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Metal on metal – removal of an extruding mandibular titanium reconstruction plate with a high-speed electrical surgical drill

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ABSTRACT

Plate extrusion is one of the most common complications following mandibular reconstruction with free vascularised bone flap, and partial plate extrusion commonly occurs. Patients who experience such complications often have compromised wound healing from previous surgery and radiation therapy. We describe a novel technique of segmental plate removal in which a high-speed electrical surgical drill with a 3.2-mm round burr was used to partially remove the exposed plate. This method was selected due to the precision and control that the burr provides, allowing for effective and precise removal of the exposed plate with minimal tissue damage.

Keywords: extrusion, high-speed drill, mandible, reconstruction, titanium

INTRODUCTION

Osteocutaneous free flap surgery is the gold standard for mandibular reconstruction after head and neck cancer resections.(1) Under experienced hands, it yields high success rates and low rates of serious complications. Late complications related to hardware, however, have been reported in 15% of patients.(2) In most cases, only partial plate extrusion occurs which can lead to further operative procedures, prolonged antibiotic use and an overall reduced quality of life.(3)

Removing the entire plate with a large incision within the site of the previous surgery can cause wound healing problems. In addition, the majority of these patients would have undergone radiation therapy and suffered radiation skin damage that would further compromise their wound healing. In view of this, segmental removal of extruded mandibular plate is preferable to minimize soft tissue trauma while maintaining bone stability. The surgical pin

cutter has been described for this purpose by Boyd.[4] However, this instrument is bulky and can limit precision and manoeuvrability needed in such clinical situation.[4]

We present a technique from our institution using the high speed electrical surgical drill with 3.2-mm round bur (Midas Rex® Legend 10-cm long, 3.2-mm head diameter Ball-Fluted burr tool, Medtronic, Minnesota, USA) (Figure 1). This method provides the precision and control that one needs in the removal of extruded mandibular reconstruction plate. Future plate extrusion can also be prevented by smoothening the rough edges of the remaining plate with the same burr.

SURGICAL TECHNIQUE

Prior to hardware removal, radiological imaging such as X-ray or computed tomography (CT) scan was taken to identify the position and number of screws that require removal. Under general anaesthesia, two stab incisions were made laterally to extend the exposure of the mandibular plate. One more screw hole will be exposed distally and proximally, and the exposed screws can then be removed through the same stab incisions. Protective eyewear for surgeons and assistants were worn to protect against cutting debris. During plate cutting, a periosteal elevator or a malleable retractor was placed under the plate to avoid damage to the underlying structures such as oral mucosa. The operating field was irrigated with normal saline to dissipate heat generated and the soft tissue was retracted to avoid damage. In addition, irrigation can wash away metal debris generated while cutting. Gauzes were lined around the wound edges to catch the metal debris for easy removal while preventing metal debris from being trapped in the wound. Appropriate screws and the resected mandibular plate were

removed. The sharp edges of the remaining plate were smoothed off with the same burr. Wounds were washed and closed in layers.

Case 1

A 69-year-old woman with squamous cell carcinoma (SCC) of the right lower alveolar ridge underwent a right segmental mandibulectomy and fibular free flap for osseous reconstruction. Fixation of the fibula to the mandible was performed using a preformed titanium mandibular reconstruction plate that spanned from the right mandibular ramus to the symphysis. Recurrence occurred four months post surgery, and re-resection was carried out followed by radiation therapy.

Three months after radiation therapy, partial extrusion of the mandibular reconstruction plate occurred. An orthopantomogram (OPG) confirmed the bilateral bony union of the free fibula to mandible (Figure 2). The surgical site did not show any signs of infection around the extruded plate (Figure 3).

The skin quality around the reconstructed mandible was friable and thin. We decided to approach the extruded mandibular plate directly without disrupting surrounding bone and skin.

Plate removal was done following the surgical technique described above. Bearing in mind the importance of locating the correct position of the plate to be removed and ensured adequate soft tissue retraction during the procedure to avoid soft tissue damage (Figure 4). After plate removal, the remaining plate edges were rounded off with the same burr to prevent future extrusion. The wound was washed and closed with PDS 4/0 and Vicryl Rapide 5/0 (Ethicon, Johnson & Johnson, NJ, USA). It healed well with no further plate extrusion (Figure 5).

Case 2

A 79-year-old Chinese man underwent right mandibulectomy for SCC of the oral cavity in 1998. Osseous reconstruction with a free fibular flap was performed a month after the resection. Nine years after the resection, part of the plate was exposed with granulation tissue overlying extruded implant (Figure 6). A CT scan showed gross resorption of bone underlying the mandibular reconstruction plate centred around the loose screw. No signs of infection was seen. Plate removal was performed with the similar method described above. It healed well with no further plate extrusion at post-operative one year (Figure 7).

DISCUSSION

Hardware-related complications necessitating removal in the patient population has been reported to be approximately 15% of the cases.[2] Tobacco use, radiation therapy and prior hyperbaric oxygen treatment have been noted as associated risk factors that could cause hardware complications.[2,5] Patients who received radiation therapy also demonstrate a statistically association with plate removal[6] and wound healing complications is expected to be high in this group of patient.

In patients with a chronic wound resulting from an exposed plate, it would mean repeated clinic visits, prolonged use of antibiotics and hospital admissions. Our technique allows for selective segmental mandibular plate removal without the need to raise a large skin flap in a scarred and irradiated operative field, which might cause facial nerve injury or wound complications.

This approach is most suitable for patients with extensive post-radiation changes to their skin. This technique provides a safe and efficient method to remove a segment of the

mandibular reconstruction plate and avoids the morbidity that can be associated with a total plate removal. Patients can be discharged on the same day, alleviating financial and emotional burdens.

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Figure 1. 3.2-mm round surgical burr

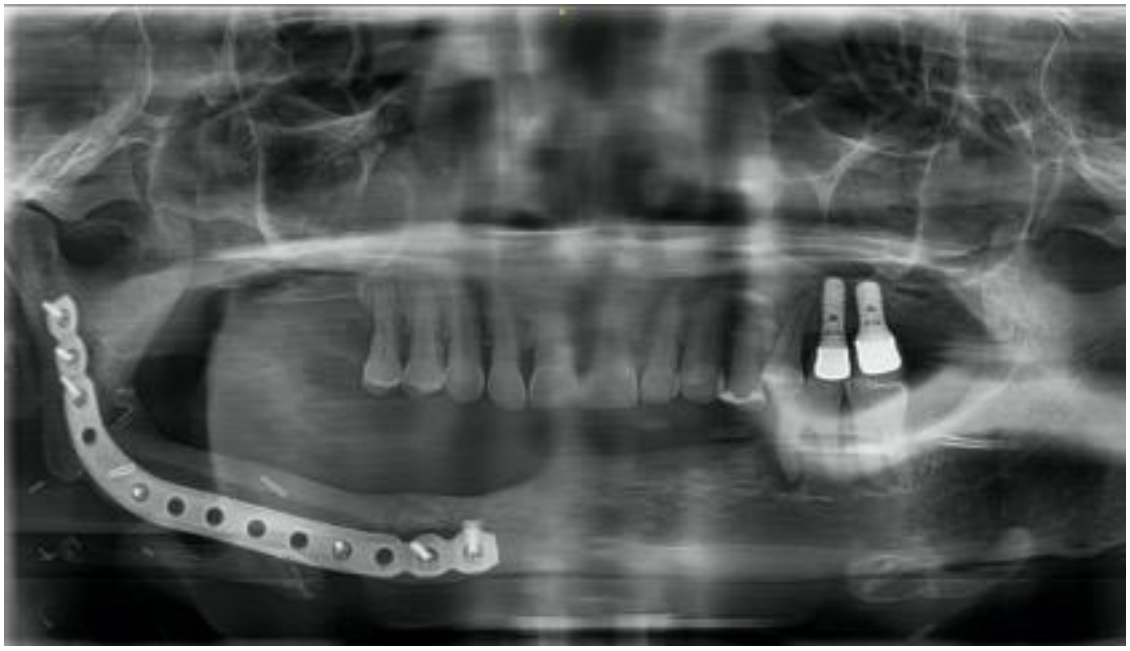

Figure 2. Case 1: Preoperative orthopantomogram

Figure 3. Case 1: Preoperative photograph with extruded implant

Figure 4. Case 1: Intraoperative picture of using 3.2mm round surgical drill. Good soft tissue retraction for protection. Irrigation during cutting to wash away metal debris and dissipate heat.

Figure 5. Case 1: Post-removal of extruded implant 6 months

Figure 6. Case 2: Granulation tissue overlying extruded implant

Figure 7. Case 2: Post-removal of extruded implant 1 year