



How Do We Better Control Periodontal Plaques and Alveolar Pyorrhoea for A Subjection of Oral Bacteria-Related Systemic Diseases?

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Abstract: Periodontal disease eventually causes tooth loss due to alveolar pyorrhoea, and in recent years, systemic diseases, such as Alzheimer's disease and type 2 diabetes, caused by oral bacteria have attracted much attention. *Porphyromonas gingivalis* has also been reported to cause Alzheimer's disease. However, periodontal disease remains a major problem in humans. In recent years, the bactericidal power of ozone has attracted attention because palmoplantar pustulosis, which is thought to be caused by oral bacteria, exerts a therapeutic effect when sterilized with ozone water. Irrigation with ozone saline solution is believed to be effective in treating periodontal abscesses. However, periodontal disease cannot be completely cured with this treatment, and oral bacteria that are resistant to ozone oxidation exist. Furthermore, *P. gingivalis* has an oxidation-resistant structure. Therefore, preventive measures are required before the onset of *P. gingivalis*-induced Alzheimer's disease. Under these circumstances, the removal of dental plaque is not always easy; therefore, high-pressure washing has been proposed, UV (ultraviolet) light treatment has been attempted for gingivitis, and ultraviolet-A (UVA) light has also been suggested as an application for the geographic tongue, which is suggested to involve bacteria. Here, we discuss the applicability of new therapeutic strategies for oral diseases caused by oral bacteria.

Keywords- *Pyorrhoea, Oral bacteria, Systemic diseases, Palmoplantar pustulosis, Ozone nanobubble water, Oral care*

I. Introduction

Periodontal diseases (1), such as periodontitis and abscess (Figure 1), have plagued mankind since its inception and continue to affect many people from their thirties. The market is saturated with oral care products, and the awareness of oral hygiene is increasing. Despite this, not only oral diseases caused by oral bacteria, but also various systemic diseases (2), such as Alzheimer's disease and type 2 diabetes, attributed to oral bacteria have become significant health concerns in recent years. Beyond periodontal disease and gingival inflammation, extremely problematic conditions (1), such as apical abscesses (1) and alveolar pyorrhoea(3), are some of the potential problems for patients and dentists. The most problematic condition is alveolar pyorrhoea(3), advanced conditions of gingival inflammation (1), with symptoms including painful chewing, swollen or puffy gums, gum

bleeding, and pus in the gums. The resolution of this predicament remains elusive and a definitive solution is required.

Oral Bacteria

Hundreds of species of bacteria, such as *Actinobacillus actinomycetemcomitans*, settle in the oral cavity (4). Depending on the bacterial species, some can invade the mucous membrane into the gingival tissue (5), leading to periodontal abscess (1) (Figure 1) and/or eventual alveolar pyorrhoea (3) (Figure 1 [arrows]), sometimes resulting in loss of teeth. Although a few studies have analyzed bacteria based on their mobility (6), Scanapieco et al. (7) first reported that many fimbriate bacteria were present in the oral cavity and few flagella were present. Thus, motile bacteria may be significantly involved in the progression of periodontal disease. Bacteria that invade submucosal tissues as in gingivitis have also been confirmed (5). Most recently, it has been shown that Alzheimer's disease (8) is caused by *Porphyromonas gingivalis* (*P. gingivalis*), a fimbriate bacillus, and the importance of the constituents of mobile bacteria has been highlighted.

Oral Bacteria-related Systemic Diseases

In recent years, it has been found that periodontal bacteria associated with periodontal disease are involved in some systemic diseases (2), such as Alzheimer's disease (8) and type 2 diabetes, and have received significant attention. However, periodontal disease, on the other hand, cannot be cured in the first place. Oral bacteria-related diseases include inflammatory skin diseases, palmoplantar pustulosis (PPP) (9), a unique inflammatory skin disease that exhibits prominent pustules specifically affecting the palms and soles (Figure 1), which has been linked to periodontal bacteria, and patients frequently demonstrate poor oral condition (10), such as periodontitis. Moreover, PPP (10) was reported to be successfully treated with oral rinsing with ONB water (11). However, patients with alveolar pyorrhoea cannot be completely cured. Here we propose a method to treat alveolar pyorrhoea, the endpoint of periodontal disease which remains difficult to cure. So far, periodontal disease treatment includes not only periodontal disease control, but also periodontal bacteria-related systemic diseases, including PPP (10).

Handling of Periodontal Plaques

Currently, although many patients are trained in proper oral hygiene, including teeth brushing, flossing, and use of mouthwash daily, many still suffer from periodontal diseases, such as gingivitis (1). Despite training and the abundance of oral healthcare products widely available, including chlorhexidine (12), and triclosan (13), oral health diseases remain a prominent issue. Beyond periodontal disease and gingival inflammation, extremely problematic conditions (1), such as apical abscesses (1) and alveolar pyorrhoea(3), are some of the potential problems for patients and dentists. Although various nonsurgical methods (14) for controlling plaque and gingivitis have been investigated in dentistry, we propose a high-pressure washing method (15) for controlling periodontal plaque.

Pressure washing and power washing (15) are widely used in real-life environments (Figure 2). Many models are commercially available and can be used for household electricity. High-pressure water spray is used to remove dirt from surfaces such as loose paint, mold, grime, dust, and mud; and objects such as buildings, vehicles, and concrete surfaces (15). Machine pressures are extremely high, ranging from 750 to 30,000 psi (5 to 200 MPa) or more (15). This powerful pressure has a threatening cleaning effect that removes dirt that cannot be removed by rubbing with a brush.

Furthermore, it is also used to remove stains from food, vegetables, fruits, etc., (16). In medical and surgical settings, it is also used to wash grafts (17), and wounds (18), using high-pressure (5 to 8 psi) irrigation in traumatic wounds.

In the dental field, low-pressure water washing is sometimes used, even though high-pressure is not required. To the best of our knowledge, equipment for high-pressure washing in dentistry has not been found yet. Low-power lasers are also used for periodontal plaque treatment (19) but may present visual challenges since the irradiation point is too small. Whether such a high-pressure washer can be made is a different matter,

even if it is smaller than a home-use washer and can be used to remove dental plaque. Good handling is essential because it is used in narrow and detailed parts of the oral cavity. Additionally, it is necessary to continuously absorb and drain water because it is uncomfortable if the inside of the mouth is soaked in water. Also, it is necessary to consider how much high-pressure is appropriate for removing dental plaque and stains from teeth.

Alveolar Pyorrhoea

Alveolar pyorrhoea(3) is a severe condition that can result in tooth loss. It is now considered under periodontal diseases and is no longer treated centrally as it once was. As bacteria that have invaded the gingival tissue cannot be washed away and the tissue cannot be sterilized, a PPP patient with pyorrhoea could not be cured using ONB water treatment, as shown in the PPP report (10). The author further observed that two women and three men with PPP aged 43–64 years, had PPP lesions that were not completely cured, and were confirmed to still have pyorrhoea in dentistry. A 64-year-old patient showed marked improvement in PPP skin symptoms for a short period when a single tooth lesion of pyorrhoea was extracted and treated, but had other teeth with pyorrhoea that could not be completely cured when he ceased treatment. Therefore, it is expected that if pyorrhoea can be completely cured, PPP can be completely cured. Patients with PPP who did not have pyorrhoea participated in a clinical trial at my facility have been confirmed to be completely cured by ozone treatment, with no cases of recurrence for more than 10 years.

The bactericidal action of ozone gas has been known for a long time, but with the advent of nanosized ozone water (20), which dissolved nanosized ozone gas particles in water or saline, the bactericidal action of ozone has begun to revolutionize the response to medical and dental infectious diseases as a new bactericidal agent. Ozone water does not damage the oral mucosal tissue and its bactericidal activity does not generate resistant bacteria (11). On the other hand, in periodontal diseases, treatment using ozone gas has been attempted (21), but has not been found to be correlated with significant improvement in periodontal recovery. It has been pointed out that periodontal pathogens are eradicated within approximately 30s of ozone exposure (11). However, based on the experience of daily medical care, it is not possible to completely cure periodontal disease with nano-ozone water alone, and it may be necessary to examine the susceptibility of individual bacteria to the oxidizing action of ozone.

Gingivitis and Ultraviolet Light Therapy

Gingival inflammation is considered as a marker of the onset of periodontal disease (1). Attempts have been made to sterilize the bacteria that have invaded the gingival tissue at that level using ultraviolet (UV) light (22), and UVA sterilization treatment of geographic tongue (23) and tongue bacteria (24), which is also a source of periodontal bacteria, has been proposed. Plaque control, which is the most important factor in periodontal disease management, requires supragingival and subgingival plaque control, particularly for inaccessible pockets or other risk factors, and periodontal debridement under local anesthesia is sometimes selected. However, it has been noted that supragingival plaque reappears within hours or days of removal, raising concerns about plaque management difficulties.

Proposal of Therapies for Pyorrhoea

Pyorrhoea should be treated without tooth extraction. We proposed direct injection cleaning with the introduced ONB physiological saline (25) over injection routes such as periodontal pockets (Figure 1), which have recently entered the market. We have already suggested that this method should be indicated for the treatment of dental fistulae (26), which may be secondary to a periodontal abscess (25). We expect that it will be examined in the clinical setting of dentistry and that pyorrhoea can be treated without tooth extraction to the extent possible. As pyorrhoea is extremely difficult to treat, it is expected that the new option of ONB saline injection into periodontal lesions (25,26) will be thoroughly examined in a clinical setting.

II. DISCUSSION

Over 500 varieties of bacteria live in the oral cavity (4). Even with the difficulty in overcoming gingivitis and periodontal disease (1), the current situation remains discouraging despite much trial and error. As mentioned previously, the bactericidal effect of ozonated water on PPP was beneficial (10). Although ozonated

water has been clinically examined as an adjunct sterilization method for periodontal disease (20), it cannot cure periodontal disease completely. Moreover, *P. gingivalis* of Alzheimer disease (8) has only been established for bacteria that cause systemic diseases. *P. gingivalis* is resistant to oxidation (27), and in contrast to the effectiveness of ozonated water on the inflammatory skin disease PPP, *P. gingivalis* sterilization is becoming more difficult. It is unknown whether clinical adaptation will be performed; however, hopefully, pressure washing will also be considered. The importance of periodontal plaque treatment and ultraviolet therapy in gingivitis should be actively investigated. The resolution of periodontal disease and management of alveolar pyorrhoea are also important issues. Oral antibiotics are administered in general practice for Pyorrhoea; however, there are limits to their use. Because it does not provide a complete cure, the procedure needs to be repeated. Ozonated saline irrigation for alveolar pyorrhoea may also be considered (25), even if it requires surgical intervention rather than tooth extraction. Implants may not be suitable in all cases.

III. CONCLUSION

Alveolar pyorrhoea (3) is a severe periodontal disease. The treatment of alveolar pyorrhoea remains a serious dental proposition for the treatment of systemic diseases caused by oral bacteria. Oral diseases caused by oral bacteria are also a major proposition that we must overcome in order to overcome the systemic diseases caused by them.

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Competing Interests

The author declares that I have no competing interests.

Authors' Contributions Conceptualization:

Yasuhiro Horiuchi: Conception and design of the study, literature review, analysis and interpretation, writing of the manuscript, final approval of the manuscript.

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Figure 1 Representative illustration of oral bacteria-related systemic diseases, examples of clinical features of periodontal abscess and palmoplantar pustulosis, and a lucent image (arrowheads) of root tissue in an X-P view of alveolar pyorrhoea. Figure of inserting a needle into the periodontal pocket.

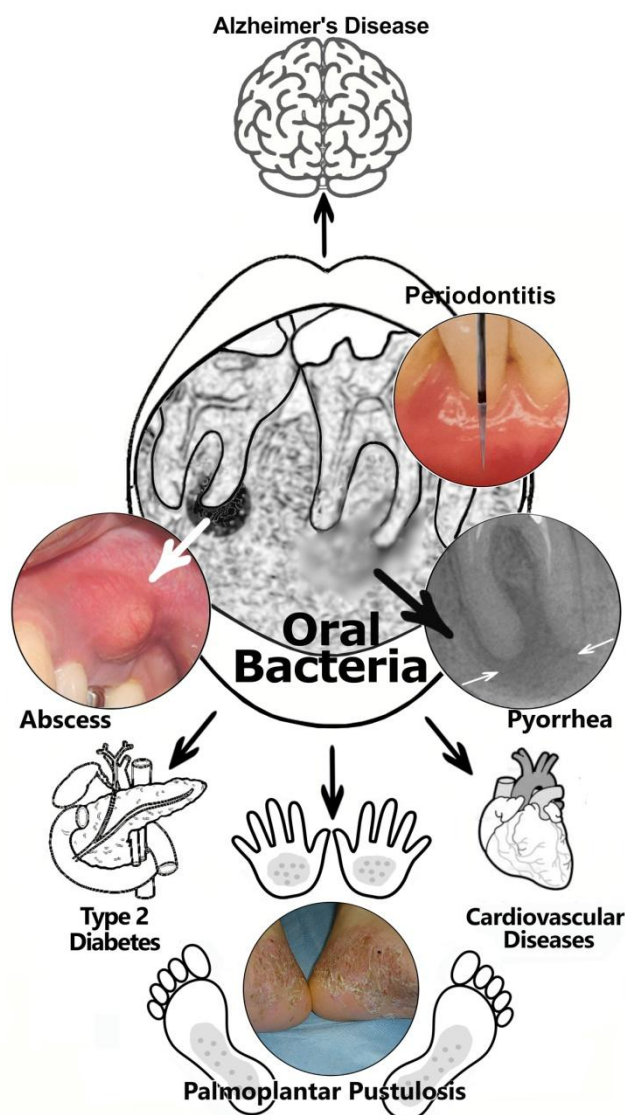


Figure 2 Household high-pressure washing usage

