

## PERIODONTAL DISEASE : A RISE IN PREVALENCE IN MILITARY TROOPS PENYAKIT PERIODONTAL

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### ABSTRACT

**Background:** Oral condition is one of substantial factors in general health. Good oral health will determine dental fitness or readiness in military troops. Oral diseases affecting soldiers may have negative impacts in readiness on deployment or fight and contributes to lowering morale among personnel. At the recruitment stage, the prevalence of periodontal disease is low and controlled before the commencement of the training. As a matter of fact, periodontal health was not considered to be maintained and found to be worsening through the course of time. In the end, many of soldiers were found to suffer from periodontal diseases.

**Method :** This review article aims to discuss several factors in military way of life related to oral condition.

**Result :** Lack of oral hygiene practices, stress, deficiency of nutritious food, and smoking among military personnel may contribute to the prevalence of periodontal disease. Several attempts should be incorporated in military life to reduce the negative impacts of these factors on oral health.

**Conclusion:** Periodontal therapy should be provided early in the military careers and repeated at intervals specific to the needs of each personnel. Several risk factors contributing to the development and severity of periodontal disease should be assessed and overcome to arrest the progression of the disease.

### INTRODUCTION

Oral health is an essential part of human being, it is integral to general health and a determinant factor for quality of life. In the armed forces, oral health influences the health status of military personnel and their readiness to deploy and fight/military operation. The dental readiness and dental fitness of the military personnel have significant impacts on military operations since the untreated oral condition can lead to increase prevalence of disease and non-battle injury for deployed soldiers.<sup>1</sup> Diseases affecting oral cavity and the system supporting its function can cause impaired duty performance, lost duty time, decrease

unit effectiveness, disruption of routine care, hindrance of the military mission, unbearable pain and inability to sleep. Therefore, all active duty personnel need to be in a state of dental as well as physical health, to be ready for extended training, deployment, or war/military operation. In addition to being a force multiplier, dental readiness also contributes to increased morale among personnel. In the last decade, dental emergencies during many conflicts are still a major concern, since they can reduce combat effectiveness. Mostly caused by untreated dental caries and oral surgery related problems, this situation is believed to be preventable by proper diagnosis and prompt

treatment.<sup>2</sup> It is evidenced that the rate of dental emergencies is higher for units whose soldiers deploy with poor oral health.<sup>3</sup>

Military dental service has the primary mission in maintaining the dental health of the military personnel at an optimum level to ensure their operation readiness. There has been a decline in dental caries experience in military personnel as a successful outcome of this integrated program.<sup>4</sup> Most of the members of military division worldwide have both universal access to care and a usual source of care. In addition, they are required to have regular examinations and to maintain a certain level of oral health.<sup>5</sup> Despite the decline in prevalence of dental decay in military members, periodontal disease is overlooked and has the potential to be a significant health problem among military personnel. In Israeli permanent-force military members, only 1.19% out of 1300 subjects demonstrated healthy periodontal tissue, despite their obligatory routine medical and dental examination.<sup>6</sup> In Indian Army Soldiers, the caries experience was considerably low compared with Army population elsewhere, but the need of periodontal treatment was high.<sup>7</sup> Moreover, a large number of cases (82.7%) of gingivitis and periodontitis were detected in Pakistan Army population, which shows lack of awareness and self-consciousness among troops regarding their oral hygiene.<sup>8</sup> Studies from Serbia Army and Thailand military personnel revealed that periodontal condition of the subjects were still below the average.<sup>9,10</sup> Furthermore, periodontal reason was still the main cause of tooth loss in a group of Greek Army personnel, reflecting that longevity of the tooth is not achieved.<sup>11</sup>

Periodontal disease is an infection affecting the tooth supporting tissues. The main etiology of the

disease is bacterial plaque attached to tooth surfaces. In its early stage, the gum become swollen, red and may bleed upon stimulation, i.e. tooth brushing or spontaneously. This condition is called gingivitis, which inflammation is still limited in the gingival tissue. To date back, an acute condition of gingival inflammation with distinct figure of necrotic 'punched' interdental papilla, accompanied by spontaneous bleeding and pain, was well documented during World War II, affecting soldiers as an epidemic.<sup>12</sup> This condition, known as Vincent's angina, Trench mouth or Necrotizing Ulcerative Gingivitis (NUG), was investigated on the suggestion of the Director General of the Army Medical Services (DGAMS) and the Pathological Committee of the War Office from patients in military hospitals in England during the period from July 1918 to April 1919. To this day, NUG is still seen in the British army.<sup>13</sup> Opportunistic fusospirochetal infection resulting from the commensal oral flora is the main cause of NUG, predisposed by diminished immune system.<sup>14</sup>

If not treated, gingivitis may progress to periodontitis. The inflammation spreads widely affecting the underlying tissues, i.e. periodontal ligament, cementum and alveolar bone. Clinical signs of the disease are deepening of the pocket and tooth mobility. Untreated periodontitis is the most common cause of tooth loss among adults.<sup>15,16</sup>

Periodontitis is a multifactorial disease; in principle it is caused by an imbalance between environmental factors and the host defense. The environmental factors include the infectious component (bacterial pathogens) in dental plaque and unfavorable life-style factors and living conditions. The innate immunity in host response may be hyper-reactive resulting in an exuberant

inflammatory response. In addition, malnutrition, genetic and certain systemic diseases can impair the host defense and therefore may play a role in the development of the disease. The pathogenic bacteria that have been associated in periodontal disease include *Aggregatibacter actinomycetemcomitans*, *Porphyromonas gingivalis*, *Prevotella intermedia*, *Tannerella forsythia*, *Fusobacterium nucleatum*, *Parvimonas micra* and *Treponema denticola*.<sup>17,18,19</sup> In addition, virus infections have been suggested to be related to periodontitis.<sup>20</sup>

Taking into consideration that some factors are related to periodontal disease, military way of life may have influences on the prevalence and progression of periodontal disease as described below :

#### **Inadequate Oral Hygiene and Irregular Maintenance Care**

Studies showed that the prevention of periodontal disease requires improved oral hygiene. Public health experts have attempted to develop educational programs which stress the importance of adequate professional and personal health care services. Proper oral hygiene may resolve gingivitis and prevent progression of periodontal disease.<sup>21,22</sup> Repeated maintenance care once in every 2-3 months which was included instruction and practice of oral hygiene techniques as well as meticulous prophylaxis was successful in prevention of periodontal disease compared to traditional dental care providing sporadic periodontal treatment. In a cohort of young Navy personnel, with over 98 percent of the study population exhibited some level of periodontal disease at initial examination, gradual deterioration over time was markedly found in subjects with irregular maintenance care.<sup>23</sup> The

lack of adequate oral hygiene may facilitate plaque redevelopment and recolonization, resulting in accumulation of bacterial plaque detrimental to the periodontal tissue.<sup>24</sup>

Utilization of military dental services is not in optimal level yet, since most of the personnel would come when they have dental problem such as toothache or painful condition.<sup>25</sup> In some regions, regular dental check-up is not a norm among them, even in the peacetime status. Most of them are symptomatic attendees who only visited the dentist to relieve pain and after an emergency visit, they would not come for any maintenance cares.

In wartime, military maneuvers may avoid their personnel from performing normal oral hygiene. Moreover, oral maintenance care may be neglected due to operational circumstances and absence of normal life. Failure to properly remove plaque from the teeth and gingiva for a week or more usually results in the development of gingivitis in response to bacterial dental plaque. Worsening of the average periodontal condition after 6 months of deployment was seen in soldiers deployed to Iraq.<sup>26</sup> Under extremely difficult conditions, soldiers did not attend regular dental visits, brushed their teeth infrequently, which led to a tendency towards the deterioration of oral health with an increase in time spent on battlefields.<sup>27</sup> A study in 912 Croatian soldiers revealed that the oral health of the examined population was mostly poor, as a consequence of inadequate prevention of illnesses of the oral cavity associated with insufficient oral hygiene.<sup>3</sup> Such condition makes most of the soldiers unreliable for peace operations that would last 6 months, because it lowers their combat readiness.

#### **Stress**

Stress has been related to the onset and progression of periodontal disease.<sup>28</sup> Currently, stress is classified as a 'risk indicator' for periodontal disease. Stress impairs periodontal health through changes in behavior and complex interactions among the nervous, endocrine, and immune systems. Since oral diseases are behaviour-related, some changes in the oral cavity could be expected. Mechanisms through physiologic pathways may influence periodontal tissues through alteration in saliva, changes in gingival blood circulation, endocrine imbalances, and altered host resistance. Moreover, psychological stress can down-regulate the cellular immune response. Communication between the central nervous system and the immune system occurs through a complex network of bidirectional signals. One of the important markers of psychological stress is cortisol, it depress immunity by inhibiting the production of secretory immunoglobulin A and G (IgA, IgG), and neutrophil functions, all of which may impair defense against infection by periodontal microorganisms. Hilgert et al (2006) evaluated the extent and severity of chronic periodontitis and its association with the levels of cortisol and the scores of an inventory of stress symptoms in a population aged >50 years.<sup>29</sup> The results showed a positive association between cortisol levels and extent and severity of periodontitis. A cross-sectional pilot study reported by Rosania et al (2009) explored the associations between stress, markers of periodontal disease, psycho-neuro-immunologic variables and behavior. The results of this study suggested that stress and salivary cortisol are important correlates of periodontal disease.<sup>30</sup> Military personnel are exposed to specific psychological, physical and environmental conditions, not only in war, but also

in peacetime. The most notable example is the documented relationship between stress and necrotizing ulcerative gingivitis (NUG) during military service. This condition probably predisposed by favoring bacterial overgrowth and/or weakening host resistance.<sup>31</sup> Immune system may be diminished by mechanisms acting through the autonomic nervous system and endocrine glands resulting in elevation of corticosteroid and catecholamine levels. It has been reported that NUG patients as compared to healthy subjects presented defective function of polymorphonuclear leukocyte i.e. chemotaxis and phagocytosis; and reduced proliferation of lymphocytes upon stimulation by a nonspecific antigen. NUG patients were also more stressed than healthy subjects, with increased corticosteroid activity, suggesting that depression of some host defense mechanisms, under stress conditions, may be necessary in the pathogenesis of NUG.<sup>32,33</sup>

### **Nutrition**

In addition to poor living conditions, several major risk factors relate to unhealthy lifestyles. One of important lifestyle factors associated with periodontal disease is nutrition.<sup>34</sup> There is evidence to suggest that periodontal disease progresses more rapidly in undernourished populations and the important role of nutrition in maintaining an adequate host immune response may explain this observation.<sup>35</sup>

Periodontal disease results from the loss of a delicate balance between microbial virulence factors and a proportionate host response. Innate and adaptive defenses of the host, including phagocytic function, cell mediated immunity, complement system, secretory antibody, and cytokine production and function were impaired by

malnutrition.<sup>36</sup> Prolonged malnutrition could modify the response of human gingival and periodontal tissues to local irritants.<sup>37</sup> In addition, oral microbial ecology was markedly changed, resulting in a pathogenic anaerobic bacteria predominance, increased predisposition of bacteria to bind to oral mucosal cells, attenuation of acute phase protein response, and dysfunction of the cytokine system.<sup>38</sup> This depleted condition in nutrients is associated with a progressive damage to the mucosa, lowered immunity, and a diminished resistance to colonization and invasion by potential pathogens.<sup>39</sup> One distinctive features of malnutrition in oral cavity is the evidence of NUG in impoverished African children who are generally immune-compromised by malnutrition and common tropical infections. If not promptly treated, NUG and other oral inflammatory lesions may evolve into noma (cancrum oris).<sup>40</sup>

Tissue and cellular depletion of key nutrients is often markedly occurring in malnutrition, particularly the major antioxidant nutrients. Cellular depletion of antioxidant nutrients promotes immunosuppression, accelerated replication rate of ribonucleic acid viruses and increased disease progression.<sup>35</sup>

Nutrients can be classified into six major classes: carbohydrates, fats, minerals, protein, vitamins, and water. These nutrient classes can be categorized as either macronutrients (needed in relatively large amounts) or micronutrients. Micronutrients are dietary compounds, such as vitamins, minerals, trace elements, amino acids, poly-unsaturated fatty acids (PUFA) that are required only in small quantities (micrograms or milligrams per day) by living organisms and are essential for optimal health, proper growth, and metabolism.

Low micronutrient levels in plasma/serum is associated with periodontitis. One of micronutrients that have been associated with periodontitis is vitamin C. The importance of vitamin C for periodontal health has been known for quite some time. Insufficient consumption of vegetables and fruits, the two major sources of vitamin C, can lead to depletion or deficiency states for the vitamin.<sup>41,42</sup> Severe vitamin C deficiency and malnutrition may result in aggravated periodontal disease conditions. In addition, evidence shows that plasma vitamin C levels are inversely related to the severity of periodontitis.<sup>43,44,45</sup>

Malnutrition may occur in extremely difficult condition during war. Meals were less frequent (on average twice a day) and canned food was the only one available.<sup>27</sup> Imbalanced food intake may lead to depletion of micronutrients that is essential for optimal health and metabolism. Fresh vegetables and fruits are scarce, resulting in depletion or deficiency states for the vitamin. This condition may depress immune system and dysregulate various parameters of the host system, which is in turn increased vulnerability of the periodontal tissues to inflammatory stimuli from dental plaque.

### **Smoking**

Another most important lifestyle factors related to the development and severity of periodontal disease is smoking. Depending on the definition of disease and the exposure to smoking, the risk to develop destructive periodontal disease is 5- to 20-fold elevated for a smoker compared to a never-smoker, regardless of levels of plaque accumulation.<sup>46</sup> Chronic and heavy smoking can reduce gingival bleeding and therefore mask the clinical marker of bleeding on probing often used by dentists to monitor periodontal health.<sup>47</sup> This has

implications for potential misdiagnosis and failure to detect periodontitis at an early stage.

Several studies have shown that prolonged smoking increased periodontal disease sites concomitant with loss of periodontal bone height.<sup>48,49</sup> It was hypothesized that smoking altered the microbiota composition, diminished immune response, and reduced healing capacity of the periodontium. The mechanism on which smoking may have detrimental effects to periodontal health is that smoking lead to a shift in the composition of the subgingival biofilm with an increase in the prevalence of periodontal pathogens.<sup>50</sup> Moreover, smoking has been implicated in the delay of neutrophils recruitment and migration into periodontal tissues, thus compromising the acute immune response.<sup>51</sup> This fact would increase the threshold of aggression necessary to the periodontal tissue to initiate the inflammatory cascade. In addition, it has been suggested that smoke would shift the balance of neutrophil activities to a more destructive nature.<sup>52</sup>

Current smokers were correlated with a high prevalence of aggressive periodontitis among Israeli Army personnel.<sup>53</sup> The higher prevalence of tobacco habit was found among young army personnel than older and there was a significant association of smoking and periodontal disease.<sup>54</sup>

In a survey conducted in 1980-2005, cigarette smoking in military service members was increased significantly between 1998 and 2002.<sup>55</sup> Possible explanations for this higher military tobacco use include greater exposure to tobacco, peer pressure, stress, boredom, inexpensive cigarettes, and lack of other forms of recreation. Many recruits began to smoke after entering the military.<sup>56,57,58</sup> In another study, there were 57% ex-smokers who had quit

and then resumed the habit after entering the military.<sup>59</sup>

Increasing rate of smoking during military deployment was evidenced.<sup>60,61</sup> Among 556 British Armed Forces during their sixth week of deployment to Iraq, 29% reported that they had smoked before deployment, but by 6 weeks into deployment this number had increased to 38%.<sup>62</sup> In a study evaluated smoking behaviors involving 150 U.S. primarily Marines and Navy personnel deployed to Iraq, only 36% of those interviewed indicated smoking prior to their deployment, but more than half (56%) reported smoking during deployment.<sup>63</sup> Barton et al. 2010 revealed a pattern toward increased rates of smoking when deploying to a combat zone followed by declines in smoking upon returning to post-deployment status. The majority of the respondents reporting smoking during deployment increased their tobacco use while deployed (59%), and a larger group (81%) expressed their intent to stop smoking upon returning to the United States.<sup>64</sup>

The stress of military deployment may compound occupational stress experienced in the military and manifest in maladaptive coping behaviors such as cigarette smoking. Smoking is perceived as a stress relief, a calming agent and a status elevator. Military personnel are at high risk for tobacco use, taking into account that military work environment cause work stress and depression in military employees.<sup>65</sup>

## DISCUSSION

Oral health is important for military personnel who deploy around the world in military operations or peacekeeping service. Dental emergencies, as defined as a condition of oral disease, trauma or loss of function or other condition that causes

patient to seek immediate dental treatment, can be prevented by maintenance of good oral health. In order to screen the military population, NATO has established a system of Dental Fitness Standards. The system identifies those military members dentally fit for an overseas deployment where dental resources may be limited.<sup>66</sup>

The rate of dental emergencies is higher for units whose soldiers deploy with poor oral health. If they are not prevented or treated early, oral diseases can cause severe, life-threatening illness and may even require medical evacuation from deployment. To prevent the worsening of periodontal disease, e.g. acute gingivitis, soldier must improve oral hygiene and use an antimicrobial mouth rinse. In the case of extreme gingival tenderness, soldiers may be encouraged to reestablish oral hygiene procedures using viscous lidocaine on their toothbrushes rather than a dentifrice. Non-commissioned officers should ensure that the oral hygiene routine of all troops includes toothbrushing, at least once daily at a minimum, preferably twice daily, with fluoride toothpaste to prevent dental caries and gingival problems; rinsing several times a week with an antimicrobial mouthwash containing thymol or chlorhexidine gluconate (for those with chronic periodontal conditions).<sup>67</sup> In addition, the use of chewing gum or lozenge that contains probiotic as the active ingredient in navy sailors at sea, prevents dental decay and periodontal disease, even in the situations with diminished efficacy of personal oral hygiene, as it helps the good microorganism keep a natural balance in the oral cavity.<sup>68</sup> The assigned chewing gum may be distributed in theater dining facilities in the accessory pack of the MRE (meal, ready-to-eat).

The stress of deployment may change some behavior.<sup>69</sup> Since periodontal disease is related to behavior, unfavorable changes in behavior may

have detrimental effect on periodontal health. During deployment or other stressful conditions, dietary habit may change and leads military members to suffer from nutrition deficiency and dehydration.<sup>70</sup> Since the oral epithelium relies on micronutrients and hydration to continually performs high rate of cellular turnover, these deficiencies can affect oral health by preventing repairing and renewing itself.<sup>71</sup> These conditions may be manifested in oral cavity as glossitis, angular cheilitis, stomatitis and gingivitis.<sup>72</sup> Furthermore, increased progression of periodontitis is also associated with malnutrition since several micronutrients i.e. vitamins A, B, C, D, E and minerals such as zinc, iron, magnesium and calcium are important for repairing and renewing oral epithelium and periodontal attachment ensuring an adequate amount of saliva, as a defense against oral disease, in sufficient quality to protect the oral cavity. Stressful circumstances may compromise saliva composition or flows which in turn may impair antifungal, antiviral and antibacterial properties.<sup>73</sup>

Soldiers should be trained in stress reducing techniques to avoid these problems (as well as the many other negative effects of combat stress). Stress relieving activities may include exercise, art/music therapies, dancing, mindfulness, yoga and engaging with nature, as it have been proven to reduce stress and enhance well-being.<sup>74</sup> The pattern cortisol secretion, which are regulated by the brain, are a key mediator of stress and well-being links.<sup>75</sup> Cortisol is secreted as a response of negative feedback, during situation perceived as stressful via the hypothalamic-pituitary-adrenal (HPA) axis. Nowadays, stress-relieving strategies included positive psychological intervention such as expressing gratitude, identifying and using personal strength or writing about the good things in

someone's life, have been shown to reduce stress and enhance well-being among adults.<sup>76</sup> Moreover, physical exercise, art and music therapies, dancing in groups, yoga practice and exposure to nature have been proven to help people coping with stress.<sup>77</sup>

When smoking is used as a coping mechanism for stress, the magnitude of tissue destruction will be escalated. A military dentist should be engaged in tobacco intervention efforts. Tobacco intervention includes tobacco cessation activities, prevention, and public policy development. The intervention is called 5 A, Ask, Advice, Assess, Assist and Arrange. Ask patients about smoking and during every visit, every patient is asked about tobacco use, and the answer is documented in the patient's record. Advise all smokers to stop. A military dentists should demonstrate the oral effects of tobacco if present, or inform patients about the increased risk of poor response or healing after dental procedures relevant to the patient. Assess the patient's willingness to stop. If the patient is willing to make an attempt to quit, dentists should assist the patient. If the patient is unwilling to quit, the military dentist should accept the patient's decision and make a note in the record for future reference or the patient can be referred to a tobacco cessation specialist (if available). Assist the patient in stopping. If a patient has a desire to stop, the dentist should help the patient set a realistic quitting date which should be soon but not immediately so that the patient has time to prepare. Nicotine replacement therapy (nicotine patch, nicotine gum, inhaler or nasal spray) can be very helpful.<sup>78</sup> Recently, an alternative method to help smokers unwilling to quit, called Tobacco Harm Reduction, is suggesting reduced-risk products, i.e. Electronic Nicotine Delivery Systems (ENDS), heated tobacco

products and Snus, that is considered to be less harmful than combustible cigarettes.<sup>79</sup> Study finds that military services members smoke at a lesser rate than the general population and that 11.1 percent of military service members report daily e-cigarette use.<sup>80</sup> Arrange follow-up contact, it is very important as the chances of a successful outcome are improved when patients know their progress will be reviewed. The dentist should confirm the quitting date, show continuing support, and encourage another try if unsuccessful.

## CONCLUSION

From the review aforementioned, it may be concluded that despite the integrated programs to decline dental decay prevalence, preventive dentistry services and periodontal therapy should be provided early in the military careers and repeated at intervals specific to the needs of each patient. Several risk factors related to military way of life that contributing to the development and severity of periodontal disease should be assessed and overcome to arrest the progression of the disease.

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