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Retrospective Analysis of Alveolar Osteitis (Dry Socket) Cases Over Two Years

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ABSTRACT

Objective: Alveolar osteitis (AO) is a common complication after tooth extraction that negatively affects the quality of life of patients. The aim of this study is to evaluate the etiological risk factors, clinical features and treatment management in alveolar osteitis cases.

Methods: In this study, 123 cases of patients diagnosed with AO in the oral and maxillofacial surgery clinic over a two-year period were retrospectively examined comprehensively. A previously prepared AO patient follow-up form was used to collect patient data.

Results: Among 3278 patients who underwent tooth extraction, 123 cases (47 males, 76 females) diagnosed with AO, aged between 19 and 84 years (mean age: 41.33±12.76 years) were included (AO prevalence: 3.75 %). While 23.6% of the cases had systemic disease, 22.8% were smokers and 8.1% were menstruating or using oral contraceptives. In AO cases, it was observed that the relevant teeth were mostly extracted due to dental caries (53.7%) and most often (56.1%) occurred after mandibular tooth extractions. 59.3% of AO cases occurred after traumatic tooth extraction, and pain (100%), difficulty eating(61.78%), and bad smell/taste (55.28%) were the most common symptoms. While irrigation was performed in 98.37% of the patients, topical alveogel was also applied in 45.5% of the patients.

Conclusion: The results of the study confirm the etiological risk factors stated in the literature in AO cases. In this study, successful results were obtained with the combination of irrigation, topical alveogel application and medical treatment in the treatment of AO cases.

Keywords: Alveolar osteitis, dry socket, retrospective analysis

1. INTRODUCTION

Alveolar osteitis (AO) is one of the common complications after tooth extraction and was named dry socket by Crawford in 1896 (1). AO is defined as "postoperative pain that increases in severity in and around the extraction site, accompanied by a partially or completely ruptured blood clot in the alveolar socket, with or without bad breath, between 1 and 3 days after tooth extraction" (2). While pain, bad odor/taste and difficulty in eating are common in AO cases, symptoms such as swelling, bleeding and fever are observed less frequently (3,4).

The etiology of AO is not known exactly, but some risk factors that play a role in etiology have been described in the literature. Some patient-related risk factors such as age, gender, presence of systemic disease, medication use, oral hygiene, smoking, alcohol use, menstruation, menopause, and oral contraceptive use have been reported (5–7). Clinical and surgical-related risk factors such as the extracted tooth's region, the extraction indication, the extraction difficulty, the extraction socket's condition, and the dentist's experience have also been reported (8–10). It may be caused by a combination of more than one factor, especially mechanical factors that cause the clot to break down or not form, such as diabetes mellitus, smoking, and factors such as traumatic tooth extractions (11–14). However, the presence of risk factors does not always indicate that AO will develop after tooth extraction.

Many combined treatment protocols have been proposed for relief of symptoms and tissue healing in AO cases (15,16). Universal treatment protocols such as irrigation, local agents and use of painkillers are widely used in the treatment of AO cases (17). The irrigation procedure is important in eliminating debris and microorganisms in the socket before placing any agent into the socket, and sterile saline solution and iodopovidone are often used for this purpose. Locally, topical anesthetics, CHX gel, paracetamol gel, zinc oxide eugenol paste, PRF, Alveogyl, SaliCept Patch, topical antibiotics (clindamycin, rifampicin), agents such as Vitamin C are used (18–23). In recent years, new treatment protocols

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such as hyaluronic acid, plasma-rich fibrin and low-energy laser therapy have been proposed. While anti-inflammatories and pain relievers are used in the treatment of AO, antibiotics are generally not preferred except for systemic involvement (such as fever and lymphadenopathy). Antibiotics can often be prescribed after tooth extractions (especially surgery extractions) to reduce the risk of AO (24–27).

AO is an annoying condition for patients with symptoms such as severe pain, bad taste in the mouth, and difficulty in eating after tooth extraction. It can negatively affect patients' quality of life and disrupt their daily workflow. When the studies are examined, the etiological risk factors of AO cases are not fully known, and there are different approaches in the literature for prevention and treatment. The aim of this study is to comprehensively examine the demographic variables, clinical findings, and treatment strategies in AO cases seen after tooth extraction in the oral and maxillofacial surgery clinic of a university.

2. METHODS

A retrospective descriptive study was designed and AO cases that developed after tooth extraction at Afyonkarahisar Health Sciences University, Faculty of Dentistry, Department of Oral and Maxillofacial Surgery between 30 October 2020 and 30 October 2022 were included in the study. Permission for the study was obtained from the Clinical Research Ethics Committee of Afyonkarahisar Health Sciences University (approval date 04.11.2022 and number 2022/528) and the study was conducted in accordance with the rules of the Declaration of Helsinki.

In this study, 123 AO cases who were diagnosed with AO in the oral and maxillofacial surgery clinic over a two-year period and whose treatment and follow-up were performed in the same clinic were retrospectively examined.

The most significant finding in the diagnosis of alveolar osteitis is an increase in pain severity a few days following tooth extraction. The lack of a blood clot and moderate to severe pain are diagnostic of alveolar osteitis and do not necessitate further laboratory or radiographic tests. Alveolar osteitis can be assumed when a patient presents within the first week after extractions with severe pain (16). Painful conditions occurring a few days after tooth extraction were evaluated as AO in this study.

A previously prepared AO patient follow-up form and patient radiographs were used to collect patient data. This form included information about the patient's socio-demographic data, medical history, etiological risk factors, clinical examination findings, surgical treatment and follow-up processes. Panoramic and periapical radiographs were used to identify retained tooth fragments, bone sequestrations, or other pathological conditions. Cases with missing clinical examination and radiological data were excluded from the study.

Statistical analysis of the data was performed using the SPSS statistical program, version 20 (SPSS Inc, Chicago, IL, USA). Mean and standard deviation values were given in descriptive statistics of continuous data, and number and percentage values were given in nominal data.

3. RESULTS

3.1. Socio-demographic Characteristics

Among a total of 3278 patients who had tooth extraction between 2020-2022, 123 cases (47 men, 76 women) who applied to our clinic with AO symptoms after extraction and were diagnosed with AO were included in the study. In the study, the prevalence of AO was found to be 3.75%.

The sociodemographic characteristics of the cases were given in Table 1. The majority of the cases (61.8%) were females. The age range of the cases is between 19 and 84 years (mean age: 41.33±12.76 years). When the age distribution of the cases was examined, the majority (35.8%) was between the ages of 30-39, followed by those aged 50 and over (26.8%). When the cases were examined according to their educational status, primary school graduates (37.4%) came first, while when the professions of the cases were examined, the first place was housewives (47.2%) (Table 1).

Table 1. *Socio-demographic characteristics of the cases*

		n	%
Age	19-29	23	18.7
	30-39	44	35.8
	40-49	23	18.7
	50 and above	33	26.8
Gender	Male	47	38.2
	Female	76	61.8
Education level	Primary school	46	37.4
	Middle school	15	12.2
	High school	26	21.1
	Undergraduate	36	29.3
Occupation	Housewife	58	47.2
	Student	13	10.6
	Officer	21	17.1
	Employee	25	20.3
	Self employment	6	4.9
	Total	123	100

3.2. Etiological Risk Factors

Etiological risk factors were examined under 2 subheadings: patient-related etiological risk factors, and local anatomic and/or surgery-related etiological risk factors. It was observed that 23.6% of the cases had a systemic disease and 28.5% were using medication regularly. The most common systemic diseases were hypertension and diabetes mellitus. Five of the AO patients were using antiaggregant drugs and one was using anticoagulant drugs. Less than half of the patients (41.6%) reported brushing their teeth twice a day, and 14.6% reported brushing their teeth less than once a day. The rate of smokers was 22.8%, and 15.4% of the cases reported

smoking immediately after tooth extraction. While the rate of those who were menstruating or using oral contraceptives was 13.15% among women, it was 8.1% in total (Table 2).

Table 2. *Etiological risk factors related to the patient*

		n	%
Presence of systemic disease	No diseases	94	76.4
	Hypertension	12	9.75
	Diabetes mellitus	10	8.13
	Thyroid diseases	6	4.87
	Osteoporosis	4	4.87
	Rheumatic diseases	3	2.43
	Asthma	2	1.62
	Other diseases (Heart disease, myasthenia gravis)	2	1.62
Drug use	Yes	35	28.5
	No	88	71.5
Teeth brushing frequency	Less than once a day	18	14.6
	One time per day	55	44.7
	Two times a day	50	41.6
Tobacco use	Yes	28	22.8
	No	95	77.2
Alcohol consumption	Yes	13	10.56
	No	110	89.44
Smoking after tooth extraction	Yes	19	15.4
	No	104	84.6
Menstruation/oral contraceptive use	Yes	10	8.1
	No	113	91.9
	Total	123	100

When the indications for extraction of the relevant tooth in AO cases were examined, it was seen that the teeth were mostly extracted due to tooth decay (53.7%) and pericoronitis (19.5%). In the majority of cases (86.2%), only one tooth was extracted in the same session, while in 4.9%, 3 or more teeth were extracted at the same time.

Traumatic tooth extractions constituted the majority of AO cases (59.3%). Routinely, simple tooth extractions performed using forceps and an elevator were considered atraumatic (nonsurgical) extraction. In contrast, a fracture of the tooth and the need for flap removal were considered a traumatic (surgical) extraction. Impacted dental surgery was performed in 3.3% of the cases. While the extraction sockets were left open in the majority of patients (69.1%) after extraction, the socket was approximated with sutures in 29.3%, and the sockets were closed with sutures in 1.6%. It was observed that local anesthesia containing a vasoconstrictor (68 mg articaine hydrochloride and 0.020 mg epinephrine hydrochloride) was used during tooth extraction in all patients with AO.

It was observed that the majority of the patients (77.2%) were prescribed medication after the relevant tooth extraction. The majority of medications prescribed to patients (28.5%) are solely anti-inflammatory/painkillers. In most patients (65%), no granulation tissue was observed in the extraction sockets during clinical examination (Table 3).

Table 3. *Etiological risk factors related to the extracted tooth and surgical procedure*

		n	%
Tooth extraction indication	Tooth decay	66	53.7
	Periodontitis	8	6.5
	Periapical lesion	11	8.9
	pericoronitis	24	19.5
	tooth root extraction	14	11.4
Number of extracted teeth	One	106	86.2
	Two	11	8.9
	Three and more	6	4.9
Type of tooth extraction	Atraumatic	46	37.4
	Traumatic	73	59.3
	Impacted tooth extraction	4	3.3
Socket closing	Socket open	85	69.1
	Suture approximation	36	29.3
	Full coverage	2	1.6
Post-operative drug use	None	28	22.8
	Antibiotic	6	4.9
	Painkiller/anti-inflammatory	35	28.5
	Mouthwash	6	4.9
	Antibiotic and painkiller	8	6.5
	Antibiotics and mouthwash	2	1.6
	Painkiller and mouthwash	5	4.1
	Antibiotics, painkillers and mouthwash	33	26.8
Post-operative bleeding	Yes	33	26.8
	No	90	73.2
Post-operative granulation tissue	Yes	43	35
	No	80	65
	Total	123	100

3.3. Clinical Signs and Symptoms

Pain was the most important symptom and was observed in all patients. Apart from pain, difficulty in eating (61.78%) and bad odor/taste (55.28%) were observed in most of the cases. The least common symptom was fever (4.06%). In most cases, more than one symptom was observed simultaneously (Figure 1).

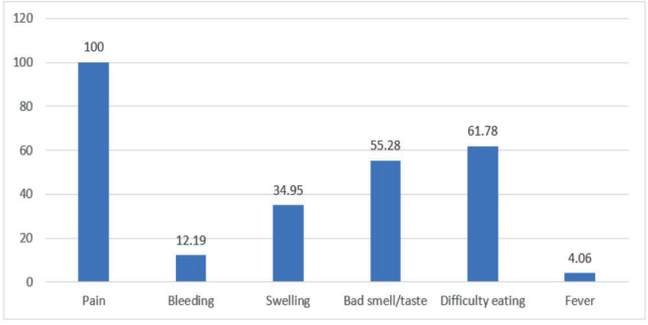

Figure 1. *Distribution of clinical symptoms in alveolar osteitis cases*

While mandibular 3rd molar tooth sockets were the area where AO was most frequently observed (32.5%), this was followed by mandibular 1st molar and mandibular 2nd molar teeth. The place where AO was least common was the mandibular anterior region (1.6%) (Figure 2).

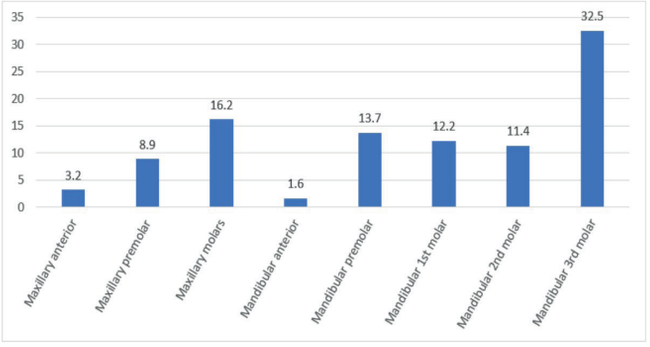

Figure 2. *Distribution of tooth areas where alveolar osteitis occurs*

Clinical symptoms appeared most frequently on the 2nd day after tooth extraction (28.5%), followed by the 3rd day with 23.6% (Figure 3).

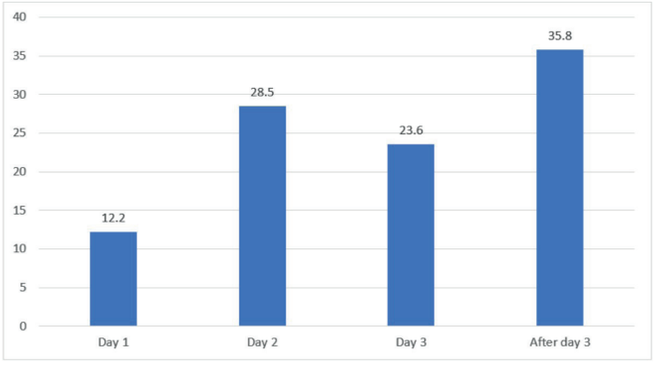

Figure 3. *Distribution of symptoms onset days in alveolar osteitis cases*

3.4. Treatment Management

Much of the current discussion around AO revolves around treatment strategies, although no consensus guidelines have been produced. Therefore, treatment management focuses on symptom relief rather than a specific disease process. Intra-alveolar irrigation is the most widely supported initial therapy technique for alveolar osteitis since it lowers the bacterial load, and eliminates necrotic tissue and clot debris. Except for only 2 patients (98.4%), irrigation was performed to remove debris in the socket and reduce the microorganism load in this study. Two patients did not accept irrigation and were only prescribed medication. The irrigation phase was applied with sterile saline solution, iodopovidone and their combination.

Topical local anesthetic gels can be used to alleviate pain following irrigation. In 45.5% of patients who underwent irrigation and had high pain levels, treatment was supported with alveogel. Curettage of a dry socket is not suggested since it exposes the bone further. In this study, curettage was applied in addition to irrigation to remove foreign bodies such as tooth and bone fragments and debris from the extraction socket in only 3.3% of the cases. Oral analgesics, particularly nonsteroidal anti-inflammatory medications (NSAIDs), can be used in addition to local anesthetics. All patients were treated with analgesic/anti-inflammatory drugs to relieve acute pain. All patients presenting with signs of AO were treated with medication (Figure 4). The most common prescription for patients was a painkiller/mouthwash combination (46.3%), followed by those prescribed only painkillers (26%) (Table 4).

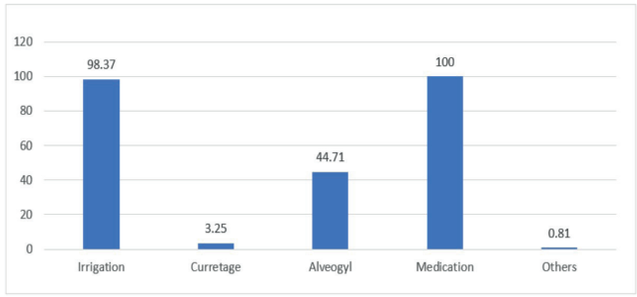

Figure 4. *Distribution of treatment modalities applied in alveolar osteitis cases (%)*

Table 4. *Treatment management of alveoler osteitis cases*

		n	%
Local treatment methods	Irrigation	61	49.6
	Irrigation and curettage	4	3.3
	Irrigation and alveogel	56	45.5
	Other	2	1.6
Medication	Antibiotic	2	1.6
	Painkiller	32	26
	Antibiotics and painkillers	6	4.9
	Painkiller and mouthwash	57	46.3
	Antibiotics, painkillers and mouthwash	26	21.1
	Total	123	100

4. DISCUSSION

AO, which is frequently encountered after tooth extractions, can reduce the quality of life of patients and cause significant workforce losses. On the other hand, when treatment management is done correctly in AO cases, recovery can be achieved without causing serious complications. The cases that developed AO in the oral and maxillofacial surgery clinic were evaluated retrospectively in terms of etiological risk factors, clinical features and treatment approaches. In this study, the prevalence of AO developing after tooth extraction over a two-year period was found to be 3.75%, and this result was found to be consistent with the results of other studies in the literature (between 0.5% and 5%) (16,28).

In previous studies, AO cases were more common in females than in males (6,8,12). In this study, AO was more common in women, similar to the literature. A higher incidence of AO after tooth extraction in non-menopausal females has been associated with estrogen levels, use of oral contraceptives, and hormonal levels changing as a result of the menstrual cycle affecting epithelialization (28–31). The mean age of AO cases in this study was 41.33±12.76 years. Diego et al. (10) in their study, the average age of patients presenting with AO complaints was found to be 39.7 years. AO cases may occur more frequently in older ages due to factors such as decreased healing potential as age progresses, increased systemic disease and drug use, and difficulty in tooth extraction. However, in some studies, no direct correlation was found between AO and the age of the patient (7,8,10).

In the literature, diabetes, oral hygiene and smoking have been reported as risk factors for AO (32,33). In this study, while diabetes was seen in 8.1% of all participants, it constituted 34.5% of those with systemic diseases. In a study conducted in Australia, no significant relationship was found between AO and diabetes (34). Most studies have shown a significant relationship between poor oral hygiene and the occurrence of AO (35,36). In this study, 14.6% of patients stated that they did not brush their teeth even once a day. In most published studies, smoking is one of the most important risk factors for the occurrence of AO (11,14,37). It has been reported that the likelihood of AO increases when the number of cigarettes smoked per day increases or when one smokes immediately after tooth extraction (especially in the first 24 hours) (38–40). In this study, 22.8% of the cases were smokers, and 67.9% of these smokers reported smoking immediately after tooth extraction, which is consistent with Meechan et al. (38) supports study findings reporting the negative effects of smoking on recovery.

In the etiology of AO, the socio-demographic characteristics of the patient as well as the type of tooth extraction and surgical procedures play a role in the emergence of AO. It has been emphasized that the experience of the dentist, especially the traumatic extraction/tooth extraction difficulty, the extraction site and the extraction indication are high-risk factors for AO. In particular, the difficulty of extraction is important in terms of the risk of AO (11,12,41,42). In this study, 59.2% of AO cases were observed after difficult tooth extraction. While this rate was found to be 65% in the study of Halab et al.(10), it was found to be 66.2% in the study of Oginni et al. (12). In the studies conducted, no significant difference was found between the number of teeth extracted and AO, on the contrary, single tooth extractions constitute the majority of AO cases (5,8,11). Taberner-Valverdu et al. (5) reported that 82.35% of AO cases occurred after a single tooth extraction. In this study, it was observed that 86.2% of AO cases occurred after a single tooth extraction, similar to the literature. It should be noted that this result may be related to the fact that single-tooth extraction is more common than multiple-tooth extractions. It has been reported that high doses of local anesthesia and especially its vasoconstrictor properties may be a predisposing factor for dry socket (43). In this study, local anesthesia with a vasoconstrictor (68 mg articaine hydrochloride and 0.020 mg epinephrine hydrochloride) was used in all patients with AO. Local anesthetics especially those with vasoconstrictor, can cause local ischemia and pave the way for the formation of AO.

Previous studies have revealed that AO cases are more common in the mandible than in the maxilla(5,10,12). In the study conducted by Taberner-Valverdu et al. (5), the mandible was 70.59%, maxilla was 29.41%, respectively; In the study conducted by Oginni et al. (4), the mandible was found to be 75.8% and maxilla was found to be 24.2%. In this study, similar to the literature, AO cases occurred in 69.9% of the mandible and 30.1% of the maxilla. AO occurs frequently in the posterior tooth regions of the mandible. In this study, AO cases were most frequently seen in the mandibular 3rd molar tooth region (32.5%), followed by the mandibular 1st molar (12.2%) and 2nd molar (11.4%). 16.2% of the cases were seen in the maxillary molar region. In the study conducted by Oginni et al. (4), AO cases were most frequently seen in the mandibular 1st molar (34.6%) and 2nd molar (27.9%) regions, respectively, followed by the 3rd molar (11.8%) and maxillary 1st molar (10.3%).

A relationship can also be established between AO cases and the indication for extraction of the relevant tooth (2,4,41). In the study conducted by Younis et al. (11), the majority of AO cases were teeth extracted due to caries (41.2%), followed by extractions due to periodontal disease, combined caries/periodontal disease and pericoronitis. Similarly, in this study, it was observed that the majority of teeth extracted before alveolitis (53.7%) were extracted due to tooth decay. Pericoronitis is another common reason for extraction in AO cases, and in this study, the pre-extraction pericoronitis rate in the relevant teeth was found to be 19.5%, which is similar to the pericoronitis rate (16.8%) seen in the study by Leung et al.(8). Studies have shown that the presence of pericoronitis or acute infection before extraction increases the incidence of AO (4,44,45).

In cases of AO, different symptoms may occur that may affect the daily life of the patient. AO patients often have severe pain; difficulty in eating, bad odor/taste, swelling and bleeding are other common symptoms, and these symptoms often occur together (4,9,40). In this study, clinical symptoms such as pain (100%), difficulty in eating (61.78%), bad smell/taste (55.28%) and swelling (34.95%) were observed in AO cases. Although rare, systemic symptoms such as lymphadenopathy and fever may be observed in addition to local findings in some cases. Severe pain, which is the first symptom in AO cases, usually begins between days 1 and 4 (2). In the study conducted by Oginni et al (4), pain occurred between days 1 and 3 in 85.7% of the patients. In this study, consistent with the literature, alveolitis symptoms appeared in 64.3% of the patients between days 1 and 3.

The etiology and pathophysiology of AO are not fully known and the effectiveness of treatment methods is still debated. However, a number of measures can reduce the occurrence

of AO. Blum explained these common precautions as follows: Careful planning, minimum trauma-maximum care, ensuring the presence of a blood clot after the extraction, reducing the preoperative plaque level and maximum oral hygiene, encouraging the patient to quit smoking, Performing tooth extraction between days 23 and 28 of the menstrual cycle in patients using oral contraceptives, giving the patient comprehensive verbal instructions before and after surgery, and communicating these instructions in writing for maximum compliance (2).

Some treatment procedures can be followed in the treatment management of AO cases. As a result of a comprehensive literature review conducted in Argentina, 39 different routine treatment protocols for AO were identified (15). In AO cases, procedures that aim to create new granulation tissue in the socket for 7-10 days, accelerate healing, and relieve symptoms during this healing process come to the fore (16,17,46). These procedures can be listed as irrigation, dressing with topical agents and drug therapy. Blum summarized these procedures as follows: no stimulus should remain at the extraction site, local anesthetic for pain, irrigation with warm sterile saline, no curettage, prescription of analgesics, and use of CHX mouthwash (2).

Irrigation procedures are of great importance for AO cases. In studies, different procedures and agents are recommended by different authorities (15,46,47). As a result of the comprehensive screening of 17 studies conducted by Garola et al. (15), sterile saline solution was used in commonly in all studies. In addition, there are also studies using a combination with povidoneniod, clindamycin, rifampicin, and hydrogen peroxide irrigations (21,48). When we look at AO treatment protocols, irrigation agents alone are ineffective in relieving symptoms. Topical agents are applied to the socket to heal the socket and relieve symptoms (17,20,22). It is recommended that these agents should not be left on for a long time and should be renewed in order to avoid causing a foreign body reaction (16). Similar to the literature, an irrigation procedure with a combination of sterile saline and povidone-iodine was applied to all but 2 of the AO cases. Alveogel has long been the first choice agent in the treatment of AO due to its antimicrobial, anesthetic and analgesic properties. In this study, in addition to sterile saline povidone-iodine combination irrigation in AO treatment management, alveogyl was routinely applied to the socket every other day in 56 patients (45.5%).

Although there is insufficient evidence to support the use of antibiotics in the treatment management of AO, antibiotics continue to be widely prescribed for prophylaxis and postoperative purposes (2). If the patient's immune system is not suppressed or there are no systemic symptoms such as fever, weakness, and lymphadenopathy, systemic antibiotics are considered unnecessary in AO cases (49). Prescribing long-acting local anesthesia and systemic analgesics are the most effective methods for controlling pain and relieving other symptoms (16). In this study, while analgesics were prescribed to all AO cases, antibiotics were prescribed only to 27.64%. The majority of patients (67.47%) were also prescribed a 0.12% CHX mouthwash.

5. CONCLUSION

AO is a condition frequently encountered after tooth extraction in oral and maxillofacial surgery practice, which negatively affects the daily life of the patient with severe pain and bad odor/taste. The lack of a definitively effective treatment method in the treatment of AO shows the importance of risk factors and protective/preventive activities involved in the etiology. Atraumatic tooth extraction, primary closure of the extraction socket, patient compliance with post-operative recommendations, and good oral hygiene are the basic principles to be followed in reducing AO cases. In addition, continuous education of dentists about the risk factors and management of AO cases and raising patients' awareness about AO after tooth extraction may reduce the number of patients presenting to the hospital with AO after tooth extraction.

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Design of the study: ÖE
Acquisition of data for the study: ÖE, İÇ
Analysis of data for the study: ÖE
Interpretation of data for the study: ÖE
Drafting the manuscript: ÖE, İÇ
Revising it critically for important intellectual content: ÖE
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