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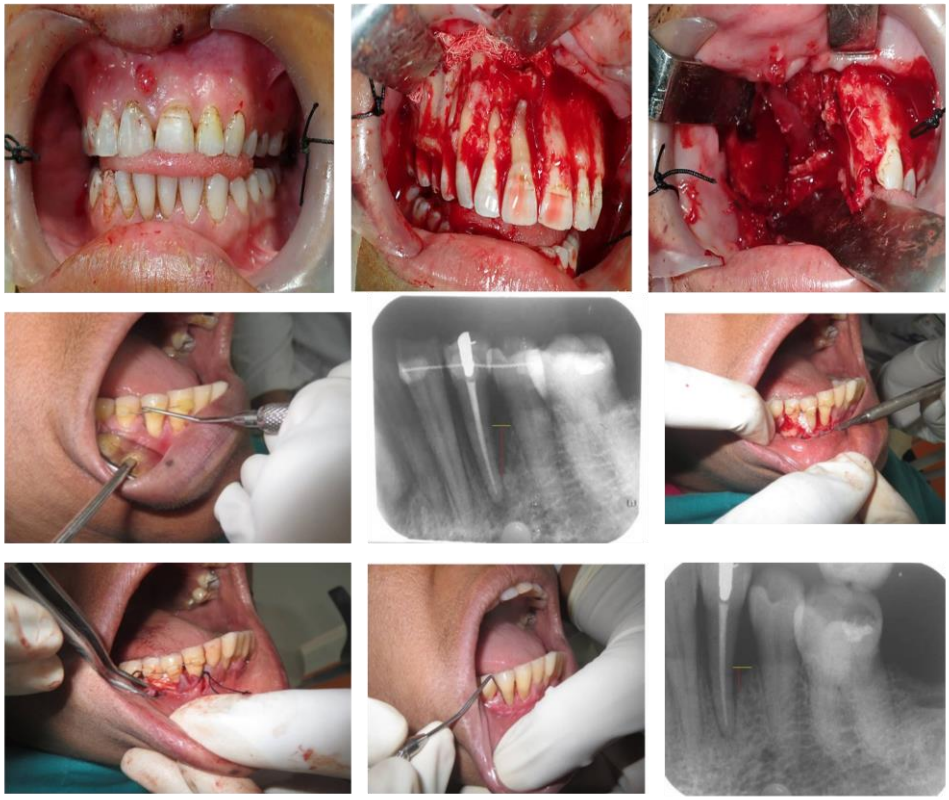
Journal of Dental Research



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From the Desk of Editor-in-Chief

With immense pleasure I would like to announce that we are publishing the Volume 3 issue 1 of MIDSR Journal of Dental Research after the successful publication of complete two volumes. ***"Everything is possible when you have right people to support"*** I would like to extend my heartfelt thanks to the authors and our management for their constant faith in me and their utter support in this hard time of corona pandemic.

The Volume 3 Issue 1 has been created with the great efforts of providing the quality manuscripts rather than the quantity, the volume contains applicability of 2017 classification of periodontal and peri-implant diseases and conditions, perceptions about online teaching in India and knowledge and attitude about personnel protective equipments. Apart from this a case report on placental barrier membrane for regenerative therapy in intrabony defects is elaborated. The special emphasis was given on mucormycosis, lip prints and veneers all these things are elaborated in well in the manuscript.

I dedicate this issue to all the faculty members of MIDSR Dental College, Latur who immediately responded to the call for manuscripts and submitted their valuable work to the Journal.

Dr. Suresh S. Kamble
Principal,
MIDSR Dental College, Latur

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Applicability of 2017 classification of periodontal and peri-implant diseases and conditions among postgraduate students of department of Periodontics- A Questionnaire Survey

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Abstract:
The World Workshop on the Classification of Periodontal and Peri-implant Diseases and Conditions was co-sponsored by the American Academy of Periodontology (AAP) and the European Federation of Periodontology (EFP) and included expert participants from all over the world. Planning for the conference, which was held in Chicago on November 9 to 11, 2017, began in early 2015.

As 26 months have passed since publication, we wanted to know whether it has been implemented or not. So, this is a small attempt to assess implementation of 2017 classification of periodontal and peri-implant diseases and condition in daily OPD cases of department of periodontics among post-graduate students.

Materials and methods

The method used to collect the responses from each participant was based on questionnaire type. An online google form was created on 27/10/2020 displaying 15 questions. The participation of the subjects was voluntarily answering the questions and was considered their consent for the same. All their responses were kept confidential and used for academic purpose only. The study protocol was approved by the local institutional research committee.

Study design

This is cross-sectional type of survey to check the applicability of 2017 classification of periodontal and peri-implant diseases and conditions among postgraduate students in periodontics

Results: The results are extrapolated from the online generated graphs

Conclusion: 97% of post graduates are aware of the classification because of compulsion from their guides. Out of that only 68% of post graduates have started using it, that to recently from Jan-2020 just before the lockdown.

Keywords: New classification, Periodontitis, Gingivitis, Peri-implant diseases, Questionnaire survey.

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INTRODUCTION:

Classification is the systematic arrangement of classes or groups based on perceived common characteristics. It helps in the diagnosis, prognosis, and treatment planning of the disease. It helps to understand the etiology, pathology of the disease.[1] Most importantly, it helps to communicate among clinicians, researchers, educators, students, epidemiologists, and public health workers.

Among various dental ailments, periodontitis has always had a high popularity. It is defined as microbially associated, host-mediated inflammation that results in loss of periodontal attachment, subsequently leading to edentulism.[2] Until recently, the accepted standard for the classification of periodontal diseases was the one agreed upon at the 1989 World Workshop in Clinical Periodontics. This classification system, however, had its weaknesses. In particular, some criteria for diagnosis were unclear, disease categories overlapped, and patients did not always fit into any one category.[3] Also, too much emphasis was placed on the age of disease onset and rate of progression, which are often difficult to determine. Finally, no classification for diseases limited to the gingiva existed.[3] In 1999, an International Workshop for a Classification of Periodontal Diseases and Conditions was organized by the American Academy of Periodontology to address these concerns and revise the classification system which is widely used in clinical practice for 17 years across the globe. But it had some drawback as:[4]

1. Inappropriate emphasis on the severity of the periodontal disease
2. Grouping of aggressive periodontitis as a separate category.
3. Absence of peri-implant diseases in the classification
4. Absence of categorizing gingivitis as localized or generalized
5. Absence of neoplasms related to the periodontium
6. Inappropriate classification criteria for recession.

With the increase in knowledge and understanding of the subject, the new classification of periodontal diseases and conditions hence was proposed by the joint committee of the American Academy of Periodontology (AAP) and European Federation of Periodontology (EFP) in the workshop held in Chicago on November 9 to 11, 2017, began in early 2015.[5]

This classification is proposed internationally and is in routine use for all postgraduate students in Periodontology worldwide. As 26 months have passed since publication, we wanted to know whether it has been implemented or not. This is a small attempt to assess the implementation of the 2017 classification of periodontal and peri-implant diseases and conditions in daily OPD cases of the department of Periodontics among postgraduate students.

SUBJECTS AND METHODS:

Settings and source of data:

The survey population consists of postgraduate students in Periodontics irrespective of the year in which they are in. The method used to collect the responses from each participant was based on questionnaire type. An online Google Form was created on October 27, 2020 displaying 15 questions. The questionnaire was formulated simply and clearly. The participation of the subjects was voluntarily answering the questions and was considered their consent for the same. All their responses were kept confidential and used for academic purposes only. The local institutional research committee approved the study protocol.

Study design and sample size:

This is a cross-sectional type of survey to check the applicability of the 2017 Classification of Periodontal and Peri-implant Diseases and Conditions among postgraduate students in Periodontics. The number of participants who responded to this survey was 43. The sample size considered was 43.

Inclusion criteria

- All Postgraduates students of First, Second and Third year were included.
- Postgraduates all over Maharashtra were considered.

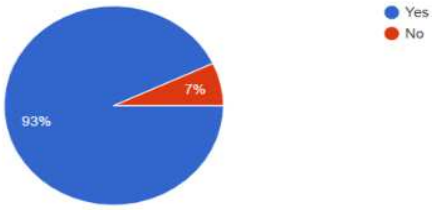
Exclusion criteria

- The participants who were not aware of this classification were excluded from answering the rest of the questions.

STATISTICAL ANALYSIS:

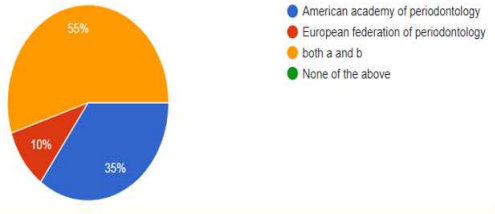
RESULTS:

The survey was conducted in October 2020 created online on Google Forms. A total of 43 participants responded to the survey to assess the applicability of the 2017 Classification of Periodontal and Peri-Implant Diseases and Conditions. This sample comprised all postgraduate students of First, Second and Third year in Periodontics with 20.9%, 32.6%, and 46.5% of students. Out of 43 students, 88.4% belong to Government/Private University, and rest 11.6% belongs to Deemed University. This classification is in routine use for all Postgraduates students in Periodontics since 2018, and almost 93% are aware of this classification ***(Graph 1)***



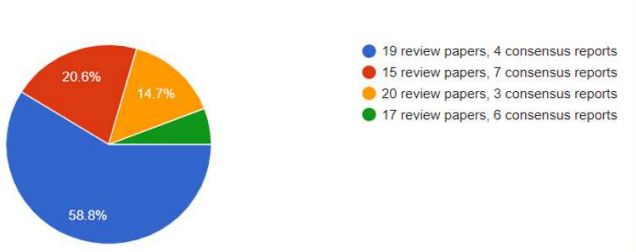
Graph 1: Are you aware of 2017 classification of periodontal and peri-implant diseases and conditions?

55% of postgraduates responded that this classification is given by both the American Academy of Periodontology and the European Federation of Periodontology ***(Graph 2)***



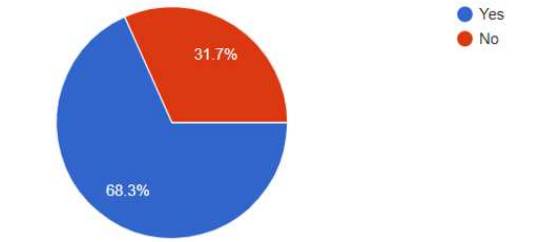
Graph 2: Who have/has given this classification?

58.8% of students opted that 19 review and 4 consensus reports have been published for the classification ***(Graph 3)***.

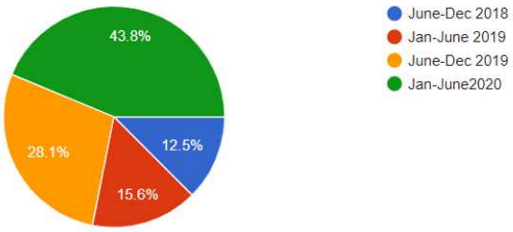


Graph 3: This classification is commissioned with

Diagnosing the cases according to 2017, classification was started by 68.3% of postgraduate students ***(Graph 4)***. The classification was proposed in 2017, and 43.8% have started diagnosing their cases from Jan- June 2020, 28.1% from Jun-Dec 2019, 15.6% from Jan- June 2019, and 12.5% Jun-Dec 2018 ***(Graph 5)*** .



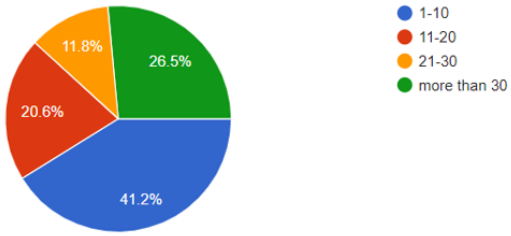
Graph 4: Have you started diagnosing your patient in your daily OPD according to this classification?



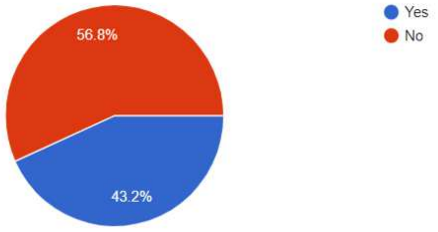
Graph 5: When have you started diagnosing OPD cases according to this classification?

Till today 41.2% of students have diagnosed 1-10 cases, 26.5 % of students diagnosed more than 30 cases. 20.6% and 11.8% of students have diagnosed 11-20 and 21-30 cases ***(Graph 6)***. 56.8% of students

feel that it is not easy to diagnose OPD cases according to this classification ***(Graph 7)***.

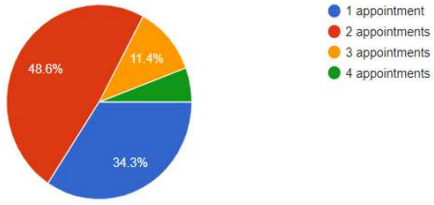


Graph 6: Number of cases diagnosed

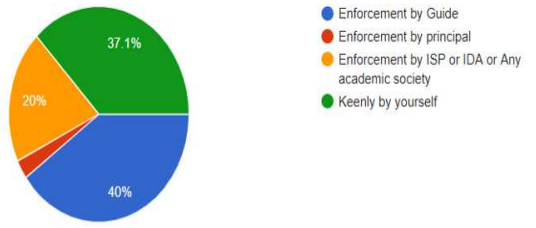


Graph 7: Is it easy to diagnose a patient in your daily OPD, according to this classification?

To diagnose according to this classification, 46.8% of students take two appointments. 34.3% and 11.4% of students take 1 and 3 appointments to diagnose ***(Graph 8)***. Most of the students (40%) have implemented this classification because of the enforcement of the guide. 37.1% of participants have implemented it because of their own will. 20% and the rest of them have been implemented because of enforcement by ISP or IDA and by principle ***(Graph 9)***

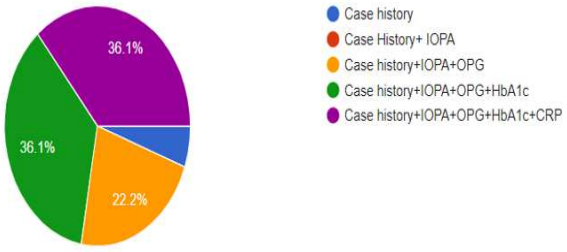


Graph 8: Appointments taken for diagnosis

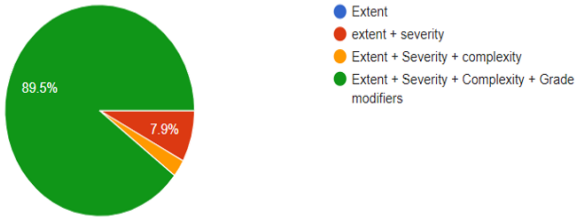


Graph 9: Implementation of this classification by

To use this classification, 36.1% of students think that case history+ IOPA+OPG+HbA1c+CRP are required patient related data ***(Graph 10)***. 89.5% students opted that extent+ severity+ complexity+ grade modifiers are the key elements in 2017 classification ***(Graph 11)***.

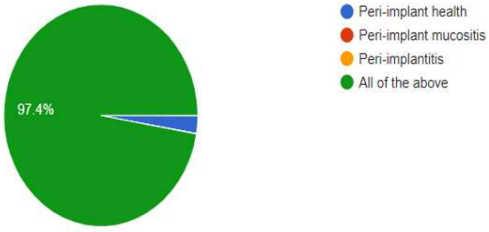


Graph 10: Patient required data to use this classification

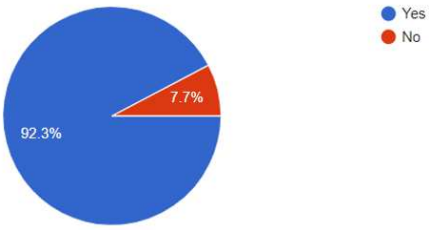


Graph 11: Key elements in 2017 classification

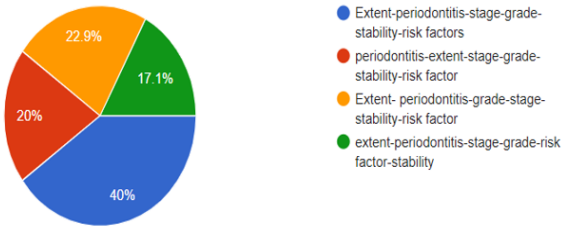
Peri-implant health, peri-implant mucositis, peri-implantitis were opted in classifying peri-implant diseases and conditions by 97.4% of postgraduates ***(Graph 12)***. 92.5% of students can differentiate between periodontitis and non- periodontitis patients ***(Graph 13)***. 40% of post-graduates said that extent+ periodontitis+ stage+ grade+ stability+ risk factors is the correct order of diagnosis ***(Graph 14)***. 70% of students feel that the 1999 classification of periodontal diseases is easier than the 2017 classification ***(Graph 15)***.



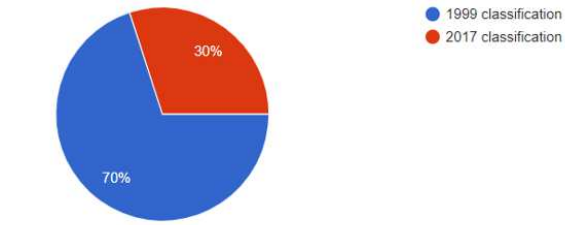
Graph 12: Classifying peri-implant diseases and conditions



Graph 13: Are you able to differentiate between periodontitis and non-periodontitis patients?



Graph 14: Correct order of diagnosis



Graph 15: Which classification is easier?

DISCUSSION:

The survey attempted to know the applicability of the 2017 Classification of Periodontal and Peri-implant Diseases and Conditions among postgraduate students in Periodontics. This classification is in routine use for all Postgraduates students in Periodontics since 2018, and almost 93% are aware of this classification.

Though these many students are aware, only 68.3% have started diagnosing their daily OPD according to this classification. Most of the students (43.8%) started diagnosing their OPD cases from Jan-June 2020. The majority of students (41.2%) have diagnosed only 1-10 cases in their daily OPD till date.

58.8% of students think it is not easy to diagnose according to this classification, and 48.6% take two appointments to diagnose. 40% of total students diagnose their OPD cases using this classification due to enforcement by their guides.

The most number of variations in the answer is seen for question no. 10; that is, 36.1% of students opted for both the options d and e.

Almost 90% of the student population knows the key elements required for diagnosing the 2017 classification.

The peri-implant workgroup is the new addition to this classification, including peri-implant health, mucositis, and implantitis, in which 97.4% of students have given the correct answer. 92.3% of the population was able to differentiate between periodontitis and non-periodontitis patients. According to this classification, the 14th question asked for the correct diagnosis, and 14 responses (40%) presented with the correct answer. After

comparing both the classification, 70% of students feel that the 1999 classification is more comfortable to diagnose.

CONCLUSION:

The classification is now 26 months old, at least from its publication. In the era of instant information transmission, the classification would have been used for at least 20 months from now. Our survey indicates that 97% of postgraduates are aware of the classification because of their guides' compulsion. Out of that only, 68% of postgraduates have started using it recently from Jan-2020, just before the lockdown.

According to this classification, the total number of patients diagnosed is minuscule because of the Covid pandemic. Thus, the classification is not understood well by the students and may take another 2 years to comprehend the classification.

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Perceptions of dental students and teaching faculties about online learning in India

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Abstract:
Aim: This study aimed to assess the influence of online learning on dental education as perceived by dental students and teaching faculties.
Materials and methods: In an institutional review board (IRB) approved protocol; a 16-question survey was created and electronically distributed to undergraduate, postgraduate, and teaching faculties of dental colleges in India. Participation was considered voluntary, and all responses were anonymous.
Results: The survey targeted dental students and staff, of which 256 responded. Of the respondents, 166 students (64.8%) preferred traditional lecture mixed with online learning, while 60 students (23.8%) preferred only the conventional lecture style. Out of the total, 26.6% believed in replacing the traditional lecture with an online lecture, while the majorities (50%) were neutral about the opinion. The responses also indicated that 87.5% of the people gave high credibility (more than 5 out of 10) about their experience in operating online lecture platforms. The opportunity to learn from the best teachers of our faculty worldwide was the most opted advantage of online lectures and technical problem as the most common disadvantage. Online classes should also include live demonstrations is the modification needed by the majority in online lectures.
Conclusion: Students and staff gave a neutral response to replace the traditional lectures with online learning and were hopeful of engaging in online learning along with traditional lectures after improvisation in the future curriculum.
.
Keywords: Dental education, COVID-19 pandemic, traditional lecture, e-learning, online learning.

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INTRODUCTION:

Since the last decade, the use of social media has dramatically increased and gained popularity due to the exponential use of Smart phones, the internet, and smart devices. Social media applications like Facebook, Twitter, Google+, WhatsApp have much helped dental students, teachers, and practitioners connect, collaborate, and communicate among their peer group on a global scale.[1]

The impact of the COVID-19 pandemic was evident on various walks of life throughout the world.[2-4] During the Covid-19 pandemic lockdown period, smart phones and a digital platform like ZOOM have mainly increased.[5] Though online learning (e-learning) is not a new phenomenon, the outbreak of Covid-19 and the country going under lockdown shifted the whole education system into a virtual mode. Digital platforms have played a very

significant role in resuming dental college's academic work during the country's lockdown period.[2]

India is a developing country where education in dental institutions is mostly traditional chalk and board method or PowerPoint presentation in the lecture halls as opposed to some online lectures which are a prominent part of education in universities in developed countries.[5]

Online learning is a very potent tool that transforms the traditional method of learning because it strengthens the capacity of teaching and learning.[6] It also provides a platform for interaction and active learning, which promotes collaboration and idea-sharing among students and instructors.[7] Online learning provides an opportunity to learn without restrictions due to geographical constraints and gives a good option for lifelong learning.[8] Technology creates sustainable opportunities for the academic and professional growth of people and their role as participants and beneficiaries of institutional and social activities.[9]

In the post-Covid-19 era, when the dental colleges will reopen in full form, online learning will have its value in terms of getting the best dental faculties to lecture available at our doorsteps. Rather than depending on our dental college faculties, dental students will have access to the best education possible anywhere in the world at any time from smart devices.

The purpose of this study was to assess the success of online education by getting collective information about the perception and experiences of dental students and teaching faculties about e-learning and their interest in incorporating e-learning into courses. It will also help in understanding the advantages, disadvantages of e-learning and what modifications should be brought out to support dental student education. This study hypothesized that the implementation of e-learning and virtual education improves lecture attendance and students' perception of improved academic performance.

Material and Methods:

The survey instrument was designed to evaluate dental students' and teaching staff's perceptions of the influence of online applications and lectures on their perceived academic performance during the COVID-19 lockdown period. The exclusion criteria included those who did not consent to the survey; and those who did not complete the survey. This study targeted dental undergraduate, postgraduate students, and teaching faculties of various dental colleges in India. The study consisted of 16 questions, of which six were personal and general information about the participants which consisted of name, age, gender, degree, college, and department. The later 10 questions included: 4 multiple choices, 3 Likert scale questions with sublevels, 2 closed-ended and 1 open-ended questions. The open-ended question was to allow participants to add their suggestions for improvement needed in conventional and/or online lectures. The estimated time to complete the survey by a participant was less than 5 minutes. Institutional review board approval was obtained to conduct this survey.

The confidential and voluntary consent form and survey were accessed online through Google Forms, a web-based survey, and evaluation tool, with a link provided to the participants in a WhatsApp, Facebook, and e-mail invitation. The survey was conducted during a 2-month period from October to December 2020. Participation in the survey took place entirely online with all participants completing the survey anonymously using a device and browser of their choice, and at a time and place convenient for their schedules. No computer Internet Protocol (IP) addresses were collected. The survey's anonymity was assured that no personal information will be revealed of the participants.

Results:

The survey targeted undergraduate, postgraduate students and teaching staff of various dental colleges in India. Of which 256 participated from 36 different colleges from 11 different States in India. The majority of participants were from Maharashtra state and 14 different colleges of Maharashtra participated in the study. Out of the total participants, 64.5% were female and 35.5% were males. **[Figure 1]** The majority of participants were undergraduate students (65.2%) followed by postgraduates students (21.9%) followed by teaching staffs (12.9%). **[Figure 2]** Postgraduates and teaching staffs of Orthodontics

and Dentofacial orthopedics participated more compared to other post-graduation departments.

Two hundred and forty-three participants had attended (94.9%) the online lectures during the lockdown period and the rest thirteen participants (5.1%) did not attend any online lectures before.**[Figure 3]**

One hundred and sixty (62.5%) participants also presented online lectures out of the total **[Figure 4]** and the majority (73.9%) had rated their experience more than average. Majority of participant found online platforms as a good platform to share knowledge and has rated 5 or more out of 10 on an increasing betterment grade scale.

Regarding the advantages, disadvantages, and modifications needed in online lectures, the participants opted for all the options in the majority **[Table 1-3]**. The majority of participants (50%) were neutral about the opinion of conventional lectures by online lectures. **[Figure 5]** The majority of participants (64.8%) preferred both conventional and online lectures as the method of learning. **[Figure 6]**

One of the open-ended survey questions allowed each of the participants to freely suggest what they would like to add in conventional or online lectures to enhance their learning. Of the 256 participants, only 36 chose to comment on this. The majority of participants wanted the teachers to highlight the important points at the end of both conventional and online lectures.

Table 1: Analysis of question 11 regarding the advantages of online lectures.

Advantages	Number of responses	% of responses
Opportunity to learn from best faculties lecture all over the world	81	31.6
Students and practitioners could interact and share their knowledge and experience with their co-learner	41	16
The recorded lecture is good for revision	63	24.6
Question and answer session is helpful in learning	36	14.1
Social distancing	66	25.8
Continuation of academic progress in a situation like pandemic	68	26.6
Saves traveling time and cost	48	18.8
All of the above	158	61.7
None of the above	3	1.2
Total	**256**	**100**

Table 2: Analysis of question 12 regarding disadvantages of online lectures.

Disadvantages	Number of responses	% of responses
Technical problem	91	35.5
Internet data cost	66	25.8
Smartphone or computer requirement	50	19.5
Students may fake their attendance	61	23.8
Chances of personal information being hacked	42	16.4
Easily distracted	76	29.7
Privacy concerns	41	16
Unconducive home environment to study	49	19.1
Teachers and students lacking skills to operate digital platforms	33	12.9
All of the above	126	49.2
None of the above	7	2.7
Total	**256**	**100**

Table 3: Analysis of question 13 regarding modification needed in online lectures.

Modifications	Number of responses	% of responses
Short breaks should be included in a very long session lecture	60	23.4
Specific day or weekend should be allotted for doubt solving and discussion	53	20.7
A short exam of objective type question should be conducted after completion of a particular topic or session	53	20.7
Online lectures should also include live demonstrations	68	26.6
A special online platform should be created for lectures and discussions for dental students at the state and country level	48	18.8
Financial assistance from the government to very poor students for buying smartphones	40	15.6
All of the above	146	57
None of the above	5	2
Total	**256**	**100**

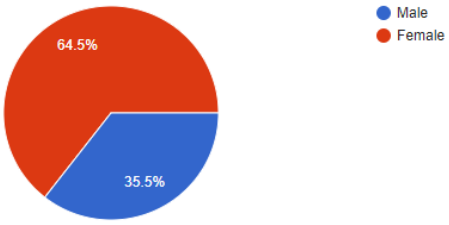

Figure 1: Gender of the participants

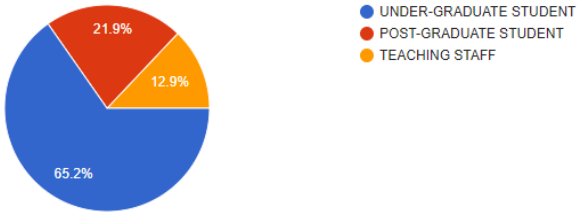

Figure 2: Designation of the participants

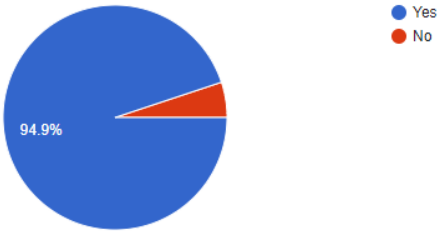

Figure 3: Participants attended an online lecture

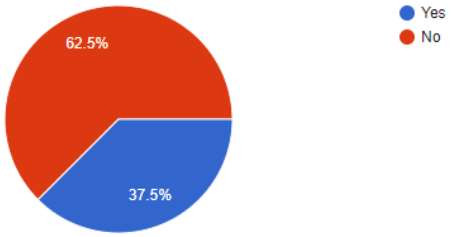

Figure 5: Response of question regarding replacement of tradition lecture by online lecture

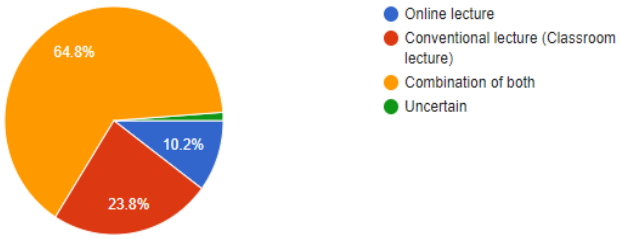

Figure 6: Response of question regarding the preference of method of learning

DISCUSSION

Digital technology always has the potential to boost education, but it had not been used to its full potential in dental education in our country.[5] The unprecedented measures and strict enforcement of lockdown during the COVID-19 pandemic led to the closure of all the colleges' throughout the country and forced the dental colleges to use online learning as a tool for education. From this study, we come to know various advantages, disadvantages, and modification that is needed to bring out in online lectures. The growing popularity of this technology-based learning and its importance in the post-COVID-19 era when all dental colleges will reopen in full form was obvious from this study.

The majority of students and staff have attended and presented lectures during the COVID-19 pandemic lockdown and the majority of them found operating online platforms easy to operate. They found it a very effective means of sharing knowledge, especially in such pandemic times. It allows learning from the best faculties throughout the world is one of the major advantages considered by the majority of participants. It also has various other advantages like, on these digital platforms students and practitioners can interact and share their knowledge and experience with their co-learners and juniors. Recorded lectures are good for revision purposes. Recorded lectures can be heard anytime and anywhere feasible. It also helps to continue our education and learning by maintaining social distancing in such pandemic times. It saves traveling time and cost for students and staff and is also cost-effective for dental colleges.

There are also difficulties faced by the students and staffs during online lectures and the majority of participants considered technical problems, internet data cost, Smartphone or computer requirement, student faking their attendance, hacking of personal information, easy distraction, privacy concerns, unconducive home environment to study, teachers and students lacking skills as its disadvantages.

To tackle these problems students and staff wanted some modifications to be carried out like a short break should be included in between the long-duration online lectures for their mind refreshment. The teachers should a specific day or probably a weekend for doubt solving and discussion among the students of the same year and department. The lecturer should conduct a short test of objective type question after completion of a particular topic or session, which would help in assessing the quality of learning by the students and would point out the key concepts about the session. They also wanted that online lectures should be followed by a live demonstration on the patients the next day, which would further clarify the concepts and knowledge. A special online platform should be created by our government for all the dental students of our country on which best faculties throughout the country will give lectures. Renowned international lecturers should also be invited on this platform to deliver lectures. This will help the student to not only rely on their college teachers but also help them to receive the best education possible anywhere in the world sitting at their home. Government should also provide some financial assistance to very poor students especially in the rural areas in buying smart phones or computers. An innovative and effective solution for unstable internet connectivity would be the development of e-learning software that functions smoothly even at low bandwidths.[10]

Even though e-learning has various advantages but the majority of participants were neutral about the decision to replacement of traditional lectures with online lectures. They preferred the combination of traditional and online lectures as the method of teaching in dental colleges.

This onset of the pandemic has brought to light various difficulties faced in academic fields and possible changes that needed to be brought out in the method of teaching in both medical and dental fields while facing such calamity. Online learning should be imbibed in the future curriculum of learning. The problems faced by both the learners and the faculty should be kept in mind to plan e-lectures where the drawbacks can be limited and will be of maximum benefit for students.

CONCLUSION

Students are equally inclined toward traditional teaching and online teaching. Government, administration, and faculty members should take necessary measures for improving online teaching

quality to help with better learning of students and making it a part of the future curriculum. We should be well prepared for any similar calamities or pandemics like COVID-19 in the future and take necessary steps so that education does not suffer.

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Knowledge, Attitude and compatibility of Personal Protective Equipments among dental practitioners- A Questionnaire survey

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Abstract:

Aim:

The risk of cross infection between dental practitioners and patients may be high due to the dental procedures containing aerosols, and splatters so the dental practitioners are at the greatest risk for COVID 19. Proper protocols are to be followed by the dental practitioners is of utmost necessity during this pandemic time. Proper knowledge of selection and usage of PPEs are of paramount importance in the field of dentistry. So this study was undertaken to assess the knowledge, awareness and compatibility regarding personal protective equipment among dental practitioners in such a critical time of COVID 19 Pandemic.

Methodology:

It was a cross - sectional questionnaire survey based study carried out to assess the awareness, knowledge and compatibility regarding personal protective equipment among dental practitioners. The sampling was done by complete enumeration method and dental practitioners, were included for this study. We forwarded the google form to 100 dental practitioners in Marathwada region. Google forms were used to record responses of the study participants.

Results:

The results are extrapolated from the online generated graphs.

Conclusion:

In the present study, dental practitioners have shown positive attitude about use of PPE in protecting dentist against COVID 19 virus though many of the participants are not compatible with its use. More than half of the respondents have knowledge and awareness about guidelines and online refresher courses to boost infection prevention and control (IPC) strategies in healthcare facilities. Further studies can be conducted on the assessment of the knowledge, awareness and compatibility regarding personal protective equipment among dental practitioners with large sample size.

Keywords: Covid-19, dental practitioners, blood, gingival crevicular fluid, healthcare professionals.

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INTRODUCTION:

Coronavirus disease 2019, known as COVID-19, is a highly expanding pandemic caused by a novel coronavirus, an enveloped single-stranded RNA virus, previously known as 2019-nCov.[1] The first case of the novel coronavirus was detected in Wuhan city in late December 2019. Severe acute respiratory syndrome coronavirus 2 (SARS-COV-2) is transmitted from person to person through inhalation of aerosols from an infected individual. Spread of SARS-CoV-2 can occur through direct, indirect, or close contact with infected people through infected secretions such as saliva and respiratory secretions or their respiratory droplets, which are expelled when an infected person coughs, sneezes, talks. Airborne transmission of SARS-CoV-2 can occur during medical, dental procedures that generate aerosols ("aerosol-generating procedures").[2]

Worldwide, healthcare systems have been severely challenged since the outbreak of COVID-19. Though dental practitioners and physicians have different scopes of practice, their training share many similarities. Hence, with their knowledge of basic human science and sterile surgical techniques, dental practitioners played an invaluable resource in the COVID-19 pandemic response. Overall, it is commendable that many dentists have risen to the challenge in the fight against COVID-19 by administering COVID-19 diagnostic tests such as nasopharyngeal and oropharyngeal swabs and have also seen to continue their emergency dental services, so the dental practitioners were a prime candidate to volunteer in the fight against COVID-19. In addition to physical risks, the pandemic has triggered extraordinary levels of psychological stress on health workers exposed to high-demand settings for a long duration. Guidelines for healthcare workers and online refresher courses have been developed by World Health Organization (WHO), Centers for Disease Control (CDC), and various governmental organizations to boost the knowledge and prevention strategies.[3] According to the WHO,[4] personal protective equipment "consists of garments placed to protect the health care workers or any other persons to get infected." Personal protective equipment (PPEs) are designed in a fashion such that they block the portal of entry of microbes during contact with vicious fluids (blood, saliva, and GCF). Each PPE is intended to protect the operator from contamination by aerosols and splatter to skin and mucous membranes. Before COVID 19, pandemic PPE was used for the dental treatment of patients suffering from diseases such as hepatitis B virus, human immunodeficiency virus, Mycobacterium tuberculosis.

Proper knowledge of the selection and usage of PPEs is of paramount importance in the field of dentistry. However, PPE was not routinely used in the medical as well as dental field, not always following the regulations and is also based on their comfort as there is a lack of enforcement of government's occupational and safety regulations also the low-cost, uncertified, and sub-standard products that decrease the safety levels of personnel.[5] Certain factors that control the selection of PPEs are fit, which is important for PPE since comfort improves compliance, biocompatibility, longevity, and cost.[6] The risk of cross-infection between dental practitioners and patients may be high due to the dental environment containing airborne droplets, aerosols, and splatters, so the dental practitioners are at the greatest risk for COVID 19. Proper protocols are to be followed by the dental practitioners are of utmost necessity during this pandemic time. To our knowledge, no such study has been conducted in the past. So this study was undertaken to assess the knowledge, awareness, and compatibility regarding personal protective equipment among dental practitioners in such a critical time of COVID 19 Pandemic.

MATERIALS AND METHODS:

A cross-sectional questionnaire survey-based study was used to assess the knowledge, awareness, and compatibility regarding personal protective equipment among dental practitioners. Ethical approval of the institutional research ethics committee was taken before the data collection. Participation in the survey was voluntary, answering these questions considered as participants' consent. Since the country maintained a lockdown and movement restriction to reduce the spread of

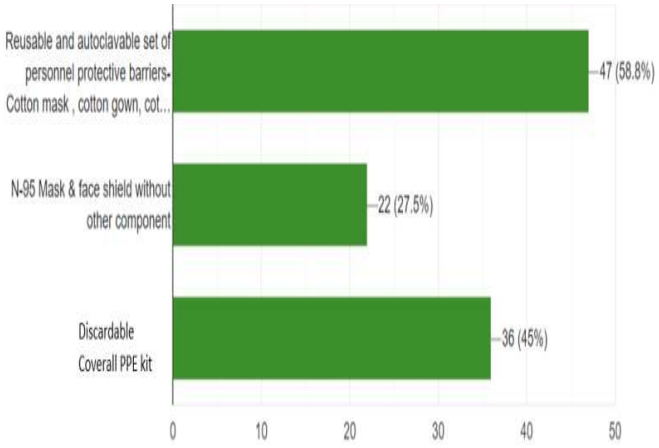
COVID-19, participants were conveniently selected using the online method. We used Google forms in the web-based approach. The link was shared through email, different social platforms (Facebook, WhatsApp), and other authors' networks to record the study participants' responses. Undergraduate students, Postgraduate students, and Interns were excluded from this study. The participants were told none of the responses would be associated with personally identifiable information and to answer the question to the best of their knowledge. Data collected will be used for academic purposes only.

QUESTIONNAIRE DESIGN:

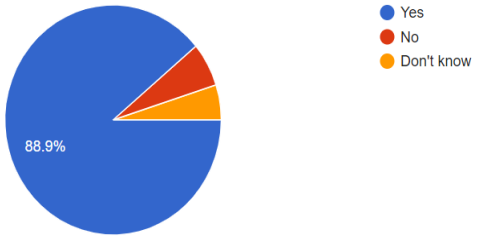
The questionnaire comprised 10 closed-ended questions designed based on a considerable literature review, PPE wearing guidelines for the healthcare providers by WHO,[7] guidelines issued by CDC,[8] to assess the knowledge, awareness, and compatibility regarding personal protective equipment among dental practitioners. A pilot study was previously conducted with five dental practitioners and assessed question understanding and completion time. We approached each participant individually by sharing a link to the questionnaire using Google forms via social media. According to the pilot study, practitioners completed the questionnaire within 5-8 minutes. After accomplishing the pilot study, we made several changes in the questionnaire to simplify technical words to understand the participants.

RESULTS:

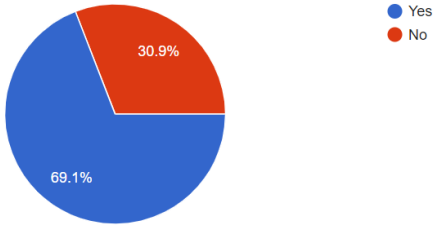
We approached 100 dental practitioners out of them, responses were recorded from a total of 81 dental practitioners (BDS or MDS) 26 were males, and 55 were females in the Marathwada region. Responses were recorded from a total of 81 dental practitioners. Results of knowledge, attitude, and compatibility of personal protective equipment among dental practitioners have revealed the following graphs. About 81.5 % of participants have not used the PPE kit before COVID 19 pandemic. More than half (58.8%) participants use a reusable, autoclavable set of PPE, which includes a cotton mask, cotton gown, cotton head cap, goggles, face shield; only 45% of participants use discardable coverall PPE. Only 25.9 % of them use PPE for OPD **(Graph-1)**. About 88.9% of participants agreed on personal protective equipment (PPE) useful in protecting dentists from COVID 19 suspected or infected patients; among the remaining participants, 4.9% are unaware whether it is effective or not **(Graph-2)**. About 45 % of dental professionals use coverall discardable PPE kits mainly for aerosol-generating procedures. Of most participants, 58% do not change PPE for every patient, and 69.1 % of participants particularly reuse N-95 masks **(Graph-3)**. Only 8.6% of participants do not feel breathlessness and anxiety after wearing PPE, the remaining participants sometimes feel breathlessness. 44.9 % of participants know the recommended grams per square meter (GSM) of the PPE kit, and 33.3 % were unaware. 54.3% of participants have attended a free online information course on COVID 19 safety measures available to all medical and dental operators promoted by Integrated Government Online Training (IGOT) **(Graph-4)**. 36.3% of participants have separate space for donning and doffing, and 30% have separate but not adequate space for donning and doffing **(Graph-5)**.



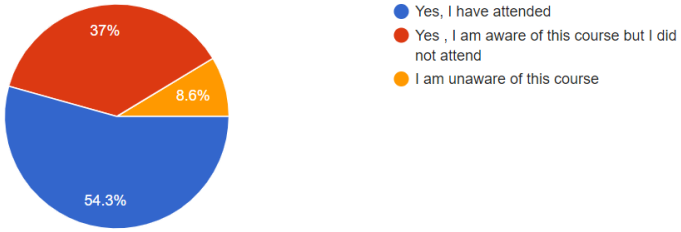
Graph 1: Participants who use discardable coverall PPE kit



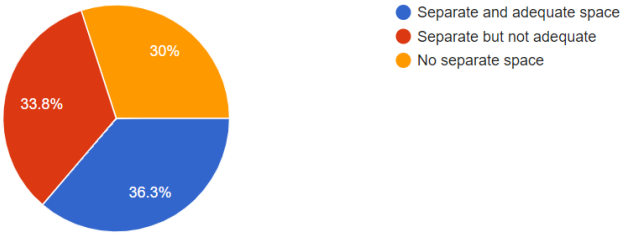
Graph 2: Responses of participants on effectiveness of Personal protective equipment's (PPE) useful in protecting dentist from COVID 19 virus



Graph 3: Percentage of respondents who reuse N-95 mask



Graph 4: Percentage of respondents who have attended free online information course on COVID 19 safety measures promoted by Integrated Government Online Training (IGOT)



Graph-5 Percentage of respondents who have separate and adequate space in the clinic for donning and doffing of PPE

DISCUSSION:

As the covid-19 virus affecting a wide population, health care professionals are also at high risk of getting affected. To treat these increasing numbers of patients every day, we need better protective measures to protect them. Exposure to people infected with the disease in their work leads to the death of a large number of doctors and also affects a wide range of healthcare professionals, while the general population is in lockdown.[9] The infection chain of any disease consists of a susceptible host, pathogen, and a portal of efficient entry. Effective infection control strategies are intended to break this chain of infection at any particular point. The best way for practitioners to prevent this infection is through proper personal protective equipment and competency in donning and doffing.[10] The PPE is designed with this concept as the prime focus to protect the skin and mucous membranes of dental healthcare personnel's eyes, nose, and mouth from exposure to blood or other potentially infectious material.

This study provides an insight into the level of knowledge, attitude, and preparedness of health care professionals towards PPE and decontamination protocol during the outbreak of COVID-19. In our study, 88.9% of the dental practitioners agreed that the PPE could protect from COVID 19 infected or suspected patients. Among them, 81.5 % of participants had not used PPE before COVID 19 pandemic; as such a widespread outbreak had not happened in recent history, it is expected that not every health care worker (HCW) would have used PPE before this pandemic. About 58.8 % of participants use a reusable and autoclavable set of personnel protective barriers- Cotton mask, cotton gown, cotton head cap, goggles/face shield, and 45 % of dental practitioners use coverall disposable PPE kit mainly for aerosol-generating procedures. Only 25.9 % of them use PPE for OPD. WHO recommends: contact and droplet precautions to be applied during care for patients with suspected, probable, and confirmed COVID-19. Additionally, airborne precautions are recommended to be used during aerosol-generating procedures.[11]

About 42% of dental practitioners change PPE for every patient after the dental procedure as WHO

does not recommend PPE reuse.[11] About 60.1% of dental practitioners reuse the N-95 mask. Here we found a remarkable absence of knowledge regarding the use of the mask. These may be because of the factors influencing the purchase of PPE are cost-effectiveness and its availability. N95 masks are designed for one-time use.[8] The CDC and National Institute for Occupational Safety and Health (NIOSH) do not formally recommend the reuse of N95 masks but acknowledge that in times of scarcity, these strategies are options that can be considered based on individual clinical judgment and the institutional resources available. These methods are options for times of crisis and should not be used routinely if mask supply is sufficient.[12] The CDC reports that prolonged N95 mask use (including between patients) can be safe for up to 8 hours. Current guidelines encourage wearing a face shield over the N95 to decrease the chances of contamination of the mask. Because coronaviruses lose their viability significantly after 72 hours, many organizations have promoted a rotation and reuse strategy.[13] Assuming there is minimal to no viral contamination to the mask, the CDC suggests that masks can be reused up to 5 times by acquiring a set number of N95 masks (at least 5 as per the CDC), and rotate their use each day, allowing them to dry for long enough that the virus is no longer viable (> 72 hours). Proper storage for this technique requires either hanging the mask to dry or keeping them in a clean, breathable container like a paper bag between uses. Make sure the masks should not be kept closed and that you should not share your mask with other people. A user seal check should be performed before each use.[14] The masks should be changed regularly to forbid the risk of transmission of the infection. Although studies have shown that human coronavirus like SARS-CoV & Middle East respiratory syndrome (MERS-CoV) have limited capacity to live on dry surfaces, it has also been proved that they can remain viable on a surface for a few days, especially those which are suspended in human secretion.[15]

Nearby 44.9 % of dental practitioners prefer the PPE kit of ≥90 GSM, and 33.3 % of dental practitioners were unaware of GSM of PPE. There are no specific recommendations about the GSM of PPE. However, as per the Integrated Government Online Training (IGOT) course, it was suggested ≥90 GSM could protect from the COVID 19 virus to a greater extent. Around 54.3% have attended free online information course on COVID-19 safety measures available to all medical and dental operators promoted by IGOT, while the 8.6% were unaware of this course. Nearby 36.3 % of dental practitioners have separate and adequate space in their clinic for donning and doffing of PPE and about 30% of participants do not have separate space. Aside from factors related to PPE knowledge, meticulous donning and doffing of PPE is a vital step in reducing contamination of healthcare workers treating patients with transmissible infectious diseases, so there should be separate and adequate space for donning and doffing.[16] Pandit AP et al. have conducted a study to observe the personal protective equipment used for infection control in dental practices.[6] They stated that it is also important to increase the awareness among HCWs about the standards of infection control that should be followed at their dental clinics and introduce training initiatives with superior quality PPE to ensure personnel and patient safety. Thus, the need of the hour is to enforce and implement superior measures of infection control to improve the practice of dentistry in India. Alharbi G et al., in their study, showed that dental undergraduate students and faculty members at KSU (King Saud University, Riyadh, Kingdom of Saudi Arabia) demonstrated good adherence to infection control guidelines. On the other hand, there was a lack of knowledge of the basics of infection control standards.[17] Arora S et al., in their study, concluded that Indian dentists have presented satisfactory knowledge with adequate preparedness as the majority of them had a fair level of knowledge with significantly higher knowledge among female respondents and those with post-graduation studies.[18]

Our study's limitation is that we could not collect more responses from participants as the study was conducted through an online platform. We could not interact with practitioners in person.

CONCLUSION:

In the present study, dental practitioners have shown a positive attitude about the use of PPE in protecting dentists against the COVID 19 virus though many of the participants are not compatible with its use. More than half of the respondents have knowledge and awareness about guidelines and online refresher courses developed by WHO and various governmental and private organizations to boost infection prevention and control (IPC) strategies in healthcare facilities. As the global threat of COVID-19 continues, more strategic efforts through educational campaigns that target HCWs are urgently needed. Dental practitioners should make judicious utilization of all the precautionary measures to practice dentistry safely. Proper preparation for a potential second wave or another virus should be undertaken. As we are going through an evolutionary phase where new advances are expected to evolve, dental clinics should be designed in accordance with separate and adequate space for donning and doffing. We will arise successfully out from the crisis of the COVID-19 pandemic. Further studies can be conducted to assess the knowledge, awareness, and compatibility regarding personal protective equipment among dental practitioners with large sample size.

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Placental membranes – A neoteric guided tissue regenerative membrane for periodontal reconstructive procedures: A Case Report

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Abstract:
Background: The placental membranes have gained a lot of popularity over the years due to their non-immunogenic property along with antibacterial and anti-inflammatory action. In periodontal therapy, they have been used as a barrier membrane during the treatment of intrabony defects and for recession coverage. The present case report provides evidence supporting the use of placental membranes in the treatment of intrabony defect.

Conclusion: The use of placental membrane- chorion, enables in accelerated wound healing. The additional advantage of non-immunogenic property makes it an ideal allogenic graft material

Keywords: Alloplast, Guided Tissue Regeneration, Intrabony defect.

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INTRODUCTION:

Regenerating the lost periodontium is the goal of periodontal therapy. Over the years, various materials such as bone grafts, guided tissue regeneration (GTR) membranes, growth factors, etc., have been used to achieve this goal. But to date, no material is said to be the gold standard for achieving complete periodontal regeneration. To promote regeneration, Melcher, in 1976, gave the concept of compartmentalization, where the periodontal ligament cells are allowed to repopulate over the root surface.[1] Periodontal ligament cell repopulation over the root surface is favorable for regeneration as it has the potential to differentiate into progenitors of the periodontal ligament, bone as well as cementum. Ever since the introduction of this concept in periodontal therapy, various materials have been tried as GTR membranes.

One of the new material which has also been tried recently includes placental membranes, i.e., amnion and chorion.[2] The placental membranes gained a lot of interest in medicine and dentistry due to their non-immunologic, antimicrobial and anti-inflammatory properties.[3] Moreover, they release various growth factors such as platelet-derived growth factor (PDGF), vascular endothelial growth factor (VEGF), epidermal growth factor (EGF), keratinocyte growth factor (KGF), as well as, they contain various collagens such as type I, III, IV, V, VI. These unique properties of the amnion and chorion

placental membranes were suggested to enhance wound healing and regeneration.[2]
The present case report imparts substantial evidence emphasizing the use of placental membranes for achieving periodontal regeneration of intrabony defects.

Materials and methods:
A 45 years old female patient reported with a chief complaint of dull aching pain and loosening of teeth in the right lower back tooth region for the past 7 months. The medical history revealed the diabetic status of the patient, and she was under metformin medication for the past 4 years. Clinical examination revealed fair oral hygiene status of the patient based on plaque index given by Silness and Loe. The patient further gave a history of chewing on hard substances on the right side of her dentition. #44 (according to FDI system) was grade II mobile with probing pocket depth (PPD) of 8 mm, and clinical attachment level (CAL) was 10 mm. The radiographic examination revealed vertical bone loss with respect to the distal aspect of #44 **(Figure 1)**.

Figure 1: Pre-operative radiograph revealing the vertical defect in relation to #44. The yellow and red line depicts the width and the height of the defect, respectively

On evaluating the occlusion, the primary etiology for PPD was identified to be trauma from occlusion (TFO). Surgical periodontal therapy for the vertical defect was planned after the root canal treatment as the defect extended up to the apical third of the tooth. Prior to the commencement of the surgery, the procedure was explained to the patient, and written informed consent was obtained.
During the periodontal examination, PPD was measured using William's probe from the gingival margin to the base of the pocket at all six sites of the tooth. CAL was measured from the fixed point, i.e., from the cementoenamel junction to the base of the pocket. Following oral prophylaxis, occlusal adjustments were performed with high-speed airotor and finishing bur to eliminate TFO. The tooth was further splinted to aid in the reduction of mobility and was maintained for 2 months. The PPD on 2 months recall visit was 8 mm **(Figure 2),** so surgical periodontal therapy was planned for the patient.

Figure 2: Pre-operative image showing the PPD in relation to #44

The surgical periodontal therapy was commenced with local anesthesia using lignocaine HCl with adrenaline 1: 1,00,000 ratio. Papilla preservation flap with two vertical releasing incisions was reflected with respect to #44. Thorough debridement was done to remove the granulation tissue, and the root surfaces were planed with Gracey's area-specific curette. On flap elevation, two walled intrabony defect in relation to #44 was observed **(Figure 3).**

Figure 3: Deep intrabony defect noted in relation to #44

The defect was treated with nanocrystalline hydroxyapatite (HA) **(Figures 4 and 5).**

Figure 4 and 5: Bone alloplast HA placed in the defect region in relation to #44

The Chorion membrane was trimmed according to the defect and placed over the defect site for guided tissue regeneration **(Figure 6).** Once the chorion membrane comes in contact with it, it hydrates and adheres to the underlying tooth and bone surface. Flaps were re-approximated, and sutures were placed with 4-0 silk suture material.

Figure 6: Chorion membrane trimmed according to the defect area and placed after pre-suturing the flap

The patient was prescribed with 500 mg of amoxicillin TID for 5 days and 400 mg of ibuprofen BD for 5 days. Moreover, the patient was instructed to use 0.2% chlorhexidine mouth rinse twice daily for two weeks. The patient was recalled after 10 days for suture removal and then appointed for further periodontal maintenance at 3-month interval. The clinical and radiographic assessment was done at 3 and 6 months post-operatively.

Uneventful healing was noted during suture removal. The patient did not report any adverse events such as pain, allergic reactions, or abscess formation during healing. The patient reported for further periodontal evaluation at 3 months. PPD was reduced to 3 mm from the pre-operative PPD of 8 mm, and CAL was 5 mm **(Figure 7).**

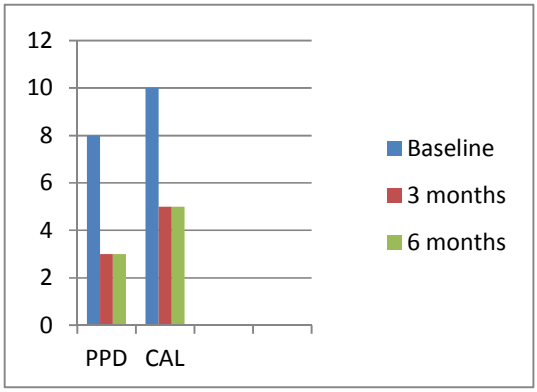
Figure 7: Reduction in PPD noted during the 6 months follow-up visit

The patient was further re-scheduled for evaluation at 6 months. The results remained stable in terms of PPD and CAL **(Table 1) and (Graph 1).**

Table 1: Showing the values of clinical parameters pre-operatively and 3 months, 6 months postoperatively (measured in millimetres)

Clinical parameter	Pre-op	3 months post-op	6 months post-op
Probing Depth	8	3	3
Clinical Attachment Level	10	5	5.5

Graph 1: Showing the improvement in clinical parameters compared from baseline to 3 months and 6 months



During the postoperative follow-up visit at 6 months, removal of the splint was done, and a reduction in tooth mobility was noted. The radiographic examination comparing the pre-operative (**Figure 1**) and post-operative bone level showed an increase in bone level at 6 months postoperatively **(Figure 8).**

Figure 8: Gain in the height of alveolar bone observed during the 6 months follow-up visit. The yellow and red lines clearly depict the reduction in defect width and height.

DISCUSSION

The main advantage of the placental membranes is that, though they are allografts in nature, they are non-immunogenic. Lack of immunogenicity is due to HLA-A, HLA-B, HLA-D, and HLA-DR antigens in the human placental membranes.[4] Additionally, they also have anti-inflammatory and anti-scarring property. The amnion and chorion membranes used in the case report are freeze-dried and irradiated to eliminate the possibilities of immune reaction and transmission of diseases such as HIV, HBV, etc.

Placental membranes consist of various adhesion molecules like laminins. Laminin-5, present in the placental membranes, plays a vital role in the cellular adhesion of gingival cells.[5] Also, various collagens such as collagen type I, III, IV, and V play a key role in accelerating the wound healing process.[2] Above all, the placental membranes possess an innate anti-microbial property that makes ACM one of the most unique regenerative materials of the decade. Ashraf H, in 2019 through his In Vitro study, provided evidence that ACM is as bactericidal as tetracycline treated positive controls.[6]

Temraz A, in 2019 in a randomized controlled trial, compared the ACM with OFD and demineralized bone matrix putty (DBM) with OFD.[7] The results of the study suggested that ACM with OFD had clinical and radiographic outcomes similar to DBM with OFD, both the groups showing statistically significant improvement in terms of PPD, CAL and radiographic measurement of the bone defect area.

Bone alloplast containing nanocrystalline HA was chosen as the bone graft material due to easy availability, cost efficiency, and remarkable biocompatibility with little inflammatory response when implanted within connective and bone tissues. Singh VP in 2012 compared nanocrystalline HA in combination with collagen membrane and OFD alone for the treatment of periodontal intrabony defects.[8] The study promoted nanocrystalline HA as it provides a clinical advantage in achieving periodontal bone fill. So, in the present case report, nanocrystalline HA in combination with ACM was chosen as the material of choice for regenerating intrabony defects.

Ines Velez, in 2010 evaluated cryopreserved amniotic membrane (CAM) for helping cicatrization and wound healing after dental implant surgery.[9] Epithelialization, pain, infection, inflammation, and scarring were studied. In this study, CAM was placed in surgical wounds related to implant surgery. The extent of healing was evaluated by a masked investigator for lesion size, epithelialization, pain, infection, inflammation, and scarring. The results of the study showed statistically significant differences, where the experimental group showed improved outcomes when compared with the control groups regarding cicatrization, wound healing, and pain.

Holtzclaw et al., in 2013, in a retrospective observational report, documented the use of amnion-chorion membrane (ACM) for combination GTR treatment of periodontal intrabony defects with a minimum of a 12-month post-surgical observation.[10] The results of the study showed promising results in terms of improved level of clinical parameters and wound healing. The author concluded that further controlled long-term studies to evaluate the effectiveness of ACM need to be carried out.

The results of the present case report is in accordance with the above-mentioned studies, however, a systematic review and meta-analysis by Zhou S in

2018 suggested that, amongst all the biomaterials used in combination with bone grafts for periodontal regeneration, platelet-rich fibrin (PRF) showed commendable outcome.[11] Enamel matrix derivatives and placental membranes had little additive effects, but not very significant changes were appreciable.

CONCLUSION:

The use of the human placental membrane, chorion, when used as a GTR membrane, allows rapid healing and aids in periodontal regeneration. The probable mechanism of action of the membrane for attaining this improved result is the abundant supply of GFs and stem cells. Nonetheless, randomized controlled clinical trials with long-term follow-up comparing placental membranes with other GTR membranes are necessary to confirm the importance of placental membrane in periodontal regenerative procedures.

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Conflict of interest: None declared

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Lip Prints (Cheiloscopy): An Insight

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Abstract:

Lip print is a forensic investigation method that deals with the recognition based on lip traces. Positive identification of living or dead persons using the characteristic traits and features of the teeth and jaws forms a foundation of forensic science. Based upon the research, it was known that the arrangement of lines on the red part of human lips is distinctive for each human being. The pattern of wrinkles on the lips has appearances like fingerprints. They are unique, permanent and immobile even after death. Identification plays a very vital role in any crime investigation. The present article reviews in detail the history, classification, applications, scope of cheiloscopy and use of lip prints in crime detection.

Keywords: Cheiloscopy, criminal issues, fingerprints, lip prints.

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INTRODUCTION:

Personal identification is becoming significant not only in legal medicine but also in criminal investigation, identification, and genetic research.[1] Lip prints are distinct lines and fissures in the forms of wrinkles and grooves present in the zone of transition of the human lip, between the inner labial mucosa and outer skin examination known as cheiloscopy. Cheiloscopy derived from Greek word chelios-lips and skopein- the study of lip prints. Two Japanese scientists, Y. Tsuchihashi and T. Suzuki, in 1968-71, recognized that the arrangement of lines on the red part of the human lip in human beings is unique for each human being.[2] The grooves present on human lips (Sulci labiorum) are exclusive to each person and can determine individuality. Forensic science refers to the area of effort used in a judicial setting and acknowledged by the court and the general scientific community to separate truth from untruth.

Fingerprints, post-mortem analysis, dental records, and DNA investigations have been successful; just like these methods, lip prints can be helpful in identifying a person positively and can be used to confirm the presence or absence of a person at the crime scene.[3] It has also been suggested that variation in pattern among males and females could help in personal identification and sex determination.[1,4] It has been confirmed that they recover after undergoing alterations like inflammation, trauma, and diseases like herpes and that the disposition and form of the furrows do not vary with environmental factors.[5] These are unique as finger prints and do not change during the life of a person.[1] The lip prints can be used to verify the presence or absence of a person from the crime, provided there has been consumption of beverages, drinks, usage of cloth, tissues, or napkin at the crime scene.[6] Studying in-depth and establishing more facts and evidence in lip prints will help as useful in forensic dentistry.

Classification of Lip Prints:

(1) Martin Santos Classification (1966)[1]

I. Simple wrinkles
   a) Straight lines
   b) Angled lines
   c) Sine shaped curve

II. Compound wrinkles
   a) Bifurcated
   b) Trifurcated
   c) Anomalous.

(2) Suzuki and Tsuchihashi Classification (1970) [7-9] *[Figure 1]*

Type I: Clear cut grooves running vertically across the lip

Type I^a: Straight grooves; disappear halfway instead of covering the entire breadth of the lip

Type II: Fork grooves in their course

Type III: Intersecting grooves

Type IV: Reticulate grooves

Type V: Undermined

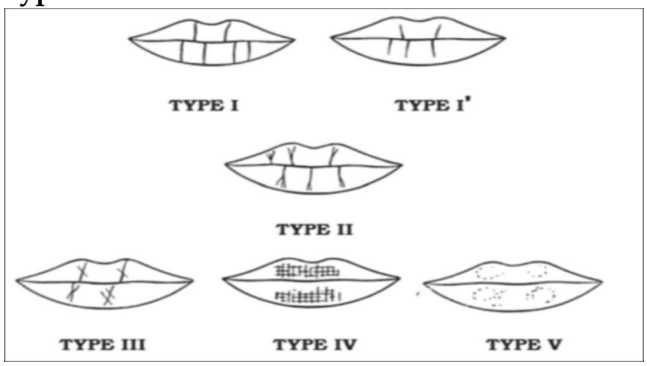

Figure 1: Suzuki and Tsuchihashi classification

(3) Raynaud's Classification:[7]

a. Complete vertical
b. Incomplete vertical
c. Complete bifurcated
d. Incomplete bifurcated
e. Complete branched
f. Incomplete branched
g. Reticular pattern
h. X or coma form
i. Horizontal
j. Other forms (ellipse, triangle).

(4) Afchar–Bayat Classification (1979):[1]

A1: Vertical and straight grooves covering the whole lip
A2: Vertical and straight grooves, but not covering the whole lip
B1: Straight, branched grooves
B2: Angulated branched grooves
C: Converging grooves
D: Reticular pattern grooves
E: Other grooves.

(5) The sex of the individual was determined as given by Vahanwala et al.[5]

1. Type I and I^i pattern dominant: Female
2. Type I and II pattern dominant: Female
3. Type III pattern dominant: Male
4. Type IV pattern: Male
5. Type V varied patterns: Male.

(6) Only a 10 mm portion of the middle part of the lower lip is used recently for the basis of the classification [1,5]

- Linear "L" – if the lines prevail
- Bifurcation "R" – if the bifurcation is dominant
- Reticular "S" – if the lines cross
- Undermined "N" – when no superiority can be established.

(7) 23 types of individual features are characterized to establish individual features of patterns of the lines [5,10] *[Figure 2]*

An eye		A closing bottom furcation	
A hook		A delta-like opening	
A bridge		A simple opening	
A line		A closing top bifurcation	
A dot		A pentagonal arrangement	
A rectangle like		A branch like top bifurcation	
A triangle like		A star like bifurcation	
A group of dots		A fence	
A simple top furcation		A branch like bottom bifurcation	
A simple bottom furcation		Double fence	
A double eye			
Hexagonal arrangement			
Crossing lines			

Figure 2: Individual features of patterns of the lines

Cheiloscopy [Examination of lip prints]:

Lip prints have to be taken within 24 hours of the time of death to prevent inaccurate data that would result from post mortem changes of the lip. Lip print outline depends on whether the mouth is opened or closed. In a closed-mouth situation, the lip exhibits well-defined grooves, whereas in an open position, the grooves are relatively ill defined and difficult to understand.[1] Any pathology of the lip such as mucocele or any postsurgical alteration of the lip can change the lip print pattern. Loss of support because of loss of anterior teeth can cause changes in lip prints. Any debris or fluid on the lip surface, application of a thick layer of lipstick, or over-stretching of cellophane tape can change lip print record.[6]

Recording of lip prints:

The following methods can be used for tracing lip prints at the crime scene.

1. Direct photography of prints on a glass surface
2. Make use of fingerprint powders and fixing on foil. (Aluminum powder, Silver metallic powder, Silver nitrate powder, Cobalt oxide and Magnetic powder)[11]

A lip print at the scene of the crime can be a foundation for conclusions as to the character of the event, the number of people involved, cosmetics used, people habit, sexes, occupational traits, and pathology of the lips themselves. Traces of lip prints should be looked particularly if a meal is taken at the scene of crime.[12]

Recording lip prints from suspect:

The lip prints can be photographed on a nonporous flat plane such as mirror, enlarged and overlay tracings made of the grooves. Rouge is applied to the lips, and then lips are photographed.[13] After applying lip stick, the impression should be taken on a paper until the lipstick has exhausted. Applying special creams on the lips and then transferring it. Print taken is directly photographed or enclosed by a cellotape to maintain a permanent record. Recently, Softwares are used for the recording of lip prints.[13,14]

Application of Cheiloscopy:

1. For Personal identification: The specific grooves on the Human Lips play a great role in the identification of a Human being, and many studies have proven that.[1]
2. In Sex Determination: In a study conducted by Vahanwala - Parekh, suggested that the sex of the individual was determined as: Type I and I a patterns are dominant in females in the third and fourth quadrants, i.e., lower lip and Type II pattern is common in males in the second quadrant, i.e., upper lip, left side. Individuals with different patterns in all quadrants were common in males, whereas having the same pattern in all quadrants were seen in females.[4,15]
3. A tool in crime investigation: Lip prints added proof to a crime scene, and this is valuable, especially in cases of lacking other evidence, like fingerprints.[5]

Merit of Lip Prints:

When the lip prints are not clear that is only the shape of the lip is printed, specific identification of a human being is very difficult. In these cases, it is acceptable to examine the substance which constituted the trace, e.g., saliva as a biological tracing.[1] The huge potential for DNA typing from the lip print is marked.[5] The lines are printed unclearly in the case where the lips are covered with food or cosmetics, and the trace will have the shape of the stain and can be subjected to chemical examination, to determine the substance covering the lips.[5]

Demerits of Lip Prints:

According to the method, pressure, and direction used in taking the print, lip prints may vary in appearance that's why the same person can produce different lip prints. If lipstick is used as a recording medium, the quantity applied may also affect the print. Blurring of the lip prints may occur. The existence of some pathological conditions such as lymphangiomas, congenital lip, fistula, lip scleroderma, Melkersson–Rosenthal syndrome, syphilis, and lip cheilitis are the other causes which can invalidate the cheiloscopic study.[14] The lip wrinkle pattern is on the vermilion border of the lip, which is the mobile portion of the lip.[5]

Use of Lip Prints in Crime Detection:

Lip prints used as a detecting tool in forensic sciences, just like fingerprints and teeth. Traces of lips should be observed for on cutlery and crockery items, on the window or door glass, on photographs or letters. Lip prints may also look side by side with tooth marks on food products. In practice, lip prints

have also been discovered on the surface of windows, paintings, doors, plastic bags, and cigarette ends.[14] They can most commonly appear in the scene of murders, rapes, and burglaries. Traces with clear lines and individual elements allow individual identification of a human being. It has the same significance as dactyloscopic traces. In the case of traces, in the shape of stains, the documentation examination terminates with group identification; in their character, they are like to other chemical and biological traces.[16]

CONCLUSION

Lip prints are constant of an individual for lifetime; it may be used as a record for individual along with the fingerprints. A standard and uniform procedure has to be developed for the collection, development and recording of lip prints and the confirming comparison. However, many researches are still necessary to know more about the science of Cheiloscopy.

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ORAL CAVITY- A MAJOR TARGET OF COVID-19: PART 2

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Abstract:
The outbreak of corona virus disease 2019 is posing a severe threat to global health management system since it has been detected in the humans. This disease was characterized by severe acute respiratory syndrome corona viruses 2 (SARS-CoV-2) and rapidly developed into a public emergency worldwide with an alarming increase in cases and deaths. Now after living with the disease for one year may different manifestations have been reported from all over the world by different medical and Dental Professionals. These manifestations range from minor taste changes to devasting findings like necrosis of jaws. This second part of the review aims to shed some light on such manifestations which are clinically relevant for dentists and their prior knowledge is important to combat this vicious pandemic.

Keywords: Osseous manifestations, Mucormycosis, Osteomyelitis, Taste disorders, Ageusia.

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INTRODUCTION:

The doctors of a hospital in New Delhi claimed to have witnessed more than 12 cases of Civid-19 triggered mucormycosis fungus- which causes loss of eyesight, removal of the nose and jaw bone, and 50% mortality in cases where it affects the brain- within 15 days. Black fungus, or mucormycosis, previously called zygomycosis, is a serious but rare fungal infection caused by a group of molds called mucormycetes that exist in the environment. Even though rare, it is a severe fungal infection that mainly affects patients who are highly immunocompromised. Early clinical suspicion noticed by the doctors working at the frontline in this pandemic is- nose obstruction, swelling in the eye or cheeks, and black dry crusts in the nose. (Reported 15/12/2020). If this is true, the repercussions of covid-19 are alarming, and dentists play an essential role in the early detection of these lesions as the jaw bone, and vital structures in its vicinity are involved.

Fig 1: News report of Mucormycosis associated with Covid-19

Part one of this review covered the soft tissue lesions and the taste disorders in relation to the covid-19 pandemic

CLINICAL PRESENTATIONS OF ORAL OSSEOUS LESIONS

The maxilla is one of the primary bones of the face and is involved in the formation of the significant portions of the upper jaw, i.e., palate, nose, and orbit. The maxilla's alveolar process holds the upper set of teeth and plays a vital role in speech and mastication. Maxillary necrosis rarely occurs when compared to mandibular necrosis due to the high vascular supply of the maxilla. If maxillary necrosis does occur, it may be due to bacterial infections such as osteomyelitis, viral infections like herpes zoster, fungal infections like mucormycosis, or secondary to trauma, radiation, etc.

PRESENTATION 1 - OSTEONECROSIS OF JAW (Case Courtesy- Dr. Khimji Gohil)

The pathogenesis of COVID-19 has several repercussions for the patient, such as immunological changes, hypercoagulability, ischemic phenomena, use of high dosage corticosteroids, etc.; these factors can be directly linked to the development of osteonecrosis of the jaw.

Excessive immune responses in intensive care patients lead to fibrosis and lung damage, causing functional disability and reduced life quality. As a specific drug is absent for the treatment of COVID-19, a range of existing host-directed therapies could potentially be repurposed to treat it. Tocilizumab is a humanized anti-interleukin-6-receptor (IL-6R) monoclonal antibody that inhibits interleukin-6 (IL-6) signaling used as a treatment in rheumatoid arthritis (RA). Tocilizumab was administered intravenously in the treatment of COVID-19 in China and Italy with encouraging results. Whether the drug tocilizumab can restore T cell counts in the COVID-19 patients by suppressing IL-6 signaling is still uninvestigated. After literature research, a possible correlation between tocilizumab and medication-related osteonecrosis of the jaws (MRONJ) was highlighted, similar to the complication of antiresorptive and antiangiogenic drugs cancer therapy.[1]

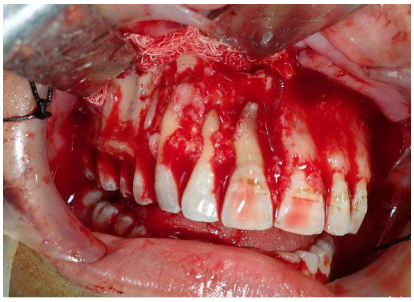
Hence, studies are required to find the possible correlation between tocilizumab and MRONJ, but the dental community should be aware of its potential risk, especially during procedures involving jawbones.

CASE PRESENTATION-

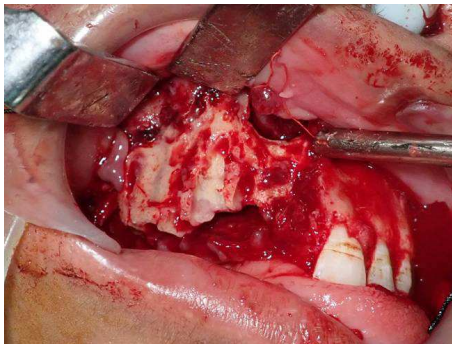
Patients with a recent history of COVID-19 infection and a history of uncontrolled diabetes reported pain and mobility of teeth in the upper jaw during mastication of food. Oral examination showed multiple draining sinuses and mobile teeth in the right upper jaw of the patient. 3D CT scan revealed multiple irregular osteolytic lesions involving a significant part of the maxilla along with the maxillary sinus. The affected teeth were extracted, infected sinus lining was removed, and curettage was done under local anesthesia. Histopathological examinations were done from multiple sites, including bone, granulation tissue, sinus lining, which were suggestive of Avascular Necrosis in Maxilla and ruling out any fungal or malignant lesion.

The final diagnosis was made as a rare and severe complication of post-COVID-19 infection in the maxillofacial region due to impaired vascular supply in the maxillary region's minor blood vessels with supra-added sinus infection associated with uncontrolled diabetes mellitus.

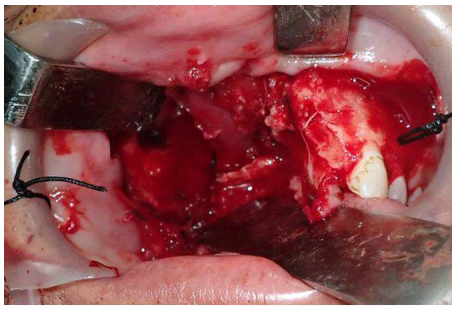
Normal looking maxilla with sinus opening



Bone loss from anterior teeth to molars in the anterior region (Photo courtesy- Dr. Khimji Gohil)

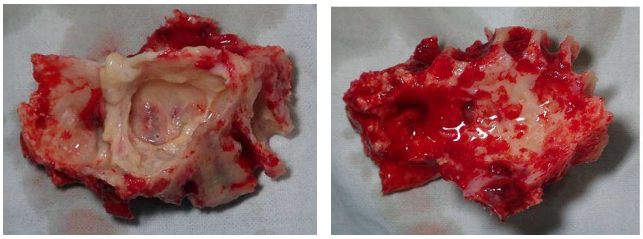


Necrosis of entire right maxilla



Resected Maxilla

(Photo courtesy- Dr. Khimji Gohil)



Completely necrosed maxilla
(Photo courtesy- Dr. Khimji Gohil)

Fig 2: Clinical presentation of Osteonecrosis of Jaw

PRESENTATION 2 - MUCORMYCOTIC OSTEOMYELITIS (Case Courtesy- Dr. Akshay Dhoble)

Osteomyelitis is an inflammation of the bone that begins in the medullary cavity and ends in the periosteum involving the Haversian system. Various factors are involved in developing the disease, such as trauma, surgical therapy, bacteremia, fungal infection, and systemic diseases that decrease host defense mechanisms such as diabetes, malignancy, anemia, radiation, and malnutrition, osteoporosis, osteopetrosis, and Paget's disease. In all of these conditions, the vascular supply is decreased, thereby predisposing the infection. Microbes' entry into cancellous bone causes the compression of blood vessels preceded by the inflammation and edema of marrow. Severe compression of vascular supply leads to ischemia and subsequent necrosis of bone. This immobile and stagnant blood leads to nidus for the development of infection. Osteomyelitis is more commonly seen in males (80.36%) than in females (19.64%), with its peak incidence in 30–39 years of age.[2]

Osteomyelitis due to fungal organisms is rare and is seen more in immunocompromised patients. Fungal microorganisms that are usually causing osteomyelitis are *Candida parapsilosis* and *Aspergillus*. These organisms are from the initial infection that has not been appropriately treated, commonly from dental extraction. Among fungal osteomyelitis, Candida is the most frequently encountered, followed by aspergillosis and mucormycosis. Mucormycosis is an opportunistic fulminant fungal infection usually seen in immunocompromised patients; It is also commonly seen in diabetic patients as the ketone bodies favour the organism's favourable environment's growth. Clinical features of fungal osteomyelitis are similar to bacterial osteomyelitis, exposed bone, and pain with varying intensity. If not diagnosed and treated earlier, fungal osteomyelitis is more invasive than bacterial. The diagnosis of mucormycosis is challenging. Hence it has to be treated as early as possible; otherwise, it may be fatal. There is no recommendation to guide the diagnosis and management of mucormycosis despite the affected patient's infection morbidity and mortality. The American Infectious Disease Society has presented specific guidelines to be used on evidence criteria.[3]

The guidelines, in brief, are as follows:

(1) The diagnosis of mucormycosis relies on histology and detection of the organism by culture from the involved sites to identify and isolate the species level.

(2) Antifungal chemotherapy should be able to control the underlying predisposing condition after surgical debridement.

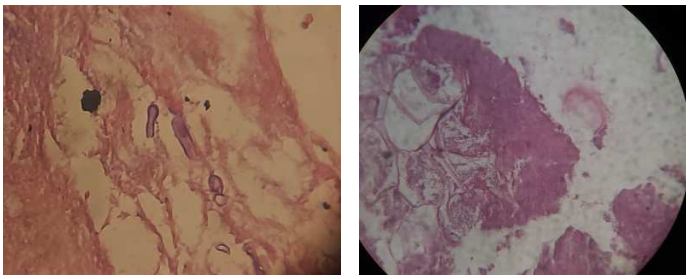
Computed tomography and magnetic resonance imaging techniques were used as early diagnostic tools. Bone scintigraphy is more accurate than a CT scan because bone erosion and remodeling in CT may be confused with osteomyelitis. Hyphae were microscopically identified with stains like H&E (hematoxylin and eosin), PAS (periodic Schiff), and GMS (Grocott's methenamine silver), and in particular, the type of hyphae, whether septate (or) nonseptate is seen by GMS staining. Identification of hyphae was made through histological sections, but the exact species were identified only through culture.

CASE PRESENTATION:

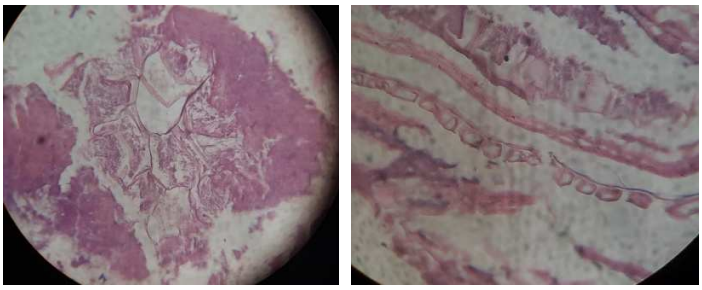
A patient with a recent history of COVID-19 reported a large lesion on the left side of the oral cavity. The patient has a history of uncontrolled diabetes.

The lesion was excised and examined microscopically.

(Photo courtesy- Dr. Akshay Dhoble)



(Photo courtesy- Dr. Akshay Dhoble)



(Photo courtesy- Dr. Akshay Dhoble)

Fig 3: Clinical presentation of Mucormycotic Osteomyelitis

The microscopic examination revealed the bony trabeculae consisting of empty lacunae intermixed with broad and septate hyphae, branching greater than 90°. These features are suggestive of mucormycotic osteomyelitis. Further, the specimen is stained with the PAS stain, which shows the fungal hyphae in magenta color.

TASTE DISORDERS

While the most prevalent signs/symptoms in COVID-19 patients like cough, fever, and fatigue, as mentioned in a recent meta-analysis, have been used as cardinal clinical diagnostic criteria since the beginning of the outbreak, and the new olfactory and taste disorder(s) were not initially linked to SARS-CoV-2 infection and have not been used for case identification and testing prioritization by the US Centers for Disease Control and Prevention (CDC) or World Health Organization (WHO) until August 2020.[4]

The first systematic assessments of the evidence available up to March 2020 failed to identify associations between signs like anosmia/ageusia and COVID-19.[5] For example, none of the studies included in an early systematic review reported features like olfactory or gustative dysfunctions.[6] In sharp contrast, the most recent meta-analysis analyzing smell and taste alterations not only reported that almost half of COVID-19 patients had these symptoms but also that 15% of patients had

olfactory and gustatory abnormalities as their initial clinical manifestations.[7] Now, due to the growing body of evidence, sudden onset of signs like anosmia, ageusia, or dysgeusia have now started to be recognized as major clinical characteristics of the disease and have been included in the list of key clinical criteria for case definition of COVID-19 by the European Centre for Disease Prevention and Control as well as other Public Health surveillance organizations across the world such as CDC, WHO, and Public Health England.[8] Taste disorders were relevant symptoms as compared amongst the data on overall signs and symptoms in patients with COVID-19.[9]

Taste disorders can be-

1. Dysgeusia - characterized by an altered or impaired sense of taste.
2. Hypogeusia – characterized by partially reduced ability to taste things.
3. Ageusia – characterized by complete loss of taste function.

A systematic review aimed to summarize evidence on the prevalence of oral signs and symptoms in patients with COVID-19 was reviewed.[10] Systematic review was reported as per the PRISMA checklist, and their literature search was conducted in 6 databases and grey literature. Studies published in any language mentioning oral symptoms and signs in patients with COVID-19 were included by them. After a 2-step selection, 40 studies were included: 33 cross-sectional and 7 case reports, and overall, 10,228 patients (4,288 males, 5,770 females, and 170 unknown) from 19 countries were assessed. Gustatory impairment was the most common oral manifestation reported, with a prevalence of 45%. The data for different taste disorders were 38% for dysgeusia and 35% for hypogeusia, while ageusia had a prevalence of 24%. Almost all studies diagnosed taste disorders through in-person, online, or phone call questionnaires, except the study by Vaira, Hopkins, Salzano, et al. (2020), who conducted a standardized and validated study. (Table 1)

Table 1: Taste disorder characterization in pateints with Covid-19 (n=33 cross sectional studies)[10]

Study	Taste Disorders, %			Period of Appearance	Duration, d, Mean±SD (Range)	TD Diagnosis Method
	Dysgeusia	Hypogeusia	Ageusia			
Aggarwal (2020), United States	19					
Beltran-Corbellini (2020), Spain	10.1	8.8	17.7	First symptoms in 11 (35.5%)	7.1 ± 3.1	Questionnaire applied by phone
Bénézit (2020), France		62				Questionnaire applied online
Carignan (2020), Canada	63.4		50.7			Questionnaire applied by phone
Chary (2020), France		31.3	31.3		15 (4 to 27)	Questionnaire applied by phone
de Maria (2020), Italy		50.5		Occurred early (within 5 d from onset of fever)		Questionnaire applied in personal
Dell'Era (2020), Italy		66.4		First symptoms in 31 (13.3%)	10 (2 to 25)	Questionnaire applied in person or by phone
Gelardi (2020), Italy	72.2			Mean 2.8 d (range, 1 to 4) before the respiratory symptoms	16.1 (7 to 22)	
Giacomelli (2020), Italy	15.2		13.55	Before hospitalization in 91% of patients		Questionnaire applied in person
Kim (2020), South Korea		33.7		First symptom in 44 (28.6%)		Questionnaire applied in person
Klopfenstein (2020), France	85.1					Recorded medical files
Kluytmans-van den Bergh (2020), Netherlands		7				Questionnaire applied in person
Lapostolle (2020), France			28			Questionnaire applied by phone
Lechien (2020), Belgium,	21.1	78.9				Questionnaire applied in person or by phone
Lee, Lockwood, (2020), Canada		57.1		First symptoms in 26 patients (46.4%)		Questionnaire applied online
Lee, Min, (2020), South Korea			13.05		6.0 (3.0 to 10.0)	Questionnaire applied by phone
Levinson (2020), Israel	33.3			Mean 3.3 d after illness onset (range, 0 to 7 d)	7.1 (0 to 7)	Questionnaire applied online or by phone
Liguori (2020), Italy	46.6			More frequent on patients interviewed after the 7th day of hospitalization		Questionnaire applied in person
Mao (2020), China		5.6		Median onset until hospital admission: 2 d (range, 1 to 5)		Recorded medical files
Meini (2020), Italy		41			32	Questionnaire applied by phone
Mercante (2020), Italy		55.4				Questionnaire applied by phone
Merza (2020), Iraq		26.7				
Noh (2020), South Korea			22.6		7.5 ± 5.6	Questionnaire applied in person
Pademo (2020), Italy and Sweden		63.1		First symptom in 57 (11.22%), delayed symptom in 451 (88.7%)	Complete resolution: Questionnaire applied in person 9.2 ± 5.4; ongoing disorder, 12.4 ± 6.8	
Patel (2020), United Kingdom			63.1		Questionnaire applied by phone	
Romero-Sánchez (2020), Spain	6.2			Fist symptom in 31 (60%)	Recorded medical files	
Sayin (2020), Turkey	25	56.3	12.5	First symptom in 14 (30.4%)	Questionnaire applied in person	
Sierpinski (2020), Poland		47.5			Questionnaire applied by phone	
Speth (2020), Switzerland and United States		25.2	39.8		Questionnaire applied by phone	
Sultan (2020), United States		10				
Vaira, Hopkins, Salzano (2020), Italy		34.5	10.4	Taste disorders were more frequent on days 0 to 4 of the disease	191 of 256 (74.6%) Standardized and validated test followed up presentedusing prepared solutions≤7 d of chemosensitive symptoms duration	

The Odds Ratio (OR) analysis showed a positive association between taste disorder symptoms and COVID-19, with an OR of 12.68; $P < 0.00001$. These results confirm that taste disorders may be a significant and specific symptom of mild/moderate COVID-19 cases. Taste disorders, as easily and early detectable symptoms would allow mild/moderate case identification and self-isolation orientation; thus, they can directly contribute to contain the quick spreading of the disease, especially in countries having reduced testing capability.[10]

DISCUSSION

Although the pathogenesis of taste disorder in patients with COVID-19 is not entirely understood, several hypotheses have been formed (Finsterer and Stollberger 2020; Mariz et al. 2020; Vaira, Salzano, Fois, et al. 2020). Finsterer and Stollberger (2020) highlighted the possibility of a local inflammatory response resulting from rhinitis triggers, which could hamper taste buds' normal function. However, the occurrence of signs and symptoms of nasal mucosal inflammation is unnecessary for taste impairment in patients with COVID-19. Nonetheless, patients with COVID- 19 present taste disorders even without smell dysfunction since the prevalence of taste disorders are frequently higher. Another questionable hypothesis of taste disorder as a side effect of certain drugs for COVID-19 treatment is analyzed. The association between taste disorders and mild to moderate cases corroborates Finsterer and Stollberger's (2020) conclusion that these symptoms also occur in patients with COVID-19 who did not use the drug. The interaction of SARS-CoV-2 and gustatory components and ACE2 receptors supports a direct effect in COVID-19– related taste disorders, and as cranial nerves innervate gustatory buds, related functions may be impaired, resulting in taste disorders.[11] The SARS-CoV-2 may bind essential salivary mucin components, such as sialic acid, consequently accelerating taste particle degradation and disturbing gustatory sensation.[12] The tongue presents a high expression of ACE2[13], and its interaction with SARS-CoV- 2 might affect normal gustatory functions through the dopamine and serotonin synthesis pathway coregulation.[14] Besides, ACE inhibitors and ACE2 blockers are associated with impairment of taste sensation.[15] These drugs play a role in taste disorders by G protein-coupled and sodium channel inactivation.[16] Similar to patients with COVID-19 experience after infection recovery, there is a regression of the gustatory sense effect by ACE inhibitors a few weeks after discontinuation. Furthermore, ACE2 high expression was demonstrated in rats' taste buds associated with the production of angiotensin II in mice taste buds. The disorderly taste responses are suggested to be a result of the inability of ACE2 to degrade this protein during COVID-19 infection .[17,18]

COVID-19- A PERIODONTAL VIEWPOINT…

The SARS-CoV, with its spike mediated entry into target cell through ACE-2 receptors, affecting lungs is the etiopathogenesis for COVID-19. Pascolo et al. (2020) demonstrated that the associated expression of ACE-2 and trans-membrane serine protease TMPRSS2 in salivary glands are required to facilitate the virus into the cell. Saliva lodges numerous SARS-Co Viruses, and a periodontal pocket is in its close vicinity. Breach of the pocket epithelium results in direct contact of the virus and activation of the host immune response with the release of pro-inflammatory cytokines like CL8, CXCL10, C3a, C5a stimulating macrophages, granulocytes, and natural killer cells, which releases IL-1β, IL-6, IL-8, TNF-α, IFN-γ. These aggravate the pocket formation by downward displacement of the junctional epithelium. "Focal infection theory" by William Hunter states that oral foci of infections spread through the bloodstream and affect systemic organs. In SARS-CoV-2 infection, the primary pathology behind the lung damage is "Cytokine storm" or "Macrophage activated syndrome," which is auto-amplifying cascades of host immune response. ACE-2 receptors in the lungs aggravate the entry of SARS-CoV-2 and activate cytokines damaging the respiratory epithelium and lung parenchyma. Cytokine storm, in turn, suppresses the innate and adaptive immunity against SARS-CoV-2. IL-6 and TNF-α] are noticed to increase excessively in severely ill hospitalized individuals. Thus, a hypothesis based on this is a relationship of COVID-19 to periodontal pocket wherein the cytokine responses happen to be common. The increased cytokines in the periodontal

pocket could further aggravate the COVID-induced destruction of the lungs. Future research focusing on this issue could prove the hypothesis's authenticity and highlight the importance of a periodontists managing the deadly virus.[12]

CONCLUSION

Even in a small number of reported studies, taste alterations are the most prevalent reported oral manifestation. These findings have highlighted the possible development of dysgeusia and anosmia early in the course of SARS-CoV-2 infection; therefore, these manifestations should be considered a disease marker by dentists working in the frontlines of the pandemic. Taste disorders like ageusia, even though not life threatening, may have a severe psychological impact on the patient.

The osseous lesions associated with Covid-19 have a very fast spread and grievous after-effects. Resection of a major part of the jaw can create high levels of psychological and physical trauma for the patients. This additional trauma in these already testing times can cause an overall burden on the patient's day-to-day life. Hence along with treatment of the oral lesions, the patients should be provided with psychological support associated with the disability. In these challenging times, it is pertinent for dental professionals to consider the patient's overall physical and mental health.

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Aesthetic veneering materials and systems: A Comprehensive Review

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Abstract:

Objective: The clinician must choose the restorative material depending on its composition, optical properties, strength and fabrication processes. This article offers a systematic overview of advanced ceramic materials and technologies, their thorough understanding and effective clinical use.

Overview: Porcelain laminate and veneers have received a substantial attention over the last several decades as one of aesthetic dentistry's most popular restorations. By the advent of new materials and techniques based on aesthetic potential and functional reliability of available bonding procedures, laminates have shown reliability in treatment of defects of teeth with respect to malformations, malposition, discoloration, spacing, fractures and wear of tooth structure. One of the most critical factors for the clinical success of ceramic laminate veneers is the appropriate case selection and choice of material to restore aesthetics.

Conclusion: Porcelain laminate veneers have proven to be restorative technique that offers high clinical success and have predictable patient outcome. Effective provision of veneers requires selection of ideal material ensured by preoperative planning and design, use of advanced and minimally invasive technique, characteristics and properties of materials which should complement clinical requirement.

Keywords All-Ceramic material, Ceramic veneers, Dental Ceramics, Laminate Veneers, Porcelain laminate veneers, Esthetic Restoration.

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INTRODUCTION:

A winsome smile comes up with a self-confidence, personality, social life, and psychological effects in an individual. The growing demands of patient for the tooth-colored restorations, as well as a more alluring smile, has now passed the boundaries of exclusive clinicians.[1] Based on their strength, conservative nature, longevity, aesthetics, and biocompatibility; veneers have been considered one of the most viable treatment modalities as anterior and aesthetic restoration.[2] This has led to its use in the anterior region where more conservative approach can be used to enhance the aesthetics. Dr. Charles Pincus in 1930's introduced thin porcelain veneers to enhance the appearance of the teeth.[3] A porcelain laminate veneer is a thin shell of porcelain applied directly to the labial surface of tooth structure which requires minimally invasive tooth preparation.[4]

Indication for laminate veneers includes teeth discolorations, non-aesthetic tooth shape or contour requiring morphologic modifications, diastema closure, minor tooth alignment, dental fluorosis with enamel mottling, slight chippings, or fracture of teeth. Patients presenting with unfavorable

conditions for laminate veneers are anterior deep bite, severe bruxism or other para-functional habits, presence of any soft tissue disease, severely malpositioned teeth, and teeth with extensive existing restorations. Evaluation, diagnosis, treatment planning of case is necessary as it will determine the treatment goals, which in turn will dictate the choice of material and technique.[5]

Wide ranges of materials are available in the market to restore aesthetic/functional defects such as porcelain, resin composite. Each type of material has its distinctive composition, optical characteristics, and fabrication process.[6] several techniques have been developed to fabricate and adapt porcelain as laminate and veneers. Successful bonding of the luting material to both the restorative material and the tooth structure is crucial for the retention and longevity of the restoration.

This article explores the current literature on porcelain laminate veneers and provides clinicians the basis for selecting the suitable application and acknowledging their clinical limitations.

2. Indication ceramic veneers

Magne and Belser presented classification for indications of ceramic veneers as follows:[7]

Type I: Teeth resistant to bleaching

1. Type IA: Tetracycline discoloration
2. Type IB: Teeth that are unresponsive to bleaching

Type II: Major morphologic modifications

1. Type IIA: Conoid teeth
2. Type IIB: Diastema or interdental triangles to be closed
3. Type IIC: Augmentation of incisal length or facial prominence

Type III: Extensive restorations

1. Type IIIA: Extensive coronal fracture
2. Type IIIB: Extensive loss of enamel by erosion and wear
3. Type IIIC: Generalized congenital malformations.

3. Glass based ceramics:

3.1. Feldspathic porcelain

Traditionally feldspathic porcelain is used for layering veneers and metal substructures.[8] Feldspars are primarily composed of silicon oxide (60%–64%) and aluminum oxide (20%– 23%) and are typically modified in a different manner to create glass that can then be used in dental restorations.[3]

Properties

Feldspathic veneers are generally the most conservative and the most translucent of all-ceramic material, containing silica dioxide (60-64%) and aluminum oxide (20-23%).[8] Its lower mechanical properties and its poor flexural strength ranging from 60 to 70 MPa makes it more susceptible to fracture under mechanical stress because of the high volume of glass particles.

They are indicated in patients where no or minimal tooth preparation is required, including teeth that have: diastema closure, malalignment anterior teeth, fluorosis with enamel mottling and tetracycline stains. They are used when enamel reduction is 0.3 to 0.5 mm or require minimal preparation. The feldspathic veneers present limitations to counteract severe staining, in such situations, additional removal of tooth structure was proposed and required using sub-layer of opaque composite below the layer of translucent porcelain veneer.[9]

Advantages of feldspathic porcelain to fabricate ceramic laminate veneers:

1. Reproducibility of natural tooth color with a thin layer of material,
2. Low laboratory cost
3. Excellent mechanical retentive characteristics after etching with hydrofluoric acid and the presence of an adequate amount of enamel.
4. Superior bonding characteristics with the use of suitable silane bonding agents

Two techniques are used for fabrication of feldspathic porcelain:

1. Refractory die technique

The advantages of the refractory die technique are: No special equipments are required; extremely smooth effects of color and translucency can be obtained through a full-thickness layering technique.

2. Platinum foil technique.

The advantage of the platinum foil technique is that it presents as the closest alternative to the refractory die technique and requires less effort in cast fabrication. Besides, data from the early 1990s repeatedly showed the superior marginal fidelity of platinum foil veneers.[10]

Cementation protocol

The prepared tooth surface is etched with 37% phosphoric acid followed by rinsing with spray and gentle drying and then a thin layer of dental adhesive is applied. The inner surface of prepared feldspathic ceramic etched with 9% hydrofluoric acid for two minutes, immersed in an ultrasonic bath with distilled water. A silane coupling agent applied for 2 minutes and heated with a dryer, a thin layer of adhesive is applied. Finally, cement is placed inside the veneer and placed on the teeth with even pressure.[9]

3.2. Reinforced glass-ceramic restorations

They are similar to feldspathic ceramic in many ways. As compared to feldspathic ceramic, they have improved strength due to proper filler particles that are evenly dispersed throughout the glass. The clinical use of glass-ceramic depends on the type of filler particles.

Properties

Glass-ceramics as compared to feldspathic porcelain have enhanced mechanical fracture resistance, better thermal shock insulation, and resistance to corrosion.[7] Its mechanical properties depend on the size and amount of crystals as well as on the interaction of the crystals and glassy matrix. Glass ceramics may be opaque or translucent depending on the chemical composition and amount of crystals embedded in the matrix.

They have enhanced flexural strength, which depends on the shape and volume. The resistance to flexion of reinforced leucite ceramics and lithium dioxide is 160-300 MPa and 320-450 MPa respectively.[11]

Based on type of glass and its mechanical behavior; the reinforced glass ceramics particles subdivided into two types: [8]

1. Glass-ceramics reinforced with leucite
2. Glass-ceramics reinforced with lithium disilicate

Leucite and lithium are preferred material to fabricate veneers because of their optical properties and acid-sensitive feature. They have a low refractive index of crystals, due to which they become translucent even with high crystalline content.[11] Glass-ceramics are fabricated from lost wax technique and heat pressing methods. In heat pressing method, the restoration is first waxed-up and invested; the ingot is then made using ceramic sintered. Sintered ceramic is softened and pressed into a mould under pressure. The shades of the ingot provide the required shades which can be modified by staining.[10] These materials can be also fabricated using CAD/CAM technology and are available in the form of monochromatic or multicolored.[11]

3.2.1. Glass-ceramics reinforced with leucite

Leucite reinforced glass ceramics (IPS Empress-Ivoclar Vivadent) contains 50% - 55% of crystal material. The refractive index of leucite is very close to feldspathic ceramics.

Cementation protocol:

The enamel of the prepared teeth should be cleaned using flour of slurry pumice, washed with water, and air-dried. The prepared teeth surface to be etched with 37% phosphoric acid for 15 s; then dentin adhesive to be applied in thin layer for 15 sec and air-dried for 3 sec. Leucite reinforced ceramics have a faster rate of etching than basic glass ceramics, these features allow for resin cement to create a strong micromechanical bond.[11] The inner surface of the ceramic veneers was to be etched with 9% hydrofluoric acid for 4 min, washed thoroughly with water, and air-dried, A silane coupling agent is applied on inner surface of leucite glass ceramic for 30 sec and gently air-blown. A thin layer of bonding agent is applied and air- dried. The cement should now be applied evenly to the inner surface on ceramic and placed on the teeth surface.[12]

3.2.2. Glass-ceramics reinforced with lithium disilicate

Lithium disilicate (IPS Empress II—Ivoclar Vivadent) are glass-ceramics containing 70% of crystal. Its hardness ranges from 360 - 500 MPa. Indication of Lithium disilicate are intrinsically discolored teeth and teeth that required change in shape, size, and color. They possess properties as high fracture resistance, hardness, provide translucency, aesthetic appearance, chameleon effect.[8]

IPS e.max Press (Ivoclar Vivadent) was introduced in 2005 with improved physical properties.[11] IPS e-max PRESS as compared to IPS Empress and IPS Empress

II have different crystalline volume and refractory index and exhibits more translucency.

Cementation protocol

The prepared teeth surfaces should be polished and rinsed and etched with 37% phosphoric acid gel for 15 secs followed by rinsing and gentle drying. The bonding agent to be applied on the etched teeth surfaces for 20 seconds. The inner surface of the ceramic laminates to be etched with hydrofluoric acid-containing gel, rinse with water, A silane coupling agent should be applied, and left to dry. After drying, self-adhesive resin cement should be applied to the inner surface of the laminates, and gently pressed on to the teeth.[5]

4. Alumina based ceramics

The aluminium oxide was the first high strength core ceramic material. They have less glass content, so also called as glass infiltrated aluminum-oxide ceramics. Alumina based ceramic materials are classified into two types i.e. In-Ceram porcelains and Procera All Ceram.

4.1. In-Ceram porcelains

In-Ceram porcelains are fabricated through the slip-casting technique, during firing the die shrinks so it can be withdrawn from the core. At this stage, the core is a weak, porous structure, to improve the strength outer side of the core is painted with a slurry of lanthanum containing glass and refiring it. According to composition, they are divided into In-Ceram Spinell, In-Ceram alumina and In-Ceram zirconia.

4.1.1. In-Ceram Spinell

In-Ceram Spinell was an alternative to the opaque core of In-Ceram Alumina. They have enhanced translucency due to a mixture of magnesia and alumina ($MgAl_2O_4$) in the framework. They have low flexural strength as compared to In-Ceram Alumina, thus recommended for only anterior crowns.

4.1.2. In-Ceram Alumina

In-Ceram alumina was introduced in 1989. They contain 85% aluminium oxide particles. Its resistance to flexion ranges from 400 - 600 Mpa. In-Ceram Alumina ceramics as compared to leucite reinforced glass ceramics and conventional feldspathic have a higher strength and fracture toughness.

4.1.3. In-Ceram zirconia

In-Ceram Zirconia is manufactured using 67% aluminium oxide and 33% partially stabilized zirconium oxide. In-Ceram Zirconia as compared to In-Ceram Alumina has higher fracture toughness and resistance to flexure. Its flexural strength ranges from 600 – 800 Mpa. They have an opaque core that lacks translucency.

4.2. Porcera All-Ceram

Procera is fabricated from copings that contain 99.9% high purity aluminum oxide. These copings are coated with conventional aluminum ceramic. Procera as compared to glass and In-Ceram ceramics have high strength, but its strength is lower than zirconia-based ceramic.

Surface treatment: The inner surface of ceramic abraded with air particles with 50- micrometer aluminium oxide powder at 7 pounds per square inch; later adhesion agent should be applied to contain MDP and dried.

5. Zirconia based ceramics:

Ceramics based on zirconia are polycrystalline material and does not contain glass. The polycrystalline ceramic atoms are compressed into uniform crystalline clusters that form a matrix that is more resistant to cracks compared to less structured and erratic glass networks. Zirconia has high crystalline content and it exists in three crystallographic forms: monoclinic, tetragonal, and cubic phases. Yttria is used to stabilize ceramics in the tetragonal phase.[13] They have high fracture resistance compared to those associated with lithium disilicate and feldspathic veneers and have ability to mask the dark substrate.[14]

Recently, zirconia ceramics having better translucency without significantly losing their property of fracture resistance are introduced. Thus, translucent zirconia is indicated for single crowns, anterior and posterior monolithic fixed prostheses, and veneers and ultrathin veneers. The conventional zirconia contains 0.5%-1.0% of alumina and 3%-6% of yttrium oxide in its weight. Whereas translucent zirconia containing 0.11% to 0.26% alumina and 12% of yttrium oxide in its weight. The strength ranges from 900 to 1200 Mpa and 500 to 800 Mpa for

tetragonal (opaque) zirconia and cubic ultra-translucent zirconia respectively.[15]

Zirconia is less retentive as compared to that of the glass-ceramics, for this reason, many surface treatments have been proposed to modify the surface of zirconia and to optimize adhesion to resin cement. The various surface treatments are: sandblasting with aluminum oxide, cement containing 10-methacryloxydecyl dihydrogen phosphate (MDP) monomer, tribochemical silica coating followed by salinization, feldspathic glass infiltration, selective infiltration etching technique, glaze-on technique, and heating of silanes. Among these treatments, silica coating has presented with some of the best bonding results.[15]

Cementation protocol

The tooth surface is cleaned with pumice and water, and then rinsed and thoroughly dried. Later tooth surface should be etched with 35% phosphoric acid for 20 seconds, rinsed and dried. This surface is ready to be treated with an adhesive system. The intaglio surfaces of the ceramic needs to be abraded with particles of aluminum oxide coated with silica for 20 seconds (2.8 bar, 10-mm standoff distance) and dried to increase surface bonding. Silane should be applied and left to dry for two minutes. Later adhesive agent should be applied without curing. Resin cement is applied to ceramic material and gently pressed on to the teeth. Glycerin gel is applied immediately after removal of excess resin cement to prevent oxygen inhibition layer.[15]

6. Choice of ceramic material according to clinical situation

Two factors are considered for selecting the correct ceramic materials:

1. Effect of functional loading
2. Shade selection

6. 1. Effect of functional loading

High fracture resistant ceramic material is to be used in the maximum functional load tooth surface. The higher tensile and shear stress occurs in case of deep overbites, diastema closure and teeth with chipping or fracture due to the presence of unsupported porcelain, due to bonding veneers to more flexible substrates such as dentin and composite etc. In such cases, the choice of materials is high strength ceramics like alumina-based ceramics and zirconia-based ceramics.[16] In the case of parafunctional habits such as bruxism, choice of ceramic material is monolithic zirconia.[17]

According to Dawson, Anterior guidance restores the functional form through increased anterior relationships. Disocclusion created by anterior guidance plays a very important role in protecting the posterior teeth from protrusive and lateral stresses. Porcelain veneer restorations can be considered as ideal restorations for the corrections of poor anterior relationships and anterior-guidance. Restorations improve the anterior relationships for optimum guidance as well as occlusal maintenance that may require a modification of maxillary anterior teeth morphology. This is achieved by:[18]

1. Modify the palatal surface to correct insufficient horizontal parameters.
2. Incisal lengthening with modified palatal morphology to correct insufficient vertical parameters following the incisal wears.

Unfavourable anterior guidance leads to anterior alveolar bone loss and teeth mobility when there are susceptible periodontal tissues and excessive forces. For the achievement of ideal aesthetics by restoring suitable forms and dimensions should be combined with the re-establishment of correct function.[19] The material used for restoring anterior guidance should have high fracture resistance and tensile strength.

6.2. Shade selection

Shade matching is as much an art as a science. For the restoration of the anterior teeth, the most critical factor is that the shade of the replaced tooth should match to adjacent natural tooth. The improper shade selection is the second most common reason for the remake of a ceramic restoration. The oldest method of shade selection is a visual analysis using a commercial shade guide. Another system for shade selection is with the help of instruments. The commonly used instruments are: spectrophotometer, spectropolarimeter, colorimeter, spectroradiometer, and digital camera.[20]

The final color of ceramic restorations depends on many factors such as the thickness of the porcelain veneer, color, and extent of the luting agents and the color of the underlying tooth structure.[21] Translucency is a common, varying phenomenon

among ceramics. Clinicians usually face difficulty in shade selection and replication of optical properties comparable to those of highly translucent adjacent natural teeth, particularly when the prepared teeth are severely discolored. The amount of reflection and scattering of light affects the translucency of ceramic material and influences the shade of final laminate veneer restoration.[22] The amount of light that is absorbed, transmitted, and reflected depends on the chemical nature and size of the particles within the core material.

As translucency has improved with lighter ceramics, it is difficult to disguise the underlying dark tooth structure, and therefore the color match in porcelain laminate veneers is more complicated. Sadaqah et al.[11] classified the patient into two categories for a correct selection of ceramic material with color consideration.

a) Type I patients: These types of patients receive aesthetic changes where teeth present no color alternations. The only aim in these cases is to apply porcelain laminate veneers for shape modifications.
b) Type II patients: These types of patients receive aesthetic changes, and the teeth present color alternations. Restorative material must be able to hide the underlying teeth color.

A. Type I patients

In type I patients, a new aesthetically pleasing external surface is bonded to the tooth without changing the tooth color. The choice of material is conventional feldspathic ceramics due to their excellent optic characteristics that will afford optimum aesthetic results.[11] Generally, feldspathic porcelain materials are indicated where the restoration replaces enamel and minimal preparation within the dentin is done. For example, teeth that have deformed shapes or contours and lack of size and volume, malpositioned teeth, requiring morphologic modifications; diastema closure, alignment of the anterior tooth, restoring localized enamel malformations, and fluorosis with enamel mottling. If tooth reduction is more than 0.5 mm, in such a situation, glass-ceramics should be considered instead of feldspathic ceramics due to their increased strength and toughness, as well as provide enough scope to achieve the desired aesthetics.

B. Type II patients

In these patients, the teeth show moderate to severe discoloration that must be masked by restoration. Less translucent core material should be considered for discolored teeth.[11] In such situations, both the porcelain and cement must provide various degrees of opacity to hide the color alternations. This, in turn, creates difficulty to secure the desired optic effects in terms of translucency and reflectance and consequently aesthetic outcome.[9] Another factor is modification in dental preparation (0.8 - 1mm) and finish line (slightly subgingival). The choice of materials is ceramics that offer the possibility of selecting the opacity of the base material.[9]

The zirconia laminate veneers have an opaque nature. It offers an advantage over traditional feldspathic and glass-based ceramics in masking undesirable tooth color. The color difference between the zirconia core and the adjacent natural teeth should be reduced through the layering technique for the veneering porcelain.[11]

7. Luting agents

The shade of the luting agent also affects the color masking ability of the veneers. Currently, the varieties of shades of resin cement are available for luting ceramic veneers.[21] Luting agents are classified into 3 types depending upon the activation system. They are chemical- cured, light-activated resin cement, and Dual-cured resin cement. The shade of resin cement is determined by the different amounts of opaque ingredients in cement. There may be color difference in final porcelain laminate veneers because of different shade of resin cement.[23] Before cementation, Ceramic veneers should be tried in using a transparent shade try-in paste to assess marginal adaptation and shade. Various try-in pastes available and these are Variolink Veneer try-in paste, Ivoclar Vivadent, Schaan, Liechtenstein etc.[24]

Chemically polymerized resin cement does not provide appropriate shade and translucency; therefore are not used for laminate veneers. Nowadays for the cementation of PLVs, a light-curing luting composite is preferred. It is indicated

when the ceramic is thin and fairly translucent, allowing the transmission of light through it to reach the resin cement.[25] Light- cure composite cements as compared to dual-cure or chemically cured composites have longer working time. This allows sufficient time to remove excess composite before curing and thus reduces the finishing procedures. Light-cure composite has much better color stability compared to dual-cure or chemically cured composites because of the absence of the aromatic amine as a self-curing catalyst.[26]

Dual-polymerized resin cement is indicated where the ceramic material is thick or opaque to allow transmission of light through it.[25] They have superior mechanical properties such as flexural strength, hardness, elastic modulus, and degree of conversion as comparison to light- activated or chemical curing. Dual cure resin cement contains tertiary amines that compromise the color stability (amine discoloration); thus, they are normally contraindicated with thin and translucent porcelain laminate veneers.[26] In the case of ceramic with a thickness of more than 0.7 mm, light-cured resin composites do not reach their maximum hardness. In these situations, a dual-cured luting composite is advisable.[11]

8. Discussion

Over the last three decades, dentistry has undergone an evolution of all ceramic systems for aesthetic rehabilitation. Conventional feldspathic porcelain was considered the best material for providing optimum aesthetic results for porcelain veneers for many years.[27]

In recent years, developments in dental ceramics has resulted in higher-strength porcelain, but such products appear to have limited translucency. In a given clinical scenario, the question is how much translucency is required. Various ceramic systems developed for porcelain veneers have differing degrees of translucency, and traditional feldspar porcelain is the most transparent of them, and the texture and shade of lithium disilicate ceramic influence its translucency; nevertheless, the thickness has the most significant effect. Translucent ceramics are indicated in full coverage and partial coverage crowns. They are aesthetic but have properties that are weaker in strength. Opaque ceramics are stronger and lack translucency. Hence, are not sensitive to the shade of luting cement.[28] Examples of translucent materials include traditional sintered feldspar porcelain produced from refractory dies or platinum foil, pressable ceramics (e.g., IPS Empress Esthetic) and some in-office machinable ceramics produced from computer-aided design / computer-aided manufacturing (e.g. Vitablocs Mark II).[29] On the opposite, Silva et al[30] stated that the lithium disilicate glass-ceramic crown (IPS E-max CAD) offers a higher fatigue load to exceed the failure value than the zirconium oxide crown (Y-TZP). An early veneer failure of IPS E-max ZirCAD was found in another study which also compared the fatigue behavior of the monolithic disilicate lithium against the veneered Y-TZP crown (IPS E-max ZirCAD).[31] One of the most common problems triggered by the restoration of zirconium is the chipping or fracturing of veneering ceramics.[32] The lithium-disilicate restoration, on the contrary, can be fabricated without the need for ceramic veneering as a single unit (monolithic). No significant differences in marginal adaptation were found. IPS E-max Press and IPS E-max CAD using extra-oral digital impression technique, whereas significant differences were encountered when IPS E-max CAD was fabricated using two different intraoral digital impression techniques.[33] Study conducted by Tidehag et al[34] observed fabricated by CAD/CAM technique had better marginal fit than prosthesis fabricated by lost wax technique. Anadioti et al[35] had the contradictory results showing marginal fit was better with IPS E-max Press as compared to than IPS E-max CAD.

Alkadi and Ruse et al.[36] conducted a comparative study on the fracture toughness of pressable IPS E-max and machinable IPS E-max according to the type of manufacturing process. The result showed that lithium disilicate which was fabricated by press technique and CAD-CAM technique has 400 Mpa and 360 Mpa of facture toughness, respectively.[37] Lower mechanical properties of machinable IPS E-max are due to reduces crystal size and crystal phase of lithium disilicate. Pressable IPS E-max has a high survival rate for thineers, partial and full veneer crowns, no-prep veneers. Machinable IPS E-max are indicated for inlay, onlay, partial coverage crowns, anterior and posterior crowns. An approach to

CAD/CAM machining 40% partially crystalized lithium metasilicate in the lithium silicate system increased flexural strength and resulted in less shrinkage of material. Consequently, lithium disilicate behaved perfectly with no fracture, chip or sensitivity. These findings offer many benefits for the restoration of natural teeth.[38]

9. Conclusion

A correct diagnosis and a multidisciplinary treatment plan are essential to improve the treatment prognosis and patient satisfaction. The use of porcelain laminates to improve smiles with aesthetic or functional problems has presented as recommended option. Clinicians must be aware of different types of all-ceramic material that are available in the market, have knowledge about the different ceramic system, characteristics, and properties of the material, in order to offer the suitable, esthetic and long-lasting cosmetic treatment.

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NANO TECHNOLOGY: AN UPDATE IN MAXILLOFACIAL SURGERY- A REVIEW

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Abstract:
Nanotechnology has been defined as "the creation of functional materials, devices and systems through control of matter on the nanometer scale (1-100 nm), and exploitation of novel phenomena and properties (physical, chemical, and biological) at that length scale. The generally recognized nanotechnology categories include diagnostics, imaging, medical devices, drug discovery, drug delivery, and regenerative medicine. 'Nanotechnology' influences almost every facet of everyday life, from security to medicine. Nanomedicine can offer impressive resolutions for various life-threatening diseases. This article discusses the inception of nanotechnology, its advantages, disadvantages, and its application in the field of oral & maxillofacial surgery.

Keywords: Nanotechnology, Nano-medicine, Oral& Maxillofacial Surgery.

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INTRODUCTION:

Richard Feynman (1959) introduced the concept of nanotechnology. Nanotechnology is defined as it is technology as well as research development at the atomic, molecular, or macromolecular levels; on the scale of approximately 1 to 100-nanometer scale; to provide a fundamental understanding of phenomena and materials at the nanoscale; and to create and use structures, systems, and devices which have novel properties and functions because of their small and/or intermediate size.[1]

Although nanotechnology is a relatively new field, there are many applications in use or under investigation. Different specialties have benefitted from nanoscale refinements of diagnostic and therapeutic techniques. Oral & Maxillofacial Surgery is a diverse specialty encompassing trauma, oncologic and congenital reconstruction; Implantology, and aesthetic surgery. Currently, Maxillofacial Surgeons are researching the utility of nanoscale devices for drug delivery, bone regeneration, soft tissue repair, cancer treatment, nerve repair.

This article discusses the inception of nanotechnology, its advantages, disadvantages, and its application in oral and maxillofacial surgery.

DISCUSSION:

Due to the high surface area to volume ratio, nanoparticles provide mechanical, optical, chemical, and magnetic properties superior to the original materials.

Types of nanoparticles-

Nanoparticles are divided into three categories-

1) Fullerenes-These are the carbon allotropes that can adopt different shapes, such as carbon nanotubes. The cylindrical shape of a nanotube is derived from the hexagonal lattice of carbon atoms, forming a sheet that can be rolled up. This molecular arrangement provides considerable stiffness and tensile strength (50 times stronger than steel). When combined with an anti-thrombogenic surface, carbon

nanotubes are suitable for applications such as vascular microcatheters and implants.[2]

2) Quantum Dots (QD's)- Semiconductor quantum dots (QDs) are emerging as a new class of fluorescent labels in the era of maxillofacial surgery for imaging and the treatment of tumors. In comparison with organic dyes and fluorescent proteins, these tiny light-emitting particles have unique optical and electronic properties, with superior signal brightness, resistance to photobleaching, and broad absorption spectra for simultaneous excitation of multiple fluorescence colors. QDs also provide a versatile nanoscale scaffold for designing multifunctional nanoparticles with both imaging and therapeutic functions.[3]

3) Nanocomposites- The nanocomposites are multiphase solid materials where one of the phases has one, two, or three dimensions of up to 100 nm diameter. In tissue engineering, scaffolds are made up of nanoparticulate fillers, distributed between layers to increase surface area for the interaction of components. Different Fillers are silicones, nanoclays, carbon nanotubes, and polyhedral oligomeric silsesquioxane (POSS), synthetic nanocomposite. Polyhedral oligomeric silsesquioxane has superior physical properties such as oxidative resistance to the composite and mechanical strength. These properties of POSS increase the ability of the nanocomposite to support cell adherence and growth, making it ideal for tissue engineering.[2,4]

Programming of nanotechnology

Nanotechnology can bring tremendous changes to the fields of maxillofacial surgery with the aid of nanorobotics, nanomaterials, and biotechnology. The diameter of Nanorobots ranging from 0.5–3 µm, and these are made of components size ranging from 1 nm up to 100 nm in diameter. They can be programmed by clinicians, thus enabling clinicians to execute accurate procedures at the cellular and molecular levels.[5]

Different Applications of nanotechnology in Oral and Maxillofacial Surgery:

1. Drug delivery-Nanoparticles have a very small size; because of that, they can penetrate some barriers that cannot normally be crossed by larger microparticles and thereby reduce systemic toxicity.[6] Deep tissue infection with multiple drug-resistant organisms coupled with the morbidity of serial operations and potentially toxic systemic therapies can be overcome by a nano-drug delivery system.

2. Nerve tubulization-

Nerve regeneration is an area of special interest to both maxillofacial surgeons and nanotechnology researchers. Traumatic nerve injuries results in loss of nerve tissue more than 5 mm frequently require nerve grafting, often from an autologous source.

Nanoscale manufacturing techniques have been employed to avoid the morbidity of autologous nerve grafting and to develop new techniques for the repair of the peripheral nerve. To guide the regenerating nerves tubular and porous nanostructured conduits, using various natural materials, have been developed. To aid in regeneration, these structures have been loaded with various biomaterials or cell types such as embryonic stem cells, Schwann cells, neural stem cells.[5]

Wang et al. studied Chitosan nanofiber mesh tubes in sciatic nerve injuries in a rat model, in which they found the partial recovery of sensory function as the nerves elongated through the tubes.[7]

3. Soft tissue repair and healing-

Wound healing can be improved by wound dressings constructed using nanoscale fabrication techniques. In rat models, scaffolds made up of collagen nanofibers accelerate acute wound healing by enhancing capillary and fibroblast proliferation.

In a study by Choi et al., immobilized recombinant human epidermal growth factor (EGF) on electron biodegradable nanofibers to cure the diabetic ulcers in a rat model.[8]

Chitin and chitosan nanofibrils are the nanocrystals obtained from the skeletons of the crustaceans. These fibrils have been used in different formulations to assist wound healing. Muzzarelli et al. showed in murine models that different formulations of chitin nanofibrils almost lead to normal physiologic repair of wounds.[9]

4. Bone regeneration-

For bone regeneration, the induction of progenitor cells into osteoblasts is an important component. The novel application of nanotechnology uses specific

nanoscale surfaces to produce specific cellular responses, such as osteoblastic differentiation.

Oh et al. studied the effect of culturing human mesenchymal stem cells (hMSC) on Titanium Oxide nanotubes ranging from 30 nm to 100 nm in diameter. They found that the larger nanotubes cause the elongation of human mesenchymal stem cells and consequently encouraged differentiation into osteoblastic cell lines. This technique could improve the previous methods of osteoinduction that involve gene therapy.[10]

5. Cancer treatment-

Quantum dots and Colloidal gold Nanometer-sized particles have size-tunable properties that neither discrete molecules nor bulk materials can provide.[3] These particles have properties like the potential for tumor localization, mapping of sentinel lymph nodes, detection of tumor margin, identification of important adjacent structures, and detection of residual tumor cells or micrometastases.

6. Local nanoanaesthesia-

Local Nanoanaesthesia is a colloidal suspension containing millions of anesthetic dental nanorobots that would be used for induction of local anesthesia. After deposition on the gingival tissue, the nanorobots would move to the dentin and then reach the pulp through the dentinal tubules; a path towards the pulp would be guided by temperature gradients, chemical differentials, and positional steering by a nanocomputer under the control of the clinician. After reaching the pulp, the analgesic robots may close down all sensations in the tooth. After the treatment procedure has been concluded, the nanorobots may be ordered to reestablish all sensations and exit from the tooth. This technique is advantageous as it reduces apprehension and is fast and reversible.[11, 12]

7. Nanoneedles-

Nanostructured stainless steel crystals have been used to manufacture suture needles. nanotweezers are also underway that may enable cell surgery feasibly.[13,14]

8. Nano sterilizing solution:

Gandly Enterprises Inc Florida has developed a new sterilizing solution following the nanoemulsion concept. The concept is the nanosized oil droplets attack and destroys pathogens.[15], E.g., Eco Tru Disinfectant

CONCLUSION:

Nanotechnology has an enormous range of applications in oral and maxillofacial surgery. Specifically, wound management, imaging, implant, tissue engineering, and drug delivery systems have each been influenced by advances in nanotechnology. The use of nanotechnology will increase exponentially as the understanding of biology on the nanolevel progresses. These features make nanotechnology an influential tool when applied to all aspects of oral and maxillofacial surgery.

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Dental Aerosols: A risk for spread of Covid-19 in dentistry

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Abstract:
The outbreak of 2019 novel coronavirus (2019- nCoV), has strongly impacted the immune system of health care professionals, which challenged the system as treatment was not available. This disease was characterized by severe acute respiratory syndrome-corona virus-2 (SARS-CoV-2) and rapidly developed into a public emergency worldwide with an increase in cases and deaths. In dentistry, most dental procedures generate significant amounts of droplets and aerosols, posing potential risks of infection transmission. Understanding the significance of aerosol transmission and its implications in dentistry can facilitate the identification and correction of negligence in daily dental practice. In addition to the standard precautions, some safety precautions that should be implemented during an outbreak have been raised in this review.

Keywords: Corona virus disease 2019 (COVID-19); Aerosol; Infection control, precautions.

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INTRODUCTION:

At the end of 2019, an epidemic disease pneumonia with unknown etiology occurred in Wuhan, China. The cases were mostly linked to a local seafood market where live animals are sold, and these were the sources to transform pathogens from animals to humans and later on from human to human. The pathogen was recognized and named 2019 novel coronavirus (2019- nCoV), and the disease is called coronavirus disease 2019 (COVID-19).

The COVID-19 pandemic has strongly impacted the immune system of health care professionals, which challenged the system as treatment was not available.[1]

During clinical work, dental professionals are exposed to high risks of infection by 2019 novel coronavirus due to contact with blood, saliva, and other body fluids, combined with the handling of sharp instruments and procedures that generate aerosols.[2]

The 6th Edition of COVID-19 Treatment Regimen published by the National Health Commission of the People's Republic of China (2020) states that the possible routes of COVID- 2019 transmission are mainly by direct contact and droplet transmission. Aerosols become a potential transmission route when exposed to high concentrations of aerosols in a relatively packed environment. There is a potential risk to dental care personnel and patients in routine aerosols generated during dental procedures.

Dental team should be alert and maintain a healthy environment for both the patients and themselves. Furthermore, to prevent this pandemic transmission, it is essential to understand aerosol transmission and its implications in dentistry. In addition to standard precautions, some other special precautions are implemented during this period.[3]

The aim of this review is to encompass the role of aerosols in the transmission of diseases and discuss all safety precautions to be taken by the practitioner along with enlisting techniques to reduce the generated aerosols during every dental procedure, to avoid infection of COVID 19.

AEROSOL

The terms aerosol and splatter were given by *Micik and colleagues*.[3] Particles that are less than 50 micrometers in diameter, which remain airborne for an extended period before they settle on environmental surfaces or enter the respiratory tract called "aerosol." Airborne particles larger than 50 µm in diameter called as Splatter.[4]

- **Aerosols significance in the transmission of diseases:**

Direct transmission of aerosol may happen through secretions or droplets from an infected person by the oral, nasal, and conjunctival mucosa when that person coughs, sneezes, laughs, or talks. SARS-CoV-2 is primarily transmitted through respiratory **droplets** (particles >5µm in diameter); recent findings suggest that virus transmission may be possible through aerosolized **droplet nuclei** (particles ≤ 5µm in diameter). **Droplet nuclei** may remain in the air for 30 min to 2 hr, and it can contaminate surfaces in a range of 3 feet.[5] Droplets quickly settle to the ground or surfaces as countertop, sink, bracket, table, computer, patient, or operator quickly due to gravity and travel to shorter distances. Therefore, droplet transmission requires close physical proximity between an infected and susceptible individual. **(Fig. 1).**[2]

Human corona-viruses, including SARS-CoV and the Middle East respiratory syndrome-coronavirus (MERS-CoV), do not survive on a dry surface, but few studies have reported that they can persist on a surface for a few days, particularly when suspended in human secretion and undergo onward transmission *(Otter et al., 2013)*.[6] The aerosols from highly virulent pathogens like severe acute respiratory syndrome-coronavirus (SARS-CoV) can travel more than six feet *(Kutter et al., 2018)*.[7]

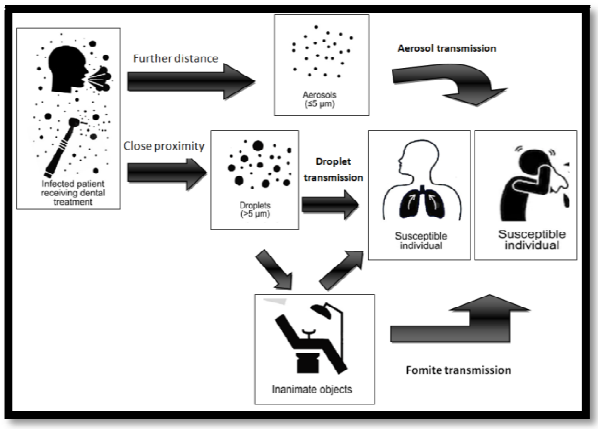

Fig 1: Different routes of transmission in dental setting via the aerosols.

Dental procedures performing with a high-speed handpiece, friction between the tooth and the rapidly rotating bur would create excessive heat. Without a coolant, the heat could cause damage to hard dental tissue and lead to pathological changes to the dental pulp. To overcome this heat gain, when performing dental procedures, the use of water coolant is necessary for procedures such as oral surgical therapies, prophylaxis, surgical extractions, tooth preparations, caries restorations, and access cavity preparation *(Farah, 2019)*.[8] The generated aerosols have shown in **Fig. 2**.

The water coolant generates visible and invisible aerosols.[4] Bio-aerosols that are commonly contaminated with bacteria, fungi, and viruses, have the potential to float in the air for a considerable amount of time and are inhaled by dentists or other patients. *(Jones and Brosseau, 2015)*.[9]

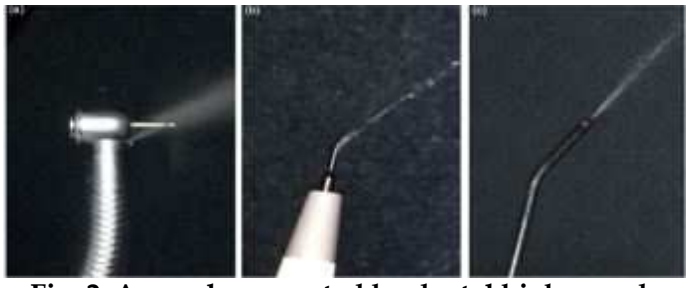

Fig. 2: Aerosols generated by dental high-speed handpiece (a), ultrasonic scaler (b), and air-water syringe (c)

❖ **Oral microflora associated with respiratory infections caused due to aerosols:**

More than 700 microbial species in the oral cavity are inhabited by fungi and viruses from the respiratory tract. Common inhabitants of the oral cavity include Streptococcus species, Actinomyces, Neisseria, Porphyromonas, Prevotella, Campylobacter, Capnocytophaga, and Fusobacteria. Oral biofilm resists antibiotics, antimicrobial agents, and the body's immune system. Removal of bacteria in dental biofilm is best achieved by physical disruption, so this process contributes to aerosol production.[10]

Generated aerosols consist of water, saliva, blood, debris, and microorganisms (e.g., bacteria, fungi, viruses, and protozoa), with their metabolites, such as lipopolysaccharides/endotoxins and other toxins.

❖ **Diseases known to be spread by droplets or aerosols**

COVID-19 disease includes the common cold, influenza, sinusitis, pharyngitis, pneumonia, tuberculosis, and severe acute respiratory syndrome. Through dental bioaerosols, nasal congestion, asthmatic episodes, and headaches have also been triggered.[9] The specific bacteria were likely to cause all the diseases, including **Legionella, Pseudomonas, and Nontuberculous mycobacteria. (Table 1)** Aerosolized bacteria and Dental treatments from waterlines can cause severe infections and even death.[4]

TABLE 1. DISEASES KNOWN TO BE SPREAD BY DROPLETS OR AEROSOLS[4]

DISEASE	METHOD OF TRANSMISSION
Pneumonic Plague	Patient to patient without the usual insect vector (flea); apparently by inhalation of the causative bacteria
Tuberculosis	Droplet nuclei expelled from the patient by coughing; once considered an occupational disease for dentists
Influenza	Apparently associated with coughing but may require direct contact with the patient
Legionnaires' Disease	Aerosolization of Legionella pneumophila has been associated with air conditioning systems and hot tub spas
Severe Acute Respiratory Syndrome	Spread by direct contact and aerosolized droplets

❖ **Precautions in dental practice from the generated aerosols:**

The outbreak and transmission of COVID-19 have undoubtedly shown that health professionals are at higher risk. The incubation period lasts up to 14 days; it is impossible to recognize the asymptotic carriers early or without testing. A report given by *Rothe et al. 2020,*[11] stated that the infection transmission from asymptomatic contact, implying that COVID-19 is contagious during the incubation period.

The cell receptor for COVID-19 infection is the angiotensin-converting enzyme II (ACE2) receptor which, is highly expressed in the oral cavity mucosa.[12] Markedly, this receptor is present in the epithelial cells of the tongue. These findings specify that the oral cavity is a potentially high-risk transmission of COVID-19 infection and will be used in future prevention strategies in the setting of clinical practice. The special precautionary measures targeted toward aerosol transmission should be taken to prevent and control the spread of this highly contagious disease. *(Xu et al., 2020).*[13]

Patient screening:

In routine, dentists should take a medical history thoroughly from each patient and confirm the health status. During this pandemic, must ask the targeted screening questions to patient related to COVID-19. These questions should include travel, personal, and epidemiological history.

If possible, strongly advised for tele-screening of the patients and record the COVID-19 symptoms, recent contact with confirmed COVID-19 patients, or disease epicenters. The confirmed non COVID-19 patient and recovered cases (≥30 day) should only be considered for dental treatment after coordination with the primary physician. Disease history and current stage should be meticulously evaluated. Suspected or confirmed COVID-19 patient's treatment should be postponed if possible or performed in airborne infection isolation rooms (AIIRs) or negative pressure rooms, ideally at a hospital setting.[14]

After the screening, patients are proposed to be divided into five groups **(Fig. 3)**:

A. Asymptomatic and unsuspected, unconfirmed COVID-19 case.
B. Symptomatic and/or suspected, unconfirmed COVID-19case.
C. Stable confirmed COVID-19 case.
D. Unstable confirmed COVID-19 case.
E. Recovered confirmed COVID-19 case.

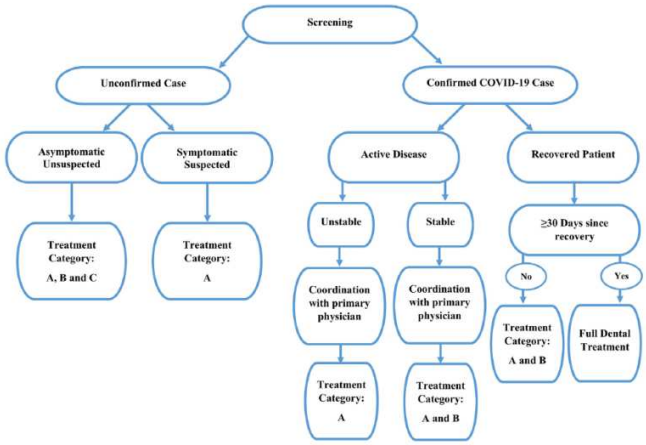

Fig. 3: The screening, patients are proposed to be divided into five groups[14]

D and E treatment category patient are non-urgent and elective so treatment can be postponed for the time being. **(Table 2)**

Table 2 Guidance table showing the categories of dental treatments and the variety of treatments that can be provided for the patient during the COVID-19 pandemic. Dental Treatments Categories[14]

A	B	C	D	E
Emergency	**Urgent conditions that can be managed with minimally invasive procedures and without aerosol generation**	**Urgent conditions that need to be managed with invasive and/ or aerosol-generating procedures**	**Non-urgent**	**Elective**
Unstable maxillofacial fractures that can compromises the patient's airway.	Severe dental pain (7≤) from pulpal inflammation that requires tooth extraction.	Severe dental pain (7≤) from pulpal inflammation that need to be managed with aerosol generating procedures.	Removable dentures adjustments or repairs.	Initial or periodic oral examinations and recall visits.
Diffuse soft tissue bacterial infection with intraoral or extraoral swelling that can compromises the patient's airway.	Severe dental pain (7≤) from fractured vital tooth that can be managed without aerosol generation.	Severe dental pain (7) from fractured vital tooth that need to be managed with aerosol generating procedures.	Asymptomatic fractured or defective restoration.	Aesthetic dental procedures.
Uncontrolled postoperative bleeding.	Dental trauma with avulsion/ luxation that can be minimally managed without aerosol generation	Dental trauma with avulsion/ luxation that need invasive/ Aerosol Generating Procedures	Asymptomatic fractured or defective fixed prosthesis.	Restorative treatment of asymptomatic teeth.
	Surgical postoperative osteitis or dry socket that can be managed without aerosol generation.	Deboned fixed prosthesis cleaning and temporary cementation.	Asymptomatic fractured or defective orthodontic appliance.	Extraction of asymptomatic teeth.
	Pericoronitis or third-molar pain that can be managed without aerosol generation.	Removable dentures adjustments for radiation/ oncology patients.	Chronic periodontal disease.	Orthodontic procedures other than those in category B/C
	Stable maxillofacial fractures that requires no intervention	Fractured or defective fixed prosthesis causing soft tissue injury.		Routine dental cleaning and preventive therapies.
	Localised dental/periodontal abscess that can be managed without aerosol generation	Acute periodontal disease.		Replacement of missing tooth/teeth with fixed or removable prosthesis
	Fractured or defective fixed orthodontic appliance causing soft tissue laceration.			Dental implant surgery.

❖ **Special precautions in routine practice from the aerosols:**

- **Hand hygiene**

Ethanol is widely used in gel form for hand rubbing, foams, and alcohol-based disinfectants are promising substances to protect healthcare workers against SARS-CoV-2. The mechanism of alcohol-based sanitizers is denaturing proteins so that enveloped viruses, including coronavirus, are removed using these sanitizers. Several epidemiological studies suggested hand-washing with soap and 70%–90% alcohol-based hand rubs (ABHRs) effectively controlled SARS transmission.[15]

The alcohol-based hand rubs contain at least 60% ethanol to provide adequate protection. Healthcare workers should consider hand rubbing in 5 moment's i.e.

1. Before touching a patient.
2. Before aseptic treatments.
3. After exposure to body fluids
4. After touching a patient.
5. After touching the patient's surroundings.[2]

- **Preprocedural mouth rinse**

In oral aerosols reducing the proportion of microorganisms is the most effective method. (Feres et al., 2010)[16] A meta-analysis showed that the use of preprocedural mouth rinse including chlorhexidine (CHX), Povidone-iodine (PV-I, 0.23-1%), cetylpyridinium chloride (CPC, 0.05-0.10%), and hydrogen peroxide (0.5-1.5%) resulted in a mean reduction of 68.4% colony-forming units in a dental aerosol. *(Marui et al., 2019)*[17]

According to *Chitguppi R. et al. 2020*,[18] only mouth rinse like Chlorhexidine, owing to their clinically significant substantivity, can be of clinical use in the prevention of COVID-19 spread and offer maximum protection to the healthcare workers. Mouth rinses like povidone-iodine and hydrogen peroxide that lack substantivity may kill the virus when they come in contact with it but offer little protection to healthcare workers and be of little use in the prevention of disease spread in the clinics & in community settings.[18]

For patients who develop mucosal irritation or other side effects such as tongue stain, 0.05% CPC could be a good alternative. Preprocedural mouth rinse can efficiently inactivate the SARS-CoV, MERS-CoV, and influenza virus A (H1N1) within 1 min. *(Feres et al., 2010)*[16]

Mouthwash containing chlorhexidine or CPC can prevent the biofilm adhesion and formation of viridans streptococci, Candida albicans, and proinflammatory effects.[17]

Since SARS-CoV-2 is vulnerable to oxidation, antiseptic mouthwash or gel containing broad-spectrum oxidative agents, such as hydrogen peroxide or PV-I, is recommended to reduce the oral microbiota and potentially SARS-CoV-2 as well. **(Table 3)**[17]

Table 3: Preprocedural mouth rinse[17]

Mouth rinses	Characteristics	Coronaviruses sensitive	Sources
Povidine iodine (PV-I, 0.23-1%	Reduce the number of oral microbiota. Inhibit the biofilm formation of viridancs streptococci and the adhesion, proinflammatory effects, and immune escape abilities of Candida albicans.	SARS-CoV, MERS-CoV and potentially SARS-CoV-2 sensitive.	Kariwa et. Al 2006; Eggers et al, 2015, 2018; Ardizzoni et. Al, 2018; Kampf et al, 2020; Li and Meng,2020
Cetylpyridinium chloride (CPC, 0.05-0.10%)	Reduce the number of oral microbiota. Inhibit the biofilm formation of viridancs streptococci and the adhesion, proinflammatory effects, and immune escape abilities of Candida albicans.	SARS-CoV, MERS-CoV sensitive. SARS-CoV-2 sensitivity is currently unknown.	Kariwa et. Al 2006; Eggers et al, 2015, 2018; Ardizzoni et. Al, 2018; Kampf et al, 2020; Li and Meng,2020
Hydrogen peroxide (H_2O_2, 0.5-1.5%)	Reduce the number of oral microbiota.	SARS-CoV, MERS-CoV and potentially SARS-CoV-2 sensitive.	Kariwa et. Al 2006; Eggers et al, 2015, 2018; Ardizzoni et. Al, 2018; Kampf et al, 2020; Li and Meng,2020
Chlorehexidine (CHX, 0.02- 0.05%)	Reduce the number of oral microbiota. Inhibit the biofilm formation of viridancs streptococci and the adhesion, proinflammatory effects, and immune escape abilities of Candida albicans.	0.02% CHX is ineffective against coronaviruses while 0.05% is SARS-CoV sensitive	Ardizzoni et al, 2018; Chin et al, 2020

- **Environmental surface disinfection**

Aerosol-generating procedures, droplets containing infective pathogens could be deposited on the surrounding surfaces. Cleaning and disinfection are important for frequently touched surfaces in patient care areas, especially those closest to the patient and most likely contaminated surfaces. (e.g., dental chair, desks, elevators, bathroom sinks, floor surface, cabinets, doorknobs, and all equipment close to the patient).[19] The 22 studies are analyzed revealed that human coronaviruses, like SARS and MERS, can persist on inanimate surfaces for up to 9 days. They can be efficiently inactivated by surface disinfects

within one minute. These surface disinfectants contain 62%–71% ethanol, 0.5% hydrogen peroxide, and 0.1% (1 g/L) sodium hypochlorite.[20]
Methods of disinfecting and cleaning are presented in (**Table 4).**[20]

Disinfecting non-critical surfaces in patient-care areas[20]			
Vaporized hydrogen peroxide		**Disinfectants**	
Types	**Virucidal efficacy**	**Hypochlorous acid (HOCl)**	**Other disinfectants**
Non-condensing vaporized hydrogen peroxide (VHP) technology (Steris) and condensing search hydrogen peroxide vapour (HPV) technology (Bioquell)	Limited evidence is available for the virucidal activity of condensing HPV systems. Recently, several studies have demonstrated the in vitro activity of condensing HPV systems against individual viruses, including feline calicivirus (FCV), adenovirus, lactococcal bacteriophages6, and MS2 coliphage	**Virucidal efficacy** • Virucidal ability of solutions containing a high amount of HOCl is better than those containing HCl • Reduction of efficacy after spraying from a distance more than 30 cm • Minimum concentration should be more than 40 ppm for effective virucidal effect • The 100 and 200 ppm concentrated solutions inactivated more than 99.9% of AIV directly after spraying, while the 50 ppm concentration required at least 3 min of contact	Alkalis, oxidizing agents, alcohols, and aldehydes

- **Personal protective equipment**

Personal protective equipment (PPE) can form an effective barrier against most hazards of aerosols generated from an operative site. In COVID-19, PPE recommendations are masks, respirators, gloves, goggles or face shields, and long gowns.
More body coverage leads to better protection. Donning and doffing PPE should be simple as the complexity of use leads to an increased risk of self-contamination, especially during doffing.[21]
The correct sequence of donning and doffing is depicted in **(Figs. 4, 5, 6, 7)**[20]

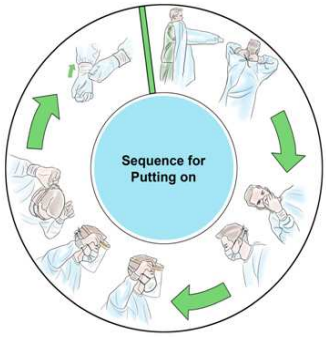

Fig. 4 Personal protection equipment donning

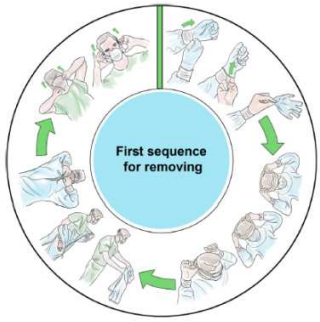

Fig. 5 Personal protection equipment first doffing

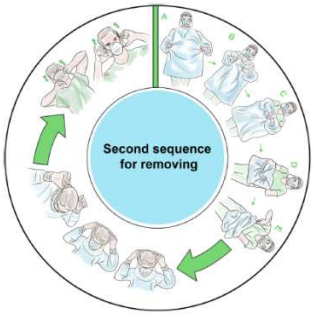

Fig. 6 Personal protection equipment second doffing order

Fig. 7 Personal protection equipment

- **Masks and respirators**

Waterproof surgical masks protect staff against both infected droplets and contact contamination by preventing the spread of respiratory droplets in the environment and reducing COVIID-19 contamination by at least 80%.

Filtering facepiece respirators (FFRs), including N95 respirators having a network of polypropylene microfibers and electrostatic charges, are protective and effective equipment infiltration. Powered air-purifying respirator (PAPR) is also recommended for protection against SARS-CoV-2.

Comparisons between different masks and respirators are given in **Table 5.**[20]

Table 5: A brief comparison between masks and respirators[20]

Mask type	Standard	Filtration effectiveness			Re-usability
Single-use medical masks	China: YY/T0969	3.0 microns: > 95% 0.1 microns: not effective			No
Surgical masks	China: YY 0469	3.0 microns: > 95% 0.1 microns: not effective			No
Surgical masks	USA: ASTM F2100	Level 1 3.0 microns: > 95% 0.1 microns: > 95%	Level 2,3 3.0 microns: > 95% 0.1 microns: > 95%		No
Surgical masks	Europe: EN 14683	Type 1 3.0 microns: > 95% 0.1 microns: > 95%	Type 2,3 3.0 microns: > 95% 0.1 microns: > 95%		No
Respirator masks	USA:NIOSH 42 CFR 84	N95 0.3 microns: > 95%	N99 0.3microns: > 99%	N100 0.3microns: > 99.97%	Yes (under especial conditions)
Respirator masks	Europe:EN 149:2001	FFP1 0.3 microns : >80%	FFP2 0.3 microns : >80%	FFP3 0.3 microns : >80%	Yes (under especial conditions)
Elastomeric respirators	USA:NIOSH 42 CFR 84			Yes	
PAPR	USA:NIOSH 42 CFR 84			Yes	

PAPR powered air-purifying respirator. APF assigned protection factor

For extended use mask, the CDC recommends up to 8 hr use of N95 respiratory mask, and should note that FFRs can be reused up to 5 times via the following strategies:

1) Mask rotation: The mask should be numbered and reused in turn. A used mask should be kept at least 72 hr, as the SARS-CoV-2 loses its viability. If a mask is used in the aerosol-generating process or is damaged, it should be discarded.

2) Reprocessing/decontamination: N95 models that do not contain cellulose, such as the 1860 model, can be reuse after decontamination with the hydrogen peroxide vaporization.

The other decontamination methods are moist heat (heating at 60–70 °C and 80–85% relative humidity), proper UV treatment of N95 masks, and the mask at 70 °C dry heating for 30 min decontamination. Among all, only the proper UV treatment of N95 masks is recommended for SARS-CoV-2. Correct way of putting on and removing a respirator mask. **(Fig. 8)**[20]

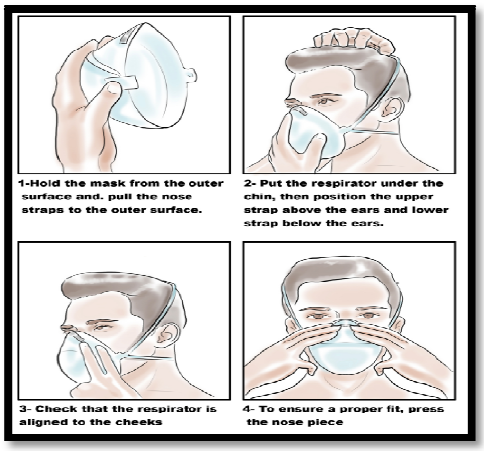

Fig 8: Correct way of putting on and removing a respirator[20]

- **Gowns**

Different qualities have been reported for gowns. Models of gowns mostly leave the neck exposed, which can be a route of contamination. The most protection is assigned to coverall followed by long gowns, gowns, and aprons, respectively.[2]

- **Gloves**

The risk of contamination can be reduced by adding tabs to the gloves for taking them off from the hands.

Donning three layers of gloves due to the complex doffing process is not suggested due to more risk of self-contamination. Gloves cleaning with quaternary ammonium or hypochlorite may decrease hand contamination except for alcohol-based hand rubs. Dentists should use arm-length surgical gloves. **(Fig.9)**[2]

- **Eye protectors**

The efficacy of face shields is to reduce contamination by breathing and coughing. The face shields are effective for large infectious particles to reduce exposure, but smaller particles can flow around a face shield and remain airborne to be inhaled. Face shields **(Fig 10)** are more bulky than goggles **(Fig 11)** and protect the entire face. Goggles give a standard eye protector by providing a full eye seal. *(Lindsley et al)*[21]

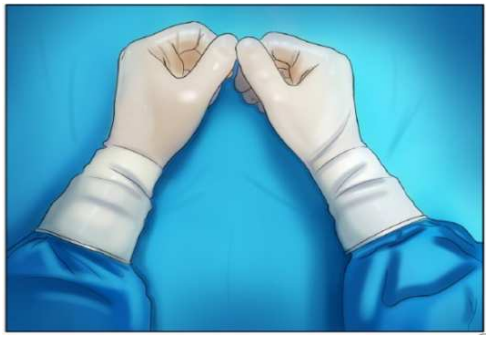

Fig 9: Arm-length surgical gloves that completely cover the wrist area[20]

Fig 10: Face shield

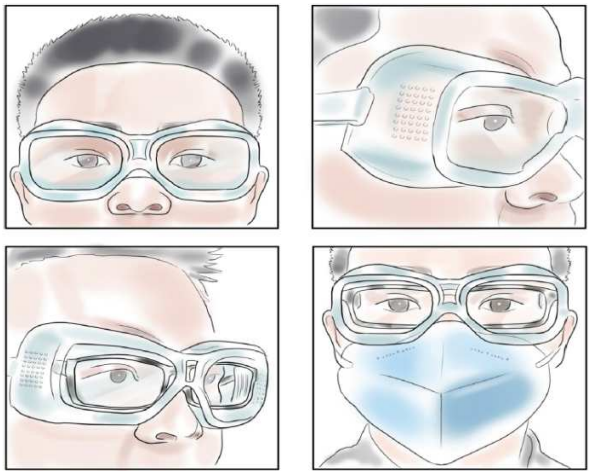

Fig 11: Standard eye protector[20]

- **Other methods to reduce generated aerosols**

Strategies to reduce aerosols generation in different dental disciplines **(Table 6)**

Table 6: Other methods to reduce droplet generation in different dental disciplines[2]

Dental discipline	Special precaution
Endodontics	Rubber dam must be applied during endodontic treatment. Root canal treatment usually requires a number of endodontic instruments and devices, therefore minimizing unnecessary hand contact with surfaces and equipment in the dental office to reduce possibility of fomite transmission.
Restorative dentistry and pediatric dentistry	Avoid using rotary instruments during cavity preparation. In selective cases, consider using chemochemical caries removal or atraumatic restorative techniques. If rotary instrumentation must be performed, rubber dam isolation should be applied.
Periodontics	Hand and ultrasonic instrumentation are equally effective in removing plaque and calculus deposits; if required, manual scaling and polishing are recommended (Krishna and de Stefano, 2016)
Prosthodontics	Salivary suction must be performed with care to avoid gagging. Select and adjust trays to the right size for impression taking to avoid cough reflex. For highly sensitive patients, consider applying oral mucosa anesthesia to the throat before impression taking. During fixed partial denture or single-crown preparation, treatment alternation may be considered to incorporate rubber dam application. For example, design supra-gingival margin for posterior bridge or use a split-dam technique (Li et al., 2004). During removable partial denture or complete denture try-in, avoid touching other objects in the dental office after contacting patients' saliva. Upon removal from patient's mouth, dental prosthesis, impressions, and other prosthodontics materials (e.g., bite registration) should be thoroughly disinfected by a disinfectant having at least intermediate level activity.
Oral-maxillofacial surgery	When performing simple extraction, treat the patient in a supine position to avoid working in the breath way of a patient

- **Removal/filter of contaminated air**

There are several methods to remove/filter contaminated air in treatment areas; the two most commonly used devices include the inexpensive High Volume Evacuator (HVE) and the expensive High-Efficiency Particulate Arrestor (HEPA) filters.

High-volume evacuation filter (HVE): It reduces more than 90% aerosol produced during ultrasonic instrumentation. *(Harrel et al., 1996)*[22] *(Jacks, 2002)*[23] Within a short period, HVE systems remove a large volume of air (up to 1003 feet of air/ minute) and typically have a large bore or opening on the tip (≥8 mm). *(Harrel and Molinari, 2004)*[4]

The inlet of the HVE attachment needs to be held close enough (10–20 mm) to the source of aerosols to evacuate those aerosols while avoiding contact of the HVE attachment with the ultrasonic instrument and the patient's intra-oral tissues. *(Mamoun, 2011)*[24] Without a dental assistant, clinicians might face difficulty to operate it with one hand.

Newer HVE devices currently available offer modifications, such as lighter weight, shorter length, angled configuration, and mirrored surfaces, which ease the use of the HVE by the sole practitioner. **Figure 12** illustrates several of these products.

Fig 12: a) Bull Frog aluminum lightweight HVE hand piece – short; (b) mirror/suction device for HVE; (c) Pelotte angled evacuation tips.[25]

To reduce the aerosols that have escaped into the operatory air, the HVE suction should remain on continuously during the entire debridement procedure, even during momentary stops in instrumentation, and should be kept on for a few minutes after the procedure is completed.[24]

High-Efficiency Particulate Arrestor (HEPA filter): An air filtration device can remove 99.97% of the particles measuring 0.3 µm in diameter. Disadvantages are that the filter may become a source of microbes if the retained microorganisms proliferate and enter back into the filtered air, and soiled HEPA filters are difficult to clean, and these are expensive to replace. *(Day et al., 2018)*[26]

Device to reduce aerosol dispersion

A device with the aspiration and filtering system. *(Meng et al. 2020)*[27]

In dental clinics, the main purpose of this device is to reduce aerosol dispersion, isolating the operator 'external environment' and patient in an 'internal environment' through which access to perform the dental procedures while protected by a physical barrier.[28]

A variety of aerosol boxes have been proposed in the medical field *(Canelli et al. 2020)*[28], *(Cubillos et al. 2020)*[29], *(Francom et al. 2020)*[30] Earlier extra-oral dental suction systems have been proposed and commercialized, but no one is aware of the use of the aerosol box. Some devices to capture the aerosols under high negative pressure include a large clear cup-shaped acrylic plate to limit the dispersion of aerosol particles with no physical barriers.

The pre-existing devices may likely reduce but not prevent the aerosol dispersion in the air room and, therefore, may not completely prevent the contact of aerosol particles with the operator and their assistant. The cost for a device prototype is relatively less, and if it is produced on large numbers, the costs may be more reduced.

On the dental chair to fit the designed prototype, the device consists of a rigid translucent acrylic structure (methyl polymethacrylate) **(Fig. 13a)** covering the patient's chest, neck, and head. On the dental chair, the device is propped up, positioned simultaneously when the patient sits **(Fig. 13b).** For the aspiration and filtering of air, there is a piping system within the acrylic structure **(Fig. 13c)**, which provides a negative pressure inside the chamber. In the chamber, two hoses are strategically positioned for the aspiration system, and a suction unit is composed.

The working position of operator with the device is shown in **(Fig. 14a)**. Due to the use of the fluorescent dye, the simulations were carried out using an ultraviolet flashlight illumination in the working

field **(Fig. 14b**). The aspiration system aims to neutralize circulating microorganisms and toxic particles before the air returns to the external environment and forces the air to pass through an external box containing an antiseptic solution (2% NaOCl) **(Fig. 14c).**

Through three oval-shaped holes in the acrylic chamber, which provide access for the operator's hands, allowing for dental procedures, it can be performed seated in the 9 to 3 o'clock ergonomic positions. Translucent flexible polyvinyl chloride (PVC) films are covered to these orifices, on which small incisions are made. It allows the operator's hands and arms to reach inside the device while keeping the distance too short between the operator to the patient. Flexible PVC films should be used to seal the back of the device, which is open (no rigid acrylic structure). The PVC film protects the chair from contamination, and the patients can comfortably support themselves in the chair.[31]

Fig 13: Detailed images of the device: Translucent acrylic chamber (a); positioning of the acrylic chamber (b); and positioning of the aspiration piping (c) [31]

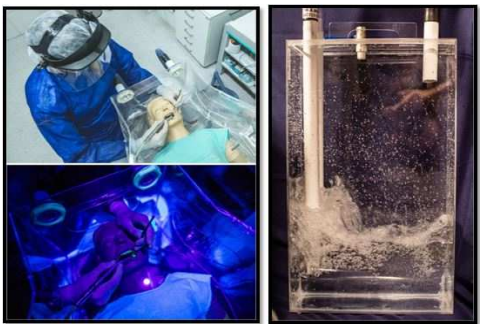

Fig 14: Images showing the work position of the operator (a). Ambient lights off and ultraviolet lights on to start the simulated dental procedure (b). (c) Image of the aspiration and filtering.[31]

Some limitations of the present device as, between patients the disinfection of the internal walls of the apparatus may be time-consuming, and the disinfection of the aspiration system piping is challenging. Presently, a 0.2% quaternary ammonium compound solution has been used for disinfection of the acrylic surfaces of the device in the service where the device is being tested. The internal walls of the piping system are being disinfected by aspiration of a 2% NaOCl solution.

Drawbacks with of this device are restriction to movement for patient and may experience anxiety, claustrophobic sensation. Difficulty in visualization of operative field by the operator and limitations regarding the communication between dentist and patient may occur.[31]

CONCLUSION

Dentists, by nature, are at high risk of exposure to infectious diseases. The emergence of COVID-19 has brought new challenges and responsibilities to dental professionals. Patients and practitioners are regularly exposed to tens of thousands of aerosols generated during procedures, and this exposure increases the potential for respiratory infections. To ensure patient and operator safety, oral health professionals should adapt the latest CDC guidelines and recommendations. This includes providing preprocedural mouth rinses, maintaining dental unit water quality, and wearing proper PPE. To reduce further risk, improve air quality, air cleaning systems and HVE or an isolation-and-evacuation device can be employed. Ultimately, combining multiple methods may be the most effective approach for managing dental aerosols.

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Nutrition and Oral Cancer: A Review

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Abstract:
Cancer is a leading cause of death worldwide. Cancer is a result of multiple genetic defects resulting from exposure to environmental, dietary and infectious agents. About 35% of known cancers are associated with tobacco use and about 55% with inappropriate nutritional habits. Cancer can be prevented by increasing defense mechanism, inducing cancer cells to apoptosis, decreasing angiogenesis of cancer cells. Nutritional factors play a major role in cancer prevention. Increase intake of vegetables and fruits can prevent cancer. The present paper describes the significant role of diet in cancer prevention along with an elaborate overview of various mechanisms by which several active nutrient molecules intercept carcinogenesis.

Keywords: anterior Cancer, Environmental, Genetic defects, Nutrition.

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INTRODUCTION:

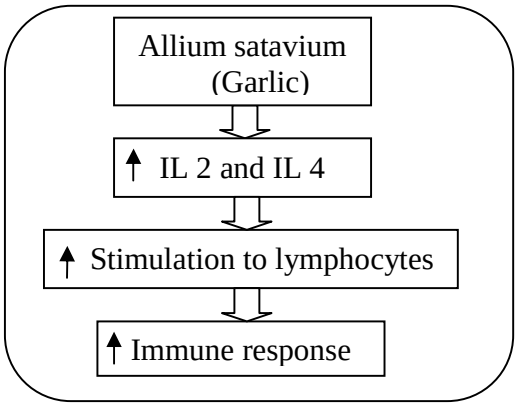
The benefits of a healthy, balanced diet on general health are well known. Since ancient times it is believed that certain foods are known to have components that enhance our immune system and thus effectively combat infections and other diseases.[1] The rising incidence of cancer is an alarming cause of concern in today's world. Cancer is the eventual outcome of the transformation of normal cells caused by DNA-reactive genotoxic carcinogens and the growth promotion of mutated cells by enhancing factors.[2] Many studies have consistently stated that abundant consumption of foods of plant origin, such as fruit, vegetables, whole grains, nuts, seeds, and tea, can decrease the risk of developing various cancers.[3] Some studies also suggest that vegetables provide an essential source of molecules with chemopreventive properties.[4]
Carcinogenesis is a multistep process that has check-point controls at each step. Thus the process of carcinogenesis can be intercepted at all these various levels by a variety of molecular events.[5] Different steps involved in carcinogenesis are initiation, promotion, progression, and growth. Initiation results from exposure to a carcinogen, which leads to the promotion of a normal cell to the cancer cell. These further advances to progression and growth of the cancer cells. These cancerous cells must accumulate several mutations in the genes involved in cell cycle arrest, resistance to apoptosis, and induction of angiogenesis to grow and invade the host tissues. The nutrients with their active components can act on genetic alterations occurring in cancer cells. They can also alter the regulation of apoptosis, cause cell cycle arrest, and control angiogenesis in tumor cells. Certain nutrients even restrict tumor growth potential.[1,6,7] The present paper describes the significant role of diet in cancer prevention and an elaborate overview of various mechanisms by which several active nutrient molecules intercept carcinogenesis.

Nutrients enhancing immune mechanism:

The immune system is the first line of defense in our body. Cancer occurs due to the formation of mutated cells; hence they are often encountered by the immune system (immune surveillance)[8] The nutrients such as β-carotene and α-tocopherol stimulate the immune cells like macrophages, mast cells, lymphocytes which in turn are responsible for the release of cytokines TNF- α and TNF- β. These chemical mediators identify cancer cells and destroy them by the apoptosis mechanism. β - carotene is present in broccoli, carrot, and a lesser amount in tomatoes, while α-tocopherol is present in cabbage and sweet potato.[6,8]

The extracts of *Allium sativum* (garlic) enhance the immune system significantly by stimulating the proliferation of lymphocytes by increasing IL-2 and IL-4 production.[9] Also, the garlic extract effects are seen with antioxidant activity or detoxification by binding to sulfur compounds in garlic. The mechanism of direct tumor cell inhibition has not yet been determined. Perhaps the most important action of garlic in the inhibition of cancer is by enhancing the immune response.[10,11]

Chart 1: Garlic causing an increased immune response.[9-11]



Nutrients modifying genetic alterations:

p53 is a tumor suppressor gene responsible for repairing damaged DNA at the G1 phase of the cell cycle. Mutation of this gene leads to the abnormal proliferation of cells with damaged DNA. The main cause of tumor progression is dysfunction of the *p53* gene resulting in uncontrolled check-points and failure in apoptosis of tumor cells.[6,7] Nutrients with phytochemicals like ellagic acid, β-carotenes, vitamin-E, and vitamin-C are responsible for the arrest of the dysfunctional *p53* gene. Ellagic acid is present in berries like raspberries, strawberries, and blackberries. Almonds are rich in vitamin E, and citrus fruits are a rich source of vitamin C.[1,6,7,8]

Nutrients regulating apoptosis:

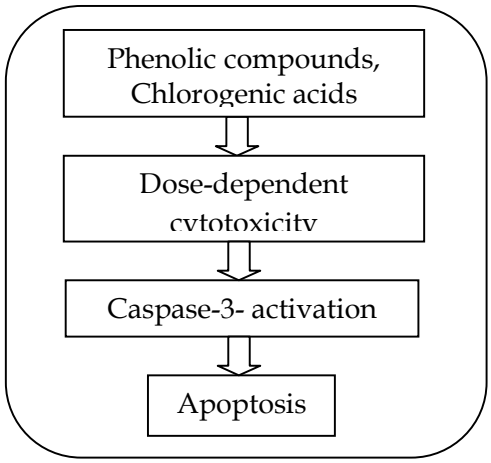
It is a known fact that dysregulated cell proliferation and apoptosis lead to cancer formation. The induction of apoptosis is one of the newest therapeutic concepts known to be effective against cancer cells. Many studies have been carried out that suggest apoptosis in cancer cells by using natural or synthetic agents.[7] At the molecular level, apoptosis takes place by two pathways. The intrinsic apoptotic pathway involves mitochondrial membrane permeabilization, the release of Cytochrome c into the cytosol, followed by activation of the caspase-3 mechanism, which acts as an executioner for cell death. Other pathway, i.e., the extrinsic pathway, is initiated by TNF-α and Fas ligand, which ultimately causes activation of the caspase-3 mechanism, which leads to cell death.[12]

Many studies suggest an absence of functional CKIs like p16, p21, p27, p57 found in oral squamous cell carcinoma. These CKIs are the regulators of apoptosis; studies show that overexpression of these CKIs such as p16, p21, p27, p57 results in induction of apoptosis. This mechanism is seen in the green tea users in which the active component epigallocatechin-3-gallate (EGCG) increases the expression of p21 and p27. This leads to cell cycle arrest and activation of the caspase-3 mechanism leading to apoptosis of tumor cells.[13,14]

Tomato is rich in various carotenoids. Lycopene is one of them. Carotenoids induce apoptosis through caspase-3activation.[15] Resveratrol present in grapes induces apoptosis and inhibits the growth of various human tumor cells, including oral squamous cell carcinoma.[16] The allyl-sulfur compounds derived from garlic have significant anti-proliferative activity against human cancers.[17,18] Phenolic compounds present in ginger, chlorogenic acid, which is a phenolic compound present in coffee, can induce caspase-3-dependent apoptosis in cancer cells.[7] Curcumin is a major active polyphenolic component

of turmeric (*Curcuma longa*). It is established that curcumin induces apoptosis in tumor cells via a *p53*-dependent pathway.[19] Luteolin, a flavonoid present in apple, carrots, and broccoli, kills cancer cells by inducing apoptotic cell death in many cancers like epidermoid carcinoma and leukemia.[20] Luteolin causes activation of caspase -8, 10, 9, and 3 mechanisms which lead to apoptosis by extrinsic pathway.[21] It also activates the intrinsic apoptosis pathway by inducing DNA damage and *p53* activation.[22,23]

Chart 2: Nutrition's causing apoptosis in cancer cells.[7]



Nutrients controlling angiogenesis:

Angiogenesis is the process that stimulates the formation of new blood vessel networks. This process is essential for tumor growth by providing oxygen and nutrients to developing tumor cells. It is a proven fact that tumors cannot grow beyond 1mm3 unless they are vascularized.[24] The key receptors involved in tumor angiogenesis are vascular endothelial growth factor receptor-2 and platelet-derived growth factor receptor.

Nutrients like phytochemicals have strong anti-angiogenic activity against the tumor cells. Epigallocatechin-3-gallate (EGCG), an abundant polyphenol found in green tea, inhibits vascular endothelial receptor-2 and has an anti-angiogenic property.[25] Ellagic acid, a phenolic acid found in fruits like raspberries, strawberries, and grapes, and also delphinidin, an anthocyanidin in blueberries, block vascular endothelial growth factor receptor-2 activity as well as strongly inhibits platelet-derived growth factor receptor activity. This combined inhibitory effect leads to inhibition of angiogenesis of tumor cells.[26, 27]

Luteolin, a flavonoid, is known to be a potent angiogenesis inhibitor. Luteolin causes suppression of VEGF secretion, causing an anti-angiogenesis effect.[28] Tumor angiogenesis is dependent on the activity of MMP-9.[29] Luteolin may cause an anti-angiogenic effect via suppression of MMPs.[30]

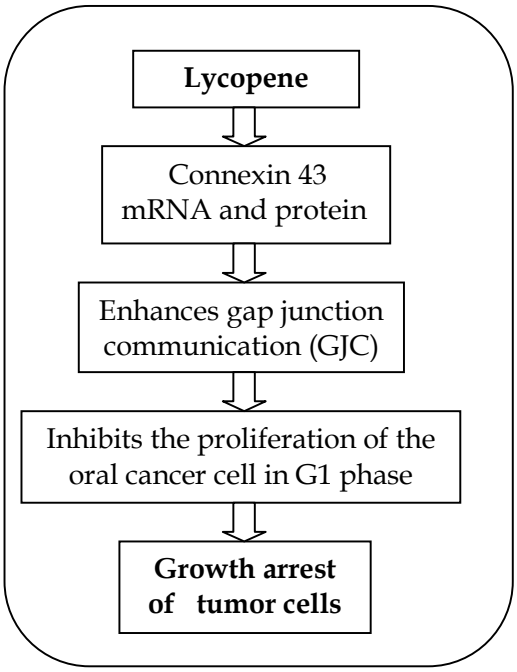
Nutrients causing cell cycle arrest:

Cell cycle arrest of cancer cells leads to the growth arrest of tumor cells. Studies suggest that EGCG present in green tea induces G0/G1- phase cell cycle arrest in human epidermoid carcinoma cells, inhibiting proliferation and inducing apoptosis in many cancer cells.[31-33]

Organo-sulfur compounds called isothiocyanates found in papaya restore the cell cycle to eliminate cancer. Isothiocyanates can inhibit both the formation and development of cancer cells through multiple pathways and mechanisms.[34] Flavonoids have been found to inhibit the proliferation of many cancer cells by arresting cell cycle progression either at the G1/S or G2/M check-points.[35,36] The G1 cell cycle arrest induced by luteolin is associated with the inhibition of CDK2 activity. This arrest is achieved by up-regulation of the CDK inhibitors p27/kip1 and p21/waf1, or direct inhibition of CDK2 activity.[37, 38]

The nutrient lycopene acts as an antioxidant, which traps the ROS and reduces oxidative damage to lipids, proteins, and DNA by lowering oxidative stress. Studies show that lycopene inhibits the proliferation of tumor cells and enhances their gap junction communication (GJC).[39] The gap junctions are water-filled pores allowing an exchange of low molecular weight compounds. Lycopene enhances GJC by increasing levels of connexin-43 mRNA and protein, a major gap junction protein. There is decreased expression of connexins-43 in human tumors compared to normal tissue. Hence increased GJC may reverse the malignant process in carcinogenesis.[7,39] Lycopene is present in abundance in tomatoes, apricots, papaya, and yellow pigmented fruits.[40]

Chart 3: Lycopene causing an anticarcinogenic effect.[7,39]



Allyl sulfur compounds present in garlic and onion can slow or prevent the growth of tumor cells. These compounds make cells vulnerable to the stress-created by-products of cell division. As cancer cells divide rapidly, they create more stress compared to normal cells. Hence cancer cells are damaged by the presence of allyl sulfur compounds.[41] Lau *et al.* stated that *Allium sativum* extracts have anti-tumor activity in sarcomas, squamous cell carcinomas, and mammary carcinomas.[42]

Table no 1- Showing different food with their active components causing anticarcinogenic effect.

Food	Active components	Anticarcinogenic activity	References
Apple , cabbage, carrrot	Luteolin (Flavonoids)	Apoptosis in tumor cells and restricts angiogenesis to tumor cells	20
Broccoli	β - carotene	A potent immune response against cancer cells	6,7,8
Blackberries	An anthocyanidin	Growth arrest of cancer cells by antiangiogenic effects	6,7,8
Grapes	Rasveratrol	pro-apoptotic activity against tumour cells	6,7,16
Green Tea	Epigallocatechin-3-gallate (EGCG)	Apoptosis in tumour cells and growth arrest of tumor cells.	13,14
Ginger	Phenolic compounds	Apoptosis in tumour cells	7
Onion, Garlic	Allyl sulphur compounds	Apoptosis in tumour cells and antiproliferate activity against human cancers and toxic to cancer cells.	10,11, 19,41
Papaya	Isothiocyanide	Restore the cell cycle to eliminate cancer	34
Raspberries	Ellagic acid, (a phenolic acid)	Growth arrest of cancer cells by inhibition of angiogenesis of tumour cells	26,27
Strawberries	Delphinidin,	Growth arrest of cancer cells by blocking angiogenic factors	26,27
Sweet potatoes	β - carotene	A potent immune response against cancer cells	6,7,8
Tomatoes	Lycopene	Inhibites the tumour growth and can reverse the carcinogenesis process	15
Turmeric	Curcumin	Induces apoptosis in tumor cells	19

SUMMARY:
Many studies indicate that abundant consumption of food of plant origin reduces the risk of cancer. The chemopreventive effect is related to the high content of nutrients like phytochemicals, lycopene, phenolic compounds, β-carotene, flavonoids, etc. These foods have a potent anticancer property. Thus, the present paper is a compilation of various nutrients and their effect in preventing cancer progression.

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Mucormycosis & Covid-19: Need of an hour to implement quaternary prevention

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INTRODUCTION:

We all are aware of the proverb "prevention is better than cure." The present need of the time is to implement the same in our practice. Prevention is categorized into five groups includes Primordial, Primary, Secondary, Tertiary & Quaternary prevention. The quaternary prevention is comparatively a new concept introduced to the world in the year 1995 by Jamoulle M, Roland M in a Paper presented at the Hong-Kong Meeting of the Wonca Classification Committee.[1] The meaning of quaternary prevention is "action is taken to identify patient at risk of over-medicalization, to protect him from new medical invasion, and to suggest him interventions ethically acceptable."[2]

In the present ongoing pandemic of the Covid-19, a rare mould infection is spreading rapidly amongst the patients suffering from the Covid-19, specifically the one with the co-morbidity such as diabetes mellitus. The other factors which may be responsible for its spread are overzealous use of steroids, prolong hospitalization & compromised immunity, etc.[3] The prevalence of mucormycosis in India is about 80 times the prevalence in developed countries, being approximately 0.14 cases per 1000 population.[4] The mucorals are ubiquitous moulds found in the hospital air due to predominantly hot & humid conditions. An important virulence trait of Mucorales is the ability to acquire iron from the host, which is an essential element for its growth; in addition to this, corticosteroids can amplify the situation by causing hyperglycemia and by the immune suppressant effect.[5] The exact reasons are sufficient to make the host susceptible to mucormycosis. The incidences of such cases are increasing during the second wave of Covid-19 in several parts of the countries.[6,7]

The reason above is the demand of time to look after the quaternary prevention in the present fight with the ongoing pandemic and protect the patients from the life-threatening diseases arising from over medicalization.

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