

Original Article

Knowledge and perception of the French ANSM recommendations for acute odontogenic cellulitis in French private dental practices: a national survey

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Abstract – Introduction: Caring for acute odontogenic cellulitis involves drainage, treatment of the tooth and the administration of antibiotic therapy (ANSM 2011). The emergence of bacterial resistance mechanisms has led to formulating actions to promote better use of antibiotics, but France stay one of the largest consumers in Europe. **Objectives:** Evaluate the impact of ANSM's recommendations on dental surgeons in France for treatment of this affection. **Methods:** We performed a national survey with 12365 practitioners who received the questionnaire by email. **Results:** On 690 responder practitioners, 13% followed the recommendations to the letter and 70.5% performed a clinical intervention on the day of emergency. Only 1/3 of cases involved the prescription of amoxicillin alone for first line treatment. **Conclusion:** Few data exist on the evaluation of the impact of recommendations regarding this subject, but it is generally accepted it they are seldom followed. The reasons expressed are many: disagreement between practitioners on the efficiency of recommendations, lack of time and organizational constraints.

Introduction

In French private dental practices, acute odontogenic cellulitis is a frequent occurrence and accounts for 13.4% of the dentist's daily prescriptions [1]. Management of such infections is most often ambulatory and based on both medical and surgical treatment [2]: a curative probabilistic antibiotic regimen coupled with surgical treatment of the local entry point (debridement, drainage or tooth avulsion) and of the suppurative collection (mucosal drainage incisions or root canal drainage when feasible).

In July 2011, the French National Drug Safety Agency (*Agence Nationale de Sécurité du Médicament et des produits de santé*, ANSM) published good practice guidelines regarding antibiotic prescription in dental medicine and notably in the

context of odontogenic cellulitis management [3,4]. Such guidelines advocate the use of 2 g of oral amoxicillin (total dose, b.i.d) for 7 days as first line treatment (or 1200 mg of oral clindamycin b.i.d for 7 days in case of allergy to betalactams). Second line treatments are proposed in case of first line treatment failure (with persistent signs of infection) or major cervico-facial infections with the aim of broadening the antibiotic spectrum. Amoxicillin-clavulanic acid (2 g b.i.d for 7 days) or amoxicillin-metronidazole (2g amoxicillin and 1500 mg metronidazole b.i.d or t.i.d for 7 days) associations are possible. In case of betalactam allergy, amoxicillin can be substituted by azithromycin 500 mg once daily and associated with metronidazole for 7 days as previously described. In the presence of clinical signs of severe infection antibiotic bitherapy can be proposed as a first line treatment [4].

These guidelines are part of a global campaign for better antibiotic prescription in France, established as a result of the major increase in antibiotic resistance these last twenty years.

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Revered as miracle treatments throughout the first half of the twentieth century, immoderate use of antibiotics has led to a dramatic increase in antibiotic resistance and a subsequent rise in antibiotic treatment failure, even for common infections. In such a context, numerous national policies have been developed throughout the world to work towards preventing the rise of antibiotic resistance by limiting and optimizing antibiotic prescriptions. Despite an initially favorable impact, there has been a rebound in antibiotic prescription in France, with a 5.4% increase since 2010 mostly resulting from prescriptions delivered in both medical and dental private practices [5].

In 2015, the ANSM reported that France is one of the leading European countries in terms of antibiotic prescription [5]. In that context, the aim of this study was to evaluate the knowledge and application of the 2011 ANSM antibiotic prescription guidelines by French dental practitioners during the management of acute odontogenic cellulitis by means of a nationwide survey. The motivations for adhering or not to the guidelines were sought out. National adherence rate and underlying factors for such adherence were also investigated.

Materials and methods

Population sample

The studied population corresponded to the French dentists working in the metropolitan area with no distinction for subspecialty training or professional orientation. The dentist population comprised 41,248 practitioners in 2017 of which 49.9% were over 50 years old [6]. The study population was sampled in collaboration with the French Union for Oral Health (*Union Française pour la Santé Bucco-Dentaire*, UFSBD), an association created in 1966 regrouping 12365 French private dental practitioners with a similar demography than in French dentist population. It was included practitioners adherents to the UFSBD. There was no exclusion criterion.

Inclusion and exclusion criteria

The inclusion criteria were to hold a diploma in dental surgeon and declare to take charge of acute odontogenic cellulitis. Dental surgeons who did not receive patients with acute odontogenic cellulitis were excluded from this study.

Survey development and distribution

The survey questionnaire (Table. III) used in the present study was developed based on previous surveys administered to French dentists [7], in other medical specialists [8], and in others countries [9,10]. It was tested and improved following contributions from a group of part-time hospital dentists that were not included in the study sample.

Like others similar survey [11], the questionnaire was mailed along with a cover letter requesting assistance and participation. The survey took place between December 2015 and March 2016. The questionnaire was sent individually to

each French dentist who was a member of the UFSBD, and each practitioner was sent a reminder up to 5 times maximum during the previously defined inclusion period. The questionnaire was anonymous and comprised of 28 close-ended questions on various themes: management of acute odontogenic cellulitis; knowledge of 2011 ANSM guidelines and their application; initial training of the dentist; continued professional development and the dentist's individual professional profile. Some questions were mandatory, others were not, and some practitioners did not want to answer all of the items. This resulted in a difference in the total number of practitioners responding per question.

Statistical analyses

The characteristics of the practitioners are reported as numbers and percentages for categorical variables and as means, medians and range for continuous variables, as appropriate.

Factors associated with the adherence to guidelines were analyzed using univariate and multivariate analysis. Categorical variables were compared with chi-square or Fisher's exact tests, and continuous variables were compared with Student's *t*-test or a Wilcoxon test, as appropriate. All factors associated with the adherence (p -value < 0.05) in the univariate analysis were included into a multivariate logistic regression model. Odds ratio (OR) were reported with their 95% confidence interval (CI95%).

Results

Population characteristics (Fig. 1)

The number of participants in the survey is 690 and it was comprised of an equal share of male and female practitioners, most of which worked in major urban centers (26% in Paris, 8% in Lyon and 8% in Toulouse) near an hospital or dental emergency clinic (two-thirds of practitioners working less than 10 km from such centers). The majority of practitioners (58%) worked in individual private practices, mostly as the incumbent (85%) and were general dental practitioners for 89% of them (3% were periodontists and 4% oral surgeons). Furthermore, 25% hold or previously held a part-time hospital and/or academic position. The majority of surveyed practitioners claimed participating in continuous professional development activities: 90% attend scientific meetings; 78% subscribe to a scientific journal.

Acute odontogenic cellulitis management

The frequency of occurrence of acute odontogenic cellulitis management in the surveyed dentists' practices is resumed in Figure 2A. Such a frequency was variable across the sample: 19% of dentists treated acute odontogenic cellulitis once or twice per year, against once or twice per week for 11% of dentists. Most often, the practitioners were rarely the attending dentist of the patients who consulted for this pathology (24%). Regarding the medical treatment, almost all dentists prescribed antibiotics for the cellulitis (98%), as

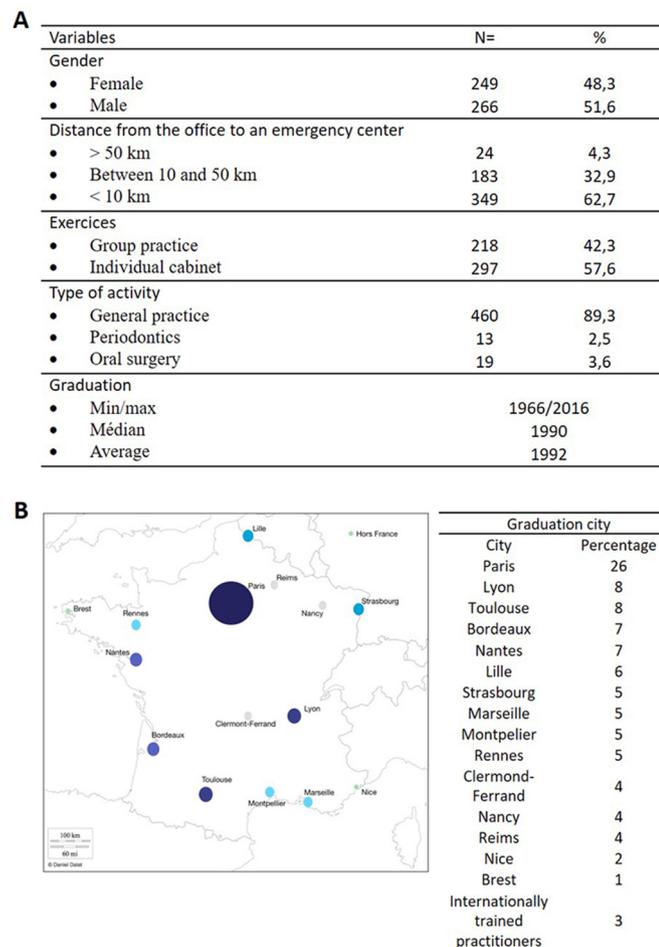


Fig. 1. Study sample demographic data. (A) Study sample characteristics; (B) Geographic repartition based on graduation location.

follows (Fig. 2B): amoxicillin (33%), amoxicillin-clavulanic acid (23%), spiramycine-metronidazole (13%). Furthermore, 45% of surveyed dentists added anti-inflammatory drugs with the antibiotics. Regarding the surgical treatment (Fig. 2C), the drainage of the suppurative collection was most often performed during the first emergency consultation (63%) or postponed for 48 h (12%) or further (21%). Three other surgical treatments were performed: root canal drainage, mucosal drainage incisions or tooth avulsion. Most practitioners instated a follow-up appointment, most often at 7 days (56% of dentists) or 48 hours (33% of dentists). 58% of dentists had at least once observed the aggravation of the initial infection during the follow-up visit. Furthermore, 59% of dentists managed the complications on their own. Otherwise, the patient was referred to a hospital department (23%) an MD-trained oral surgeon (10%) a DDS-trained oral surgeon (5%) or an oral and maxillofacial surgeon (3%).

Knowledge and adherence to the ANSM guidelines

Knowledge and adherence to the ANSM guidelines by the surveyed dentists was investigated in the second part of the survey (Fig. 3). 68% of the respondents claimed knowing the

ANSM guidelines (Fig. 3A) either via their initial training (35%), a scientific journal (26%) or a scientific congress (19%). 52% of the respondents claimed to always follow the guidelines when prescribed antibiotics and 26% claimed to never follow them (Fig. 3B). When the practitioners did not follow the guidelines at all, they justified their decision by an important risk of infection aggravation when prescribing amoxicillin only (54%); by their lack of knowledge of the guidelines (17%) or by their personal preference (14%). In the present study, total guideline adherence was defined as the right antibiotic prescription (first or second line of treatment) in association with a surgical drainage procedure. Based on this definition, only 31% of practitioners actually adhered to the guidelines (Fig. 3C).

Factors influencing the adherence to the guidelines

The next part of the survey focused on the potential factors influencing the adherence to the guidelines. No significant differences could be observed between the sexes ($p=0.4254$). The distance from a hospital or dental emergency clinic ($p=0.3664$), the age of graduation ($p=0.2447$) or the type of practice ($p=0.5550$) did not influence the adherence to the guidelines either (Results not shown). Furthermore, working or having worked in a hospital setting or academic position was not associated with better adherence to the guidelines ($p=0.5260$) or the type of practice ($p=0.4112$) or the participation in continued professional development activities whatever the nature: reading scientific journals ($p=0.6122$); participating in scientific meetings ($p=0.1221$) or scholarly training sessions ($p=0.5225$). Nevertheless, 3 factors were associated with adequate adherence to the guidelines in the univariate analysis, and were thus introduced in the multivariate analysis (Table. I): claiming to know the guidelines (OR=7.57, IC [4.17;13.74], $p < 0.0001$), working in a multi-practitioner practice (OR=1 vs. OR=0.62 for those working alone, IC [0.41;0.93], $p=0.0210$) and referring the patient to a dental emergency center (or hospital department) after first line and/or second line treatment failure(s) (OR=3.08, IC [1.92;4.92], $p < 0.001$).

Discussion

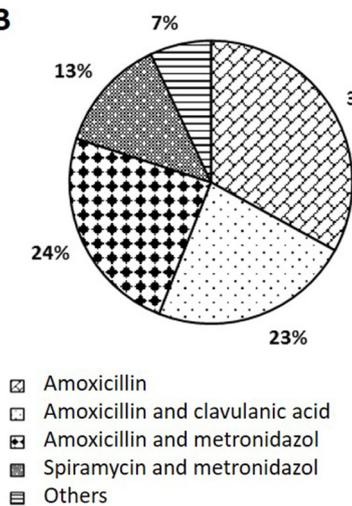
The demographic breakdown of our sample is similar to others survey realized in France [12,13], the overall French dentist population. Indeed, the sex repartition, the median age, and type of practice have no significant differences (sex repartition 48% vs 52%; median age 50 vs 48; 89% omnipractice vs 85%) [6].

Although the sample is theoretically representative, the limitations of this survey is that the sample studied corresponds to approximately 5.6% of the members of society UFSBD and of 1.67% of the French dentists in active service in 2015. Otherwise, as this association does not separate practitioners by professional orientation, such a selection bias is avoided.

A

| Frequency of medical management | % | n = |
|---------------------------------|-------|-----|
| Less than once a year | 14,06 | 97 |
| Once or twice a year | 18,55 | 128 |
| Once or twice a semester | 26,38 | 182 |
| Once or twice a month | 28,12 | 194 |
| Once or twice a week | 11,45 | 79 |
| Once a day | 1,45 | 10 |

B



C

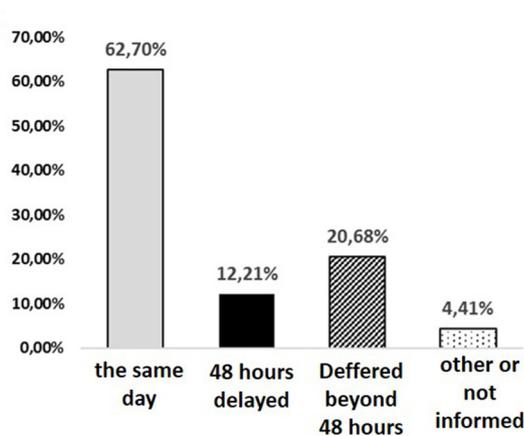


Fig. 2. Management practices for treatment of acute odontogenic cellulitis. (A) Frequency of occurrence of acute odontogenic cellulitis management in percentages and absolute value (*n*). (B) Frequency of antibiotic prescriptions in percentages (without any differentiation between first line and second line treatments). (C) Surgical procedures performed and timing of procedure (in percentages).

Only two third of practitioners said they knew the recommendations of the ANSM. In our study, we defined the respect of the recommendations by the correct prescription of the antibiotherapy associated with the realization of a drainage of the collection. On this definition, only one-third actually respected the recommendations. We sought to identify the factors associated with the correct follow-up of the recommendations. Two factors were identified: the knowledge of them and work in a group practice. Unfortunately, this study was not able to assess the best teaching method for these guidelines (between initial training, continuous professional development or hospital-based practice) as no correlation could be evidenced between these aforementioned factors and the right antibiotic prescription. Finally, the lack of adherence to the ANSM guidelines was mainly explained by the dentists' lack of confidence in them.

Almost half of the study sample (48%) did not systematically follow the guidelines for first line antibiotic treatment and the prescription of spiramycine-metronidazole in 13.6% of cases is representative of the lack of up to date evidence-based practice in this field (these antibiotics are considered ineffective in the management of acute odontogenic cellulitis). Furthermore, the association amoxicillin-clavulanic acid was

often prescribed as a first line treatment, as described in other international studies [14–16], a worrisome observation as this antibiotic association is known to generate multiple antibiotic resistances. Yet, narrow spectrum antibiotic prescription is feasible, as illustrated in a Norwegian study of 2004 and 2005 reporting that dentists mainly prescribed a narrow spectrum antibiotic: phenoxymethylpenicillin (73 and 75% of total prescriptions, all dental infections considered) [17]. Furthermore, although the ANSM guidelines were published in 2011 and this study carried out 4 years later (between 2015-2016) only 68% of surveyed dentists claimed knowing them.

Such a lack of knowledge was also reported by a study conducted by the national health insurance in 2005 focusing on the impact of the ANSM guidelines, where such guidelines were only evoked in 8.2% of cases [1]. The results from the present study do indeed show a correlation between the adherence to the guidelines and the knowledge practitioners have of them. An incitement to a clear and wide dissemination of these guidelines, as suggested in other recent studies is warranted [6].

The means of disseminating up to date medical data to the practitioners are numerous as suggests the literature, but there is a lack of consensus on the most efficient method. In our

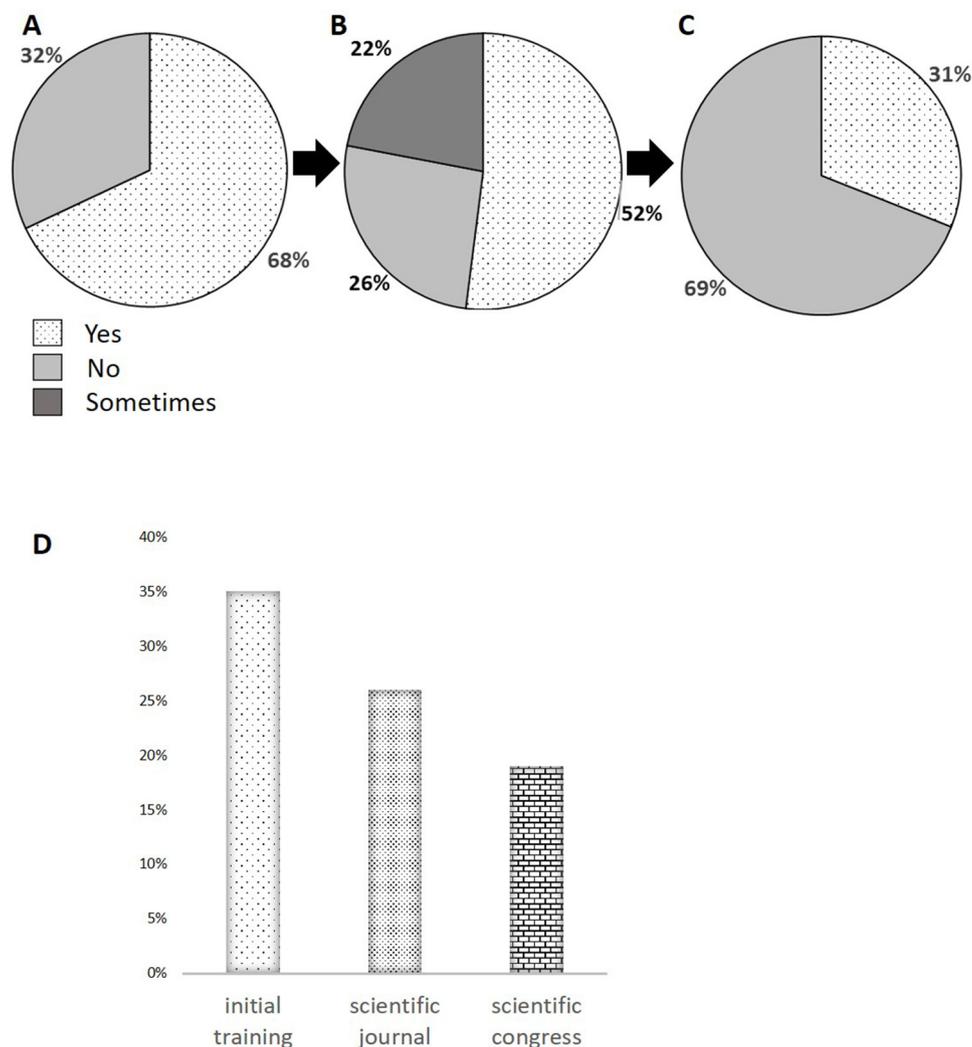


Fig. 3. Knowledge of the ANSM guidelines, adherence claims and actual prescription habits. (A) Frequency of self-reported knowledge of the guidelines and (D) origin of the knowledge (in percentages). (B) Frequency of self-reported adherence to the ANSM guidelines for first line treatment of acute odontogenic cellulitis (in percentages). (C) Frequency of actual adherence to the ANSM guidelines (in percentages).

Table I. Factors influencing adherence to the ANSM guidelines.

| Factors associated with the adherence to recommendations | Odd Ratio* (CI95%) | P |
|---|------------------------|---------|
| Knowledge of recommendations | 7,57 IC (4,17 ; 13,74) | < 0,001 |
| Individual exercise | 0,62 IC (0,41 ; 0,93) | 0,021 |
| Referral to emergency centers after failure of first and second line management | 3,08 IC (1,92 ; 4,92) | < 0,001 |

*OR greater than 1 is interpreted as a higher probability of adhering to recommendations

study sample, continuous professional development was prominent. Only 0.72% of the surveyed sample (5 practitioners) claimed following no continuous professional development activities at all despite being mandatory by French law. Nevertheless, following continuous professional development training did not guaranty adequate adherence to the ANSM guidelines. Yet, public health issues are often discussed during

scientific meetings and in scientific journals and recent guidelines often benefit from multiple reminders in numerous trainings. The lack of correlation between knowledge of the guidelines and adherence to them does not stem from continuous professional development insufficiencies and still remains to be explained. Working (part-time) in a hospital/academic setting or being a freshly graduated dentist does not insure more proper adherence to the guidelines either. Yet, as the guidelines were published in 2011, the younger graduated dentists did have training on these guidelines during their studies. Such a problematic issue should be discussed as part of the global reflection on the training of the European dental student [18].

Furthermore, the data from this survey show mistrust towards the guidelines within the French private practice dental community. Indeed, several practitioners did express doubts regarding the validity and/or applicability of the guidelines. In some instances, the inappropriate prescriptions were justified by the importance of the clinical signs (size of the collection, presence of hyperthermia, etc.) responsible for

Table II. Synthesis of the main relevant international antibiotic prescription guidelines.

| | First-line antibiotic therapy | Antibiotic therapy of second intention or if infection from the outset severe |
|---|---|--|
| American Association of endodontists (2012) | Penicillin V and K, 5 days, Clindamycine in case of Penicillin allergy | Amoxicillin + Clavulanic acid, 5 days |
| Afssaps (2011) | Amoxicillin 2g/d, 7 days | Amoxicilline + clavulanic acid, 2 to 3g/d, 7 days |
| Public Health England (2017) Guidelines for the Treatment of Infections in Primary Care | Amoxicillin 1500 mg/d ou phenoxymethylpenicilline 500mg/d, 5 days in case of Penicillin allergy : Clarythromycine 500 mg/d, 5 days | Amoxicilline + clavulanic acid, 250/125 mg, 5 days in case of Penicillin allergy : Clarythromycine 300 mg/d, |
| Dental Clinical Guidance (2016) Scottish Dental Clinical Effectiveness Program | Amoxicillin 1500 mg/d or phenoxymethylpenicilline 500mg/d, 5 days in case of Penicillin allergy : métronidazole 600 mg/d | Clindalycine 150mg/d; amoxicillin + clavulanic acid 250/125 mg/d in case of Penicillin allergy : Clarithromycine 500 mg/d |

the preferential use of broad-spectrum antibiotics (instead of the recommended amoxicillin monotherapy). Understanding the underlying motivations of the practitioners for not following the guidelines has been the subject of several previous investigations, suggesting a multifactorial origin to this problem [19,20]. In 2013, Teixeira Rodrigues et al. underlined the notion that antibiotic prescription is a complex process relying on multiple factors, several intrinsic to the doctor (socio-demographic data, knowledge, attitudes) and other extrinsic (patient-related factors and health system-related factors) [20]. Such factors have indeed been observed in our study. As previously stated, several practitioners have raised doubts regarding the guidelines' validity or applicability in general dental practice mainly because of time and personal investment constraints. Several practitioners prescribed antibiotics with a broader spectrum when they weren't able to follow-up with the patient the next week or when they feared the aggravation of the infection.

Table III. Summary of the main questions of the survey questionnaire.

| |
|--|
| Q1: How often do you receive patients with acute suppurative cellulitis? 1 time per day - 1-2 times per day / per month / per semester / per year - Less than once a year |
| Q2: Is it most often patients where you are the family dentist? Yes No |
| Q3: What attitude do you adopt? Prescription drug / • Prescription drug + clinical act / • Clinical act alone |
| Q4: Do you prescribe antibiotics? Yes No |
| Q5: If yes, which antibiotics are prescribed? Amoxicillin alone (clindamycin in case of allergy) 2g / J / • Amoxicillin 2g / J + metronidazole 1.5g / J Augmentin 2g / J / • Spiramycin + metronidazole (Rodogyl [®] , birodogyl [®]) |
| Q6: Do you prescribe other associated medications? • Anti inflammatories? Yes - no / • Analgesics yes - no / • Antiseptics? Yes No |
| Q7: When taking care of acute suppurative cellulitis, do you perform a clinical act? (Drainage, avulsion, etc ...): No / Yes the same day / Yes at 48 hours / later |
| Q8: what type? : Chamber opening drainage / • mucosal drainage / • Avulsion |
| Q9: After emergency management, do you control? Yes No |
| Q10: Have you ever seen a patient in control with a worsening of his condition despite compliance with the prescription? Yes No |
| Q11: In this case, did you take care of your office as second-line? Yes No |
| Q12: What did you prescribe as second intention? (many possible responses) |
| Q13: What is your approximate distance from the office of a nearest hospital or dental emergency center? and indicate his postal code? |
| Q14: More generally, send patients with acute suppurative cellulitis to this emergency center: From the diagnosis / After failure of the PEC in 1st intention? / After failure of the PEC in 2nd line? |
| Q15: Do you know these recommendations? Yes No |
| Q16: Did you know them by: Professional Journal / Congress? / Website ? / Initial training? |
| Q17: Does your practice follow these recommendations? [...]: Yes always / yes, sometimes / never |
| Q18: If you do not follow them, is it because: You prefer your own therapeutic modalities / You know them badly / Too many recurrences |

In France, improper antibiotic prescription is not solely apparent in the field of dental medicine but also in other medical specialties. For instance, in studies focusing on general medicine (family medicine) in private practices, correct management (and prescriptions) for common diseases such as type 2 diabetes [8] or tonsillitis [21] was only observed in less than half of cases. The same case can be done for pediatrics, where in treating otitis media one third of practitioners do not adhere to the relevant guidelines [22]. Such a problem is obviously not restricted to France, as similar results have been shown in other countries [23]: a study on Irish general practitioners has evidenced an overuse of broad-spectrum antibiotics for treating lung diseases, with improper prescriptions in 78.05% of cases (as compared to the national guidelines) [24]. In the UK, another study analyzed the prescriptions from dentists in 2003 and 2004, revealing that amoxicillin and metronidazole were the two most frequently prescribed antibiotics (63.4% and 21.2% respectively) such prescriptions being adequate (i.e. in adherence with the national guidelines) in only 29% of those cases [25], and a study realized in 2016, shows a high level of inappropriate antibiotic prescribing amongst the General Dental Practitioners [26]. Another study in the Minnesota, have done to assess the knowledge of antibiotic usage practices among dentists, and had reported greater antibiotic in prophylactic and curative treatment use than currently recommended by existing guidelines for both of uses [27].

On an international level, amoxicillin as first line treatment and amoxicillin-clavulanic acid as second line treatment are the most often recommended antibiotic regimens (except for the AAE), and are in global adherence with the French ANSM guidelines, the only main difference being the duration of treatment (7 days in France versus 5 days in the other guidelines). Most of the national prescription guidelines are comparable and based on a similar rationale, summarized in Table II [25,26]. In 2012, the American Association of Endodontists (AAE) published guidelines for the management of endodontic infections advocating the use of penicillin V-K as a first line treatment based on its efficacy in treating polymicrobial infections, a narrow spectrum that includes most common endodontic pathogens and limited toxicity and cost [26]. In these guidelines, amoxicillin and amoxicillin-clavulanic acid should be reserved for second line treatments and for immunocompromised patients. Metronidazole is not recommended as a first line treatment because of many resistant bacteria [26]. The English Public Health and Scottish Dental Clinical Guidance published, respectively in 2017 and 2016, their guidelines for the management of dental infections [25]. The Guidelines for the Treatment of Infections in Primary Care and the Scottish Dental Clinical Effectiveness Program both advocate the first line use of amoxicillin or phenoxymethylpenicillin for 5 days, with respectively clarithromycin and metronidazole as alternative treatments in cases of allergy to betalactams. Clindamycin and amoxicillin-clavulanic acid are recommended as second-line treatments (Table. II). A survey

realized in Trieste in 2014, shows that patients treated with a combination of two or more antibiotics had a higher probability of a longer healing time [27].

This study has limitations, mostly due to its declarative nature. As the survey implies an auto-evaluation, it is not necessarily an accurate reflection of the true professional activities and capacities of the practitioners. There was a necessary selection bias, as the questionnaire was not sent to all the French dentists. Finally, it would have been interesting to investigate the perceptions behind the term “cellulitis” as the lack of a consensual definition frequently complicates the study of such infections and the relevant bibliographic studies. This aspect is actually discussed in the rationale of the 2011 ANSM guidelines [3].

Conclusion

For conclusion, this survey shows that amoxicillin-clavulanic acid is the most prescribed antibiotics, whereas amoxicillin monotherapy is the recommended regimen. Several practitioners surveyed in this study revealed that there were too many complications and complaints when using amoxicillin alone and there is a clear mistrust from surveyed dentists towards the guidelines. Improving antibiotic prescription is feasible and must be sought for, as the rise of antibiotic resistance is becoming one of the greatest global health threats of this century.

Conflicts of interests: The authors declare that they have no conflicts of interest in relation to this article.

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