Evaluation of extent of aerosols around dental chair during dental treatments

B. Revathi, N. P. Muralidharan*

ABSTRACT

Aim: The aim of this study is to evaluate the extent of aerosols around dental chair and to take preventive and control measures to reduce the risk in dental clinics. Introduction: Aerosols are the solid of liquid particles which cause environmental contamination in dental clinic. They have the potential to spread diseases to doctors and patients due to cross-contamination. Dental waterlines and dental equipment have the potential to produce aerosols. They are generated using high-speed handpieces, ultrasonic scalers, etc. Aerosols mostly cause respiratory diseases and oral infection among patients in and around dental clinic.

Materials and Methods: A total of 20 samples were collected from Saveetha Dental College. Brain heart infusion plates are kept at three different positions (1 foot away, 2 feet away, and 1 foot height) for 30 min from the dental chair. It is then incubated at 37°C/overnight aerobically and CFU was calculated. Results: The aerosol dissemination is seen clearly in all the plates and the colonies were counted. The maximum contamination was seen in 2 feet away followed by 1 foot away and 1 foot height, and the average of CFU is found to be 171.5, 144.2, and 131.9, respectively. The maximum aerosols are found to be ejected to the extent of two feet. The result shows the least contamination at one foot above from the dental chair. Conclusion: Aerosols can be reduced by following evidence based protective techniques. Protective measures are not only for the dentist’s wellness but also for the patients in dental chair. The main criteria includes usage of personal protective equipments like gloves, head cap, face mask which adapt to contours, eye wear, rubber dam wherever and whenever possible.

KEY WORDS: Aerosol, Around dental chair, Contamination in different positions, Prevention, Protection

INTRODUCTION

Aerosols are minute particles suspended in atmosphere and it creates a great impact on dental field. They are seen around the dental chair and ejected during a dental procedure as solid or liquid particles.[1] These are the invisible particles which transmit airborne diseases. It leads to cross-contamination through several vectors. The infections are transmitted from sources such as dental equipment and patient’s oral secretions. The dental unit waterlines are considered to be the main reservoir of infection.[2] Most of the dental treatments cause splatter of aerosols when inhaled it leads to different diseases such as pneumonia, hepatitis B, bronchitis, and other nosocomial diseases in health-care facilities.

The microbial load of aerosols is different in various dental procedures and at different positions from the working area. The quantitative analysis of aerosols differs from each patient and working site.[3] The aerosols in air attack the immunosuppressed patients easily. According to the recent study, the aerosols are increased to 50–70% during the dental treatments and the peak of bacterial contamination dissipates only within 30 min after finishing the work in closed operatory. Another study conducted by Shivakumar et al.[4] observed that the aerosols produced during working session are 4 times higher than before and after working sessions.

Aerosols are capable of spreading pathogens from clinician to patient and vice versa. Hence, the study conducted by Sandeep Chirmana et al.[5] stated that the aerosol contamination is highest at the distance < 1 m from the patient. The blood contamination and splatter droplets may be a potential source of infection.[6] The proper temperature and environmental conditions in the dental clinics determine the risk of aerosols. Lack of awareness of health risk is the main reason why the dentist seldom takes protect measures against aerosols.[7]

Department of Microbiology, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, Tamil Nadu, India

*Corresponding author: Dr. N. P. Muralidharan, Department of Microbiology, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, Tamil Nadu, India. Phone: +91-9840560487. E-mail: mugaidar@yahoo.com.

Received on: 18-04-2019; Revised on: 26-06-2019; Accepted on: 28-07-2019
MATERIALS AND METHODS

The study was conducted in 20 chairs during dental treatment in Saveetha Dental College. Waterline and the handpieces were disinfected with 2% glutaraldehyde and the booster bottles were disinfected with 3% sodium hypochlorite. The aerosol was collected by placing brain heart infusion agar. The sample was collected by placing three culture plates in different positions from the patient. The plates are kept for exposure with the running of aerator handpiece. Based on the previous reference, culture plates are kept at three different positions to collect the aerosols and exposed for 30 min exactly. They are placed in 4'O clock position at 1 foot away, 2 feet away, and 1 foot height from the patient’s dental chair [Figure 1].

After the collection of aerosols, the culture plates are transported immediately to the microbiology laboratory for incubation at 37°C for overnight aerobically, and the colonies were counted to estimate the total colony-forming unit to know the extent of aerosols and to evaluate the risk of transmission of infections.

RESULTS

The aerosol dissemination is seen clearly in all the plates and the colonies are counted. The maximum contamination was seen at 2 feet away followed by 1 foot away and 1 foot height with a corresponding CFU count of 171.5, 144.2, and 131.9 [Table 1]. From the result, the aerosols are ejected and seen to be highest at 2 feet distance and the least contamination at 1 foot above from the dental chair.

DISCUSSION

The distance of spread and sedimentation depends on the particle size and the nature of the particle matter. In dental treatment, splatters are more than the aerosol which could settle near the patient side, whereas the lighter particles that are generated may not settle nearby but can remain suspended and carried to longer distance, especially in a closed air-conditioned dental office.

According to Veena et al., the contamination is found to be highest at 1 ft in 4’O clock position.[9] Hence, the aerosols are suspended in the air with the favorable environment and seen to be spread even in areas that are away from the actual source.

It is obvious that the transmission arises from aerosol cloud. During dental surgery, the ejection of saliva and blood is seen; hence, the spread of microbes is unavoidable. The presence of aerosols is not same in all patient positions and dental treatments and also the concentration of aerosols is lower at the end of the day and more in the starting.[9] They are found to be less than a micron in size present in air for many hours at the end of the treatment. They are seen impartially in both closed operatory and multichair dental clinics. They are observed even in non-working areas.[10]

Numerous airborne particles along with blood, food debris, dental plaque, and restorative material cause skin irritation, fungal, viral, and bacterial infections. It leads to a risk of infectious agent transmission-associated diseases such as influenza, tuberculosis, meningitis, or

<table>
<thead>
<tr>
<th>Set number</th>
<th>1 foot away</th>
<th>2 feet away</th>
<th>1 foot above</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>128</td>
<td>95</td>
<td>99</td>
</tr>
<tr>
<td>2</td>
<td>124</td>
<td>114</td>
<td>117</td>
</tr>
<tr>
<td>3</td>
<td>228</td>
<td>164</td>
<td>170</td>
</tr>
<tr>
<td>4</td>
<td>86</td>
<td>Confluent/overlapping</td>
<td>45</td>
</tr>
<tr>
<td>5</td>
<td>121</td>
<td>195</td>
<td>139</td>
</tr>
<tr>
<td>6</td>
<td>217</td>
<td>212</td>
<td>164</td>
</tr>
<tr>
<td>7</td>
<td>202</td>
<td>198</td>
<td>163</td>
</tr>
<tr>
<td>8</td>
<td>144</td>
<td>99</td>
<td>236</td>
</tr>
<tr>
<td>9</td>
<td>124</td>
<td>106</td>
<td>206</td>
</tr>
<tr>
<td>10</td>
<td>113</td>
<td>230</td>
<td>49</td>
</tr>
<tr>
<td>11</td>
<td>142</td>
<td>177</td>
<td>102</td>
</tr>
<tr>
<td>12</td>
<td>129</td>
<td>127</td>
<td>84</td>
</tr>
<tr>
<td>13</td>
<td>200</td>
<td>181</td>
<td>142</td>
</tr>
<tr>
<td>14</td>
<td>91</td>
<td>159</td>
<td>50</td>
</tr>
<tr>
<td>15</td>
<td>171</td>
<td>202</td>
<td>184</td>
</tr>
<tr>
<td>16</td>
<td>129</td>
<td>261</td>
<td>196</td>
</tr>
<tr>
<td>17</td>
<td>213</td>
<td>164</td>
<td>152</td>
</tr>
<tr>
<td>18</td>
<td>66</td>
<td>319</td>
<td>149</td>
</tr>
<tr>
<td>19</td>
<td>160</td>
<td>116</td>
<td>122</td>
</tr>
<tr>
<td>20</td>
<td>97</td>
<td>140</td>
<td>129</td>
</tr>
</tbody>
</table>

Average 144.2 171.5 131.9

Figure 1: The position of the culture plates around the dental chair
severe acute respiratory syndromes. There is a greater prevalence of respiratory diseases in dental clinic. The blood-borne pathogens lead to HBV and HIV. 

The main source of aerosols is ultrasonic scaler, aerator, dental waterlines, high-speed rotary instruments, and water syringes. The dental waterlines initiate the colonization of bacterial groups and act as the potent for sequential development of health hazards. It affects both the dentists and patients; hence, the required distance should be maintained to avoid cross-infection.

The chance of aerosol inhalation is unpredictable. Nowadays, air filter equipment or purifiers are not preferred by many. Clinical habits are very significant to keep the working area away from aerosols such as weekly evaluation, regular DWL monitoring, and selection of qualitative operatory instruments determine the effectiveness of aerosol control. It has been proved that using the rubber dam reduces the bacterial contamination significantly. The adjudicative use of hydrogen peroxide with chlorhexidine is superior to lone usage of chlorhexidine in combating the dental aerosols. The negative perception is seen toward rubber dam among students and the percentage of usage is decreased by 1% once they start the independent practice.

CONCLUSION

With all the emergence of new pathogens and resistant producing microorganisms, it is necessary to pursue universal barrier technique. Aerosols can be reduced by following evidence-based protective techniques. Protective measures are not only for the dentist’s wellness but also for the patients in dental chair. The main criteria include the usage of personal protective equipment such as gloves, head cap, and face mask which adapt to contours, eyewear, rubber dam wherever, and whenever possible. Some clinician believes that for practicing over years, they gain immunity toward dental pathogens. However, the chance of getting infected is probably high when they grow older and also due to emergence of newer pathogens. Hence, the recommended guidelines must be followed to lower the aerosol contamination up to some limitations.

REFERENCES


Source of support: Nil; Conflict of interest: None Declared