2021-06-25

COVID-19: dental aerosol contamination in open plan dental clinics and future implications

Ali, Kamran

10.1038/s41432-021-0168-0
Evidence-Based Dentistry
Springer Nature [academic journals on nature.com]

Accepted Version

Title

Coronavirus disease 2019 (COVID-19): Dental Aerosol contamination in open plan dental clinics and future implications

Authors

Kamran Ali (University of Plymouth Peninsula Dental School) Mahwish Raja, Newcastle University

A Commentary on

Holliday R, Allison JR, Currie CC, Edwards DC, Bowes C, Pickering K, Reay S, Durham J, Lumb J, Rostami N, Coulter J, Nile C, Jakubovics N. Evaluating contaminated dental aerosol and splatter in an open plan clinic environment: Implications for the COVID-19 pandemic. J Dent. 2020. 21:103565. doi: 10.1016/j.jdent.2020.103565.

Data sources: Not applicable

Study design: An experimental study design was used to investigate the spread of splatter /aerosol during simulated dental procedures on a mannequin in an open plan clinic and dental clinical teaching laboratory settings. All experiments were based on crown preparation of an artificial maxillary central incisor using a high-speed air turbine over a 10-minute period. Fluorescein dye introduced into the irrigation system of the handpiece (Model 1); and mannequin's mouth to simulate salivary flow (Model 2) under varying experimental conditions (suction flowrate, cross ventilation, and exposure time). Six experiments were conducted in the open plan clinic while three experiments were undertaken in clinical laboratory.

Customized rigs with collection platforms consisting of filter papers were placed in open plan bays and adjacent walkways. Samples were also collected from a 400cm^2 area in each of the eight adjacent bays. Time course experiments repeated the same procedures on three occasions in a clinical laboratory and utilised a rig with eight 4m rods supporting collection platforms around a dental mannequin. The distribution of fluorescein dye was analysed by fluoroscopy and spectroflurometry.

Results:

Contamination levels showed variations under different experimental conditions. In the absence of suction and cross ventilation, contamination was observed at large distances. Use of suction reduced contamination in the operating bay by 53% and 81.83%. while cross ventilation reduced contamination in adjacent and distant areas by 80-89%. Minimal contamination was detected at a distance of >5m from the operating bay with the use of medium volume suction demonstrating that 1.5m high partitions with open fronts limit 99.99% of splatter from AGPs to the operating bay. Minimal additional aerosol contamination was detected 10 minutes after the procedure.

Conclusions

Contamination from dental AGPS have the potential to contaminate distant sites in open plan clinics. Risk of cross infection is small if the bays are $\geq$5m apart and contamination can be minimised with the use of suction and cross ventilation. .

Commentary

The coronavirus disease (COVID-19) caused by the novel coronavirus (SARS-CoV-2) has had the most remarkable impact on delivery of clinical dental services and education in living memory. Following an initial period of fear and anxieties at the start of the pandemic, dental practices and institutions across the globe are now back in operation albeit at lower efficiency levels due to additional precautions mandated by professional guidelines. One of the major concerns with clinical dentistry relate to the risks of SARS-CoV-2 contamination during aerosol generating procedures. The virus is present in nasopharyngeal secretions, saliva, and blood and bioaerosols generated in dental clinical environment may cause cross infection through inhalation, contact with eyes, and contaminated work surfaces.[1]. Although there is no direct evidence to substantiate the spread of SARS-CoV-2 through dental aerosols, guidelines continue to advise additional precautions to reduce the risk of cross infection.[2]

The COVID-19 pandemic has posed unique challenges for dental organizations with open plan clinics particularly dental hospitals and universities.[3] Dental teaching institutions have had to adopt a wide range of risk mitigation strategies for AGPs in open plan clinics since the start of the pandemic. These include a combination of physical and temporal separation measures; compartmentalization of open plan clinics to create self-contained pods for AGPs; use of high volume intra and extra oral suction devices; speed-increasing handpieces, and installation of air exchange systems.[4] In any case, these cross-infection control measures have impacted adversely on dental services with significant resource and logistic implications for the providers. Clinical training of dental students is usually provided in open plan clinics. It has been immensely difficult for students to achieve their annual clinical targets since the start of the pandemic which has impacted on their sign off for finals and it continues to be a huge challenge for dental schools globally.

The current study by Holliday et al., provides new evidence regarding the spread and pattern aerosol spread in simulated open plan dental clinical environments. The authors have used a variety of standardized experimental conditions to quantify aerosol spread and its impact on fallow time for dental AGPs. The findings of this study are corroborated by a recent study by Ehtezazi et al.[5] The evidence emerging from these studies indicates that with appropriate use of personal protective equipment, suction devices, air exchange systems, and disinfection of clinical environment, it may be possible to reduce the fallow time for AGPs to 10 minutes in open plan clinics. Further studies in real-time open plan clinical settings are required to substantiate these findings to inform professional guidelines.

The ongoing COVID-19 vaccination campaigns provide a glimmer of hope that some degree of normality might be restored in the future. However, the rapid emergence of mutant strains of SARS-CoV-2, and lack of clarity regarding the longevity of immune protection imparted by vaccines add to the existing uncertainties related to COVID-19. In addition, fake propaganda on social media platforms fueled by conspiracy theories is a barrier to widespread uptake of vaccines particularly amongst some sections of the society.[6] With the third wave of COVID-19 already looming, it seems likely that COVID-19 is here to stay in some form and the dental profession must continue to adapt in the light of emerging scientific evidence.

Practice Points:

1. The risks of COVID-19 infection with bioaerosols generated during AGPs in open plan clinics may be minimized with the use of PPE, intra-oral suction, rubber dam isolation (when appropriate), speed increasing handpieces, disinfection of clinical environment, and appropriate air exchange systems.
2. Dental institutions should continue to implement standard operating procedures including a fallow period based on national / international guidelines.
3. Further research may help generate more evidence to reduce fallow period in open plan dental clinics.

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