Print ISSN: 2321-6379
Online ISSN: 2321-595X

Original Article

Pulse Oximeter Monitoring Hemodynamic Variability during Periodontal Therapy

Trupti Sarda, Ashish Maheshwari, Surekha Rathod, Girish Bodhare

Consultant, Department of Oral Maxillofacial and Dental Surgeon, Police Line Hospital, Gwalior, Madhya Pradesh, India

Abstract

Aim: The aim of the study was to assess and compare hemodynamic variations during phase I therapy (Scaling and root planning) and periodontal flap surgery procedure in chronic periodontitis patients.

Materials and Methods: The research was carried out on 50 chronic periodontitis patients. Inclusion criteria were subjects diagnosed with chronic periodontitis, with pocket probing depth of ≥5 mm and clinical attachment level ≥5 mm and not having any systemic disorder. Phase I therapy was given to patients and they were re-evaluated after 6 weeks. 50 subjects who received Phase I therapy and had a need for surgical intervention were compared during Phase I therapy and flap surgery in the study with respect to hemodynamic variables which were assessed preoperatively, intraoperatively, and postoperatively. Hemodynamic variables assessed were heart rate (HR), blood pressure (BP), and oxygen saturation levels (SpO_2).

Results: Intraoperatively, there was an increase in diastolic BP, HR and a fall in SpO_2 during both treatment procedures, that is, Phase I therapy and periodontal flap surgery but within normal limits. The hemodynamic variations were more pronounced during surgical procedure as compared to variations during Phase I therapy.

Conclusion: BP and HR are significantly increased and there is fall in SpO_2 after anesthetic injection during surgical periodontal therapy as compared to Phase I therapy, but are within normal limits.

Key words: Blood pressure, Chronic periodontitis, Heart rate, Oxygen saturation, Pulse oxymeter

INTRODUCTION

Treatment and management of periodontal disease include simple medical procedures such as health education, prophylaxis, scaling and root-planning (SRP), gingival grafts, gingivectomy, and different types of flap operations.[1] Dental treatments are usually accompanied by patients' hemodynamic changes; such as, alterations in blood pressure (BP) and heart rate (HR). Most of the periodontal treatments are conducted under local anesthesia and it is well known that dental surgery causes increase in BP, even in normotensive patients. It is important to determine factors causing the BP response during dental surgery because fatal subarachnoid hemorrhage and massive bleeding related to dental surgery and high BP have been reported.[2]

Access this article online

www.ijss-sn.com

Month of Submission : 06-2021
Month of Peer Review : 07-2021
Month of Acceptance : 07-2021
Month of Publishing : 08-2021

A dental patient is exposed to stressors, such as physiological responses to emotional factors and/or pain. Stress and anxiety can alter the respiratory rate which, in time, may alter oxygen saturation (SpO_2) and/or carbon dioxide levels in the blood.[3] Pain and anxiety are important stimuli for the secretion of endogenous adrenaline, which plays a significant role in cardiovascular responses during dental treatment. Anxiety may be defined as either a cognitive, emotional, and physical reaction to a dangerous situation or the anticipation of a threat. Under most circumstances, it is impossible to provide effective dental care without the use of local anesthetics and vasoconstrictors. Pain and anxiety triggered by dental treatment can induce the secretion of endogenous catecholamines. When the situation is combined with local anesthetics with vasoconstrictors use, it may increase its undesirable effects on the cardiovascular system and the respiratory system.[4] Life-threatening medical emergencies, although very rare, can and do occur in the practice of dentistry. The most commonly encountered emergency situation in dentistry includes hyperventilation and vasodepressor syncope and is almost exclusively precipitated by psychological stress.[5]

Corresponding Author: Dr. Ashish Maheshwari, Department of Oral Maxillofacial and Dental Surgeon, Police Line Hospital, Gwalior, Madhya Pradesh, India.

One of the global methods of observation and data recording is monitoring of body organ and system function that afford constant information to ensure continuous evaluation of the patient's physical condition.[6] The essential information for assessing vital signs is provided by basic monitoring. It provides both the circulatory and respiratory vital signs and fundamentally comprises the control of BP, rhythm, HR and SpO_2.[7] The advantage of pulse oximeter being a non-invasive method, is that it allows the monitoring of the oxygenation of a patient's hemoglobin and pulse rate. Acceptable normal ranges of SpO_2 are from 95% to 99%.

The changes in the hemodynamic variables have been studied during various steps of periodontal surgery by Amoian *et al*. in 2003.[8] There is a limited body of evidence comparing the hemodynamic variations during non-surgical and surgical periodontal therapy. Giving importance to monitoring patients' hemodynamic changes during dental surgery, the present study has been conducted to investigate alterations and compare variations in hemodynamic parameters during Phase I therapy SRP and periodontal flap surgery in chronic periodontitis patients.

MATERIALS AND METHODS

This research was conducted on moderate to severe chronic periodontitis patients. A total of 93 patients reporting to the Department of Periodontics and Implantology were screened, out of that 70 patients were diagnosed as having moderate to severe chronic periodontitis. Subjects were diagnosed with moderate to severe chronic periodontitis based on the 1999 consensus classification of periodontal disease.[9] Inclusion criteria were: (1) Presence of chronic periodontitis characterized by at least eight sites with probing pocket depth (PPD) of ≥5 mm and clinical attachment loss (CAL) of ≥5 mm, and (2) subjects in a good state of general health. Exclusion criteria were (1) subjects who were on CNS depressants (alcohol, opioids, barbiturates) with existing respiratory depression, (2) aggressive periodontitis, (3) anemia, (4) any systemic disorder and any condition with severe uncontrolled pain and patients with impending dental treatment due to decompensated systemic diseases, and (5) pregnancy or lactating mother. The patients fulfilling the above mentioned criteria were recruited into the study. Seventy subjects diagnosed with moderate to severe chronic periodontitis were provided with full mouth deep supragingival and subgingival SRP under local anesthesia using ultrasonic and hand instrumentation in a single appointment. At the time of SRP, these subjects were assessed for three hemodynamic parameters which were SpO_2, BP, and HR at three different time point, that is, preoperatively, intraoperatively, and postoperatively. After 6 weeks, these patients were re-evaluated for need of surgical intervention. Out of 70 patients, 54 patients had a need for periodontal flap surgery and were explained about the surgical procedure. Written informed consent was obtained from the subjects who agreed to participate in the study. Out of 54 patients, four patients did not turn up for the flap surgery and thus a total of 50 patients underwent periodontal flap surgery. Ethical clearance was obtained from Institutional Ethics Committee.

50 subjects who received Phase I therapy SRP and had a need for surgical intervention were compared during SRP and flap surgery in the study with respect to hemodynamic variables which were assessed preoperatively, intraoperatively, and postoperatively. In 50 subjects, during SRP the hemodynamic parameters were assessed 10 min before starting the procedure (pre-operative), after giving local anesthesia (intra-operative) and 10 min after completing the procedure (post-operative). When these 50 subjects were subjected to flap surgery after approximately 6 weeks, the hemodynamic parameters were again assessed 10 min before starting flap surgery (pre-operative), during giving local anesthesia and incision (intra-operative) and 10 min after completion of flap surgery when the patient was allowed to relax. Intraoperatively, SpO_2 and HR were monitored continuously and the lowest drop in the values was recorded.[10] All the values of the above mentioned parameters were noted by a single examiner. Furthermore, the clinical parameters recorded before the surgical and nonsurgical therapy were the PPD, CAL plaque index (PI) (PI by Sillness and Loe, 1964), and Papillary Bleeding Index (PBI) (PBI by Muhlemman 1977).

All periodontal flap surgeries were done using Kirkland's modified Flap operation (Kirkland 1931) or conventional flap procedure. Local anesthesia with adrenaline was considered as mandatory during both surgical and nonsurgical therapy.

The equipments utilized in the study were Finger Pulse Oximeter (ChoiceMMed) and automated sphygmomanometer (Omron). Pulse oximetry utilizes a pair of small light-emitting diodes facing a photodiode through a translucent part of the patient's body, usually a fingertip.

Statistical Analysis

Data were recorded at three time periods: (1) Preoperatively, (2) intraoperatively, that is, the minimum drop in the SpO_2 during the treatment, (3) postoperatively. The recorded data were analyzed and compared between 2 treatment modalities (SRP and periodontal flap surgery) and within each of the treatment procedure using two-way repeated measures ANOVA.

RESULTS

The present research was conducted on 50 patients visiting the Department of Periodontics and Implantology for periodontal diseases and undergoing SRP as well as periodontal flap surgery. Patients were within the age range of 30–50 years (mean: 38.5 ± 5.82). Among the study participants there were 24 males and 26 females. In all the participants, HR, SpO_2, systolic BP (SBP), and diastolic BP (DBP) were monitored preoperatively, intraoperatively, and postoperatively during SRP as well as periodontal flap surgery. Furthermore, the clinical parameters such as PPD, CAL, PI, and PBI were recorded at baseline before the start of Phase I therapy SRP and 6 weeks after Phase I therapy SRP and subjects having need of flap surgery after Phase I therapy were subjected to surgery.

The mean value of SpO_2 during SRP was 98.08 ± 0.49% when assessed preoperatively, was 97.86 ± 0.53% intraoperatively and 98.02 ± 0.47% when assessed postoperatively. When measured during periodontal flap surgery, the mean values were 98.1 ± 0.46% preoperatively, 97.56 ± 0.73% intraoperatively, and 98.08 ± 0.56% postoperatively [Table 1 and Figure 1]. Two-way repeated ANOVA showed that intraoperatively, there was significant reduction in SpO_2 during each treatment modality when compared to preoperative values (Time: F = 29.81, $P < 0.0001$). SpO2 during intraoperative monitoring was significantly reduced during periodontal flap surgery as compared to during SRP (F-statistics = 6.655 and $P = 0.002$). During post-operative monitoring, that was done after 10 min of the completion of the procedure, SpO2 levels reached near baseline values during both treatment modalities. When the intraoperative values of SpO_2 were compared with the pre-operative values during SRP and flap surgery, the reduction in SpO_2 intraoperatively was 0.22 ± 0.46% and 0.57 ± 0.70%, respectively. This reduction was found to be statistically significant ($P = 0.0049$). When the post-operative values of SpO_2 were compared with the pre-operative values during SRP and flap surgery, the reduction in SpO_2 postoperatively was 0.06 ± 0.31% and 0.02 ± 0.24%, respectively, which shows that the post-operative values reached near to baseline values [Table 2].

According to the statistical analysis, the HR varied with treatment time. The mean value of HR was 80.66 ± 10.26 beats/min during SRP and 82.74 ± 8.86 beats/min during periodontal flap surgery as assessed preoperatively and 85.7 ± 10.50 beats/min during SRP and 86.8 ± 9.03 beats/min during periodontal flap surgery as assessed intra-operatively [Table 1]. Thus it can be noted that preoperatively the HR values were higher during periodontal flap as compared to values during SRP [Figure 2]. HR was significantly raised intraoperatively during both treatment modalities as compared to pre-operative values. The increase in HR intra-operatively was 5.04 ± 4.62 beats/min for SRP and for periodontal flap surgery it was 4.06 ± 2.37 beats/min and was statistically nonsignificant when compared for those 2 treatment modalities [Table 2]. When the post-operative values of HR were compared with the pre-operative values during SRP and flap surgery, the reduction in HR post-operatively was 2.94 ± 3.04 beats/min and 3.24 ± 2.52 beats/min, respectively. This reduction was found to be statistically insignificant ($P = 0.5384$) [Table 2].

Furthermore, the variations in SBP showed a similar pattern during both treatment modalities. The mean value of SBP was 115.2 ± 12.78 mm of Hg during SRP and 117.52 ± 11.96 mm of Hg during periodontal flap surgery as assessed preoperatively. From Table 1, it is evident that SBP was significantly raised intra-operatively as well as

Table 1: Comparison of various parameters between Group I and Group II at different time intervals

Parameter	Time	Group	
		Group I (Non-surgical)	Group II (Surgical)
SpO_2	Pre-operative	98.08±0.49	98.1±0.46
	Intraoperative	97.86±0.53	97.56±0.73
	Post-operative	98.02±0.47	98.08±0.56
HR	Pre-operative	80.66±10.26	82.74±8.86
	Intraoperative	85.7±10.50	86.8±9.03
	Post-operative	77.72±9.95	79.5±8.72
SBP	Pre-operative	115.2±12.78	117.52±11.96
	Intraoperative	119.24±12.62	123.92±11.91
	Post-operative	117.0±12.50	119.56±12.21
DBP	Pre-operative	79.8±10.28	81.08±7.91
	Intraoperative	78.12±10.08	78.2±8.40
	Post-operative	80.16±10.21	81.44±8.41

SpO_2: Oxygen saturation, HR: Heart Rate, SBP: Systolic Blood Pressure, SBP: Diastolic Blood Pressure

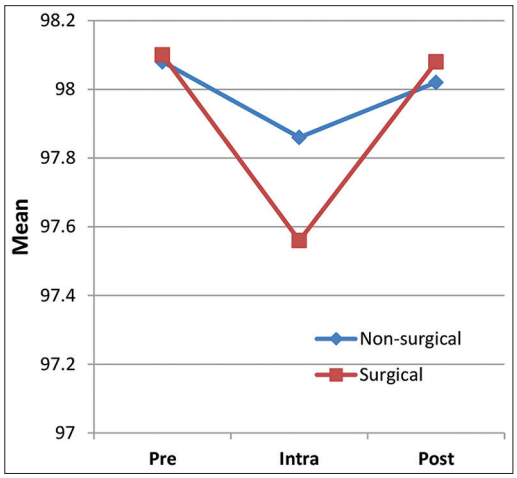

Figure 1: Oxygen saturation at different time period in non-surgical and surgical group

Table 2: Difference in intra-operative values and post-operative values of hemodynamic parameters when compared with the pre-operative (baseline) values

Parameter	Time	During SRP	During periodontal flap surgery	*P*-value
SpO_2	Intra-operative	0.22±0.46†	0.57±0.70†	0.0049, HS
	Post-operative	0.06±0.31†	0.02±0.24†	0.4851, NS
HR	Intra-operative	5.04±4.62§	4.06±2.37§	0.1237, NS
	Post-operative	2.94±3.04†	3.24±2.52†	0.5384, NS
SBP	Intra-operative	4.04±2.87§	6.4±2.21§	<0.0001, HS
	Post-operative	1.8±2.32§	2.04±2.19§	0.6009, NS
DBP	Intra-operative	1.68±1.68†	2.88±2.42†	0.0002, HS
	Post-operative	0.36±1.19§	0.36±1.43§	0.1000, NS

§-increase, †-reduction, SpO2: Oxygen saturation, HR: Heart Rate, SBP: Systolic Blood Pressure, SBP: Diastolic Blood Pressure, SRP: Scaling and root-planning

postoperatively as compared to pre-operative values during both treatment modalities. (Time: F-statistics = 300.39 and $P < 0.0001$). There was a significant rise in SBP during surgery at intra-operative monitoring, but SBP reached near to baseline values post-operatively [Figure 3]. There were significant changes in DBP at different time points during both treatment modalities. DBP was significantly reduced during surgery as compared to SRP when assessed intraoperatively but similar changes in DBP were noted post-operatively in both treatment modalities [Figure 4]. When the intraoperative values of SBP were compared with the pre-operative values during SRP and flap surgery, the increase in SBP was 4.04 ± 2.87 mm of Hg and 6.4 ± 2.21 mm of Hg, respectively. This increase in SBP was found to be statistically significant ($P < 0.0001$). When the post-operative values of SBP were compared with the pre-operative values during SRP and flap surgery, the increase in SBP postoperatively was 1.8 ± 2.32 mm of Hg and 2.04 ± 2.19 mm of Hg, respectively. This increase was found to be statistically insignificant ($P = 0.6009$) [Table 2].

When the intraoperative values of DBP were compared with the pre-operative values during SRP and flap surgery, the decrease in DBP as seen intraoperatively was 1.68 ± 1.68 mm of Hg and 2.88 ± 2.42 mm of Hg, respectively. This decrease in DBP was found to be statistically significant ($P = 0.0002$). When the post-operative values of DBP were compared with the pre-operative values during SRP and flap surgery, the increase in DBP post-operatively was 0.36 ± 1.19 mm of Hg and 0.36 ± 1.43 mm of Hg, respectively. This increase was found to be statistically insignificant [Table 2].

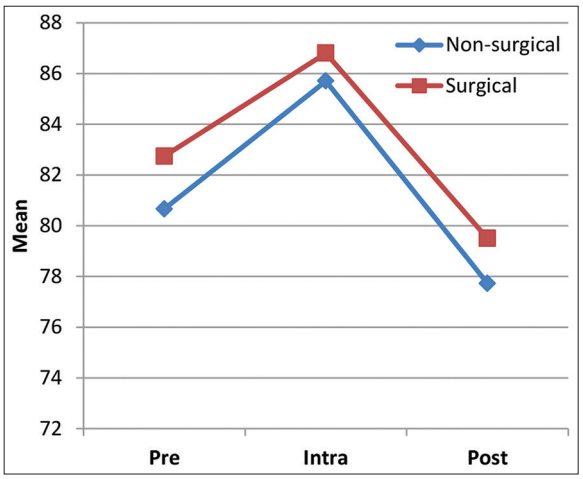

Figure 2: Heart rate at different time period in non-surgical and surgical group

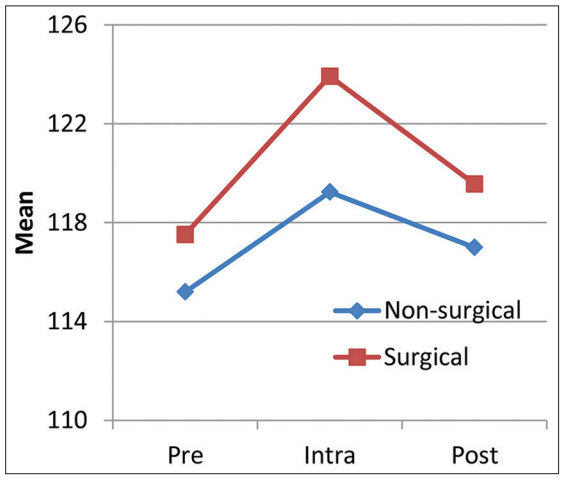

Figure 3: Systolic blood pressure at different time period in non-surgical and surgical group

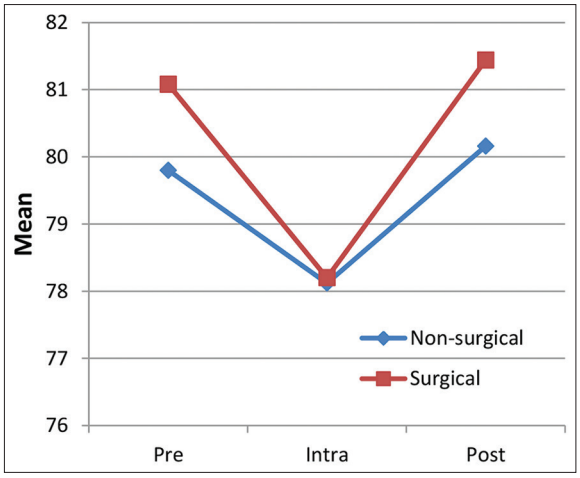

Figure 4: Diastolic blood pressure at different time period in non-surgical and surgical group

All the variations in hemodynamic parameters, both during SRP and periodontal flap surgery, at all points in times were

within normal limits. There was a significant reduction in PPD, PI, PBI, and a significant gain in CAL after Phase I therapy as compared with baseline values [Table 3].

DISCUSSION

Reduction in PD, PI, and PBI and gain in CAL are the major clinical outcomes measured to determine the success of any periodontal treatment. In the present study a significant reduction in PD, PI, and PBI and gain in CAL were found after Phase I therapy SRP.

Cardiovascular system continuously adapts to both the external and the internal stimuli. Both the autonomic nervous system and endocrinological factors directly affect the action of heart. When patients know that the dental treatment is scheduled their BP and HR is increased. Before oral surgery, patients had SBP of +13 mm of Hg and a DBP +5 mm of Hg in comparison of the day after the intervention.[11] In contrast, anticipation of dental hygiene treatment which included SRP induced only a limited increase in SBP (+3 mm of Hg).[12] The action of sitting down in the dental chair increased HR considerably (=12 bpm).

We concur with other investigators as our results were in accordance to above study in terms of changes in hemodynamic parameters (HR, BP). There was a limited increase in SBP and HR during SRP as compared to periodontal flap surgery procedure during the intraoperative monitoring. Furthermore, there was a fall in SpO_2 intraoperatively during both the treatment modalities. Studies carried out by various authors have demonstrated that an increase in BP during periodontal surgery seems to be mediated primarily by an activation of the sympathetic nervous system. On the other hand, it has been proven that the release of endogenous catecholamine is triggered by pain and anxiety during periodontal treatment. When such a situation is combined with local anesthetics with vasoconstrictors, in turn, can give rise to hemodynamic changes, such as increases in BP and HR (which is indicative of ventricular contraction), which in time, may alter SpO_2 and/or carbon dioxide levels in the blood and may even produce arrhythmias.[13]

Table 3: Comparison of clinical parameters before Phase I and after Phase I therapy SRP

Clinical parameters	Before SRP (baseline)	6 weeks after SRP	% (reduction*/ gain+)	*t*-value	*P*-value
PPD	6.62±0.28	5.02±0.40	24.2‡	36.66	<0.0001, HS
CAL	5.91±0.42	5.22±0.48	11.7¶	13.00	<0.0001, HS
PBI	2.03±0.35	1.51±0.24	25.6‡	17.23	<0.0001, HS
PI	3.09±0.45	2.33±0.37	24.6‡	9.62	<0.0001, HS

‡ % reduction, ¶ % gain, PPD: Probing pocket depth, CAL: Clinical attachment loss, PI: Plaque index, PBI: Papillary Bleeding Index, SRP: Scaling and root-planning

In the present study, SBP and HR were increased after injection of anesthesia during both the treatment procedures but were within normal limits. Elevated BP during periodontal surgery is attributed to response of sympathetic nervous system. On stimulation of sympathetic nervous system, the sympathetic and adrenomedullary secretion of catecholamines adrenaline and noradrenaline occurs. A peptide transmitter Substance P which is associated with pain is also produced by adrenomedullary cells. This release of Substance P may lead to tachycardia and increase in BP.[14] In a similar kind of study, significant increase in SBP (5–12 mm of Hg) was observed during deep SRP which is a painful condition. A study investigating changes in BP and HR during periodontal surgery revealed an increase in both parameters after anesthesia with 2% lidocaine and epinephrine in concentration of 1:80000.[15] Findings of the present study are compatible with the results from other authors.

In contrast to our study, in a survey conducted by Faraco *et al*. in 2007 on effect of anesthetics containing lidocaine and epinephrine on cardiovascular changes during dental implant surgery, HR and BP was evaluated during ten steps, results showed no significant difference in HR and BP variability.[16]

In a study conducted by Meyer in 1987, the mean SBP increased +3 to +10 mm of Hg during injection of local anesthesia.[17] However, they did not observe any significant changes in DBP during the injection. In another study, most of the patients showed a decrease in DBP after injecting lidocaine with 1:100000 epinephrine.[18] Our results for DBP variations are in accordance with the above study. In our study, DBP decreased significantly after injecting local anesthesia during both the treatment modalities but the fall was within normal limits.

Furthermore, the hemodynamic variations such as increase in HR, BP and a fall in SpO_2, in our study, were more pronounced during the surgical procedure as compared to SRP but were within normal limits. This can be clarified from the clinical perception of periodontal surgical procedure being more stressful and traumatic when compared with non-surgical therapy. If psychological stress is minimized or controlled, rare medical emergencies occurring in dental office can also be avoided or tackled and blood gas homeostasis can be maintained.

In our study, BP was slightly elevated postoperatively as compared to baseline (more during surgical procedure when compared with SRP). This can be due to suturing at the end of the surgery and probably due to feeling of pain by patient and decrease in effect of anesthetic agent.

In a preliminary study on SpO_2 of patients during periodontal surgery carried out by Aeschliman *et al.* (2003) he noticed that diazepam given orally in adult dosages does not cause significant respiratory depression and is safe for those healthy patients who may require slight to mild sedation during periodontal surgery.[19] Anxiolytic or sedation to attenuate stress can be used to reduce cardiovascular response associated with patient anxiety, although dentist mediated patient behavior control play a fundamental role.

CONCLUSION

Different stages during surgical and non-surgical SRP periodontal therapy are accompanied by diverse effects on hemodynamic variability and pulse oximetry. Based on acquired data of present study, BP and HR are significantly increased and there is fall in SpO_2 after anesthetic injection during surgical periodontal therapy as compared to non-surgical therapy SRP, but are within normal limits. Periodontal therapy associated with systemic inflammation might be of particular interest as inflammation, bacteremia, and release of acute phase reactants could lead to an acute state of vascular dysfunction and a possibly increase risk of hypoxemic vascular events.

The possible detrimental vascular effects during periodontal procedures can be controlled by proper anesthesia, continuous patient monitoring and by dentist mediated behavioral control.

ACKNOWLEDGMENTS

Nil.

REFERENCES

1. Wilson KE, Dorman ML, Moore PA, Gird NM. Pain Control and anxiety management for periodontal therapies. Periodontol 2000 2008;46:42-55.
2. 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.
3. Brand HS, Gortzak RA, Palmer-Bouva CC, Abraham RE, Abraham-Inpijn L. Cardiovascular and neuroendocrine responses during acute stress induced by different types of dental treatment. Int Dent J 1995;45:45-8.
4. Brown RS, Rhodus NL. Epinephrine and local anesthesia revisited. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2005;100:401-8.
5. Malamed S. Medical emergencies in the dental office. In: Handbook of Local Anesthesia. 5th ed. St Louis: The CV Mosby Company; 2000. p. 4.
6. Merchant HW, Carr AA. Blood pressure measurement: Problems and solutions. J Am Dent Assoc 1977;95:98-102.
7. Alemany-Martinez A, Valmaseda-Castellon E, Berini-Aytes L, Gay-Escoda C. Hemodynamic changes during the surgical removal of lower third molars. J Oral Maxillofac Surg 2008;66:453-61.
8. Amoian B, Rabíee M, Aghvami M, Milani S. Evaluation of hemodynamic and SpO_2 variability during different stages of periodontal surgery. J Indian Soc Periodontol 2013;17:612-6.
9. Armitage GC. Development of a classification system for periodontal diseases and conditions. Ann Periodontol 1999;4:1-6.
10. Padma R, Goel S, Shriniwas M, Shreedhara A, Malagi S, Radhika B. Comparative evaluation of oxygen saturation levels using pulse oxymeter during nonsurgical and surgical periodontal therapy in chronic periodontitis patients. J Contemp Dent Pract 2012;13:661-4.
11. Cheraskin E, Prasertsuntarasai T. Use of epinephrine with local anesthesia in hypertensive patients. I. Blood pressure and pulse rate observations in the waiting room. J Am Dent Assoc 1957;55:761-74.
12. Singer J, Meiller TF, Rubinstein L. Blood pressure fluctuations during dental hygiene treatment. Dent Hyg 1983;57:24-8.
13. Laragnoit AB, Neves RS, Neves IL, Vieira JE. Locoregional anesthesia for dental treatment in cardiac patients: A comparative study of 2% plain lidocaine and 2% lidocaine with epinephrine (1:100,000). Clinics (Sao Paulo) 2009;64:177-82.
14. Brand HS, Inpijn LA. Cardiovascular responses induced by dental treatment. Eur J Oral Sci 1996;104:245-52.
15. 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.
16. Faraco FN, Kawakami PY, Mestnik MJ, Ferrari DS, Shibli JA. Effect of anaesthetics containing lidocaine and epinephrine on cardiovascular changes during implant surgery. J Oral Implantol 2007;33:84-8.
17. Meyer FU. Haemodynamic changes under emotional stress following a minor surgical procedure under local anaesthesia. Int J Oral Maxillofac Surg 1987;16:688-94.
18. Salman L, Schwartz SP. Effects of vasoconstrictors used in local anesthetics in patients with diseases of the heart. J Oral Surg 1955;13:209-13.
19. Aeschliman SD, Blue MS, Williams KB, Cobb CM, MacNeill SR. A preliminary study on oxygen saturation levels of patients during periodontal surgery with and without oral conscious sedation using diazepam. J Periodontol 2003;74:1056-9.

How to cite this article: Sarda T, Maheshwari A, Rathod S, Bodhare G. Pulse Oximeter Monitoring Hemodynamic Variability during Periodontal Therapy. Int J Sci Stud 2021;9(5):122-127.

Source of Support: Nil, **Conflicts of Interest:** None declared.