

1 **A survey on systemic antibiotic prescription among dentists in**
2 **Romandy**

3 **Accepted for publication: July 11, 2023**

4 Alexandre Loume¹, Panagiotis Gardelis¹, Alkisti Zekeridou¹ and Catherine
5 Giannopoulou^{1*}

6 Institutional affiliation:

7 ¹ Division of Regenerative Dental Medicine and Periodontology, University Clinics of
8 Dental Medicine, Faculty of Medicine, University of Geneva, Geneva, Switzerland

9

10

11 Corresponding author: Panagiotis Gardelis

12 panagiotis.gardelis@unige.ch

13

14 Address: University Clinic of Dental Medicine
15 Division of Regenerative Dental Medicine and
16 Periodontology
17 University Clinics of Dental Medicine, Faculty of Medicine
18 University of Geneva
19 1 rue Michel-Servet
20 1211 Geneva 4, Switzerland
21 Phone: +41 22 379 40 31
22

23 **Running title:** Antibiotics in dentistry

24 **Key words:** Questionnaire, French-speaking dentists, antibiotic prophylaxis,
25 antibiotic therapy

26 **Abstract:**

27 Antimicrobial resistance (AMR) is a significant global health threat that arises from
28 the excessive and incorrect use of antibiotics. As key players in the evolution of
29 AMR, medical and dental practitioners are often questioned on their indications for
30 antibiotic prescription during daily practice. The present survey aimed to evaluate
31 self-reported practices regarding systemic antibiotic prescription among Swiss
32 dentists in Romandy. An electronic questionnaire was sent to 331 dentists working in
33 the French-speaking part of Switzerland and the responses were analyzed on a
34 three-point Likert scale. The response rate was 28%. Results showed that the main
35 indications for antibiotic use were abscesses with systemic symptoms (89%),
36 cellulitis (81.5%), acute sinusitis (62%) and necrotizing periodontitis (52%). Surgical
37 procedures most frequently combined with antibiotics were sinus floor elevation
38 (59.8%) and implant placement (60.9%). Amoxicillin was the first-choice antibiotic,
39 and clindamycin was mostly prescribed for patients with a penicillin allergy (87%).
40 The majority of dentists recommended prophylaxis with 2g of amoxicillin, one hour
41 before the procedure for patients with a high risk of endocarditis (82.6%),
42 immunodeficiency / immunosuppression (50%), or joint replacement during the last
43 year (47.8%). Most participants (76.1%) expressed the need for specific guidelines
44 on the use of antibiotics in dentistry. The research findings suggested antibiotic
45 prescriptions in dentistry could profit from stricter guidelines.

46

47 **Introduction**

48
49 The World Health Organization (WHO) has identified antimicrobial resistance (AMR)
50 as one of the top 10 global public health threats facing humanity due to the
51 inappropriate and unnecessary use of antibiotics, which makes bacteria, viruses,
52 fungi and parasites become resistant to existing drugs. This phenomenon leads to
53 infections harder to treat and increases the risk of disease spread, severe illness and
54 death. The Antimicrobial Resistance Collaborators group reported in 2022 that 1.27
55 million deaths per year are directly caused by bacterial AMR, and almost 5 million are
56 associated with bacterial AMR (ANTIMICROBIAL RESISTANCE COLLABORATORS
57 2022). The annual epidemiological report for 2021 established by the European
58 Centre for Disease Prevention and Control has stated that the prescription of
59 antibiotics varies from country to country, with higher consumption observed in the
60 southern countries and a constantly reducing prescription in the northern countries.
61 As a result, a decrease in AMR was observed between 2012 and 2021 (EUROPEAN
62 CENTRE FOR DISEASE PREVENTION AND CONTROL 2018). Further
63 opportunities exist for antimicrobial stewardship of broad-spectrum and last-line
64 antibiotics.

65 In 2017, the Swiss government published a list of action items aimed at limiting the
66 development and spread of AMR in the environment (ZUMBRUNN 2017) and today
67 Switzerland has one of the lowest rates of antibiotic consumption in Europe, although
68 wide variations exist between cantons (FILIPPINI ET AL 2006). Worldwide, dentists
69 are responsible for about 10% of all prescribed antibiotics, significantly contributing to
70 global antibiotic use (TEOH ET AL 2020). Dental practitioners prescribe antibiotics
71 for either prophylactic or therapeutic reasons. Antibiotic prophylaxis is mostly
72 administered to prevent endocarditis or prosthetic joint infection in high-risk patients;

73 while antibiotic treatment is mainly prescribed to manage orofacial infections or to
74 minimize the risk of complications after a specific, often invasive dental procedure.
75 However, antibiotic prescription by dentists is often empirical, leading to inappropriate
76 use (BIANCO ET AL 2021; KOYUNCUOGLU ET AL 2017).

77 While a decrease in prescribing antibiotics among other health practitioners has been
78 observed in several countries, dental prescribing of antibiotics has remained
79 unchanged (DURKIN ET AL 2018) or even increased (KJOME ET AL 2022).

80 Discrepancies between countries are observed not only on the number of dental
81 prescriptions but also on the class of the prescribed antibiotics. For example, fewer
82 antibiotic prescriptions are issued by dentists in Norway and Sweden compared to
83 England and Scotland, with phenoxymethyl penicillin dominating prescriptions in
84 Sweden/Norway, while Amoxicillin and Metronidazole are more frequently used in
85 England/Scotland (SMITH ET AL 2020). Several surveys addressed to dentists found
86 that antibiotic prescription, in terms of choice, duration, and dose, was inappropriate
87 in 14% of cases (DURKIN ET AL 2018; KOPPEN ET AL 2018). The study of Cope et
88 al. 2018 reported that 80% of antibiotics for treating acute dental conditions were
89 unnecessary, as dental infections are generally amenable to treatment by a dental
90 procedure without the need for adjunctive antibiotics (COPE ET AL 2018). Similarly,
91 Suda et al. (2019) reported that 81% of antibiotic prophylaxis prescription before
92 dental visits was unnecessary (SUDA ET AL 2019).

93 The U.S. Centers for Disease Control and Prevention defines appropriate antibiotic
94 prescribing as only prescribing antibiotics when needed, selecting the right antibiotic
95 at the right dose and duration, and following evidence-based national and local
96 clinical practice guidelines.

97

98 The aim of the present survey was to assess self-reported practices towards
99 systemic antibiotic prescription among Swiss dentists in Romandy,

100

101 **Methods**

102 *Sample and data collection*

103 The present cross-sectional survey involved 331 dentists practicing in the French
104 part of Switzerland. An electronic version of the questionnaire, along with an
105 information sheet, was emailed to registered dentists working in private or public
106 clinics, including both general and specialist practitioners. The questionnaire was
107 sent out again three months later to maximize the number of responses. The study
108 was exempt from the Swiss legislation regulating research on human subjects, as it
109 was deemed to fall outside of its scope. The questionnaire consisted of seven main
110 sections and was adapted from existing questionnaires used in similar studies
111 (AGOSSA ET AL 2021; BAUDET ET AL 2020; CHOUDHURY ET AL 2001;
112 FALKENSTEIN ET AL 2016; KÖHLER ET AL 2013). The first section collected
113 general and demographic data, such as age, sex, practice location, years since
114 graduation, university of graduation, and the number of working hours per week. The
115 second and third sections contained questions related to antibiotic prescription in
116 various situations and procedures, using common clinical vignettes. In the fourth
117 section, participants were asked which antibiotic they most frequently prescribed, as
118 well as their first alternative in case of penicillin allergy. The fifth and sixth sections
119 concerned the prophylactic use of antibiotics, such as the type of patients who
120 require antibiotic prophylaxis, and the procedures in which prophylactic antibiotics
121 are prescribed before the procedure. This section solely focused on the healthy
122 population, without any immunocompromised individuals or patients at risk of

123 infective endocarditis. The last part consisted of questions about dentists' education
124 during pre-graduate studies and/or continuous education on the use of antibiotics in
125 dentistry. The final question of this section asked about the practitioner's willingness
126 and need for specific guidelines on this topic. Items were answered using a three-
127 point Likert scale. A pilot questionnaire was created and pre-tested on a small group
128 of general practitioners (N=6).

129

130 *Statistical analysis*

131 We utilized descriptive statistics, including frequency and percentages, to analyze the
132 various items addressed to the dentists. For questions that required participants to
133 rank different items simultaneously (from most often to least often), a ranking design
134 was used. The weightings were applied in reverse order; the answer most frequently
135 set to the first place by the participants received the highest weighting, while the
136 answer least frequently set to the first position received the lowest weighting.
137 Specifically, the answer set to position 1 received a weight of 7, the answer set to
138 position 2 received a weight of 6, and so on.

139

140 **Results**

141 *Demographics*

142 A total of 331 questionnaires was distributed electronically to dentists practicing in
143 Romandy between April 2022 and October 2022. The response rate was
144 approximately 28%, with 92 completed questionnaires being included in the analysis.
145 Of the respondents, 65.2% (N=60) were male and 34.8% (N=32) were female. Nearly
146 half of the participants were over 50 years old. As indicated in Table I, the years of
147 experience since graduation ranged widely, with 50% reporting more than 20 years

148 of experience. 77.2% of the participants had obtained their degree from a Swiss
149 university, while 22.8% had graduated from other universities. 84.8% of the
150 participants reported working 5-6 days per week, with 15.2% reporting working
151 between 3-4 days per week. Almost all practitioners (89.1%) had their own private
152 practice, while 27.2% reported also having an academic position. More than half of
153 the dentists (54.4%) reported seeing 40-60 patients per week and 89% of them
154 prescribing antibiotics between 1 to 5 times per week. (Table I).

155 Table II presents self-reported antibiotic prescription by the participants for various
156 situations and procedures in the healthy population. The most common reasons for
157 antibiotic prescription were abscess with systemic symptoms (89%), cellulitis
158 (81.5%), oral-sinus communication (62%), acute maxillary sinusitis of dental origin
159 (62%), and necrotizing periodontal disease (52.2%). Procedures that led to antibiotic
160 prescription by the practitioners were mainly implant surgery (60.9%), sinus floor
161 elevation (59.8%), surgery for peri-implantitis (44.6%), and extraction of impacted
162 wisdom teeth (42.4%). The only procedures for which antibiotics were not prescribed
163 were endodontic treatment of vital teeth (95.6%) and of teeth with necrotic pulp
164 (59.8%) (Table III).

165 Using a scale from 1 to 7, participants were asked which antibiotic they prescribe
166 most often. As shown in Figure Ia, amoxicillin was the most frequently prescribed
167 antibiotic (weight of 6.67), followed by clindamycin (weight of 5.67), amoxicillin+
168 clavulanic acid (weight of 5.18), and amoxicillin+ metronidazole (weight of 4.45). For
169 patients allergic to penicillin, clindamycin was by far the most frequently prescribed
170 antibiotic by the participants (87%) (Figure Ib).

171

172 *Procedures for prophylactic antibiotic prescription*

173 The results regarding antibiotic prophylaxis are presented in Table IV and Table V.
174 Most dentists prescribed prophylactic antibiotics for patients with a high risk of
175 endocarditis (86.9%), followed by those with immunodeficiency/immunosuppression
176 (50%), patients with joint replacement in the past year (47.8%), and those receiving
177 IV bisphosphonate treatment (40.2%). Among the dentists who prescribe
178 prophylactic antibiotics, most of them (82.6%) used a dose of 2g of amoxicillin
179 administered one hour before the procedure.

180 Concerning antibiotic prophylaxis for individuals without any underlying health
181 condition, about 50% of dentists prescribed it before implant surgery, 40.2% before
182 sinus floor elevation, and 32.6% before extraction of impacted wisdom teeth. Only
183 24% of dentists prescribed prophylactic antibiotics before surgical treatment of peri-
184 implantitis, as shown in Table V.

185

186 *Dentists' education on the use of antibiotics in dentistry*

187 Courses and /or recommendations on this topic during pre-graduate and continuous
188 education curricula are rare, as reported by most of the practitioners (68.5% and
189 65.2%, respectively). The need for specific guidelines was highlighted by the
190 participants (76.1%) (Table VI).

191

192 **Discussion**

193 In Switzerland, there has been a noteworthy 19% reduction in total antibiotic
194 consumption since 2019, which may be attributed to COVID-19 measures. The Swiss
195 Antibiotic Resistance Report reveals that Switzerland has one of the lowest levels of
196 antibiotic use in Europe, especially for antibiotics that contribute to antibiotic
197 resistance. Outpatient settings account for most of the antibiotic use (85%) compared

198 to hospitals (15%). Usage varies regionally, with higher consumption in French- and
199 Italian-speaking areas and lower usage in German-speaking regions. The report
200 focuses primarily on antibiotic consumption and resistance in human and veterinary
201 medicine, and no data on antibiotic consumption in dental medicine is provided
202 (FEDERAL OFFICE OF PUBLIC HEALTH AND FEDERAL FOOD SAFETY AND
203 VETERINARY OFFICE 2022). Based on the European Medicines Agency's 2021
204 report, in the field of veterinary medicine there has been a significant reduction in the
205 sale of antibiotics as veterinary antimicrobial agents across 31 European
206 Union/European Economic Area countries. The total amount sold in 2021 was
207 reported to be 5,219.6 tons (EUROPEAN MEDICINES AGENCY 2022), which is
208 noticeably lower compared to the 8,421 tons sold in 2011, as indicated by a previous
209 study (EUROPEAN MEDICINES AGENCY 2013).

210 Considering these findings, a question arises regarding the extent to which dentists
211 contribute to antibiotic resistance when treating infections. Mombelli et al. (2016)
212 reported that the total amount of penicillin, approximately 1,947 tons, administered to
213 food-producing animals in a year is equivalent to the dosage needed to treat 247
214 million human cases of periodontitis. This calculation assumes a dosage of 375mg of
215 amoxicillin taken three times a day for seven days. Although it seems minimal
216 compared to veterinary prescriptions, dental health professionals should not
217 underestimate their role in contributing to antibiotic resistance (MOMBELLI ET AL
218 2016).

219 The primary objective of this cross-sectional survey was to examine the antibiotic
220 prescribing patterns among a group of Swiss dentists practicing in the French-
221 speaking region of Switzerland, primarily in the cantons of Geneva and Vaud.
222 According to the Federal Statistical Office, there were a total of 259 and 390 dental

223 offices in these cantons in 2020, respectively. Hence, our survey encompassed
224 nearly half of the dental workforce in these regions (FEDERATION OF SWISS
225 DOCTORS, FEDERAL STATISTICAL OFFICE 2022).The survey obtained a
226 response rate of 28%, which is higher than that reported in a study targeting
227 German-speaking dentists (response rate of 20%) (KÖHLER ET AL 2013) but
228 significantly lower than those reported in surveys conducted in France (BAUDET ET
229 AL 2020) or Italy (BIANCO ET AL 2021), in which the response rates were 58.75%
230 and 52.6%, respectively. Given that the estimated number of dentists practicing in
231 Switzerland is around 3500, it can be calculated that our study included
232 approximately 2.62% of the dentists (n=92 participants). Notably, almost one third of
233 the participants reported having an academic position, suggesting that this sample
234 may be less representative of the general population. These points are addressed as
235 limitations of the study.

236 Interestingly, in this study, it was found that a high proportion of participants (89.1%)
237 prescribe antibiotics 1-5 times per week. Systemic antibiotics were most prescribed
238 as first-line therapy in cases of abscess with systemic symptoms (89.1%), cellulitis
239 (81.5%), oral-sinus communication (62%), and acute maxillary sinusitis of dental
240 origin (62%). For certain procedures, such as implant surgery and sinus floor
241 elevation, antibiotics were prescribed by 60% of the participants. These findings are
242 consistent with a systematic review of survey-based studies on antibiotic prophylaxis
243 for dental implant surgery in healthy patients, which reported that three-quarters of
244 dentists routinely prescribe prophylaxis for implant surgery, mainly perioperative,
245 followed by postoperative and preoperative (in decreasing order of frequency)
246 (BERNABEU-MIRA ET AL 2021). In 2015, the European Association of
247 Osteointegration consensus report stated that antibiotic prophylaxis has not been

248 shown to be beneficial for straightforward implant placement but may be beneficial
249 for complex cases with grafting or immediate implant placement and/or patients with
250 systemic comorbidities (KLINGE ET AL 2015).

251 For complex tooth extractions or extractions of impacted teeth, 17% and 42.4% of the
252 participants responded prescribing antibiotics, respectively. Antibiotic use after tooth
253 extraction, especially those of broad-spectrum, increased over a period of 17 years
254 (CHOI & LEE 2021). In a retrospective cohort study, the only factor influencing the
255 prescription of antibiotics was the number of extracted teeth (SHEIKH REZAEI ET AL
256 2022).

257 Apparent uncertainty was observed for situations such as aggressive periodontitis
258 (34.8% prescription) and necrotizing periodontal disease (52.2% prescription) as well
259 as for several periodontitis/periimplantitis treatment procedures (periapical surgery,
260 resective periodontal surgery, regenerative periodontal surgery, or surgical treatment
261 of peri-implantitis). In the management of aggressive periodontitis, the addition of
262 Metronidazole or Amoxicillin and Metronidazole to mechanical treatment was
263 reported to improve clinical parameters (RABELO ET AL 2015). Herreira et al. (2014)
264 recommended the use of systemic antimicrobials adjunctively to mechanical cleaning
265 only in severe cases or in non-responsive conditions for the treatment of periodontitis
266 (HERREIRA ET AL 2014). Furthermore, the EFP S3 level clinical practice guideline
267 for the treatment of Stage I-III periodontitis indicated that the adjunctive use of
268 specific antibiotics may be considered for generalized periodontitis Stage III in young
269 adults (SANZ ET AL 2020). For peri-implantitis treatment, no specific drug
270 prescription recommendation exists (ROCUZZO ET AL 2018), resulting in
271 heterogeneity observed for surgical management, with 56.7% of dentists sometimes
272 prescribing antibiotics.

273 The current results showed that amoxicillin was the most prescribed antibiotic,
274 followed by clindamycin and amoxicillin and clavulanic acid. This trend is consistent
275 with previous studies conducted in other European countries and the United States
276 (BAUDET ET AL 2020, GERMACK ET AL 2017, PALMER ET AL 2000,
277 RODRIGUEZ-NUNEZ ET AL 2009). For patients with penicillin allergies, clindamycin
278 was the preferred alternative antibiotic, prescribed by most participants (85.9%),
279 followed by azithromycin (4.3%), which is also consistent with findings from similar
280 studies in other countries (GERMACK ET AL 2017, RODRIGUEZ-NUNEZ ET AL
281 2009).

282 Antibiotic prophylaxis was primarily prescribed for patients at high risk of endocarditis
283 (86.9%), followed by those who have undergone joint replacement less than one year
284 ago (47.8%), patients with immunodeficiency/immunosuppression (50%), and those
285 receiving bisphosphonate treatment (40.2%). The participants agreed on the
286 appropriate dosage of prophylactic antibiotics.

287 According to a study conducted by WALSH ET AL (2021), there was a significant rise
288 in the prescription of broad-spectrum antibiotics among Australian dentists between
289 2005 and 2016 (WALSH ET AL 2021). Most of the increase occurred between 2011
290 and 2016, which contrasts with the national antimicrobial stewardship initiatives and
291 guidelines. However, it is worth noting that Australia had the lowest antibiotic
292 prescription rate compared to England, the United States, and Canada. In fact, the
293 United States had a prescription rate that was twice as high as Australia's, with
294 clindamycin being the most prescribed antibiotic (THOMPSON ET AL 2021). Limited
295 available data exists regarding the prescription of antibiotics by dentists in
296 Switzerland. The only similar survey to ours was conducted in the German-speaking
297 part of Switzerland (KÖHLER ET AL 2013) and various uncertainties regarding

298 accurate diagnosis and treatment were discovered. However, when comparing the
299 two surveys, only minor differences were observed in antibiotic prescription patterns
300 for different clinical conditions. The most notable contrast was observed in the
301 treatment of aggressive periodontitis, where 65.8% of dentists in the German-
302 speaking part of Switzerland prescribed antibiotics as an adjunct to mechanical
303 treatment, compared to only 34.8% of the dentists of the French-speaking part.
304 Furthermore, 67% of the responders in the survey of KÖHLER ET AL (2013) had
305 expressed the need for specific guidelines on the prescription of antibiotics which
306 was slightly less than the 76% reported in the present survey.

307 It is important to note that in dentistry, there are currently no control mechanisms in
308 place for monitoring antibiotic prescriptions. This differs from the veterinary field,
309 where veterinarians are required to register all prescriptions for livestock in the
310 Information System for Antibiotics in Veterinary Medicine (IS ABV). This stringent
311 control system has contributed to a consistent decline in the sales of antibiotics in
312 veterinary medicine over the past decade (FEDERAL OFFICE OF PUBLIC HEALTH
313 AND FEDERAL FOOD SAFETY AND VETERINARY OFFICE 2022).

314 In a recent development, the Swiss Dental Journal published guidelines on the use of
315 antibiotics in various dental specialties, including periodontology and endodontology
316 (MOMBEELLI &WALTER 2019, NEUHAUS ET AL 2020). These guidelines serve as
317 a valuable resource for dental professionals, promoting responsible and evidence-
318 based antibiotic use.

319 In conclusion, the use of antibiotics in Romandy appears to be cautious among
320 dentists. However, there is a clear need for specific guidelines on the prescription of
321 antibiotics in their daily practice. Obtaining an accurate diagnosis is a crucial step in
322 limiting the prescription of antibiotics. In addition, there is a pressing need for high-

323 level evidence to inform clear guidelines on antibiotic prescribing in dental infections.
324 This will be crucial in reducing the inappropriate use of antibiotics in dentistry and
325 ultimately mitigating the development of antimicrobial resistance.

326

327 Acknowledgments

328 The authors wish to thank all the participants who took the time to fill out the
329 questionnaire.

330

331 Conflict of interest

332 The authors declare no conflict of interest.

333

334 **REFERENCES**

335 AGOSSA K, SY K, MAINVILLE T, GOSSET M, JEANNE S, GROSGOGEAT B,
336 SIEPMANN F, LOINGEVILLE F, DUBAR M: Antibiotic Use in Periodontal Therapy
337 among French Dentists and Factors Which Influence Prescribing Practices.
338 *Antibiotics* 10 (2021)

339

340 ANTIMICROBIAL RESISTANCE COLLABORATORS: Global burden of bacterial
341 antimicrobial resistance in 2019: a systematic analysis. *Lancet* 399 :629-655 (2022)

342

343 BAUDET A, KICHENBRAND C, PULCINI C, DESCROIX V, LESCLOUS P, THILLY
344 N, CLÉMENT C, GUILLET J: Antibiotic use and resistance: a nationwide
345 questionnaire survey among French dentists. *Eur J Clin Microbiol Infect Dis.* 39:
346 1295-1303(2020)

347

348 BERNABEU-MIRA JC, PEÑARROCHA-DIAGO M, PEÑARROCHA-OLTRA D:
349 Prescription of Antibiotic Prophylaxis for Dental Implant Surgery in Healthy Patients:
350 A Systematic Review of Survey-Based Studies. *Front Pharmacol.* 11 (2021)

351

352 BIANCO A, CAUTELA V, NAPOLITANO F, LICATA F, PAVIA M: Appropriateness of
353 Antibiotic Prescription for Prophylactic Purposes among Italian Dental Practitioners:
354 Results from a Cross-Sectional Study. *Antibiotics* 10 (2021)

355

356 CHOI Y Y, LEE K H: Changes in Antibiotic Prescription After Tooth Extraction: A
357 Population-Based Study from 2002 to 2018. *Int Dent J.* 71:491-499 (2021)

358

359 CHOUDHURY M, NEEDLEMAN I, GILLAM D, MOLES D R: Systemic and local
360 antimicrobial use in periodontal therapy in England and Wales. J Clin Periodontol.
361 28:833-839 (2001)

362

363 COPE A L, FRANCIS N, WOOD F, CHESTNUTT I G: Systemic antibiotics for
364 symptomatic apical periodontitis and acute apical abscess in adults. Cochrane
365 Database Syst Rev. 9 (2018)

366

367 DURKIN MJ, FENG Q, WARREN K, LOCKHART PB, THORNHILL MH, MUNSHI
368 KD, HENDERSON RR, HSUEH K, FRASER VJ : Centers for Disease Control and
369 Prevention Epicenters. Assessment of inappropriate antibiotic prescribing among a
370 large cohort of general dentists in the United States. J Am Dent Assoc. 149: 372-381
371 (2018)

372

373 EUROPEAN CENTRE FOR DISEASE PREVENTION AND CONTROL: Annual
374 epidemiological report for 2016. European Centre for Disease Prevention and
375 Control, Stockholm, (2018)

376

377 EUROPEAN MEDICINES AGENCY: Sales of veterinary antimicrobial agents in 31
378 European countries in 2021. Trends from 2010 to 2021 Twelfth ESVAC report,
379 Publications Office of the European Union, Luxembourg (2022)

380

381 EUROPEAN MEDICINES AGENCY: Sales of veterinary antimicrobial agents in 25
382 EU/EEA countries in 2011, Third ESVAC report, European Medicines Agency, (2013)

383

384 FALKENSTEIN S, STEIN JM, HENNE K, CONRADS G: Trends in antibiotic use and
385 microbial diagnostics in periodontal treatment: comparing surveys of German dentists
386 in a ten-year period. Clin Oral Investig. 20: 2203-2210 (2016)
387

388 FEDERAL OFFICE OF PUBLIC HEALTH AND FEDERAL FOOD SAFETY AND
389 VETERINARY OFFICE: Swiss Antibiotic Resistance Report 2022. Usage of
390 Antibiotics and Occurrence of Antibiotic Resistance in Switzerland, Bern (2022)
391

392 FEDERATION OF SWISS DOCTORS, FEDERAL STATISTICAL OFFICE: Staff and
393 density of doctors, dental offices, and pharmacies, by canton. OFS (2022)
394

395 FILIPPINI M, MASIERO G, MOSCHETTI K: Socioeconomic determinants of regional
396 differences in outpatient antibiotic consumption: evidence from Switzerland. Health
397 Policy 78:77-92 (2006)
398

399 GERMACK M, SEDGLEY C M, SABBAH W, WHITTEN B: Antibiotic Use in 2016 by
400 Members of the American Association of Endodontists: Report of a National Survey.
401 J Endod. 43:1615-1622 (2017)
402

403 HERRERA D, ALONSO B, DE ARRIBA L, SANTA CRUZ I, SERRANO C, SANZ M :
404 Acute periodontal lesions. Periodontol 2000 65: 149-177 (2014)
405

406 KLINGE B, FLEMMING T, COSYN J, DE BRUYN H, EISNER B M, HULTIN M,
407 ISIDOR F, LANG NP, LUND B, MEYLE J, MOMBELLI A, NAVARRO J M,
408 PJETURSSON B, RENVERT S, SCHLIEPHAKE H: The patient undergoing implant

409 therapy. Summary and consensus statements. The 4th EAO Consensus Conference
410 2015. Clin Oral Implants Res. 26 Suppl 11:6467 (2015)

411

412 KÖHLER M, MEYER J, LINDER M, LAMBRECHT J T, FILIPPI A, KULIK KUNZ E M:
413 Prescription of antibiotics in the dental practice: a survey of dentists in Switzerland.
414 Schweiz Monatsschr Zahnmed.123: 748-59 (2013)

415

416 KOPPEN L, SUDA KJ, ROWAN S, MCGREGOR J, EVANS CT: Dentists' prescribing
417 of antibiotics and opioids to Medicare Part D beneficiaries: Medications of high
418 impact to public health. J Am Dent Assoc.149: 721-730 (2018)

419

420 KOYUNCUOGLU C, AYDIN M , KIRMIZI N I , AYDIN V , AKSOY M , ISLI F , AKICI
421 A: Rational use of medicine in dentistry: do dentists prescribe antibiotics in
422 appropriate indications? Eur J Clin Pharmacol 73:1027-103 (2017)

423

424 MOMBELLI A & WALTER C: Antibiotic guidelines in periodontology. Swiss Dent J
425 129 (2019)

426

427 MOMBELLI A, CIONCA N, ALMAGHLOUTH A, CHERKAOUI A, SCHRENZEL J,
428 GIANNOPOULOU C: Effect of Periodontal Therapy With Amoxicillin-Metronidazole
429 on Pharyngeal Carriage of Penicillin- and Erythromycin-Resistant Viridans
430 Streptococci. J Periodontol. 8: 539-547 (2016)

431

432 NEUHAUS W K, CONNERT T, SCIENTIFIC COMMITTEE OF THE SWISS
433 SOCIETY OF ENDODONTOLOGY : Systemic antibiotic use in endodontics. Swiss
434 Dent J 130 (2020)
435
436 PALMER N A, PEALING R, IRELAND R S, MARTIN M V: A study of therapeutic
437 antibiotic prescribing in National Health Service general dental practice in England.
438 Br Dent J.188: 554-548 (2000)
439
440 RABELO C C, FERES M, GONÇALVES C, FIGUEIREDO L C, FAVERI M, TU Y K,
441 CHAMBRONE L: Systemic antibiotics in the treatment of aggressive periodontitis. A
442 systematic review and a Bayesian Network meta-analysis. J Clin Periodontol.
443 42:647-657 (2015)
444
445 ROCCUZZO M, LAYTON D M, ROCCUZZO A, HEITZ-MAYFIELD L J: Clinical
446 outcomes of peri-implantitis treatment and supportive care: A systematic review. Clin
447 Oral Implants Res. 29 Suppl 16: 331-350 (2018)
448
449 RODRIGUEZ-NÚÑEZ A, CISNEROS-CABELLO R, VELASCO-ORTEGA E,
450 LLAMAS-CARRERAS J M, TÓRRES-LAGARES D, SEGURA-EGEA J J: Antibiotic
451 use by members of the Spanish Endodontic Society. J Endod. 35:1198-203 (2009)
452
453 SANZ M, HERRERA D, KEBSCHULL M, CHAPPLE I, JEPSEN S, BEGLUNDH T,
454 SCULEAN A, TONETTI M S: Treatment of stage I–III periodontitis—The EFP S3 level
455 clinical practice guideline. J Clin Periodontol 47 Suppl 22:4-60 (2020)
456

457 SHEIKH REZAEI S, LITSCHAUER B, ANDERLE K, MAURER S, BEYERS P J,
458 REICHARDT B, WOLZT M: Antibiotic prescription after tooth extraction in adults: a
459 retrospective cohort study in Austria. BMC Oral Health 22: 519 (2022)
460
461 SMITH A, AL-MAHDI R, MALCOLM W, PALMER N, DAHLEN G, AL-HARONI :
462 Comparison of antimicrobial prescribing for dental and oral infections in England and
463 Scotland with Norway and Sweden and their relative contribution to national
464 consumption 2010-2016. BMC Oral Health 20 (2020)
465
466 SUDA K J, CALIP G S, ZHOU J, ROWAN S, GROSS A E, HERSHOW R C, PEREZ
467 R I, MCGREGOR J C, EVANS C T: Assessment of the Appropriateness of Antibiotic
468 Prescriptions for Infection Prophylaxis Before Dental Procedures, 2011 to 2015.
469 JAMA Netw Open. 2 (2019)
470
471 TEOH L, THOMPSON W, SUDA K: Antimicrobial stewardship in dental practice. J
472 Am Dent Assoc. 151:589-595 (2020)
473
474 THOMPSON W, TEOH L, HUBBARD C C, MARRA F, PATRICK D M, MAMUN A,
475 CAMPBELL A, SUDA K J: Patterns of dental antibiotic prescribing in 2017: Australia,
476 England, United States, and British Columbia (Canada). Infect Control Hosp
477 Epidemiol. 43:191-198 (2022)
478
479 WALSH L J, FORD P J, MCGUIRE T, VAN DRIEL M, HOLLINGWORTH S A :
480 Trends in Australian dental prescribing of antibiotics: 2005-2016. Aust Dent J. 66
481 Suppl 1: S37-S41 (2021)

482

483 ZUMBRUNN C: Antimicrobial Resistance and Antibiotics Research in Switzerland.

484 Chimia 71: 508-509 (2017)

485

486 **Résumé**

487 Introduction

488 La résistance aux antibiotiques est une menace sanitaire importante qui résulte de
489 l'utilisation excessive et incorrecte des antibiotiques. Au niveau mondial, les dentistes
490 sont responsables d'environ 10 % de l'ensemble des prescriptions. En tant
491 qu'acteurs clés de l'évolution de la résistance, ils sont souvent interrogés sur leurs
492 indications de prescription au cours de leur pratique quotidienne.

493 Plusieurs enquêtes adressées aux dentistes ont montré que la prescription
494 d'antibiotiques, en termes de choix, de durée et de dose, était inappropriée dans 14
495 % des cas, que 80 % des antibiotiques utilisés pour traiter des affections dentaires
496 aiguës étaient inutiles et que 81 % des antibiotiques prophylactiques prescrits avant
497 une visite chez le dentiste étaient inutiles.

498 La présente enquête visait à évaluer les pratiques déclarées par les dentistes
499 suisses en matière de prescription d'antibiotiques systémiques.

500

501 Matériels et méthodes

502 Un questionnaire électronique a été envoyé à 331 dentistes de Suisse romande et
503 les réponses ont été analysées sur une échelle de Likert en trois points.

504

505 Résultats

506 Le taux de réponse a été de 28%. Les résultats ont montré que les principales
507 indications pour l'utilisation d'antibiotiques étaient les abcès avec symptômes
508 systémiques (89%), la cellulite (81,5%), la sinusite aiguë (62%) et la parodontite
509 nécrosante (52%). Les interventions chirurgicales les plus fréquemment associées à
510 des antibiotiques étaient l'élévation du plancher sinusal (59,8 %) et la pose

511 d'implants (60,9 %). L'amoxicilline était l'antibiotique de premier choix, et la
512 clindamycine était surtout prescrite aux patients allergiques à la pénicilline (87 %). La
513 plupart des dentistes ont recommandé une prophylaxie avec 2 g d'amoxicilline, une
514 heure avant l'intervention, pour les patients présentant un risque élevé d'endocardite
515 (82,6 %), une immunodéficience/immunosuppression (50 %) ou un remplacement
516 articulaire au cours de l'année précédente (47,8 %). La plupart des participants (76,1
517 %) ont exprimé le besoin de lignes directrices spécifiques sur l'utilisation des
518 antibiotiques en médecine dentaire. L'étude a conclu que, bien que la prescription
519 d'antibiotiques par les participants semble être prudente, dans plusieurs situations, la
520 prescription d'antibiotiques est aléatoire.

521

522 Discussion

523 Il existe donc un besoin évident de lignes directrices spécifiques sur les conditions et
524 procédures appropriées pour lesquelles les antibiotiques sont indiqués et pour choisir
525 le régime approprié lorsque c'est nécessaire. Cela sera crucial pour réduire
526 l'utilisation inappropriée des antibiotiques en médecine dentaire et, en fin de compte,
527 pour atténuer le développement de la résistance aux antibiotiques.

528

529 **Zusammenfassung**

530 Einleitung

531 Die Antibiotikaresistenz (AMR) ist eine erhebliche globale Gesundheitsbedrohung,
532 die aus dem übermäßigen und falschen Einsatz von Antibiotika resultiert. Weltweit
533 sind Zahnärzte für etwa 10 % aller verschriebenen Antibiotika verantwortlich. Da sie
534 eine Schlüsselrolle bei der Entwicklung der Antibiotikaresistenz spielen, werden sie

535 in ihrer täglichen Praxis häufig zu ihren Indikationen für die Verschreibung von
536 Antibiotika befragt.
537 Mehrere an Zahnärzte gerichtete Umfragen ergaben, dass die Verschreibung von
538 Antibiotika in Bezug auf Auswahl, Dauer und Dosis in 14 % der Fälle unangemessen
539 war, dass 80 % der Antibiotika zur Behandlung akuter Zahnerkrankungen unnötig
540 waren und dass 81 % der Antibiotikaphylaxe-Verordnungen vor
541 Zahnarztbesuchen unnötig waren. Ziel der vorliegenden Umfrage war es, die
542 selbstberichteten Praktiken der Schweizer Zahnärzte bei der Verschreibung
543 systemischer Antibiotika zu bewerten.

544

545 Material und Methode

546 Ein elektronischer Fragebogen wurde an 331 Zahnärzte in der Westschweiz
547 verschickt, und die Antworten wurden anhand einer dreistufigen Likert-Skala
548 ausgewertet.

549

550 Resultate

551 Die Rücklaufquote betrug 28 %. Die Ergebnisse zeigten, dass die Hauptindikationen
552 für den Einsatz von Antibiotika Abszesse mit systemischen Symptomen (89%),
553 Zellulitis (81,5%), akute Sinusitis (62%) und nekrotisierende Parodontitis (52%)
554 waren. Die am häufigsten mit Antibiotika kombinierten chirurgischen Eingriffe waren
555 die Sinusbodenelevation (59,8 %) und die Implantation (60,9 %). Amoxicillin war das
556 Antibiotikum der ersten Wahl, und Clindamycin wurde am häufigsten für Patienten
557 mit einer Penicillinallergie verschrieben (87 %). Die meisten Zahnärzte empfahlen
558 eine Prophylaxe mit 2 g Amoxicillin eine Stunde vor dem Eingriff für Patienten mit
559 einem hohen Endokarditisrisiko (82,6 %), Immunschwäche/Immunsuppression (50

560 %) oder Gelenkersatz im letzten Jahr (47,8 %). Die meisten Teilnehmer (76,1 %)
561 äußerten den Wunsch nach spezifischen Leitlinien für den Einsatz von Antibiotika in
562 der Zahnmedizin. Die Studie kam zu dem Schluss, dass die Teilnehmer Antibiotika
563 zwar mit Bedacht verschreiben, die Verschreibung von Antibiotika in verschiedenen
564 Situationen jedoch aleatorisch ist.

565

566 Diskussion

567 Daher besteht ein eindeutiger Bedarf an spezifischen Leitlinien für die geeigneten
568 Bedingungen und Verfahren, bei denen Antibiotika indiziert sind, und für die Auswahl
569 eines geeigneten Behandlungsregimes, wenn dies erforderlich ist. Dies wird
570 entscheidend dazu beitragen, den unangemessenen Einsatz von Antibiotika in der
571 Zahnmedizin zu verringern und letztlich die Entwicklung von Antibiotikaresistenzen
572 einzudämmen.

573

TABLE I. Background characteristics of responders (n=92)

Personal characteristics	
Gender	
• Female	32 (34,8%)
• Male	60 (65,2%)
Age	
• Range 25-30 years old	3 (3,3%)
• Range 31-40 years old	26 (28,3%)
• Range 41-50 years old	18 (19,6%)
• >50 years old	44 (47,8%)
• No answer	1 (1%)
Graduation from	
• Switzerland	71 (77,2%)
• Other country	21 (22,8%)
Years of experience since graduation	
• < 5 years	1 (1,1%)
• 5-10 years	9 (9,8%)
• 11-20 years	32 (34,8%)
• > 20 years	50 (54,3%)
Speciality (multiple answers possible)	
• General Dentistry	64 (69,6%)
• Periodontology	12 (13%)
• Oral Surgery	0 (0%)
• Endodontology	2 (2,2%)
• Other	14 (15,2%)
Occupancy rate (in days per week)	
• 1-2 days	0 (0%)
• 3-4 days	14 (15,2%)
• 5-6 days	78 (84,8%)
Type of practice	
• Private practice	82 (89,1%)
• Academic	25 (27,2%)
• Hospital	18 (19,6%)
• Dental Clinic	6 (6,5%)
Region of practice	
• Urban	80 (87%)
• Rural	15 (16,3%)
Number of patients per week	
• 20-40 patients	27 (29,3%)
• 40-60 patients	50 (54,4%)
• >60 patients	15 (16,3%)
On average, how many times a week do you prescribe antibiotics	
• 1-5 times	82 (89,1%)
• 5-10 times	6 (6,5%)
• 10-20 times	1 (1,1%)
• >20 times	0 (0%)
• No answer	3 (3,3%)

575

576 **TABLE II.** Situations in which you prescribe antibiotics for the healthy population (not

577 immunocompromised, no risk of infective endocarditis)

Situations combined antibiotic therapy in the general population	Yes	Sometimes	No	No answer
Pulpitis (reversible or non-reversible)	1 (3,3%)	16 (17,4%)	68 (74%)	5 (5,3%)
Pulp necrosis	6 (6,5%)	47 (51,1%)	33 (35,9%)	6 (6,5%)
Chronic periodontitis	4 (4,3%)	33 (35,9%)	50 (54,3%)	5 (5,5%)
Aggressive periodontitis	32 (34,8%)	38 (41,3%)	18 (19,6%)	4 (4,3%)
Necrotizing periodontal disease	48 (52,2%)	30 (32,6%)	9 (9,8%)	5 (5,4%)
Peri-implantitis	23 (25%)	43 (46,7%)	21 (22,8%)	5 (5,5%)
Abscess without systemic symptoms	16 (17,4%)	39 (42,4%)	34 (37%)	3 (3,7%)
Abscess with systemic symptoms	82 (89,1%)	6 (6,5%)	2 (2,2%)	2 (2,2%)
Cellulitis	75 (81,5%)	8 (8,7%)	5 (5,4%)	4 (4,4%)
Acute maxillary sinusitis of dental origin	57 (62%)	24 (26,1%)	9 (9,8%)	2 (2,1%)
Oral-sinus communication	57 (62%)	24 (21,7%)	12 (13%)	3 (3,3%)

578

579

580 **TABLE III.** Procedures for which you prescribe an antibiotic therapy for the healthy
 581 population (not immunocompromised, no risk of infective endocarditis)

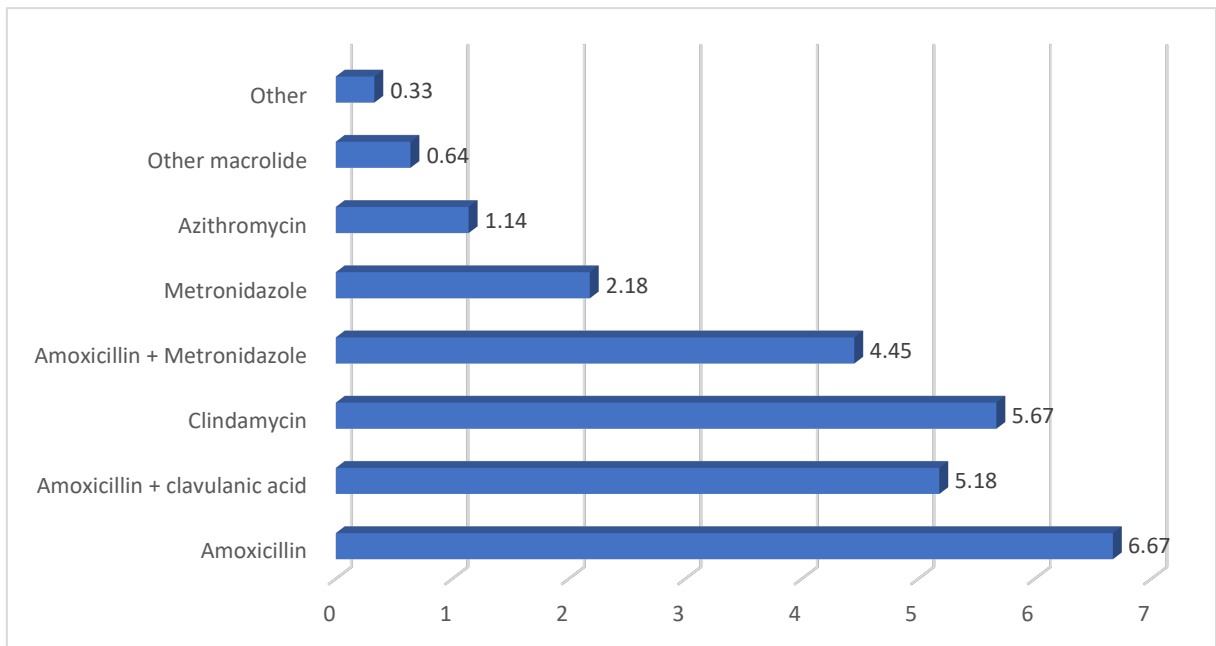
Procedures combined antibiotic therapy in the general population	Yes	Sometimes	No	No answer
Endodontic treatment of vital teeth	0 (0%)	1 (1.1%)	88 (95,6%)	3 (3,3%)
Endodontic treatment of necrotic pulp teeth	2 (2,2%)	32 (34,8%)	55 (59,8%)	3 (3,2%)
Periapical surgery (with or without bone substitute)	25 (27,2%)	33 (35,9%)	28 (30,4%)	6 (6,5%)
Resective periodontal surgery or oral surgery	18 (19,6%)	42 (45,6%)	25 (27,2%)	7 (7,6%)
Regenerative periodontal surgery	30 (32,6%)	30 (32,6%)	21 (22,8%)	11 (12%)
Complex tooth extractions	16 (17,4%)	59 (64,1%)	15 (16,3%)	3 (2,2%)
Extraction of impacted wisdom teeth	39 (42,4%)	37 (40,2%)	12 (13%)	4 (4,4%)
Implant surgery	56 (60,9%)	17 (18,5%)	14 (15,2%)	5 (5,4%)
Surgery for peri-implantitis	41 (44,6%)	30 (32,6%)	14 (15,2%)	7 (7,6%)
Sinus floor elevation	55 (59,8%)	11 (12%)	14 (15,2%)	12 (13%)

582

583

584

585 **Figure 1a: Antibiotic prescription**

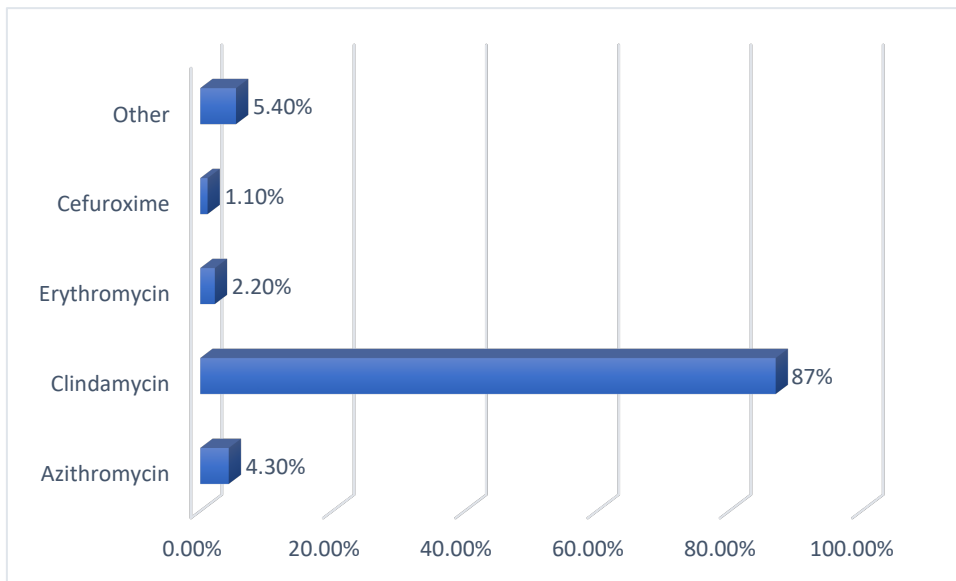


586

587

588

589 **Figure 1b: Antibiotic prescription in the case of penicillin allergy**



590

591

592

593

594 **TABLE IV.** Prophylactic antibiotherapy

595

Prophylactic antibiotherapy	
Type of patients you prescribe prophylactic antibiotics	
Immunodeficiency/immunosuppression	46 (50%)
Treatment with biphosphonates per os	25 (27,2%)
Treatment with IV biphosphonates or injection	37 (40,2%)
Joint replacement less than one year old	44 (47,8%)
High risk of endocarditis	80 (86,9%)
Head and neck radiotherapy/chemotherapy	29 (31,5%)
Autoimmune diseases	11 (11,9%)
Vascular stents	11 (11,9%)
Pacemaker	2 (2,2%)
Other	3 (3,3%)
If antibiotic prophylaxis is indicated, what dosage would you prescribe	
Amoxicillin 2G-1 hour before	76 (82,6%)
Amoxicillin 1G-1 hour before	1 (1,1%)
Amoxicillin 1G-1 hour before/ 6 hours afte	10 (10,9%)
Other	5 (5,4%)

596

597

598

599 **TABLE V.** Procedures for which you prescribe prophylactic antibiotic only before the
600 procedure (for the healthy population; not immunocompromised, no risk of infective
601 endocarditis)

602

Prophylactic antibiotic	Yes	Sometimes	No	No answer
Endodontic treatment of vital teeth	0 (0%)	0 (0%)	89 (96,7%)	3 (3,3%)
Endodontic treatment of necrotic pulp teeth	1 (1,1%)	14 (15,2%)	74 (80,4%)	3 (3,3%)
Periapical surgery (with or without bone substitute)	15 (16,3%)	24 (26,1%)	40 (43,5%)	13 (14,1%)
Resective periodontal surgery or oral surgery	10 (10,1%)	34 (36,9%)	37 (40,2%)	11 (12,8%)
Regenerative periodontal surgery	20 (21,6%)	19 (20,6%)	38 (41,3%)	15 (16,4%)
Complex tooth extractions	13 (14,1%)	29 (31,5%)	44 (47,8%)	6 (6,6%)
Extraction of impacted wisdom teeth	30 (32,6%)	22 (23,9%)	34 (36,9%)	6 (6,6%)
Implant surgery	46 (50%)	16 (17,6%)	23 (25%)	7 (7,6%)
Surgery for peri-implantitis	22 (23,9%)	28 (30,4%)	32 (34,8%)	10 (10,9%)
Sinus floor elevation	37 (40,2%)	15 (16,3%)	27 (29,3%)	13 (14,2%)

603

604

605 **Table VI. Education**

Education	
During your studies did you take specific courses on the use of antibiotics in dentistry?	
<ul style="list-style-type: none"> • Yes, often • Yes, but rarely • No, never • No answer 	<p>23 (25%)</p> <p>63 (68,5%)</p> <p>5 (5,4%)</p> <p>1 (1,1%)</p>
During continuous education courses, have you ever received recommendations on the use of antibiotics in dentistry?	
<ul style="list-style-type: none"> • Yes, often • Yes but rarely • No, never • No answer 	<p>28 (30,4%)</p> <p>60 (65,2%)</p> <p>3 (3,3%)</p> <p>1 (1,1%)</p>
Do you think that a course on antibiotic prescribing guidelines would be useful in your practice?	
<ul style="list-style-type: none"> • Yes, certainly • Moderately necessary • Not at all necessary 	<p>70 (76,1%)</p> <p>20(21,7%)</p> <p>2 (2,2%)</p>

606

607