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Review Article

Forestalling measures for ensuring safety of Dental clinics during Pandemic of COVID 19.A narrative review

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Abstract

World Health Organization (WHO) Director General on March 11, 2020 declared that 2019 coronavirus disease outbreak is a pandemic caused by severe acute respiratory syndrome viral infection of Coronavirus 2 (SARS-CoV-2). It causes cough, fever, pneumonia like infections of respiratory tract. The objective is to understand the preventive measures required in dental clinics for safety of dental team including general dentist, dental staff and patients in pandemic of COVID 19. Most of the dental team members do not have a complete familiarity with COVID 19 pandemic in comparison to healthcare professionals working in other disciplines of healthcare settings. Main focus of this article is to well equip a dental team with updated knowledge about modified dental practices from all over the world and precautionary measures followed by different Dental Associations in COVID 19 pandemic. Motivation behind this narrative review writing is basically prevention of dental community and patients from COVID19 pandemic. The aim of this article is provision of safety guidelines at all levels identified by dental care providers of different countries for protection of dental community all around the globe during and after pandemic of COVID 19. Dental care providers should have knowledge and preparedness with proper pathways for tackling challenges of infectious disease pandemic spread.

Keywords :

ADA: American Dental Association, ART: Atraumatic Restorative Treatment

Declaration of Competing Interest:

The authors declared that there is no conflict of interest

Objectives:

The objective is to understand the preventive measures required in dental clinics for safety of dental team including general dentist, dental staff and patients in pandemic of COVID 19. It will be done by knowing about:

1- Bird-eye view of COVID 19.

2- Transmission and Fast Spread modes of virus COVID 19.

3- How dentistry vulnerable to COVID 19?

4- Guidelines for triaging and screening of dental patients during pandemic of COVID 19.

5- Guidelines for Tele dentistry; a platform for patient online communication and evaluation.

6- Precautionary measures for treating emergencies of dental patients who are non-COVID19 including: Dental waiting areas precautions, proper use of PPEs in Dentistry during COVID 19,

7- Precautions recommended in dental room during pandemic of COVID 19.

8- Precautions recommended in dental room for confirm COVID 19 cases.

9- Preventive Trainings and Modified Guidelines for Dental Teams.

Another objective is to motivate dental researchers and dental care authorities to do more research and devise new detailed practical plans and pathways for provision of safe dentistry during and after pandemic of COVID 19 in dental settings.

Introduction:

Most of the dental team members including general dentist and dental working staff do not have a complete familiarity with COVID 19 pandemic like other healthcare professionals working in Intensive care units, surgery departments, medicine department and different other departments of healthcare settings. Although general dentist usually perform multidirectional duties in most of the public and private hospitals by doing surgical management of dental patients, dental consultations and also by dealing with dental emergencies. So it is a need of hour for a dental team to have a complete awareness of COVID 19 from its structure, first identification, fast spread, ways of communication in dental practices and effect of this pandemic on dental team and patients. Dental team should have an updated knowledge of triage, screening of patients, Tele dentistry, proper use of PPE'S and precautionary measures in dental settings to remain safe from COVID 19. If dental team failed in paying attention to all precautionary measures related to pandemic of COVID 19, it is quite possible that not only dentists and dental staff themselves get infected but they can also become a source of infection to healthy patients, their own families and to a negotiable extent to surrounding public people. Main focus of this article is to well equip a dental team including general dentist and dental staff with updated knowledge about modified dental practices from all over the world and precautionary measures followed by different Dental Associations in COVID 19 pandemic. Motivation behind this narrative review writing is basically prevention of dental community and patients from COVID19 pandemic.

1-Bird's - eye view of COVID 19:

COVID 19 is an RNA virus which is single stranded, belongs to Coronaviridae family and of nidovirales order^[1]. Corona virus on its outer surface has crown-like spikes that's the reason for having a name of coronavirus. Size of this virus is small 65–125 nm in diameter and length from 26 to 32kbs.^[2] COVID 19 is labelled as a novel virus. In China Wuhan COVID-19 is first identified, during the month of December in 2019, and later on 30th of January 2020, it is declared as an emergency of public health which is of international concerns, by World Health Organization^[3]. World Health Organization (WHO) Director General on March 11, 2020 declared that 2019 coronavirus disease outbreak is a pandemic caused by severe acute respiratory syndrome viral infection of Coronavirus 2 (SARS-CoV-2). It causes cough, fever, pneumonia like infections of respiratory tract.^[4] COVID 19 is very transmittable and still there is no vaccine for this disease.^[5] COVID 19 is spreading in a very fast manner and creating a sense of fear throughout the world hence people are following safety measures strictly.^[6] COVID 19 virus is spreading from one individual to another individual via contaminated surfaces, aerosols and respiratory droplets associated with saliva^[7]. Due to virus identification in stool of infected patients, transmission via fecal oral route is possible^[8]. It spread internationally within one month after first identification in china and created a pandemic situation^[9]. coronaviruses have 4 genera alpha (α), beta (β), gamma (γ) and delta (δ). From which alpha, beta have ability of causing infection in mammals, gamma and delta have ability to cause infection in birds. In humans, infection causing coVs are of six types including α-CoVs HCoV-229E, HCoV-NL63, β-CoVs HCoV-HKU1, HCoV-OC43 are with low pathogenicity^[10]. COVID 19 is a member of betacoronavirus group two of which had already created epidemics of severe acute respiratory syndrome (SARS) in 2002 and Middle East respiratory syndrome (MERS) in 2012^[11]. Diagnosis of COVID 19 is done through Oropharyngeal and nasopharyngeal swabs, genome sequencing, real time polymerase chain reaction (PCR) and by cell culture^[12]. Isolation of Viral RNA is done from plasma of some infected patients^[13]. The incubation period of COVID 19 is about 2- 12 days but some studies revealed that this period is of 24 days.^[14] The virus also has a transmission capacity from asymptomatic carrier patients who are infected with COVID 19.^[8]

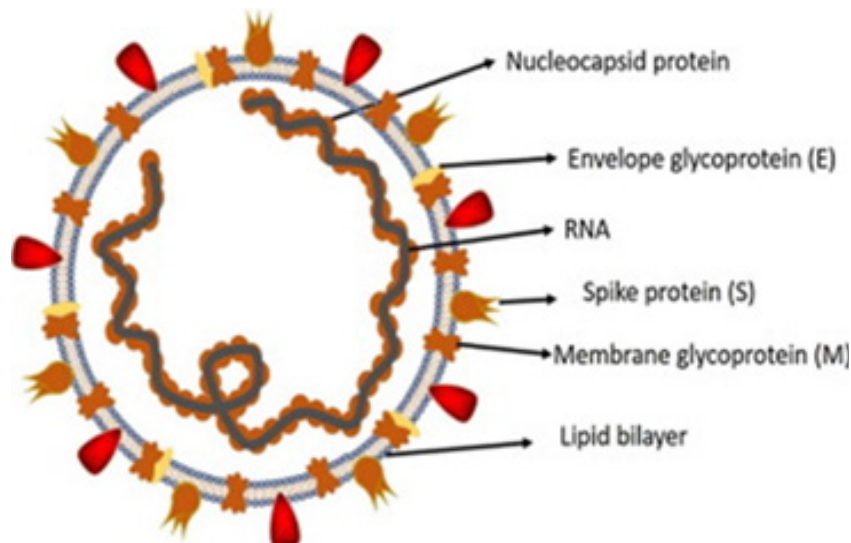


Figure 1: Structure of human coronavirus causing respiratory syndrome. [2]

2-Transmission and Fast spread modes of virus COVID 19:

The patients of Wuhan china with history of unidentified viral pneumonia shared that they had visited Huanan seafood market.^[15] It is assumed that the main transmission of virus is through these open markets of china. Where bats, snakes, marmots, frogs, rabbits and birds were frequently sold alive^[16]. This pandemic started from china and now it is continuously spreading throughout the globe. After evolutionary analysis and genome sequencing of virus it is suspected that bat is a natural host of COVID 19 and it is transmitted to human beings through intermediate host which is not known yet. But it is confirmed that COVID 19(SARS cov2) and SARS cov1 infects humans by using ACE2 receptors (angiotensin-converting enzyme 2 receptors)^[17]. This virus is spreading from one person to other individuals via aerosols, respiratory droplets, cough and sneeze of infected persons.^[18, 19] Aerosols generated during different medical and non-medical procedures are main source of its spread. These aerosols have ability to penetrate lungs of human body through inhalation^[20, 21]. Oral mucosa is considered as one of the entry route of COVID 19 in body^[22]. Oral mucosa mainly of floor of mouth and also tongue contain ACE2 receptors, which are used by COVID 19 for its cellular entry. These receptors are also present on gingival and buccal epithelial cells.^[23] Biological, clinical and empirical evidences give strength to the findings that oral mucosa is the initial site for entry of COVID 19 and oral symptoms like taste loss Ageusia, smell loss anosmia and mouth dryness may be possibly early signs of infection of COVID 19 before onset of dry cough, fever, breath shortness, fatigue and many other symptoms.

3-How dentistry vulnerable to COVID 19?:

Spread of any infection causing agent from one person to another is called cross infection. In hospital or dental settings cross infections commonly occur among doctors, paramedical staff and patients.^[21] Dental procedures are main source of COVID 19 transmission because these procedures produce aerosols and respiratory droplets spatter containing saliva, blood, viruses and bacteria which can be a cause of its further transmission^[24].

Recent studies showed that COVID 19 is present in saliva of infected patients^[25]. SARS-CoV-2 Virus has ability to infect epithelial cells of salivary glands because of this ability these epithelial cells become a major source of salivary viral overload^[26]. This shows that saliva can be a major source of cross contamination during procedures that generate aerosols most probably by the use of air water syringes, air turbine hand piece and ultrasonic scalars, so it is very crucial for dental health care professionals to improve preventive measures while doing dental procedures^[24]. Different prosthetic procedures are main source of transmission of infections from patients to dental laboratories via impressions and other prosthetic items, if mishandled. Many dental laboratory procedures generates aerosols that cause contamination of air, dental laboratory equipment and materials^[27]. When these contaminated equipment and materials are used for other prosthetic procedures without proper sterilization or disinfection, they can contaminate new appliances resulting in transmission of infection to clinics and patients^[28]. In dental clinics, doctors and auxiliary staff are in continuous contact with patient's saliva, blood and aerosols. This causes higher risk for them to get infections.^[29] splatter generated during scaling and other procedures like tooth cutting using burs with high speed motors, are main source of air contamination through aerosols^[30]. In a recent study conducted on dental students from different institutes of Pakistan showed that they have positive attitude and good knowledge regarding cross infection control but their practices are less satisfactory.^[31]

4- Guidelines for triaging and screening of dental patients during pandemic of COVID 19:

This portion include general recommendations from recent models proposed by WHO and different countries for triaging and screening of dental patients.

According to response plan on COVID 19 by the US Government this pandemic could continue for more than 18 months ahead (HHS, 2020), published on 13th of March 2020 by (HHS) Department of Health and Human Services^[32, 33]. Impact of COVID 19 pandemic on dental services is not clear yet to many Institutes of dentistry, regulatory bodies, and General dentists working in both private and public sector hospitals all around the world. Dental associations of different countries are taking Varying degrees of actions for provision of dental services in pandemic. Some suggest to completely close dental practices^[34], some advice to reduce their number of daily patients check-ups^[35], some advice to do only dental emergencies^[36], some countries have not still given any advisory separately for dentistry. Due to lack of any universal guidelines for provision of dental care services in pandemic, it is a need for every country to set some standard protocols for dealing dental patients of every sort during and after COVID 19 pandemic in a proper documented form according to their own culture of healthcare system dental settings. Because every country do not have same healthcare system, variations are existing in trends of equipment's, manpower, management, protocols and many others among healthcare facilities of low and high income countries. A recent study showed that COVID 19 have a strong impact on use of dental emergency facilities. Dental problems distribution frequency was changed to a significant extent with marked increase in percentage of oral infection patients, decrease in percentage of dental trauma patients and decrease in patients with non-urgency problems in comparison to pre pandemic conditions^[37]. If dental practices are completely stopped during spreading time of COVID 19 pandemic then patients who need emergency medical care will suffer a lot. Dental morbidity prevention is a mandatory part of dentistry. In some studies it is recommended to treat all dental patients by making guidelines for patient dental fitness. These guidelines will provide estimation of severity of disease and help in deciding emergency treatment required by which patient.

A- Triages:

WHO recommends the establishment of pre check triages in dental clinics of every healthcare setting during COVID 19 pandemic outbreak for recording the temperature and taking complete medical history including travelling and recent contact with infected person?^[38].

Dental triage in primary care should need to focus on the providing three A to patients:

- 1- Advice;
- 2- Analgesia;
- 3- Antimicrobials (where appropriately needed).^[39]

Patients will be advised that, at this time treatment options are restricted severely and they will have to call back if symptoms persist after 48-72 hours. Local pharmacy should be advised to keep all recommended medical products available for patients. Patients who need emergency dental treatment which cannot be manageable by patient will be shifted to dental emergency care settings by following local guidelines protocols. Proper contact record of patients should be taken and saved appropriately. Referral of patients should follow local guidelines and protocols.

Triage of Commonly Presenting Dental Problems:

The given diagram is showing a simple method for management of dental care patients by use of a telephone triage. This diagram is not so much comprehensive but it deals with many of most common presenting oral symptoms. Before dental triage it is mandatory to establish status of patient with regard to pandemic of COVID 19 is first.

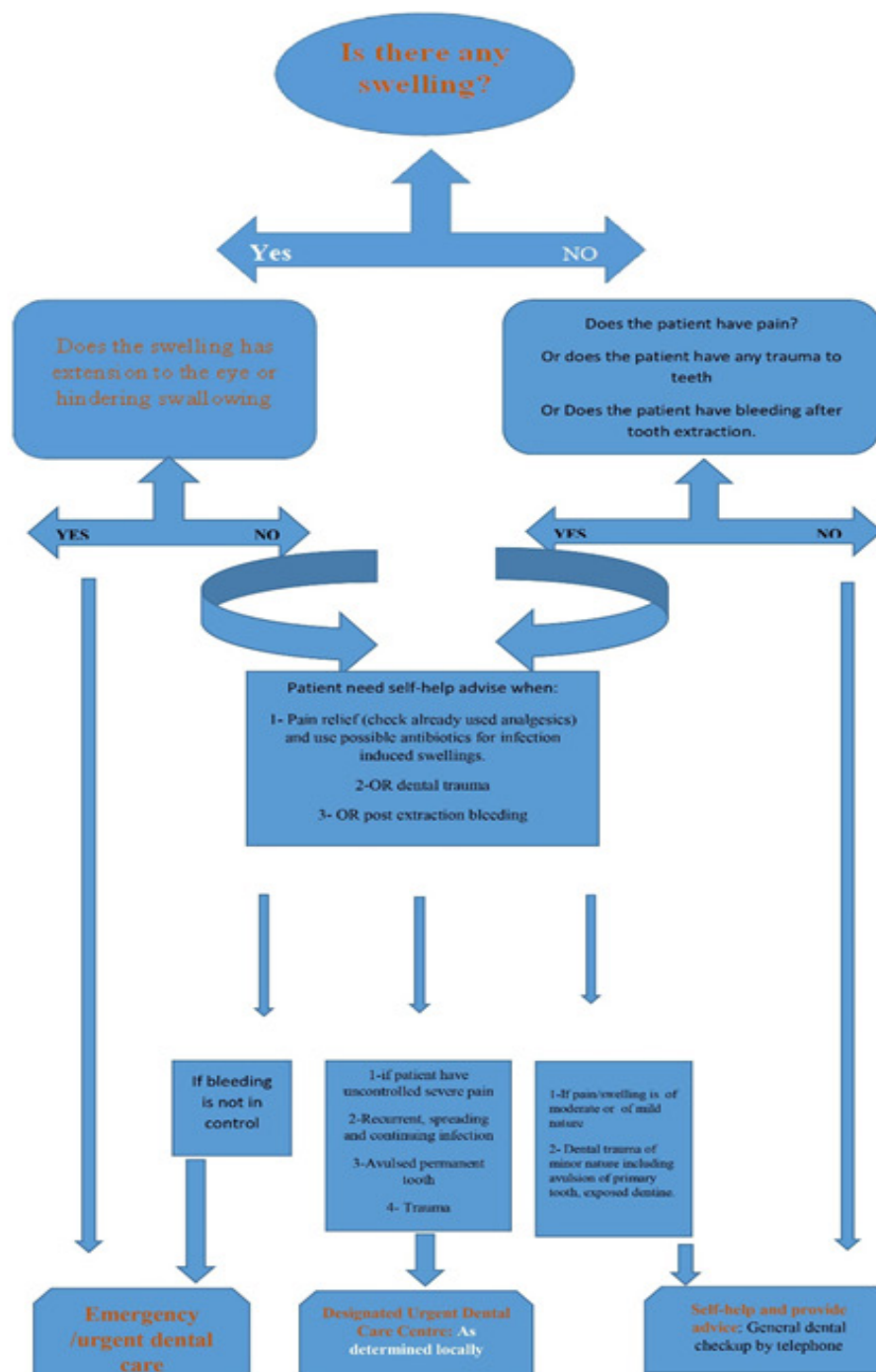


Figure: Flow sheet is SDCEP Management for Acute Dental Problems during pandemic of COVID 19.



Figure 2:During COVID 19 outbreak diagram of emergency care area of Wuhan university ,school and hospital of stomatology.Another model in china showing triaging and ppes use.

Yellow color indicate triage and waiting room area,orange color indicate dental clinic, disinfection of this is done once every half day,red color indicate isolation room for: suspected patients of covid 19 ,for recovering patients of covid 19 after their discharge from hospital and for patients who need dental aerosols and droplets producing procedures and this area is disinfected immediately after every procedure of every single patient,green color indicate resting room area for dental staff only where they allowed to enter by turn in room.Triage staff wear disposable cap surgical,mask,working clothes. Dental clinic staff wear PPE's ,gloves ,N95 masks,shoe cover ,goggles,cap ,gowns and faceshields.Red area staff wear protective clothing along with all ppes and use separate exit and entrance passages for patients showing with red arrow and for staff showing with the blue arrows.green area staff wear medical masks all time except eating and drinking.^[40]

It is recommended that test of all patients for COVID 19 screening should be done if testing kits are available in adequacy for authentic confirmation before doing any dental procedure.

B -Screenings:

It is mandatory to do screening of all dental patients before entrance to clinical setting by considering every single patient as a carrier of COVID19.Every patient who has recovered from infection of COVID 19 should be considered as a carrier for 30 days at least after recovery, confirmation of recovery is done by laboratory test. Focus will be on identification of urgent need of patient and management should be done with least invasive procedures .Categorizing dental patients according to severity and urgent need of treatment they required. Identify the dental treatment required, its risks and benefits for each patient.

Patients Screening and Categorization:

Tele screening is advised if possible. If not possible than on first contact patient should be screened for corona symptoms by medical history and taking travel history from diseased areas. Dental treatments need to be done with coordination of physician for all covid 19 active and recently recovered patients in airborne infection isolation rooms and negative pressured rooms of hospitals .If possible then try to postpone all suspected and confirmed cases patients treatments till recovery. It is proposed that all patients are divided into five groups after completion of screening.

A- unsuspected, Asymptomatic and unconfirmed case of COVID19.

B. suspected, Symptomatic and unconfirmed case of COVID-19.

C. confirmed case of COVID-19 but is stable.

D. confirmed case of COVID-19 but is Unstable.

E. confirmed case of COVID-19 now Recovered.

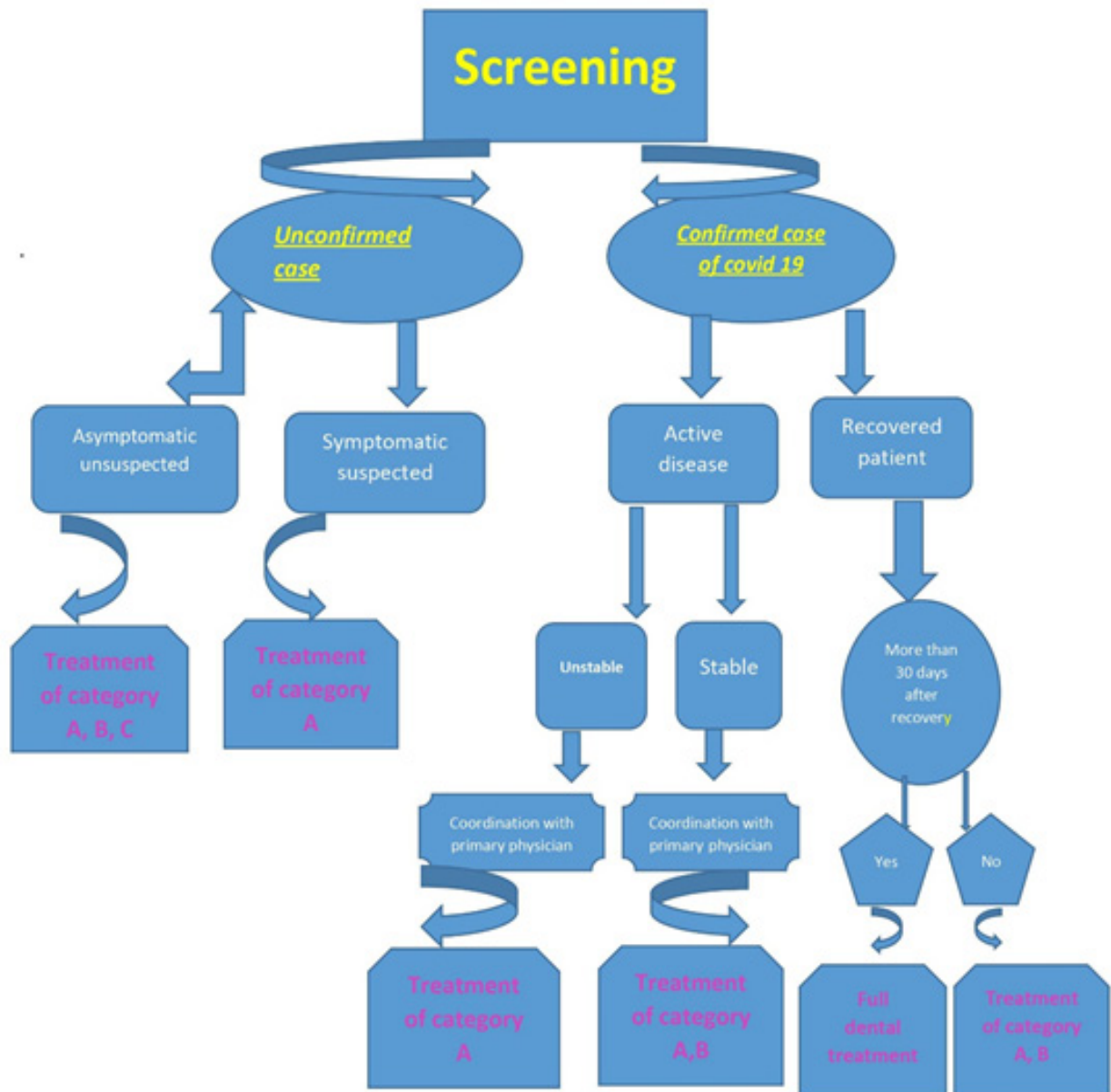


Figure 3: Flowchart showing the sequence of screening for dental patients, their categorization for treatment during pandemic of COVID-19. 83

American Dental Association (ADA) give a detailed guideline for dental emergency and non-emergency dental care on 18 March 2020 for prevention of spread of COVID 19 and for decreasing burden on hospital emergency department settings. The guidance may be changed with progression of COVID 19 pandemic, according to ADA, dentist should determine the patients need for urgent treatment by using their own professional judgments.^[41]

Categories of Dental Treatments (42) :

A type Category	B type Category	C type Category	D type Category	E type Category
(Emergency and urgent conditions)	(Emergency conditions that need management with minimum invasive procedures without generation of aerosols).	(Emergency conditions that can be managed by invasive procedures which produce aerosols)	(Non-Emergency / urgent conditions)	(Elective)
1-maxillofacial fractures which are Unstable and will be able to compromise the airway of Patients.	1- dental pain (7≤) of severe nature because of inflammation of pulp and need extraction of a tooth. That will be managed without generation of aerosols	1- dental pain (7≤) of severe nature because of inflammation of pulp and need extraction of a tooth. That will be managed with generation of aerosols	1-Adjustments and Repairs of removable dentures.	1- Oral examination and recall visits for routine dental checkups.
2-Bacterial infection of soft tissues which are of diffuse type like in cellulitis or bacterial infections causing swelling either intraoral or extra orally ,all these will be able to Compromise the airway of patient.	2-dental pain (7≤) of severe nature because of vital tooth fracturing and will need to manage without generation of aerosols.	2- dental pain (7≤) of severe nature because of vital tooth fracturing and will need to manage with generation of aerosols.	2-Defective and fractured Restoration which is asymptomatic need no urgent treatment .The restoration will be from removable, fixed, orthodontic or any other category.	2-Dental procedures of aesthetic purposes.
3-postoperative bleeding of uncontrolled type.	3- Dental trauma results in tooth luxation avulsion/ that will be managed without generation of aerosols.	3- Dental trauma results in tooth luxation /avulsion that will be managed with generation of aerosols.	3-periodontal disease of chronic type.	3-Restorative treatment of teeth which are asymptomatic.
	4-Dry socket/ postoperative osteitis.	4- Deboned fixed prosthesis cleaning and applying temporary cementation		4-Extraction of teeth which are asymptomatic.
	5- Pericoronitis and pain of third-molar.	5- In patients of oncology / radiation department who need adjustments of Removable dentures.		5-Orthodontic procedures which don't fall in category type B,C

	6- Fractures of Maxillofacial region and are of stable nature That need no urgent intervention	6-Fixed prosthesis causing soft tissues injury after getting fracture.		6-Routine dental therapies including scaling ,pit and fissure sealants application etc.
	7-Localized abscess of dental/ periodontal Origin.	7-periodontal diseases of acute nature.		7-provision of fixed or removable type prosthesis for missing teeth replacement.
	8- Fixed orthodontic defective and Fractured appliances that will be able of causing lacerations of Soft tissues.			8- Implant surgeries for lost teeth.

Table 1: showing guidelines of the five categories required different dental treatments during pandemic of COVID19 developed by modifying ADA.

It is advised to general dentist working all around the world to take forward steps in doing patient screening by following their own recommended models as per their settings until pandemic get over.

5-Guidelines for Tele dentistry; a platform for patient online communication and evaluation:

Dentists are lying at forefront position of cross infection between patient and doctor during pandemic of COVID 19.For decreasing the risk of cross infection it is recommended to reduce face to face dentists and patient consultations. Dentistry has inherent visual nature so it can be easily practiced as a tele dentistry.⁽⁴³⁾ Now -a -days focus of the world is towards redesigning of existing healthcare models by adding telehealth in more details through extension of its domains⁽⁴⁴⁾.Teledentistry uses smartphones, internet networks, devices and other telecommunication technologies for provision of dental information and services by direct communication of dentists and patients, without coming of patients to hospitals and dental waiting rooms. It will be able to help remote assessment triage and continuation of care in a safe course of action. Its use is also beneficial for elder patients with preexisting medical conditions, terminally ill patients, patients with low immunity and patients in quarantine status .Previous studies showed that patients can transmit clinical data via mobile phones including history and images of teeth ,oral cavity or any pathosis to dentists.⁽⁴⁵⁾. Telecommunication devices applications networks will help the dentists in taking dental history ,dental videos, dental photographs of patients for making proper clinical preliminary diagnosis .Confidentiality of patient data must be ensured while using teledentistry.⁽⁴⁶⁾ Initial management of non-emergency cases is done with palliative medication therapy like analgesics, antimicrobials. If patient belongs to emergency case category he /she will be referred to dental care setting which is well-equipped, after initial screening of COVID19 for further evaluation and treatment.⁽⁴⁷⁾ Tele dentistry will also provide a dedicated platform where difficult cases can be easily discussed among healthcare providers. Effectiveness and smart use of tele dentistry depends upon proper management and dissemination of this system in healthcare settings, which requires good infrastructure at both sides of consultations. Limitation of teledentistry use are also existing with its benefits some of which are: clinical examination mandatory for some diseases like periodontal probing for periodontitis, x rays imaging for peri- apical pathosis are not possible on the spot of consultation.

6-Precautionary measures for treating emergencies of dental patients who are non-COVID19:

A- Dental waiting areas precautions:

Dental settings waiting areas are common sites for likelihood of cross infection between patients and dental team. Some preventive measures are needed to reduce the Chances of spread of COVID 19 infection. Number of patients present in waiting room area at one time should be closely regulated on daily basis to avoid massive gathering. Number of patients can be managed by informing patients to come on scheduled time , call before come ,wait in their own car if number of sitting spaces

are already occupied in dental setting waiting room area. First use triage or screening to appoint a patient during outbreak of pandemic COVID 19 by teledentistry. When patients are in waiting room area social distancing should need to be strictly ensured. Social distancing was very effective method for prevention of disease transmission from one human to another, seen in epidemics of past and had obvious impact in reducing disease spread.^[48-49] Recently in china use of social distancing with range of epidemic control safety measures resulted in prevention of virus spread.^[50] Social distancing can be maintained by making alterations in sitting patterns of patients chairs, spaces between two chairs are of 2 meters^[51]. Info graphic images showing techniques of proper hand hygiene, Social distancing, cough etiquette etc which can be easily understandable and readable to patients should be posted in waiting room areas of dental clinics.^[52] Different studies have shown that COVID 19 has ability of survival on different surfaces from few hours to many, so special modifications are needed in the setup of waiting room areas of dental clinics to limit cross infection.^[53] Remove all unnecessary items like magazines, toys need to be done from the waiting room area because these items can harbor virus on their surfaces. Frequent cleaning of surfaces which are used by many patients like door knobs, handles, reception counter surface, toilet door, arms of chairs on which patient sits while waiting, need to be done with proper antiseptic solution.^[54] Virus of COVID 19 can only alive after its entrance inside of living cells and it is non-replicating or inert outside of body.^[55] When virus is outside of body its protein structure will be easily disassembled by using common disinfectants in 5 minutes^[56]. Staff working in waiting room areas should need to wear disposable cap most suitable surgical, mask, and working clothes. Staff should be trained in taking history from the patient orally and record or store it digitally and all necessary data should be shifted to essential working files later. Sanitize pen or discard if disposable pen is used, for taking informed consent, payment and billings. Patients should be advised prior, to come with their own masks foot covers and sanitizers if possible. Patient should be advised try to come alone if belongs to non-emergency case but not to come alone in case of pediatric patients /emergency patients. Payments or billing should be done digitally if possible and use precautionary measures where non digital mode of payment is used. Front desk staff should be present in waiting room area with transparent glass sheet or barrier from patients.

B-Proper PPEs use in Dentistry during COVID 19:

Personal protective equipment's are very essential tools for medical and dental practitioners in order to seek prevention from hazardous materials, injuries and infections.^[57] Purpose of PPE'S is to preserve worker's physical integrity.^[58] For workers safety PPE'S should be easy to maintain, well protected, strong, durable and of practical nature.^[59] PPE'S include gloves for protection of hands, face masks or face shields for protection of mouth, nose and respiratory tract, eye wear for eyes protection and apron or gown for protection of clothes, shoe cover for protection of feet, surgical cap, N95 masks^[60]. Gloves need to be worn before contacting the body fluids, skin and the mucous membranes, gloves after use should be discarded immediately and hands should need to be properly washed. Gowns need to be non-sterile, fluid resistant and protective against splashes of blood, saliva, fluids, secretions and body excretions. All disposable PPE'S need to be disposed of properly and non-disposable PPE'S should be disinfected before every reuse.^[61] Primary PPE'S in dental setting are gloves, protective eye wear, surgical mask face shields and protective jackets and gowns from last many years.^[62]

According to a previous study conducted in turkey showed that a large number of dental surgeons use gloves and face masks^[63]. Surveys in Pakistan showed that in dental practices 68-100% of dental surgeons used to wear face masks.^[64-65] A recent study in Pakistan revealed a great variation in wearing PPE'S among dentists working at different settings. Wearing of gloves, face masks, protective eye wears, disposal of sharp needles and surface disinfection have statistically significant difference among Pakistani dentists.^[66] Dental department, being on potential risk of cross infection of COVID 19 due to nature of dental procedures, requires strict protocols for infection control urgently. Effective infection control protocols include surface disinfection of everything within dental settings, use of different items of personal protective equipment's including gloves, gowns, face masks and face shield of eye wears and frequent hand washing. COVID 19 spread through respiratory tract so National Institute for Occupational Safety and Health recommended N-95 masks and European Union have authenticated FFP2-standard masks for daily dental practice^[67]. Aerosols are either solid particles or liquid particles of diameter less than 50 µm size will remain suspended in the air for prolonged time periods. Splatters are constituted of water, air and solid substances of diameter 50 µm to many millimeters. Under normal circumstances regular use of surgical face masks offer 80 percent of filtration rate. Size of COVID 19 is of about 120 nm or 0.12 µm. Use of respirators FFP3 offers filtration of about 99 percent. It is a misconception that use of regular surgical masks give protection from aerosols of dental procedures during COVID 19 pandemic.^[68]



Figure 4: Different items of PPE'S

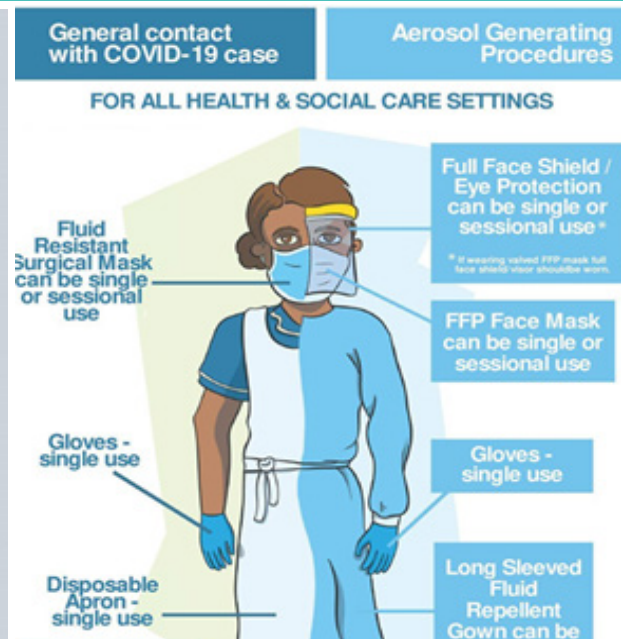
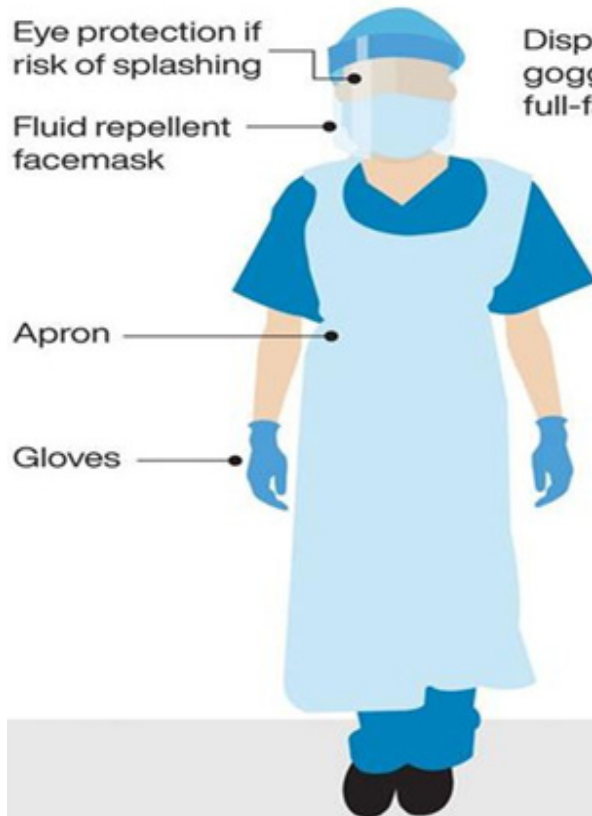


Figure 5: PPE'S used during aerosols generation

Personal Protection Equipment (PPE) for health workers

Within metre of patient with possible/confirmed Covid-19



For procedures likely to cause coughing (such as putting patients on ventilators)



Figure 6: PPE'S for healthcare workers

CDC (Centre for disease Control), recommended methods of wearing and removing different items of personal protective equipment's:

There are variations in use of PPES according to level of precautions needed like contact precautions, aerosols precautions. COVID19 transmits through inhalation of virus laden respiratory droplets or aerosols and from contamination of conjunctiva epithelium of eyes by infectious droplets. [69]

1-Gowns:

Gown should have full coverage of trunk starting from neck and extending up to knees, from shoulders to the wrist for arms, wrap will be done around back. Fasten the gown in back of waist, also in the back of neck.

Removal of gown:

After use, sleeves and front of gowns are contaminated parts. If hands will get contaminated during the removal, should be washed or sanitized with sanitizer containing alcohol. ties of gown will be unfastened cautiously to avoid gown sleeves touching body. After that gown will be pulled off away from both the neck and shoulders. Touch inside surface of gown only. After removal gown should be turned inside surface out. Roll it in a bundle shape and discard/put this gown in a waste container.



Figure: showing proper wearing of PPES



Figure: proper removal of PPES

2-Respirator or Mask:

Ties and bands will be secured properly at the middle of neck and head. At Nose Bridge flexible band need to be fitted properly, snug to face and chin below. checking of respirator fit should be done.

Removal of mask:

Do not touch front side of mask /respirator because it is contaminated after use. If hands will get contaminated during the removal, should be washed or sanitized with sanitizer containing alcohol. Grasp it from ties at bottom of mask and then from top and remove it without touch on front side. Discard/put this mask in a container of waste.

3-Face shield or Goggles:

Should be placed on eyes and face and do adjustments for its fit.

Removal of face shield/goggles:

Outer side is contaminated after use. If hands will get contaminated during the removal, should be washed or sanitized with sanitizer containing alcohol .Remove face shield /goggles from back side by lifting earpiece or head band. If it is re-useable then put it in special container for reprocessing. If non re-useable then discard it by putting in a container of waste.

4-Gloves:

Should extend from fingertips to the wrist of gown wear.

Removal of gloves:

Outer surface of gloves is contaminated after use. If hands will get contaminated during the removal, should be washed or sanitized with sanitizer containing alcohol .use one glove hand for grasping the palm surface of other gloved hand and peel it off. Hold this glove in other gloved hand .slide fingers of ungloved hand under the wrist of gloved hand and peel off this second glove along with first glove holding in it. Put both in a container of waste.

Wash hands properly or sanitize hands with alcohol based sanitizer after removal off all of the PPES. Hand washing will also be ensured before and after any dental treatment session with mild soap for at least 20 seconds.

7-Precautions recommended in dental room during pandemic of COVID 19:

1-All equipment's used during any sort of dental treatment should be sterilized and disinfected before patient's entry in dental room. All dental room staff including dentist should be well equipped with PPES. All inanimate surfaces should be disinfected after every patient with recently approved chemicals effective for COVID 19 because virus of COVID 19 is viable in the aerosols and can survive on inanimate surfaces for nearly 3 days at normal room temperature ,in humidity survival of virus is also favorable.^[70]Dry environment should need to be maintained to restrict spread of COVID 19.^[71]

2-It is advised to all patients to rinse their mouth pre operatively with 1 percent hydrogen peroxide and 0.2 percent povidone iodine .^[72,73,74]Pre procedural mouth rinse for at least 15 seconds will reduce the microbial count in oral cavity and reduce the risk of aerosols generated cross infection.^[75,76]

3-Radiographs should only be taken when of urgent necessity and extra oral radiographs like OPG etc should be advised. Intraoral radiographs should not be advised because these can induce cough gag reflex and increase secretion of saliva in mouth .If intraoral radiograph is mandatory then use of double barriers should be advised for prevention of cross contamination by perforation.^[77]

4-Use of rubber dam is advised by New Zealand Dental Association, American Dental Associations, Indian Endodontic society and many others. Because isolation with rubber dam have ability to reduce aerosols in diameter of 3 foot of working field by 70 percent.^[78]

5-Dental invasive and aerosols generating procedures should be minimized if possible. Avoid use of equipment's that generate aerosols as much as possible, advised by different dental Associations of World. These include hand piece of high and low speed, triple syringe, ultrasonic scalars, intraoral sandblasters, air abrasion devices .Use of hand instruments is recommended .slow speed hand piece without spray of water, use of high volume saliva ejectors, use of hand piece with anti-reflux design or anti retraction valve is recommended.^[78]Use of disposable instruments is usually recommended by most of the guidelines if possible .Autoclave hand piece after every patient. Atraumatic Restorative treatment(ART) should be preferred.

6-History of drug intake should need to be taken carefully from Patients. Because most of the patients have already taken self-medication during lock down of covid 19 pandemic.

7-Post operative instructions should include putting up contaminated cotton swabs in lid laden dustbins.

8- Absorbable sutures should be preferred in emergency cases. CT of chest should be recommended before treating severe maxillofacial traumatized patients and patients with life threatening conditions.

9-Treatment of painful irreversible pulpitis should include chemo mechanical caries removal before pulp retrieval. Patients who need moderate level of urgent treatment should be scheduled in the list of clinical day as last one patient to avoid nosocomial infection.

8-Precautions recommended for confirm COVID 19 cases in dental room.

All Elective Treatments and regular checkups of patients who are confirmed cases of COVID19 after diagnostic testing should be postponed until they recovered completely. However in case of dental emergency if it is not feasible to defer treatment then patient should be referred to the facilities which have Airborne infection isolation rooms (AIIRs).These rooms are for single patient and are negatively pressured relative to surroundings and 6 air changes per hour are done in these room minimally .HEPA filter integration in the systems of air conditioning is essential in these rooms for filtration of air before recirculation. In these rooms furniture and non-essential equipment's should be minimum .Only

mandatory things for dental procedures should be present. These rooms should always be closed except at the time of procedures and entry /exit of these rooms should be minimum .All staff including dentist should be well equipped with PPES, N95 masks or respirators of higher level.

9-Preventive Trainings and Modified Guidelines for Dental Teams:

Dental team of healthcare dental clinics including dentist and Allied staff should be trained in triaging, screening, tele dentistry, proper use of PPES and proper hand hygiene techniques with reference to COVID 19 by online courses and video lectures as a part of Continuous Professional Development .Modified Guidelines should be provided to every member of dental team for safe dental practices in pandemic of COVID 19 by higher authorities and regulatory bodies of every country according to their contextual practices.

Discussion:

World Health Organization (WHO) Director General on March 11, 2020 declared that 2019 coronavirus disease outbreak is a pandemic caused by severe acute respiratory syndrome viral infection of Coronavirus 2 (SARS-CoV-2).After exploring the nature of COVID 19 to some extent, dental care Associations of different countries of the world have developed different guidelines for dental settings and dental team members highlighting preventive measures against COVID 19 spread through dentistry. Because dental procedures are aerosols generating procedures so dental team members and patients are highly susceptible to cross infection by COVID 19.So it a need of hour for all dental community healthcare members to ensure safe dental practices by keeping themselves updated with current guidelines for preventive measures. Guidelines discussed in this paper are general dentistry guidelines during COVID 19 pandemic by different dental associations of world according to their practices however after familiarity with these guidelines modifications are needed further by dental health advisory of any country according to their contextual practices . Final decision for implementation of Classifications, protocols mentioned in this paper will be done according to dental practitioner's case evaluations and judgment's. Categorization of dental patients mentioned above have included most of dental cases but not all sort of dental cases. Triaging and screening models mentioned above are proposed by different dental associations of the world as a forestalling measure for prevention during pandemic of COVID 19 .The aim of this article is provision of safety guidelines at all levels identified by dental care providers of different countries for protection of dental community all around the globe during and after pandemic of COVID 19.Dental care providers should have knowledge and preparedness for tackling challenges of infectious disease pandemic spread. Extensive detailed guidelines are mandatory even for every single procedure from all effected countries of the world designed according to their own setups.

Conclusion:

It is concluded that dental associations of different countries are providing continuous preventive guidelines against COVID 19 pandemic to their dental team members in accordance of their contextual practices and updated knowledge. Many dental procedures are source of cross infection by producing spatter and aerosols .But still many areas of dentistry seems to be under consideration for further guidelines with regard to COVID 19. Dental care providers should have excel in knowledge and preparedness for tackling challenges of COVID 19 without losing their own safety. It is recommended that every department of dentistry like operative dentistry ,prosthodontics ,orthodontics and maxillofacial surgery should develop separate guidelines and safety measures at local regional level according to their specialty emergency preferences which can help a dental team member including general dentist in doing safe practices and prevent further spread of COVID 19 cross infection. It is supposed that this article will provide general overview of common dental precautionary guidelines proposed by different dental associations and dental care authorities of world.

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