Change In Blood Pressure During Root Canal Therapy In Irreversible Pulpitis Cases: Short Study

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Abstract— Objectives: The purpose of this study was to evaluate change in blood pressure during root canal therapy in irreversible pulpitis cases .

***Material and methods**: 100 patients (50 males, 50 females) with irreversible pulpitis in two age groups (group 1: 21-40 yrs; group 2: 41-60 yrs) were evaluated. . All patients underwent complete root canal treatment (3 visits) under local anesthesia with 2% lingocaine with 1:100,000 epinephrine (1.7 ml). In the 1st visit, Access opening was done. In the instrumentation or preparation visit (2nd visit), complete preparation of the root canal system was performed using rotary files. In the obturation visit (3rd visit), the canals were obturated by gutta-percha cones with a sealer using a cold lateral condensation technique. During each session of Root canal treatment, blood pressures including systolic blood pressure (SBP) and diastolic blood pressure (DSP) were monitored and recorded with Omron smart elite HEM7600t sphygmomanometer. Mean arterial pressure was calculated and average of mean arterial pressure during the procedure was determined. Mean arterial pressure (MAP) was calculated and Data were analyzed using SPSS software, and descriptive statistics, analysis of variance (ANOVA), least difference analysis (LSD) and Independent t-tests were used in our study.*

***Results:** The ANOVA showed significant difference. According to age group, in both the age groups, there was increase in MAP during the procedure compared to resting MAP in all visits. Change in MAP between first, second and Third visits was found to be statistically significant in both 21-40yrs and 41-60 yrs age group(P <0.05, Table 3)*

***Conclusion:** Blood pressure changes during treatment are more in old age but not significant when compared to the younger patients. Dentist should be aware of possible change in blood pressure and possible risk of hemodynamic instability when performing the vital pulp extirpation.*

Index Terms—mean arterial pressure, irreversible pulpitis.

I. Introduction

Dentist must be aware of the various factors that may decrease or increase blood pressure during endodontic treatment. During root canal treatment infected, injuredor dead pulp is removed from the tooth. The infectedtoothmay be associated with pain and abscess aroundthe roots of tooth[1,2]. Many patients experience stressand anxiety during dental treatment[3]. Even though various dentaltreatment 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. Pain sensation or anxiety in patients is directly related to change in BP (increase or decrease). Pain elicited during the first visit of root canal treatment may lead to a sympathetic response resulting in hypertension or tachycardia[3,4]. Pain and anxiety can increase sympathetic tone.

Liau et al. hypothesized that the anxiety has an additive effect on cardiovascular responses in patients undergoing RCT using the block anesthesia for the inferior alveolar nerve[5]. 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.

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)[6,7,8]. 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.

Throughout the access-opening appointment, pain or anxiety may cause in activation of the SNS, leading to changes in heart rate and BP. This can be due to the release of endogenous catecholamines (adrenaline and noradrenaline) and not due to the effect of exogenous catecholamines found in local anesthetics[8].

In this study, we recorded and analyzed BP measurements before, during and after root canal treatment in the teeth with vital irreversible pulpitis treated over three visits. We assessed the mean percentage reductions of systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean arterial pressure (MAP).

II. MATERIALS AND METHODS

In this study, we evaluated 100 patients (50 males, 50 females) with irreversible pulpitis in two age groups (group 1: 21-40 yrs; group 2: 41-60 yrs). A written consent form was obtained from all patients for blood pressure measurements, root canal treatment agreement and publishing data. All patients underwent complete root canal treatment (3 visits) under local anesthesia with 2% lingocaine with 1:100,000 epinephrine (1.7 ml). The injection technique was either infiltration or nerve block according to the treated tooth.

The vitality of pulp was checked before giving anesthesia using a pulp tester; only vital teeth were selected for this study. Patients with systemic diseases, pregnancy, or mental retardation, those who where heavy smokers (more than 10 cig/day), those who taking any medication for pain, and those with their 3rd molar teeth were excluded from the study. Anesthesia was given at only first visit. All root canal treatments during each visit were performed with rubber dam isolation and by same endodontist.

In the 1st visit, Access opening was done. The vital pulp tissue was removed using a barbed broach, and the working length was determined by hand file (initial size) with the aid of an Apex locator (Root ZX mini, J Morita) and digital X-ray sensor. Then, irrigation was performed with 2.5% sodium hypochlorite (NaOCl) and finally with normal saline, after which the canals were dried with paper points and teeth were sealed with a temporary filling.

In the instrumentation or preparation visit (2nd visit), complete preparation of the root canal system was performed using Gold ProTaper rotary files from Dentsply with a Proglider. Repeated 2.5% NaOCl irrigation was performed throughout the sequence of filing, and the final irrigation was with normal saline. Then, the canal was dried with a paper point and sealed with sterile cotton and a temporary filling.

In the obturation visit (3rd visit), the length of the canal was checked again using a digital X-ray sensor and irrigated with 2.5% NaOCl and then with normal saline. The canal was then dried with a paper point, and the canals were obturated by gutta-percha cones (Dentsply) with a sealer (Apexit Plus-Ivoclar Vivadent) using a cold lateral condensation technique.

During each session of Root canal treatment, blood pressures including systolic blood pressure (SBP) and diastolic blood pressure (DSP) were monitored and recorded with Omron smart elite HEM7600t sphygmomanometer.

The technique used for accurately determining BP included seating the patient in a chair for approximately 5 mins before measurement, with the patient's feet on the floor in front of the chair and their hands on the chair arms.

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= (Diastolic blood pressure +1/3rd 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 {(MAP before treatment + average of MAP during treatment)/2} was calculated for comparison.

Data were analyzed using SPSS software, and descriptive statistics, analysis of variance (ANOVA), least difference analysis (LSD) and Independent t-tests were used in our study. The results with P-values less than 0.01 are highly significant (HS), and the results with Pvalues between 0.01 and 0.04 are significant (S), while Pvalues equal to or greater than 0.05 represent non significant (NS) results.

III. RESULTS :

Among 100 patients enrolled in the study, 50 (50%) were male and 50 (50%) were female. Total patients were divided into two age groups , group 1: 21-40 yrs included 50% of patients; group 2: 41-60 yrs included 50% of patients.

During first visit, the resting MAP was 96.27±10.18 mmHg , MAP during procedure was 99.19±11.06 mmHg and MAP after procedure was 94.21±10.11 mmHg.

During Second visit, the resting MAP recorded was 94.25±9.23 mmHg, MAP during procedure was 96.56±12.11 mmHg and MAP after procedure was 91.61±8.13 mmHg.

During Third visit, the resting MAP recorded was 92.18±11.02 mmHg, MAP during procedure was 90.45±12.15 mmHg and MAP after procedure was 90.15±11.05 mmHg.

Comparison of Change in MAP before treatment, MAP during treatment and MAP after treatment was done in between First - Second, Second-Third and First - Third visits.

Before the treatment started, Change in MAP for First - Second and Second-Third visit

was found to be statistically significant ($P < 0.05$, Table 2). There was significantly higher reduction in MAP in First -Third visit before treatment($P = 0.02$, Table 2).

During the treatment , Change in MAP for First - Second and Second-Third visit

was found to be statistically significant ($P < 0.05$, Table 2). There was significantly higher reduction in MAP in First -Third visit before treatment($P = 0.041$, Table 2).

After the treatment , Change in MAP for First - Second, Second-Third visit and First - Third visit

was found to be statistically significant ($P < 0.05$, Table 2).

According to age group, in both the age groups, there was increase in MAP during the procedure compared to resting MAP in all visits. Change in MAP between first ,second and Third visits was found to be statistically significant in both 21-40yrs and 41-60 yrs age group(P <0.05, Table 3

Table 1: Comparison of MAP before, during and after treatment .

Parameter		Mean±SD (mmHg)	P value
Blood pressure before procedure	1st visit	96.27±10.18	<0.05
	2nd vist	94.25±9.23	
	3rd visit	92.18±11.02	
Blood pressure during procedure	1st visit	99.19±11.06	<0.05
	2nd vist	96.56±12.11	
	3rd visit	90.45±12.15	
Blood pressure after procedure	1st visit	94.21±10.11	<0.05
	2nd vist	91.61±8.13	
	3rd visit	90.15±11.05	

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

Parameter		**Mean±SD (mmHg)**	**P value**
Change in MAP before treatment	1st – 2nd visit	1.92±6.28	<0.05
	2nd – 3rd visit	2.17±5.68	<0.05
	1st – 3rd visit	6.09±6.78	0.02
Change in MAP during treatment	1st – 2nd visit	2.63±8.36	<0.05
	2nd – 3rd visit	4.11±7.12	<0.05
	1st – 3rd visit	8.74±4.38	0.041
Change in MAP after treatment	1st – 2nd visit	1.6±10.01	<0.05
	2nd – 3rd visit	1.1±3.21	<0.05
	1st – 3rd visit	2.7±5.26	<0.05

Table 3: Comparison of MAP according to Age

Age	**Parameter**		**Mean±SD (mmHg)**	**P value**
21 – 40 yrs	Average BP	1st visit	97.31±12.56	<0.05
		2nd vist	95.58±9.76	
		3rd visit	94.05±10.65	
	Change in BP	1st visit	5.15±8.78	<0.05
		2nd vist	3.34±5.32	
		3rd visit	1.26±6.34	
41 – 60 yrs	Average BP	1st visit	99.28±11.67	<0.05
		2nd vist	97.62±16.21	
		3rd visit	96.21±15.32	
	Change in BP	1st visit	6.38±7.87	<0.05
		2nd vist	3.59±10.1	
		3rd visit	2.12±9.10	

IV. DISCUSSION:

In this study, we observed a decrease in blood pressure during the three visits of RCT. The blood pressure reduction was greater in the first RCT visit in which the vital pulp extirpation was performed than in the subsequent visits in which only minimal interference with the dental nerve was experienced. The phenomenon of blood pressure drop during RCT session occurred more commonly than we expected. Here, before treatment there was significantly higher reduction in MAP in First - Third visit (P =0.02, Table 2).

In addition, the MAP reduction percentages were not associated with the clinical variables including the patient's gender, treated tooth type, and anesthesia type. Here in this study, During treatment there was significantly higher reduction in MAP in First -Third visit.(P =0.041, Table 2).

In a WANG ET AL study, patients demonstrate a physiological stress response during dental checkups and treatment[9].Local anesthesia and tooth extraction may activate the adrenal cortex to produce cortisol. After drilling and filling or extraction of teeth Changes in adrenaline or noradrenaline concentrations in the plasma and urine have been reported. Moreover, anticipation of a dental checkup increases blood pressure in patients[10,11]. During restorative treatment without local anesthesia both SBP and DBP increase. It suggests that the pain and anxiety experienced by the patient contributes to the rise in blood pressure. Dentists should be aware that the increased blood pressure during dental treatments may induce cardiovascular complications[12].

In contradiction to our study, Goulart et al. observedthat 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 ofthe dental treatment[13].

This study showed a decrease in BP during treatment (minimum measured BP) at all visits. This is due to the fact that after anesthetizing the tooth with pulpitis, the pain decreases and disappears gradually, and the brain sends signals to activate the PNS, which leads to a decrease in BP in patients[14,15]. HERE After treatment , Change in MAP for First - Second, Second-Third visit and First - Third visit was found to be statistically significant (P <0.05, Table 2).According to our study, the percentage reductions at the 3rd visit were significantly higher than at the 1st and 2nd visits for all groups where there were nonsignificant differences.

This may be related to the fact that in access opening (1st visit), the vital pulp tissue and nerve were extirpated and removed, while at the 2nd visit, there was minimal remaining pulp tissue, so intervention with the dental nerve branches was reduced or nonexistent; at the 3rd visit, there was no remaining pulp tissue so the change in MAP was less .

The percentage reductions in BP were minimally high in older patients than in young patients at all visits but are not statistically significant, and this result agrees with Huang et al study[15].

V. CONCLUSION:

This study concludes that there is slight increase in blood pressure before treatment started. The blood pressure decreases after the complete extirpation of pulp. Fall in Blood pressure is seen in second and third visit due to minimal interference with the dental nerve subsequently less pain and anxiety. Blood pressure changes during treatment are more in old age but not significant when compared to the younger patients. Dentist should be aware of possible change in blood pressure and possible risk of hemodynamic instability when performing the vital pulp extirpation.

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