

Fine Aerosols and Perceived Risk of COVID-19 among Italian Dental Practitioners: An Experimental Survey

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ABSTRACT

Aim: The aim of the present study was to take a survey on Italian practitioners concerning the perceived risks of aerosol contamination in COVID-19 times and their attitude toward modifications of treatment protocols to reduce this risk.

Materials and methods: Power analysis calculated a minimum sample size of 150 participants at 99% confidence level with a 5% margin of error. To homogenize responses elicited by different preventive measures by various national governments, only Italian dentists were included in the survey: overall 500 responses were collected.

Results: Of the 500 analyzed respondents, there were 266 females and 234 males; 379 practitioners were allocated in the more experienced groups, and the remaining 121 in the less experienced group based on less or more than 5 years of practice. The 70% of the dentists consider the dental practice more dangerous for the diffusion of COVID-19 than other social activities. The 5% consider dental practice more dangerous only for the patients. Aerosol contamination was perceived as a risk from the most dentist (70%), but there was agreement on the most dangerous way of cross infection in dental settings. Most of the dentists (55%) believed implementations in their protocols were needed to reduce the risk of COVID-19 infections. No significant differences were found within the groups: both women and men, as well as practitioners with different experience levels (younger or older than 35 years) perceived very similarly the problems related to COVID-19 in dentistry ($p > 0.05$).

Conclusion: The survey demonstrated that COVID-19 had a great impact on dental practitioners; it increased not only fear of aerosol contamination during dental treatments but also influenced the fear of close contacts.

Significance: Airborne and waterborne infections are related with dental treatments and considered the preferred ways of diffusion for COVID-19. The risk of aerosol-related infections could interfere with the clinical practice of the dentist, during the COVID-19 pandemic; the limitations that provided changes to everyday behavior could affect the perception of the safety of the operators, staff, and patient and this could also affect economically the dental office.

Keywords: Airborne infections, Coronavirus, COVID-19, Dental practice.

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INTRODUCTION

Fine aerosols (FAs) are commonly produced by dental ultrasonic devices and high-speed handpieces, mainly when used with water.¹⁻³ These FAs are a mixture of moisture droplets, spatters of often blood-contaminated saliva and debris, that can remain suspended in air and then land on adjacent surfaces in the dental office, including also personal protection equipment (PPE). Their dimensions are very small (generally 5 microns or less in diameter), and due to their nature, FAs are difficult to be seen on surfaces. It has been demonstrated that without using proper protection, FAs can directly affect dentists and dental assistants nearby by reaching the eyes, the facial skin, and mucous membranes of the mouth, as well as respiratory passages up to the depths of the lungs.¹ Experimental studies have shown that highly dangerous bacteria, like *Mycobacterium tuberculosis*, can be found in FA particles generated during simulated use of high-speed handpieces on patients with active tuberculosis.⁴ Moreover, bacteria in FAs can contaminate surfaces and PPEs in the dental offices, requiring special attention during decontamination of surfaces and removal of PPEs.¹ Over the last decades, these observations resulted in the adoption of universal barrier precautions and effective infection control in all dental offices as routine procedures during the treatment of all patients, to prevent contamination from both airborne and blood infections.

The recent dramatic outbreak of COVID-19 infection⁵⁻¹⁰ has generated a renewed attention from governments worldwide

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toward dental procedures. Potential transmission of disease in dental settings⁹ has become a source of increased concern both to the dental profession and to the public. Therefore, governments – including the Italian one – promoted rules or recommendations to suspend routine dental treatments during the pandemic period and dentists had to reorganize urgent treatments by implementing appropriate measures to avoid the risk of getting infected by the

virus (i.e., triage by telephone, avoiding gatherings in waiting rooms). In addition, measures to reduce or avoid production of droplets and aerosols were highly recommended, and in some cases, alternative protocols were suggested, like the prescription of analgesic drugs instead of performing endodontic cavity access in mild pulpitis. In such unprecedented times, with different instructions from the various scientific organizations and governments worldwide, and a profound economic downturn due to the full or partial closure of dental offices, a general anxiety is growing among dentists.¹¹⁻¹³

Besides the negative economic impact on their incomes, when so little is known about COVID-19 contamination, survival in the air or on surfaces, contagion from asymptomatic patients, with often limited or contradictory scientific information provided, practitioners are worried about the patients' safety as well as their own one. To date, only a few articles are available in scientific databases concerning the implications of COVID-19 on dental care.¹³⁻¹⁸

Based on these premises, the aim of the present study was to make a survey on Italian practitioners concerning the perceived risks of aerosol contamination in COVID-19 times and their attitude toward modifications of treatment protocols to reduce this risk.

MATERIALS AND METHODS

A pilot study was conducted on 30 dentists/dental students at University of Rome, School of Dentistry. The findings of such study revealed that 100% of the participants were aware of COVID-19. Based on this, sample size was calculated at 99% confidence level with a 5% margin of error. Power analysis calculated a minimum sample size of 150 participants. The survey was conducted in 5 days, in April 2020, with data collected through the Google Form software, from Italian practitioners, randomly contacted through different dental groups in Italian social media. We registered 729 responses from Italian dentists or dentists trained in Italy, but all of them currently practising in Italy. Therefore, we included only a total of 500 dental practitioners; those not currently working in Italy were excluded so as to have a more homogeneous group and avoid differences related to possible variations of lockdown measures in various countries.

The questionnaire maintained the privacy and confidentiality of all information collected in the study and ethicality of the study was preserved, as the data were treated at an aggregate level, and responses were given voluntarily. Such survey environment, where anonymity is guaranteed, is likely to induce respondents to answer more honestly.

As regards the structuring, the questions were in English and in the form of a multiple choice. The questionnaire consisted of eight inquiries and had two parts. The first part gathered personal information concerning gender (male or female), country where practising (Italy or other), and years of experience (more or less than 5 years). The second part gathered responses concerning dental practice and COVID-19, it was elaborated following the pertinent literature as well as international guidelines. In the second part, for each question, (all of them closed) a multiple choice between three answers was asked, to make the survey more simple and rapid. The following questions were asked and only one answer could be provided (Yes, No, or Not sure).

- Do you think (Y, N, or Not sure) dental treatments may produce for patients more risk of COVID-19 than other social behaviors (i.e., going to food markets, restaurants, and beauty salons, etc.)?

- Do you think COVID-19 increased potential risks mainly for dentist and staff (Y) or mainly for patients (N) or equally for both (Not sure)?
- Do you think aerosol contamination has become a more relevant risk in COVID's time (Y, N, or Not sure)?
- In your opinion, which of the following COVID-19 risks is the highest in a dental office? Aerosol direct contamination, aerosol nondirect contamination of surface and instruments, close distance between patients, practitioners, and staff in a small, close room?
- Are you in favor to slightly modify the way you suggest choice between procedures and/or the procedure protocols to reduce the COVID-19 risk (Y, N, or Not sure)?

As the main data were categorical, a cross tabulation, also known as contingency tables, was used to understand the correlation between different variables. Statistical analysis was performed using STATA software to detect patterns and trends within the data.

RESULTS

Among the 500 analyzed respondents, there were 266 females and 234 males; 379 practitioners were allocated in the more experienced groups, and the remaining 121 in the less experienced group.

Overall, the 70% of the dentists consider the dental settings more dangerous for the diffusion of COVID-19 than other social behaviors (i.e., going to food markets, restaurants, and beauty salons, etc.) (Table 1). Considering the categories more at risk in the dental settings, the majority of respondents thought that the dentists were undergoing highest risks, while only the 5% of respondents considered patients be the ones more at risk; a relevant number of respondents believed risks to be equally divided between patients and dental professionals (Table 2). Fine aerosol producing treatments are perceived as an increased risk by the majority (70%) of dentists (Table 3), but there is not a real consensus on which one, between direct aerosol (32%), nondirect aerosol (35%), and close contacts (33%), is the most dangerous way of transmission of infection (Table 4). Finally, most of the dentists (55%) favored implementation of protocols to avoid/reduce in-office COVID-19 infections (Table 5).

The contingency Tables 1 to 5 resume the answers given by the two proposed groups differentiated by the following: (a) years of experience (more experienced dentists with more than 5 years of practice) and (b) gender; pie charts are shown in Figure 1.

When relating the overall results to the two subgroups, the main finding is that, in nearly all answers, there were no significant differences within the groups, meaning that women and men, as well as practitioners with different experience levels perceived very similarly the problems related to COVID-19 in dentistry ($p > 0.05$).

DISCUSSION

The present survey was designed to be simple to understand and rapid to be filled, by reducing number of questions and multiple choices. The aim was to increase compliance and reduce the incidence of dishonest or bored answers and the errors induced by misinterpretation of questions. Indeed, such surveys always show some limitations, mainly related to the difficulties in convey feelings and emotions into multiple-choice answers. In the present case however, due to use of simple, direct questions, all were answered and the results were never contradictory.

Table 1: Question no. 1: “Do you think dental treatments may produce for patients more risk of COVID-19 than other social behaviors?”

<i>Answer</i>	<i>Less expert</i>	<i>More expert</i>	<i>Male</i>	<i>Female</i>	<i>Total (%)</i>
No	18	87	49	56	105 (21%)
Not sure	14	31	22	23	45 (9%)
Yes	89	261	163	187	350 (70%)
Total	121	379	234	266	500 (100%)

Table 2: Question no. 2: “Do you think COVID-19 increased potential risks mainly for dentist and staff or mainly for patients or equally for both?”

<i>Answer</i>	<i>Less expert</i>	<i>More expert</i>	<i>Male</i>	<i>Female</i>	<i>Total (%)</i>
Patient	8	14	10	12	22 (5%)
Both	51	170	89	132	221 (44%)
Staff	62	195	135	122	257 (51%)
Total	121	379	234	266	500 (100%)

Table 3: Question no. 3: “Do you think aerosol contamination has become a more relevant risk in COVID times?”

<i>Answer</i>	<i>Less expert</i>	<i>More expert</i>	<i>Male</i>	<i>Female</i>	<i>Total (%)</i>
No	12	37	23	26	49 (9%)
Not sure	17	49	30	36	66 (21%)
Yes	92	293	181	204	385 (70%)
Total	121	379	234	266	500 (100%)

Table 4: Question no. 4: “In your opinion, which of the following COVID-19 risks is higher in a dental office?”

<i>Answer</i>	<i>Less expert</i>	<i>More expert</i>	<i>Male</i>	<i>Female</i>	<i>Total (%)</i>
Aerosol	38	131	73	85	159 (32%)
Nondirect aerosol	41	140	77	95	181 (35%)
Close contact	42	138	84	86	170 (33%)
Total	121	379	234	266	500 (100%)

Table 5: Question no. 5: “Are you in favor to slightly modify the way you suggest choice between procedures and/or the procedure protocols to reduce the COVID-19 risk?”

<i>Answer</i>	<i>Less expert</i>	<i>More expert</i>	<i>Male</i>	<i>Female</i>	<i>Total (%)</i>
No	14	83	46	51	97 (19%)
Not sure	41	88	58	71	129 (26%)
Yes	66	208	130	144	274 (55%)
Total	121	379	234	266	500 (100%)

Table 1 shows the responses of the practitioners when asked if dental treatments may produce more risk of COVID-19 for patients than other social behaviors might. Overall, the bulk of the respondents (70%) gave a positive response. This answer is probably consistent with the fact that, even if in Italy dental offices were not officially forced to shut down, the routine care was drastically reduced by dentists, as it was ethically and morally impelling to avoid the spread of the coronavirus. On the contrary, nearly one-third of practitioners did not perceive the risk in the dental office higher than in other public places and activities, probably due to the preventive measures every dental office routinely carries out. Interestingly, this was a common perception both in males and females, while some small differences were found between the more and less experienced subgroups; the latter providing a slightly smaller percentage of positive answers. The findings that asymptomatic patients could also spread infection and the relatively small number of diagnostic tests performed on both population and dental practitioners could also have increased this perception.

Table 2 shows the response of the practitioners when asked whether COVID-19 increased potential risks mainly for dentist and staff, mainly for patients, or equally for both. Respondents were asked to make a choice between the possible answers. The risk of contagion was deemed to be high for both patients and dentists, but dentists were believed to be most exposed. Very few respondents thought patients were the category most at risk. These findings could have been caused by reports and media news concerning the high percentage of deaths or contagions in medical doctors and nurses treating COVID-19 patients, which generated some anxiety also among dentists. Interestingly, there were differences in the gender subgroups, with male practitioners being more concerned about dentists’ health rather than about the patients’ one.

Tables 3 and 4 show the response of the practitioners concerning the perceived risk of aerosol contamination during dental procedures and differentiated in direct and nondirect. Moreover, the perceived risk of close contacts within a dental office

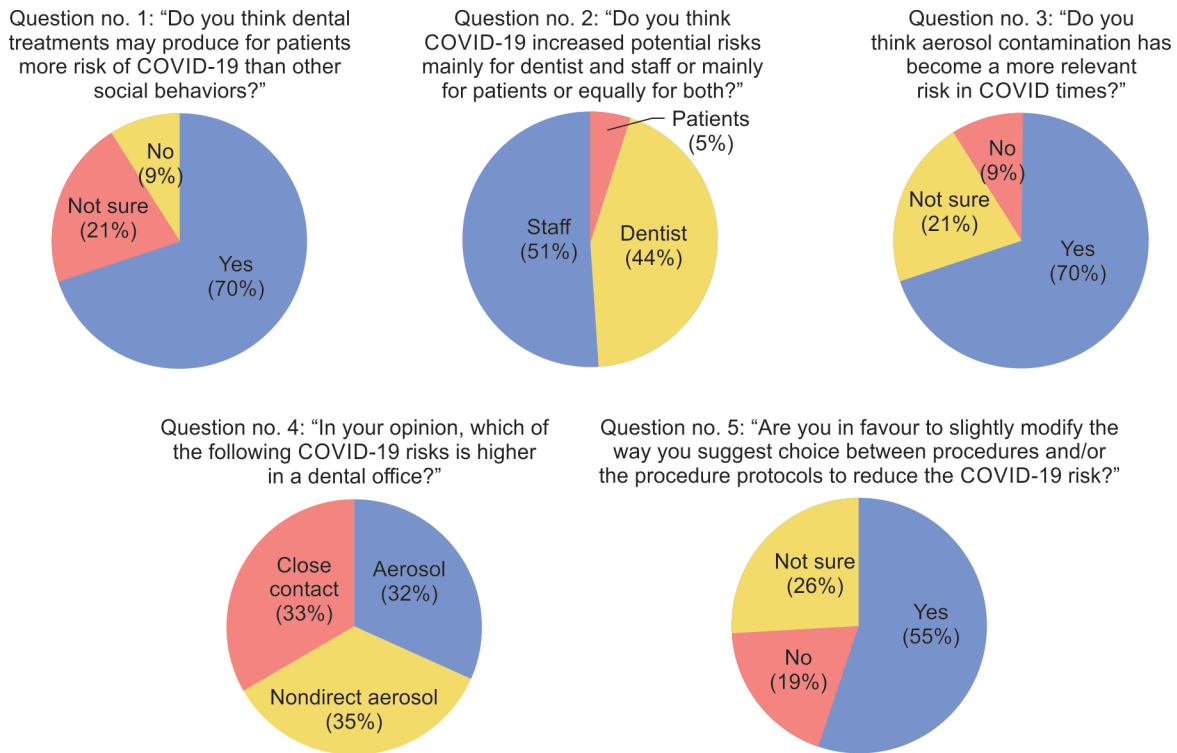


Fig. 1: Pie charts representing the overall results of the survey

was also investigated. Interestingly, practitioners' answers were almost identical to those given to the first question, showing that when perceiving the influence of COVID-19 in dental practice, there is not a big difference between the overall risk, the risk related to one of the main cause (aerosol), and the risk compared with other social environments. This explains how strongly COVID-19 risk is perceived in dentistry. Despite the limitations of the present study, the results point toward a clear direction: dentists are worried and perceive a high risk of COVID-19 contagion. When the risk is more precisely analyzed, there is no significant difference between the three factors: direct aerosol, nondirect aerosol, and close contacts got a similar percentage of answers. This is probably related, as previously described, to the fact that the risk is considered as a combination of different ways of contagion. Indeed, little is known about COVID-19 contamination, especially in asymptomatic patients, as well as possible reinfections. Moreover, COVID-19 survival in air or surfaces is not well established. Given the fact that most of practitioners utilize proper PPEs, the direct contamination of aerosol was considered to be a potential COVID-19 risk similar to the other options. It is quite surprising how the risk perception is almost identical in the two groups, independently from gender and experience. The huge impact COVID-19 had generated globally in all people, and the lockdown measures introduced all over the world, increased concerns both about health and economy; such a relevant impact was also found in the present survey with all the different categories (young and old, male or female dentists) perceiving quite identical risk and increased concern. In pandemic times, people tend to show similar behavior to face a common danger.

There is consistency also in the answers given to the last question (Table 5), concerning the possibility to make slight changes to the procedures or to the organization/planning of treatments, aiming at reducing the COVID risk. This possibility

is favored by the majority of practitioners (55%), especially by the most experienced ones. It is logical to predict that to reduce close contacts and gatherings in the waiting rooms, besides social distancing measures, dentists could decide to increase the amount of time for each visit and, if possible, make more treatments during each visit. Other procedures, i.e., professional hygiene could be performed more with manual scalers than with ultrasonic tips. In any case, there is a general perception that COVID-19 will reshape the working environment for health practitioners, and especially dentists.

CONCLUSION

Hence, we may conclude that the survey demonstrated that COVID-19 had a great impact on dental practitioners; it increased not only fear of aerosol contamination during dental treatments but also influenced the fear of close contacts. This perception may strongly alter the organization of dental practices in the next months, aiming not only at improving PPE and decontamination of work environments but also social distancing measures. Moreover, some minor changes in the treatment organization and execution should be adopted.

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