

**ORAL HEALTH – A GATEWAY TO PULMONARY HEALTH- A REVIEW****Ankita Garg<sup>\*1</sup>, Aditya Sinha<sup>2</sup>, Shailendra Singh Chauhan<sup>3</sup>, Satendra Sharma<sup>4</sup>, Deepika<sup>5</sup>, Gaurav Jain<sup>6</sup>**<sup>1,5</sup>Post Graduate Student, Department of Periodontology, Kanti Devi Dental College and Hospital, Mathura, Uttar Pradesh, India.<sup>2,4</sup>Reader and MDS, Department of Periodontology, Kanti Devi Dental College and Hospital, Mathura, Uttar Pradesh, India.<sup>3</sup>Professor and Head of Department, Department of Periodontology, Kanti Devi Dental College and Hospital, Mathura, Uttar Pradesh, India.<sup>6</sup>Consultant, Department of Pulmonary Medicine, Max HOSPITAL, Patparganj, Delhi, India.**\*Corresponding Author: Dr. Ankita Garg**

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**ABSTRACT**

Periodontitis is a chronic inflammatory disease which is characterized by inflammation of the periodontium resulting in destruction of supporting structures of teeth and bone loss. Various researches and studies have shown association of periodontitis and pulmonary diseases, the major factor causing lung infection is aspiration of oral pathogens or colonization of respiratory pathogens into oral mucosa. So, if pulmonary health is related to periodontitis, it is advisable to implement oral hygiene measures and periodontal treatment to keep respiratory health in check or as a supportive treatment to medical management of pulmonary diseases. The present article briefly reviews pathogenesis, risk factors and dental interventions which are taken for pulmonary patients for an effective oral health care.

**KEYWORDS:** Periodontitis, Chronic Obstructive Pulmonary disease, Pneumonia, Asthma, Covid, Dental Management.**INTRODUCTION**

Periodontitis is a group of inflammatory diseases that affect the connective tissue attachment and supporting bone around the teeth that further leads to destruction of periodontal ligament and bone. It is widely accepted that the initiation and the progression of periodontitis are dependent on the presence of virulent microorganisms capable of causing disease.<sup>[1]</sup> American academy of Periodontology has stated that bacteria from periodontal region enter systemic circulation and begin new infections in the other target organs. Periodontal infections if not treated is a probable risk factor for cardiovascular diseases, respiratory disorders etc.

Respiratory diseases are the most prevalent diseases which is responsible for considerable suffering in humans and results in morbidity and mortality in human populations. Recent report ranked lower respiratory infections as the third most common cause of mortality worldwide in 1990 (causing 4.3 million deaths), and chronic obstructive pulmonary disease as the sixth leading cause of mortality (2.2 million deaths).<sup>[2]</sup> Certain evidences suggest that oral lesions particularly periodontal infections are associated with the course of respiratory infections like bacterial Pneumonia, COPD and Asthma.<sup>[1]</sup>

The anatomical continuity between the lungs and oral cavity makes oral cavity a potential reservoir of respiratory pathogens. Dental plaque may act as reservoir of respiratory pathogens or some bacteria may be inhaled into the lungs through oropharyngeal secretions. Healthy lungs have protective defenses whereas diseased lungs are not able to defend themselves that will increase the risk and make lung problems worse. So the failure of host defense mechanism to eliminate the contaminating bacteria which when multiply causes the infection in the respiratory tract.<sup>[2,3]</sup>

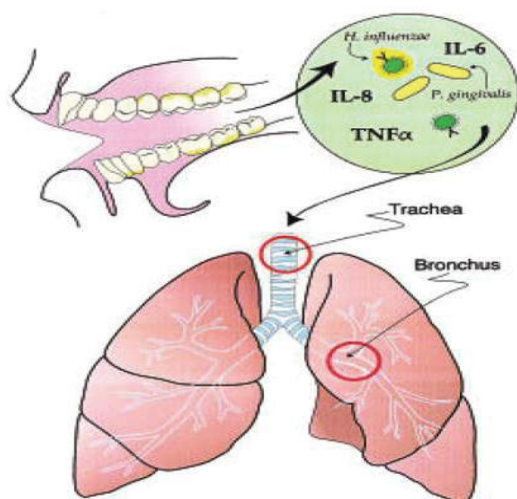
A severe acute respiratory syndrome corona virus 2(SARS-CoV-2) or a novel corona virus 2019 causing the acute respiratory disease emerged as global outbreak in Wuhan City, Hubei, China in December 2019. World Health Organisation (WHO) termed it as COVID-19. It was declared as pandemic and health emergency of international concern on 30th January 2020.

COVID-19 appears as an emerging challenge to the dental practitioners and patients as there is high risk of cross infection amongst the both. The pathogenic microorganisms can be transmitted in dental settings through inhalation of airborne microorganisms that can remain suspended in the air for long periods. Other

modes of transmission could be direct contact with blood, oral fluids, or other dental materials, contact of conjunctival, nasal, or oral mucosa with droplets and aerosols containing microorganisms generated from an infected individual and propelled a short distance by coughing and talking without a mask.<sup>[4]</sup>

### Pathogenesis of respiratory bacterial infection

The lung has numerous units that is formed by the progressive branching of the airways. Each terminal respiratory unit of airway (bronchiole, alveolar duct, alveolar sac and alveoli) is lined by epithelial cells which permits the exchange of gases. The upper airways are heavily contaminated with microorganisms from the oral and nasal surfaces whereas the lower airways are usually sterile. Sterility of the lower airway is maintained by intact cough reflexes, the action of tracheobronchial secretions and mucociliary transport of inhaled microorganisms and oropharyngeal secretions and immune and nonimmune defence factors. The lung also contains a rich system of resident phagocytic cells, which remove microorganisms and particulate debris. (Figure.1)



**Figure 1: Aspiration of oral pathogens.**

According to Scannapieco and Mylotte, Microorganisms can contaminate the lower airways by four possible routes:

- Aspiration of oropharyngeal contents,
- Inhalation of infectious aerosols,
- Spread of infection from contagious sites, and
- Hematogenous spread from extrapulmonary sites of infection (e.g., translocation from the gastrointestinal tract)

### Association of periodontal infection and respiratory infection

The dental plaque serves as a reservoir and bacteria from the dental plaque is translocated to respiratory tract through two possible routes

#### ▪ Hematogenous spread

Hematogenous spread may occur even after simple prophylactic measures or due to adverse effect of some dental treatments.

#### ▪ Aspiration

Three mechanisms are related to aspiration. First is poor oral hygiene or periodontal disease due to which highest number of periodontal pathogens are present in saliva that further get aspirated.

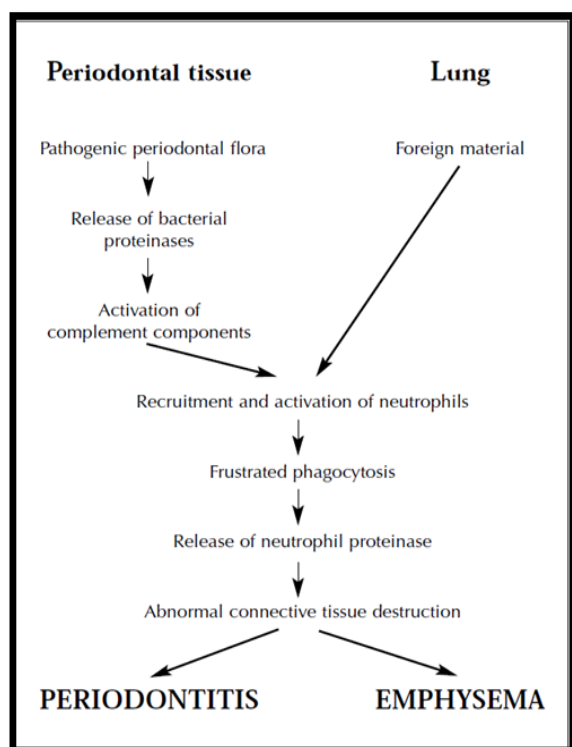
Second is dental plaque harbor growth of pulmonary pathogens.

Third is periodontal pathogens facilitate the colonization of pulmonary pathogens in respiratory tract.

### Role of oral bacteria in the pathogenesis of respiratory infection

Several mechanisms have been proposed to explain the connection between periodontitis and respiratory infections.

- Aspiration of oral pathogens (such as *Porphyromonas gingivalis*, *Aggregatibacter actinomycetemcomitans*, etc.) into the lung to cause infection.
- Periodontal disease-associated enzymes in saliva may modify mucosal surfaces to promote adhesion and colonization by respiratory pathogens, which are then aspirated into the lung.
- Periodontal disease-associated enzymes in saliva may destroy salivary pellicles on pathogenic bacteria.
- Cytokines originating from periodontal tissues may alter respiratory epithelium to promote infection by respiratory pathogens.<sup>[2]</sup> (Figure. 2)



**Figure 2: Mechanism of tissue destruction in periodontal disease and emphysema.**

### Periodontitis and COPD

Chronic obstructive pulmonary disease (COPD) is one of the major respiratory disorders and is associated with significant concomitant chronic diseases which increase its morbidity and mortality. According to the Global Initiative for Chronic Obstructive Lung Disease (GOLD) guidelines (2021) COPD is defined as a common, preventable and treatable disease characterized by persistent respiratory symptoms and airflow limitation due to airway and alveolar abnormalities mainly caused by significant exposure to noxious particles or gases. Cigarette smoking is the most significant etiologic factor. The airway obstruction in bronchial asthma is essentially reversible, with recurrent exacerbations.<sup>[5]</sup>

### Risk factors for COPD

The main risk factor for COPD is tobacco smoking but other exposures such as fuel exposure and air pollution and genetic conditions may contribute to COPD. COPD and periodontitis share some common pathogenic mechanisms as smoking is a major risk factor for both the conditions.

Similarly, neutrophils are found in increased numbers in both COPD and periodontitis and play a major role in initiation of inflammation.

The most common symptoms include dyspnoea, chronic cough or sputum production, wheeze, fatigue, anorexia may be seen.

Oral manifestations include periodontitis, thrush, alveolar bone loss due to colonisation of respiratory pathogens over the plaque biofilm.<sup>[6]</sup>

### Periodontitis and Pneumonia

Pneumonia is the infection of lungs caused by bacteria, virus, fungi, parasites out of which Bacterial Pneumonia is most significant one. This could be due to colonization of respiratory pathogens. It depends on degree of oropharyngeal bacterial colonization and oral inflammation.

### It is broadly classified into two categories on the basis of causative agents

Community acquired pneumonia is defined as an acute infection of the pulmonary parenchyma in a patient who has acquired the infection in the community outside the health care system and is caused by microorganisms that are present in oropharyngeal mucosa as streptococcus pneumonia, mycoplasma pneumonia and haemophilus influenza.

Hospital acquired or Nosocomial pneumonia refers to any pneumonia contracted by a patient in a hospital at least 48-72 hours after being admitted and is due to aspiration of oropharyngeal secretions as gram negative bacilli as E coli., Pseudomonas aeruginosa and Staphylococcus aureus.<sup>[2]</sup>

Clinical features include fever, chills, cough, shortness of breath, cyanosis, pleuritic chest pain, loss of appetite and weakness.

Oral manifestations include caries, gingivitis, periodontitis, dysphagia.

Along with medical management center for disease control care has implemented oral health care programme to prevent ventilator associated pneumonia including following measures:

- Tooth brushing 2-4 hours
- Swabbing with alcohol free mouth rinse
- Frequent suctioning of oral and pharyngeal secretions.
- Application of local antimicrobial agents.<sup>[7]</sup>

### Periodontitis and Asthma

According to Global Strategy for Asthma Management and Prevention (GINA 2021) Asthma is a chronic respiratory disease associated with airway obstruction with recurrent episodes affecting people of all ages. This is due to inflammation and tightening of muscles around small airways. Trigger factors include exposure to an allergen or irritant, viruses, exercise, emotional stress and others.

Clinical features include wheezing, breathlessness, chest tightness, cough, increase mucus production and dyspnea.<sup>[8,9]</sup>

The use of inhaled bronchodilators (salbutamol) and corticosteroids have an impact of oral health.

Oral manifestations include increase caries rate, xerostomia, anterior open bite, v shaped palatal vault, periodontal diseases, dental erosion, oral candidiasis, fissured tongue.<sup>[6]</sup>

Proper instructions if given timely oral complications can be reduced to a certain extent.

- Proper oral hygiene instructions can reduce the risk of caries, gingivitis, periodontitis.
- Fluoridated mouth rinses.
- Use of sugar free chewing gums and lozenges.<sup>[1]</sup>

### Periodontitis and Covid

Corona virus disease (covid 19) is a severe acute respiratory syndrome due to corona virus SARS COV 2. Dental practitioners are facing a new challenge as there is high risk of cross infection. It's an enveloped single stranded RNA corona virus leading to COVID 19 with high rates of mortality.

Routes of transmission could be face to face communication or through exhaled droplets, aerosols or

through contaminated surfaces. Virus can persist on surfaces for extended periods and can be detected in aerosols upto 3 hours postoperatively. (Figure.3)

Through inhalation virus enters into respiratory tract where it attacks alveolar cells leading to pneumonia and after replication alveolar cells damaged and signals are released in the form of cytokines storm and produce cough reflex and fever. Increased vascular permeability leads to leakage of fluid resulting in pulmonary edema. This further causes dyspnea and hypoxia. If proper interventions don't start by time this can further cause sepsis and multiple organ involvement that could further leads to death.<sup>[10]</sup>

Clinical features include fever, shortness of breath, sore throat, persistent dry cough, chest pain, body aches, rashes on skin, conjunctivitis, loss of taste and smell, abdominal pain, diarrhea.

Oral manifestations include swelling and edematous gingiva, ulcers, erosion, fissured tongue, halitosis. Covid 19 effect on oral tissues manifest as aphthous stomatitis, candidiasis, angular cheilitis, necrotizing periodontal lesion leads to bone loss.<sup>[11]</sup>

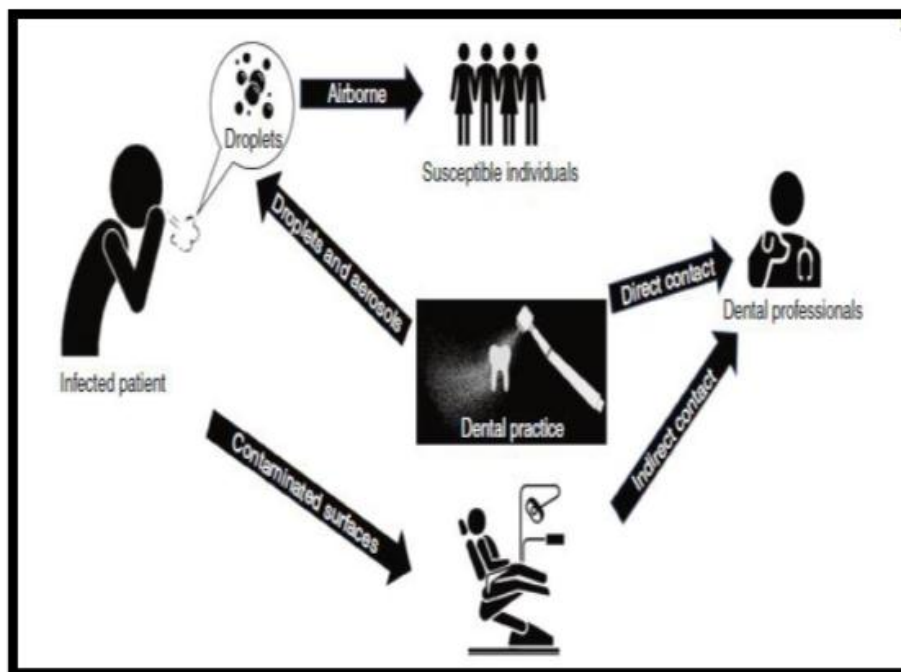


Figure 3: Routes of transmission.

### Dental Management

The WHO package of essential noncommunicable disease interventions includes protocols for the assessment, diagnosis and management of chronic respiratory diseases and emphasize on healthy lifestyle counselling that includes tobacco cessation and selfcare.

- Proper placement of intra oral trays, rubber dam, suction tips, upright position of patients during

treatment. Nitrous oxide can be used as it is neither a respiratory depressant nor irritant.

- Routine oral examination of the teeth, gums, tongue, mucous membranes and lips.
- The use of a soft bristled tooth brush and dental floss to remove debris and dental plaque twice a day.
- The use of mouth swabs.
- The use of oral rinses such as 0.12% chlorhexidine gluconate.



- Minimize the use of dental appliances e. g. removal of dentures during sleep.
- Restoration of cavities to minimize plaque retention.

So, a proper medical history and frequency of exacerbation and triggers of attacks before dental treatment will save the dentist from any further medical emergencies and help the dentist to take proper measures to avoid dental complications.

- As in COPD cases patient, patient might be on oxygen or nasal cannula, proper chair position is must usually upright position.
- Use of rubber dams to avoid aspiration of any instruments or foreign object or aerosols that can cause lower respiratory infections. Anxiety can trigger asthma attacks. Aspirin and NSAIDS should be avoided as they can exaggerate asthmatic attacks.
- Adequate Measures should be taken for screening and management of dental emergencies during covid as it's a global health emergency.
- Tele screening should be done first and patients travelling history, history of covid and patient's vaccination status should be recorded. If any signs

and symptoms of COVID-19 then patient should be referred immediately to designated hospitals.

- Dentist and assistant should sanitise their hands before the PPE.
- N95 masks, eye shield, headcaps, face mask, face shield water repellents coats should be worn.
- Dental chair and all tools should be equipped with disposable films. Dental rooms should have proper ventilation.
- Before start of treatment patient is asked to rinse with chlorhexidine or povidone iodine.
- Instead of intraoral X rays' patient is advised to go for extraoral X rays.
- During dental procedures saliva should be ejected by high volume excavator to allow removal of high volume of air in a short period of time.
- Instruments should be disinfected and sterilised.
- Time interval of 15-30 mins should be kept between the patients after each therapy, meanwhile dental chambers should be disinfected.

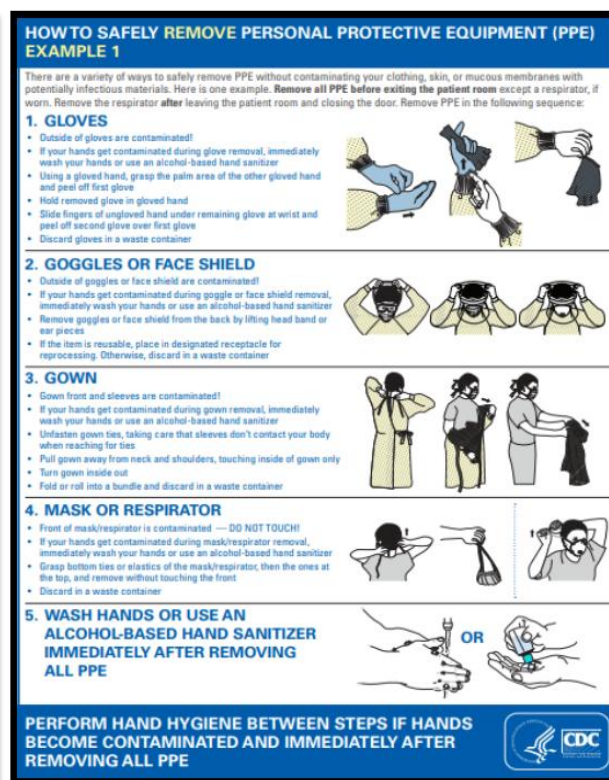
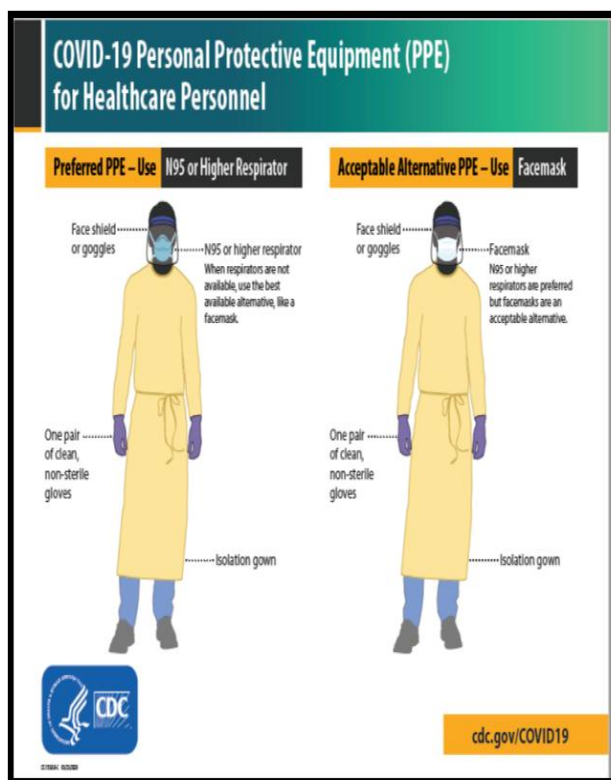


Figure 4 & 5: Personal Protective Equipment (PPE) for health care personnel.

## CONCLUSION

Oral colonization of respiratory pathogens can further contribute to respiratory infections as well as oral inflammation release cytokines from the periodontal tissues which when aspirated leads to respiratory infections. Importance of good oral hygiene, periodontal treatment should be emphasized to reduce bacterial count

and regular dental checkups should be planned so as to reduce risk of pulmonary infections.

The dental professionals should be knowing about the oral manifestations of pulmonary diseases and should be trained to offer effective and safe treatment to the pulmonary patients.

All the dental clinics should be equipped with medical emergencies kits so as to avoid complications. However a direct association of oral and pulmonary diseases has not been clearly proven, further more studies and intervention trials are still required to validate the present evidence.

## REFERENCES

1. Hupp S.W. Dental Management of Patients with Obstructive Pulmonary Diseases, *Dent Clin N Am*, 2006; 50: 513–527.
2. Bansal M., Khatri M., Taneja V., Potential role of periodontal infection in respiratory diseases-a review, *Journal of Medicine and Life*, July-September, 2013; 6(3): 244-248.
3. Mojon P, Oral Health and Respiratory Infection, *Journal of the Canadian Dental Association*, June, 2002; 68: 6.
4. Giudice A. Bennardo F., Antonelli A., Barone S. and Fortunato L., COVID-19 is a New Challenge for Dental Practitioners: Advice on Patients' Management from Prevention of Cross Infections to Telemedicine, *The Open Dentistry Journal*, 2020; 14.
5. Gold guidelines (2021 report) Global strategy for the diagnosis, management and prevention of chronic obstructive pulmonary disease for chronic obstructive lung disease.
6. Cojocaru D., Andrei Georgescu A., Negru R., Oral manifestations in pulmonary diseases– Too often a neglected problem, *International Journal of Medical Dentistry*, April/June, 2015; 5(2).
7. Muthu J., Muthanandam S., Mahendra J., Mouth the mirror of lungs: where does the connection lie, *Front Med.*, Dec, 2016; 10(4): 405-409.
8. GINA (2021 update), Global strategy for Asthma management and prevention.
9. Chapman S., Robinson G., Shrimanker R., Turnbull C., Wrightson J., *Oxford handbook of Respiratory medicine*, 4<sup>th</sup> edition.
10. Gisele Maria Campos Fabri, Potential Link between COVID-19 and Periodontitis: Cytokine Storm, Immunosuppression, and Dysbiosis, *OHDM*, December, 2020; 19(7).
11. Patel J., Woolley J., Necrotizing periodontal disease: Oral manifestation of COVID 19, [wileyonlinelibrary.com/journal/odi](http://wileyonlinelibrary.com/journal/odi), *Oral Diseases*, 2020; 00: 1–2.