

Evaluation of Minimum Required Safe Distance between Two Consecutive Dental Chairs for Optimal Asepsis

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ABSTRACT

Cross infection and self-protection, these two words are like a lurid to the health care professionals. A balance has to be maintained among those two words if not, it's after affects are unpredictable. It is believed that even after following the code of practice, some elements such as the aerosols that are evolved during the use of high speed rotary instruments such as airtor and scaler are difficult to handle. Aerosols containing microbes from oral cavity of the patient are a risky source of infection. The best way to fight against these aerosols is to keep a distance from them. But it is not known how far these airborne microorganisms spread under various clinical environments. This article emphasizes the safe distance that has to be maintained around each dental chair to prevent cross contamination.

Keywords: Dental chairs, Safe distance, Aerosols, Litmus paper, Cross contamination, Self-protection.

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INTRODUCTION

Occupational health hazards are not uncommon¹ in the present field of health care. Apart from hazards related to stress, allergy, radiation, musculoskeletal disorders,² the health care professional is also exposed to infectious agents which may be present in blood or saliva. Studies have shown that dentists report more frequent and worse health problems than other high risk medical professionals.³ This led the dental councils all over the world to find out the causes for the cross infection and there by incorporation of the methods and precautions that are to be followed by all health care professionals. The dental council has introduced a code of practice⁴ that has to be followed by the dental personnel. This code of practice emphasizes the use of sterilization, disinfection, use of protective equipment and also providing the maximum possible protection for the patient. In spite of all the meticulous measures and precautions, a good number of cross infections are still being reported. One among the many causes of these infections are the aerosols. Aerosols produced during use of scaler or airtor contains droplet nuclei particles which remain in the environment for long

periods of time, and is a source of infection for the patient as well as the health care provider.⁵ Aerosol is a general term and may be defined more specifically as true aerosol and splatter. True aerosol is made up of smaller particles of 50 µm or less in size that become suspended in the air around the point of generation.⁶ The concentration of total bacterial aerosols has been shown to be clearly associated with clinical working hours in dental surgeries.⁷ The potential air contamination of dental surgery offices by infectious aerosols has also been pointed out by the 'Centers for Disease Control and Prevention in Atlanta', which recommends that all sources of blood contaminated splatter and aerosols can be minimized with face masks, high velocity evacuation of air, and proper positioning of the patient.⁸ Apart from the saliva and blood the microbes in the water lines can be attributed equally for the potential effects of the aerosols.⁹

The potential effects of the aerosol contamination not only affect the health of the health professional but also the patient. All the measures taken for optimal asepsis are usually pertinent to either before or after the treatment procedures. However, asepsis during treatment procedures is the most neglected part. The best way to escape the attack from these aerosols is to maintain a distance from them. The question of how much distance to be moved depends on several environmental conditions prevailing in a clinical setup. The present study was done to discover the amount of safe distance around a dental chair, simulating the environmental conditions routinely present in the clinical practice.

MATERIALS AND METHODS

A super torque airtor handpiece (NSK, Japan with 2 lakh rpm under 35 psi pressure) was used for the production of aerosols. Citric acid solution diluted in water to the ratio of 1:10 is filled in the booster bottle instead of water. Commercially available blue litmus paper strips (Fig. 1) are taken and placed in all possible directions around the dental chair. A measuring tape is used for exact placement of litmus paper at regular intervals of 1 feet extending over 10 feet distance from the center of the dental chair. Approximately 1,000 litmus papers are placed around the chair with the help of adhesive (Fig. 2). The principle reason behind the use of citric acid solution is it's acidic pH at a



Fig. 1: Materials used in the study



Fig. 2: Dental chair surrounded with litmus papers

range of 2.1 to 7.4 which on contacting the blue litmus paper will turn it into red.

The procedure started with running the airtor handpiece for 20 minutes with 35 psi pressure, thereafter a 5 minutes lapse was provided for the aerosols to settle down (Fig. 3). At this point the litmus papers were examined for any change in color (Fig. 4). This change of color is noted both in distance as well as direction. Different clinical environmental conditions are simulated, such as with A/C on, with fan on, with fan and A/C on and fan and A/C off and the above said procedure was repeated using new set of litmus papers, each time.

All the findings were noted and presented as graphical representation which depicts the environmental conditions like fan on, A/C on, fan and A/C on and fan and A/C off on X-axis and distance of spread of aerosols on Y-axis (Fig. 5). Each wing here represents the direction and extent of spread of aerosols around the dental chair.

RESULTS

It is inferred from the study that the spread of aerosols was maximum at 2 feet distance in all directions irrespective of the environmental conditions. Whereas it was a minimal to negligible spread at 6 feet distance in all directions under all environmental conditions simulated. There was no color change in litmus paper after 6 feet, which indicates that the minimum safe distance that has to be followed around a dental chair is 6 feet.

DISCUSSION

Hall has classified the space zones which people (consciously or unconsciously) maintain from each other during common social activities as intimate (0-45 cm), personnel (60-120 cm), social (1.2-3 m), and public (over 3 m).¹⁰ Distance always played a significant role in social



Fig. 3: Airtor working

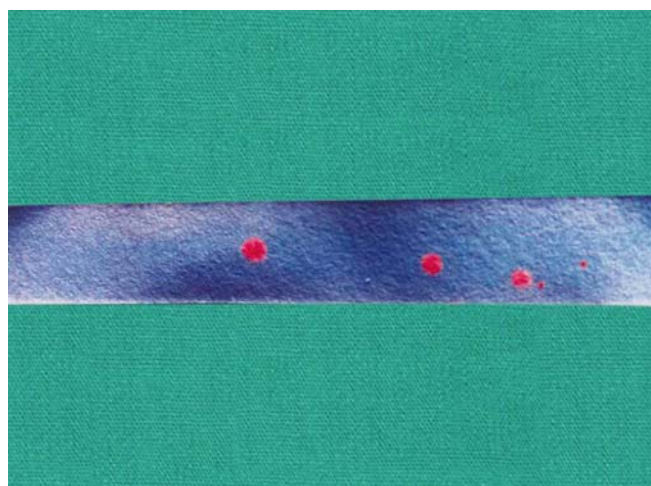


Fig. 4: Color change of litmus papers when contact with aerosol

relations. When applied to sciences, the dentist, however, must by necessity maintain a position within an intimate distance of his patient during most dental procedures. Dental aerosols, irrigants and coolant water entering the patient's mouth during dental procedures often contain large numbers

of organisms in the range 104 to 108 colony forming units (CFU)/ml. The mean density of aerobic oral bacteria was 823 CFU/m²/h at <1 m distance from the patient. At distances >1.5 m, the density was 1,120 CFU/m²/h. The increase in the contamination density with respect to distance from the patient was not statistically significant.¹¹ Aerosols contain a mix of small particles being released during treatment procedure as well as bacteria. They remain in the air for certain periods of time becoming a major source of infection for both dental personnel and patients.¹²

As suggested in the infection control guidelines of the 'American Dental Association', operators and dental assistants should always wear masks, gloves and eyeglasses with lateral protective shields.¹³ However, the patient is also equally exposed to potentially infective environment of splatter and aerosols during treatment procedures. The measures being taken for their protection are always under query.¹⁴ Various means have been investigated to prevent or reduce bacterial aerosols during dental treatment. These include use of a rubber dam, which has been shown to be highly significant in reducing contamination of the atmosphere, and giving the patient an antiseptic mouthrinse before treatment.^{15,16}

Another practical way proposed to keep away from these aerosols is to maintain a safe distance. How much should be this distance is not specified due to lack of adequate research base regarding the extent of the spread of the aerosols. According to study by Micik, Miller et al, the contaminated area with aerosols was thought to extend 1 to 1.5 m from the patient's mouth, and the risk for contamination and cross-infection beyond that distance was assumed to be minimal.¹⁷ Several other suggested guidelines for hospitals have been published but how useful they are in dentistry, how they should be understood and how up to date they are in the situations, where patients and oral health

care personnel are surrounded by microbial aerosols during dental treatment with turbine burs, water air sprays and other aerosol forming instruments^{18,19} is another matter.

The present study was done to evaluate the minimum required safe distance around a dental chair. This was done in an attempt to obtain an effective and simple method to reduce the airborne cross contamination. The assessment of the extent of the spread of the aerosols in this study was done under various environmental conditions, i.e. with fan, without Fan, with A/C and without A/C, which usually influence the extent of spread of airborne particles. The spread of aerosols was more when both A/C and fan were on and the extent of spread beyond 6 feet was negligible. Noro et al found that an extraoral vacuum aspirator was effective in reducing the spread of oral streptococci, and recommended this for treating patients with infectious diseases.²⁰ However, in practice, it is impossible to totally eliminate bacterial aerosols during dental treatment. Hence, following a protocol in maintaining a safe range of distance around a dental chair would minimize the airborne cross contamination.

CONCLUSION

This research demonstrated the need for the management of possible risk of infective hazards, among dental personnel and patients due to aerosols. The role and challenges of hygiene in dentistry have changed radically over the past decades. The prevalence of cross contamination in the field of dentistry is toughened by the emergence of new pathogens. At this juncture it becomes imperative to procure meticulous measures and precautions for optimal asepsis. The present study concludes that a minimum of 6 feet distance around a dental chair is an effective way to minimize the risks of airborne contamination.

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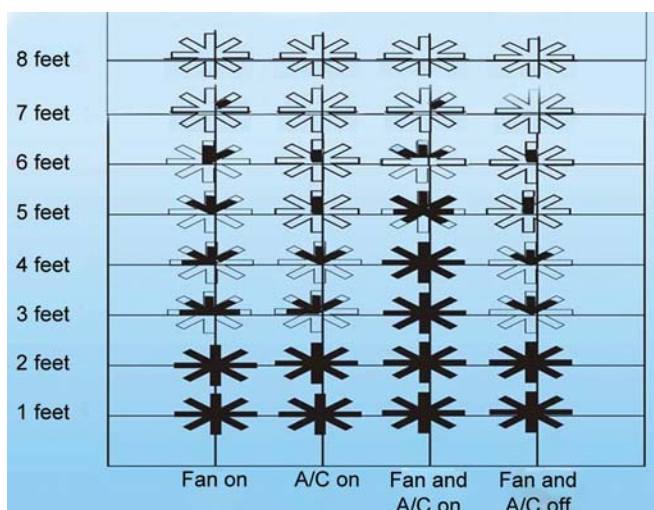


Fig. 5: Graphical representation

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