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Evaluation of Optimal Chair Position for Patients Undergoing Dental Procedures using Pulse Oximetry- A Prospective Clinical Study

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Abstract

Patient anxiety in the dental office creates an unacceptable situation for the dentist as well as patient, during procedures. Patient position on a dental chair can influence the levels of patient anxiety. The aim of the study was to determine the best patient position for maximal comfort and minimal anxiety. The objectives were (1) to assess the heart rate and (2) to assess the oxygen saturation in five different positions on a dental chair. The study was a prospective clinical trial involving 108 subjects. The inclusion criteria were healthy patients, aged 18-25 years. The exclusion criteria were patients with respiratory disorders, anaemia, cardiac disorders and other systemic problems. Every patient was made to assume 5 different postures - (1) Standing, (2) Sitting upright, (3) Semi-supine, (4) Semi-supine with legs bent and (5) Supine. A pulse oximeter probe was attached and the SpO2 (in percentage) and pulse rate (in beats/min) of every subject was recorded. As a result, the oxygen saturation was the highest in the standing posture (98.07) followed by sitting upright (97.85), supine and semi-supine posture (97.79), respectively. The heart rate showed a marked reduction from sitting upright (86.19) to supine (77.46) posture and the difference was statistically significant. When the patients bent their legs, there was a sudden spike in SpO2 as well as heart rate (P value-0.03) which was statistically significant. The study concluded that patient was most comfortable in semi-supine or supine posture with periodic legs-bent position.

Keywords: Chair Position, Dental Treatment, Pulse Oximetry, SpO2

1. Introduction

An ideal patient position during dental treatment should provide maximum comfort to the patient as well as the dentist. Patient comfort on a dental chair is reflected in reduction of anxiety[1] and favourable clinical parameters such as physiological heart rate, blood pressure and SpO2.[2] Review of literature reveals that patient position in a dental clinic is dictated predominantly by the dentist's comfort of working which is related to his/her visibility of the anatomic site of focus and ease of instrumentation[3,4].

To facilitate the comfort of working, patients are generally positioned in upright or semi-supine posture depending on the jaw involved[4]. But there is scanty literature regarding the chair position which is the most comfortable to the patient. Patient's physical and psychological comfort in a dental clinic is important in influencing the patient's response and co-operation to treatment[5]. Many studies have assessed the levels of patient comfort subjectively as well as objectively. But so far none of the studies have explained about the effect of dental chair position on the SpO2 of patient,

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which is a reliable indicator of patient's physiological status.

SpO2 is considered as the 5th vital sign by numerous studies because of the accuracy in the replication of oxygen carrying capacity of blood at the tissue level/perfusion. The careful monitoring of SpO2 is very important in the peri-operative phase to identify any emergency medical situations.

This research paper analyses the chair position which provides the patient with optimal oxygenation while reducing anxiety and improving comfort.

2. Aim and Objectives

The aim of the study was to determine the best patient position suited for maximal oxygenation and optimal heart rate.

The objectives of the study were (1) to assess the heart rate (in beats/minute) and (2) to assess the oxygen saturation (in percentage) in five different positions on a dental chair.

3. Materials and Methods

The study was conducted as a prospective clinical trial involving 108 subjects who reported to the Department of Oral and Maxillofacial surgery. Approval for the study was obtained from the Institutional Review Board. Consent for the study was obtained from the patients after explaining about the study. The inclusion criteria were healthy patients (ASA I & II) without any physical and/or psychological indisposition, between the age group of 18-25 years. The exclusion criteria were patients who were not in the above-mentioned age group, patients with respiratory disorders, anaemia, cardiac disorders and other systemic problems.

Every patient belonging to the study sample was made to assume 5 different postures (Figure 1) - (1) Standing, (2) Sitting upright, (3) Semi-supine, (4) Semi-supine with legs bent and (5) Supine. A pulse oximeter probe (ChoiceMMed) was attached to the Right hand middle finger[6] and the SpO2 and pulse rate of every subject was recorded. Once the readings stabilized by the end of 60 seconds[7], the values were recorded. Patients were instructed not to make any sudden movements while recording the pulse.

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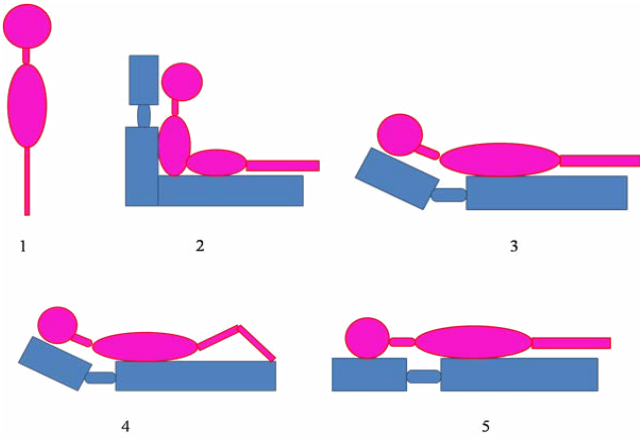


Figure 1: Patient posture at different dental chair positions

(1) Standing

(2) Sitting upright

(3) Semi-supine

(4) Semi-supine with legs bent

(5) Supine

4. Results

The demographic data included **108** subjects as the sample size; **30** males and **78** females. The mean age of the subjects was **21.97** for male, **21.46** for female.

Statistical analysis of the data revealed that the mean difference in oxygen saturation was the highest in the standing posture **(98.07)** followed by sitting upright **(97.85)** with a gradual reduction which was less than 1% as noted in supine posture and semi-supine posture (97.79), respectively. The lowest value was noted in semi-supine with leg bent i.e. 97.77; from which, the inference was that the oxygen saturation does not significantly reduce with change in posture (p value - 0.59) as shown in (Table 1).

The heart rate however, showed a marked reduction from sitting upright **(86.19)** to supine **(77.46)** posture and the difference was statistically significant. Also, when the patient bent their legs during semi-supine posture **(86.22)**, there was a sudden spike in the SpO2 as well as heart rate before it stabilized (P value-0.03) which was statistically significant.

Table 1: Comparison between all five positions

	Position	N	Mean	Std. Deviation	Mean diff	p value
SPO2	Supine	108	97.7963	.69389	.00	0.59
	Semi-supine	108	97.7963	.79436		
	Standing	108	98.0733	.66562		
	Sitting upright	108	97.8519	.73389		
	Semi-supine with legs bent	68	97.7761	.75520		
Pulse rate	Supine	108	77.4630	11.33387	3.47	0.03
	Semi-supine	108	80.9352	11.62600		
	Standing	108	98.0734	12.90958		
	Sitting upright	108	86.1927	11.42039		
	Semi –supine with legs bent	68	86.2206	12.72770		

5. Discussion

Patient comfort on a dental chair is one of the major factors which influences the patient's perception of treatment as well as co-operation towards procedures[1]. The various methods by which patient comfort in a dental facility is improved are pharmacological or non-pharmacological. Music distraction is a non-invasive method of relaxing as well as distracting a patient with pleasant music during a stressful procedure[8,11]. Voice control also plays a major role in patient management by behavioral intervention. These may be long lasting as compared to pharmacological methods which provide temporary anxiety control which is restricted to the day of the dental appointment[9]. Certain studies suggest that environmental factors play a major role in anxiety control; a clinic with ambience which is more inclined towards art and nature such as paintings or wall murals, fish tanks and pets were found to provide better relaxation to the patient prior to a dental treatment[5].

However, all the above-mentioned modalities may not have a great impact within the operatory. Sight of dental chair aggravates anxiety leading to increased heart rate and clinical signs such as sweating, dry mouth[9], palpitations, panting and syncope. Studies suggest that some patients feel prolonged tiredness following the dental procedure[10,18]. Reducing anxiety on a dental chair still remains a challenge to dentists.

Ideal positioning of patient is one such method which greatly ensures patient comfort. However, the patient position indicated by conventional teaching is in favour of the dentist's comfort; upright position for both maxillary and mandibular impression making and during extraction of mandibular teeth whereas semi-supine for extraction of maxillary teeth which allows the maxillary occlusal plane to make an angle of 60 degrees to the floor[13]. Though these chair positions improve the visibility and accessibility to the dentist, they play a major role in aggravating a patient's apprehension. A study by Corah et al.[14] shows the subjective assessment of patient's anxiety on a dental chair by means of a questionnaire provided to the patient prior to the procedure. Objective assessment of anxiety in a dental clinic has not been studied in detail.

Therefore, this prospective clinical trial was designed to identify the chair position that would provide maximal patient comfort through objective parameters. This study analyzed the change in the levels of SpO2 and heart rate which are clinical indicators of patient comfort using pulse oximetry.

SpO2 which is often considered as the 5th vital sign, indicates the partial pressure of oxygen in the arterial blood[15,16]. It reflects the level of oxygen perfusion to tissues[12]. The normal SpO2 is 94-98%[17] which decreases in high altitudes[19], respiratory disorders and cardiac conditions[20]. Pulse oximetry is a simple clinical method used to measure SpO2 based on the principle of spectrophotometry[21]. Though the accuracy of the readings varies with skin pigmentation, thickness, movement of the patient during recording, presence of nail enamel, external light and temperature, pulse oximetry is a reliable clinical indicator of SpO2 when recorded appropriately[22]. The use of pulse oximetry has certain limitations. The record of values is not accurate in conditions such as presence of dyshaemoglobin (carboxy haemoglobin and meth haemoglobin), skin pigmentation, anemia, low perfusion states and the presence of diagnostic dye. Accuracy of pulse oximeter in carboxy haemoglobinema may be improved by use of multi wavelength oximeter. An altered value observed during motion has also been reduced to greater extent by using the signal extraction technology with conventional pulse oximetry[7].

Burcu Ceylan et al.[23] (2016) had conducted similar studies correlating the values of SpO2 is peripheral capillary oxygen saturation and Heart rate to changes in body position. However, these were studies conducted on normal chair or bed. This is the first study which has compared the same on a dental chair. The other major difference between the above-mentioned studies and our study is in the study sample involved. Our study recruited normal healthy patients in contrast to the other studies which involved patients who were systemically compromised or post-operative patients[24]. The results of this study have greater clinical implications because most of the dental patients are systemically not compromised. However dental phobia is considered serious issue which may alter the hemodynamics of the otherwise normal patient which may be compounded by unfavourable chair positions. Hence, the role of a dentist is very important in reducing patient anxiety through ideal patient positioning.

6. Outcome of the Study

The study clearly demonstrates the effect of chair position on achieving a favourable oxygen status and heart rate. It was noted that a sudden increase in SpO2 and heart rate on bending the legs is a clinically useful finding, especially for patients who develop a vasovagal syncope. This is because, bending the legs a couple of times, increases the blood flow to the brain which makes the physiological status of the patient normal. The changes in vitals may be significant in a patient with compromised CVS and RS.

The positives of the study include a homogenous sample which added more validity to clinical data and non-invasiveness of the study. The study assessed patient comfort objectively rather than subjectively which could lead to bias in interpretation of data. The results of the study can be projected to patients with compromised cardiac and respiratory status.

7. Conclusion

The ideal chair position during dental treatment must not only aim at physician's comfort but also at patient's relaxation. The study demonstrates that the patient is most relaxed and comfortable in semi-supine or supine posture as indicated by optimal oxygenation and heart rate which is the closest to the normal range.

8. Ethical Approval

Obtained-SRMU/M&HS/SRMDC/2017/B.D.S-UG Student/002

9. Patient consent

Obtained

10. References

1. Appukuttan DP. Strategies to manage patients with dental anxiety and dental phobia: Literature review. Clin Cosmet Investig Dent. 2016; 8:35. https://doi.org/10.2147/CCIDE.S63626. PMid:27022303 PMCid:PMC4790493
2. Dhuva DJM, Kshisagar RA, Dhuvad MM, et al. Comparative evaluation of vital parameters during third molar surgery under local anaesthesia with and without sedative agents. J Clin Diagn Res. 2014; 8:57–60. https://doi.org/10.7860/JCDR/2014/11043.5332. PMid:25654033 PMCid:PMC4316339
3. Pallí EJ, Obispo CA, Navarro BG, Murat J, Montero RA, Rojas S, et al. Analytical parameters and vital signs in patients subjected to dental extraction. J Clin Exp Dent. 2017; 9:223–230. https://doi.org/10.4317/jced.53474. PMid:28210440 PMCid:PMC5303322
4. Peterson LJ, Ellis E, Hupp JR, Tucker MR, et al. Contemporary Oral and Maxillofacial Surgery, 4th Edition; 2003.
5. Ulrich RS. Effects of healthcare environmental design on medical outcomes. Design and Health: Proceedings of the Second International Conference on Health and Design. Stockholm, Sweden: Svensk Byggtjanst; 2001. p. 49–59.
6. Basaranoglu G, Bakan M, Umutoglu T, Zengin SU, Idin K, Salihoglu Z, et al. Comparison of SpO2 values from different fingers of the hands. SpringerPlus. 2015; 4:561. https://doi.org/10.1186/s40064-015-1360-5. PMid:26543696 PMCid:PMC4627972
7. Jubran A. Pulse oximetry. Critical care. 1999; 3:11. https://doi.org/10.1186/cc341. PMid:11094477 PMCid:PMC137227
8. Lahmann C, Schoen R, Henningsen P, Ronel J, Muehlbacher M, Loew T, Tritt K, Nickel M, Doering S, et al. Brief relaxation versus music distraction in the treatment of dental anxiety: a randomized controlled clinical trial. J Am Dent Assoc. 2008; 139:317–324. https://doi.org/10.14219/jada.archive.2008.0161. PMid:18310736
9. Corah NL, O'Shea RM, Ayer WA, et al. Dentists' management of patients' fear and anxiety. J Am Dent Assoc. 1985; 110:734–736. https://doi.org/10.14219/jada.archive.1985.0427. PMid:3859545

10. Cohen SM, Fiske J, Newton JT, et al. Behavioural dentistry: The impact of dental anxiety on daily living. J Am Dent Assoc. 1985; 110:734–736.
11. Lee WL, Sung HC, Liu SH, Chang SM, et al. Meditative music listening to reduce state anxiety in patients during the uptake phase before Positron Emission Tomography (PET) scans. Br J Radiol. 2017; 90:20160466. https://doi.org/10.1259/bjr.20160466. PMid:27897034 PMCid:PMC5685102
12. Collins JA, Rudenski A, Gibson J, Howard L, O'Driscoll R, et al. Relating oxygen partial pressure, saturation and content: The haemoglobin-oxygen dissociation curve: Breathe (Sheff). 2015; 11:194–201. https://doi.org/10.1183/20734735.001415.PMid:26632351PMCid:PMC4666443
13. Gupta A, Bhat TMM, Bansal N, Gupta G, et al. Ergonomics in dentistry. Int J Clin Pediatr Dent. 2014; 7: 30–34. https://doi.org/10.5005/jp-journals-10005-1229 PMid:25206234. PMCid:PMC4144062
14. Corah NL, Gale EN, Illig SJ, et al. Assessment of a dental anxiety scale. J Am Dent Assoc. 1978; 97:816–819. https://doi.org/10.14219/jada.archive.1978.0394. PMid:31377
15. Elliott M, Coventry A, et al. Critical care: The eight vital signs of patient monitoring. Br J Nurs. 2012; 13; 21:621–625. https://doi.org/10.12968/bjon.2012.21.10.621. PMid:22875303
16. Mower WR, Myers G, Nicklin EL, Kearin KT, Baraff LJ, Sachs C, et al. Pulse oximetry as a fifth vital sign in emergency geriatric assessment. Acad Emerg Med. 1998; 5:858–865. https://doi.org/10.1111/j.1553-2712.1998.tb02813.x. PMid:9754497
17. Smith GB, Prytherch DR, Watson D, Forde V, Windsor A, Schmidt PE, Featherstone PI, Higgins B, Meredith P, et al. SpO2 values in acute medical admissions breathing air-Implications for the British Thoracic Society guideline for emergency oxygen use in adult patients?. Resuscitation. 2012; 83:1201–1205. https://doi.org/10.1016/j.resuscitation.2012.06.002. PMid:22699210
18. Hall GM, Salmon P, et al. Physiological and psychological influences on postoperative fatigue. Anesth Analg. 2002; 95:1446–1450. https://doi.org/10.1097/00000539-200211000-00064. PMid:12401642
19. Banchero N, Sime F, Peñaloza D, Cruz J, Gamboa R, Marticorena E, et al. Pulmonary pressure, cardiac output, and arterial oxygen saturation during exercise at high altitude and at sea level. Circulation. 1966; 33:249–262. https://doi.org/10.1161/01.CIR.33.2.249. PMid:25823098
20. Marklew A. Body positioning and its effect on oxygenation-a literature review. Nurs Crit Care. 2006; 11:16–22. https://doi.org/10.1111/j.1362-1017.2006.00141.x. PMid:16471294
21. Tierney Jr LM, Whooley MA, Saint S, et al. Oxygen saturation: A fifth vital sign? West J Med. 1997; 166:285–286.
22. Jensen LA, Onyskiw JE, Prasad NG, et al. Meta-analysis of arterial oxygen saturation monitoring by pulse oximetry in adults. Heart & Lung. 1998; 27:387–408. https://doi.org/10.1016/S0147-9563(98)90086-3
23. Ceylan B, Khorshid L, Güneş ÜY, Zaybak A, et al. Evaluation of oxygen saturation values in different body positions in healthy individuals. J Clin Nurs. 2016; 25:1095–1100. https://doi.org/10.1111/jocn.13189. PMid:26879626
24. Gift AG, Stanik J, Karpenick J, Whitmore K, Bolgiano CS, et al. Oxygen saturation in postoperative patients at low risk for hypoxemia: Is oxygen therapy needed? Anesth Analg. 1995; 80:368–372. https://doi.org/10.1213/00000539-199502000-00028