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Original Research Article

Evaluation of treatment outcomes and clinical indications for antibiotic prophylaxis in patients undergoing implantation procedures

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ABSTRACT

Purpose: The use of antibiotic therapy during implantation to reduce the risk of an early implant failure is widely discussed among clinicists. However, half an hour after the procedure a quarter of patients show bacteremia which could decrease the efficacy of the surgery. Implant failure is associated with destruction of bone tissue within the alveolar process and may lead to an alternative but compromised treatment plan. The aim of the study was to evaluate the influence of perioperative antibiotic protection on success of implantation.

Material and methods: The retrospective study involved 1915 patients (females: 57.3%, males: 42.7%) with no systemic or local diseases, who required antibiotic therapy during surgical procedures. Group 1 comprised 203 patients with diagnosed vertical or horizontal bone atrophy within the alveolar ridge requiring reconstruction procedure before implantation. Group 2 included 1712 patients who did not need any surgical procedures before implantation. All the subjects took three types of antibiotics twice a day for 7 days. The data were statistically analyzed.

Results: A total number of 3309 implants were placed. Implantation efficacy in group 1 amounted to 98.53% and in group 2 it was 99.24%. Complications occurred most commonly after administration of cephalosporin which proved to be statistically significant for the patients who underwent augmentation with a bone block before the implant procedure (p 0.0209).

Conclusions: Perioperative use of antibiotic therapy beneficially influences tissue healing, provides safety and success of the surgical procedure, as well as translates into high efficacy of implantation (99.52%).

1. Introduction

The use of implants in rehabilitation of the stomatognathic system as alternative for conventional prosthetic restoration appears to be the biggest revolution in dentistry for the last two decades [1]. Restoration of a dental defect with an implant is a long-term, aesthetic, safe, and predictable solution [2]. However, in spite of a high implantation success rate, not all the procedures are successful and implant failure is associated with significant destruction of the bone tissue within the alveolar ridge, which puts the doctor and the patient in a very difficult situation when they develop an alternative treatment plan [3–5].

The most common reasons of an early implant failure are the lack of primary stability, surgical trauma, and infection [6], induced by mixed oral flora. The bacteria most frequently involved in these types of infections include streptococci, anaerobic gram positive cocci and anaerobic gram negative rods [7]. The research by Bölükbaşı confirmed occurrence of bacteremia 30 min after implantation procedure in 23% of patients and the following strains were found: Staphylococcus epidermidis, Eubacterium spp., Corynebacterium spp. and Streptococcus viridans [8].

Antibiotic therapy during implantation is broadly discussed but it is necessary to consider perioperative prophylaxis in the group of patients individually qualified for the surgical procedure, who present high implant infection risk (technical difficulties and developmental abnormalities). The authors agree that perioperative antibiotic prophylaxis is indicated in patients with systematic

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diseases such as cardiac conditions, immunosuppression or long-term bisphosphonate therapy [9,10]. Preventive antibiotic therapy in subjects qualified for the procedure as generally healthy aimed at decreasing the early implant failure is still being discussed [11]. Literature analysis showed 92% implantation success with no antibiotic protection, 96% if before the procedure the perioperative prophylaxis was used and the patient received a single dose of an antibiotic, and 97% procedure success if an antibiotic was administered before and after the implant was embedded [12]. Results of other studies demonstrated 2–3-fold increase in terms of the failure risk if no antibiotic protection was used [13].

1.1. Study objective

Evaluation of the perioperative antibiotic protection on implantation success.

2. Materials and methods

The study was aimed at retrospective evaluation of treatment outcomes analyzed based on data included in the patients' medical history. The inclusion criteria covered patients of over 18 years of age, seeking consultation with a dental surgeon to restore one or more dental defects with an implant(s).

The exclusion criteria covered patients with an uncontrolled metabolic disease, osteonecrosis, radiation treatment at the surgical site, uncontrolled or untreated dental disease, uncontrolled cardiovascular and endocrine diseases, uncontrolled diabetes, alcoholism or drug abuse and pregnancy. Patients who required antibiotic therapy during surgical procedures due to their systemic diseases were also excluded from the study or did not attend the subsequent treatment stages. Patients who required their antibiotic to be changed due to unreported allergy were also excluded from the study. All the patients signed the informed consent form.

The subjects were divided into two groups. Group 1 comprised patients diagnosed with vertical or horizontal bone atrophy within the alveolar ridge requiring reconstruction procedure before implantation. Group 2 included patients who did not need any surgical procedures before implantation. Lack of acute, exacerbated, and chronic inflammation at the planned site of implant embedment constituted a condition for the implant procedure. Due to this fact no patients who underwent an immediate or early implant procedure were included in the study.

Eventually the study involved 1915 patients (817 males and 1098 females) aged 19–71 treated in the Medicare Dental Clinic between 2007 and 2014. The analysis covered 203 and 1712 subjects in group 1 and 2, respectively. Before implantation in group 1 patients alveolar ridge augmentation was performed with allogeneic bone received from the Department of Transplantology and Central Tissue Bank at the Medical University of Warsaw. The total number of 173 sinus lifts were performed (in 164 patients) as well as 52 procedures of block grafting (39 patients) (Table 1).

During the implantation procedure all the patients underwent treatment in compliance with the developed clinical protocol (the surgical method was the same in each case as well as performed by the same surgeon). When the implant was submerged in the bone, after the primary stability was obtained, the wound was sutured. The implants remained untouched for 3 months in case of the mandible and 6 months in case of the maxilla, i.e. time required for formation of durable connection between the implant and the bone. Immediately after implantation each patient received empiric antibiotic therapy to prevent implant infection and postoperative complications, which might have adversely affected osteointegration of the graft. It is worth mentioning that each patient was administered the first dose of the drug being still in the clinic. The antibiotic was recommended to be used twice a day for 7 days after the procedure.

Table 1
Distribution of pre-implantation procedures in Group 1 patients.

Close sinus lift	Open sinus lift	Bone blocks	Graft localization	
		16		Mandlible
13		4	First premolar	Maxilla
42	13	1	Second premolar	
83	19	5	First molar	
3		0	Second molar	
		26	Front	
141	32	52	Total	

If there were no general contraindications, patients were prescribed amoxicilin (Forcid 1000) to be taken every 12 h. When the medical history revealed possible allergy to the antibiotic, the patient was recommended to take clindamycin (Dalacin C 300) also with the twice-a-day dosing regimen (167 patients). In the investigated clinical material 14 patients reported allergy both, to penicillin and clindamycin; therefore in those cases cephalosporin (Ceroxim 250 mg) was prescribed to patients after implantation to be taken twice a day. Patients reported for the scheduled follow-up visits 14 days and a month after the procedure was performed as well as for an implant uncovering visit (after 3 months in case of the mandible and 6 months in case of the maxilla). When the time required for osteointegration passed, the implants were uncovered and loaded with prosthetic crowns.

The obtained data were statistically analyzed. The study used the chi-squared test or Fisher's exact test (if the numbers were too small) for comparisons between the groups. The data were tested in terms of complications as well as implant failures for both the groups in total and for the groups individually. Additionally, complications and the number of implant failures in individual groups (with a procedure and without a procedure) as well as various types of pre-implantation procedures in group 1 were tested for statistical dependency on the administered antibiotic.

3. Results

The total number of embedded implants amounted to 3309 (491 implants in group 1 and 2818 implants in group 2) IDI, BIOMED 3I and Zimmer (Tables 2a and 2b).

Under amoxicillin protection 3093 implants were placed and under clindamycin and cephalosporin protection the total of 216 implants were embedded. Of all the implants embedded during this study 16 early implant failures were noted (4 in the mandible and 12 in the maxilla) during the osteointegration period (3 months in the mandible and 6 months in the maxilla). In group 1 three of the implants (0.98%) did not integrate with the bone and in group 2 there were 13 such cases (0.67%) (Table 3), which did not reach the level of statistical significance though.

A type of antibiotic used occurred statistically insignificant. Allergy to penicillin occurred in 9.45% patients qualified for the study, whereas allergy to penicillin and clindamycin was found in

Table 2a
Distribution of implants in the groups depending on implant location.

	Maxilla	Mandible	Total
Group I	266	225	491
Group II	1548	1270	2818
Total	1814	1495	3309