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A New Detection Method for Submerged Implants: Oral Tattoo

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Keywords
Dental implant; tattoo; submerged implant.

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This study was presented as a poster presentation at the 22nd International Congress of the Turkish Association of Oral and Maxillofacial Surgery, Bodrum, Muğla, Turkey, 19–23 May 2015.

The authors declare no conflict of interest for this study.

Accepted October 1, 2016

doi: 10.1111/jopr.12563

Abstract

Purpose: To evaluate the marking potential of tattoo ink in determining the definitive locations of submerged implants at the time of surgical exposure of the implants.
Materials and Methods: In total, 104 implants in 32 patients were included in this study. After placement of the implants, cover screws were inserted. Overlying mucosa was marked with tattoo ink using a 20 g needle through the center of the cover screw. At the time of surgical exposure the tattoo marks were evaluated relative to visibility.
Results: At the time of the surgical exposures, tattoo ink was clearly visible at 91 implants, slightly visible at 8 implants, and not visible at 5 implants. After detection and classification of tattoo ink, the overlying mucosa was gently removed by tissue punch under local anesthesia.
Conclusion: The results of this study seemed to indicate that marking the location of implants with tattoos at the time of implant placement can be an inexpensive, easy, healthy, and practical way to identify the location of marked submerged dental implants.

Dental implant therapy has become a popular treatment modality for the partially or totally edentulous patient.[1] Different strategies, including implant surface modification, no longer submerging an implant in anticipation of a second surgery to uncover, or shortening the time needed for adequate osseointegration period, have been described to increase implant survival and improve treatment outcomes.[2]

Submerged (two-stage) implant placement protocol was described by Brånemark to obtain an optimal process of new bone formation and remodeling after implant installation.[2,3] One- and two-stage protocols yield predictable long-term outcomes.[4,5] Nevertheless, submerged implant protocols have some disadvantages. A second surgical operation, increased chair time, greater risk of morbidity, possible bone resorption due to flap elevation, and increased treatment costs have been reported.[2,6-8] In addition, precise detection of the locations of submerged implants can be challenging when intraoral tissues are thick, the surgeon is inexperienced, or multiple implants have been inserted into edentulous jaws. In light of these difficulties, a second-stage surgery may be more invasive.[10]

Radiological assessments have been one of the primary choices of detection of the location of submerged implants after the requisite healing period. Although detecting implant position is a 3D challenge, routine radiological images only provide 2D information.[10]

The history of the tattoo dates back to ancient times (5000 BC).[9] Tattoos were used by the ancient Egyptians as a way to enhance beauty and were also thought to protect against illness and ward off bad souls.[11] In addition, tattoos have been used for medical purposes.[12] In 1991 in the Tyrolean Alps, scientists discovered a well-preserved human body that was about 5000 years old. Tattoo markings were found on several parts (joints) of the body, and radiological examination showed osteoarthritis in these joints. The conclusions of the experts involved indicated that the marking points were similar to acupuncture points.[11] Furthermore, tattoos have been used to assist in treatment of patients with chronic diseases such as diabetes mellitus or Alzheimer's disease, as well as to identify an unconscious or deceased patient.[12] Tattoo marks can also be used for cosmetic reasons, to hide skin scars and discolorations, or modify the appearance of eyebrows, lips, and eyelids.[13]

The aim of this study was to evaluate the effectiveness of an ink tattoo in determining the definitive location of submerged implants at the time of surgical uncovering.

Table 1 Implants used in this study

Brand	Manufacturer	Location
Straumann Dental Implants	Institut Straumann AG	Basel, Switzerland
Astra Tech Implant System	Dentsply Implants	Mannheim, Germany
Dyna Dental	Dyna Dental Engineering	Halsteren, The Netherlands
Implantium	Dentium	Gwanggyo, Korea
Implance Dental Implant System	AGS Medical	Istanbul, Turkey

Materials and methods

This study followed the Declaration of Helsinki on medical protocol and ethics: the regional Ethical Review Board of Gaziosmanpasa University approved the study (Ref. No: 83116987-312). Patients who had a relevant history of allergy or refused to participate in this study were excluded. A total of 32 subjects with 104 dental implants (68 implants in 12 edentulous patients, 36 implants in 20 partially edentulous patients) were included in this study. Full-thickness flap elevation was performed in all patients, and endosseous implants were placed following the manufacturers' recommendation (Table 1). After placement of dental implants and cover screws, the overlying mucosa was marked with tattoo ink (Intenze True Black; Intenze Products, Inc., Rochelle Park, NJ) using a 20 g needle through the center of the cover screw. Primary mucosal closure was performed with 3/0 silk suture. Antibiotics, analgesics, and mouth rinse with chlorhexidine were prescribed to all patients.

After an uneventful osseointegration period of 3 months, all subjects underwent second surgical procedure to uncover the implants. At the time of the second surgical procedure, two oral surgeons evaluated the tattoo marks. The marks were classified as falling into one of three groups, specifically "clearly visible," "slightly visible," or "invisible." Histologic examination of the mucosal biopsies were performed on tissues from five randomly selected subjects.

Results

The postimplant placement healing period was free of complications for all subjects. At the time of second-stage surgery, tattoos were "clearly visible" in the mucosa of 91 implants (87.5%), "slightly visible" in the mucosa of 8 implants (7.7%), and "invisible" in the mucosa of 5 implants (4.8%). After the detection and classification of the ink tattoos, the overlying mucosa was atraumatically removed with a tissue punch under local anesthesia. Healing caps were inserted, and patients referred for prosthetic rehabilitation (Fig 1).

The histologic examination showed acanthosis in the epithelium and black pigment accumulation in the interstitial areas of the submucosal connective tissue. Of importance, tissue specimens were free of inflammation, and no foreign body reaction was observed.

Discussion

Submerged and non-submerged implant placement protocols have similar, predictable long-term outcomes[4,5] even though a submerged protocol has disadvantages, such as the need for a second surgical procedure, increased chair time per patient, and increased treatment costs.[2] The main goals of a submerged protocol have been identified as avoiding bacteria invasion through the gingiva and to minimizing occlusal loading during the osseointegration process; however, it can be problematic to determine the location of submerged implants after waiting for the healing period in some patients when the overlying mucosa is thick, the surgeon is inexperienced, or when multiple implants are placed in fully edentulous jaws. In such cases, flap elevation may be indicated to expose the dental implants and their cover screws. Perez-Albacete et al compared flapless and conventional flap techniques for implant placement and showed that the flapless technique led to less crestal bone loss.[6] In addition, Vhalovic et al[7] and Vohra et al[8] demonstrated bone loss regardless of the type of surgical protocols used when they reported that flap elevation induced bone resorption. Marking the oral mucosa using tattoo ink may provide easy detection of cover screws during second surgery. In fact, according to the results of this study, 87.5% of marks were clearly visible, and 7.7% were slightly visible.

Radiological assessment has been the main method to detect submerged implants.[9] Although detecting implant position is a 3D challenge, routine radiological images only provide 2D.[9] In some cases, radiological examination can be misleading and result in the need to use a longer incision than necessary. For this purpose, Culjat et al described an ultrasonic detection device that determined the place of submerged implants beneath 5 mm of soft tissue thickness.[10] Another manufacturer (CTI Dental Implant Pointer, Ashburton, Australia) has developed this system and launched it for commercial use. This is a portable device with a sound warning system that gets louder as the center of the cover screw is approached. Despite good intentions, these systems have some disadvantages in that battery supply can be variable, and the sensor can become unreliable when the battery strength is low, and if a sensor malfunction occurs, the system may give false results. Additionally, to replace the battery or the sensor unit brings extra cost for the practitioner. In light of the results of present study, tattoo ink has been shown to be a safe and inexpensive alternative option compared to ultrasonic devices.

Center et al treated an African patient with gingival vitiligo from Kenya with an oral tattoo.[13] In Kenya, depigmentation of oral tissues were viewed by some as an indication that an individual is HIV positive and, consequently, causes psychological problems for patients. Center et al marked the depigmentation areas of the gingiva with oral tattoo to create a more natural appearance. They followed up with an incisional biopsy from the tattooed area, and histological examination showed black deposits in the submucosal connective tissue free of foreign body reaction or inflammation.[13] In this study, histological examination of biopsies showed acanthosis in epithelium and black pigment accumulation in the interstitial areas of the submucosal connective tissue. The findings were similar to those of Center

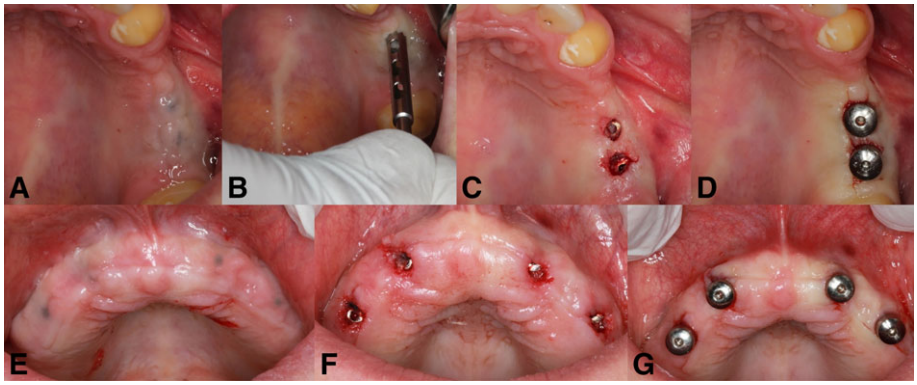

Figure 1 (A) Intraoral view of the tattoo ink at the time of second surgery; (B) overlying mucosa removed by a punch (C) cover screws became visible at the middle of the surgery site; (D) healing caps inserted; (E) ntraoral view of the tattoo ink at the time of second surgery; (F) cover screws became visible at the middle of the surgery site; (G) healing caps inserted.

et al,[13] in that tattooed tissue was free of inflammation, and no foreign body reaction was evident.

Conclusion

Within the limitations of this study, using an oral tattoo proved to be an inexpensive, easy, and practical option to overcome the problem of locating submerged dental implants. Tattoos may lead to decreased operation times and may provide more comfortable postoperative healing by avoiding flap elevation.

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