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Barriers to Surface: A Dental Operatory Amidst the Covid-19 Pandemic

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INTRODUCTION

Amidst the Covid-19 global pandemic, dental professionals face the highest risk of contracting the bacterial, viral and fungal infections. Dental work force frequently are exposed to the infection on a daily basis due to the close proximity of the dentist to the patient mouth and the bio-aerosol production makes them more susceptible to infectious diseases.[1-3] A typical dental chair, consists of unit pedestal, arms, the instrument tray, the dental light, the holders and the spittoons as shown in Fig.1. The complex components of the dental chair further tend to complicate the strict disinfection control required during these pandemic times. The dental chair and the environment in a dental clinic are vulnerable to be soiled with germs during patient care.

Essentially, environmental surfaces in a dental clinic consists of clinical contact and housekeeping surfaces.The clinical contact surfaces have a great potential for microbial cross-infection from patient through aerosol spatter generated by the dental procedures and through contact with dentist's gloved hand from the patient's mouth. These surfaces can further contaminate adjacent instruments or equipments. Clinical contact surfaces, include the dental chair components such as handles, trays, dental chair surfaces. Housekeeping surfaces are the surfaces that are not indirect contact with patients or devices used in clinical procedures. Hence, they face a narrow hazard of cross-infection spread. House keeping surfaces in a dental clinic are the walls, sinks, and floors. [4]

ABSTRACT:

The close proximity of the dentist working with the patient makes the dental health care professionals most vulnerable in contracting microbial infections.While the risk of infections is well- known to dental profession and often beenhighly neglected, the expeditious rise of Covid-19 pandemic reminds the dental fraternity of the presence of the contagions and to live with them. The article attempts to present a broad discussion on the environmental surfaces in a dental operatory, focusing on the potential fomites such as air water syringe, airotor hand piece and suction handles. It further throws light on the protocol of applying surface barriers on potential fomites and discarding them.

KEYWORDS

Infection control

COVID-19

Dental Operatory

Cross Infection

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Fig.1 Parts of a dental chair[4]

DETECTION OF α-HEMOLYTIC STREPTOCOCCI ON SURFACES IN PRIVATE DENTAL OFFICES.*

SURFACE	POSITIVE SAMPLES/TOTAL SAMPLES (% OF TOTAL POSITIVE SAMPLES)
X-ray unit	8/14 (57)
Handpiece	12/22 (55)
Seat buttons	10/19 (53)
Hand mirror	3/6 (50)
UV bonding light	4/8 (50)
Telephone	5/11 (45)
Air-water syringe handles and tips	9/21 (43)
Suction	7/18 (39)
Faucet handle	8/21 (38)
Lamp handle	7/20 (35)
Drawer handles	3/14 (21)
Patient seat adjustment control	2/10 (20)
Water from air-water syringe	2/12 (17)
Doorknob	2/14 (14)

* Samples were taken after cleanup and disinfection of operatory surfaces.

Fig.2 Detection of streptococci bacteria in a typical dental office[7]

THE TOUCH AND THE SURFACE

It is palpable that the surfaces on the dental chair are frequently touched by the dentist and the dental assistants. In the event of further clinical procedures, dentists and dental assistants may touch their face, nose, mouth and eyes, making themselves vulnerable. For example, dried rhinovirus was picked from the patient fingers and environmental surfaces.[5] The trajectory of microbial cross-contamination was found to be from patient to the dentist's fingers, and to the dental chair switches and sink handles.[6] Further, the inconspicuous nature of the saliva spatter and the insufficient time for thorough disinfection of the dental clinic due to busy patient inflow makes the spread of the contagion easy.

The most frequently touched surfaces in a dental office are theair-water syringe, the airotor hand-piece, the suction handles and the light handle. Other items touched by dental health workers with potentially contaminated hands include the common diagnostic and utility dental instruments.[7] Fig.2 shows the surfaces contaminated with streptococci bacteria in a typical dental clinic.

THE PANDORA'S BOX

Having been aware of the vulnerable surfaces of the dental clinic to the contagion, it is important to discuss the ways of combating and preventing the spread of the contagion. In the following sections, the magnitude of the problem with a brief description of each of the potentially infected fomites such as the air-water syringe, the airotorhand-piece and the suction handles will be discussed.

AIR-WATER SYRINGE

As mentioned in the previous section, one of

the most contaminated surfaces in a dental chair is the air-water syringe.A typical air-water syringe is shown in Fig.3. The air-water syringe is a metallic device,that ejects a narrow stream of compressed air, water, or both. It is commonly used to clean a clinical contact surface during dental treatment.[9] It consists of a head and a syringe.[8] The head accommodates two push buttons, each to eject air and water, continuous with the dental water lines in the tubing. The push buttons are workable with the typical spring and the buttons with the O ring mechanism. The metal syringe is fixed onto the head with a syringe button. Since the air-water syringe is frequently used to force the saliva and the fluids in the patient mouth with air, its proximity to the patient mouth and the splatter makes it the most contaminated fomite. A regular practice of dismantling the air-water syringe and disinfecting the push buttons with disinfectant with cotton swabs is advised. A cross section of an overly used metal syringe shows the contamination with the stagnation of the water and its associated biofilm.[9]

Fig.3 A typical air-water syringe

AIROTOR HAND PIECE

The airotor hand-piece is an evolved dental drill, works on pressurized air and water, is used to prepare cavities and teeth for dental crowns or bridges. In their original work on aerobiology, Micik and colleagues coined the word “aerosol” and “splatter” in the dental setting. Aerosols are particles which are less than 50 µm in diameter and splatter are the particles which are greater than 50 µm.

The small particle size of the aerosol tend to make them remain airborne for a period before they reside on surfaces or enter respiratory tract. The design of the airotorhand-piece accommodates open vents for heat buildup, lumens and the crevices, which can easily harbor the pathogenic micro-organisms. Much of the concern on the source of contamination from the dental waterlines to the hand-piece is bacterial or fungal than viral as virus requires a susceptible host to survive. The prolonged contact of water in the water lines produces the hard to flush bio-film formation. Viral contagion is a grave concern, if patient microbes are harboured in the lumens, isolated from the dental waterlines. The particles of the aerosol (0.5 to 10 µm in diameter) have the potential to infiltrate to the passages of the lungs and thus can carry the higher risk for transmitting infections.[10-19] Further, while operating the airotor without cutting, the spread of the heavily contaminated aerosol splatter has been found to be at least 4 ft in

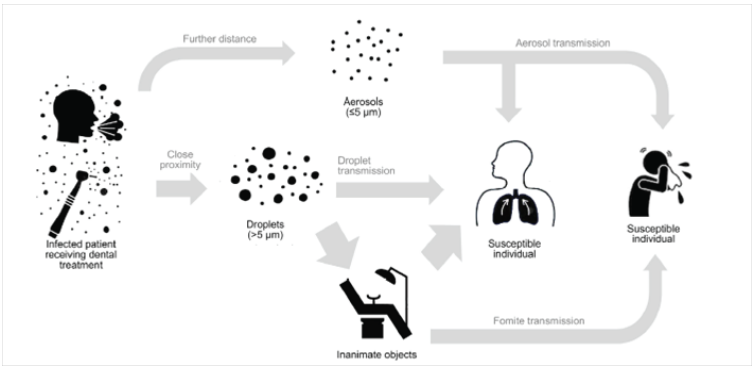

Fig.4 Trajectory of aerosol and droplet splatter on dentists and fomites in a dental clinic [22]

radius. Operating with air seems to spread more and water with the compressed air contains the spread by about two times.[20] The ultrasonic scaling procedures found the aerosol to be suspended for about 20 minutes.[21] The trajectory of aerosol contamination on dentists, patients and fomites in the dental clinic is shown as a flowchart in Fig. 4.[22]

SUCTION HANDLES

Fig.5 Barriers for air water syringes

A dental suction gathers blood, saliva, and other remains produced during dental procedures, to isolate the operating field from spray and spatter. A saliva ejector is a straw like tubing with valves, attached to the suction lines, to remove saliva and fluids in the oral cavity. Its frequent use for isolation during clinical procedures, may be the reason for its frequently touched surfaces and as a potential fomite.[23]. Though saliva ejectors are single use and disposable, the risk of back flow from the saliva ejector and the suction lines to the patient due to aspiration of saliva and the creation of a low pressure in the patient mouth when the patient occludes his or her lips.[24]

BEATING THE STORM

In the following discussion, solutions for the problems mentioned for the potential fomites will be discussed.

AIR-WATER SYRINGES

Single use disposable air water syringes with converters and tight seals have been advocated in the dental market.[25] Surface barriers such as air-water syringe sleeves, made of impervious material such as plastic wraps with adhesives or ties can be used to prevent the spread shown in Fig.5. Surface barriers must be altered between patients. Barriers are beneficial for surfaces that are hard to clean, such as switch

Fig.6 Disposable air syringes

Fig.7 A dental chair with plastic barriers in place

buttons on dental chairs. Such protocol can lessen contact of the metal surfaces to harmful chemical disinfectants. In the absence of surface barriers, a low-level disinfectantcan be used to clean and disinfect the contact surfaces.After patient procedures, if the contact surfaces are discernibly soiled with blood or other patient material, clean and disinfect the surfaces with a hospital disinfectant of tuberculocidal claim of intermediate-level.[26]

AIROTOR HAND-PIECE

Infection control measures such as autoclaving or dry heat treatment with cleaning and chemical disinfection are available for hand-pieces and their attachments. Flushing for 2 minutes early in the day and for 20-30 seconds between patients must be followed with longer flushing

at the weekends. Storage tanks must be frequently washed and disinfected, and filled with distilled clean water. [27]

SUCTION HANDLES

Disposable saliva ejectors can be replaced for every patient, shown in Fig.6. However, patients should be instructed not to close their lips around the saliva ejector tips. Since a patient may inadvertently form a closure around the ejector tip, vacuum tubes must be effectively disinfected and rinsed between each patient. Methods to prevent suck-back flow such as placing a hole in the saliva ejector tip to prevent higher vacuum in the mouth, or a safety valve in the vacuum tube are required. [28,29]

THE BARRIERS AND THE SURFACES

Surface barriers generally are applied to the potential fomite surfaces before the patient is seated. The barriers must be placed on clean surfaces. If the covered surfaces are contaminated, pre-clean and disinfect, using a water-based disinfectant such as Cavicide(17.2% Isopropanol and Ammonium Chloride) with the "spray-wipe-spray" technique. The protocol must be followed by removal of worn gloves, hands washing and drying, and placement of fresh surface covers over the surface. Toxic glutaraldehyde must not be used for disinfecting surfaces. Dry surfaces must be ensured before placing the barriers to minimize corrosion, and discoloration from prolonged contact with chemical disinfectants.Each cover must be placed so that it is firm and protects the entire surface.

Clear plastics can be used to cover the furniture and utilities at the dental office, including most touched surfaces (headrest, control panel) of the dental chair, shown in Fig.7. Wraparound chair backs of operator seating lend simple protection. Hoses must be covered with plastic tubing or bag secured with tape or a rubber band at the connector. Installing removable light handles which can be cleaned and sterilized before reuse, can be used or a simple barrier protection can be an option. Covering the air/water syringe handle with plastic wrap prevents contamination, reduces time and energy of cleaning and disinfecting the inaccessible buttons harbor invisible debris. Electrical switches should not be sprayed with disinfectant, to prevent short-circuiting. An adhesive barrier is recommended, if necessary.[30,31]

DISCARDING THE BARRIERS

While discarding the barriers, the personal protective equipment such as the examination gloves used in patient care provide sufficient protection. Each surface cover must be removed carefully without contacting the underlying surface. If a surface is touched during barrier removal, it should be pre-cleaned and disinfected and a fresh barrier must be placed. Particular care must be followed when removing foil covers, noting that sharp edges can tear the protective gloves.[30,31]

Used surface barriers with the regular office waste must be thrown out following the bio-medical waste protocols. Contaminated examination gloves must be removed carefully, hands washed and fresh surface barriers applied for the next patient.Increased costs, non-biodegradable plastic are some of the demerits when strict infection protocols are followed.[30] Overhauls and changes in the clinic design compatible with the recommended infection control guidelines, greater emphasis on awareness among young practitioners about infection control procedures and strict enforcement of policies and proceduresby faculty are essential for living with the microbes in future. [32]

CONCLUSION

The Covid-19 pandemic has taught to accept the presence of microbes around us and we must learn to adapt to the new normal of living with them, with their infections. We, the dental professionals must prepare ourselves as infection-control professionals and strongly boost the use of protective barriers in daily practice to safeguard the health of the dental fraternity and patients.

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