

## Perspective

# Periodontal Abscess and Pyorrhea: Proposal for a Novel Treatment with Ozone Nanobubble Saline Wash

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## Introduction

The evolution of the treatment technologies in dentistry is remarkable. However, despite the advancement of science and therapeutic agents, they have not been able to overcome dental caries, periodontal disease [1], nor alveolar pyorrhea [2]. We are attempting to eliminate hundreds of oral bacteria, partly because we are fighting indigenous oral bacteria [3]. 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 [4] widely available, including fluorides, chlorhexidine, and triclosan, oral health diseases remain a prominent issue. Beyond periodontal disease and gingival inflammation, extremely problematic conditions [1], such as periodontal abscesses [1] and alveolar pyorrhea [2], are some of the potential problems for patients and dentists. The most problematic condition is alveolar pyorrhea [2], advanced conditions of gingival inflammation [1], with symptoms including painful chewing, swollen or puffy gums, gum bleeding, and pus in the gums. These symptoms gradually appear, and in untreated conditions, lead to tooth loss. The advent and development of antibiotics have greatly impacted the treatment of bacterial infections. However, local bacterial infection lesions in various parts, such as dental fistulae [5], have not yet been overcome. The emergence of resistant strains is also a problem; the peculiarity of the conditions, such as fistula-like sites and infected wounds, is still a major obstacle to bacterial infections. These periodontal and gingival diseases [1] are treated with systemic antibiotics during the acute phase [4], but they are not always completely cured. It should be noted that bacterial infections in the oral cavity remain unresolved issues.

## Oral Bacteria and Hygiene

Oral bacteria [3], such as *Porphyromonas gingivalis* and *Actinomyces* spp., commonly cause problems in the oral cavity of adults. Periodontal abscess [1] can form as a small pustule on the root of the tooth or an artificial tooth. For treatment, washing

with saline and/or antibiotic paste, sometimes in conjunction with systemic antibiotics, can be performed [4], but permanently curing the periodontal abscess is difficult. With the conventional method, there is often a cycle of recurrence. Over time, the abscess may occur as an external dental fistula [5], commonly caused by periapical tooth infection [1]. Since the opening of the fistula can occur in the facial skin, such as the lower jaw, dermatologists are required to instruct patients to visit the dentist. It is difficult to clean a narrow tunnel-shaped fistula [5]; however, it is possible to clean and disinfect the inside of such a shape by applying pressure using a syringe and saline [5]. Furthermore, the gums and pockets are sites where the attachment is gradually destroyed by bacteria and collagenases [6]. Eventually, instability of the tooth at that site occurs, resulting in tooth loss. The author believes that the oral bacteria that cause tooth loss include flagellar bacteria [7] that can invade the gingival mucosa.

Unfortunately, the dynamic pathogenicity of these oral bacteria has not yet been thoroughly analyzed. However, it has recently been pointed out that flagellar bacteria can invade the mucous membrane by the flagellar rotation motor [8], which is suggested as the cause of difficulty in treating these oral diseases.

## Ozone Nanobubble Saline

Currently, to treat this condition, these local bacterial microenvironment must first be exterminated. Therefore, the potential usefulness of nano-ozone water [9] has been proposed in various medical fields, particularly oral hygiene. It is suggested that cleaning and sterilization with nano-ozone saline may be useful for external dental fistula [5]. Ozone nanobubble (ONB) water [9] has nano sized ozone gas bubbles suspended and dissolved in water. Since 2020, ONB saline has become available in Japan. However, approval for medical use has not yet been granted. Unlike antibiotics, ONB water eradicates bacteria by mechanical sterilization, does not produce resistant bacteria [9] due to its strong oxidative action, and does not damage the oral mucosa [9]. In periodontal diseases, treatment using ozone gas has been attempted [10], but has not been found to be correlated with significant improvement in periodontal recovery. Exposure for 30 s or more is required for ozone to exert its bactericidal effect [9], which is also, why the bactericidal effect of ONB water can be expected. Thus, ONB saline should be considered for dental treatment rather than using ozone gas by itself. However, daily cleaning with nano-ozone water does not always completely cure periodontal disease. The sensitivity to ozone can vary depending on the bacterial species. In the future, it will be necessary to consider it from the aspect of oral bacteriology.

## Perspective and Conclusion

ONB saline is a powerful bactericidal agent; hence, it should be used locally, since saline cleaning or antibiotics alone could not overcome the above-mentioned problems. Furthermore, since it is

a saline solution, it cannot only wash the dental fistula but can also be directly injected into the abscess at the root of the tooth. In this manner, ONB saline can be washed and sterilized by dissolving nano sized ozone gas bubbles, even in closed wounds, such as alveolar pyorrhea [2]. Therefore, we should consider going one-step further from conventional treatments and confront bacteria without relying on antibiotics. From the perspective of this oral bacteriological issue, there are hundreds of indigenous oral bacteria inhabiting the oral cavity [3], making it difficult to resolve periodontal diseases. Therefore, the author hopes that ONB saline will be used as a new treatment method for intractable oral bacterial wounds in dental treatment.

## Declaration

**Author's contributions:** The author has contributed significantly for the content of this manuscript.

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