Original Research

Alveolar Osteitis: A Review Of Risk Factors And Treatments

Amir Reza Shirazi[1*], Seyed Mohammad Mahdi Bahaeddini[2]

1. Department of oral and maxillofacial surgery faculty of dentistry Isfahan university of medical science, Isfahan, Iran. Orcid: 0009-0000-0940-2063. Amirshirazi000@yahoo.com
2. Maxillofacial Surgery Faculty of Dentistry, Isfahan University of Medical Science, Isfahan, Iran. Orcid: 0009-0004-0793-5113. Mahdibh7373@gmail.com

*__Corresponding Author: Amir Reza Shirazi__. Department of oral and maxillofacial surgery faculty of dentistry Isfahan university of medical science, Isfahan, Iran. Email Amirshirazi000@yahoo.com.

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.

Submitted: 10 Apr 2023, Revised: 30 Apr 2023 , Accepted: 21 May 2023

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 (Septodent, 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.

References

1. Crawford J. Dry socket. Dent Cosmos. 1896;38:929.
2. Blum I. Contemporary views on dry socket (alveolar osteitis): a clinical appraisal of standardization, aetiopathogenesis and management: a critical review. International journal of oral and maxillofacial surgery. 2002;31(3):309-17.
3. Daly BJM, Sharif MO, Jones K, Worthington HV, Beattie A. Local interventions for the management of alveolar osteitis (dry socket). Cochrane Database of Systematic Reviews. 2022(9).
4. Birn H. Etiology and pathogenesis of fibrinolytic alveolitis ("dry socket"). International Journal of Oral Surgery. 1973;2(5):211-63.
5. Mamoun J. Dry Socket Etiology, Diagnosis, and Clinical Treatment Techniques. jkaoms. 2018;44(2):52-8.
6. Alexander RE. Dental extraction wound management: A case against medicating postextraction sockets. Journal of Oral and Maxillofacial Surgery. 2000;58(5):538-51.
7. Brekke JH, Bresner M, Reitman MJ. Effect of surgical trauma and polylactate cubes and granules on the incidence of alveolar osteitis in mandibular third molar extraction wounds. J Can Dent Assoc. 1986;52(4):315-9.
8. Nusair YM, Younis MH. Prevalence, clinical picture, and risk factors of dry socket in a Jordanian dental teaching center. J Contemp Dent Pract. 2007;8(3):53-63.
9. Torres-Lagares D, Serrera-Figallo MA, Romero-Ruíz MM, Infante-Cossío P, García-Calderón M, Gutiérrez-Pérez JL. Update on dry socket: a review of the literature. Med Oral Patol Oral Cir Bucal. 2005;10(1):81-5; 77-81.

10. Lilly GE, Osbon DB, Rael EM, Samuels HS, Jones JC. Alveolar osteitis associated with mandibular third molar extractions. The Journal of the American Dental Association. 1974;88(4):802-6.
11. Larsen PE. Alveolar osteitis after surgical removal of impacted mandibular third molars: Identification of the patient at risk. Oral Surgery, Oral Medicine, Oral Pathology. 1992;73(4):393-7.
12. Oginni FO, Fatusi OA, Alagbe AO. A clinical evaluation of dry socket in a Nigerian teaching hospital. Journal of Oral and Maxillofacial Surgery. 2003;61(8):871-6.
13. Parthasarathi K, Smith A, Chandu A. Factors Affecting Incidence of Dry Socket: A Prospective Community-Based Study. Journal of Oral and Maxillofacial Surgery. 2011;69(7):1880-4.
14. Abramowicz S, Dolwick MF. 20-Year Follow-Up Study of Disc Repositioning Surgery for Temporomandibular Joint Internal Derangement. Journal of Oral and Maxillofacial Surgery. 2010;68(2):239-42.
15. Halabí D, Escobar J, Muñoz C, Uribe S. Logistic Regression Analysis of Risk Factors for the Development of Alveolar Osteitis. Journal of Oral and Maxillofacial Surgery. 2012;70(5):1040-4.
16. Sweet JB, Butler DP. The relationship of smoking to localized osteitis. J Oral Surg. 1979;37(10):732-5.
17. MacGregor AJ. Aetiology of dry socket: A clinical investigation. British Journal of Oral Surgery. 1968;6(1):49-58.
18. Colby RC. The general practitioner's perspective of the etiology, prevention, and treatment of dry socket. Gen Dent. 1997;45(5):461-7; quiz 71-2.
19. Haraji A, Rakhshan V. Single-Dose Intra-Alveolar Chlorhexidine Gel Application, Easier Surgeries, and Younger Ages Are Associated With Reduced Dry Socket Risk. Journal of Oral and Maxillofacial Surgery. 2014;72(2):259-65.
20. Eshghpour M, Rezaei NM, Nejat A. Effect of Menstrual Cycle on Frequency of Alveolar Osteitis in Women Undergoing Surgical Removal of Mandibular Third Molar: A Single-Blind Randomized Clinical Trial. Journal of Oral and Maxillofacial Surgery. 2013;71(9):1484-9.
21. Grossi GB, Maiorana C, Garramone RA, Borgonovo A, Creminelli L, Santoro F. Assessing Postoperative Discomfort After Third Molar Surgery: A Prospective Study. Journal of Oral and Maxillofacial Surgery. 2007;65(5):901-17.
22. Schow SR. Evaluation of postoperative localized osteitis in mandibular third molar surgery. Oral Surgery, Oral Medicine, Oral Pathology. 1974;38(3):352-8.
23. Sweet JB, Butler DP. Increased incidence of postoperative localized osteitis in mandibular third molar surgery associated with patients using oral contraceptives. American Journal of Obstetrics and Gynecology. 1977;127(5):518-9.
24. Cohen ME, Simecek JW. Effects of gender-related factors on the incidence of localized alveolar osteitis. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology. 1995;79(4):416-22.
25. Sweet JB, Butler DP. Predisposing and operative factors: Effect on the incidence of localized osteitis in mandibular third-molar surgery. Oral Surgery, Oral Medicine, Oral Pathology. 1978;46(2):206-15.
26. Ygge J, Brody S, Korsan-Bengtsen K, Nilsson L. Changes in blood coagulation and fibrinolysis in women receiving oral contraceptives: Comparison between treated and untreated women in a longitudinal study. American Journal of Obstetrics and Gynecology. 1969;104(1):87-98.
27. Catellani JE, Harvey S, Erickson SH, Cherkin D. Effect of Oral Contraceptive Cycle on Dry Socket (Localized Alveolar

Osteitis). The Journal of the American Dental Association. 1980;101(5):777-80.
28. Blondeau F, Daniel NG. Extraction of impacted mandibular third molars: postoperative complications and their risk factors. J Can Dent Assoc. 2007;73(4):325.
29. Rood JP, Murgatroyd J. Metronidazole in the prevention of ‘dry socket’. British Journal of Oral Surgery. 1979;17(1):62-70.
30. Mitchell L. Topical metronidazole in the treatment of 'dry socket'. British Dental Journal. 1984;156(4):132-4.
31. Fazakerley M, Field EA. Dry socket: a painful post-extraction complication (a review). Dent Update. 1991;18(1):31-4.
32. Swanson AE. Prevention of dry socket: An overview. Oral Surgery, Oral Medicine, Oral Pathology. 1990;70(2):131-6.
33. Vezeau PJ. Dental extraction wound management: Medicating postextraction sockets. Journal of Oral and Maxillofacial Surgery. 2000;58(5):531-7.
34. Mitchell R. Treatment of fibrinolytic alveolitis by a collagen paste (formula k): A preliminary report. International Journal of Oral and Maxillofacial Surgery. 1986;15(2):127-33.
35. Schatz JP, Fiore-Donno G, Henning G. Fibrinolytic alveolitis and its prevention. International Journal of Oral and Maxillofacial Surgery. 1987;16(2):175-83.
36. Syrjänen SM, Syrjänen KJ. Influence of Alvogyl on the healing of extraction wound in man. International Journal of Oral Surgery. 1979;8(1):22-30.
37. Summers L, Matz LR. Extraction wound sockets. Histological changes and paste packs--a trial. British Dental Journal. 1976;141(12):377-9.
38. Garola F, Gilligan G, Panico R, Leonardi N, Piemonte E. Clinical management of alveolar osteitis. A systematic review. Med Oral Patol Oral Cir Bucal. 2021;26(6):e691-e702.
39. Kamal A, Salman B, Abdul Razak NH, Qabbani AA, Samsudin AR. The Efficacy of Concentrated Growth Factor in the Healing of Alveolar Osteitis: A Clinical Study. Int J Dent. 2020;2020:9038629.