Predictors of quantitative microbiological analysis of spatter and aerosolization during scaling (Abstract): The aim of this study is to analyze the infection risk through spatter and aerosolization during scaling and to create a prediction model of the total number of hemolytic bacteria. Material and methods: Air samples were collected prior to patient’s arrival and spatter and aerosol samples were collected during scaling procedure in 80 patients of 4 different dental clinics. The dentists calculated DI, CI, DMFT. Only patients with CI>=1 were included. The bacteriological results (CFU/m³) were correlated with clinical indicators. Patients were divided into 2 groups: one that rinse with sterile water and the other with chlorhexidinemouthrinse 0.1%. Results and conclusions: Medium size effect positive correlations were found between the number of decayed teeth and the total number of bacteria and the total number of hemolytic bacteria that grew on plate attached to the dentist’s mask. The mean number of bacteria and the mean number of hemolytic bacteria that grew on plate attached to the dentist’s mask were significantly lower in the group that rinse with chlorhexidine 0.1%, when compared to the group that rinsed with sterile water. When controlling for the total number of bacteria and the total number of hemolytic bacteria from air sampling, the total number of hemolytic bacteria that grew on the plate attached to the dentist’s mask can be predicted by CI, group membership and DMFT score. Keywords: SPATER, AEROSOLS, HEMOLYTIC BACTERIA.

For dentists and oral health personnel there is a high risk of contamination with several communicable diseases, due to particularities of their work. Ultrasonic scalers are being used extensive in dental practice for the removing of dental plaque and calculus. Several authors have confirmed presence of bacteria in dental calculus (1, 2, 3, 4). Microbial aerosols are produced by ultrasonic scalers have a high risk of infection because they can contain microorganisms of oral cavity, including microbes from calculus, respiratory tract and blood, that can be carried through the aerosolisation and can contaminate skin, oral, nasal and eye membranes (5, 6). The microorganisms incriminated to be transmitted from patients through aerosolization could be Gram positive and Gram negative bacteria (7), viruses such as hepatitis B virus (HBV), hepatitis C virus (HCV), Herpes B virus, human immunodeficiency...
Regarding the exposure of dentists to aerosols, studies conducted in 1980-1995 had found higher concentrations of antigen and antibodies of HBV (9, 10) and HCV (11) than in general population. More recently other authors (12) had found significant increases in CFU/m$^3$ in air samples taken before the procedure and after the procedure in patient proximity. Rautemaa et al. (13) had found significant contamination at all distances sampled when high-speed instruments were used. They did not find higher densities in patient’s close proximity. Gram-positive cocci, namely viridans streptococci and staphylococci, were the most common findings.

The aim of this study is to analyze the infection risk through spatter and aerosolization during scaling and to create a prediction model of the total number of hemolytic bacteria using patient’s clinical features.

**MATERIAL AND METHODS**

The study included 4 dental practices and in the analysis were included 80 patients with a Calculus Index \( \geq 1 \). The patients were selected in a prior visit. These patients represented the first patient of the working day, after 12 hours lack of activity.

Air samples were taken before the patient arrived on different Petri plates that contained three different culture media: agar, blood agar and Sabouraud. For air sampling we used M.A.Q.S (Microbiological air quality sampler - Oxoid). The air is sucked by the turbine through a perforated filter. Air flow is directed to the Petri plate, situated under the grill. The air volume is 100 l/minute and for each sample is recommended the sampling of maximum 1,000 liters of air. Excising this quantity will dehydrate the surface of Petri plate.

Another sample was taken during scaling on a blood agar culture plate attached to the dentist’s mask.

Patients were divided into 2 groups and were randomized by order of arrival in the practice: one group that rinse with sterile water, and a group of patients that rinsed with an alcohol-free chlorhexidine 0.1% mouth-rinse.

The DMFT, DI and CI were calculated by the dentist, respecting the WHO indication from 1997 (14, 15), after the patient sat on the dental chair. After this procedure, the dentist placed the mask that had a Petri plate attached and begun the intervention. When the intervention was over, the Petri plate was detached, and then covered. All plates were labeled and transported to the Microbiology laboratory. All plates were incubated 24 hours at 37°C. We used the following bacteriological indicators: the total number of bacteria (UFC/m$^3$), and the total number of hemolytic bacteria (UFC/m$^3$). The intervention consisted of scaling with an ultrasonic scaler.

Data were processed using IMB SPSS version 18 (2010). For the parametric correlation of data, Pearson’s correlation was used. T-Tests were used in order to compare between study groups the number of CFU/m$^3$ (total and hemolytic) that grew on the plate placed on the operator’s mask. For the prediction of the number of hemolytic CFU/m$^3$ that grew on the plate placed on the operator’s mask we used the multiple hierarchal regression.

**RESULTS AND DISCUSSION**

Females represented 52.5% of total study population. Age range was between 20 and 65 years. Mean group age is 42.74 +/- 12.38 years, with median at 45 years. Mean DMFT score for the whole group was
Predictors of quantitative microbiological analysis of spatter and aerosolization during scaling

21.3 +/- 4.94, with a minimum of 9 and a maximum of 28. We have found a significant positive correlation between DMFT score and the total number of bacteria \((r=0.37, p<0.01)\), and between DMFT score and the number of hemolytic bacteria \((r=0.39, p<0.01)\) that grew on the Petri plate that was attached to the operator’s mask. Size effect of both correlation is small \((r^2=0.14, \text{ respective } r^2=0.15)\). Stronger correlations were found when using the decayed number of teeth with the total number of bacteria \((r=0.62, p<0.01)\) and the total number of hemolytic bacteria \((r=0.57, p<0.01)\) and the size effect of latter correlations is medium.

In accordance to our results, Korean researchers (16) found that the reduced glutathione level, a major endogenous antioxidant produced by the cells, showed a significant linear relationship with the salivary Lactobacilli level \((p=0.016)\), DMFT score \((p=0.005)\). In contrary to our results, Manna et al. (17) used a pooled supragingival plaque sample per participant, obtained from posterior approximal sites and analyzed it for 15 bacterial species using the checkerboard DNA-DNA hybridization technique, did not find significant relationships between the bacterial scores and DMFT/dmft nor D/d groups.

Mean DI score for the whole group was 0.28 +/- 0.27 with a minimum of 0 and a maximum of 1.0. Mean CI score for the whole group was 2.02 +/- 0.71 with a minimum of 1.0 and a maximum of 3.0.

The results of air sampling prior to intervention indicated that the mean number of bacteria that grew on the plate was 118.01 +/- 25.07 CFU/m³ and the mean number of hemolytic bacteria that grew on the plate was 10.68 +/- 4.75 CFU/m³.

Similar results were published by Azari et al. (18), that the total bacterial counts in the air of dental surgery rooms and in non-surgery rooms without direct involvements with dental operations were in the range of 120-280 CFU/m³ and 49-128 CFU/m³ respectively. Other Romanian researchers (19) had published similar results for the mean value for the total number of germs at the beginning of the day in the air was 129 CFU/m³.

We have found that the mean total number of bacteria on the mask attached Petri plate were significantly lower in the group of patients that rinsed with chlorhexidine 0.1% \((M=66.25)\), when compared with the group that rinsed with sterile water \((M=121.35 \text{ CFU/m}³) t(78)=-5.37, p<0.001 and size effect \(\epsilon=0.26 \) is considered large according to Cohen. The mean number of hemolytic bacteria on the mask attached Petri plate were significantly lower in the group of patients that rinsed with chlorhexidine \((M=9.03)\), when compared with the group that rinsed with sterile water \((M=15.78 \text{ CFU/m}³) t(78)=-6.75, p<0.001 and size effect \(\epsilon=0.36 \) is considered large according to Cohen.

In agreement to our study, Reddy et al. (20) when investigated the reduction of bacterial aerosol contamination during use of ultrasonic scaler comparing the efficacy of sterile water rinse with non-tempered chlorhexidine rinse and with a tempered chlorhexidine mouth rinse and found significant reductions in CFU in the group that used non-tempered chlorhexidine rinse when compared to the group that rise with sterile water. Similar results were obtained by Konig et al. (21) when they used cold \((18^°C)\) rinse versus wormed rinse \((37^°C)\), with better results for wormed solution of chlorhexidine. In a study by Rosin (22), that compared the effects in bacterial re-
duction of placebo vs. a chlorhexidine 0.12% rinse, the authors obtained significant reduction in bacterial count in the chlorhexidine 0.12% rinse group.

Multiple hierarchical regression was used to assess the ability of 4 measures (the group membership, the Debris Index and the Calculus Index, DMFT) to predict the number of hemolytic bacteria that grew on the plate attached to the dentist’s mask, after controlling for the influence of total number of bacteria and the number of hemolytic bacteria cultivated from aerosols of the dental office, prior to intervention. Preliminary analyses were conducted in order to ensure no violation of the assumptions of normality, multicollinearity, homoscedasticity. In the first step, total number of bacteria and the number of hemolytic bacteria were included and the model containing these variables was not statistically significant. In the second step, besides total number of bacteria and the number of hemolytic bacteria we introduced the group membership, the Debris Index and the Calculus Index, DMFT. This model as a whole explains 69.7% of the variance of total number of hemolytic bacteria F (6.79)=27.9, p<0.001. CI has the highest beta value (beta=0.71, p<0.001), followed by the membership to the group that rinsed with sterile water before the intervention with beta=0.19, p<0.05 and DMFT with beta=0.18, p<0.05. The unique variance explained by the significant predictors was 61.1% for CI, 15.8% for group membership and 15.7 for the DMFT score.

DI, total number of bacteria and the total number of hemolytic bacteria from air sampling did not contribute significantly to the model.

*Prediction equation:* Number of hemolytic bacteria that grew on the plate attached to the dentist’s mask = -8.71 + 2.85 x sterile water group + 7.51 x CI + 0.28 x DMFT.

### TABLE I

Regression coefficients for the prediction of the total number of hemolytic bacteria that grew on the plate attached to the dentist’s mask

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
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</thead>
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<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
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<td>(Constant)</td>
<td>17.847</td>
<td>4.268</td>
<td>4.181</td>
<td>.000</td>
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<tr>
<td>Total number of hemolytic bacteria from air initial</td>
<td>-0.065</td>
<td>.181</td>
<td>-.041</td>
<td>.360</td>
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<tr>
<td>Total number of bacteria initial from air</td>
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<td>.034</td>
<td>-.134</td>
<td>-1.169</td>
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<tr>
<td>(Constant)</td>
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<td>3.663</td>
<td>-2.378</td>
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<tr>
<td>Total number of hemolytic bacteria initial</td>
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<td>.104</td>
<td>-.052</td>
<td>-.788</td>
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<tr>
<td>Total number of bacteria initial</td>
<td>-.025</td>
<td>.020</td>
<td>-.082</td>
<td>-1.247</td>
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<tr>
<td>2 Sterile water group</td>
<td>2.851</td>
<td>1.162</td>
<td>.190</td>
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<td>DI</td>
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<td>2.444</td>
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<td>CI</td>
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<tr>
<td>DMFT</td>
<td>.281</td>
<td>.115</td>
<td>.185</td>
<td>2.435</td>
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CONCLUSIONS

Small size effect positive correlations were found between DMFT score and the total number of bacteria and the number of hemolytic bacteria that grew on plate attached to the dentist’s mask. Medium size effect positive correlations were found between the number of decayed teeth and the total number of bacteria and the total number of hemolytic bacteria that grew on plate attached to the dentist’s mask.

The mean number of bacteria and of hemolytic bacteria that grew on plate attached to the dentist’s mask were significantly lower in the group that rinse with chlorhexidine 0.1%, when compared to the group that rinsed with sterile water.

When controlling for the total number of bacteria and the total number of hemolytic bacteria from air sampling, the total number of hemolytic bacteria that grew on the plate attached to the dentist’s mask can be predicted by CI, group membership and DMFT score.

Simple measures like the prior rinse with a chlorhexidine 0.1% mouth rinse reduces bacterial counts in the mouth and implicit the number of aerosolized microbes. The level of calculus is also a predictor of the quantity of aerosolized bacteria. Decayed teeth maintain a higher level of microbial flora that translates to a higher quantity of aerosolized microbes.

REFERENCES


**NEWS**

**ANTICANCER ACTIVITY OF SCLEROCARYA BIRREA**

*Sclerocarya birrea* is used in traditional medicine for the treatment of many diseases. A study performed by Tanih *et al.* aimed to scientifically prove its therapeutic properties. For this reason, water and acetone extracts of *S. birrea* were evaluated in terms of their anticancer activity on HT-29, HeLa and MCF-7 cell lines. The methods used included: cell titre blue viability assay in 96-well plates was used, acridine orange and propidium iodide staining for evaluation of apoptosis, and scanning electron microscopy for morphological examination of the treated cells. The study showed remarkable antiproliferative activities of the acetone extract of *S. birrea*. Also, the extract exerted apoptotic potential against MCF-7-treated cells. The study concludes that *S. birrea* could be very useful in anticancer therapy (Tanih NF, Ndip RN. The Acetone Extract of Sclerocarya birrea (Anacardiaceae) Possesses Antiproliferative and Apoptotic Potential against Human Breast Cancer Cell Lines (MCF-7). *ScientificWorldJournal* 2013; 2013: 956206 doi: 10.1155/2013/956206).

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