

Original Research

Alveolar Osteitis: A Review Of Risk Factors And Treatments

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Abstract:

Alveolar osteitis, commonly known as "dry socket," is a complication that may arise after tooth extraction, and its prevalence is inconsistent in the literature. This article reviews the available literature on the risk factors and treatments of alveolar osteitis. Several studies suggest that surgical trauma and operator inexperience are risk factors for the occurrence of alveolar osteitis. Additionally, smoking has been shown to impair healing mechanisms and contribute to inadequate filling of the socket with blood, making it another potential risk factor. There are conflicting findings regarding gender as a risk factor for alveolar osteitis, and differences in smoking rates between males and females could confound analyses examining the relationship between gender and alveolar osteitis. Estrogen level fluctuations in females during the menstrual cycle could also influence the risk of dry socket and confound the role of gender. Oral contraceptives have been associated with a higher incidence of alveolar osteitis. Various treatments for alveolar osteitis, including analgesics, antimicrobial agents, and intrasocket dressings, are available, but the most effective treatment remains unclear. An interdisciplinary approach that combines various treatment modalities may be the best approach for managing alveolar osteitis.

Keywords: Inflammatory factors, Disease severity, Covid-19.

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Introduction

Alveolar osteitis, also referred to as "dry socket," is a condition that involves pain in or around the area where a tooth has been extracted, as well as bad breath. It is a complication that can occur after dental extractions and was first described by Crawford in 1896 (1). Over the years, the condition has been defined in 17 different ways, from 1986 to 2018, and has been given various names, including septic socket, necrotic socket, localized osteitis, post-operative alveolitis, localized osteomyelitis, and fibrinolytic alveolitis (2).

The prevalence of alveolar osteitis (AO) is inconsistent in the literature, with varying reports. A Cochrane Review suggests that it is frequently found between 0.5% and 5% in the case of regular extractions (3). On the other hand, the review suggests that the prevalence of AO following the extraction of mandibular wisdom teeth is higher, exceeding 30%. However, Blum's research indicates that the prevalence ranges between 1% and 45% (2).

The physiological mechanisms that underlie AO have not been extensively studied and are likely to be intricate. The fibrinolytic theory proposed by Birn (4) remains the most widely accepted explanation. It suggests that traumatic force during extraction may cause osteoblast death, local ischemia, and a lack of adhesion of necrotic osteoblasts within the fibrin clot (5), which may contribute to the higher prevalence of mandibular third molar AO after surgical extractions, as reported in the literature. High levels of plasmin (4), which promote fibrinolysis and up-regulate local inflammation, have been observed around extraction sockets following tooth extraction, and this may contribute to the lack of fibrin clot formation in AO cases. AO can be a significant burden on patients, and it is frequently reported as extremely painful after tooth extraction, necessitating multiple visits to primary or secondary care for symptomatic relief and

management. This can have implications for the efficiency of care and the costs involved, as well as prolonged discomfort for the patient. Such prolonged discomfort may also reinforce negative attitudes and fears regarding access to dental care.

This article aimed to review the available literature addressing the risk factors and treatments of alveolar osteitis.

Risk factors

Extraction Trauma

Many researchers concur that surgical trauma and the complexity of surgery contribute significantly to the occurrence of alveolar osteitis (AO) (4, 6, 7). This could be attributed to a greater release of direct tissue activators following inflammation of the bone marrow due to the more difficult and hence more traumatic extractions (8). Surgical extractions are known to result in a tenfold greater incidence of AO compared to nonsurgical extractions (9). Lilly *et al.* (10) reported that AO is more likely to occur in surgical extractions that involve the reflection of a flap and removal of bone.

Operator's experience

Numerous investigations suggest that the operator's experience is a risk factor for the occurrence of AO. Larsen *et al.* (11) suggested that the surgeon's inexperience may result in greater trauma during extraction, particularly in the case of surgical extraction of mandibular third molars. Both Alexander (6) and Oginni *et al.* (12) reported a higher prevalence of AO following extractions performed by less experienced operators. Consequently, the operator's expertise and experience must be taken into account.

Tobacco smoking

Smoking has been implicated in impairing healing mechanisms, causing suction of the clot, affecting blood vessels, and contributing to inadequate filling of the socket with blood (8, 13-15). Numerous studies have shown a correlation between smoking and AO. A dose-

dependent relationship between smoking and the occurrence of AO has been observed. In a study of 4000 surgically extracted mandibular third molars, patients who smoked half a pack of cigarettes per day had a four- to five-fold greater incidence of AO (12% versus 2.6%) than nonsmokers. The incidence of AO increased to over 20% in patients who smoked a pack a day and 40% in those who smoked on the day of surgery (16). Whether a systemic mechanism or direct local effects (such as heat or suction) at the extraction site are responsible for this increase is unclear (8).

Gender

Several studies suggest that being female is a potential risk factor for the development of AO, independent of the use of oral contraceptives. MacGregor (17) reported a 50% higher incidence of AO in women compared to men in a series of 4000 extractions, while Colby (18) reported no significant difference in AO incidence based on gender.

One potential explanation for the conflicting findings regarding gender as a risk factor for alveolar osteitis is the failure to account for the many factors, such as hormonal and lifestyle habits, that may differ between males and females. Additionally, reliance on bivariate statistics, which do not control for other variables, may also contribute to the conflicting results. For example, differences in smoking rates between males and females (8, 19) could confound analyses examining the relationship between gender and alveolar osteitis. Furthermore, the fluctuation of estrogen levels in females during the menstrual cycle (8, 20) could also influence the risk of dry socket and further confound the role of gender. It is possible that antibiotic prophylaxis may also have different effects on men and women, adding to the complexity of the issue (21).

Oral contraceptives

According to various studies, oral contraceptives are associated with a higher incidence of AO in females compared to males.

Studies conducted after the 1970s have shown a significant increase in the occurrence of AO in females using oral contraceptives (22-24). Sweet and Butler (25) have found a positive correlation between the increased use of oral contraceptives and the incidence of AO. Estrogen has been suggested to play a role in the fibrinolytic process, indirectly activating the fibrinolytic system and thus promoting lysis of the blood clot (26). Catellani *et al.* (27) have further concluded that the likelihood of developing AO increases with the dose of estrogen in oral contraceptives. It has been suggested that hormonal cycles should be taken into consideration when scheduling elective exodontia in order to minimize the risk of AO (24).

Age

There is no clear consensus regarding the relationship between age and peak incidence of AO. While it is generally accepted that the risk of developing AO increases with age, the available literature provides mixed findings (6). Blondeau *et al.* (28), for example, suggest that surgical extraction of impacted mandibular third molars should be performed before the age of 24, particularly in female patients, as older patients may face a greater risk of postoperative complications.

Treatments

The main manifestation of AO is pain, which can occur with varying frequency and severity, leading patients to seek professional medical attention. The management of alveolar osteitis (AO) is considered less controversial compared to its etiology and prevention. While some authors have mentioned the "treatment" of AO (18, 29, 30), this may be misleading since the condition cannot be treated without knowing its cause. The primary goal of managing dry socket, according to Fazakerley *et al.* (31), is to manage pain until normal healing begins, and local measures are usually sufficient for most cases. In some cases, systemic analgesics or antibiotics may be necessary. Various literature

suggested (32-34), intra-alveolar dressing materials are frequently used to manage dry socket, despite the general acknowledgement that they delay the healing process of extraction sockets (35). There are various commercially available medicaments and carrier systems, but little scientific evidence exists to guide the selection process (6). It is apparent from reviewing the various formulations that all of them are simply different combinations of about 18 different ingredients. One of the commonly used products in the management of dry socket is Alvogyl (Septodont, Inc, Wilmington, DE), which contains butamben (anesthetic), eugenol (analgesic), and iodophorm (antimicrobial). However, some authors (36, 37) have observed that the use of Alvogyl led to the retardation of healing and inflammation in the sockets, and as a result, do not recommend its use in extraction sockets.

A systematic review study analyzed treatments for AO (38) and found that those utilizing intra-alveolar irrigation with sterile saline solution or iodopovidone before other therapeutic interventions had the best outcomes. Intra-alveolar irrigation is advantageous as it reduces the microbial load and removes necrotic tissue or clot debris. The majority of studies included in the analysis employed intra-alveolar irrigation as an early measure and combined it with other therapeutic strategies of varying complexity. Notably, the use of intra-alveolar irrigation and curettage without additional treatments was found to be ineffective for pain control. These results suggest that intra-alveolar irrigation procedures are necessary but not sufficient for achieving a satisfactory reduction in pain (39).

Conclusion

AO treatment can be divided into two categories: basic procedures, such as intra-alveolar irrigation, which should always be used, and specific procedures, which can help to control pain and achieve success. Specific procedures can be either invasive or non-

invasive, and they may vary in complexity. The choice of treatment may be influenced by factors such as availability, as well as the advantages and disadvantages of each option.

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