Surgical Removal of Poly-Ether-Ether-Ketone-Derived Basal Type Implants: A Case Report

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INTRODUCTION

After Branemark et al.1 reported that titanium can support a prosthesis by being osseointegrated into the alveolar bone, titanium has undoubtedly been the most used implant material. Even the use of zirconium implants—the second-most commonly used after titanium—has been limited.2 However, there have been some reports about the disadvantages of titanium implants. Researchers continue to seek alternative materials to titanium because of factors that include titanium hypersensitivity; the possibility of local inflammation;3–7; titanium elastic module differing from bone as a result of the transmission of force directly to the bone; and esthetic concerns, especially in the collar because of titanium’s dark color.8,9

Recently, poly-ether-ether-ketone (PEEK) materials that are biocompatible and have a similar elastic module to bone (3.6 Gpa) have been used in orthopedics10,11 and traumatology.12,13 For this reason, it has been proposed that implants made from PEEK may be used in the treatment of edentulism. Additionally, animal studies support the clinical use of PEEK-derived implants.14

To date, not only the implant materials but also different dental implant structures have been tried. Although bone grafts, mental nerve displacement, and maxillary sinus lifting procedures have been used with acceptable results in the treatment of severe bone resorption and insufficient bone volume, different treatment approaches are still being sought due to the second surgery area, higher complication risk, and potential patient refusal. Apart from the frequently used cylindrical implants, blade, pin-shaped, transmandibular and subperiosteal implants have also been used in the treatment of total or partial edentulism. Basal type implants, used as an alternative treatment option for severely atrophic alveolar bone, are among the preferred methods, although existing short- and long-term studies are insufficient.15

This case report presents the surgical removal of PEEK-derived basal type dental implants due to failure of osseointegration.

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CASE DESCRIPTION

A 58-year-old female presented to Ondokuz Mayis University Faculty of Dentistry Department of Periodontology with complaints of mobility and pain related to her implants, which had been implanted in another clinic 12 months earlier. The patient had no systemic diseases (in particular, diabetes mellitus and osteoporosis) and was not a regular drug user or smoker. Intraoral and radiographic examination showed 4 basal-type PEEK implants in the right maxillary molar area, the left mandibular molar area, and the right mandibular premolar and molar areas, as well as a cylindrical titanium implant in the left mandibular premolar area (Figure 1a through c). The patient related that the crown bridge restoration in the right maxillary area had been completed immediately because of her aesthetic concerns; an implant on the right maxillary premolar area had been removed 2 months after insertion. The porcelain fused to metal crown bridge was sectioned, and the posterior PEEK implant remained in place with its crown. The mandibular implants had never been loaded. Following the initial placement, the implants remained mobile, and episodes of intense pain were reported. These episodes were treated with oral antibiotics. On the panoramic X ray, peripheral radiolucency was noted around the PEEK implants (Figure 2). The chosen intervention was explantation of the implants associated with mobility and screening for probable infection. After removal of her implants, the patient did not request further implants due to her previous unfortunate experience. Because of the shape of the basal type implants, the reverse protocol of the implants’ insertion process planned. After local anesthesia, a mucoperiosteal flap was reflected, and the implants were gripped with forceps from their abutment and removed with a slight force from the insertion route in the vestibule bone (Figure 3a through c). All of the implants except the one at the mandibular molar area were removed easily with this technique. Due to the bone retention at the vestibule bone, the remaining implant was removed after bone removal under sterile saline irrigation with burs. After curetting the granulation tissues, the flap was repositioned with 4-0 silk sutures. Antibiotics (amoxicillin/clavulanic acid 1 g oral every 12 hours for 5 days), nonsteroid anti-inflammatory analgesics (flurbiprofen 100 mg oral every 12 hours for 5 days), and chlorhexidine mouth rinse (every 12 hours) were prescribed. The sutures were removed 1 week later, and the healing was uneventful. The patient had no further pain. Two years after the procedure, intraoral examination showed that the soft tissue defect in the maxillary molar area that had occurred after
the removal of PEEK implant was more prominent than at the other removal sites (Figure 4a through c). Radiolucent areas in radiographic examination revealed that complete bone fill was not attained (Figure 5).

**DISCUSSION**

In recent years, considerable research has been carried out about different shapes, surfaces, and materials as alternatives to cylindrical and titanium-surfaced implants. Positive results following in vitro and in vivo studies have encouraged researchers to move forward with clinical applications. There are a limited number of studies claiming that PEEK materials—one such alternative—are appropriate to be used in dental surgery as implants. Most of the studies refer to cranioplasty operations and spinal surgeries; however, in the mouth, implants get support from the bone, and the mechanical forces are significantly different. PEEK materials are used as an intermediary implement for the gingival former and bar prosthesis over implants; these applications are different than the mechanical forces that are applied over the implant.

In studies carried out with titanium materials, risk factors for peri-implant diseases have been identified, including insufficient oral hygiene, local biomechanical factors, systemic diseases, parafunctional habits, early occlusal contacts, and iatrogenic factors, such as lack of primer stabilization. It is still not clear, however, how PEEK material will respond to these factors. In our case, although the crown bridge restoration of the right maxillary implants had been completed immediately after surgery, the excessive occlusal load would be a weak failure reason because mandibular implants had never been loaded. Among the limited number of studies, a case report demonstrated advanced bone resorption and broad infection resulting from the failure of PEEK dental implants. Another experimental animal study reported that PEEK material was more sensitive to infections when compared with titanium. In this case, in addition to PEEK implants, losing the cylindrical titanium implant and not knowing other reasons (including clinician-related factors) that might have caused infection during the operation makes one consider that there may be other factors, apart from the PEEK material’s effectiveness, in this unsuccessful result.

To date, several types of implants have been designed to insert through the bone at the top of alveolar crest; however, placing the basal implants into the bone is by means of entrance through the vestibule of the bone. This approach, contrary to that of many implants, requires removing the implant through the vestibule, which is the opposite of the protocol (through the top of the alveolar crest). When trying to remove basal implants through the top of the crest, the implant either cannot be removed or will be chipped, and the process will be even more complex. In this case study, because of unsuccessful osseointegration, all of the PEEK implants except one were removed easily from the insertion route in the vestibule bone. However, as was encountered in one of the implants, if the entrance is narrower than the implant itself (as a result of bone formation in the vestibule), the bone retention should be excavated first and then the implant removed through the vestibule, instead of forcing the implant. Another issue that must be noted when basal type implants are removed is that basal type implants come into close contact with the surrounding tissue.