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Clinical Paper
Dental Implants

Removal of dental implants: review of five different techniques

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Abstract. The aims of this study were to review five different explantation techniques for the removal of failing implants and to propose a practical clinical protocol. During a 10-year period, 95 implants were explanted from 81 patients. Explantation techniques used were the bur–forceps (BF), neo bur–elevator–forceps (ηBEF), trephine drill (TD), high torque wrench (HTW), and scalpel–forceps (SF) techniques. The following parameters were analyzed: indications for explanation, site of implantation, and the type, diameter, and length of the implant removed. The most frequent indications for implant removal were peri-implantitis ($n = 37$) and crestal bone loss ($n = 48$). The posterior maxilla was the most frequent site of implant removal ($n = 48$). The longer implants were more frequently removed ($n = 78$). The majority of implants were removed after 1 year in function ($n = 69$). The BF/ηBEF and SF techniques were found to be the most efficient. Explantation techniques appeared to be successful for the removal of failing implants. The BF/ηBEF and SF techniques demonstrated 100% success. The ηBEF technique enabled safe insertion of a new implant in the same explantation site. The HTW technique appeared to be the most elegant technique with the highest predictability for insertion of another implant. An explantation protocol is proposed.

Key words: dental implant explantation; dental implant failure; peri-implantitis; dental implant complications.

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The current literature provides ample data on the high success rates of dental implant treatment, which range from 90% to 97%. Failing implants are usually removed either because of progressive bone loss due to a peri-implant infection,[1,2] frequently associated with occlusal overload,[3] or due to placement in aesthetically unacceptable locations.[4] Explantation is also performed on osseointegrated orthodontic implants following the termination of the orthodontic treatment.[5] Furthermore, implants associated with a good bony and soft tissue condition are occasionally removed in psychologically unstable patients.[6]

Different techniques for dental implant removal have been proposed in the literature, such as the use of thin burs or a trephine drill at low speed under water cooling,[6–8] the use of an electro-surgery unit to cause thermo-necrosis of the bone and subsequent weakening of the bone–implant interface,[9,10] and laser-assisted explantation,[11] as well as a removal torque procedure.[12,13]

Available data on explantation techniques appear to be inconsistent, therefore there is no reported unique treatment protocol for the successful and least traumatic removal of dental implants. The employment of less traumatic manoeuvres seems to be required to create minimal residual bony defects and spare the soft tissues.

Ideally, the explantation procedure should be followed either by the installation of another implant or by guided bone regeneration (GBR), or both at the same sitting, when indicated.

The aim of this study was to review five different explantation techniques based on the authors' clinical material, in order to describe their advantages and disadvantages and to offer a practical clinical protocol for the explantation of failing implants.

Materials and methods

In this retrospective cohort study, the dental records of 112 patients of both sexes who had been subjected to the removal of a total of 129 dental implants over a 10-year period (2003–2013) were examined. Seventy patients were referrals. The dental records of 31 patients from whom 34 implants were removed were excluded from the study on the basis of the following criteria: accidental removal of the implant (1) at the time of the cover screw being replaced by the healing abutment ($n = 6$); (2) with the tightening force of 35 N cm applied for mounting the abutment ($n = 13$); (3) as a result of failing osseointegration without symptoms or signs of peri-implantitis at routine follow-up ($n = 8$); (4) becoming loose in the infected bone ($n = 3$). All other failing implants, irrespective of the cause, were removed using dental forceps and rotational and/or rocking movements only ($n = 4$).

The dental records of the remaining 81 patients with a total of 95 implants removed were analyzed with respect to the effectiveness of the surgical techniques applied, indications for explantation, the anatomical distribution of the implants removed, and the implant types, diameters, and lengths.

Surgical techniques applied in the present study are described as the bur–forceps technique (BF), the neo bur–elevator–forceps technique (ηBEF), the trephine drill technique (TD), the high torque wrench technique (HTW), and the scalpel–forceps technique (SF). Apart from the SF technique, all techniques were used only for implants indicated for removal with a minimum of 1/3 of the threads and that were well osseointegrated without any mobility.

The bur–forceps technique (BF)

After elevation of a mucoperiosteal flap, a small sized round and/or fissure bur (Nos. 3–4) is used to remove the bone, usually from the facial aspect down to the apex of the implant, taking care to preserve the lingual cortex and as much of the bone as possible mesially and distally (Fig. 1). If bone resorption is found on the lingual side (this occurred in two cases), with the facial cortex intact, then the bony defect is deepened on the lingual side sparing the facial cortex. The implant is then grasped with the dental forceps and an attempt made to remove it by rotational and slight rocking movements, similar to tooth extraction. If this is not feasible, more bone is drilled out until it is possible to either unwind it or luxate it towards the bone-removed region, thus creating a three-wall bony defect.

The neo bur–elevator–forceps technique (ηBEF)

This technique commences with the removal of bone mesially and distally from the implant, aiming towards the apex. Round and/or fissure burs (No. 1) are used, with copious running saline, trying to maintain a close distance to the implant surfaces (Fig. 2A). The implant head is grasped with the corresponding tooth/Lyer forceps and turned clockwise and anticlockwise. When resistant to such attempted movements, a thin straight elevator (Couplands elevator No. 3) is placed into the mesial and distal crevices, intermittently applying small gentle rotating movements similar to those used for the extraction of buried roots, until the implant is noted to be slightly tilted to one side (Fig. 2B). Then, the elevator is placed into the crevice on the contralateral side and similar movements performed. The implant head is then grasped with dental extraction forceps and gentle rocking movements applied, pushing it mesially and distally only, thus preserving both the facial and the lingual cortical plates (Fig. 2B). When little resistance is felt, the implant is removed with a final anticlockwise rotation leaving an ovoid defect (Fig. 2C).

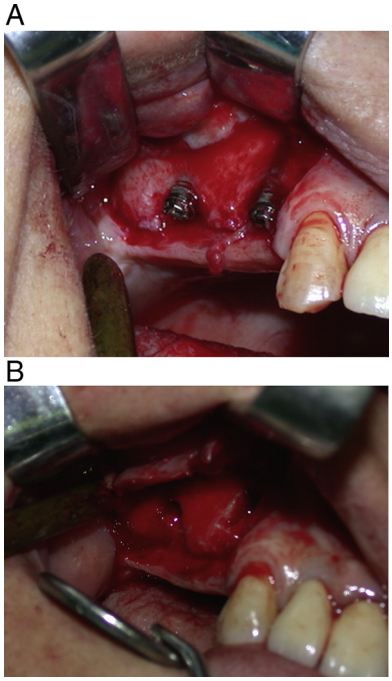

Fig. 1. Failing implants in the posterior maxilla removed using the bur–forceps (BF) technique. (A) Preoperative condition with the bone loss affecting the buccal aspect of the implants. (B) Three-sided bone defects following explantation.

The trephine drill technique (TD)

An appropriate trephine drill with a diameter and length corresponding to the size of the implant to be removed is selected (Fig. 3A). The healing abutment or abutment/crown is unscrewed and a mucoperiosteal flap raised if necessary. The trephine drill is sunk over the implant into the bone using low speed 50–80 rpm drilling and light pressure with running saline cooling. A hole is drilled taking care that the trephine has been sunk to the exact depth by controlling the outside rings on the drill. For implant systems that do not provide a guiding cylinder/pin, a healing abutment of smallest emergence profile diameter is mounted before using the trephine. For Straumann Standard and Standard Plus implants, the polished neck is reduced with a high-speed diamond drill to correspond to the diameter of the guided cylinder (Fig. 3B). In the event that the implant is still firm after the trephine has been lifted (in cases of insufficient drilling depth), a Couplands elevator is placed into the empty space and lightly twisted to break the bony connections, enabling easy removal of the implant using the fingertips.

The high torque wrench technique (HTW)

For the patients included in this study, the Neo Fixture Remover Kit (Neobiotech Co., Korea) was used for this technique. The compatibility list was consulted first to determine the correct dimension of the fixture remover screw and the implant remover to fit to the implant chamber and outer diameter, respectively.

The procedure commences with the removal of the cover screw or the abutment of the implant to be removed. The fixture remover screw is inserted clockwise (Fig. 4A) and tightened using the torque