

Changes in Blood Pressure during Root Canal Treatment in First and Subsequent Visit

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ABSTRACT

Introduction: Anxiety, stress, and fear of pain are unpleasant emotions associated with dental treatment. The sensation of pain or anxiety in patients may cause undesirable cardiovascular changes and in some cases, it might lead to a medical emergency.

Objective: The present study was conducted to observe the changes in blood pressure before and during treatment and to compare the changes in blood pressure between first and subsequent visit.

Materials and Method: In this quantitative analytical cross-sectional study, 132 patients visiting the AIMS dental clinic due to acute pulpitis from May 1st to October 31st 2019 were included after getting institutional ethical approval. Resting blood pressure was measured in supine position before treatment. Local anaesthesia without adrenaline was injected and blood pressure was again recorded 10 and 20 minutes after injecting local anaesthesia during the procedure. Change in mean arterial pressure and average of mean arterial pressure was determined during each visit for comparison.

Result: At each visit, there was rise in blood pressure during procedure in both sexes across all age groups. The change in mean arterial pressure between first (5.43 ± 7.42 mmHg) and second (4.86 ± 5.76 mmHg) visit was not significant ($P > 0.05$). Average mean arterial pressure during second visit (92.46 ± 10.49 mmHg) was lower than first visit (95.81 ± 11.62 mmHg) which was found to be significant ($P < 0.05$).

Conclusion: Pain and anxiety related to dental treatment causes rise in blood pressure. As pain subsides and patient becomes comfortable with the clinical environment there is fall in blood pressure.

Keywords: Anxiety; blood pressure; pulpitis.

INTRODUCTION

Root canal treatment (RCT), also known as endodontic treatment, is the process of saving the tooth. During root canal treatment infected, injured or dead pulp is removed from the tooth. The infected tooth may be associated with pain and abscess around the roots of tooth.^{1,2} Many patients experience stress and anxiety during dental treatment.³ Despite the technological advances, anxiety and the fear of pain

associated with dental procedure remain globally widespread and is considered a major reason to

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avoid dental treatment.⁴ Even though various dental treatment can evoke anxiety and fear in patients, extraction and root canal treatment were found to cause higher levels of anxiety. A survey conducted by American Association of Endodontists observed negative perception of public for endodontic therapy because of the associated pain.^{5,6} The stress caused by anticipation related to dental treatment may cause in activation of the sympathetic nervous system and hypothalamus-pituitary-adrenal axis. This can lead to increased heart rate, vasoconstriction and release of catecholamines and cortisol resulting in rise in blood pressure (BP).^{3,7,8} As the root canal treatment is completed in multiple visits, the aim of the study was to compare anxiety induced changes in BP in first and subsequent visit to dental clinic.

MATERIALS AND METHOD

This quantitative, analytical cross-sectional study was conducted in AIMS dental clinic, Jadibuti, Kathmandu, from May 1st to October 31st 2019. In this study, 132 patients were included by convenience sampling. The patients visiting the clinic due to acute pulpitis between the ages of 16-60 and those undergoing treatment for single tooth were included in the study. Mentally retarded, pregnant woman, patient taking anti-anxiety drugs, root canal treatment indicated due to other than acute pulpitis and patient undergoing treatment for multiple teeth were excluded. Total patients were divided into five age groups: 10-20; 21-30; 31-40; 41-50; 51-60. This clinical observational study was approved by institutional review board of KIST Medical College and Teaching Hospital (Ref. 2075/76/63). Informed consent was taken from all the patients participated in this study. In case of patient below 18 years, consent was taken with their parents.

Proper counselling of the patients regarding the procedure was done before treatment. Each patient was allowed to rest at least five minutes in reception area before recording the blood pressure. After proper counselling and consent, resting blood pressure was recorded in supine position on the dental chair. Blood pressure was measured by blood pressure monitor marketed by Sigma medical technology Co., Hongkong. The accuracy of electronic BP sphygmomanometer was checked against mercury sphygmomanometer according to the guidelines provided by American Medical Association.⁹ After recording resting blood pressure, local anaesthesia (LA) without adrenaline

was injected and root canal treatment was started. Local anaesthesia without adrenaline was injected without exceeding the maximum recommended dosages (MRDs) for local anaesthetic drugs by Food and Drug Administration.¹⁰ Around 92% patients received 5 ml of LA during each visit. Length of each appointment was about 30 minutes. In first visit, access opening, partial pulp extirpation was done and devitalizing agent was placed. In second visit, working length determination and complete root canal debridement and enlargement was done with hand instruments. During the procedure blood pressure was recorded two times: 10 minutes and 20 minutes after the local anaesthesia.

Mean arterial pressure was calculated and average of mean arterial pressure during the procedure was determined. Mean arterial pressure (MAP) was calculated by the formula, $MAP = (\text{Diastolic blood pressure} + 1/3\text{rd of Pulse pressure})$.¹¹ Same procedure was repeated in second visit. During each visit, change in the mean arterial pressure (Average of MAP during treatment- MAP before the treatment) and average MAP $\{(\text{MAP before treatment} + \text{average of MAP during treatment})/2\}$ was calculated for comparison. The obtained value was recorded in working proforma. Paired t-test was done using IBM Statistical Package for Social Sciences (SPSS) Statistics for Windows, version 25 (IBM Corp., Armonk, N.Y., USA). $P < 0.05$ was considered as statistically significant.

RESULT

Among 132 patients enrolled in the study, 47 (35.60%) were male and 85 (64.40%) were female. Total patients were divided into five different age groups: group 1 (10-20) included 16.70% of patient, group 2 (21-30) included 24.20%, group 3 (31-40) included 25%, group 4 (41-50) included 15.20 % and group 5 (51-60) included 18.90% of patients respectively. The resting mean arterial blood pressure during first visit was 94.27 ± 11.63 mmHg and mean arterial blood pressure during procedure in first visit was 99.68 ± 13.10 mmHg. The resting MAP recorded during second visit was 90.96 ± 11.08 mmHg and MAP recorded during procedure was 95.78 ± 10.95 mmHg. In both visits, there was increase in blood pressure during procedure (Table 1). The MAP recorded before the treatment and during the procedure in second visit was comparatively less than first, which was statistically significant ($P < 0.05$, Table 1). There was fall in average pressure

Table 1: Comparison of MAP before and during treatment.

Parameter		Mean±SD (mmHg)	P value
Resting blood pressure	First visit	94.27±11.63	<0.001
	Second visit	90.96±11.08	
Blood pressure during procedure	First visit	99.68±13.10	<0.001
	Second visit	95.78±10.95	

Table 2: Comparison of MAP between first and second visit.

Parameter		Mean±SD (mmHg)	P value
Average BP	First visit	95.81±11.62	<0.001
	Second visit	92.46±10.49	
Change in BP	First visit	5.43±7.42	0.424
	Second visit	4.86±5.76	

Table 3: Comparison of MAP according to sex.

Parameter	Male	Mean±SD (mmHg)	P value	Female	Mean±SD (mmHg)	P value
Average BP	First visit	97.17±11.62	<0.001	First visit	95.07±11.63	<0.001
	Second visit	94.55±11.83		Second visit	91.30±9.54	
Change in BP	First visit	2.59±5.91	0.211	First visit	2.75±6.27	<0.001
	Second visit	1.98±3.88		Second visit	3.12±5.76	

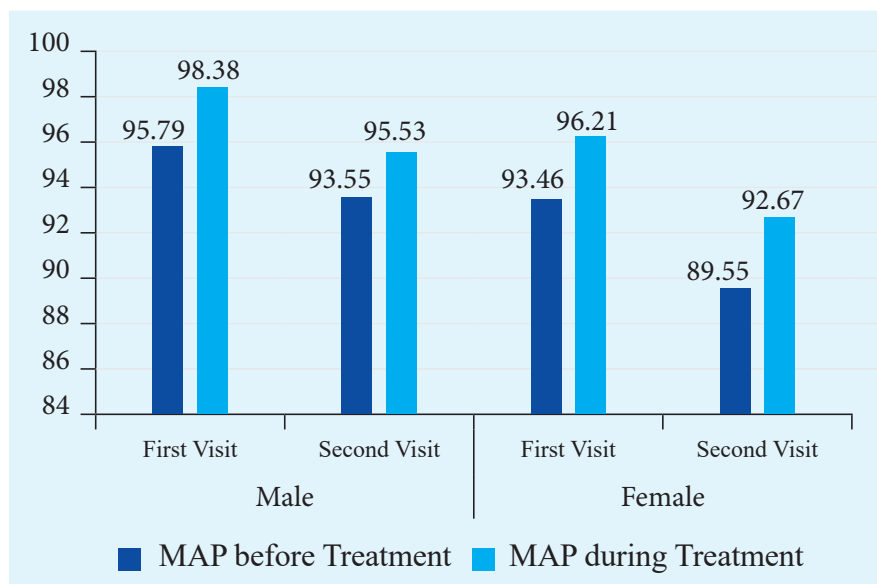


Figure 1: MAP recorded before and during treatment in first and second visit.

during second visit (92.46±10.49 mmHg) than the first visit (95.81±11.62 mmHg), which was found to be statistically significant (P <0.05, Table 2).

According to the sex, in both visits, there was increase in blood pressure during the procedure in both male and female (Figure 1). The changes in MAP between 1st and 2nd visit in female was found to be statistically significant (P <0.05, Table 3). In both sex, there was fall in average pressure during second visit which was found to be statistically significant (P <0.05, Table 3).

According to age group, in all age groups, there was increase in MAP during the procedure compared to resting MAP in both visits. In all age groups, MAP recorded before treatment and during treatment in second visit was comparatively lower than the first visit. Change in MAP between first and second visit was found to be statistically significant only in age group: 51-60 (P <0.05, Table 4). In all age groups, there was fall in average pressure during second visit and found to be statistically significant (P <0.05, Table 4).

Table 4: Comparison of MAP according to age group.

Age group (Years)	Parameter	Mean±SD (mmHg)	P value
10-20	Average BP	First visit	99.20±14.52
		Second visit	96.20±14.57
	Change in BP	First visit	6.71±8.34
		Second visit	5.38±5.00
21-30	Average BP	First visit	95.03±9.33
		Second visit	92.96±10.20
	Change in BP	First visit	5.54±8.25
		Second visit	3.78±3.51
31-40	Average BP	First visit	97.03±13.23
		Second visit	91.54±10.14
	Change in BP	First visit	4.90±7.28
		Second visit	5.09±7.04
41-50	Average BP	First visit	93.65±8.86
		Second visit	89.65±7.49
	Change in BP	First visit	5.35±8.19
		Second visit	5.05±8.43
51-60	Average BP	First visit	94.44±11.83
		Second visit	92.32±9.59
	Change in BP	First visit	4.96±5.09
		Second visit	5.40±4.40

DISCUSSION

Fear, anxiety, stress, and pain are unpleasant emotions associated with dental treatment that affect a great part of the population. These emotions extremely influence the patient's behavior and makes the dental treatment difficult.¹²⁻¹⁴ To our best knowledge, only few studies have been conducted which attempt to evaluate the influence of anxiety on blood pressure during root canal treatment in first and subsequent visit.

It was observed that, irrespective of sex, age group or number of visits, MAP increased during the procedure compared to MAP before treatment. During the procedure, anxiety or anticipation of pain may cause activation of sympathetic nervous system which can lead to increase in heart rate and adrenal gland stimulation and thus results in increase in blood pressure.⁷ Different studies have shown that physiologic stress peaks early in a RCT appointment, around the time of local anaesthesia delivery and initial instrumentation.^{15,16}

In contradiction to our study, Goulart et al. observed that there was no difference in the behavior of the systolic and diastolic blood pressure in relation to

anxiety and pain level, measured at different times of the dental treatment.¹⁴ The difference in observation may be due to use of local anaesthesia without adrenaline. Several previous studies have observed that anaesthetics with vasoconstrictor promotes pain control and avoids the anxiety. On the other hand using local anaesthetics without vasoconstrictor proved to be more superficial and less lasting, generating pain and anxiety in the patients, thus causing a significant rise in blood pressure in normotensive patients.¹⁷

It was found that MAP increased by 5.43±7.42 mmHg and 4.86±5.76 mmHg during first visit and second visit respectively. Even though, change in MAP during second visit was only marginally less than the change in first visit, it was consistently observed in both males and females across all age groups. In addition, in both sex and among all age groups there was fall in average MAP during second visit compared to first visit and was found to be statistically significant (P <0.05). We also observed that the MAP recorded before the treatment and during the procedure in second visit was comparatively less than first visit and was statistically significant (P <0.05). It indicates that, after first appointment as the symptoms

subsides and as the patient becomes familiar with the clinical environment and procedure, becomes less anxious and less fearful thus results in less activation of sympathetic nervous system. Hussein et al. stated that if the pain disappears, the same area sends another signal and activate the parasympathetic nervous system which leads to decrease in blood pressure.⁷ In addition, past experiences of root canal treatment seems to decrease anxiety; experience may counteract negative hearsay.⁶

However, Pereira et al. reported that the mean systolic blood pressure (MSBP) and mean diastolic blood pressure (MDBP) during the different dental procedures of each appointment or between appointments for endodontic treatments of pulpitis teeth were statistically similar.¹⁹ The contradictory findings is probably due to difference in local anaesthesia. Pereira et al. in their study used articaine (4%) with epinephrine (1:100,000 or 1:200,000), both of which were found to be highly effective for pulpal anaesthesia. In addition, several studies observed that rise in blood pressure and heart rate during endodontic treatment depends on presence of pain. These parameters were significantly higher in patient with symptomatic pulpitis than asymptomatic pulpitis.^{18,19}

In our study, we found that change in MAP between 1st and 2nd visit in female was statistically significantly ($P < 0.05$, Table 3) indicating that female are more anxious than male. Various studies have reported that, in general, females are more reactive to a specific stimulus (like a needle prick) than males, thus it accounts for the higher level of dental anxiety in females.^{20,21} Many authors have also reported that dental anxiety is more common in women which is similar to our findings.²²⁻²⁴

In the present study, change in MAP between first and second visit was found to be statistically significant in the age group of 51-60. Our finding demonstrated higher level of anxiety in old age group. Phodse et al. in their study reported higher level of anxiety in the age group of 46 to 55 years and 56 to 65 years which supports our finding.²⁵ Similarly Matsumura et al. also found that middle-aged and older patients had a greater increase in blood pressure during dental surgery.²⁶ On the other hand, Marya et al. reported that

age was strongly associated with dental anxiety and younger participants were more anxious than older ones which is not in correlation with our findings.²⁷ However, Sinha et al. showed no statistically significant difference in anxiety levels between the age groups.²⁸ These inconsistent finding suggests that the association between anxiety and age group is still debatable. The difference observed in the results may be due to the atherosclerotic changes and augmented vascular reactivity in older patients.²⁶

Limitations of this study were small sample size and data collection from single dental clinic. In this study, we failed to observe the blood pressure after completion of the procedure. Furthermore, in the present study we only observed the change in blood pressure but failed to consider other markers of anxiety like heart rate, pulse rate, respiratory rate and change in pupillary diameter. Including these parameters could have further validated the observation.

CONCLUSION

This study concludes that there is rise in blood pressure during the endodontic treatment compared to resting blood pressure. At the same time, there is fall in blood pressure in subsequent visit due to less pain and anxiety compared to previous (first) visit. Only limited studies have been conducted to study anxiety related cardiovascular changes during endodontic treatment and the reported findings are not consistent. Therefore, it is suggested that further research in larger scale should be done in this area for more information.

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Conflict of Interest: None.



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