Necrotising Ulcerative Gingivitis: A Literature Review

James Dufty\textsuperscript{a} / Nikolaos Gkranias\textsuperscript{b} / Nikos Donos\textsuperscript{c}

**Purpose:** The literature surrounding necrotising ulcerative gingivitis (NUG) is extensive, yet the rare nature of this disease means that there is a lack of good quality research available. This paper aims to scrutinise the literature and provide an up-to-date summary of the available information.

**Materials and Methods:** A literature search was performed electronically using the Cochrane Library, Ovid Medline, Embase, PubMed Clinical Queries and Google Scholar. Keyword searches were carried out, utilising MeSH terms and free text. English language articles primarily were included, with key foreign language (French and German) articles included where possible from the 1900s to the present day.

**Results:** Necrotising ulcerative gingivitis is a rare disease (prevalence <1%), with an acute, painful and destructive presentation. It is an opportunistic bacterial infection which is predominantly associated with spirochetes. Treatment of NUG must be provided on a case-by-case basis, tailored to what the individual can tolerate and the extent of the infection.

**Conclusion:** Although there is low prevalence of NUG, its importance should not be underestimated as one of the most severe responses to the oral biofilm. Risk factors must be investigated and addressed. Treatment should consist of gentle superficial debridement, oral hygiene instruction and prescription of mouthwash and antibiotics in severe cases.

**Key words:** necrotising ulcerative gingivitis, NUG, trench mouth

Thus, a review of the literature was performed to provide an up-to-date summary of the history, prevalence, clinical manifestations, aetiology and treatment of NUG.

**MATERIALS AND METHODS**

A literature search was performed electronically using the Cochrane Library, Ovid Medline, Embase, PubMed Clinical Queries and Google Scholar. Keyword searches were carried out, utilising MeSH terms and free text. The search terms utilised included: gingivitis, necrotizing ulcerative, ulcerative stomatitides OR Vincent’s gingivitis OR fusospirillary gingivitides OR Vincent gingivitis OR necrotizing ulcerative gingivitis OR fusospirillary gingivitis OR infection Vincent’s OR phagedenic gingivitis OR infection Vincent OR gingivitides fusospirillary OR membranous gingivitides acute OR Vincent’s stomatitis OR gingivitis acute membranous OR anginas Vincent OR gingivitis phagedenic OR phagedenic gingivitides OR acute membranous gingivitis OR gingivitis necrotizing ulcerative OR Vincent angina OR gingivitides acute membranous OR Vincent stomatitis OR gingivitis Vincent’s OR gingivitides phagedenic OR mouth trench OR ulcerative gingivitis necrotizing OR stomatitides ulcerative OR acute necrotizing ulcerative gingivitis OR gingivitis fusospirillary OR angina Vincent OR Vincent’s infection OR ulcerative stomatitis.
Much was written about NUG during and following the First World War, with significant evidence being presented by Colyer.13 His research showed a prevalence of 0.3% for troops in the rear and up to 0.7% for troops returning from the trenches.13 Bowman discussed the wide prevalence of ulceromembranous stomatitis amongst troops returning from the front line.7 Although he distinguished the condition from Vincent’s angina, he did not describe specific prevalence data, merely stating that the disease seemed to have been rife. Bouty,5 despite writing primarily about Vincent’s angina among soldiers in France, noted that pyorrhea alveolaris (periodontal disease) often presented as well as stomatitis and gingivitis.5 The reports on Vincent’s infection may therefore have been misleading, as not all studies have distinguished between the tonsillar and gingival infections.

**RESULTS**

Following comprehensive searches of the above databases, 57 articles were included in the review.

**Historical References of NUG**

The war records of Xenophon’s troops, dating from the 4th century BC, are credited as the first reference to an oral disease with signs and symptoms similar to NUG.26 Xenophon noted, during his Army’s retreat from Persia (401 BC), that many of his soldiers suffered from ulcerated, sore, foul-smelling oral problems.30 Prior to this, most of these NUG-like symptoms had been attributed to scurvy.48 It wasn’t until a British Physician, James Lind, wrote about scurvy in 1772 and noted that oral ulceration was not always associated with it, that a separate diagnosis was sought for these oral symptoms.48 In 1778, John Hunter was credited with making this first distinction between the oral symptoms of scurvy and NUG. He described the ‘gum between the teeth’ as being ‘swollen and spongy with ulceration, tenderness and bleeding’.48 However, much of the literature in the 19th century that came from French authors does not appear to acknowledge Hunter’s conclusions.26

In 1859, Bergeron described a NUG-like clinical picture while serving with French soldiers. Furthermore, he drew evidence from the available literature to show that the same infection affected the general population of adults as well as children.26 In 1886, Hirsch expanded the diagnostic features of NUG to include involvement of the submaxillary lymph glands,ropy saliva, malaise and fever.26

Plaut and Vincent recognised the involvement of fusiform spirochetes in NUG in the 1890s.55 It is Vincent, however, who is widely credited with the identification and understanding of what would eventually become known as NUG.30 Vincent was a physician serving with the Military Medical Service of France. Part of his remit was to look at the differences between oral fusiform-spirochete infections, namely tuberculosis and syphilis. In 1892, Vincent recognised the ulceromembranous condition that affected the oral cavity and tonsils that would later bear his name ‘Vincent’s angina’.30 Plaut further described the condition in relation to the tonsils in 1894, with Birnheim in 1898 pointing out the similarity between the bacteriology associated with Vincent’s angina and the ulcerative gingivitis.48 Following these publications, Vincent’s infection drew greater interest from the dental field, as it became recognised as a separate entity from the tonsillar condition.48

**Vincent’s Infection as a Solely Gingival Problem**

Part of the difficulty in determining the prevalence of NUG before, during and after the First World War, despite its apparently high frequency (leading to the introduction of the term ‘trench mouth’), is distinguishing exactly which disease was being described in each report.44 ‘Vincent’s angina’ is described as confined to the throat/tonsillar area, and ‘Vincent’s infection’ as confined to the mouth.31 Other authors have noted how Vincent’s disease has been designated in various ways, depending on its anatomical location or the pathological process involved.39 Pindborg’s list of 33 possible terms for NUG magnifies the extent of the problem.44 As he puts it, ‘No doubt the list of synonyms has not been exhausted… but it appears on the basis thereof how difficult it can be to form an estimate of the existing literature when so different terms are used’.44

Therefore, despite many texts referring to trench mouth and what we now call NUG, there are many others that utilise different nomenclature and some in which it is unclear which form of the disease was studied.

**Studies After World War 2**

Many of the studies on NUG have been based on military populations. Dean and Singleton44 investigated the prevalence of NUG in US Coast Guard and Marine trainees, where they found an overall prevalence of 8.4%. Pindborg studied Danish Naval Sailors and Army soldiers during the period 1945–1948. 6960 men were examined with an incidence of NUG of 6.9%.44 Yet only five years later in a US military population in 1956, a lower rate of approximately 2% of subjects was reported by Grube and Wilder.21

Manson and Rand37 reported on 61 recurrent cases of Vincent’s infection who attended the Royal Dental Hospital, London. Barnes et al4 went on to study 218 patients who were receiving treatment for NUG in the military population (including dependents) at military dental centres in Fort Knox, Kentucky, USA. The number of cases seen over a 12-month period represented a prevalence rate of 0.19%.4

Falkier et al17 studied NUG in a US periodontal clinic. From their results, we can calculate the prevalence rate to be 0.93%. Hornung et al29 studied a military population based at the Naval Training Center in San Diego, California.
They found a prevalence of NUG of 0.45% (calculated from data; 0.5% was actually recorded in the paper).

The most recent prevalence data we have for NUG in the military is from Collet-Schaub,12 who studied the prevalence of NUG in Swiss Army recruits. No cases of NUG were detected and the study provides a prevalence rate calculated to be < 0.03% (actually 0.0%, as no NUG was seen).12

Prevalence of NUG
The studies discussed above support the statement that NUG is rare.1 There is a wide range in variance in the prevalence from the literature, ranging from < 0.03% to 9.4%.12,14 The highest rates were reported during the First and Second World Wars.7,14,22 However, since then, there has been an overall decline in the prevalence of NUG.1 Albandar and Tinoco1 point out that as a rare disease, there are few studies designed to assess its prevalence. Melnick et al38 state that the ‘true prevalence of … NUG… is unknown’, with most of the evidence coming from studies based on military recruits, which are unlikely to be truly representative of the general population. In fact, it is difficult to determine what prevalence should be expected in a general military population, but from analysis of more recent studies it can be expected to be < 1%.

Table 1 and Fig 1 illustrate the prevalence of NUG in different specific populations studied during the period 1943–2000.

Clinical Characteristics and Diagnosis
Necrotising ulcerative gingivitis is a painful oral condition.50 It is unique amongst the periodontal diseases in that it demonstrates an acute presentation, characterised by the rapid onset of pain from the gingivae that is accompanied by bleeding and necrosis of the interdental gingiva.50

The three key clinical signs of NUG are intense pain, punched-out appearance of the gingival papilla, and gingivae that bleed with little or no provocation.33,50 Fever, regional lymphadenopathy, malaise, malodor / fetor oris and metallic taste may also be signs.3 Patients suffering from NUG tend to seek treatment due to the intensity of the pain.50

Chronic forms of NUG have been presented in the literature.44 However, it is most likely that these are recurrences of the disease.50 Other differential diagnoses should be ruled out as part of the diagnostic process.28 These include apthous stomatitis, traumatic ulcers, desquamative gingivitis, erythema multiforme, agranulocytosis, infectious mononucleosis, acute leukaemia, allergic stomatitis and secondary syphilis. It is believed that primary herpetic gingivostomatitis most resembles NUG, yet it could be argued that, despite the similarities of some of the clinical manifestations of both diseases, they are patently dissimilar.28

Pindborg et al46 set out a staging system for the diagnosis of NUG. They described four stages: tip of interdental papilla only involved, involvement of marginal gingiva with presence of punched-out papilla, attached gingiva also involved, and exposure of bone. Unfortunately, these stages do not distinguish between the necrotising periodontal diseases. Staging pathways for NUG have not been widely adopted, and diagnosis now relies on the key clinical signs associated with the different disease processes, even though there may be some overlap.

Aetiology
NUG is an opportunistic bacterial infection which is predominantly associated with spirochetes, with the main cultivatable bacteria being Treponema sp. and Fusobacterium sp.27,36 Rowland50 states that amongst the periodontal diseases, NUG is one of the strongest examples that shows a primary bacterial aetiology.

Plaut and Vincent’s work in 1894 and 1896 were the first studies that suggested the bacterial aetiology of NUG.10 Cahn9 discovered bacterial invasion of the periodontal tissues in a patient with NUG. Many years later, Listgarten35 used electron microscopy to investigate gingival biopsy specimens from eight patients who had lesions typical of NUG. He described four zones of bacterial invasion. Starting from the most superficial layer, these were the bacterial zone, neutrophil-rich zone, necrotic zone, and zone of spirochetal infiltration. These layers, however, were not always clearly demarcated and could be missing altogether. This study also showed that spirochetes invade non-necrotic tissue as well as necrotic tissue. Spirochetes were present in all four zones, although more so in the deep than the superficial tissues. Unfortunately, this study was unable to shed any light on the pathogenesis of NUG.35

Spirochetes, fusiforms and bacteroides have all been frequently cultivated from NUG lesions,17,36 but a definitive periodontal pathogen is yet to be implicated in the onset or progression of this disease.24 It has been suggested that the bacteria involved in NUG may not be different from those involved in gingivitis, and recent research gives plausibility to the statement that it is a mixed bacterial infection which is modified by particular risk factors.20,47 Yet its bacterial aetiology does appear to indicate that it should be considered as different from other periodontal diseases.50

Transmissibility
Concerns about the transmissibility of NUG persisted in the military during World War 1, World War 2 and beyond,48 leading to the incidence of NUG in soldiers within barracks and in the field being investigated. A higher incidence of NUG was found in soldiers in field conditions. However, it was also noted that there may be less opportunity for transmission whilst outdoors, as soldiers had their own cooking and eating equipment and slept in the open air, rather than in the group rooms within the barracks.52

The American Dental Association stated that NUG was not communicable, after research by Rosebury failed to show any good evidence of its transmission.49 This statement is supported by the literature that regards NUG as an endogenous infection.

Maintaining sanitary conditions in the military environment is still essential for the prevention of transmission of other communicable diseases, for example, diarrhoea and vomiting.2 From the perspective of NUG, it would be more useful to look at which factors predispose an individual to the disease.
Potential physiological alterations associated with stress are feasible. Potentially, there are many confounding factors, and consideration should be given to what else may be implicated and why other individuals in the same environment are not similarly affected.

Malnutrition
Malnutrition has been associated with NUG. Vitamin deficiency, particularly of vitamin C, has been linked with an increased risk of NUG. However, the effect of malnutrition and its link with NUG currently remains unclear.

Oral hygiene
Poor oral hygiene has been associated with NUG, with NUG patients having poorer oral hygiene and greater deposits of calculus when compared to a control group. Pre-existing gingivitis has frequently been associated with NUG.

Socioeconomic status
There appears to be an increased risk of NUG associated with lower socioeconomic status, where status is measured by occupation, income and education. This is of particular interest when considering recent findings from British Army recruits (when compared with Royal Navy and Royal Air Force recruits), showing that they are from the most deprived quintiles on the Index of Multiple Deprivation.

Immunosuppression
NUG has been described in patients with systemic disease and immunosuppression, including patients with von Willebrand's disease.
brand’s disease, malignancy, drug-induced agranulocytosis, systemic lupus erythematosus and acquired immunodeficiency syndrome (AIDS).42

Seasonal Variation
The seasonality of NUG has been investigated in several studies, yet there is unfortunately no consistent evidence showing increased occurrence of infection during any one season.38

Age at Presentation
NUG is regarded as a disease of young adults in developed countries, with a mean age of onset of 23 years.38 The mean age of the patients in the Manson and Rand study37 was 24.6 years, with the majority of patients being in the 20-24 year-old age group. The number of recurrences ranged from one to more than three. More than one area was usually affected, with the mandibular anterior region being affected most commonly.37 In the Barnes et al study,4 the vast majority of patients were young (mean age 22 years), male, Caucasian soldiers.

Treatment
Many different forms of treatment have been suggested over the centuries, from the use of topical iodine, boric acid rinses, chromic acid, mercury, silver compounds, aniline dyes, sodium perborate rinses, glycerine, hydrogen peroxide and arsenicals to antibiotics and root surface debridement.6,16,37,50 It was only in the 1960s that debridement became recognised as a viable technique for the treatment of NUG.24 It had previously been rejected due to the perceived risks that it could lead to bacteraemia and the potentially life-threatening Vincent’s angina.24 Nevertheless, it is clear that the response to therapy is different from other forms of periodontal disease, since removal of the bacterial challenge results in a quick resolution of the disease.50,56

Treatment can be split into two separate phases: the acute phase and the maintenance phase. The acute phase of treatment aims to arrest disease and relieve pain.34 Treatment during the acute phase is difficult, as the gingi-
have discussed the fact that the evidence may not be conclusive, advice on diet and stress reduction should occur and smoking cessation advice must be given. These factors also have much wider health implications.

**Treatment summary**

Treatment of NUG must be provided on a case-by-case basis, tailored to what the individual can tolerate and the extent of the infection. Efforts should initially be directed at self-care by the patient, with concomitant debridement under local anaesthesia by the dentist. Antiseptics can be used where brushing is too painful, and antibiotics should be used where there is evidence of systemic involvement. Prompt treatment and management of predisposing factors is essential.

**Maintenance**

It has been suggested that patients who have had NUG should be placed in a supportive care programme, to ensure that they are able to maintain high personal oral hygiene and to prevent recurrence. It has also been stated that healed gingival crater sites can still act as areas where plaque can accumulate and the infection may recur. In these areas, it may be necessary to consider surgical intervention in order to improve the gingival architecture and prevent disease recurrence.

**CONCLUSION**

NUG is a rare disease, the prevalence of which has decreased since the end of the Second World War. Despite the number of reports and studies available, our understanding of NUG remains limited and further studies are needed in order to accurately characterise it.

**REFERENCES**