

## **Current status of antibiotic use and management of alveolar osteitis in different countries**

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### **Summary**

Antibiotic prescriptions for surgical extractions of wisdom teeth, management of alveolar osteitis and oral infections have basically the same treatment ways, but they differ from a clinician to another among different countries. We, therefore, planned to document the opinions of practicing oral and maxillo-facial surgeons and to compare them with current scientific evidence. With this aim, a questionnaire form was sent to 85 clinicians practicing dentoalveolar surgery all over the world. According to the results, we concluded that the prophylactic use of antibiotics is still contradictory, but amoxicillin is generally prescribed for third molar surgery and penicillin is not preferred as frequently as in the past due to its increasing resistance rate. However, we also found out that many surgeons don't prescribe antibiotics for the surgical removal of wisdom teeth. Our questionnaire showed that non-surgical management of alveolar osteitis is the most favorable method all over the world.

**Key words:** questionnaire, antibiotic, alveolar osteitis, wisdom tooth.

### **Introduction**

Dental health is improving in the world and there is a general impression that always the same kinds of antibiotics are used or the same kind of dental procedures are performed in all countries. Antibiotic prescription for surgical extractions of wisdom teeth, management of alveolar osteitis (AO) and treatment of oral infections differ from a clinician to another. Surprisingly, no information is available in the literature concerning the drug and treatment choice in management of orofacial infections in different countries.

One of the most common postoperative complications following the extraction of permanent teeth is a condition known as dry socket. This term has been used in literature since 1896, when it was first described by Grawford [1]. Since then, several other terms have been used in referring to this condition, such as alveolar osteitis (AO), localized osteitis, postoperative alveolitis, alveolgia, alveolitis sicca dolorosa, septic socket, necrotic socket, localized osteomyelitis and fibrinolytic alveolitis. AO is a painful but self-limiting condition in the majority of patients, but it is a potentially serious postoperative complication in immunosuppressed persons [2, 3]. Several

prophylactic agents like antibacterial agents, antiseptic agents, antifibrinolytic agents, lavage, steroid antiinflammatory agents, obtudent dressings, clot support agents are used in the management of AO. Its incidence has been reported as 3-4% following routine dental extractions and ranges from 1% to 45% after the removal of mandibular third molars [3, 4].

The aim of the present study was to obtain information about different patterns of antibiotic use in dental cases among oral and maxillo-facial surgeons from different countries all over the world and to gain information about the way they perform the treatment of AO.

### **Methods**

The e-mail addresses of oral and maxillo-facial surgeons from different countries were obtained from the announcement book of 16th Congress of the European Association for Cranio-Maxillo-Facial Surgery in Muenster - Germany. A total of 85 surgeons were asked join the investigation by filling the questionnaire form found at <http://mimoza.marmara.edu.tr/~bdsener/questionnaire.htm> (table 1). The questionnaire form consisted of seven questions.

**Table 1.** Questionnaire form

Title	Name	Surname
Institute		
Address		
City	Zip	Country
Phone		
e-mail		
1- Do you use antibiotics for impacted third molar surgery? If yes, what's your protocol?		
	Pharmacological Name	Dose
		Days
		S
Preoperatively		X
Intraoperatively		X
Postoperatively		X
2 - What's your professional comment about perioperative antibiotic use for 3 <sup>rd</sup> molar surgery?		
3 - What is your first choice for acute periapical/periodontal infections?		
4 - Which antibiotic do you prefer to manage space infections (like submandibular abscess)?		
5 - Have you see any antibiotic resistance? If yes, which antibiotic it was/they were?		
6 - Can you give an approximate incidence ratio for alveolitis? .....%		
7 - How do you manage alveolitis?		

**Results**

A total of 68 questionnaires returned, giving a response of 80%. The participants from each of country were, as follows: Germany: 11 surgeons, Netherlands: 5 surgeons, Turkey: 3 surgeons, UK: 3 surgeons, Belgium: 3 surgeons, Finland: 3 surgeons, Greece: 3 surgeons, USA: 3 surgeons, Japan: 2 surgeons, Korea: 2 surgeons, Spain: 4 surgeons, Romania: 4 surgeons, Macedonia: 2 surgeons and 1 surgeon from the other countries such as Canada, Emirates, Serbia, Czech Republic, France, Hungary, Austria, Slovakia, Sweden, Poland, Latvia, Bulgaria, Portugal, Denmark, India, Pakistan, Australia, Chile, Argentina and Egypt.

For the surgical removal of wisdom tooth, 18 surgeons (26%) noticed that they do not prescribe any antibiotic and the rest (74%) do prescribe.

Choices of antibiotic administration schedule (whether pre-, intra- or post-operatively) of clinicians who prescribe antibiotics are listed in *table 2*.

When preferring to prescribe a preoperative antibiotic, most of the participants vote for amoxicillin at different doses. Apart from the amoxicillin; clindamycin, penicillin, and ornidasole were most often administered preoperatively (*table 3*). *Table 4* is showing the intraoperative administration and *table 5* shows the postoperative administration of antibiotics.

Comments about the perioperative use of antibiotics in the surgical removal of wisdom teeth are shown in *table 6*.

The first drug choice in periodontal/ periapical infections was amoxycillin again, in 28 questionnaires. This was followed by penicillin (n: 16) and clindamycin (n: 4). Combinations, like amoxycillin and metronidasole or penicillin and

**Table 2.** Preferences of antibiotic administration schedule in impacted 3<sup>rd</sup> molar surgery

	n	%
Preoperatively	2	2.94
Postoperatively	22	32
Preoperatively + Postoperatively	10	14.70
Preoperatively + Intraoperatively + Postoperatively	3	4.41
Intraoperatively	4	5.88
Intraoperatively + Postoperatively	7	10.29
Preoperatively + Intraoperatively	2	2.94

**Table 3.** Pharmacological name and doses of preoperatively prescribed antibiotics

Ornidazole 250 mg, PO, 2 x 2, 1 day
Penicillin 500 mg, PO, single dose, 1 hour before the operation
Penicillin 600 mg, i.m, 1 x 1, 1 hour before the operation
Clindamycine 300 mg, PO, single dose, 1 hour before the operation
Amoxicillin 1 gr, PO, 2 x 1, 5 days
Amoxicillin 625 mg, PO, 3 x 1, 4 days
Amoxicillin 2 gr, PO, single dose, 1 hour before the operation
Amoxicillin 1 gr, PO, single dose, 1 hour before the operation
Amoxicillin 3 gr, PO, single dose, 1 hour before the operation
Amoxicillin + Clavulanic Acid 500 mg, PO, 1 x 1, 1 hour before the operation
Amoxicillin + Clavulanic Acid 500 mg, PO, 3 x 1, 3 days

**Table 4.** Pharmacological name and doses of intraoperatively prescribed antibiotics

Amoxicillin 1 gr, single, i.v.
Penicillin V 2 IU, PO, single
Cephtriaxone 2 gr, PO
Ampicillin 1 gr, i.v.
Amoxicillin + Clavulanic Acid 1 gr, PO
Amoxicillin + Clavulanic Acid 625 mg, PO
Benzylpenicillin 1 gr, i.v
Amoxicillin + Sulbactam 3 gr, 1 x 1, i.v.
Cefuroxime, single dose, i.v.
Penicillin V, PO
Ampicillin + Sulbactam 3 gr i.v.

**Table 5.** Pharmacological name and doses of postoperatively prescribed antibiotics

Ampicillin + Sulbactam 3 gr, single, i.v.
Ornidazole 250 mg, PO, 2 x 2, 5 days
Cephalexin 500 mg, 5 days, 2-4 x 1, PO
Pen V K 500 mg, PO, 7 days, 2 x 1
Azithromycin, PO, 2 x 1, 3 days
Cefdinir 300 mg, PO, 5 days, 3 x 1
Penicillin G 1,2 mega, 3 days, 3 x 1, PO
Pen V K 500 mg, PO, 5 days, 4 x 1
Penicillin 250 mg + Metranidazole 200 mg, PO, 3 days, 3 x 1
Penicillin 800 mg, PO, 5 days, 2 x 1
Penicilin V 1 IU, 5 days, POV-pen mega, 3 x 1, 7 days, PO
Amoxicillin + Clavulanic Acid 1 gr, 2 x 1, 5 days, PO
Amoxicillin + Clavulanic Acid 625 mg, PO, 2 to 5 days, 3 x 1
Amoxicillin + Clavulanic Acid, Metronidasole 500 mg, 5 days, 3 x 1, PO
Amoxicillin 3 gr, single, PO
Amoxicillin 1 gr, 2-3 x 1, 4 to 5 days, PO
Amoxicillin 500 mg, 5 days, 3-4 x 1, PO
Amoxicillin 250 mg, 3 x 1, 5 days, PO
Cefuroximaxetil, 2 x 1, 5 days, PO
Eritromycin 200 mg, 4 x 1, 5 days PO
Tetracycline, 3 days, Topical
Cephtriaxone 2 gr, 3 day, 1 x 1, i.v.
Clindamycin 150 mg, 3 x 1, 5 days, PO
Clindamycin 300 mg, 2-3 x 1, 5 days, PO
Clindamycin 900 mg, 7 days, PO

**Table 6.** Professional comment about the perioperative use of antibiotics in the surgical removal of wisdom teeth

	Participants
Absolutely necessary	14
It is a point of discussion	31
It is not essential	23

**Table 7.** Types of commonly preferred antibiotics in the periodontal/periapical infections

Antibiotic	Surgeon
Ornidazole	1
Penicillin	7
Cephalosporin	2
Amoxicillin + Clavulanic Acid	11
Amoxicillin	17
Clindamycin	1
Sulbactam + Ampicillin	2
Penicillin V	2
Penicillin G	1
Clindamycin	4
Metronidasole	2
Penicillin + Metronidasole	2
Penicillin + Phenoxyethyl	12
Penicillin V + Feneticillin	1
Penicillin + Clindamycin	1
Amoxicillin + Metronidasole	1
Tetracyclin	1
Ampicillin	2

clindamycin, are rarely used. Antibiotic preferences of the surgeons are shown in *table 7*.

High dose of antibiotic regimen was selected for space infections. A total of 23 antibiotic types were selected as the first drug choice for space infections (*table 8*). However, 24 (35%) participants selected combination and single use of amoxicillin for the management of this type of infections. The second mostly preferred antibiotic was the single use of clindamycin (10 surgeons - 15 %).

19 participants noted that they did not meet any antibiotic resistance. The others notified that they mostly met with penicillin (n: 14) as a resistant antibiotic. Cephalosporin (CEP) and ampicillin took the 2<sup>nd</sup> and 3<sup>rd</sup> places (*table 9*).

The incidence rate of AO is shown in *table 10*. As treatment of AO, 17 (25%) surgeons pre-

**Table 8.** Types of commonly used antibiotics in space infections

Antibiotic	Surgeon
Clindamycin	10
Amoxicillin + Clavulanic Acid	17
Amoxicillin	3
Sulbactam	2
Cefuroxime	1
Penicillin G	1
Penicillin + Metronidasole	5
Ciprofloxacin	1
Clindamycin + Gentamycin	1
CEP + Clindamycin	1
Amoxicillin + Metronidasole	4
Metronidasole	2
Lincomycin	2
Penicillin (Crystal)	1
Lincomycin + Gentamycin + Metronidasole	1
Clindamycin + Ampicillin + Sulbactam	1
Penicillin	5
CEP + Metronidasole	2
Cephalosporin	7
Ampicillin	1

**Table 9.** Resistant antibiotics mostly encountered by the participants

Resistant Antibiotics	Surgeons
Penicillin	14
Ampicillin	4
Amoxicillin	3
Clindamycin	3
Methicillin	4
Spiramycin	2
Lincomycin	1
Amikacin	1
Sulfomethaxole	1
Clarhitromycin	1
Sulbactam	1
Tetracyclin	1

ferred curettage and the rest 75% of participants reported treating AO without curettage. Among 17 surgeons who preferred curettage, 10 surgeons did it with prescribing antibiotic (like clindamycin, amoxicillin and metronidasole) and

**Table 10.** Alveolar osteitis incidence ratios around the countries

Turkey	3%	Czech Republic	3%
USA	3%	France	15%
Japan	2%	Hungary	3%
Canada	6%	Austria	2%
Korea	1%	Slovakia	5%
Emirates	0%	Sweden	12%
Germany	4%	Greece	1%
EUK	7%	Poland	30%
Spain	3%	Latvia	0%
NL	4%	Bulgaria	10%
Belgium	1%	Portugal	2%
Romania	6%	Argentina	0%
Finland	3%	India	20%
Makedonia	5%	Pakistan	10%
Serbia	2%	Chile	0%
Australia	0%	Egypt	10%

analgesics. Six of them packed the socket with iodoform but four of them did not use any packing. The rest 7 surgeons, who preferred only curettage, did prescribe only analgesics or anti-inflammatory drugs. The other 51 (75%) participants, who do not perform curettage, preferred only irrigation with saline or chlorhexidine rinse with antibiotic and analgesic administration. Most of them packed the socket with iodine/lidocaine, iodoform, Alvogyl® (Septodont-France) or terracotil ointment.

## Discussion

Even if clinical and laboratory studies have a determinative role on antibiotic administration, empiric use has a vital significance in treatment and prophylaxis of orofacial infections. Therefore, recent antibiotic preferences in clinical practice would be a valuable indicator of successful antibacterial treatment or prophylaxis. During the course of drawing up the guidelines for our faculty, it became apparent that, despite the published data, there were extremely diverse clinical opinions on the management of oral infections.

Results of previous studies investigating the benefits of perioperative antibiotic use for third molar surgery are contradictory. Sekhar et al [4], failed to show any advantage of prophylactic antibiotic use for wisdom teeth removal. However, Göker and Güvener [5], have proved that ofloxacin, clindamycin, sultamicillin have a sig-

nificant effect in decreasing the risk of postoperative infection and bacteriemia. Our results also showed similar appearance. Thirty-three (33.8%) surgeons noted that perioperative use of antibiotics in the surgical removal of wisdom teeth was not essential. Among our respondents, 14 (20.5%) surgeons stated that prophylactic use was necessary and the rest 31 (45.5%) surgeons pointed out that the use of antibiotic was a point of discussion. In the case of antibiotic use, most of our participants preferred postoperative administration. In our questionnaire, amoxicillin is the mostly prescribed antibiotic as the postoperative treatment of surgical removal of wisdom teeth. Our opinion is parallel to the majority of our contributors; we do not prescribe any antibiotic routinely to our each patient for the surgical removal of wisdom teeth. If the operation is performed under sterile conditions, there will not be a need for the use of antibiotic. The only drugs that we prescribe for the patient are analgesics and antiinflammatory drugs. The estimated infection rate after the removal of an impacted lower third molar is less than 1%, so the efficacy of such drugs has been questioned [6, 7]. Therefore, the use of antibiotic depends on the case and must be prescribed if any infection exists, in other words when it is necessary.

Dailey and Martin [8], reported that the most common prescribed antibiotic was amoxicillin, either alone or in combination with metronidazole in dental abscesses. Gill and Scully [9],

reported that the first 3 antibiotic choices of UK oral and maxillofacial surgeons were penicillin, broad spectrum penicillin and metronidasole. For acute periapical abscess they mostly preferred the oral route. Our study results demonstrated that combination of penicillin and metronidasole, amoxicillin and clindamycin were still used by most of the surgeons.

Yingling et al [10], demonstrated that penicillin VK 500 mg, 4 times a day, was the first choice antibiotic for patients with no medical allergies and the second choice was clindamycin 150 mg or 300 mg, 4 times a day for non penicillin allergic patients. Clindamycin 150 mg (29.59%), amoxicillin 500 mg (14.53%), cephalexin 500 mg (10%) and penicillin VK 500 mg were noted as the mostly used antibiotics in periodontal and periapical infections.

Clindamycin is a broader spectrum antibiotic than penicillin but is still narrow in its specificity toward oral pathogens. It is bacteriostatic or bactericidal, depending on drug concentration, infection site and microorganism. The recommended dose for adults is 150 to 450 mg, 4 times a day for orofacial infections [11]. In our work, clindamycin is used preoperatively or postoperatively and the combination of them like Wynn [11], but also in single dose (300 mg for one time).

Amoxicillin, a penicillin derivative with a broader spectrum, is a good choice for immunocompromised patients [12]. In our research, the combination or single use of amoxicillin was prescribed by 24 (35%) of respondents as the first drug of choice for patients having space infections and 29 (43%) of the contributors as the first drug choice for acute periodontal/periapical infections. It is even used for preoperative, intraoperative and postoperative prophylaxis in the surgical removal of the wisdom teeth. It is a good drug for orofacial infections because it is readily absorbed and can be taken with food. Due to the longer half-life and more sustained serum levels, amoxicillin is taken 3 times a day. However, its broad spectrum is more than is required for endodontic needs, and its use in a healthy individual may contribute to the global antibiotic resistance problem [10].

Azithromycin and clarithromycin are semi-synthetic derivatives of erythromycin that have been modified to create a broader spectrum of antibacterial activity and improved tissue-pene-

tration [13]. In addition, they have a longer elimination half-life resulting in decreased dosing schedules and lower incidence of gastrointestinal distress and abdominal cramping. Comments indicate two main switches: to clindamycin and to new generation macrolides such as azithromycin and clarithromycin. This is most likely due to the patient friendly, once or twice a day dosing schedule and fewer gastrointestinal side effects with the new macrolides. Five endodontists „empirically“ found that erythromycin, cephalexin, and penicillin were no longer effective against orofacial infections and decided to change [10]. In our study, one surgeon preferred oral administration of azithromycin for postoperative prophylaxis of the wisdom teeth and no one prescribed clarithromycin. Our study results show that these drugs are not routinely prescribed among the participants. These molecules are probably saved as reserve antibiotics. Metronidasole is an antibiotic that is very effective against obligate anaerobes but not against facultative anaerobic bacteria. If penicillin is not effective after 2 or 3 days of use, then metronidasole has been recommended as a supplemental medication [12]. Proper dosage and duration of this combination is important for effective treatment without increasing the likelihood of antibiotic resistance. A loading dose of 1000 mg of penicillin VK should be followed by 500 mg every 6 h for 5 to 7 days. If there is no improvement after 2 or 3 days, then a supplemental 500 mg loading dose of metronidasole should be administered followed by 250 mg every 6 h for 7 to 10 days [10]. In our research, the combinations of metronidasole with penicillin, CEP or lincomycin, are prescribed for postoperative prophylaxis and for the management of space infections. But it is solely used safely in acute periodontal/periapical infections. Some clinicians preferred ornidasole instead of metronidasole. We believe that as these two agents have the same spectrums, each other can be safely used for facultative anaerobic bacteria.

Inappropriate use of antibiotics leads to development of antibiotic resistance [14]. Use of antibiotics for minor infections, or for prophylaxis of AO, could be a major contributor to the world problem of antimicrobial resistance. When the decision is made to use an antibiotic, it is important to adhere to basic principles of antibiotic dosing:

- a) use high doses for short durations;
- b) use an oral antibiotic loading dose;
- c) achieve blood levels of the antibiotic at 2 to 8 times the minimum inhibitory concentration;
- d) use frequent dosing intervals; e- determine duration of therapy by remission of disease [15]. Penicillin, CEP and ampicillin were met as the mostly encountered resistant antibiotics in our questionnaire. This may occur due to their improper and routine use.

Prophylactic antimicrobial agents [16] have been advocated for the prevention of AO on the assumption that pathogenesis of dry socket is predominantly infective [17, 18]. Some workers have successfully used intra-alveolar tetracycline based agents [16], but results from clinical trials with systemic prophylactic antibiotic regimens including the administration of phenoxymethyl penicillin [19] and metronidazole [20] have been less consistent and have been unable to demonstrate any preventive effect of prophylaxis.

Blum [3], suggested antibacterial agents, antiseptic agents, antifibrinolytic agents, lavage, steroid antiinflammatory agents, obtudent dressings, clot support agents for the management of dry socket. But he also noted not to attempt to curette the socket. Bloomer [21], suggested that placement of medicated dry socket packing immediately after lower third molar extraction decreases the alveolar osteitis rate. Even if the curettage is left in the treatment of AO, some respondents (25%) do perform it still. Most of the surgeons used some packing materials like iodoform, iodine/lidocaine tamponades or Alvogyl® (Septodont-France). Abubaker and Benson [22], reported that curetting a dry socket could cause the condition to worsen because healing would be fur-

ther delayed and there was a risk of causing the localized inflammatory process to be spread to the adjacent sound bone. We share the same opinion, but in some cases, we could not achieve the healing of the alveolar socket without curetting it. Regarding our results, there is no standard treatment modality for AO. Each treatment method can give different results and non-invasive local and systemic medical treatments would be the first choice for pain relief. Surgical debridment can be considered in the second phase.

We acknowledge that the results may not be representative sample of the world. Nevertheless, we can conclude the following topics:

1. Prophylactic use of antibiotics is still contradictory and the number of clinicians who find its use as a necessity is smaller.
2. Even so, amoxicillin is generally prescribed in surgical removal of third molars by the clinicians who believe the necessity of antibacterial prophylaxis.
3. Penicillin is not preferred as frequently as in the past. This is most probably due to bacterial resistance.
4. Respectively amoxicillin and amoxicillin-clavulanic acid are frequently preferred for the management of periapical/periodontal infections.
5. Clavulanat added amoxicillin and antibiotic combinations are most favorable to overcome space infections.
6. Many different treatment modalities are used for AO. However, non-surgical treatment is more popular (75% of the clinicians) for AO management.

### Acknowledgements

The authors would like to express their gratitude to the contributors, who replied and e-mailed the questionnaires from different countries.

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