared with baseline BP values; while compared with the results of mepivacaine, the delayed effect lasted 15 minutes longer. Vasconcellos *et al.* found similar results [9].

This result was associated with a low dose of epinephrine (no more than 3 vials), because, according to data in the literature, the presence of vasoconstrictors in small doses would not generate significant changes in normotensive patients. Nevertheless, an increase in blood pressure after tooth extraction has been described, and this was mainly attributed to stress and anxiety caused by pain, which appeared to have remained after the surgery performed [2,11].

According to the level of anxiety, based on the Corah scale, the most frequent level for both genders was mild anxiety, with the level being 56% for the female and 55% for the male gender. Moreover, a statistically significant difference in the variation of blood pressure was found in patients who showed moderate and severe anxiety; similar results were described by Dantas M., *et al.* [4] who concluded that moderate and severe anxiety were related to very high blood pressure values.

Finally, recent studies conducted in China, India and Europe [2,8,12], found an increase in BP in the stages of both systolic and diastolic pressure. Whereas, in studies conducted in Latin America and Spain [6] significant variations in systolic pressure were found, in agreement with the results obtained in the present study.

## Conclusion

Changes in blood pressure during tooth extraction procedures can reach values considered within the conditions of hypertension,

even in normotensive patients. Systolic pressure was the most affected when compared with normal values at baseline. The level of anxiety showed by patients was correlated with the increase in blood pressure values, because higher blood pressure values occurred in patients who showed moderate to severe anxiety when compared with values occurring in those who showed mild anxiety. Whereas, the highest values of variation in blood pressure occurred in the postoperative period, which could be associated with multiple contributory factors, emphasizing that patients in the age group of 50 to 60 years showed the highest values when compared with the results obtained in young patients.

### Funding

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### Conflict of Interest

There are no conflicts of interest to declare with regard to this article.

### Ethical Approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This study was submitted for ethical approval to the Subcommittee on Ethics and Research in Human Beings of the Central University of Ecuador. (No. MSP-VGVS-2017-0955-0/11-21-2017).

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