

THE RISK OF CONTAMINATION THROUGH ULTRASONIC SCALING

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Abstract

Ultrasonic dental treatment such as scaling produce aerosol and droplets, which presents a potential risk of contamination for the patient and medical team. Aim: The purpose of the study was to evaluate the surface contamination during ultrasonic scaling in relation to certain variables of this procedure. Material and Method: The group consisted of 10 subjects for which ultrasonic scanning was applied with different frequencies, for 10 min. The distilled water was colored with a red food coloring. The measurements were made in cm for each area around the oral cavity: the right side, the left side, upper and lower as well as at the level of the doctor's chest surface contamination. Statistical analysis was performed with SPSS 20.0. Results: The largest surfaces contamination were recorded in the case of simple scaling suction, especially on the left side(39.1 cm) and the lower one (49.8 cm) for frequency 5. In the case of surgical scaling suction, the values recorded were lower. In the case of simple scaling suction, the left and lower sides of the contamination surface exceeded the contamination zone 1. Conclusions: US scaling is a cause of surfaces and air contamination by generating droplets and aerosols. The type of suction influences the degree of contamination of the surfaces. To reduce the risk of contamination, wearing protective equipment is necessary for both medical staff and the patient.

Introduction

Dentists and dental staff perform their activities in the highly contaminated environment of the oral cavity. Dental treatments such as tooth preparation and ultrasound scaling and a simple maneuver, such as using an air-water syringe, produce aerosols and droplets, which present a potential risk to the clinician, dental staff and to the patient. The composition of the aerosols differs from patient to patient depending on the nature of the procedure that creates aerosols or drops and on the source of contamination (oral cavity and microbial biofilm in the water network of the dental unit). [1-3]

There has been noticed an increase in the prevalence of respiratory disorders among dental practitioners, the symptoms being correlated with the heavily contaminated areas of the dental office after performing certain maneuvers such as ultrasonic scaling. Aerosols remain in the air for a long time after the completion of the dental operation, increasing the risk of airway contamination. The droplets evaporate, leaving very small particles that can carry bacteria or viruses, transmitting various diseases such as SARS and tuberculosis [4].

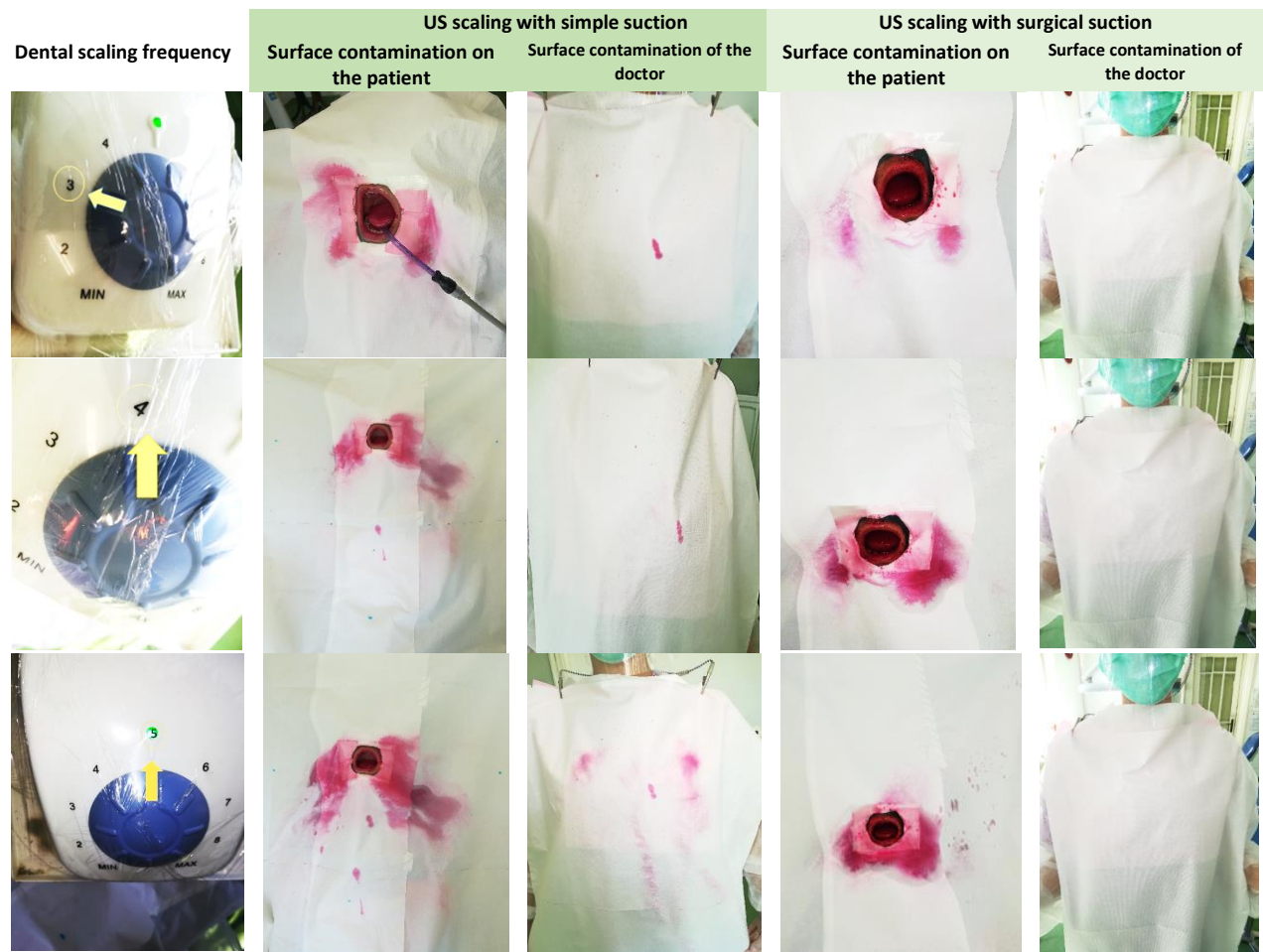
Increasing the prevalence of these conditions requires a more rigorous control of the infection in the dental practice, starting from the dental medicine schools.

Regular checks of the contaminated environment are recommended to improve the quality and safety of the medical act [5]. The purpose of the study was to evaluate the surface contamination during ultrasonic scaling in relation to certain variables of this operation.

Material and Methods

The study was conducted in the form of a clinical experiment in which 10 subjects participated, who, after signing the informed and mandated consent, participated in the clinical study in which the distance of contamination was evaluated according to certain variables after ultrasonic scaling.

The scaling was performed by a single operator using the Woodpecker UDS-K piezoelectric ultrasonic scaler in which the distilled water used was stored in a bottle (independent source), mixed with a red food dye. The data were collected in cm after modifying the frequency of descaling from 3 to 5, for 10 minutes for each frequency and for each area around the oral cavity: the right side(asldr/acldr), the left side(aslstg/aclstg), upper(ASLSUS/ACLSUS) and lower(ASLJOS/ACLJOS). Statistical analysis of collected data was performed using SPSS 20.0 software for Window and Microsoft Excel. Statistical significance was set at <0.005.



Results

The results of the statistical analysis indicate that an increase in the frequency of the scaling tip causes the increase of the contamination surface for all the clinical cases in which the suction was simple (fig. 11) and the surgical one (fig. 12), on the

right side. The differences are statistically significant between the initial values (frequency 3) and the final values (frequency 5) for both types of suction ($p=0.017$) (Figs. 11 and 12). In the case of simple suction, the contamination surface was 6.1 cm larger than the contaminated surface in the case of surgical suction (fig. 15).

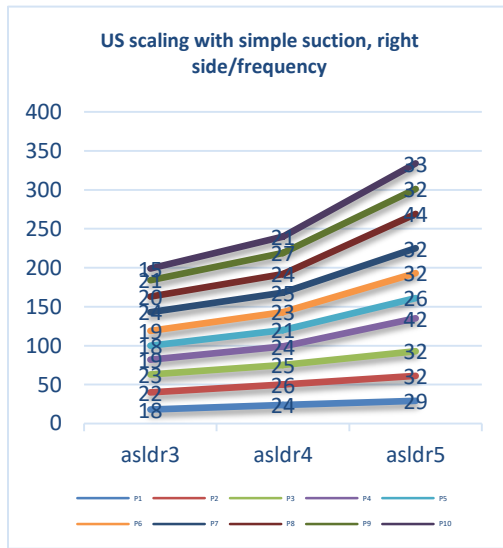


Figure 11. US dental scaling with simple suction on the right side / frequency

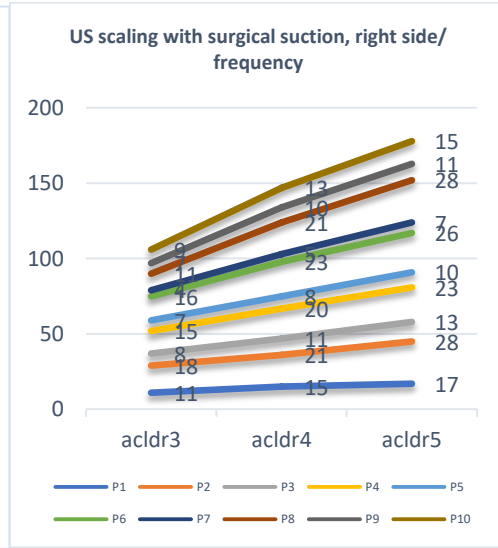


Figure 12. US dental scaling with surgical suction on the right side / frequency

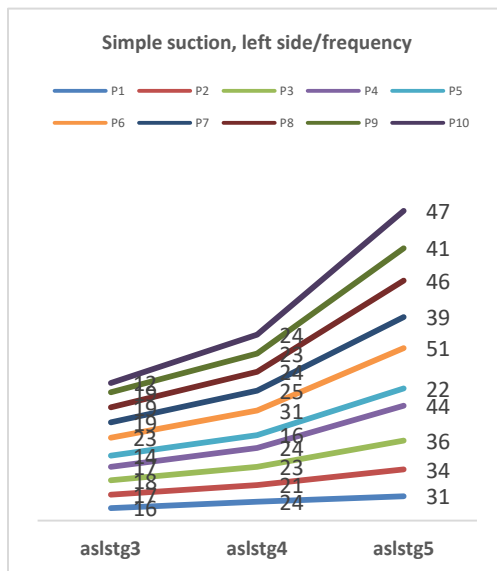


Figure 13. US dental scaling with simple suction on the left side / frequency

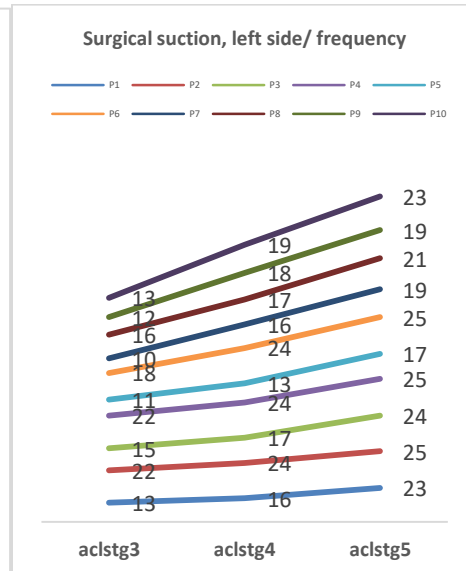


Figure 14. US dental scaling with surgical suction on the left side / frequency

The same evolution was observed on the left side in all the evaluated cases (figs. 13 and 14). In the cases with surgical suction the differences registered were not statistically significant between the initial and final values($p=0,436$) (fig. 14). There was a

significant difference regarding the contaminated surfaces between the 2 suction methods, in the case of the simple suction the contamination surface was 14.8 cm higher than the contaminated surface in the case of the surgical suction($p=0.038$).

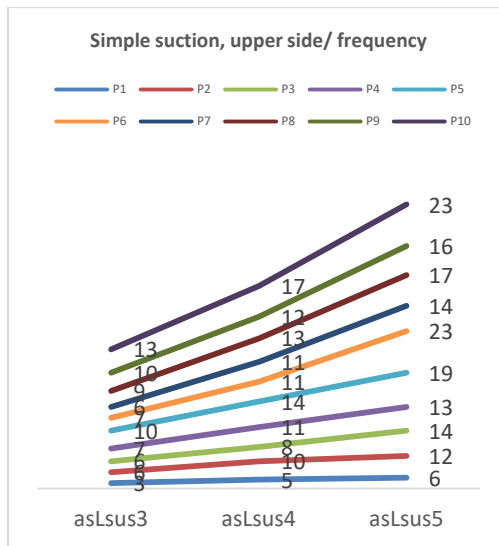


Figure 15. US dental scaling with simple suction on the upper side / frequency

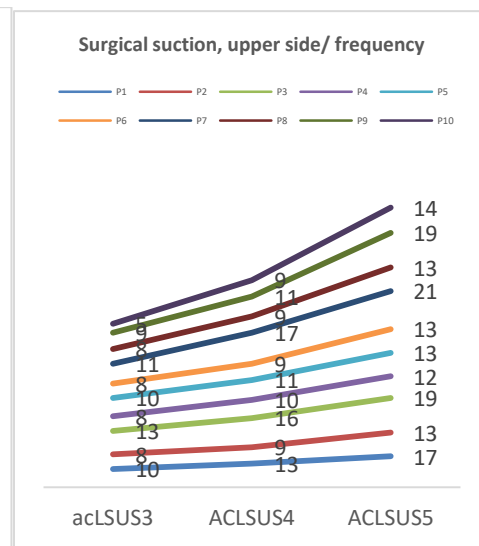


Figure 16. US dental scaling with surgical suction on the upper side / frequency

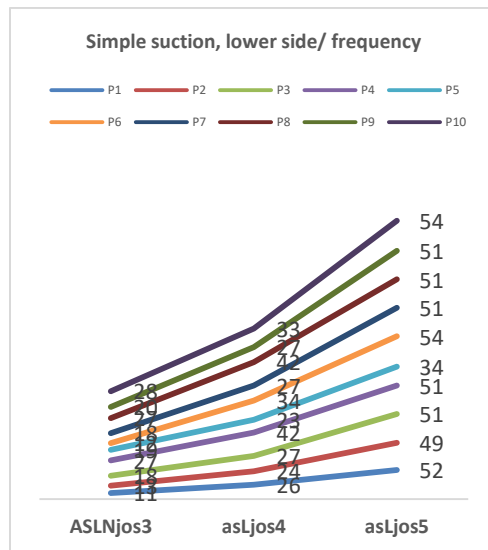


Figure 17. US dental scaling with simple suction on the lower side / frequency

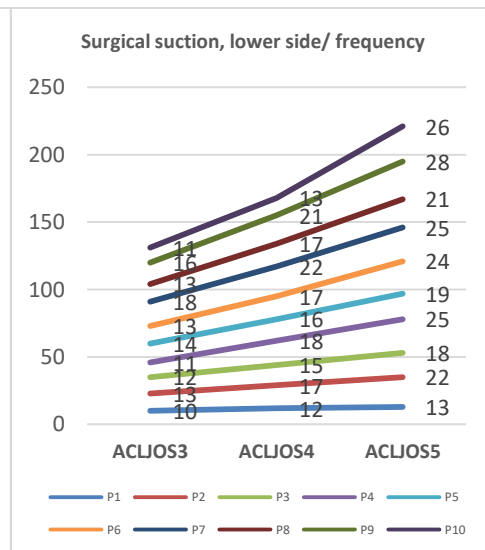


Figure 18. US dental scaling with surgical suction on the lower side / frequency

In the case of analyzing the degree of contamination in the upper area, both for the simple suction and the surgical one, an increase of the contamination surface is observed simultaneously with the increase of the scaling frequency. The differences are statistically significant between the initial values (frequency 3 - 7.7 cm) and the final values (frequency 5 - 15.7cm) for simple suction($p=0.028$) (fig. 15). In the case of surgical suction, the value increases are obvious but statistically insignificant (fig. 16). Between the two types of suction there was a small difference, statistically insignificant (difference = 1.6 cm) in favor of simple suction($p=0.439$).

The degree of contamination in the lower part was higher in the case of ultrasonic scaling with simple suction compared to the

surgical suction, the difference being statistically significant (the differences between the initial and final value simple suction = 24.9 cm and the surgical suction = 9 cm) (fig.17 and 18).

Figure 19 shows that the largest contamination surfaces were recorded in the case of simple suction scaling, especially in the left side (39.1 cm) and in the lower part (49.8 cm) for frequency 5. In the case of surgical suction scaling, the largest contamination surfaces were recorded on the left side (22.1 cm) and in the lower part (22.1 cm), also for frequency 5.

What is important to note is that only in the case of simple suction scaling the left and lower sides of the contamination surface exceeded the 1 m area of the contamination zone 1.

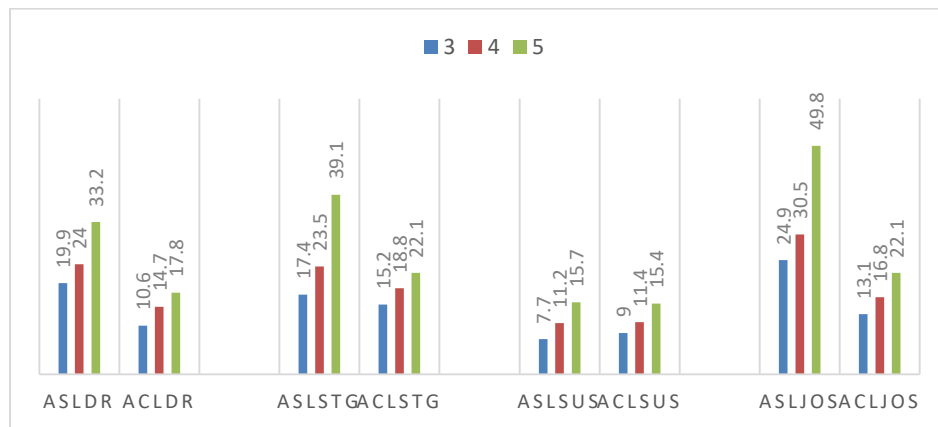


Figure 19. Comparison between the average values of both suction / frequency types

In the case of the doctor's contamination, a stronger contamination is observed in the case of simple suction scaling, the average value for frequency 3 being 12.5 cm and for frequency 5 the average value was 25.4 cm of the

contamination surface. In the case of surgical suction scaling the contamination was minimal, the average value being 0 cm for frequency 3 and 2.5 cm for frequency 5 (fig.20).

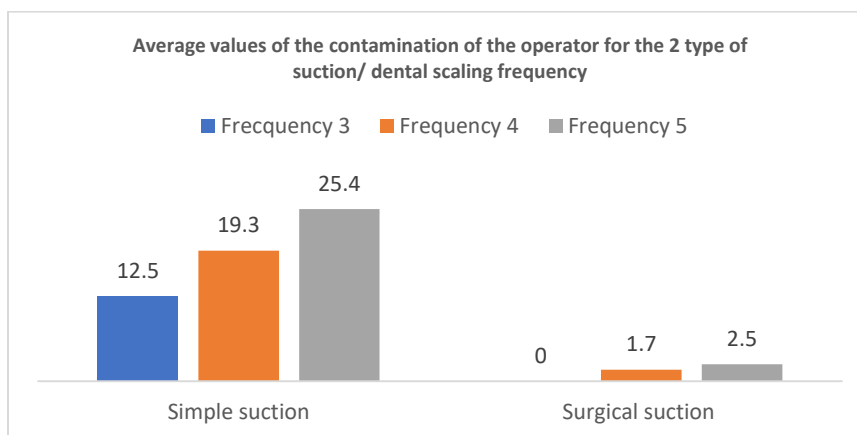


Figure 20. The average values of the contaminated surfaces in the case of the operator for the 2 types of suction / dental scaling frequency

Discussions:

Preventing the transmission of infection is a topical issue, especially in the case of aerosols or droplets, transmission methods in which the contaminating agent is carried over long distances, without being visible to the naked eye. This phenomenon becomes even more important as we become aware that these aerosols come from the oral cavity, the main source of pathogenic microorganisms in the dental cabinet.

Any medical procedure has the potential to aerosolize the saliva which can cause airborne transmission of microorganisms away from the main source. Contamination of protective equipment and clothing during clinical operations is inevitable for both medical staff and the patient.

Ultrasonic scaling produces a large amount of aerosols and droplets, which can be disseminated at a considerable distance from the source. In the *in vitro* study conducted in the past years it was determined that even in the absence of the cooling liquid used for ultrasonic scaling, aerosols and drops will also occur and will contaminate the

surrounding surface if there are liquids in the area where the scaling is performed [2]. The type of suction used can influence the degree of contamination of the surfaces, our study showing that the surgical suction can greatly reduce the contamination produced after ultrasonic scaling.

So far studies conducted to determine the degree of contamination of the dentist have shown that the areas around the nose and the internal angle of the eyes have been significantly more contaminated compared to other areas evaluated [7] results that suggest the need for the use of protective equipment by the medical personnel until leaving the cabinet because the aerosols can persist in the air for a long time post-procedurally, disappearing at 10-30 min after scaling [8]. Incorrect use due to the movement of the component elements during motion or due to other factors such as the presence of beards, the size of the hair, etc. favors the transient contamination of the airways and the increase of the frequency of respiratory diseases among the medical personnel [9].

Ultrasonic scaling generates aerosols with bacteria that reach a maximum of 300 CFU of dental operative volume. [3] Barnes *et. al* demonstrated that aerosols produced by in vivo use of an ultrasound scaler on teeth involved in periodontal disease that were contaminated with blood and that contamination occurred regardless of the level of inflammation. [10] In one study, sterile swabs were used to collect samples from the chest area and the pockets area of the dentist students' gowns, and it was showed that there was microbial contamination of this protective equipment. [11]

The aerosols and the droplets produced by the ultrasonic scaler come in the form of a fine cloud. [10] This fine cloud can cause levels of bacterial contamination that exceeds the values produced by ordinary maneuvers even by four times. [12,13]

There is also the possibility of the risk of aerosols entering the ventilation system and

the infection spreading on large surfaces so we have to use of HEPA filters or UV lamps to decontaminate the air in the ventilation system. Air decontamination with UV lamps is efficient because they have a strong fungicidal, virulicidal and bactericidal effect by distorting proteins and the AND chain [14]. However, these technologies are expensive. Therefore, the use of the surgical aspirator for suction during ultrasonic scaling is recommended as this increases the aerosol reduction rate by 93-96% [15].

Conclusions: US scaling is a method of contamination of surfaces and air by generating droplets and aerosols. The type of suction influences the degree of contamination of the surfaces. Wearing protective equipment is necessary for both medical staff and the patient to reduce the risk of contamination.

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