

An Evaluation of Antibiotic Prescribing Practices Among Dentists in Turkey for the Management of Periodontal and Peri-Implant Diseases

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ABSTRACT

Objective: The utilization of antibiotics alongside surgical and nonsurgical mechanical interventions for the management of periodontal and peri-implant diseases lacks standardization. Hence, this study aims to investigate the antibiotic prescribing practices among dentists in Turkey to elucidate the rationale and timing behind systemic antibiotic usage in the treatment of these ailments.

Materials and Methods: Between May 2021 and October 2022, 312 dentists across Turkey were invited to participate in a cross-sectional survey. A chi-squared test was used to compare categorical variables according to groups. G-power analysis was used to determine the sample size before the study.

Results: The frequency of antibiotic prescriptions during the initial management of periodontitis, peri-implant mucositis, and gingivitis was observed to be lower compared to other procedures. As treatments progressed from nonsurgical to surgical interventions, there was a concurrent rise in the frequency of antibiotic prescriptions. Amoxicillin + clavulanic acid emerged as the most frequently prescribed antibiotic, with the primary reasons for prescription being the mitigation of infection risk and adherence to established literature guidelines.

Conclusions: A discernible upward trend in antibiotic prescription is evident as treatment transitions from nonsurgical to more complex surgical modalities. The findings of our survey offer valuable insights for dentists in selecting appropriate antibiotics for the management of periodontal and peri-implant diseases.

Keywords: Antibiotics; Gingivitis; Periodontitis; Peri-implant mucositis; Peri-implantitis

INTRODUCTION

Periodontal and peri-implant diseases are common microbial infections affecting teeth and implant support tissues (1-3). Conditions such as gingivitis (a limited inflammation of the gums) and peri-implant mucositis (inflammation of the soft tissues surrounding a functioning implant) are reversible when treated. However, periodontitis, which is characterized by general inflammation of the periodontal tissue, can lead to progressive, irreversible destruction of the periodontal ligament and alveolar bone. As with periodontitis, peri-implantitis is irreversible in which bone loss is observed around the implant and soft-tissue inflammation occurs (1, 2, 4).

There exists robust evidence affirming the advantages of mechanical therapy in effectively removing supra- and subgingival plaque. However, mechanical debridement may not eliminate bacterial pathogens in the more hard-to-reach subepithelial gingival tissues, sulcular epithelium, or furcal areas (5). Hence, while debridement is an effective treatment when used alone, it is insufficient against specific periodontal pathogens such as *Aggregatibacter actinomycetemcomitans*, *Porphyromonas gingivalis*, *Prevotella intermedia*, *Tannerella forsythia*, and staphylococci and enteric rods (6). Therefore, it is not always possible to regain healthy gingiva without antibiotics (7-9), and when used appropriately, antimicrobials can solve or minimize problems stemming from these conditions by targeting specific pathogens and reaching areas inaccessible via mechanical debridement (10).

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There are a variety of microorganisms with different antibiotic sensitivities that compose the microbiota associated with periodontal diseases. Hence, broad-spectrum antibiotics can be prescribed, but this can lead to other issues, such as antibiotic resistance (11). As there is limited information in the literature concerning which antibiotics should be prescribed when treating periodontal and peri-implant diseases, most dentists act on personal experience rather than evidence-based principles (5, 12). Moreover, only a few studies have suggested clinical guidelines for systemic antibiotic use in periodontology (13).

Systemic antibiotic use for the management of periodontal and peri-implant diseases is common among dentists in Turkey; however, their use (separately or as part of a complex) has been questioned. Therefore, this study aimed to compare the antibiotics preferred by dentists in Turkey for treating peri-implant and periodontal diseases and to understand the reasons underlying their antibiotic prescribing habits. Additionally, our study focused on the following: Do dentists perceive peri-implant diseases as a type of periodontal disease and apply similar antibiotic regimens in the treatment?

MATERIAL and METHODS

This was a cross-sectional study conducted between May 2021 and October 2022. This study was approved by Erciyes University Faculty of Medicine Medical Research Ethics Committee with the decision numbered 2021/299 on 21.04.2021. A secure survey link (with Google Forms) was sent to the mobile phones of 500 dentists (who registered with the Turkish Dental Association/ were selected randomly), of which 312 responded. The survey questions were written by the article authors. We received help from various articles during the question-writing process. At the beginning of the survey, the dentists provided written consent. The survey is multiple-choice and has a total 14 questions. The survey collected demographic information about the dentists and their preferences and reasons for using antibiotics when treating periodontal and peri-implant diseases. The chi-squared test was used to compare categorical variables according to groups. Results are presented as frequencies (percentages) for categorical data. The significance level was set as $p < 0.001$. IBM SPSS Version 23 (IBM Corp., Armonk, NY, USA) was used for all analyses. G-power analysis was used to determine the sample size before the study. A minimum of 303 participants were required for the multiple-choice questionnaire comprising 14 questions. The manuscript adhered to the CONSORT reporting guidelines.

RESULTS

A total of 312 dentists participated in the survey. The average age of the respondents was 27.7 years. Women comprised 43.6% of the respondents, while men accounted for 56.4%. General dental practitioners constituted 78.2% of the participants, with 48.2% identifying as periodontists. Furthermore, 46.8% reported working in a university hospital setting, and 77.6% had accrued between 0 and 5 years of experience in their profession. The average duration of implant treatment and surgical procedures among participants was 4.9 years.

The participating dentists' antibiotic prescribing status (yes or no) is shown in **Table 1**. Status was organized by whether antibiotics were prescribed for different conditions. We found that the frequency of prescriptions increased with the complexity of the procedure. Overall, antibiotic prescriptions were not given for gingivitis (85.9%), peri-implant mucositis (42.3%), initial periodontitis treatment (75.6%), or tooth extractions due to periodontitis (68.9%).

Figure 1 lists the preferred antibiotics for the treatment of periodontal and peri-implant diseases. Amoxicillin + clavulanic acid was the most commonly used combination. Antibiotic prescriptions for other procedures were uncommon.

In cases of periodontal and peri-implant diseases, the most common reason for not using antibiotics was the survey option 'Based on available literature and guidelines,' and the second most common was 'I very rarely see infections in this procedure' (**Figure 2**).

The most common reasons cited for prescribing antibiotics in cases of periodontal and peri-implant diseases were 'Based on available literature and guidelines,' 'to reduce the risk of developing an infection,' and 'I prescribe antibiotics after surgical procedures.' (**Figure 3**).

A comparison of the antibiotics used for treating gingivitis and peri-implant mucositis is shown in **Table 2**. We found that 69.5% of respondents who did not prescribe antibiotics for gingivitis either did not prescribe them for peri-implant mucositis.

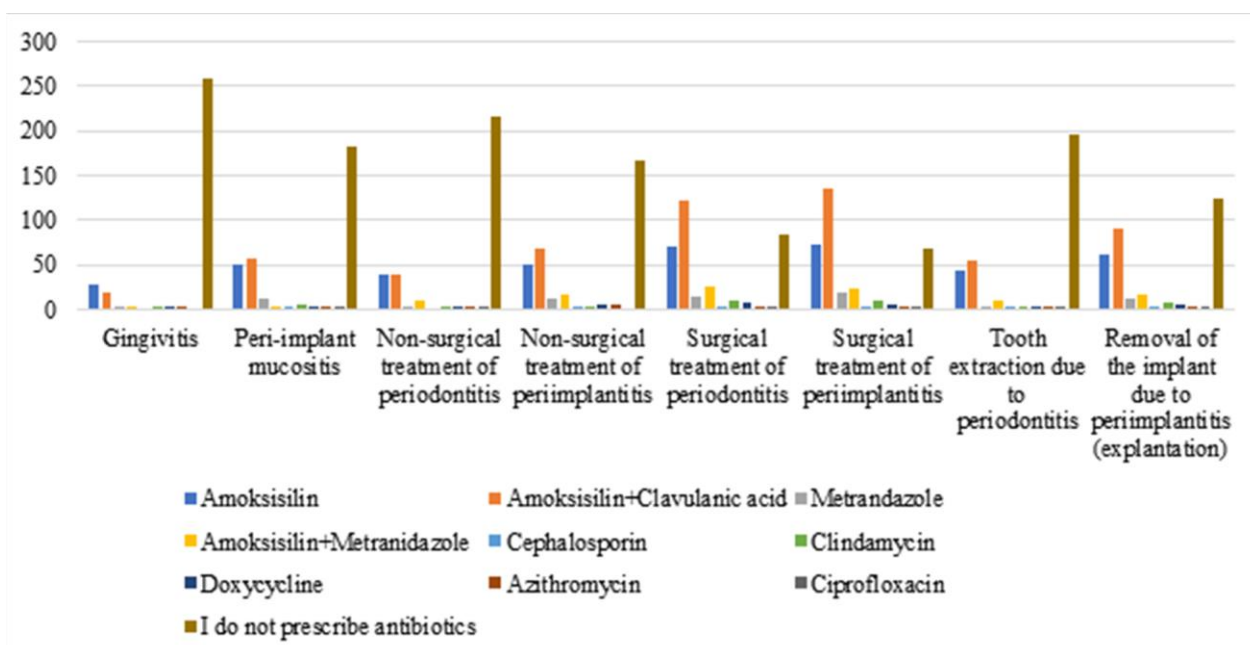
Table 3 compares the antibiotic prescribing habits for the initial, nonsurgical treatment of periodontitis and peri-implantitis. We found that 24.6% of respondents who did not prescribe them for periodontitis also prescribed them for the nonsurgical treatment of peri-implantitis, and 56.8% who did not prescribe them for periodontitis also did not prescribe them for the nonsurgical treatment of peri-implantitis ($p < 0.001$).

A comparison of antibiotic prescribing habits for the surgical treatment of periodontitis and peri-implantitis is shown in **Table 4**. Of those who prescribed antibiotics for the surgical treatment of periodontitis, 95.4% also prescribed them for the surgical treatment of peri-implantitis ($p < 0.001$). However, 48% of those who did not prescribe them for the surgical treatment of periodontitis did prescribe them for peri-implantitis.

Table 5 compares antibiotic prescription habits for tooth extractions due to periodontitis and implant removals due to peri-implantitis. Among those who did not prescribe antibiotics for tooth extraction due to periodontitis, 43.3% similarly refrained from prescribing them for implant removal (explantation) due to peri-implantitis ($p < 0.001$). Conversely, 37.2% of those who abstained from antibiotic prescription for tooth extraction due to periodontitis opted to prescribe antibiotics for implant removals associated with peri-implantitis.

Table 1. Antibiotic prescription habits of dentists in Turkey for patients with periodontal and peri-implant diseases

	Frequency (n) / Mean \pm s. deflection	Percent (%) / Median (min - max)
Treatment of Gingivitis		
I do not perform this treatment procedure	24	7,7
Yes	20	6,4
No	268	85,9
Treatment of Peri-implant mucositis		
I do not perform this treatment procedure	81	26
Yes	99	31,7
No	132	42,3
Initial periodontal treatment of periodontitis (non-surgical)		
I do not perform this treatment procedure	30	9,6
Yes	46	14,7
No	236	75,6
Non-surgical treatment of peri-implantitis		
I do not perform this treatment procedure	76	24,4
Yes	96	30,8
No	140	44,9
Surgical treatment of periodontitis		
I do not perform this treatment procedure	87	27,9
Yes	175	56,1
No	50	16
Surgical treatment of peri-implantitis		
I do not perform this treatment procedure	87	27,9
Yes	194	62,2
No	31	9,9
Tooth extraction due to periodontitis		
I do not perform this treatment procedure	40	12,8
Yes	57	18,3
No	215	68,9
Removal of the implant due to peri-implantitis (explantation)		
I do not perform this treatment procedure	78	25
Yes	135	43,3
No	99	31,7

**Figure 1.** Preferred antibiotics for the treatment of periodontal and peri-implant diseases

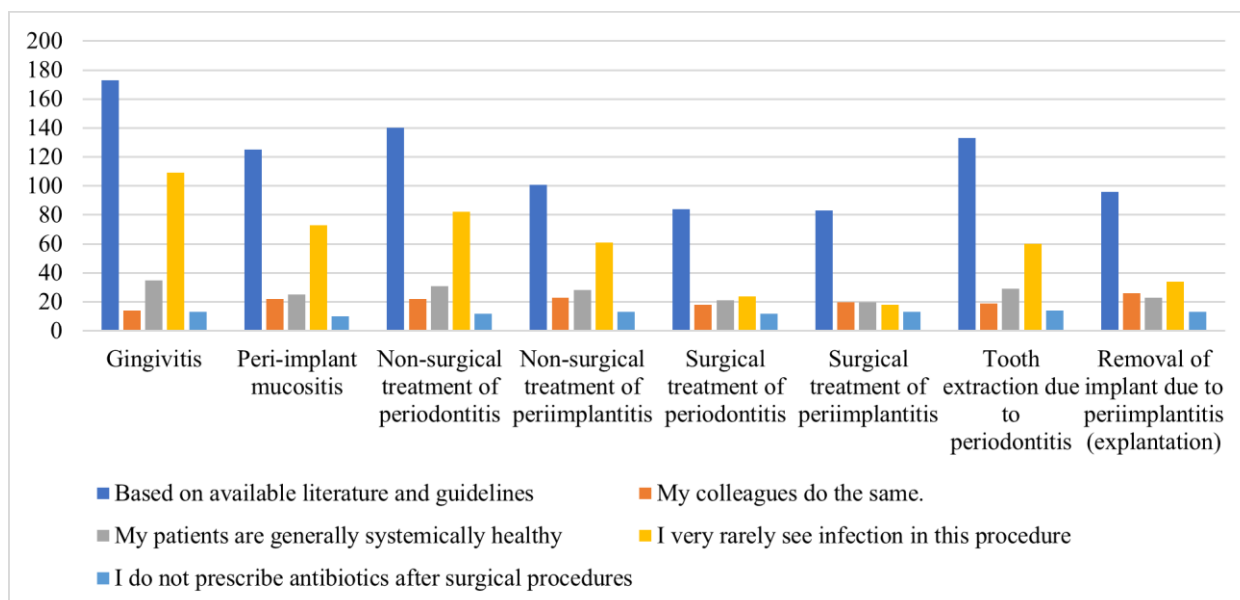


Figure 2. Reasons for not prescribing antibiotics when treating periodontal and peri-implant diseases.

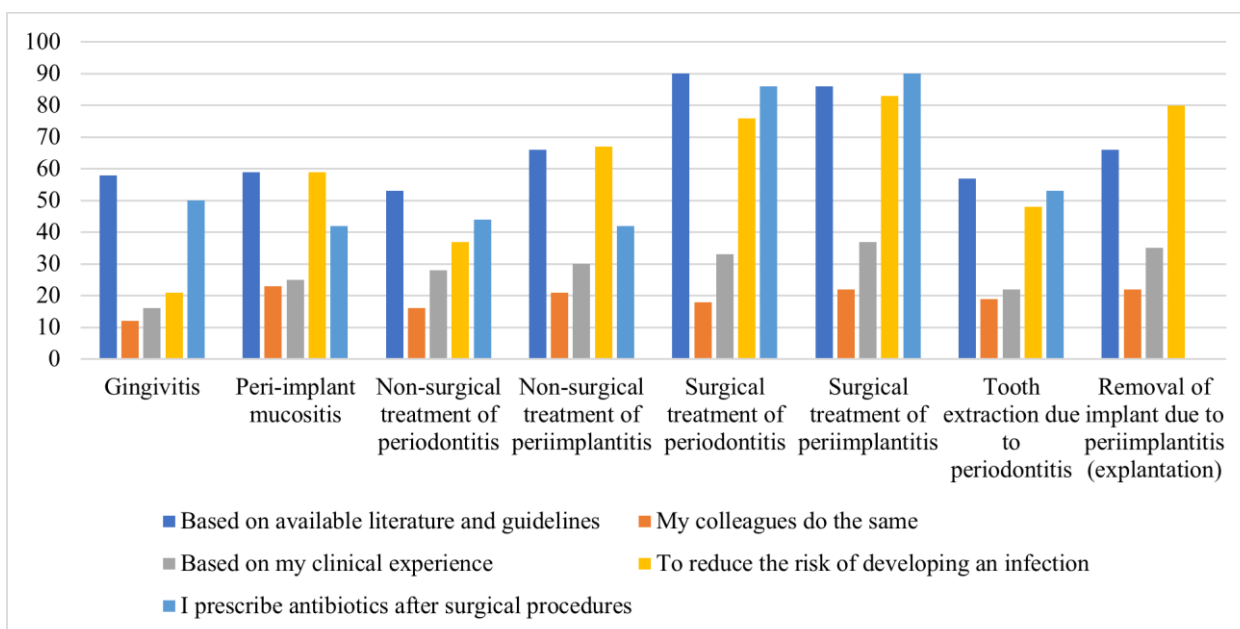


Figure 3. Reasons given for prescribing antibiotics in periodontal and peri-implant diseases

Table 2. Comparison of preferred antibiotics for the treatment of gingivitis and peri-implant mucositis

The antibiotic of choice for the treatment of gingivitis								
	Amoxicilin	Amoxicilin+Clavulanic acid	Amoxicilin+Metranidazole	I do not prescribe antibiotics	Azithromycin	Doxycycline	Clindamycin	Metranidazole
The antibiotic of choice for the treatment of peri-implant mucositis								
Amoxicilin	19 (70,4)	2 (10,5)	0 (0)	29 (11,2)	0 (0)	0 (0)	0 (0)	0 (0)
Amoxicilin+Clavulanic acid	7 (25,9)	14 (73,7)	0 (0)	36 (13,9)	0 (0)	1 (100)	0 (0)	0 (0)
Amoxicilin+Metranidazole	0 (0)	0 (0)	2 (100)	2 (0,8)	0 (0)	0 (0)	0 (0)	0 (0)
I do not prescribe antibiotics	0 (0)	2 (10,5)	0 (0)	180 (69,5)	0 (0)	0 (0)	0 (0)	0 (0)
Azithromycin	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (100)	0 (0)
Doxycycline	0 (0)	0 (0)	0 (0)	3 (1,2)	0 (0)	0 (0)	0 (0)	0 (0)
Clindamycin	0 (0)	0 (0)	0 (0)	5 (1,9)	0 (0)	0 (0)	0 (0)	0 (0)
Metranidazole	1 (3,7)	2 (10,5)	0 (0)	9 (3,5)	0 (0)	0 (0)	0 (0)	2 (100)
Cephalosporin	0 (0)	0 (0)	0 (0)	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)
Ciprofloxacin	1 (3,7)	0 (0)	0 (0)	1 (0,4)	0 (0)	0 (0)	0 (0)	0 (0)

a) Frequency (percentage), comparison not appropriate due to the number of observations

Table 3. Comparison of the antibiotics prescribed for the initial, nonsurgical treatment of periodontitis versus the nonsurgical treatment of peri-implantitis.

	Prescribing antibiotics in the initial periodontal treatment (non-surgical) of periodontitis.				
	I do not perform this treatment procedure	Yes	No	Test sta	p
Prescribing antibiotics for the non-surgical treatment of peri-implantitis					
I do not perform this treatment procedure	27 (90)a	5 (10,9)b	44 (18,6)b		
Yes	2 (6,7)a	36 (78,3)b	58 (24,6)a	132,837	<0,001
No	1 (3,3)a	5 (10,9)a	134 (56,8)b		

a) Chi-square test, frequency (percentage)

b) a-b: There is no difference between the ratios with the same letter in each row

Table 4. Comparison of antibiotic prescribing habits for the surgical treatment of periodontitis and peri-implantitis

	Prescribing antibiotics in the surgical treatment of periodontitis				
	I do not perform this treatment procedure	Yes	No	Test sta.	p
Prescribing antibiotics in the surgical treatment of peri-implantitis					
I do not perform this treatment procedure	80 (92)a	5 (2,9)b	2 (4)b		
Yes	3 (3,4)a	167 (95,4)b	24 (48)c	345,917	<0,001
No	4 (4,6)a	3 (1,7)a	24 (48)b		

b) a-b: There is no difference between the ratios with the same letter in each row

Table 5. Comparison of antibiotic prescriptions for tooth extraction due to periodontitis and the removal of an implant (explantation) due to peri-implantitis

Prescribing antibiotics for implant removal (explantation) due to peri-implantitis	Prescribing antibiotics for tooth extraction due to periodontitis				
	I do not perform this treatment procedure	Yes	No	Test sta.	p
I do not perform this treatment procedure	30 (75)a	6 (10,5)b	42 (19,5)b		
Yes	8 (20)a	47 (82,5)b	80 (37,2)a	103,383	<0,001
No	2 (5)a	4 (7)a	93 (43,3)b		

a) Chi-square test, frequency (percentage)

b) a-b: There is no difference between the ratios with the same letter in each row

DISCUSSION

Periodontal disease is common in adults. It is an inflammatory condition of bacterial origin that affects the supporting tissues of the teeth(1, 2). Similarly, the leading cause of inflammatory diseases surrounding an implant is the accumulation of microbial dental plaque (3). Despite surgical and nonsurgical treatments (and ideal oral hygiene), periodontal destruction can still occur. In systematic reviews conducted by Herrera et al. and Haffajee et al., it was found that the combination of systemic antibiotics with mechanical periodontal therapy conferred benefits in the management of periodontal disease and other inflammatory oral conditions (10, 14). Due to the high microbial diversity associated with periodontal and peri-implant diseases and the limited number of studies suggesting clinical guidelines for systemic antibiotics in periodontology, practitioners may need clarification on the most appropriate antibiotic to treat these conditions (11, 13). Therefore, in this study, we aimed to create a guide for dentists on the use of antibiotics by evaluating the compatibility of our results with data from the existing literature.

Gingivitis is a direct immune response against microbial dental plaque for which nonsurgical treatment can be successful. Therefore, there is typically no need to use systemic antibiotics (15).

This is supported by the results of a survey conducted among periodontists in Australia, where no dentists were found to prescribe systemic antibiotics in plaque-induced gingivitis (16). Similarly, in a study conducted in Germany, 94.3% of dentists said they never prescribed systemic antibiotics for the treatment of gingivitis (17). These results are in line with our study, where 85.9% of the respondents did not prescribe antibiotics for gingivitis.

Currently, CIST (cumulative interceptive supportive therapy) protocols are used for the treatment of peri-implant diseases, and protocols A and B (which include oral hygiene and motivation, mechanical cleaning, and chlorhexidine mouthwash/gel applications) are used to control inflammation in peri-implant mucositis (without systemic antibiotics) (18). In a clinical study by Hallström et al., the authors concluded that nonsurgical debridement should be the first treatment option for peri-implant mucositis, without additional systemic antibiotics (19). In a survey conducted among Australian periodontists, 63.04% said they never used systemic antibiotics to treat peri-implant mucositis (20). In this study, we also found that only 31.7% of respondents said they used antibiotics to treat peri-implant mucositis, with 42.3% stating they did not.

Of the respondents who used antibiotics, amoxicillin + clavulanic acid (18.3%) was the preferred treatment; reasons given for this were based on the available literature and guidelines and to reduce the risk of infection (30.9% for both). Interestingly, the same reasons were used by respondents who did prescribe antibiotics (55.1% and 32.2%, respectively). Hence, the results of our study are consistent with the current literature, with the number of dentists who did not prefer to use antibiotics for treating peri-implant mucositis being higher than those who did.

Gingivitis and peri-implant mucositis are similar diseases, and mechanical plaque control for removing microbial dental plaque is typically a sufficient treatment (21, 22). In our study, nearly 70% of respondents who did not prescribe antibiotics for gingivitis also did not prescribe them for peri-implant mucositis. Over 80% of the respondents stated that they did not prescribe antibiotics based on current literature and guidelines and rarely saw infections during treatment for these procedures.

For systemic antibiotics to be effective in periodontal therapy, the integrity of the organized biofilm must be disrupted by mechanical instrumentation (23). In a survey conducted in Germany, 83% of dentists stated that they never prescribed systemic antibiotics for chronic periodontitis (17). Similarly, a study conducted in Turkey reported that systemic antibiotic prescriptions are recommended for chronic periodontitis 2% of the time (24). In our research, and in line with the literature, 75.6% of the respondents did not prescribe antibiotics for the initial, nonsurgical treatment of periodontitis. Although combination therapy involving debridement and adjunctive systemic antibiotic usage has demonstrated clinical efficacy, it's noteworthy that scaling and root planing alone have shown clinical improvement in numerous cases. Moreover, nonsurgical periodontal treatment has proven successful in the majority of patients with chronic periodontitis, rendering systemic antibiotics unnecessary (15).

In a randomized, controlled clinical trial investigating the nonsurgical treatment of peri-implantitis, a mean decrease of 2.28 mm in pocket-depth-on-probe was observed after 12 weeks in patients given a combination of amoxicillin + metronidazole following mechanical debridement (25). In another study conducted with periodontists in the United States, participants stated that they always (24.3%) or frequently (34.1%) used systemic antibiotics for treating peri-implantitis. Amoxicillin (31.8%) and amoxicillin + metronidazole (38.5%) was the preferred antibiotic among respondents (26). Similarly, in a survey conducted in Australia, dentists reported that they always (43.88%) or frequently (30.61%) prescribed systemic antibiotics when treating peri-implantitis, with amoxicillin + metronidazole being the most commonly chosen combination (41.84%) (20). In our study, 30.8% of the respondents said they prescribed antibiotics during the nonsurgical treatment of peri-implantitis, while 44.9% did not prescribe them. The most commonly prescribed antibiotic was amoxicillin + clavulanic acid (21.5%). The most frequently cited reason for prescribing antibiotics was to reduce the risk of infection (33.7%), and the most common reason for not prescribing them was based on the available literature and guidelines (48.6%).

According to the Consensus Report of the 6th European Workshop of Periodontology, results of nonsurgical treatment for peri-implantitis were unpredictable and ineffective compared to surgical procedures. Hence, when nonsurgical mechanical therapy does not resolve lesions, antimicrobials and access flap surgery have been recommended (15). Furthermore, mechanical cleaning alone is not sufficient in cases of peri-implant diseases with radiographic bone loss, and according to CIST protocols, systemic antibiotics would then be required (18).

The etiologies of periodontitis and peri-implant infections are similar; therefore, therapeutic approaches should be antimicrobial. The long-term results of nonsurgical mechanical debridement and maintenance appointments are successful in mild to moderate periodontitis cases. However, in peri-implant diseases, mechanical debridement and disinfecting implant surfaces may not be sufficient to remove oral biofilms and periopathogenic bacteria due to differences in implant surface properties and the difficulty in accessing areas with prosthetic restorations (27). Moreover, as implants do not have supracrestal connective tissue, infection develops faster than periodontal tissue and can proceed directly to the bone. Therefore, peri-implantitis lesions should be treated as soon as they are diagnosed (28). However, due to a lack of adequate clinical studies comparing periodontitis and peri-implantitis, the benefits of using antibiotics and mechanical therapy with nonsurgical or surgical debridement are debatable. Still, the rapid progression of peri-implantitis and the significant differences compared to periodontitis lesions may justify using antibiotics for putative pathogens. Even if statistically insignificant, in our study, 24.6% of respondents who did not prescribe antibiotics for the initial (non-surgical) treatment of periodontitis prescribed antibiotics for the non-surgical treatment of peri-implantitis. Consistent with the literature, the results of our study show that dentists preferred using antibiotics to treat peri-implantitis as opposed to periodontitis.

Surgical treatment of periodontitis aims to provide greater accessibility for the mechanical debridement of root surfaces, removal of fibrous periodontal tissue to improve pocket reduction, providing a harmonious bone architecture for the gingiva to follow, and greater ability to follow oral hygiene by the patient and care by the dentist (29). In a survey conducted among periodontists in Australia, systemic antibiotics were frequently prescribed during the surgical treatment of chronic periodontitis and periodontal regenerative therapies. The most commonly prescribed antibiotics were azithromycin (73.3%), amoxicillin (60%), and amoxicillin + metronidazole (53.3%) (16). In a survey conducted by Hai, Justine Hoda et al., the authors found that the rate of systemic antibiotic prescriptions among dentists during traditional periodontal surgical treatments (i.e., no bone grafting required) was 22% and in GBR (guided tissue regeneration), it was 73%. The reasons for using antibiotics were to reduce the risk of infections, personal clinical experience, and patients having a condition that would contraindicate antibiotic use. In the same study, the most common reasons for not prescribing antibiotics included rarely observing infections with the procedures and following guidelines and best practices available in the literature (30).

In our study, 56.1% of respondents said they prescribed antibiotics while surgically treating periodontitis, with 43.3% preferring to use amoxicillin + clavulanic acid. The reasons for prescribing antibiotics were based on current literature and guidelines (37%), typically prescribing antibiotics after surgical procedures (31.3%), and to reduce the risk of infection (35.4%). Dentists may prescribe antibiotics for surgical procedures to avoid the consequences of an infection, which could result in adverse patient outcomes. When we reviewed the literature, we did not find a single antibiotic group preferred over another, but combined antibiotic groupings were often preferred to reduce the risk of postoperative infections. However, no studies have shown results that support these preferences.

Controlling peri-implantitis involves eliminating biofilm from the implant surface. However, the rough and uneven surface of the prosthesis and implant may complicate effective mechanical debridement.

According to CIST protocols, in cases of peri-implantitis characterized by clinical attachment loss and radiographic bone loss, mechanical cleaning alone proves insufficient. Therefore, supplemental systemic antibiotic administration is deemed necessary in conjunction with surgical interventions such as resection and guided bone regeneration (GBR) (18). In a clinical study by Carcuac et al. on respective surgical treatment of peri-implantitis with a 3-year follow-up, a radiographic bone level increase of 0.32 ± 1.35 mm was observed in patients who received systemic antibiotics (amoxicillin). In contrast, patients who did not receive antibiotics experienced a radiographic bone level loss of 0.51 ± 1.87 mm (31). In another study, 91% of dentists preferred to prescribe systemic antibiotics during GBR procedures, with 80% doing so to reduce the risk of infection (30). In our study, 62.2% of the physicians preferred to prescribe antibiotics alongside the surgical treatment of peri-implantitis, with 42.3% preferring amoxicillin + clavulanic acid. Thirty-five percent of the respondents typically used antibiotics after surgical procedures, 33.5% prescribed them based on current literature and guidelines, and 32.3% used them to reduce the risk of infection. As with the surgical treatment of periodontitis, dentists may prefer to prescribe antibiotics during this procedure as opposed to during nonsurgical ones. This may be especially common after regenerative procedures, as dentists may prescribe antibiotics under patient pressure. Practitioners may also have difficulty explaining why an antibiotic was not prescribed if the patient develops an infection. There are few clinical studies investigating the use of adjunctive antibiotics in the surgical treatment of peri-implantitis, and no consensus concerning which antibiotic would provide the most benefit.

Surgical treatment of periodontitis and peri-implantitis aims to decontaminate the implant/root surface and establish hard and soft tissue peri-implant/periodontal anatomy that promotes dental hygiene and regeneration of intraosseous defects. In an 11-year follow-up study, open debridement, CHX (chlorhexidine) irrigation, and postoperative systemic metronidazole were recommended as a first-line treatment for implants with severe bone loss. In the second treatment (occurring 4 years after treatment initiation), additional mechanical debridement with nonsurgical treatment, subgingival irrigation with CHX and tetracycline (Actisite)

were administered. After another 5 years of follow-up, stable peri-implant bone levels were observed, demonstrating the importance of antimicrobial therapy for peri-implant disease control (27). In our study, 95.4% of respondents who preferred using antibiotics in conjunction with the surgical treatment of periodontitis also used them in the surgical treatment of peri-implantitis.

However, nearly half (48%) of respondents who refrained from antibiotic usage during surgical treatment for periodontitis expressed a preference for utilizing them in the surgical management of peri-implantitis. This may be due to concerns over providing optimal treatment for peri-implantitis. Unfortunately, no randomized controlled trials or surveys directly compare peri-implantitis and periodontitis. However, separate clinical studies on peri-implantitis and severe periodontitis do exist and clearly show the benefits of systemic antibiotic use in conjunction with surgery (27, 31, 32).

Most complications from periodontal and other infections following tooth extraction can be managed with simple oral hygiene measures. Typically, there is no need to use antibiotics after a tooth extraction, except in cases requiring prophylaxis (33). In one survey, only 6% of respondents reported prescribing antibiotics due to postextraction infections, and for the treatment of these infections, 40% preferred amoxicillin (34). This is in line with the results of our study.

Removal of an implant due to peri-implantitis is similar to routine tooth extractions. In one study, 63.1% of respondents preferred implant extraction, and 52.2% used antibiotics for implants with radiographically-confirmed 75% vertical bone loss, suppuration, and 12 mm deepest probable pocket depth (35). This contrasts with results from our study, where 43.3% of respondents indicated they would prescribe antibiotics for explantation due to peri-implantitis, and 31.7% stated they would not use them. Dentists in our study who frequently prescribed antibiotics (29.3%) preferred to use amoxicillin + clavulanic acid. Those who did not prescribe them did so based on information in the current literature and guidelines (53.6%), and who prescribed antibiotics they did so to reduce the risk of infection (36.5%). To our knowledge, no studies have investigated the benefits of systemic antibiotic use for this procedure; however, dentists may prescribe antibiotics based on their clinical experience.

Implant removal and periodontal tooth extraction are no different from other tooth extraction procedures. Therefore, systemic antibiotic use for prophylactic purposes may reduce the risk of bacteremia and post-operative infection if the patient's life is at risk. In our study, physicians preferred to prescribe antibiotics for similar reasons. In this situation, some dentists may prescribe antibiotics to reduce risk, as they may be more cautious about surgical interventions to treat diseases surrounding an implant. However, as there is no study in the literature comparing these two procedures together, it is difficult to make assumptions.

The number of respondents with professional years of experience (0-5 years) was relatively high (77.6%). Therefore, systemic antibiotics could have been prescribed inappropriately, especially if there was less clinical experience with surgical procedures and a desire to avoid

possible complications. However, due to the low number of respondents, it is difficult to generalize our conclusions to all dentists in Turkey. Therefore, further survey studies with larger sample sizes are needed to better understand antibiotic prescribing habits. However, based on our results, we believe there is a need for recommendations and guidelines in the use of antibiotics to treat periodontal and peri-implant diseases.

CONCLUSION

The rate of prescribing antibiotics for gingivitis, peri-implant mucositis, nonsurgical treatment of periodontitis, and tooth extraction due to periodontitis was lower than for other dental procedures. However, there was an increasing tendency to prescribe them as procedures moved from nonsurgical to more complicated surgical ones. The most frequently prescribed antibiotic group was amoxicillin + clavulanic acid, and the most common reasons for prescribing them were to reduce the risk of infection and to follow recommendations in the available literature and guidelines. When comparing periodontal diseases with peri-implant diseases, the responses we obtained were aligned with one another. This suggests that the participating dentists considered peri-implant diseases as a type of periodontal disease surrounding the implant and treated the conditions similarly. In addition, this study is unique in that it is the first survey to compare periodontal and peri-implant diseases to one another.

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Author Contributions: **GE, DK:** Designed and directed the study, Literature search, Data collection, Statistics **GE:** Article writing, Final revisions. All authors reviewed the results and approved the final version of the manuscript.

Ethical approval: The present study was conducted in strict accordance with the principles outlined in the Declaration of Helsinki. Ethical approval for the study was obtained from the appropriate ethics committee. Informed consent was obtained from all participants of this study.

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