10.5005/jp-journals-10024-1205

ORIGINAL RESEARCH

Comparative Evaluation of Oxygen Saturation Levels using Pulse Oxymeter during Nonsurgical and Surgical Periodontal Therapy in Chronic Periodontitis Patients

R Padma, Saakshi Goel, M Shriniwas, Annaji Shreedhara, Sachin Malagi, B Radhika, BS Jagadish Pai

ABSTRACT

Background and aim: Monitoring is the global method of observation and data recording in relation to body organ and system function that afford constant information to ensure continuous evalutation of the patient's physical condition. Basic monitoring provides essential information for assessing the vital signs, both circulatory and respiratory, and fundamentally comprises the control of blood pressure (BP) and heart rate (HR) and rhythm. Pulse oxymetry is used to record HR and oxygen saturation. The objective of the study was to assess and compare hemodynamic changes by monitoring oxygen saturation level changes during periodontal surgical and nonsurgical therapy.

Materials and methods: A cross-sectional observational study was conducted in 30 chronic periodontitis patients. Patients were divided into two groups; Group A consisted of 15 patients undergoing surgical periodontal therapy, Group B consisted of 15 patients undergoing nonsurgical periodontal therapy. The hemodynamic changes were evaluated by monitoring HR and oxygen saturation level using pulse oxymeter (SaO_2). HR and SaO_2 were monitored continuously and registered pre-operatively, i.e. 10 minutes before the procedure, intra-operatively and post-operatively, i.e. 10 minutes after the procedure. One-way analysis of variance test (ANOVA) was performed for data analysis.

Results: Both the groups showed a slight fall in oxygen saturation levels intraoperatively, but within the normal range. More decrease in oxygen saturation levels was observed in non-surgical periodontal therapy as compared to surgical periodontal therapy at intraoperative levels. The differences in the values were statistically significant. There was no statistical difference seen in the postoperative and preoperative values.

Conclusion: Most of the hemodynamic changes induced during the periodontal therapy were within normal limits, taking into consideration the anxiety and stress produced by the surgical intervention. The hemodynamic change was more in nonsurgical as compared to surgical periodontal therapy.

Keywords: Oxygen saturation, Pulse oxymetry, Anxiety, Hemodynamics, Nonsurgical periodontal therapy, Surgical periodontal therapy.

How to cite this article: Padma R, Goel S, Shrinivas M, Shreedhara A, Malagi S, Radhika B, Pai BSJ. 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(5): 661-664.

Source of support: Nil

Conflict of interest: None declared

INTRODUCTION

Life-threatening medical emergencies can and do occur in the practice of dentistry. Common medical emergencies which are commonly encountered during dental practice are unconsciousness/syncope, respiratory distress, airway obstruction, hyperventilation, asthma, congestive cardiac failure/acute pulmonary edema, seizures, drug-related emergencies, chest pain, cardiac arrest.[1] Hyperventilation and vasodepressor syncope represent the most commonly encountered emergency situation in dentistry and are almost exclusively precipitated by psychological stress.[2] Anxiety may be defined as either a cognitive, emotional and physical reaction to a dangerous situation or the anticipation of a threat.[3] Stress and anxiety can alter the respiratory rate which in time, may alter oxygen saturation and/or carbon dioxide levels in the blood.[4]

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.[5]

Monitoring is defined as the global methods of observation and data recording in relation to body organ and system function that afford constant information to

ensure continuous evaluation of the patient's physical condition. Basic monitoring provides essential information for assessing the vital signs, both circulatory and respiratory and fundamentally comprises the control of blood pressure (BP) and heart rate (HR) and rhythm. Pulse oxymetry is most commonly used to record HR and oxygen saturation.[6]

Pulse oxymetry was developed in 1972, by Takuo Aoyagi and Michio Kishi, bioengineers, at Nihon kohden using the ratio of red to infrared light absorption of pulsating components at the measuring site. Susumu Nakajima, a surgeon, and his associates first tested the device in patients, reporting it in 1975.[7] It utilizes a pair of small light-emitting diodes (LEDs) facing a photodiode through a translucent part of the patient's body, usually a fingertip. It is a noninvasive method which allows the monitoring of the oxygenation of a patient's hemoglobin. Acceptable normal ranges is from 95 to 99%.

Objective of this study was to assess hemodynamic changes by monitoring oxygen saturation levels during periodontal surgical and nonsurgical therapy and to compare the values between these two treatment modalities.

MATERIALS AND METHODS

A cross-sectional observational study was done consisting of 30 chronic periodontitis patients reporting to the Department of Periodontics and Implantology, Coorg Institute of Dental Sciences, Virajpet, Coorg (district), Karnataka, India. Inclusion criteria included subjects diagnosed with chronic periodontitis characterized by at least three sites with a probing depth of 5 to 8 mm and subjects in a good state of general health without any systemic disorder. Exclusion criteria were subjects who were on central nervous system depressants (alcohol, barbiturates, opoids), with existing respiratory depression, anemic, any condition with severe uncontrolled pain. Patients with decompensated systemic diseases contraindicating or impeding dental treatment were also excluded from the study. Patients were in the age group of 25 to 45 years. After screening the patients for the above mentioned criteria, the selected patients were divided into two groups depending on the treatment modalities:

- *Group A:* Fifteen patients undergoing surgical periodontal therapy.
- *Group B:* Fifteen patients undergoing nonsurgical periodontal therapy.

Surgical periodontal treatment included periodontal flap surgeries and mucogingival surgeries. Nonsurgical periodontal therapy included scaling and root planing.

Nonsurgical treatment consisted of oral hygiene instructions and suprasubgingival mechanical instrumentation of the root surface [scaling and root planning (SRP)] using ultrasonic instrument and hand instruments (Gracey curettes) as appropriate, of sites with PPD ≥ 5 mm in single appointment. Local anesthesia was used as necessary.

Surgical treatment was done in patients with persisting pocket depth of ≥5 mm after thorough scaling and root planning was over. It was started after the phase I was over for the patients. All periodontal flap surgeries were done using Kirkland or conventional flap procedure. Muco-gingival surgeries included root coverage procedures for Miller's class I recession.

The hemodynamic changes were evaluated by monitoring HR and SaO_2, i.e. oxygen saturation level using pulse oxymeter. (CLEO-BPL). HR and oxygen saturation levels were monitored continuously and was registered preoperatively, intraoperatively and post operatively. Preoperatively value was registered 10 minutes before the start of the procedure and local anesthesia administration. Oxygen saturation level and HR was continuously monitored intraoperatively and the lowest drop in the oxygen saturation level was registered. Postoperatively oxygen saturation level and HR value was registered 10 minutes after the procedure was completed and patient was allowed to relax.

STATISTICAL ANALYSIS

Data was recorded at three time periods: (1) Preoperatively, (2) intraoperatively, i.e. the minimum drop in the oxygen saturation level during the treatment, (3) postoperatively. The recorded data was analyzed between groups and within groups using one-way analysis of variance (ANOVA).

RESULTS

The study was conducted in 30 patients who were divided into two groups based on treatment modalities. Fifteen patients (seven females and eight males) underwent nonsurgical treatment, and 15 patients (six females and nine males) underwent surgical treatment. All patients were in the age ranging from 25 to 45 years. The mean value of oxygen saturation levels was 98.06 for group A and 98.34 for group B as assessed preoperatively and the difference was not significant (Table 1). As the treatment progressed, there was fall in the oxygen saturation levels in both the groups (see Table 1).

Upon completion of the treatment, the values reached their preoperative values after 10 minutes. The difference in the oxygen saturation levels between the surgical (mean PSO_2 = 97.9) and nonsurgical (mean PSO_2 = 98.27) was not significant (Graphs 1 and 2).

Table 1: One-way ANOVA test to compare oxygen saturation levels during surgical and nonsurgical periodontal therapy

		ANOVA				
		Sum of squares	*df*	*Mean square*	*F*	*Sig.*
Preop	Between groups	0.550	1	0.550	1.124	0.299
	Within groups	13.228	27	0.490	–	–
	Total	13.779	28	–	–	–
Intraop	Between groups	7.984	1	7.984	16.537	0.000
	Within groups	13.035	27	0.483	–	–
	Total	21.019	28	–	–	–
Postop	Between groups	0.784	1	0.784	1.505	0.230
	Within groups	14.061	27	0.521	–	–
	Total	14.846	28	–	–	–

No significant change in the heart rate values was noticed at all points of treatment.

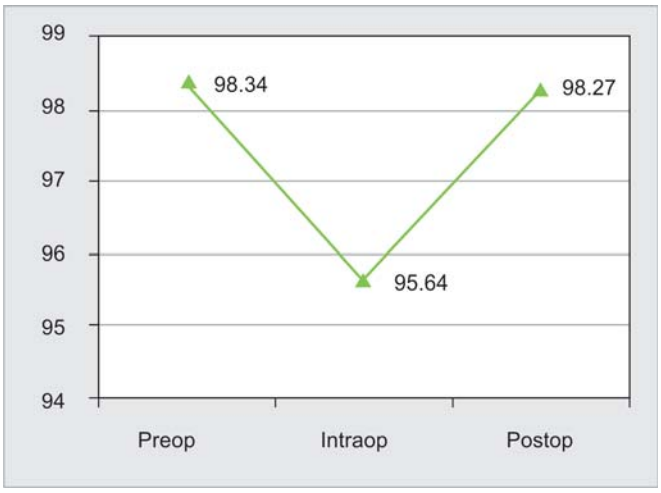
DISCUSSION

Changes in HR and SaO_2, i.e. oxygen saturation levels are affected by pain and by certain individual factors such as age, gender, hypertension, previous experience with dental treatment and psychological response.[6]

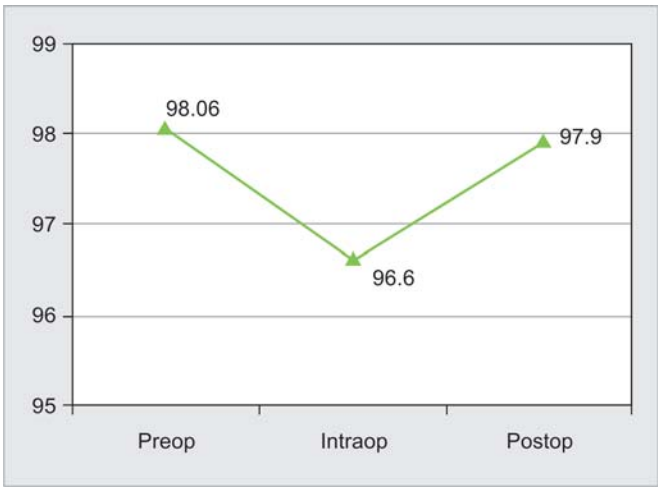
In 2003, a study by Aeschliman et al recommended the use of diazepam given orally to healthy patients who may require slight to mild sedation during periodontal surgery.[4]

The attenuation of stress with anxiolytic or sedation can be used to reduce the cardiovascular response associated with patient anxiety, although in these cases dentist-mediated patient behavioral control appears to play a fundamental role. In this study, there was more decrease in oxygen saturation levels during nonsurgical periodontal therapy than surgical periodontal therapy but was within normal range indicating that dental stress in patients can be managed by the dentist-mediated behavioral control. If psychological stress is minimized or controlled, medical emergencies in the dental office can be decreased, and blood gas homeostasis be maintained.

It is noteworthy to mention that decrease in oxygen saturation levels is more in nonsurgical periodontal therapy as compared to surgical periodontal therapy within normal limits (Graphs 1 and 2). This is somehow in contrast with clinical perception of periodontal surgical procedure being more stressful and traumatic when compared with nonsurgical therapy. We can speculate on the facts behind these findings: Traumatized surface area is smaller in surgical periodontal therapy than whole mouth nonsurgical periodontal treatment. It is also reasonable to believe that there is alleviation in patient anxiety with subsequent follow-ups, as seen in patients undergoing surgical phase of treatment when compared to patients undergoing nonsurgical phase (initial phase) of treatment. Also subgingival instrumentation would be associated with greater bacteremia as opposed to periodontal surgery.



Graph 1: Oxygen saturation levels during nonsurgical periodontal therapy



Graph 2: Oxygen saturation levels during surgical periodontal therapy

Patients undergoing periodontal treatment experience perturbations of systemic inflammation of a greater magnitude after nonsurgical than surgical periodontal therapy. Studies have also shown acute response of C-reactive proteins, serum amyloid A, D-dimers and IL-6 within 24 hours of periodontal therapy and this response is more in patients undergoing nonsurgical periodontal treatment as compared to surgical periodontal treatment.[8]

CONCLUSION

Most of the hemodynamic changes induced during the periodontal therapy were within normal limits, taking into consideration the anxiety and stress produced by the surgical intervention. The hemodynamic changes were more in nonsurgical as compared to surgical periodontal therapy.

CLINICAL SIGNIFICANCE

Periodontal therapy, whether nonsurgical or surgical, is associated with systemic inflammation. This might be of particular interest as inflammation, bacteremia and the release of acute phase reactants, which were more in patients undergoing nonsurgical treatment, could lead to an acute state of vascular dysfunction and a possibly increased risk of hypoxemic vascular events. This could be attributed to large area of treatment and instrumentation in patients undergoing nonsurgical treatment. The possible detrimental vascular effects following dental and periodontal procedures can be controlled by proper anesthesia, continuous patient monitoring and by dentist mediated behavioral control.

REFERENCES

1. Rosenberg M. Preparing for medical emergencies the essential drugs and equipment for the dental office. J Am Dent Assoc 2010;141 (Suppl 1):14S-19S.
2. Malamed S. Medical emergencies in the dental office, (5th ed). St Louis: The CV Mosby Company 2000;4.
3. Becker DE, Reed KL. Essentials of local anaesthetic pharmacology. Anesth Prog 2006;53:98-108.
4. 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: 1056-59.
5. Brown RS, Rhodus NL. Epinephrine and local anesthesia revisited. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2005;100:401-08.
6. Alemany-Martínez A, Valmaseda-Castellón E, Berini-Aytés L, Gay-Escoda C. Hemodynamic changes during the surgical removal of lower third molars. J Oral Maxillofac Surg 2008; 66(3):453-61.
7. Tremper KK. Pulse oxymetry. Anesthesiology 1989;70:98-108.
8. Graziani F, Cei S, Tonetti M, Paolantonio M, Serio R, et al. Systemic inflammation following nonsurgical and surgical periodontal therapy. J Clin Periodontol 2010;37:848-54.

ABOUT THE AUTHORS

R Padma (Corresponding Author)

Professor and Head, Department of Periodontics and Implantology Coorg Institute of Dental Sciences, Virajpet, Karnataka, India Phone: +918971484333, e-mail: padmasanskrithi@gmail.com

Saakshi Goel

Postgraduate Student, Department of Periodontics and Implantology Coorg Institute of Dental Sciences, Virajpet, Karnataka, India

M Shriniwas

Professor, Department of Periodontics and Implantology, Coorg Institute of Dental Sciences, Virajpet, Karnataka, India

Annaji Shreedhara

Reader, Department of Periodontics and Implantology, Coorg Institute of Dental Sciences, Virajpet, Karnataka, India

Sachin Malagi

Senior Lecturer, Department of Periodontics and Implantology, Coorg Institute of Dental Sciences, Virajpet, Karnataka, India

B Radhika

Senior Lecturer, Department of Periodontics and Implantology, Coorg Institute of Dental Sciences, Virajpet, Karnataka, India

BS Jagadish Pai

Professor, Department of Periodontics and Implantology, Coorg Institute of Dental Sciences, Virajpet, Karnataka, India