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Review Article

Etiology and types of necrotizing periodontal diseases

Yazeed Abdullah Alhabdan[1]*, Abdulhameed G. Albeshr[1], Ala'a Abdulkalq Albasher[2], Abdullah Saeed Alassiri[3], Mahmood Abdulaziz Shater[4], Mohammed Ali Alqahtani[5], Khaled Taib Ageely[6], Raghad Saeed Alshahrani[3], Anas Abed Alkhormani[7], Alaa Mohammed Bawakid[8], Lamia S. A. Al Huwaity[9], Rayan Ibrahim Albulushi[8]

[1]King Abdullah Medical City for National Guard, Riyadh, Saudi Arabia
[2]Dental Department, King Faisal Hospital, Al Ahsa, Saudi Arabia
[3]College of Dentistry, King Khalid University, Abha, Saudi Arabia
[4]Dental Department, East Jeddah Hospital, Jeddah, Saudi Arabia
[5]Dental Department, West Riyadh Dental complex, Riyadh, Saudi Arabia
[6]Al-Jabal Primary Healthcare, Ministry of Health, Jazan, Saudi Arabia
[7]Veneer Dental Center, Jeddah, Saudi Arabia
[8]College of Dentistry, King Abdulaziz University, Jeddah, Saudi Arabia
[9]Dental Department, Prince Sultan Military Medical City, Riyadh, Saudi Arabia

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***Correspondence:**
Dr. Yazeed Abdullah Alhabdan,
E-mail: yah11@hotmail.com

ABSTRACT

Necrotizing periodontal diseases pose a clinical significance because it has been associated with a severe prognosis that can cumulatively lead to rapid tissue destruction. A slow rate of destruction has been reported for patients with necrotizing periodontal diseases, and reports show that chronicity might be a characteristic in some patients, while many patients might also suffer from disease recurrence. The association of other oral lesions might also be a characteristic in some situations, which usually occurs in cases when systemic involvement is present. In the present literature review, we aim to discuss the etiology and types of necrotizing periodontal diseases based on evidence from the different related studies in the literature. Microbiology plays an important role in the pathogenesis of the condition, and some organisms as spirochetes were directly correlated with the etiology of the condition. Evidence also shows that the presence of the different risk factors might be the major contributor to the development of the condition as different risk factors were found to be directly correlated with the disease. Among the different factors, impacted host immune response and the presence of deteriorating systemic conditions have been widely reported in the literature as significant factors predisposing to developing the disease. Other factors as smoking and alcohol consumption, previous history of the disease, and other oral lesions, were also reported. Further research is needed for better classification of the condition and determination of more significant risk factors.

Keywords: Necrotizing periodontal diseases, Necrotizing gingivitis, Necrotizing periodontitis, Etiology, Microbiology, Classification, Pathophysiology

INTRODUCTION

The burden of periodontal disease has significantly increased over the past decade due to the increasing prevalence rates and trends of the different etiologies and risk factors. Periodontal diseases are associated with infections, tissue destruction, pain, and discomfort, and the diagnosis of the condition is usually clinical, while the pathology involves the periodontium and the surrounding structures. Many conditions were reported to affect the periodontium, including pericoronitis, pericoronal abscess, combined periodontal-endodontic lesions,

herpetic gingivostomatitis, periodontal abscess, gingival abscess, and necrotizing periodontal diseases.[1]

Estimates show that the prevalence of necrotizing periodontal diseases is low across the different settings. Nevertheless, the condition poses a clinical significance because it has been associated with a severe prognosis that can cumulatively lead to rapid tissue destruction. A slow rate of destruction has been reported for patients with necrotizing periodontal diseases, and reports show that chronicity might be a characteristic in some patients,[2] while many patients might also suffer from disease recurrence.[3,4] The association of other oral lesions might also be a characteristic in some situations, which usually occurs in cases when systemic involvement was present.[5] In the present literature review, we aim to discuss the etiology and types of necrotizing periodontal diseases based on evidence from the different related studies in the literature.

LITERATURE REVIEW

This literature review is based on an extensive literature search in Medline, Cochrane, and EMBASE databases which was performed on 4th October 2021 using the medical subject headings (MeSH) or a combination of all possible related terms, according to the database. To avoid missing poetential studies, further manual search for papers was done through Google Scholar, while the reference lists of the initially included papers. Studies discussing the etiology and types of necrotizing periodontal diseases were screened for useful information, with no limitations posed on date, language, age of participants, or publication type.

DISCUSSION

The current classification of necrotizing periodontal diseases is based on a historical 1999 classification system that included necrotizing ulcerative periodontitis, and ulcerative gingivitis under the umbrella of necrotizing periodontal diseases.[6] The classifying group also reported that diminished systemic resistance to the different pathogens is noticed among these events. This has been attributed to the fact that all of these conditions usually have the same etiology, treatment, and clinical manifestations. Furthermore,studies demonstrate that ulcerative gingivitis and necrotizing ulcerative periodontitis usually present at different stages before developing into a final stage of necrotizing periodontal diseases. Noma and necrotizing stomatitis might also develop secondary to these conditions and are considered late-stage complications (Figure 1).[7,8] The word “ulcerative” has been removed from the terminology of the condition, probably because necrosis usually comes first, and ulceration develops secondary to it.[9] However, it should be noted that although this classification is widely used, it has been suggested that further considerations should be provided to it. This is because no adequate considerations were provided to the evidenced differences in the prevalence and risk factors of the different conditions and the impact of each on the different populations. For instance, it has been demonstrated that the condition might be life-threatening among patients in developing countries, children suffering from malnutrition and patients with HIV. On the other hand, the prognosis of the condition is better among patients within developed countries with predisposing factors as smoking and exposure to stressful events. Therefore, some patients might be at high risk of developing a severe condition that passes through the different stages of the condition, including necrotizing gingivitis until developing noma. In contrast, others might suffer from a mild disease without the presence of these conditions. Therefore, the classification of necrotizing periodontal diseases should be done based on the health status and severity of risk factors affecting the exposed populations.[5]

Stage	Description
Stage 1	Necrosis of only the tip of the interdental papilla
Stage 2	Necrosis of the entire papilla
Stage 3	Necrosis involving the marginal gingiva
Stage 4	Necrosis extending into attached gingiva
Stage 5	Necrosis extending into buccal or labial mucosa
Stage 6	Necrosis exposing alveolar bone
Stage 7	Necrosis perforating the skin of the cheek

Figure 1: Staging of necrotising periodontal diseases.[50]

Although the etiology of necrotizing periodontal diseases is attributed to an infection, evidence indicates the importance of considering the different risk factors that also play important factors in the development and pathogenesis of the condition. One of the most important risk factors includes the status of the host immunity and how it responds to the potential etiologies that increase the risk of developing the condition. The bacterial etiology of necrotizing periodontal diseases has been previously described and was mainly attributed to infection by either fusiform bacteria and spirochetes.[7] Furthermore, the evidence of the impact of bacteria on the etiology and development of necrotizing periodontal diseases has been strengthened by the efficacy of antimicrobial treatment and the observed clinical improvement following mechanical debridement of the affected tissues.[10] In this context, early investigations have demonstrated that spirochetes play essential roles in the etiology based on their microscopic findings.[10-12] Another investigation that was based on culture evaluation of the necrotizing lesions reported that the constant flora that was responsible for the development of

the condition included Selenomonas and Fusobacterium, and P. intermedia, and Treponema species.[12] Other investigations that evaluated the presence of bacteria evaluating the presence of 16s rRNA through PCR and other immunoassays also reported that spirochetes species were predominant in these lesions.[13-15] Phylogenic analysis was also approached by previous investigations, which indicated that Peptostreptococcus genus and P. intermedia were directly involved in the development and pathogenesis of necrotizing periodontal diseases. HIV was also reported as a potential risk factor for the development of necrotizing periodontal diseases, and studies show that the infecting organisms in these patients are largely similar to those observed with periodontitis in the absence of HIV infections. In these situations, severe infections by superinfecting bacteria, herpes viruses, and Candida albicans invasion are the commonest etiologies for the development of necrotizing periodontal diseases. Among patients with HIV, estimates show that the prevalence of necrotizing periodontal diseases is high and it has been demonstrated that the progression of the disease is also slow. However, it should be observed that the condition might develop into a more serious status, including necrotizing ulcerative periodontitis and necrotizing stomatitis. Besides, increased risk of disease recurrence was also more frequent among these patients and the response to the different management modalities was also reported to be poor in such situations.

The role of host immune response in the development and pathogenesis of the condition has been reported by many investigations.[5,16] Nevertheless, when interpreting the findings of these investigations, the results were heterogeneous, indicating the need for additional studies. It has been furtherly reported that there are predisposing factors that can aid in the pathology of the condition, and the most important risk factors were the ones that contributed to the deterioration of the host immune response. Evidence also indicates that the pathogenesis of necrotizing periodontal diseases usually required more than one risk factor to be initiated. The presence of different systemic conditions was also reported to increase the risk of developing necrotizing periodontal diseases. These conditions might be associated with or induce the pathology of necrotizing periodontal diseases, and evidence also shows that lesions mimicking the disease might also be present as part of the systemic pathology. For instance, it has been demonstrated that 35.6% of patients with Down syndrome usually have necrotizing periodontal diseases.[17] A previous investigation by Akin et al also reported that necrotizing periodontal diseases were present among patients with disseminated histoplasmosis.[18] Previous case report studies also indicated that the condition is associated with other systemic diseases, including scurvy, malnutrition, following chemotherapy, neutropenia, and agranulocytosis.[19-22] Among the various investigations, evidence shows that malnutrition is a significant risk factor for the development and pathogenesis of necrotizing periodontal diseases, especially among individuals within poor or socioeconomic countries.[23-26] This can be attributed to the significant alteration in the acute phase response against the infections (among patients suffering from protein-energy malnutrition), in addition to the significant reduction in the number of antioxidant nutrients that are responsible for fighting the infections and strengthening the host immune response.[27,28] Other proposed strategies for developing the condition following malnutrition include defects in mucosal integrity, increased levels of free cortisol in saliva and blood, histaminemia, and inversed ratio of the helper and suppressor T-lymphocytes in the immune reaction of the infected individuals.[28,29]

Other proposed factors might include the presence of insufficient sleep or psychological stress, which can be induced by many conditions that can lead to altered psychological status or during certain situations that expose patients to increased stressful episodes. During these episodes, it has been noticed that the behavior of the affected patient remarkably changes, and the immune response is significantly altered. The association between stress and the pathogenesis of necrotizing periodontal diseases has been attributed to many biological events. These include increased periodontal pathogen levels (for instance, the levels of the infecting organism and increased virulence), worsened functions of the immune system and lymphocytes, increased levels in the salivary and urinary 17-hydroxycorticosteroid, and reduced salivary flow and gingival microcirculation.[12,30] Bad oral hygiene might also predispose to the development of necrotizing periodontal diseases. This has been attributed to the secondary development of plaque and its accumulation on the surrounding dental tissues, leading to increased virulence and hindered immune response, adding to the pathology of the disease. The accumulation of plaque can also lead to a remarkable progression of the condition because patients usually suffer from pain which furtherly limits them from brushing their teeth and taking care of their oral hygiene.[3,31,32] Having a history of previous periodontal diseases might also attribute to the development of necrotizing periodontal diseases. For instance, suffering from a previous condition, or chronic gingivitis has been linked in a significant association with developing a new episode of the condition.[2,32,33] Alcohol consumption and tobacco use were also reported as potential risk factors that might predispose to the development of the condition. Previous reports indicate that most patients with necrotizing periodontal diseases are smokers.[2,34-38] The pathology of the condition was also correlated with alcohol consumption, which has been shown to alter certain psychological and physiological factors that can significantly add to disease progression and development.[32,39]

As it has been previously demonstrated that patients living in developing or poor countries, other studies also showed that young individuals living in developing countries are also at increased risk of developing necrotizing periodontal diseases. The reported age for

young individuals ranges between 15 and 34 years old, and the risk of developing the condition has been reported especially when other predisposing factors were also present in this high-risk population.[32,38,40,41]

On the other hand, among individuals residing in other countries, evidence shows that children are the most susceptible, and the presence of infections and etiologies inducing malnutrition significantly add to the risk of developing necrotizing periodontal diseases.[25,26,29,42] There is also some evidence that suggests that the prevalence of necrotizing periodontal diseases is remarkably higher in the Caucasian population than in other communities.[32,38,43]

However, this evidence is not significant and needs to be validated by additional studies. Other studies also demonstrated that seasonal variations play a critical role in the development and pathology of necrotizing periodontal diseases. For instance, studies that were conducted in the region of central Africa reported that the prevalence of the condition was remarkably high in rainy seasons. It has been furtherly shown that abnormal patterns of the disease epidemiology were also reported among the general population, students, and military personnel.[5] Many other factors were also reported to take part in the etiology of the condition.

These were mainly attributable to local factors that are specific to conducting certain approaches and measures within the oral cavity. For instance, the pathology and development of necrotizing gingivitis were correlated with orthodontic therapy and decorative crowns.[44,45]

Besides, evidence indicates that abnormalities to allelic variations of the properdin factor B, erythrocyte catalase activity, and complement factors, in addition to the potential effects of thermoregulatory abnormalities and body geometry can all predispose to the development of the condition. However, evidence is inconclusive in this event, and additional research is still required before making conclusions.[46-49]

CONCLUSION

Microbiology plays an important role in the pathogenesis of the condition, and some organisms as spirochetes were directly correlated with the etiology of the condition. Evidence also shows that the presence of the different risk factors might be the major contributor to the development of the condition as different risk factors were found to be directly correlated with the disease. Among the different factors, impacted host immune response and the presence of deteriorating systemic conditions have been widely reported in the literature as significant factors predisposing to developing the disease. Other factors as smoking and alcohol consumption, previous history of the disease, and other oral lesions, were also reported. Further research is needed for better classification of the condition and determination of more significant risk factors.

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