Flapless Dental Implant Surgery for Patients on Oral Anticoagulants—The "WarLess Procedure": A Report of 2 Cases

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Patients with prosthetic heart valves are maintained on lifelong oral anticoagulant therapy. The optimal anticoagulant management of such patients during surgical dental procedures has been debated for a long time. Compared with conventional dental implant placement, a minimally invasive flapless approach has the potential to reduce bleeding and minimize surgical time, postoperative pain, soft tissue inflammation, and crestal bone. The purpose of these case reports is to show the clinical predictability of dental implant placement using a minimally invasive flapless approach without reducing the dosage of anticoagulants for patients on lifelong anticoagulant therapy. In this study, a 45-year-old woman and a 58-year-old man who had undergone cardiac surgery and were currently under a full therapeutic level of anticoagulation therapy (warfarin) were treated with flapless dental implant surgery without reducing their anticoagulant dosage. Postoperative clinical and radiographic assessment showed no abnormality, minimal signs of inflammation, and excellent healing. The combination of minimally invasive flapless dental implant surgery with no interruption in the normal dose of the anticoagulant medications could be an improved method for placing dental implants in patients on long-term anticoagulant therapy.

Key Words: dental implants, oral anticoagulants, warfarin, flapless implant surgery

INTRODUCTION

Adult patients on oral anticoagulant therapy, like their healthy counterparts, may have a missing tooth or teeth as a normal result of a periodontal problem and/or decay. Warfarin, a competitive inhibitor of vitamin K, is a commonly prescribed oral anticoagulant shown to reduce the risk of thromboembolism in patients with mechanical heart valves, deep vein thrombosis, and other hypercoagulable states. Its principle, the adverse effect is bleeding. The international normalized ratio

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DOI: 10.1563/AAID-JOI-D-11-00105

(INR) is used to monitor therapy so as to make it safe and effective. The target INR varies (2.0–4.5) depending on the reason for anticoagulation.[1]

Osseointegrated implants have been shown to exhibit reliable results in the rehabilitation of fully and partially edentulous patients.[2–6] Criteria for postoperative success include the absence of persistent signs/symptoms, such as pain, infection, neuropathies, parathesias, and disruption of vital structures; implant immobility; and patient/dentist satisfaction with the implant-supported restoration. Many dental implant systems have shown multiyear success rates >90% for fully edentulous patients.[7] Similarly, multiyear studies of dental implants in partially edentulous patients have generally reported success rates >90% for maxillary and mandibular prostheses.[5] Flapless surgery for dental implant placement is a modification of the conventional implant surgery protocol. Here the implants are drilled directly through the soft tissues into the bone.[8–10]

Histologically, osseointegration of dental implants placed using conventional flap and flapless techniques was reported to be similar.[11] In a study of mongrel dogs by Jeong et al,[12] the bone-to-implant contact was found to be greater in the flapless sites than at sites in which the conventional flap technique was used. Table 1 shows some of the differences between the flapless and conventional techniques.

Appropriate case selection and well-tailored surgical guides with sound surgical and prosthodontic protocols are considered to be the key elements for the success of flapless implant surgery.[10] It is also suggested that the minimally invasive flapless technique could be used as a potential substitute for a more invasive implant placement and ridge augmentation procedure,[11] Such a procedure has not been described in patients with prosthetic heart valves on long-term oral anticoagulants.

Case Presentation

Case 1

A 45-year-old woman presented to the clinic with a missing upper right first premolar (tooth 5), which had been extracted 3 months earlier because of caries. The patient had rheumatic heart disease and severe mitral and tricuspid regurgitation with mitral stenosis. The patient had also undergone mitral valve ballooning in 1993 and was currently on oral anticoagulant therapy (warfarin) (Table 2). Adjacent teeth were clinically healthy (Figure 1). Root canal treatment was performed on the right maxillary canine (tooth 6), which was then restored with a tooth-colored restoration. The periapical radiograph showed good bone quality with minimal bone loss at the extraction site (<2 mm). The option of replacing the edentulous area with an implant and the risks involved were discussed in detail with the

Table 1

Advantages and disadvantages of the conventional and flapless dental implant procedures

Conventional	Flapless
More anesthetic solution	Less anesthetic solution
Increased intensity of postoperative discomfort and pain experienced and for relatively longer periods of time	Decreased intensity of postoperative discomfort and pain experienced and for shorter periods of time
Long surgical time	Shorter surgical time
Flap reflection and suturing are needed	No flap reflection or suturing are needed
More postoperative swelling	Less postoperative swelling
Increased trauma	Decreased trauma
Decreased preservation of bone vascularization	Increased preservation of bone vascularization
Increased crestal bone loss	Decreased crestal bone loss
Increased soft tissue inflammation	Decreased soft tissue inflammation
Increased probing depth adjacent to implants	Decreased probing depth adjacent to implants
Good osseointegration of dental implants	Improved osseointegration of dental implants
Bone height achieved around implant	Bone height around implant is slightly better
Noticeable but controlled bleeding	Perceived minimized bleeding
Better clinical visibility	No clinical visibility
Compromised blood supply	Uncompromised blood supply

TABLE 2

Relevant medical and dental history of the patients along with the international normalized ratio (INR) before surgery

Patient	Reason for Tooth Extraction	Medical Conditions and Treatments	INR Before Implant Surgery
1	Dental caries	Rheumatic heart disease Mitral and tricuspid regurgitation Mitral stenosis Mitral valve ballooning in 1993	4.1
2	Dental caries	Mitral valve replaced in 1984 Moderate aortic stenosis Controlled aortic stenosis	4.0

patient. The patient was told that a modified surgical procedure (flapless) would be adopted owing to her medical condition. After ensuring that the patient clearly understood the procedure and possible complications, a written consent form was obtained.

A blood test was done 7 days before her planned surgical treatment and on the morning of the procedure. The results showed an INR of 4.1 on both occasions. Upon consultation with her treating physician, it was decided that the procedure would be performed without discontinuing the anticoagulation therapy (warfarin). Four tablets of amoxicillin 500 mg (2 g) were given to the patient 1 hour preoperatively as a prophylactic antibiotic. She was instructed to rinse her mouth for 30 seconds with a mouth rinse (chlorhexidine) before the dental surgery. Infiltration of 1 capsule of local anesthesia (2% lidocaine with 1:100 000 epinephrine) was administered around the edentulous area.

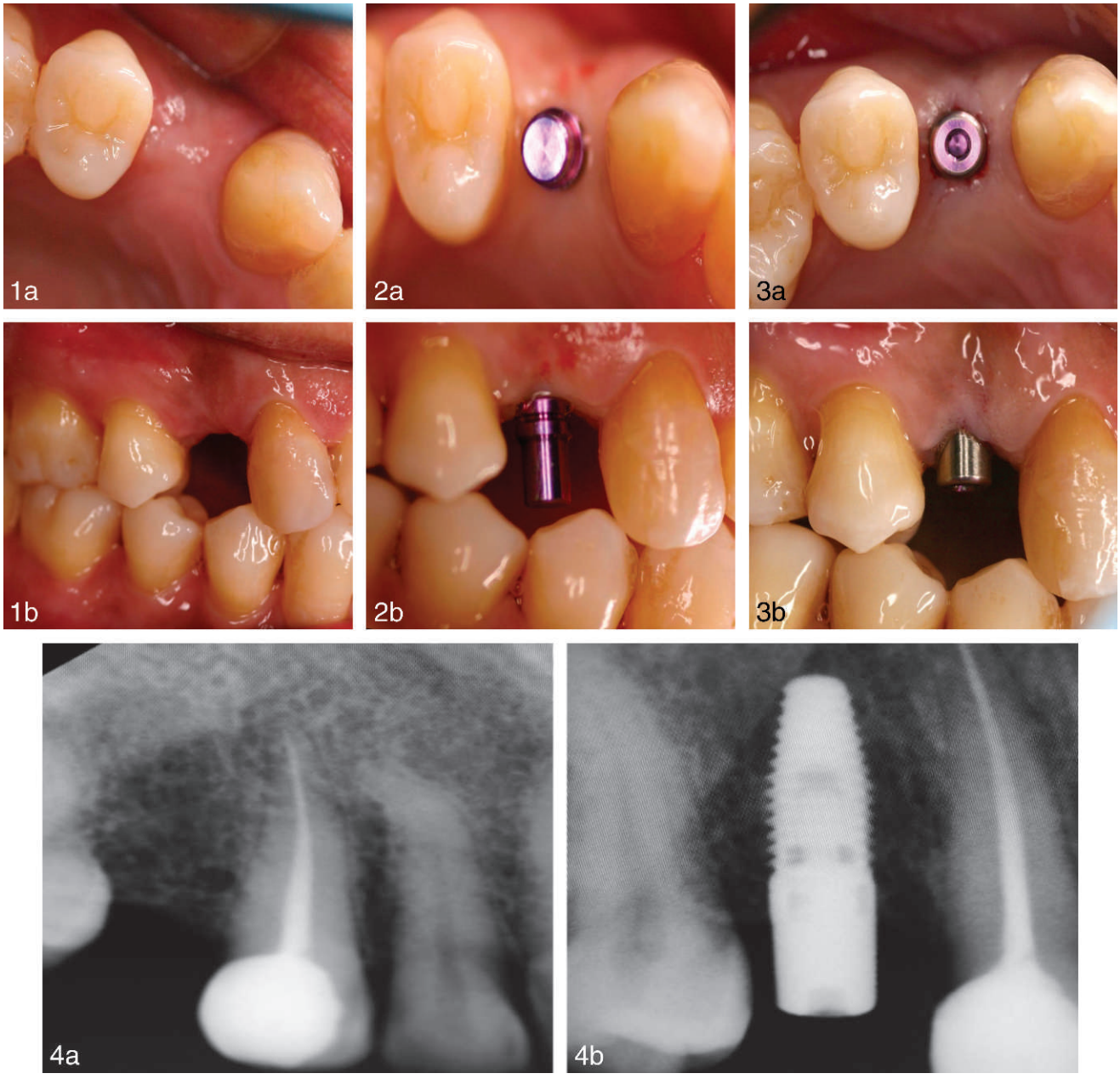
A round bur was used to penetrate the gingival tissue and cortical bone. The bone was penetrated to the desired depth using a 2-mm twist drill. Minimal bleeding was noticed during the surgery (Figure 2). An osteotomy was created to accommodate a 3.5 $\times$ 10 mm tapered implant without the reflection of the mucoperiosteal flap. Subsequently, the implant was inserted through the access hole and placed using the self-tapping feature of the implant (Replace Select, Nobel Biocare AB, Goteborg, Sweden). After implant insertion, a healing abutment was placed (Figure 2a and b). A radiographic image taken after the implant insertion showed the implant parallel to the adjacent teeth (Figure 3). Sterile gauze was then placed to cover the area.

The patient was given postoperative instructions and kept under observation 30 minutes after the operation. Intraoral examination 30 minutes after the procedure showed no bleeding in the surgical site. The gauze was exchanged, and the patient was discharged to be seen in 1 week. An antibiotic was prescribed (amoxicillin 500 mg, 3 times/day) for the next 10 days, and analgesics (ibuprofen 400 mg) were to be taken only as required. Postoperative examination was performed at the end of the week, and the patient showed good healing and no signs of bleeding. The patient was given an appointment 4 weeks later for follow-up.

A 6-month postoperative x-ray showed good bone support with minimal and insignificant bone loss, so the final prosthesis was cemented (Figure 4). The occlusal force of the final prosthesis was checked during the recall visit. No complications were encountered before, during, or after the placement. No inflammation was found, the interdental papilla filled the embrasure area, and the anatomic structure was restored.

Case 2

A 58-year-old male patient reported to the dental clinic for replacement of the upper right second premolar (tooth 4), which had been extracted due to dental caries 2 years earlier (Figure 5). The patient had a history of rheumatic heart disease and had undergone mitral valve replacement in 1984. He was also known to have moderate aortic stenosis and stable controlled atrial fibrillation (Table 2). He was on long-term anticoagulant maintenance therapy with warfarin. His INR 3 days before the procedure and on the day of the procedure was 3.9 and 4.0, respectively. Upon consultation with the treating physician it was decided to proceed with the dental implant placement without interrupting his anticoagulation therapy. After ensuring that the patient clearly understood the procedure

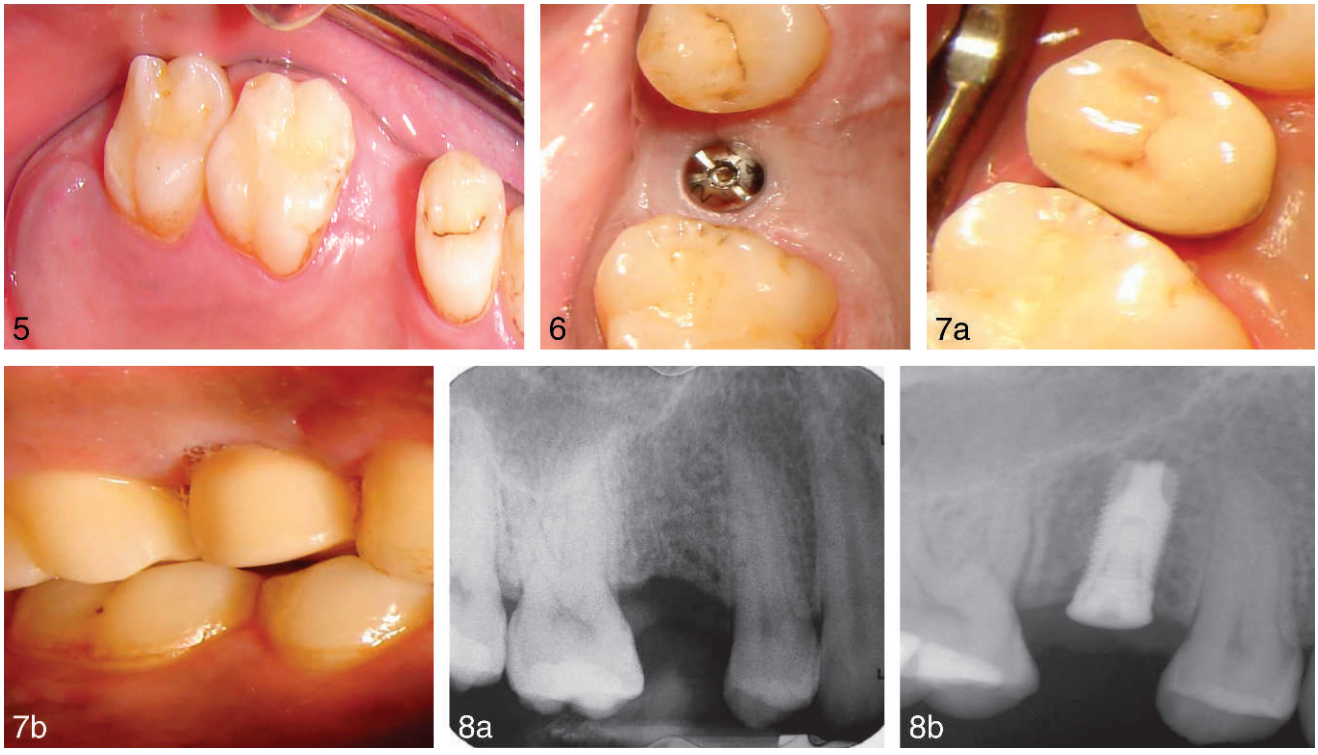


Figures 1–4. Patient 1. **Figure 1.** Occlusal and lateral view before the procedure. **Figure 2.** Occlusal and lateral view of the direction indicator placed during the surgery showing minimal bleeding. **Figure 3.** (a) Occlusal view of the healing abutment in place immediately after implant insertion. (b). Lateral view of the direction indicator placed during the surgery. **Figure 4.** Digital periapical radiographic view before and after implant placement.

and possible complications, a written consent form was obtained.

A prophylactic antibiotic (2 g amoxicillin) was given to the patient 1 hour preoperatively. Preoperative measures were carried out as in the first case report. A round bur was used to penetrate the gingival tissue and cortical bone. The bone was penetrated to the desired depth using a 2-mm twist drill. Bleeding was very minimal and of no clinical significance during the surgery. An osteotomy was created to accommodate a 4 mm wide and 11.5 mm long tapered implant Biomet 3i (Palm Beach Gardens, Fla) without the reflection of the mucoperiosteal flap. Subsequently, the implant was inserted through the access hole and placed using the self-tapping feature of the implant. After implant insertion, a healing abutment was placed.

The patient was asked to remain in the dental



Figures 5–8. Patient 2. **Figure 5.** Patient 1. Occlusal view prior to the procedure. **Figure 6.** Occlusal view of the healing abutment in place one week after implant insertion. **Figure 7.** Occlusal and lateral postoperative view of the prosthesis in place. **Figure 8.** Digital periapical radiograph view before implant placement one week after implant insertion with healing abutment in place.

clinic for the next 30 minutes. A repeat examination showed no clinical abnormality and no significant bleeding. An intraoral radiograph was taken before discharge. Postoperative medications were given as in the first case report. At the 1 week postoperative follow-up, the patients showed good healing, minimal signs of inflammation, and no signs of bleeding (Figure 6). The patient was completely asymptomatic.

A clinical evaluation 4 weeks after surgery showed no abnormality, minimal signs of inflammation, and excellent healing. The final prosthesis was cemented 6 months postoperatively after a detailed adjustment (Figure 7). The occlusal force of the final prosthesis was checked during the recall visit. Radiographic assessment (periapical intraoral) showed good bone support with slight but normal bone resorption ($<$2 mm) (Figure 8). At the 6-week follow-up, the patient had no complaints and no soft tissue abnormalities, and the anatomic structure was good.

Discussion

There are no absolute contradictions for the placement of dental implants,[13] Placing dental implants using the flapless approach is increasing in popularity. Benefits include the perceived minimized bleeding, reduced operative time, accelerated postsurgical healing, decreased amount of crestal bone loss, and increased patient comfort and satisfaction,[8–10] When soft tissue flaps are reflected for implant placement, blood supply from the soft tissue to the bone is removed, thus leaving poorly vascularized cortical bone without a part of its vascular supply, prompting bone resorption during the initial healing phase.[14] These characteristics make it an ideal option for patients maintained on therapeutic anticoagulation therapy.

A review of the literature by Brodala[15] concluded that flapless surgery is more technique sensitive than the conventional method and is not recommended to be used as a routine procedure in regular dental practice. In this study, however, the flapless procedure was preferred over the conven-

tional method because of the aforementioned advantages, taking into consideration the patient's medical condition. Further, intraoral radiographs taken using the long-cone paralleling technique showed minimal difference in the level of marginal bone for both of the patients.

Patients with prosthetic heart valves are at a relatively high risk of thromboembolism, particularly when anticoagulation therapy is discontinued for any reason.[16] Until recently, it has been debated whether anticoagulation therapy should be discontinued before simple dental procedures.[17] The risk and consequence of thromboembolism on anticoagulant withdrawal far outweigh that of bleeding on continued anticoagulation therapy.[18,19] Madrid and Sanz,[20] in their systematic review, concluded that patients with an INR of 2–4 who do not discontinue the anticoagulant medication do not have an increased risk of postoperative bleeding during implant placement. In our study, patient 1 and patient 2 had an INR of 4.1 and 4.0, respectively, before implant surgery, and there was no incidence of bleeding complications after the surgical placement of implants.

The use of antibiotics in implant dentistry is controversial. Currently, there are no widely accepted protocols for the use of antimicrobials in dental implant therapy for patients on oral anticoagulants. In our study, antibiotics were prescribed to the subjects for 10 days after implant placement. This protocol was adopted owing to the limited information available on the procedural risks involving the altered surgical technique in these patients.

It has been reported that an implant subjected to an occlusal load >1000 N may luxate and produce microhemorrhage and fibrosis leading to implant failure.[21] In this study, occlusal force was measured after loading and ensured to be within the permissible limits.

The authors propose the terminology "WarLess procedure," where "War" stands for the anticoagulant used—warfarin—and "Less" stands for the flapless method of dental implant placement. To conclude, this preliminary study highlights the fact that flapless dental implant surgeries can be safely and effectively performed for patients on anticoagulant therapy without interrupting their medical management. Until the safety of this approach is confirmed through larger clinical trials, we limit the findings of this study to the present setting.

Abbreviation

INR: international normalized ratio

Acknowledgment

This project was funded by King Abdulaziz City for Science and Technology, Riyadh, Saudi Arabia.

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