



Physiologic effects of wearing personal protective equipment kits in maxillofacial surgeons while providing patient care

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ABSTRACT:

Background- Personal protective equipment is the most required protective suit system for the health care professionals during the periods of pandemics. Unfortunately the use of personal protective equipment may increase physiological and biomechanical strain on the worker. The aim of the study is to evaluate physiological changes of wearing personal protective equipment before and after the oral and maxillofacial surgery procedures. **Methods-** This study is a descriptive study evaluating the physiological effects of wearing personal protective equipment while doing maxillofacial procedures. Maxillofacial surgeons vital signs (body temperature, pulse, blood pressure, oxygen saturation and respiratory rate) were monitored pre-donning and post-doffing. **Results-** temperature, systolic bp, diastolic bp, mean bp and respiratory rate shows statistically significant increase, where as pulse rate, oxygen saturation shows statistically significant decrease **conclusion-** this study concludes that there is a significant difference in vitals of maxillofacial surgeons before and after wearing personal protective equipment while doing maxillofacial procedures.



Introduction

Personal protective equipment (PPE) is the most required protective suit system for the healthcare professionals during the periods of pandemics. In the midst of the pressure of pandemics, PPE's gain the paramount importance to prepare for patient care and sample management for diagnostics. Unfortunately the use of PPE may increase physiological and biomechanical strain on the worker. Heat stress and additional workload due to wearing PPE can cause physiological strain that may alter the neuromuscular performance of the users¹. In humans, the primary source of heat dissipation is through the increased cutaneous blood flow and sweating².

During the patient's care, PPE may impede evaporative heat loss through sweating producing an uncompensable heat stress. It may concomitantly elevate the thermoregulatory and cardiovascular strain in the healthcare professionals wearing PPE. Consequently, studies regarding the physiological effects of wearing PPE's in healthcare professionals are of paramount importance for the health of the wearers in their occupational settings.

In the present situation of pandemic outbreak of COVID-19, our department of oral and maxillofacial surgery is using the PPE kits while doing the emergency procedures like closed reduction of maxillofacial fractures with arch bar, biopsies, incision and drainage, surgical or nonsurgical removal of infected tooth and infected cyst enucleation. The aim of the study is to evaluate physiological changes of wearing personal protective equipment before after the oral and maxillofacial surgery procedures

Material and methods

After getting approval from the institutional ethical committee we conducted a pilot study conducted on 20 maxillofacial surgeons for evaluation of sample size. After the pilot study sample size was determined as 380. Prior to the assessment of various physiological signs, each subject completed a questionnaire regarding the age, sex and medical comorbidities. Surgeons with medical comorbidity excluded from this study. After obtaining informed consent from surgeons they underwent thorough

hand hygiene protocol including sanitizing and hand washing prior to wearing the PPE kit. We have used the PPE kits while doing the emergency procedures like closed reduction of maxillofacial fractures with arch bar, biopsies, surgical or nonsurgical removal of infected tooth and infected cyst enucleation. The average time for the procedure was 30 minutes. The PPE kit used in this study was supplied by care under the strict norms of KMSCL (Kerala medical services and corporation Limited). This PPE kit includes a fully encapsulating suit, chemically resistant protective boots, inner gloves, chemically resistant surgical gloves, a face shield and a N95 mask. The major physiological signs including body temperature, pulse rate, blood pressure, oxygen saturation and respiratory rate of the surgeons are assessed before wearing the PPE kit (pre donning stage). The body temperature is measured by using the standard mercury thermometer, pulse rate by manual palpation of radial pulse, blood pressure by sphygmomanometer, oxygen saturation by pulse oxymeter and respiratory rate manually. The vital signs were also assessed in the same manner after removing the PPE kit (post doffing stage). Any other post doffing difficulty will also be assessed.

The variables evaluated based on the records: body temperature pulse rate, blood pressure, oxygen saturation, respiratory rate. Data entry was done through a statistical package for social science (SPSS) software version 22. The mean and the standard deviation were calculated for quantitative variables. The mean scores were compared by Paired T-test. $P \leq 0.005$ was considered statistically significant.

Results

A total of 380 maxillofacial surgeons were assessed during this study. The mean age of the surgeon was 24 ± 4.3 . Mean time for the procedure was 45 ± 10.3 . Table 1 shows statistically significant raise in temperature after doffing. Pulse rate was statistically significant decrease after doffing. Systolic bp, diastolic bp and mean bp show statistically significant increase after doffing. There was a statistically significant increase in respiratory rate also found. Oxygen saturation was statistically decreased after doffing. This study shows significant



changes in vitals of maxillofacial surgeons in using personal protective equipment while doing maxillofacial procedures.

Discussion

Use of personal protective equipment was unavoidable during the covid 19 pandemic condition especially in case of oral maxillofacial surgeons during their surgical procedures. Most surgeons felt fatigue after the procedures. There are no previous studies regarding the physiologic effects of personal protective equipment kits on maxillofacial surgeons.

Costello et al. conducted a clinical trial on the effects of metabolic work rate and ambient environment on physiological tolerance times while wearing explosive and chemical personal protective equipment. The study concludes that the physiological tolerance times are influenced by the external environment and workload and the cardiovascular strain is the limiting factor to work tolerance during the wearing of PPE².

Yanez benitez et al conducted a study on impact of Personal Protective Equipment on Surgical Performance During the COVID-19 Pandemic and found surgeons perceived impediment for both visibility and communication, and other non-technical skills while using PPE on emergency surgery in COVID-19 patients³.

Halena jane Wells et al conducted a prospective study demonstrates that being in full personal protective equipment (FPPE) for as little as 2.5 hours can adversely affect health care workers alertness⁴.

Raymond J Roberg et al found use of a surgical mask as an outer barrier over N95 filtering facepiece respirators does not significantly impact the physiological burden or perceptions of comfort and exertion by the wearer over that experienced without use of a surgical mask⁵.

Raymond joseph also conducted as study to review the available literature regarding the physiological burden imposed on pregnant women by their wearing filtering facepiece respirators, his study concluded that very little rigorous scientific data exist on the physiological

burden associated with the use of filtering facepiece respirators by pregnant women, and no definitive conclusions can be reached at this time⁶.

From above most of studies shows significant impact on personal protective equipment kit in health workers, this study results also correlates with previous studies. This study states that temperature, systolic bp, diastolic bp, mean bp and respiratory rate shows statistically significant increase, where as pulse rate, oxygen saturation shows statistically significant decrease. Implication of this study is that there is a definite impact on maxillofacial surgeons while wearing personal protective equipment.

Conclusion

Based on the findings of present study there is a significant change in body temperature, pulse rate, blood pressure, oxygen saturation, respiratory rate before donning after doffing of personal protective equipment during maxillofacial procedures. Further studies are required in other surgical fields to compare with this study and hence assessing adverse effects of personal protective kit.

Ethical considerations

Ethical approval obtained from institutional ethical committee of Government T D Medical College Alappuzha, certificate number EC 45/2020 dated 02/07/2020. Our study follows all ethical considerations.

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Conflict of interest

There is no conflict of interest among any of the authors involved in this study



Reference

- [1] Kincl LD, Bhattacharya A, Succop PA and Clark.S. Postural Sway Measurements: A Potential Safety Monitoring Technique for Workers Wearing Personal Protective Equipment. *Applied Occupational and Environmental Hygiene*. 2002; 17(4): 256–266.
- [2] 2.Costello JT, Stewart KL and Stewart IB (2015) ‘The effects of etabolic Work Rate and Ambient Environment on Physiological Tolerance Times While Wearing Explosive and Chemical Personal Protective Equipment.Biomed Res Int 2015;2015:857536
- [3] 3.Yanez Benitez, C. et al. (2020) ‘Impact of Personal Protective Equipment on Surgical Performance During the COVID-19 Pandemic’, *World Journal of Surgery*, 44(9), pp. 2842–284
- [4] 4.Halena jane wells et al. (2022) ‘Impact of full personal protective equipment on alertness of healthcare workers: a prospective study’ *BMJ Open Qual* 2022 Jan;11(1):e001551
- [5] 5.Raymond j roberg et al (2010) ‘Surgical mask placement over N95 filtering facepiece respirators: physiological effects on healthcare workers’ *Respirology* Apr;15(3):516-21
- [6] 6.Raymond j roberg (2009) ‘Physiological burden associated with the use of filtering facepiece respirators (N95 masks) during pregnancy’ *J Womens Health (Larchmt)* Jun;18(6):819-2

Table 1

Si no	Variable	Mean value	SD	P VALUE
1	Temperature 1	36.7960	.48346	0.001
	Temperature 2	37.2322	.46502	
2	Pulse1	90.7337	13.72322	0.001
	Pulse 2	88.1055	16.56082	
3	Systolic bp 1	111.8995	10.38066	0.001
	Systolic bp2	116.9246	13.72964	
4	diastolic bp 1	76.1307	9.44842	0.026
	diastolic bp 2	77.2965	11.57377	
5	Mean BP 1	62.6851	6.06556	0.001
	Mean BP 2	64.7309	7.40969	
6	Respiratory Rate1	16.3543	1.78649	0.001
	Respiratory Rate2	18.5226	1.20170	
7	Spo2 1	98.0678	1.09403	0.001
	Spo2 2	97.4724	1.09865	

1* before donning 2* after doffing

*Spo2 oxygen saturation