COVID-19 PANDEMIC AND ITS INFLUENCE ON THE SCOPE AND STRATEGIES OF RESEARCH IN ORAL MEDICINE AND RADIOLOGY

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ABSTRACT

Research and oral medicine are inseparable entities with profound impact on the practice of dentistry.The COVID-19 pandemic had posed a variety of challenges to research in this field. As researchers strived to overcome these challenges, it turned out that it was still possible to conduct research effectively throughout the pandemic period with a few modifications to research methodology and procedures. This paper focuses on the COVID-19 pandemic and its influence on the scope and strategies of research in oral medicine and radiology.

Keywords: Research, COVID-19, pandemic, oral medicine

INTRODUCTION

Oral medicine has always been an evolving field due to the enormous opportunity forclinical research.The arena of research in oral medicine is vast and diverse in character. It covers various aspects of oral diseases including epidemiology, prevention, diagnosis, diagnostic tools development, treatment strategies, clinical trials, orofacial pain,temporomandibular joint disorders, quality of life issues, and basic research about pathophysiologyand forensic odontology. Oral radiology, being a dynamic fieldhas been an area of innovative and cutting-

edge research. The advent of three-dimensional radiography has paved the path towards a whole new arena for research and development. Research and oral medicine are inseparable entities with profound impact on the practice of dentistry.

The COVID-19 pandemic was declared a public health emergency of international concern since January 30, 2020 by the World Health Organization (WHO).[1]The pandemic not only exerted its effect on general dental practice but also on research activities by oral medicine researchers.

CHALLENGES POSED BY THE COVID-19 PANDEMIC

- The novelty of the disease and the unclear pathogenesis[2,3]
- Disease-associated fear and anxiety among the researchers as well as the patients
- Mode of transmission being through aerosols and droplets which are commonly encountered in dental practice
- Limited interaction with patients
- Increased risk of transmission of the disease from body fluids like saliva
- Lack of normal social interaction is a hindrance to any preparative interviews with patients for data collection
- The dedication of all lab resources towards COVID-19 diagnosis and treatment

SCOPE OF RESEARCH

The different types of research studies that can be undertaken in the decreasing order of evidence are as follows:[4]

1. Metanalysis andSystematic reviews
2. Randomized control trials
3. Cohort studies
4. Case control studies
5. Cross sectional studies
6. Case reports and case series
7. Ideas, opinions and editorials
8. Animal research

Metanalysis and systematic reviews are known to give the highest level of evidence and can be undertaken during the pandemic period.[5]The availability of the publications of previously done

randomized controlled trials and studies on online databases like PubMed, Embase and Medline allow researchers to conduct elaborate systematic reviews and meta-analyses. It is time consuming but the results obtained are of high value in the research field.

Randomized controlled trials are considered the highest level of evidence to establish causal associations in clinical research.[6]Randomized controlled trials are the form of research that was most affected during this period due to dwindling patient flow in teaching hospitals. The attrition rate of patients was high and healthy patients who were in the control group were reluctant to report due to the fear of COVID-19 exposure in a hospital setting. In case of diseases that had a frequent follow-up period the schedule was difficult to adhere to, owing to the travel restrictions in the pandemic period.

Cross-sectional studies provide a snapshot of a population by determining both exposures and outcomes at one-time point. Cohort studies identify the study groups based on the exposure andthe researchers follow up with study participants to measure outcomes. Case-control studies identify the study groups based on the outcome, and the researchers retrospectively collect the respective exposure of interest.[7]Cohort and case control studies too had restrictions like the randomized controlled trials. For studies involving immunocompromised patients, it may not be ethically correct to advise them to report for review frequently to the hospital as they fall in the high-risk category for COVID-19.

Case reports and case series were not affected as much as the other study designs.Case reports on oral manifestations of COVID-19 were recorded and published. It helped in identifying the early oral signs of the disease by general dental practitioners as well as specialists.[8-10]

Retrospective studies gained a lot of significance during this period. Oral medicine being the first point of entry for patients in a teaching hospital, the vast variety of patients encountered by oral medicine specialists is beneficial for conducting prevalence studies. The decreased patient flow during this period gave more time to the clinician which can be dedicated to research. Telemedicine for educating, interviewing andexamining the patients is one of these approaches.[11] Thereare a plethora of applications and platforms that can beused for this purpose including WebEx, Skype, Zoom, Google Meet and messenger.

The availability of previous dental radiological records in the archives opens a wide range of research opportunities. Morphometric studies, volumetric studies and three-dimensional printing are good avenues of research using radiographs. The development of radiological diagnostic criteria for cystic lesions and tumors can be undertaken. The image analysis studies

like fractal dimension analysis and texture analysis can be helpful in assessment of bony architecture in health and disease. The access to free downloadable versions of image analysis softwares like ImageJ, GIMP etc. can be instrumental to image analysis studies on digital radiographs. Artificial intelligence studies using radiographic templates are another important avenue that is being explored. Application of artificial intelligence in oral medicine and radiology can help in automated diagnostic systems for diseases.[12]

In vitro studies on extracted teeth are also another interesting area of research. Elemental analysis, autofluorescence studies and biochemical analysis of teeth are innovative research methods. In vitro studies involving body fluids like saliva took a backseat due to the highly infectious nature of saliva in the COVID-19 background.[13-15]

Qualitative studies based on questionnaires and surveys have been facilitated by digital platforms which aid in the generation of online forms that can be circulated amongst the target population. It has a greater outreach than the conventional method of door-to-door surveys.

Ideas, opinions and editorials especially regarding the pandemic and dental practice gaining importance during this period. The effect of the pandemic on the mental health of medical professionals, impact on the practice of dentistry and oral manifestations of COVID-19 were discussed in much detail.[16] The changing trends in the management of COVID-19 and its manifestations were regularly updated. The role of a dentist to identify the inaugural symptoms of COVID-19 was highlighted.

Animal research especially as an initial step towards the development of vaccine against COVID-19 gained prominence.

Research in forensic odontology was on the rise and innovative methods of age estimation, sex differentiation, forensic facial reconstruction and bite mark analysis were formulated and validated. Theimage-based analysis and reconstruction methods gained a lot of significance.

CHANGING TRENDS OF RESEARCH

Availability and access to student-centered research resources on online platforms in the form of webinars, lecture series, and online workshops have been a boon during the pandemic.[17]These resources are extremely helpful for students who would like to enhance or refresh their skills in a particular area of research. The pandemic period provided an

opportunity to access the extensive digital resources in the form of online and cloud libraries. The increased promotion of tele-consultation for services like data analysis, statistics, research template development, career planning in research and funding opportunities have proven to be very beneficial. The students have also benefitted from online courses on statistical analyses which makes them better equipped with handling and appropriately analyzing the data obtained from the research studies.

The oral manifestations of COVID-19 are also an interesting area of research for oral medicine specialists. Recent research studies reveal certain oral manifestations like oral ulcers that need to be further evaluated and validated. Like many other viral infections with inaugural oral signs, COVID-19 can also be potentially noticed and diagnosed by an oral medicine specialist.[18] This substantiates the indispensable link that oral medicine has with general medicine.

RESEARCH PRESENTATIONS DURING THIS PERIOD

The presentation of research studies as posters or papers showed a shift from direct presentation at conferences to that on virtual meeting platforms. The restrictions on the events that lead to aggregation of people was responsible for this shift towards virtual presentations.Virtual presentations afford researchers the opportunity to present their research to far-reaching and international online audience, without time restrictions, distractions or the need to travel. It is also a green initiative as it greatly reduces the paper and other types of waste that would be generally generated as part of conferences and academic events. The downside is that it deprives the researchers of the opportunity of networking with peers and researchers with various research ideas.[19]

INFECTION CONTROL PRACTICES DURING RESEARCH

We must be constantly aware of infectious threats that may challenge the current infection control regimen, especially in dental practices and dental schools.Firstly, during the pandemic outbreak period, online lectures, case studies, and problem-based learning tutorials should be adopted to avoid unnecessary crowding of people and associated risk of infection. Existing smart devices and applications have already made it possible for students to listen to and review lectures whenever and wherever possible. Students should be encouraged to engage in self-learning, make full use of online resources, and learn about the latest academic

developments. Third, during this period, it is easy for students to be affected by disease-associated fear and pressure, and dental schools should be prepared to provide psychological counselling to those who need them

The oral cavity and saliva are potential modes of transmission of the COVID-19 pathogen.[20]Due to common and confirmed SARS- CoV- 2 reservoir in saliva and oropharyngeal area, as well as a potential risk of occurrence of microdroplets, also oral medicine clinicians can be potentially exposed to increased risk of COVID- 19.Ear, Nose, Throat (ENT) UK society, advises the use of enhanced PPE for any maxillofacial and/or ENT activities, including baseline examination within nasal, oropharyngeal and oral cavity areas.

Before enrolling patients as subjects for any research study or clinical trial, RT-PCR test should be done to exclude COVID-19 infection. In emergency cases, a chest CT should be prescribed if available to exclude suspected infection because the RT-PCR test, besides time-consuming, needs a laboratory with pan-coronavirus or specific SARS-CoV-2 detection capacity.The diagnosis of COVID-19 can be confirmed by positive real-time RT-PCR assay for COVID-19 using respiratory or blood samples or by viral gene sequencing of respiratory or blood samples that are highly homologous with COVID-19.

Preoperative antimicrobial mouth rinse like povidone iodine or chlorhexidine could reduce the number of microbes in the oral cavity.[21]Procedures that are likely to induce coughing should be avoided (if possible) or performed cautiously. Aerosol-generating procedures, such as the use of a 3-way syringe, should be minimized as much as possible.The use of saliva ejectors with low or high volume can reduce the production of droplets and aerosols.Research involving intraoral x-ray examination can stimulate saliva secretion and coughing. Therefore, extraoral dental radiography such as panoramic radiography and cone beam CT, are appropriate alternatives during the outbreak of COVID-19.

Prolonged saliva collection, along with intraoral drainage, some extraoral tests (Schirmer's test), intensive wound irrigation and ultrasonic nebulization could potentially produce microdroplets or splatter, so can microbiological and immunoassays swabs.Salivary reservoir, in particular, should be considered as one of the main factors since a recent study reported cases of COVID- 19 with positive salivary swabs, while negative nasopharyngeal swabs (qPCR molecular test).

The installation of advanced air ventilation systems in the premises can facilitate removal of airborne pathogens from clinical environment.[22]

ADVANTAGES AND LIMITATIONS FOR RESEARCH DURING THIS PERIOD

ADVANTAGES	LIMATATIONS
• Increased time to dedicate towards research activities.	• Reduced interaction with patients.
• Availability of online resources on all new advances in oral medicine.	• Dedication of most research facilities and resources towards COVID-19 research.
• Virtual hosting of conferences and academic events	• Less networking and interactions with peers and fellow researchers.
• Virtual access to research skill development programs.	• High level of contagiousness of oral cavity and saliva.
• Telemedicine has a good outreach in conducting interviews for enrollment into clinical studies.	• Lesser availability of research grants and funding towards non-COVID-19 research.

CONCLUSION

In conclusion, COVID-19 pandemic has been a time of a sea change in the field of oral medicine and radiology.The skill of the researcher and the ability to adapt to new circumstances is a major determinant in the smooth implementation of any research study. It was seen that with a few changes in research methodology and techniques, it was possible to conduct research in an efficient manner even during the pandemic period.

Stephen Hawking rightly said that "*Intelligence is the ability to adapt to change*".

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