Influence of Different Prophylactic Antibiotic Regimens on Implant Survival Rate: A Retrospective Clinical Study

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ABSTRACT

Background: The routine use of antibiotics in oral implant treatment seems to be widespread. The pre- or postoperative use of antibiotics in conjunction with implant surgery and its correlation with failure and success rates are poorly documented in the literature. The debate regarding overprescription of antibiotics raises the need for a critical evaluation of proper antibiotic coverage in association with implant treatment.

Purpose: The purpose of this study was to compare the implant survival rate following a 1-day single-dose preoperative antibiotic regimen with that following a 1-week postoperative antibiotic protocol.

Materials and Methods: The study included 868 consecutively treated patients. A total of 3,021 implants were placed. The population was split into two categories, either receiving a 1-day single-dose administration only, or a 1-week postoperative administration of antibiotics. Healing was evaluated at second-stage surgery (6 months for the upper jaw, 3 months for the lower jaw). Failure was defined as removal of implants because of non-osseointegration. Statistical analyses were performed with analysis of variance and the Scheffé test, with a significance level of 5% for comparison of data.

Results: No significant differences with regard to complications and implant survival were found in the study.

Conclusion: Based on the present data, a more restrictive regimen consisting of a 1-day dose of prophylactic antibiotic in conjunction with routine implant procedures is recommended.

KEY WORDS: antibiotics, dental implants, failures, microbiology, survival rate

During the last 50 years there has been considerable discussion about the use of antibiotic prophylaxis in conjunction with oral surgical procedures. The routine use of antibiotics in oral implant treatment still seems to be controversial, and such use varies widely. In oral and maxillofacial surgery the guidelines for using antimicrobial prophylaxis have been widely discussed, but such treatment has been demonstrated to be effective in preventing postsurgical wound infections.[1] However, the fundamental principles seem often to be ignored. Antibiotic therapy is often initiated at an inappropriate time and continued beyond the time required to influence the reduction of infection.[2] Antibiotic selection in implant surgery is generally aimed at streptococci, anaerobic gram-positive cocci, and anaerobic gram-negative rods, which are considered the most pathogenic for oral infections. According to Page and colleagues in 1993,[3] the antibiotics used for prophylaxis in oral surgery should be both bactericidal and the least toxic agents available. At present there are few reports concerning the duration of antibiotic use in association with implant placement. Furthermore the appropriate time for the initiation of prophylaxis is not fully known.

The purpose of this study was to compare the implant survival rate and the frequency of complications

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correlated to the use of a 1-day single-dose antibiotic prophylactic regimen or a 1-week postoperative antibiotic protocol in conjunction with routine oral implant surgery.

MATERIALS AND METHODS

Patients referred to the Department of Oral and Maxillofacial Surgery at Norra Älvsborgs Länsjukhus, Trollhättan, Sweden, for oral implant treatment were included in the study. A retrospective analysis was performed, and the patient population was divided into two groups as described below.

From January 1990 to May 1997, all patients received an antibiotic regimen consisting of 2 g phenoxymethyl penicillin (Astra, Mölndal, Sweden) twice daily for 1 week postoperatively, the first dose being given 1 hour prior to surgery (group I).

From August 1997 until December 2000 (the termination date for the study), the routine changed, and patients received only one dose of phenoxymethyl penicillin (2 g) 1 hour preoperatively and one dose postoperatively the same day (group II).

Patients with general disease and requiring extended antibiotic prophylaxis for other reasons were excluded from the study.

A total of 868 consecutively treated patients were included in the study (403 men and 465 women). The mean age was 54.1 years (range, 15–91 years). A total of 3,021 implants were installed during the study period. Two implant systems were used: the Brånemark System® (Nobel Biocare AB, Göteborg, Sweden) and the ITI Dental Implant System® (Straumann AG, Waldenburg, Switzerland). The implants were installed according to the standard protocol recommended by the manufacturer of the system used.[4] All surgical procedures were performed by three oral and maxillofacial surgeons with at least 5 years' experience in implant surgery. No statistical differences with regard to failure rates were seen among the surgeons.

In group I patients 2,236 implants (2,196 Brånemark implants and 40 ITI implants) were placed according to the group I protocol. Group II patients received 775 implants (309 Brånemark implants and 447 ITI implants).

Healing was evaluated after the recommended healing period, at the time of prosthetic rehabilitation. Postoperative infections during healing were recorded. Implant failure was defined as non-osseointegration of the implant according to the criteria of success described by Albrektsson and colleagues in 1988.[4] Statistical analysis was performed with analysis of variance and the Scheffé test. The level of significance was set at 5% for comparison of data.

RESULTS

In general few complications were seen in the present material. Postoperative swelling and edema were noted but were considered normal postoperative events. No postoperative infections were noted. Of a total of 3,021 implants placed, 67 were lost during the time of evaluation. In group I 59 of 2,236 implants failed, corresponding to an implant survival rate of 97.4%. In group II 8 of 785 implants failed to integrate, thereby contributing to an implant survival rate of 99% at the start of prosthetic rehabilitation. No statistically significant differences were seen between the two groups, and no statistically significant differences were found between the respective implant systems used during the study (Tables 1 and 2).

DISCUSSION

The installation of jawbone-anchored fixed prostheses on osseointegrated implants is a highly accepted treatment method based on high long-term implant survival rates.[4,5] In the present study high implant survival rates were seen in both groups, which is well in accordance with other authors. The failures were mostly

TABLE 1 Implants Inserted before May 1997 (Group I: Antibiotic Prophylaxis Regimen Including 1-Week Postoperative Therapy)*

Implant System	Successful Implants	% Successful Implants	Failed Implants	% Failed Implants	Total Implants
Brånemark	2,137	97.3	59	2.69	2,196
ITI	40	100	0	0	40

*No statistical differences in regard to implant survival were found between the groups.

TABLE 2 Implants Inserted after November 1997 (Group II: Single-Dose Antibiotic Prophylaxis Regimen)*

Implant System	Successful Implants	% Successful Implants	Failed Implants	% Failed Implants	Total Implants
Brånemark	304	98.3	5	1.6	309
ITI	473	99.0	3	< 1.0	476

*No statistical differences in regard to implant survival were found between the groups.

located in the maxilla, which is also in accord with reports in the literature.[6]

Reasons for implant failure have been widely discussed in the literature. In 1999 Esposito and colleagues[7] reported that one of the three major causes of implant failure might be infection associated with the surgical procedure itself. The importance of antibiotic prophylaxis is known; however, the impact of antibiotic prophylaxis in association with oral implant treatment is still somewhat scantily described in the literature. In an overview of 5,000 patients in 1997, Dent and colleagues[8] reported that the risk for implant failure was two to three times higher if no prophylactic antibiotics were given preoperatively. No differences were found between the groups that received only postoperative antibiotics or received no antibiotics at all. In a study reported in 1994, Holtz and colleagues[1] showed that giving patients antibiotics a few minutes preoperatively meets the pharmacokinetic requirements for preoperative antimicrobial prophylaxis in oral and maxillofacial surgery.

The importance of optimizing antibiotic therapy in conjunction with implant surgery should also not be neglected from a socioeconomic standpoint.[9] Overprescription of antibiotics is an environmental concern with regard to the obvious risk for the development of resistance in some of the most common pathogens in the oral cavity. The number of implant surgery procedures performed in 1 year nationally and globally is considerable. This also raises the issue regarding costs of prophylactic antibiotics for both the government and the patient.

The present study evaluated the use of a 1-day single-dose prophylactic regimen in comparison with prophylactic antibiotic therapy continued for 1 week postoperatively according to the standard protocol for implant treatment.[4] In this study the outcome of routine implant treatment was analyzed retrospectively. There are, of course, limitations in analyzing such patient material. First, the starting point and end point of the study were carefully chosen to eliminate a "learning curve" factor for the surgeons. Implant treatment was introduced at the clinic in 1986, thereby allowing at least 5 years of clinical experience for the surgeons prior to the starting point of the study. Second, the time frame between the starting point in 1990 and the end point in December of 2000 was also chosen in that only minor changes in implant design, such as self-tapping implants, were introduced at the clinic during this period. The implant survival rates of 97.5% and 99% in the respective groups (groups I and II) at the time of prosthetic rehabilitation demonstrate that a 1-day single-dose administration of antibiotic prophylaxis is a safe protocol for routine oral implant treatment. It is important that no bone augmentation procedures (ie, autogenous bone grafts or guided bone regeneration) were included. Such procedures, which create a more compromised site for wound healing initially, have yet to be analyzed from the point of view of antibiotic prophylaxis.

CONCLUSION

The results of the present study demonstrate that a reduction to a 1-day single-dose regimen of antibiotic prophylaxis in conjunction with routine oral implant surgery procedures does not affect the survival rate of oral implants and therefore can be recommended in the clinical setting.

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REFERENCES

1. Hotz G, Novotny-Lenhard J, Kinzig M, Soergel F. Single-dose antibiotic prophylaxis in maxillofacial surgery. Chemotherapy 1994; 40:65–69.
2. Norris LH, Doku HC. Antimicrobial prophylaxis in oral surgery. Curr Opin Dent 1992; 2:85–92.
3. Page CP, Bohnen JMA, Fletcher JR, McManus AT, Solomkin JS, Wittmann DH. Antimicrobial prophylaxis for surgical wounds. Guidelines for clinical care. Arch Surg 1993; 128: 79–88.
4. Albrektsson T, Dahl E, Enbom L, Engevall S, Engqvist B, Eriksson AR. Osseointegrated oral implants. A Swedish multicenter study of 8139 consecutively inserted Nobelpharma implants. J Periodontol 1988; 59:287–296.
5. Adell RM, Eriksson B, Lekholm U, Brånemark P-I, Jemt T. A long-term follow up study of osseointegrated implants in the treatment of totally edentulous jaws. Int J Oral Maxillofac Implants 1990; 5:347–359.
6. Lekholm U, Gunne J, Henry P, Higuchi K, Linden U, Bergström C. Survival of the Brånemark implant in partially edentulous jaws. A 10-year prospective multicenter study. Int J Oral Maxillofac Implants 1996; 11:450–455.
7. Esposito M, Thomsen P, Ericsson LE, Lekholm U. Histopathologic observations on early oral implant failures. Int J Oral Maxillofac Implants 1999; 14:798–810.
8. Dent CD, Olsson JW, Farish SE, et al. The influence on preoperative antibiotics on success of endosseous implants up to and including stage II surgery. J Oral Maxillofac Surg 1997; 55:19–24.
9. Friberg B. Sterile operating conditions for the placement of intraoral implants. J Oral Maxillofac Surg 1996; 54: 1334–1336.