Acta Odontologica Scandinavica. 2014; 72: 806–810

informa
healthcare

ORIGINAL ARTICLE

Antibiotic prophylaxis patterns of Finnish dentists performing dental implant surgery

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Abstract

Background. The peri-operative use of prophylactic antibiotics in clinically healthy patients undergoing dental implant surgery is very common in Finland. While antibiotics are prescribed with the hope of preventing both local and systemic complications, their application and utilization is not uniform. ***Objective.*** The aim of this study was to assess the variation in prescribing patterns among Finnish dentists performing dental implant placement operations. This study also aimed to examine the possible relationship between early implant removal and the use of the prophylactic antibiotics in Finland. ***Materials and methods.*** The National Institute for Health and Welfare in Finland granted permission to access the Finnish Dental Implant Register. The peri-operative antibiotic prophylaxis prescribing patterns were assessed in a total of 110 543 dental implant placement procedures and 1038 dental implant removal operations performed in Finland between April 1994 and April 2012. ***Results.*** A total of 61 different antibiotics or combinations were prescribed peri-operatively during implant placements in Finland between 1994–2012. Phenoxymethylpenicillin was the most commonly prescribed drug (72.2%). No statistically significant difference in early implant removal rates could be found between patients who had or had not received peri-operative prophylaxis. However, patients who had received peri-operative prophylaxis had statistically significant longer implant survival rates. ***Conclusion.*** There is a variation in antibiotic prescribing patterns among Finnish dentists placing dental implants. The results suggest that the use of prophylactic antibiotics has little effect on the prevention of primary implant surgery-related complications and, hence, success rates.

Key Words: *antibiotics, prophylaxis, dental implants*

Introduction

According to the National Institute for Health and Welfare, the success rate of dental implant operations in Finland is over 98% [1]. The rate of primary complications is under 0.4% [1]. The aim of this study was to investigate the prescribing patterns of peri-operative antibiotics in dental implant operations performed in Finland and to assess the possible correlation between early implant failure and the use of prophylactic antibiotics.

One of the main reasons for prophylactic antibiotic usage is to prevent local and systemic complications, after dental implant placement. Oral operations are considered to be high-risk procedures for transient bacteraemia [2–6]. Over 100 different species of oral bacteria have been detected in the peripheral blood after oral surgical operations, with Streptococcus viridians being the most predominant of all species [5,6]. Literature that focuses on bacteraemia following dental implant placement is, however, still very limited and controversial.

A study performed by Piñeiro et al. [7] on 50 patients undergoing dental implant placement showed no significant risk of bacteraemia; whereas a study performed by Bölükbasi et al. [2] diagnosed

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(Received 19 November 2013; accepted 24 March 2014)

ISSN 0001-6357 print/ISSN 1502-3850 online
DOI: 10.3109/00016357.2014.913194

bacteraemia in 23% of patients, after dental implant placement. According to past reports [8–11] and now a recent Cochrane review based on six randomized controlled clinical trials, the use of prophylactic antibiotics is recommended [12].

One major challenge in assessing the effects of peri-operative prophylactic antimicrobial usage is the wide variety of antibiotic drugs and dental implants in use. Finland has a long history of long-term dental implant monitoring and, to the best of our knowledge, it is the only country in the world with a national Dental Implant Register, which has been in place since 1994. The Finnish Dental Implant register is a valuable source of information for the long-term assessment of dental implants. The register provides comprehensive data on all implants placed and removed since the establishment of the register in 1994. The Finnish implant register is based on self-reported data from dentists and is collected by questionnaire.

Materials and methods

A retrospective analysis of antibiotic prescribing patterns and their effects on implant survival rates in Finland was conducted under section 4(1) of the Act on National Personal Data Registers kept under the Health Care System (556/1989, amendm. 38/1993) and section 28(1) of the Finnish Act on the Openness of Government Activities (621/1999). The National Institute for Health and Welfare (THL) granted permission to access data in the Finnish Dental Implant Register from April 1994 to April 2012 for this purely register-based research project. The study was conducted at the Oral and Maxillofacial Unit, Department of Otorhinolaryngology, Tampere University Hospital, Finland and the Science Center, Pirkanmaa Hospital District, Finland.

The implant register data used in this study is not publically available and to the best of our knowledge this is the first time that THL has granted access to an external research group to assess the effects of antibiotic prescribing patterns and their effects on implant survival rates in Finland.

After accessing and analysing the data provided by THL, it was apparent that the data contained some errors and some information was missing. It was, therefore, not possible to classify all data unambiguously and our methods for handling these errors might have differed slightly from the methods used by THL in their annual reports. The Finnish implant register is based on self-reported data from dentists and is collected by questionnaire.

In this study, we analysed question B7 of the questionnaire (Prophylactic antibiotic drug therapy) and correlated the data to question B8 (Primary complications) on the questionnaire. In question B8, several alternatives were given: infection, inappropriate position of the implant, damage to nerve and other complications (Table I).

All implants that had been placed in 2011 and 2012 had a limited follow-up time-period only up to the end of April 2012 and were, therefore, omitted from the statistical analysis.

The statistical analysis was performed using SPSS (IBM SPSS Statistics for Windows, Version 19.0. IBM Corp, Armonk, NY) and Excel (Microsoft Excel 2010). Differences in failure rates for gender, maxillary or mandibular fixture placements were analysed with Chi-square tests. The Mann-Whitney test was used for comparisons concerning follow-up time.

Results

A total of 198 538 dental implants including 51 different implant types had been placed in Finland between 1994–2012 in 110 543 separate operations. A total of 1988 implants placed in 1038 different operations developed early complications, during the first 10 days (Table I). A total of 61 different antibiotics or combinations were prescribed peri-operatively for this group of patients (Figure 1).

Antibiotics were prescribed in 1640 of the 2521 (65.1%) implant placement operations that eventually resulted in implant removals. In 16.4% ($n = 414$) of the operations, no antibiotics were prescribed. In 18.5% ($n = 467$) of the reported operations, no information could be found about the type of antibiotics used. Early implant failure occurring within 6 weeks of implant placement was 12.7% in those cases where antibiotics were prescribed and 15.0% when no antibiotics were prescribed (Figure 2). The corresponding failure proportions using an 8-week (60 days) time limit were 17.2% for the group prescribed antibiotics and 18.8% for the group not prescribed antibiotics. These differences were not statistically significant. However, when longer removal times were taken into account, more specifically in the analysis, there was a statistically significant ($p < 0.001$) difference between removal time patterns. Removal times were longer for those patients who had received peri-operative antibiotic prophylaxis. The distributions of removal times between patients groups are presented in Figure 2.

Table I. Responses to question B8 from the THL questionnaire.

Question B8	
No Complication (empty)	109 505
Infection	91
Inappropriate position of the fixture	291
Damage to nerve	34
Other complication	622

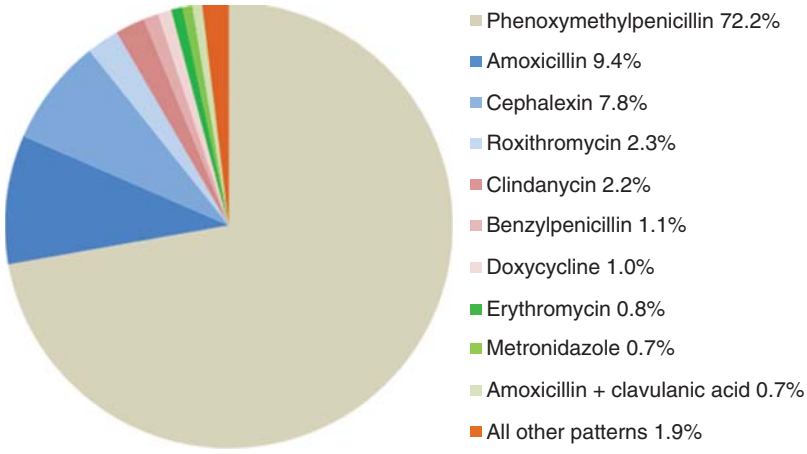

Figure 1. Distribution of the most common antibiotic prescribing patterns.

Discussion

There are no common guidelines for antibiotic prophylaxis for implant surgery in Finland. Furthermore, this study demonstrates a wide variation in antibiotic prescribing patterns amongst Finnish dentists and oral surgeons, when placing dental implants. The results also showed that phenoxymethylpenicillin was by far the drug of choice among Finnish dentists.

Growing resistance to traditionally prescribed antibiotics has been demonstrated and there has been pressure on all practitioners including dentists, to reduce their use of antibiotics [13]. Given this climate of change, there has been a trend to re-examine the use of prophylactic antibiotics in many areas of healthcare. These include neurosurgery and prophylactic antibiotics for basilar skull fractures [14], gynaecologic surgery [15], general surgery and prophylactic antibiotics for penetrating abdominal trauma [16], plastic surgery and antibiotic prophylaxis [17], antibiotic prophylaxis for mammalian bite wounds [18], otolaryngology and prophylactic antibiotics for clean-contaminated ear surgery [19] and dentistry questioning of the use of antibiotics to prevent complications following tooth extractions [20].

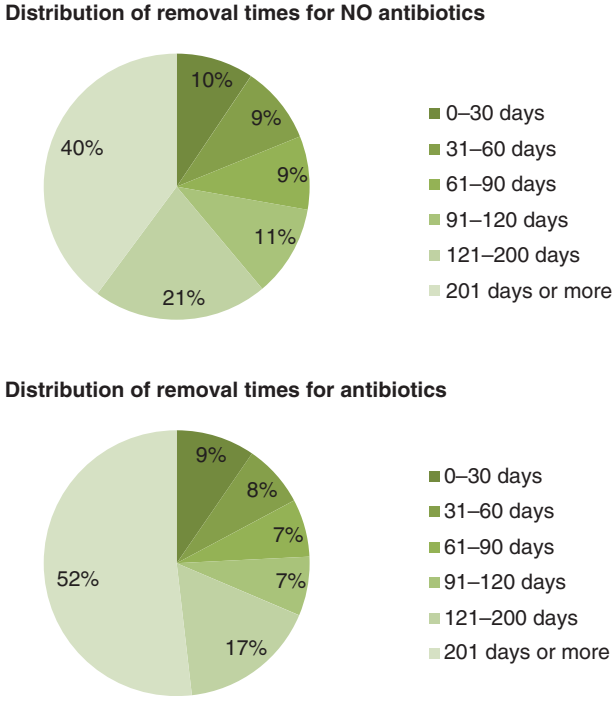

Figure 2. Distribution of implant removal times relative to antibiotic prophylaxis status.

There have also been numerous revisions of recommendations for prophylaxis of infective endocarditis (IE) by the American Heart Association (AHA) [21], the British Society for Antimicrobial Chemotherapy [22], the Australian Prevention of Endocarditis Guidelines [22] and the National Institute for Clinical Excellence (NICE) [23]. While both the AHA and NICE agree that the benefit of prophylaxis for dental treatment is as of yet unproven, NICE has recommended no antibiotic cover for any patients previously classified as 'at risk' of IE, while the AHA has recommended coverage only for patients deemed to be at high risk of developing IE [21–25]. Given this background of ongoing debate, it seems reasonable to re-examine the use of prophylactic antibiotic for surgical procedures pertaining to dental implants.

Interestingly, the results of this study of antibiotic prescribing patterns and implant surgery in Finland did not reveal any statistically significant differences in early implant failure (within 6 weeks from implant placement) between the groups of patients that had or had not been prescribed antibiotics. This suggests that the use of antibiotics does not have a significant effect on the prevention of the primary local implant complications directly after implant placement.

In addition, our results revealed that early complications seem to comprise surgical complications rather than infections. There were 3-times more early complications associated with inappropriate fixture positioning than infections, being 291 and 91, respectively.

Interestingly, when the long-term implant survival rates (201 days or more) were assessed, those patients who had received pre-operative prophylaxis had statistically significant longer implant survival rates than those who had not received pre-operative prophylaxis.

The efficacy of antibiotic prophylaxis in reducing failure of integration and post-operative complications when placing dental implants remains equivocal. According to a recent Cochrane review [12], a significant difference in early implant failures was found between the group that received antibiotic prophylaxis and the group that did not. There was, however, no difference in post-operative infections between these groups [11,12]. According to the review, the number of patients that need to be treated with antibiotics to prevent one implant failure is 25 [11]. However, according to this study, antibiotics do not seem to play a major role in the prevention of early complications.

One limitation of the study is that the Finnish implant register is based on self-reported data from dentists collected by questionnaire. Questionnaires have certain advantages and they offer a possibility of studying large data samples easily, quickly and inexpensively. However, participants may not respond truthfully, either because they wish to present their results differently or because the respondent does not understand the questions posed. The self-reported basis of the register is the major limitation of the data of this preliminary study. Efforts to improve the reliability of the implant register should be performed. One major way of improving the validity of self-reported data in the Finnish implant register would be to offer clinicians total confidentiality by excluding the name of the clinician and the dental office. This would allow respondents to give more truthful responses and to avoid possible sanctions, especially when reporting implant removals. The authors also note that it was not possible to determine if the antibiotics were used as a single dose prophylaxis or as part of a multi-dose peri-operative prophylactic regime. This is a major limitation of this study. This study highlights the need for evidence-based guidelines with respect to prophylactic antibiotic prescribing when placing dental implants.

Conclusion

A wide variation in antibiotic prescribing patterns with respect to drugs chosen, dose and duration were found in Finland. Furthermore, according to this study, antibiotic prophylaxis does not seem to play a major role in the prevention of early implant complications. Specific guidelines as well as further prospective randomized studies are needed.

Declaration of interest: The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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