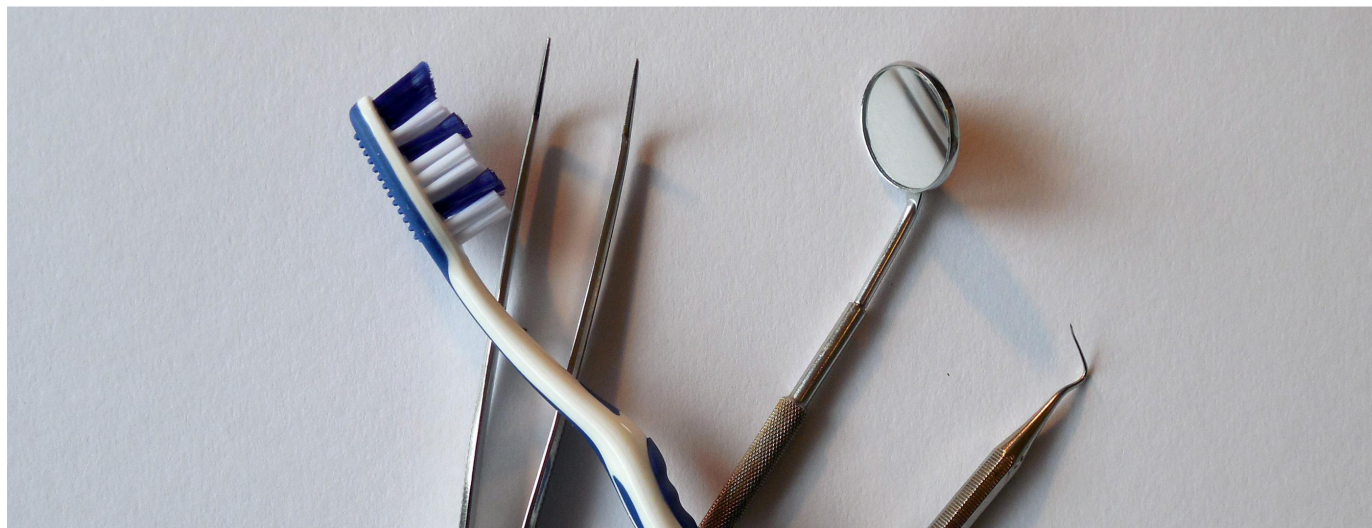


The relationship between COVID-19 and periodontitis

Gabrielle Thompson¹ and Nidhi Parmar¹

¹Year 5, Dentistry, University of Bristol

Email: gabby@thompson04.com, npp16182@gmail.com



Abstract

The subject of this news article is to summarise the current literature highlighting the novel relationship between periodontal disease and COVID-19. The aims of this news article are to outline possible associations between COVID-19 and periodontal disease, offering explanations of potential pathophysiological mechanisms and identifying common comorbidities between them. The association is significant due to the high prevalence of both diseases in the adult population. This news article also reviews whether a periodontal disease status serves as a useful risk indicator for COVID-19 severity. This in turn stipulates the importance of maintaining the health of individuals suffering from conditions with predispositions to both diseases.

Abbreviations

IL-6 - Interleukin-6

Introduction

Periodontitis is the chronic inflammation and graded destruction of the tissues surrounding and supporting the teeth, such as the periodontal ligament and alveolar bone. This is caused by unfavourable changes in the oral microbiome, resulting in dysbiosis, often associated with poor oral hygiene. Severe periodontal disease has been recorded as the 11th most prevalent condition in the world by the Global Burden of Disease Study (2016).¹ However, it can be largely stabilised and prevented by effective oral hygiene methods.² A variety of comorbidities are seen with periodontal disease, including but not limited to diabetes mellitus, cardiovascular disease, hypertension, obesity and ageing. Interestingly, these same factors have been linked with the progression and severity of COVID-19.³

The pathogenesis of COVID-19 results from the replication and release of the SARS-CoV-2 virus in lung cells, which elicits an inflammatory host response. Current evidence suggests that periodontitis may worsen the symptoms of COVID-19.³

It is possible that bacterial imbalances in the mouth and excessive proinflammatory proteins produced in response to periodontal disease can increase the risk of life-threatening respiratory conditions.³

This article reviews the connection between COVID-19 and periodontitis, their shared comorbidities and possible biological mechanisms. The reader must acknowledge the limitations of this article, considering the novel topic and lack of available current literature.

Mutual morbidities

Diabetes mellitus has shown to be an important predictor of severe COVID-19 illness. This is evidenced by individuals with diabetes displaying higher CT scores, indicating more severe illness in COVID-19.³ Interestingly, diabetes is also linked with periodontitis and a bidirectional relationship is seen.⁴ Hyperglycaemia has shown to reduce function of neutrophils, increase levels of cytokines and therefore impair healing responses to bacterial challenges faced in periodontitis.⁵ Similarly, those with periodontitis have an increased risk of developing insulin resistance and poor glycaemic control.⁶

Cardiovascular disease and hypertension have been identified as potential risk factors for increasing COVID-19 complications.

Hypertension is the most common comorbidity among individuals with COVID-19, however, the reason for this is unclear.⁷ Cardiovascular disease and hypertension are also both implicated in periodontitis. The biological mechanisms are multifactorial.

Several hypotheses include dissemination of inflammatory markers into the bloodstream from the periodontal lesion, disequilibrium of lipid marker levels and exacerbated immune responses and systemic inflammation.^{3,8}

Obesity has a significant relationship with COVID-19, increasing the risk of severe complications and death.⁹ Obesity is associated with an impaired immune response, vitamin D deficiency, chronic inflammation and reduced ventilation associated with abdominal obesity.¹⁰ Similarly, obesity has been shown to increase the risk of developing periodontitis.^{3,11,12} Many researchers believe the chronic inflammatory state induced in obesity implicates the development of periodontitis.^{9,11,12} This biological mechanism is evidenced by the presence of inflammatory cytokines, tumour necrosis factor- α and interleukin-6 (IL-6), in both obesity and periodontitis.¹¹

Ageing is a significant risk factor for both periodontitis and severe COVID-19 illness. People over 65 are the highest risk group for severe COVID-19 illness.¹³ Similarly, this age group presents a high prevalence of periodontitis.¹⁴ This is mainly due to the progressive nature of the disease with advancing age.¹⁵ Additionally, ageing is associated with reduced manual dexterity, affecting toothbrushing, and polypharmacy, leading to dry mouth. These both increase the risk of periodontal disease.¹⁴

These mutual morbidities between COVID-19 and periodontitis highlight an interesting relationship. Perhaps providing scope for further research that may benefit our understanding of COVID-19.

Pathophysiological mechanisms

Periodontal bacteria in the lungs Numerous mechanisms suggest a direct link between periodontal disease exacerbating respiratory infections including COVID-19. Individuals with periodontitis exhibit a plethora of bacterial colonies, notably, *Fusobacterium nucleatum*, *Prevotella intermedia* and *Porphyromonas gingivalis* species. Multiple theories hypothesise how the microaspiration of the high loads of bacteria from the oral cavity contribute to the immunologic homeostasis of the respiratory tract.

*These secretions modify and adhere to the lung epithelium. This in turn facilitates or exacerbates further infection by respiratory pathogens.*¹⁶

Immunopathogenesis of periodontitis and COVID-19 Periodontitis elicits the release of pro-inflammatory mediators, predominantly IL-6, that increases systemic inflammation and triggers a local inflammatory response in the lungs. Resultantly, the lung's capacity of capillary blood gas exchange and oxygen diffusion is diminished, which reduces the individual's airflow.¹⁷

The increase in IL-6 levels has been shown to predict the severity of COVID-19 in patients. A three-month study concluded that individual's with the highest IL-6 levels are predictive for respiratory complications and the need for mechanical ventilation, with a 22 times greater risk of respiratory failure.¹⁸ This link warrants the investigation of whether the exaggerated synthesis of IL-6 levels can act as a biomarker, with the clinical benefit of predicting COVID-19 severity.

Thus, the direct and summative effect of periodontal disease on individuals with COVID-19 has been successfully proposed, as well the need for further research to corroborate this association and analyse the risk in mild to severe disease forms.¹⁹

Conclusion

In line with the current literature, this article summarises the novel relationship between poor oral health, systemic transmission of oral bacteria and the synergistic effect of comorbidities and their association with COVID-19. It is pivotal to maintain the health of individuals suffering from conditions with predispositions to both COVID-19 and periodontitis. This article highlights the importance of regular oral hygiene measures and professional dental visits.

Contribution statement The two authors provided substantial contributions to the conception of the work. Both drafting the review and revising it critically for important intellectual content. Both authors gave a final approval of the review before submission to Inspire. Gabrielle Thompson is the guarantor of this work.

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Gabrielle Thompson*

Gabrielle Thompson is a general dentist working in a mixed NHS and private practice in North East London. She graduated from the University of Bristol Dental School in July 2021. Gabrielle has always had a keen interest in orthodontics and hopes to pursue specialty training in the next few years. She enjoys the clinical and academic side of dentistry, completing various research projects and publications whilst continuing her clinical roles. When she is not working in general practice, she enjoys her different volunteer roles combating loneliness in the elderly and projects abroad aiding education and oral hygiene in developing countries.



Nidhi Parmar*

Nidhi Parmar recently graduated from the University of Bristol and is a general dentist, with an interest in prosthodontics. She currently practises in North West London. Nidhi is committed to further education with a love for learning through conferences, postgraduate level courses and study days. She is actively involved in research, publishing in national and international journals. She is a full member of the British Association of Cosmetic Dentistry, the Faculty of General Dental Practitioners and the British Society of Prosthodontics.

*joint first authors