Review Article

COVID-19: Transmission & Prevention in Dentistry

Dr. Neha Jasrasaria[1], Dr. Jyotsana Agarwal[2]

[1]Dr. Neha Jasrasarial, JR, Department of Conservative Dentistry & Endodontics , King George's Medical University, UP, Lucknow.

[2]Dr. Jyotsana Agarwal, JR, Department of Conservative Dentistry & Endodontics , King George's Medical University, UP, Lucknow.

ABSTRACT

Aerosols and droplets are produced during many dental procedures. Infection control procedures for aerosols is warranted in order to prevent transmission of the droplet-spread disease like COVID-19. Airborne contamination can be minimized by layering several infection control steps into the routine precautions used during high-risk aerosol-generating procedures. These procedures may create aerosolization of high viral loads that pose increased risk to health care workers. In such situations, enhanced respiratory protection with filters may be appropriate.

Introduction:

An aggregate of pneumonia cases, caused by a newly identified β-coronavirus, was reported in Wuhan, China in December 2019. This coronavirus, was initially named as the 2019-novel coronavirus (2019-nCoV) on 12 January 2020 by World Health Organization (WHO). Later the disease was named as coronavirus disease 2019 (COVID-19) on 11 February 2020 by World Health Organization (WHO) officially and declared the outbreak as a pandemic on 11th March 2020.As on 29th June,2020 the total number of COVID-19 cases globally is 10,250,322 and in India it is 5,49,197[1].

TRANSMISSION IN DENTISTRY

Transmission of the disease can occur through small droplets when a person with COVID-19 coughs, sneezes or exhales as the droplets get aerosolized during these processes. Droplets from a cough travel at

a speed of 10m/s upto a distance of 2 meters where as those of a sneeze travel at a speed of 50 m/s upto a distance of 6 meters[2]. Apart from this, aerosolization of high viral loads can also occur in high-risk aerosol generating procedures in a dental setting[3]. In dentistry, 90% of the aerosols produced are extremely small (< 5 μm) which may contaminate surfaces in a range of three feet and remain airborne for 30 minutes to two hours[4] thereby having the potential to penetrate and lodge in the smaller passages of the lungs.[5]

Most dental procedures that use mechanical instrumentation will produce airborne particles from the site where the instrument is used. Dental handpieces, ultrasonic scalers, air/water syringe, air polishers and air abrasion units produce the most visible aerosols[6] during surgical and nonsurgical procedures that may include crown preparations, caries restorations, periodontal therapies, prophylaxes and endodontic treatment[4].

Dentists who perform aerosol generating procedures to treat their patients are at an extremely dangerous risk of inoculating themselves, their dental assistants, other office staff members, and reinoculation of the patients.[2]

U.S. Centers for Disease Control and Prevention (CDC) Guidelines for Infection Control in Dental Health-Care Settings — 2003 provides recommendations for prevention of transmission based infection which include the use of high-velocity air evacuation and preprocedural antimicrobial mouthrinses, as well as by flushing waterlines at the beginning of the workday and between each patient, wearing personal protective equipment (PPE), and using air purifications systems.[6]

RESPIRATORY PERSONAL PROTECTIVE EQUIPMENT

Healthcare workers should understand the different types of respiratory personal protective equipment and their role in providing protection from aerosol.

Respiratory protective equipment recognised by the Center for Disease Control and Prevention (CDC) in the healthcare setting include surgical masks, disposable masks/respirators (including N95 masks), elastomeric respirators, powered air-purifying respirators (PAPR), and controlled air-purifying respirators (CAPR). Disposable masks/respirators come in a variety of filter options including N, R, or P types ranging from filtration level of 95 to 100.

The filters marked N are not resistant to oil, R are somewhat resistant to oil which has a service life for at about 8 hours, and P are strongly resistant to oil which has a service life for about 40 hours. The number associated with each filter denotes

its filtering capacity for particles 0.3 microns in size. A respirator designated "95" filters at least 95% of particles 0.3 microns in size. A mask designated "99" filters at least 99% of particles 0.3 microns in size. A mask designated "100" filters at least 99.97% of particles 0.3 microns in size.

Hence, N95 filters are considered the lowest level of approved respiratory protection for airborne SARS viruses by the Centers Disease Control and Prevention (CDC) whereas P100 filters are oil proof and filter 99.97% of 0.3 micron particles thus considered the highest level of protection .

Cloth Masks- are cheap, easily available, washable and reusable and should be made with 100% cotton fabric. Depending on the thickness of the fabric, two or three layers are appropriate and this mask can be used by majority of the population in developing countries. It is not recommended for use by any health care worker in a hospital setting

Surgical Masks-made up three layers. The innermost layer is made up of an absorbent material that absorbs moisture from the wearer's breath, the middle layer is made up of a melt-blown material that acts as a filter, and the outer layer is made up of material that repels liquid. The pleats are intended to increase the surface area so that the nose and the chin can also be adequately covered. Surgical masks are intended to be used only once and then safely disposed. The life of a surgical mask generally lasts for between 3 to 8 hours depending on the environmental humidity, temperature and volume of air breathed. A surgical mask is recommended for doctors, nurses and all paramedics in routine clinical practice.

N95 masks are the most common of these and are tight fitting masks sometimes called respirators. If correctly fitted, they form an airtight seal on the face around the mouth and nose. N95 filtering capacity are non-resistant to oil and are able to filter out 95% of 0.3 micron particle. The filter of the N95 mask is made up of millions of microfibers of polypropylene layered on top of each other that have been permanently electrostatically charged. The electrical charge is necessary to retain its ability to filter microorganisms or microparticles.

The N95 mask reduces the transmission of aerosol by 70%, whereas surgical mask reduces transmission by 50% and cotton masks by 40%. Maximum protection from catching the infection from others by the aerosol route is offered by the N95 mask (99%), whereas the surgical mask offers 75-80% protection and the cloth mask by around 50-70%.

If a healthcare worker is collecting nasal swabs or throat swabs for COVID-19

testing or caring for a patient who is COVID-19 positive, it is preferable to use an N95 mask and if not available, a surgical mask.

Elastomeric Respirator are either half or full-face masks made of soft rubber that allows them to be repeatedly cleaned, disinfected, and reused. Their filtration capacity is determined by the filter attached; it ranges from N95 to P100 level particle capacity.

Powered Air Purifying Respirator (PAPR) are composed of a face mask or hood and separate motor/fan/filter unit. It creates highly filtered air flow through the hood to protect the wearer from aerosolized particles.

Controlled Air-Purifying Respirator (CAPR) is similar to a PAPR in that it uses active filtered air flow within a hood or face mask to protect the wearer. The filters used within PAPRs and CAPRs are designated as High-Efficiency Particulate Air (HEPA) filter. They filter out 99.97% of 0.3 micron particles and are considered equivalent to P100 level filters.

The European Union classifies respirator masks into FFP1, FFP 2 and FFP3 where FFP stands for Filtering Face Piece. N95 is roughly equivalent to FFP2 and N99 is roughly equivalent to FFP3 masks. FFP1, FFP2 and FFP3 are also called P1, P2 and P3.[7]

When performing aerosol generating procedures, a particulate respirator that is at least as protective as a National Institute for Occupational Safety and Health (NIOSH)-certified N95, European Standard Filtering Face Piece 2 (EU FFP2), or equivalent, should be used. When performing emergency dental treatment with suspected COVID-19 cases, a higher level of respiratory protection should be considered, such as EU FFP3 respirators conforming to European Standard 149 (EN149).[8]

Conclusion:

Patients and practitioners are regularly exposed to aerosols generated during procedures which pose a significant risk of transmission of infectious disease, hence, precautions for the same should be incorporated in daily practice. The COVID-19 pandemic has created a heightened need for knowledge regarding respiratory protective equipment. A N95 mask is the minimum approved level of respiratory protection for airborne isolation for SARS viruses and is generally sufficient for routine situations. To conclude, everybody should wear a mask, primarily because it significantly reduces the chances of spreading the aerosol route of transmission as well as offers protection against catching the infection.

References:

1 mygov.in/covid-19

2 Allam M, Cai S, Ganesh S, Venkatesan M, Doodhwala S, Song Z, Hu T, Kumar A, Heit J, Coskun AF. COVID-19 Diagnostics, Tools, and Prevention. Diagnostics. 2020 Jun;10(6):409.

3 Howard BE. High-risk aerosol-generating procedures in COVID-19: respiratory protective equipment considerations. Otolaryngology–Head and Neck Surgery. 2020 May 12:0194599820927335.

4 Transmission Precautions for Dental Aerosols [Internet]. Decisions in Dentistry. [cited 2020 Jul 8]. Available from: https://decisionsindentistry.com/article/transmission-precautions-for-dental-aerosols/https://decisionsindentistry.com/author/donnacatapano/

5 Hinds WC. Aerosol technology: properties, behavior, and measurement of airborne particles. John Wiley & Sons; 1999 Jan 19.

6 Harrel SK, Molinari J. Aerosols and splatter in dentistry: a brief review of the literature and infection control implications. The Journal of the American Dental Association. 2004 Apr 1;135(4):429-37.

7 Salvi SS. In this pandemic and panic of COVID-19 what should doctors know about masks and respirators?.

8 Zhang YZ. Possible aerosol transmission of COVID-19 and special precautions in dentistry. Journal of Zhejiang University-SCIENCE B. 2020 Mar 16:1-8.