

Analysis of Predisposing Factors and Clinical Features of Alveolar Osteitis Seen in a Hospital Emergency Room

Análisis de Factores Predisponentes y Características Clínicas de la Osteítis Alveolar Atendida en un Servicio de Urgencias Hospitalario

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ABSTRACT: This study analyzed predisposing factors and clinical features by evaluating data from a series of patients diagnosed with alveolar osteitis. The data from consecutive patients seen between January and December 2019 with alveolar osteitis at an oral and maxillofacial surgery hospital clinic were evaluated. Data like gender, sex, medical history, smoking, substance abuse, and data relating to dental extraction were noted. Additionally, the symptoms and signs presented and the clinical form were noted. Statistical analyses were performed using descriptive statistics and the likelihood ratio test. Alveolar osteitis occurred more frequently in males in their third decade of life ($p = 0.032$). Oral contraceptive use (29 %) and smoking (49 %) were prevalent. There was a mean of 1.2 extractions per patient. Difficult extraction (44 %) and lower molars (42.6 %) were the main factors related to extraction. The cases were diagnosed as dry socket (60 %) and hyperplastic/suppurative alveolitis (40 %). Malaise and radiating pain were the main symptoms but were not associated with a specific clinical form ($p > 0.05$). Mandibular trismus and halitosis were the major signs related to the dry socket clinical form ($p = 0.001$). It was concluded that individual factors such as smoking and the use of oral contraceptives and factors related to dental extraction, such as complex and isolated lower molars, should be considered predisposing factors for alveolar osteitis. In contrast, intense symptomatology not commonly associated with extractions, such as malaise, radiating pain, mandibular trismus, and halitosis, should be considered characteristics of this entity.

KEY WORDS: alveolar osteitis, dry socket, tooth extraction, risk factors, signs and symptoms.

INTRODUCTION

Alveolar osteitis or dry socket is a highly debilitating, severely painful but relatively common complication following dental extractions (Bowe *et al.*, 2011). Although no consensus exists relative to the definition of alveolar osteitis, the following definition was adopted: postoperative pain in and around the extraction site, which increases in severity at any time between 1 and 3 days after the extraction and is accompanied by a partially or disintegrated blood clot within the alveolar socket with or without halitosis (Blum, 2002). An incidence of 1 % to 4% after tooth extraction is described, reaching 30 % for mandibular third molars (Blum, 2002; Ognini *et al.*, 2003; Noroozi & Philbert, 2009; Tolstunov, 2012; Eghpour & Nejat, 2013).

The exact etiology of alveolar osteitis has not been defined. However, many local and systemic aetiological and precipitating factors have been suggested in the literature (Cardoso *et al.*, 2010). This complication is generally believed to be of multifactorial origin, but some predisposing factors have been described, such as oral micro-organisms, difficult surgery, bone or dental fragments, post-extraction irrigation or curettage, dislodgement of the clot, local blood perfusion, the use of oral contraceptives and smoking (Blum, 2002; Noroozi & Philbert, 2009; Cardoso *et al.*, 2010). Although most investigators agree that prevention is better than treatment, none of the isolated preventive methods has been successful or achieved total acceptance (Cardoso *et al.*, 2010).

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Additionally, many signs and symptoms have been related to alveolar osteitis. In general, intense pain, trismus and halitosis have been described (Cardoso *et al.*, 2010; Bowe, 2011; Tolstunov, 2012). Thus, there is a need for an objective, current description of the symptomatology of alveolar osteitis, which will contribute professional assistance in the immediate detection and prompt management of this condition.

The purpose of this study was to analyze predisposing factors and clinical features by evaluating data from a series of patients diagnosed with alveolar osteitis.

MATERIAL AND METHOD

Patients diagnosed with alveolar osteitis who were admitted to the oral and maxillofacial surgery service between January and October 2019 were evaluated. All patients who participated in the study signed an informed consent form. This study received approval from the Human Research Ethics Committee of the Municipal Health Department of São Paulo (SMS/SP) (process 0179.0.162.162-08).

Patients over 18 years of age, regardless of sex and race, who were diagnosed with alveolar osteitis, were included in the study. Individuals with odontogenic infections of dental origin and patients who refused to participate were excluded from the study.

One hundred consecutive cases of alveolar osteitis requiring treatment were included. Patients with postoperative pain surrounding the alveolus that increased in severity from 1 to 3 days after extraction, followed by partial or total clot loss into the alveolus, with or without halitosis were diagnosed with alveolar osteitis (Blum, 2002; Torres-Lagares *et al.*, 2005). The patients had undergone extractions in dental offices or clinics and were referred to our clinic. The assessment covered initial diagnosis, gender, age, medical history, smoking, and substance - alcohol or drug, abuse. Data relating to the dental extraction were recorded including whether the extraction was simple or difficult: involving reflection of a flap, the need for

bone removal, the sectioning of the tooth and/or a longer procedure, the presence of suture thread, and the type of suture material used and which teeth were extracted. The International Standards Organization Designation System (ISO System) by the World Health Organization was used for dental information (ISO 3950:2009).

The signs and symptoms presented and the clinical form were noted. Cases of alveolar osteitis were classified as dry socket when there was a painful socket partially or devoid of a blood clot, and as hyperplastic/suppurative alveolitis when there was provoked pain and the alveolus was filled with granulomatous tissue and/or suppuration (Laraki *et al.*, 2012). All cases of dry socket were treated by rinsing the socket with saline or 0.12 % chlorhexidine and the application of occlusive dressing, and the cases of hyperplastic/suppurative alveolitis were treated by curettage of the abnormal tissue, rinsing the socket with the same medications cited above and antibiotics – amoxicillin 1,500 mg/day – in selected cases.

The data were tabulated, and statistical analyses were performed. They involved descriptive statistics and the likelihood ratio test to determine the differences between the lines of each summary table for each variable. The level of significance was set at 5 % ($p < 0.050$) in all statistical analyses. The Statistical Package for Social Sciences (SPSS) version 23.0 (IBM Software Group, Chicago, USA) was used to perform the analyses.

RESULTS

The distribution of patients in age groups according to sex is shown in Table I. The predominant age group was 21- to 30- year-olds (37 % of cases), followed by 31- to 40- year-olds (23 % of cases). There was a predominance of males, comprising 54% of cases, with a ratio of males to females of 1.2:1. There was a significant difference in the proportion of each gender among the different age groups ($p = 0.032$).

Concerning the medical history, shows the prevalence of oral contraceptive use (29 %), diabetes

Table I. Crossed tabulation of patients with alveolar osteitis (n= 100) according to sex and age intervals (years).

Sex	Age interval							Total
	18 - 20	21 - 30	31 - 40	41 - 50	51 - 60	61 - 70	≥ 71	
Male	2 %	13 %	15 %	12 %	6 %	5 %	1 %	54 %
Female	4 %	24 %	8 %	7 %	3 %	0 %	0 %	46 %
Total	6 %	37 %	23 %	19 %	9 %	5 %	1 %	100 %

Likelihood ratio test, p value = 0.032.

mellitus (18 %), arterial hypertension (16 %), heart disease (7 %), bleeding disorders (6 %) and hyperparathyroidism (1 %). Smoking was very frequent (49 %). The distribution of substance abuse showed alcohol (19 %) and drug (5 %) abuse. The dental history revealed 15% of cases with previous occurrence of alveolar osteitis.

Difficult extraction (44 %) and non-sutured socket (41 %) were the main factors related to extraction. Among the sutured cases, silk thread predominated (35 %), followed by nylon (15 %) and others (9 %).

The cases were diagnosed as dry socket (60 %) and hyperplastic/suppurative alveolitis (40 %). Cross-tabulation of patients with a clinical diagnosis of alveolar osteitis according to standardized clinical classification, signs, and symptoms, demonstrates that there was a higher predominance of the dry socket type, with 60% of cases (Table II). Malaise (95 %) and radiating pain (52 %) were the main symptoms, although no significant difference was found between clinical forms of alveolar osteitis ($p > 0.05$). The signs of mandibular trismus observed in 45 % of cases, and halitosis, in 38% of cases, were the most frequent and related to the dry socket diagnosis ($p = 0.001$).

There was a mean of 1.2 extractions per patient. The teeth most frequently extracted were lower molars 52 (42.6 %), followed by lower premolars 22 (18 %), upper molars 13 (10.7 %), upper premolars 12 (9.8 %), lower canines 9 (7.4 %), upper incisors 7 (5.7 %), lower incisors 4 (3.3 %) and upper canines 3 (2.5 %).

DISCUSSION

Alveolar osteitis remains a common postoperative problem resulting in pain, days lost from work, and return surgical practice/hospital visits (Blum, 2011). This study assessed the predisposing factors and clinical picture by evaluating data from a series of

patients diagnosed with alveolar osteitis. In this study, there was a predominance of males. Other studies have shown a prevalence of females, and this finding has been associated with females taking oral contraceptives (Garcia *et al.*, 2003; Noroozi & Philbert, 2009). In our study, the higher frequency of affected males could be related to a greater tendency to smoke in this sex in our region as a confounding factor (Wilkinson *et al.*, 2005).

In our study, there was a prevalence of 21- to 30-year-olds, followed by 31- to 40-year-olds. It has been noted that postoperative complications are more frequent in older patients and that this increase starts at approximately 25 years of age (Clauser *et al.*, 2009). Age has been associated with an increased risk for alveolar osteitis (Olurotimi *et al.*, 2014; Haraji & Rakhshan, 2014). The need to be careful when planning extractions in patients older than 40 years of age has been emphasised (Cardoso *et al.*, 2010).

In this study, oral contraceptive use was prevalent in the medical history. Significant association of oral contraceptive use with dry socket incidence was described in studies on the surgical removal of impacted third molars (Garcia *et al.*, 2003; Esghpour & Nejat, 2013). Oral contraceptive use could double or even triple the alveolar osteitis risk (Metzin *et al.*, 2006). Estrogens indirectly activate the fibrinolytic system and may contribute to the onset of alveolar osteitis (Cardoso *et al.*, 2010). However, a study have shown that females have a higher incidence of alveolar osteitis compared to males regardless of the use of oral contraceptives (Arteagoitia *et al.*, 2022).

There was a high frequency of smoking. Many studies have shown a greater frequency of smoking among patients with alveolar osteitis (Nusair & Younis, 2007; Clauser *et al.*, 2009; Congiusta & Veitz-Keenean, 2013). Additionally, the degree of smoking, i.e., more than 20 cigarettes a day, has been associated with the occurrence of postoperative complications, such as

Table II. Distribution of signs and symptoms presented according to the clinical classification.

Symptomatology		Clinical classification		Total	p value
		Dry socket	Hyperplastic		
Signs	Mandibular trismus	33 %	12 %	45 %	0.001
	Halitosis	23 %	15 %	38 %	
	Fever	21 %	9 %	30 %	
	Bleeding	3 %	14 %	17 %	
Symptoms	Malaise	59 %	36 %	95 %	0.099
	Irradiated pain	23 %	29 %	52 %	
	Localized pain	12 %	12 %	24 %	

alveolares osteitis (Bortoluzzi *et al.*, 2012). Smoking can cause the introduction of harmful substances that might contaminate the surgical wound (Cardoso *et al.*, 2010). Additionally, smoking may increase platelet aggregation, increasing the risk of microvascular thromboses and peripheral ischemia and inhibiting the proliferation of fibroblasts and macrophages (Susarla *et al.*, 2003).

The dental history revealed some cases with previous incidences of alveolar osteitis. This factor has not been frequently cited, but previous alveolar osteitis is considered a risk factor associated with this condition (Blum, 2002). Additionally, previous surgical site infection has been associated with an increased risk of alveolar osteitis (Congiusta & Vertz-Keenan, 2013). A high incidence of dry socket has been reported when the extraction was considered therapeutic, with the presence of infection or caries (Tolstunov, 2012). History of pericoronitis and advanced periodontal disease should be considered risk factors for alveolar osteitis (Noroozi & Philbert, 2009). Additionally, there is a possibility that the extension of the infection into the medullary bone in alveolar osteitis cases may lead to osteomyelitis due to the presence of pyogenic microorganisms (Akinbami & Godspower, 2014).

In this paper, difficult extraction and a non-sutured socket were the main risk factors related to extraction. Increased difficulty of extraction has been associated with the risk of dry sockets (Esghepour & Nejat, 2013; Congiusta & Vertz-Keenan, 2013; Haraji & Rakhshan, 2014). Delayed wound healing has been attributed to compression of the bone lining the socket (Blum, 2002). The possibility that trauma resulting from extraction might harm the alveolar bone cells, causing inflammation of the osseous medulla and the release of cell mediators to the alveolus, where they cause fibrinolytic activity, must be considered (Cardoso *et al.*, 2010). Furthermore, the need for tooth sectioning and the length of the surgery have been associated with an increased risk for alveolar osteitis (Esghepour & Nejat, 2013; Akinbami & Godspower, 2014). Additionally, a non-sutured socket was another factor related to extraction in our study. Although not considered in the literature, this failure could favor the physical displacement of the clot, contributing to the occurrence of alveolar osteitis. In this study, there were no special findings relative to the type of suture material used.

Most cases were diagnosed as dry sockets, and the remaining cases were diagnosed as hyperplastic/suppurative alveolitis. The main symptoms were

malaise and radiating pain. Headache, insomnia, and dizziness can be present in cases of alveolar osteitis (Cardoso *et al.*, 2010). Intense, radiating pain is characteristic of alveolar osteitis (Bowe *et al.*, 2011; Noroozi & Philbert, 2013). Severe pain after extraction that persists for more than two days can indicate the occurrence of a dry socket (Bortoluzzi *et al.*, 2012). The pain can be debilitating, causing loss of sleep and affecting daily function, and it can radiate to the temple, ear and neck (Noroozi & Philbert, 2009). This severe pain has been attributed to the formation of kinins in the alveolus, which activates the primary afferent nerve terminations (Blum, 2002; Cardoso *et al.*, 2010).

The most frequent signs were mandibular trismus and halitosis related to the dry socket clinical form. Trismus is reported frequently in dry socket. This sign is secondary to masticatory muscle and fascial inflammation (Susarla *et al.*, 2003). However, it is possible that the relatively early onset of symptoms could be attributable to the co-existence of dry socket with other postoperative complications of extraction such as swelling and trismus (Akinbami & Godspower, 2014). Marked halitosis is a clinical feature of the dry socket and may occur in some patients (Noroozi & Philbert, 2009; Akinbami & Godspower, 2014).

There was a mean of 1.2 extractions per patient. The prevalence of alveolar osteitis is higher in single-extraction cases than in multiple-extraction cases (Nusair & Younis, 2007). The teeth most frequently extracted were lower molars, followed by lower premolars. Studies have reported that alveolar osteitis is 3 to 10 times greater for lower teeth than for upper teeth (Noroozi & Philbert, 2009; Cardoso *et al.*, 2010; Akinbami & Godspower, 2014). Additionally, mandibular third molar surgery is more commonly associated with alveolar osteitis than maxillary third molar surgery (Susarla *et al.*, 2003).

CONCLUSION

This study demonstrated that certain factors should be considered as predisposing for alveolar osteitis, even after simple exodontia. Additionally, the main clinical aspects were highlighted and can contribute to professional assistance in the immediate detection and prompt treatment of the condition. The occurrence of alveolar osteitis in an oral surgery or dental practice is unavoidable. However, the maintenance of excellent surgical technique may keep the incidence of this complication at low levels and minimize disabling consequences.

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RESUMEN: Este estudio analizó los factores predisponentes y las características clínicas mediante la evaluación de los datos de una serie de pacientes con diagnóstico de osteítis alveolar. Se evaluaron los datos de pacientes consecutivos atendidos entre enero y diciembre de 2019 con osteítis alveolar en una clínica hospitalaria de cirugía oral y maxilofacial. Se anotaron datos como sexo, edad, antecedentes médicos, tabaquismo, abuso de sustancias y datos relacionados con la extracción dental. Además, se anotaron los síntomas y signos presentados y la forma clínica. Se realizaron análisis estadísticos utilizando estadística descriptiva y la prueba de razón de verosimilitud. La osteítis alveolar se presentó con mayor frecuencia en hombres en su tercera década de vida ($p = 0,032$). El uso de anticonceptivos orales (29 %) y el tabaquismo (49 %) fueron prevalentes. Hubo una media de 1,2 extracciones por paciente. La extracción difícil (44 %) y las molares inferiores (42,6 %) fueron los principales factores relacionados con la extracción. Los casos fueron diagnosticados como alveolitis seca (60 %) y alveolitis hiperplásica/supurativa (40 %). El malestar y el dolor irradiado fueron los síntomas principales pero no se asociaron con una forma clínica específica ($p > 0,05$). El trismo mandibular y la halitosis fueron los principales signos relacionados con la forma clínica de alveolitis seca ($p = 0,001$). Se concluyó que los factores individuales como el tabaquismo y el uso de anticonceptivos orales y los factores relacionados con la extracción dental, como las dientes inferiores complejos y aislados, deben considerarse factores predisponentes para la osteítis alveolar. Por el contrario, la sintomatología intensa no comúnmente asociada con las extracciones, como el malestar, el dolor irradiado, el trismo mandibular y la halitosis, deben considerarse características de esta entidad.

PALABRAS CLAVE: alveolo seco, extracción dental, factores de riesgo, signos y síntomas.

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