



Successful Localization of Intraoral Foreign Body with C-arm Fluoroscopy

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Abstract

During surgical procedures, unexpected material, including surgical instruments and tissue segments, may get lost in the surgical field. Most of these should be immediately removed to prevent further complications, such as vital organ irritation, infection, and inflammatory pseudo-tumor formation. However, it is not always easy to define the exact location of the foreign body, especially if the item is very small and/or it is embedded in the soft tissue of the head and neck region. Intraoperative real-time radiological imaging with C-arm fluoroscopy can be useful to trace the three-dimensional location of small and embedded foreign bodies in the oral and maxillofacial area. We describe an unusual case of an embedded micro-screw in the intrinsic tongue muscle that had been dropped into the sublingual space during a lower alveolar bone graft procedure. The lost foreign body was accurately identified with C-arm fluoroscopy and safely removed without any further complications.

Key words: Foreign bodies, Fluoroscopy, Mouth floor

Introduction

Foreign bodies, including broken needles, endodontic files, implant fixtures, piercing bar, and surgical instruments, are sometimes lost in the oral and maxillofacial region during dental procedures or maxillofacial surgeries[1-7]. Immediate removal of these foreign bodies is recommended, because they can move to a deeper position and their presence may result in unexpected complications[6,7]. However, it is not always easy to define the exact location of the foreign body intraoperatively, especially when the lost item is small and/or embedded in soft tissue[8]. A risk of injuries to neighboring nerves or

vessels always exists during the removal procedure if the three-dimensional location of the lost material is not precisely defined. Preoperative routine radiographs and computed tomography (CT) scans yield limited information of the item's location only in the static head posture. To remove small and soft tissue-embedded items in the head and neck region, an intraoperative real-time image is needed to define the exact three-dimensional location of the item.

C-arm fluoroscopy is available to determine bone status and detect lost materials intraoperatively[2,7,8]. These radiographs can provide intraoperative real-time information concerning the location of a lost foreign body in the compli-

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cated anatomy of head and neck as well as the bony reduction status during maxillofacial bone surgery[9]. Although there have been reports of removal of foreign bodies using C-arm fluoroscopy[1-7], its application for the retrieval of a small metal screw in the oral and maxillofacial area is not common. We report an unusual case of a soft tissue-embedded small metal screw in the intrinsic tongue muscle, lost during a bone graft procedure in the lower alveolar ridge. The location of the foreign body was exactly determined by using C-arm fluoroscopy, and we removed it safely without other complications.

Case Report

A 48-year-old male patient was referred from a private dental clinic for evaluation and removal of a micro-screw, lost during an onlay bone graft procedure with titanium mesh and screws in the lower alveolar ridge. Routine radiographs and CT images revealed a 4-mm-long micro-screw in the right side of sublingual space, in the medial space of the mandibular body (Fig. 1). Under local anesthesia,

we attempted removal of the lost material after elevation of the lingual flap from the mandibular medial surface. However, the screw could not be identified and so the removal attempt failed. We assumed the lost screw became repositioned in the intrinsic tongue muscle after penetration through the periosteum. Under general anesthesia, we attempted removal of the foreign body in the sublingual space using C-arm fluoroscopy (Ziehm 8000™; Ziehm Imaging, Nuremberg, Germany). The exact three-dimensional position of the foreign body was defined with guidance of intraoperative real-time image of C-arm. The foreign body was located in the intrinsic tongue muscle, about 5 mm from the inner layer of periosteum (Fig. 2). We successfully removed the foreign body after careful dissection of intrinsic tongue muscle. To prevent post-operative infection, all bone graft materials, including allogenic bone particles, titanium mesh, and screws, were also removed from the alveolar ridge (Fig. 3). The patient experienced uneventful healing without specific complications, including lingual nerve damage or tongue motion limitation.

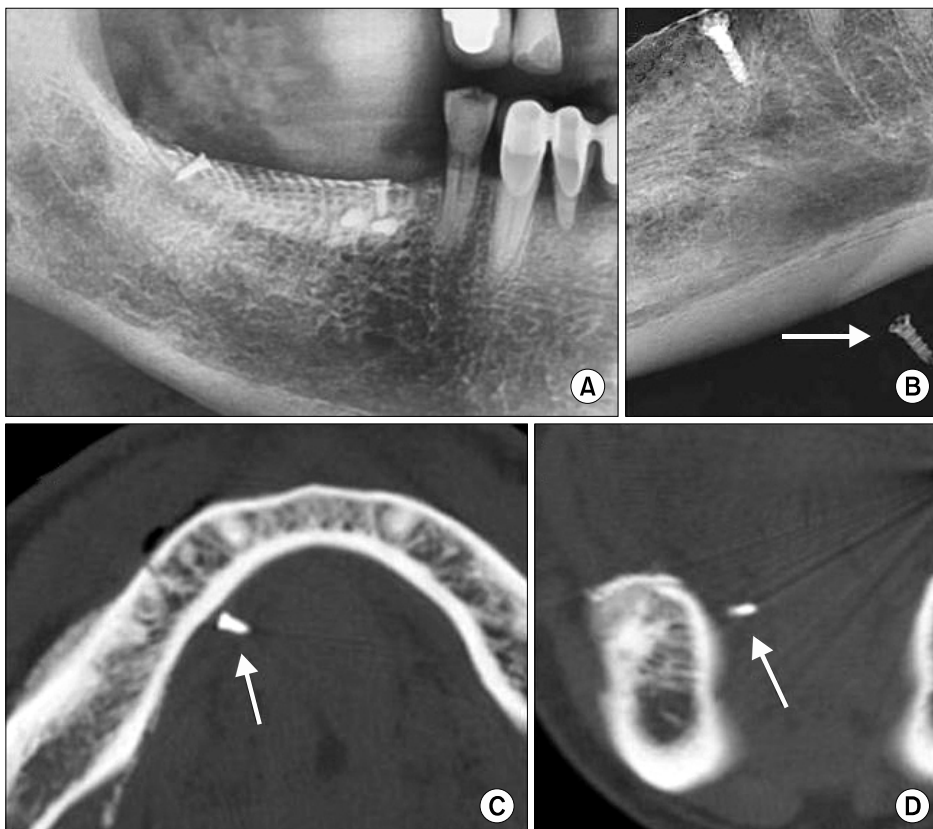


Fig. 1. Radiologic images of the lost micro-screw in the sublingual space. (A, B) Panoramic and occlusal views showed the lost foreign body (arrow), but the exact location could not be defined by these routine radiographs. (C, D) In the computed tomogram, the foreign body was located in the intrinsic tongue muscle with the screw's tail pointing to the medial side (arrows).

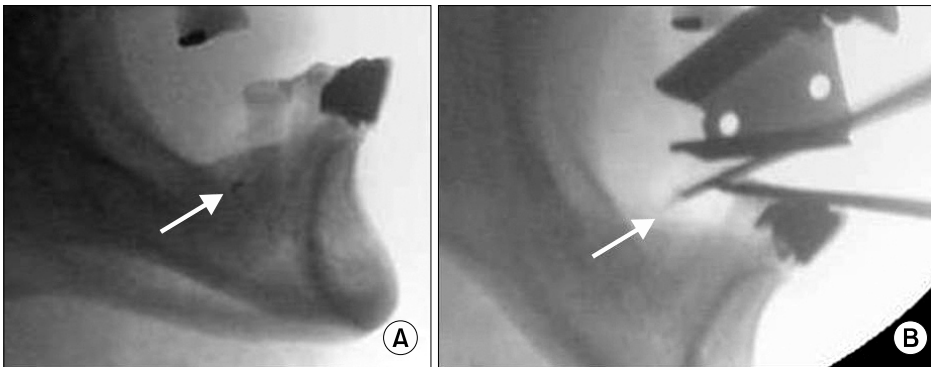


Fig. 2. The lost screw could not be detected with the naked eye after lingual flap reflection. C-arm fluoroscopy was used to define the three-dimensional location of the micro-screw. (A, B) The images show the different positions of the foreign body as a result of closing and opening of the mouth (arrows). The location of the lost screw could be exactly defined with fluoroscopy.



Fig. 3. The micro-screw embedded in the soft tissue of intrinsic tongue muscle was successfully isolated and removed under the guidance of intraoperative real-time images by C-arm fluoroscopy. (A) The 4-mm-long micro-screw that was removed from the soft tissue of the sublingual space. (B) A postoperative panoramic view showing the removal of all graft materials, including titanium mesh and screws, for preventing postoperative infection. (C) Intraoperative view after removal of the embedded foreign body, arrow indicates dissection site of periosteum.

Discussion

During both minor and major surgeries in the oral and maxillofacial region, there is always a risk of unexpected loss, ingestion, or inhalation of foreign bodies. Sudden movement of the patient or careless handling of instruments by the operator contribute to loss of surgical implements in the surgical field. The lost foreign body should be removed immediately to prevent secondary complications[10]. These foreign bodies sometimes migrate to a deeper anatomical position, raising risk of complications such as nerve and vessel injuries, infection, and inflammation[7]. However, if the lost item is a small or thin object, such as a needle or micro-screw, its exact three-dimensional location is not always easily detected intraoperatively[8]. Vigorous palpation around the area might cause the item to migrate to a deeper anatomical site and/or may embed it into the adjacent soft tissue. Thus, radiologic tools are used to detect the exact location of the foreign body in the surgical field[11].

The conventional radiologic and CT images are routinely checked in a foreign body incident, and can give some information about the location of the lost item. In addition, video endoscopy has been introduced to detect and remove foreign bodies in the head and neck region[5,12]. However, video endoscopy is not particularly useful for detection of soft tissue-embedded materials, because retraction and mobility of soft tissue during the procedure makes localization of the foreign body difficult. Computer-assisted surgery (CAS) has been introduced for three-dimensional localization of foreign bodies[11,13]. However, CAS is limited in that the image does not present the situation at the time of the retrieval operation. If the object in the soft tissue migrates prior to surgical retrieval, reassessment for the changed position is necessary[13]. Intraoperative real-time ultrasound and CT guidance systems have been used to retrieve foreign bodies in the head and neck, but in each case, the equipment is difficult to set up in the operating room, is expensive, and creates a hazard due to increased radiation exposure[8].

Table 1. Literature review of cases of foreign body removal using fluoroscopy in the oral and maxillofacial area

References	Case (n)	Anatomical site	Foreign body type	Remarks
Thompson <i>et al.</i> [1], 2003	2	Pterygomandibular space	Broken dental needle	Stereotatic-technique Two guide needles
Park and Carr[3], 2006	1	Oropharynx	Metallic brush bristle	Mobile digital C-arm Two guide needles
Nezafati and Shahi[2], 2008	1	Pterygomandibular space	Broken dental needle	
Kim <i>et al.</i> [4], 2008	1	Floor of mouth	Piercing bar	With endoscopy
Cho <i>et al.</i> [5], 2011	1	Cheek	Bullet	
Park <i>et al.</i> [6], 2012	4	Pterygomandibular space	Dental needle	Dental mini C-arm
	1	Subcutaneous tissue	Endodontic file	
	1	Mandibular body	Root picker	
	1	Mandibular ramus	Fissure bur	
	1	Maxillary sinus	Implant fixture	
	1	Sublingual muscle	Micro-screw	
Current case	1	Sublingual muscle	Micro-screw	Mobile digital C-arm

Several researchers have reported the usefulness of C-arm fluoroscopy to define and remove soft-tissue embedded metals[2,3,14]. C-arm fluoroscopy can provide three-dimensional intraoperative real-time images for the exact location of target materials, especially in the case of a foreign body in soft tissue that is movable by intraoperative traction[7]. In the oral and maxillofacial region, fluoroscopic equipment was first used for localization of a broken needle in the pterygomandibular area[1]. In that case, the stereotactic method with an image intensifier was used, a method originally developed to remove foreign bodies from the extremities[15]. Interestingly, a dental mini C-arm was also used to define the location of foreign bodies in the oral and maxillofacial area[6,7]. This smaller dental fluoroscopy unit was originally developed to aid dental implantation near the inferior alveolar nerve, maxillary sinus, and other anatomical structures, and has the advantage that it can be used on the patient positioned on the dental chair under local anesthesia, to yield intraoperative real-time information about a soft tissue-embedded foreign body[6,7]. While dental mini-fluoroscopy has many advantages in oral and maxillofacial region, conventional or mobile digital fluoroscopy has been broadly used to detect various foreign bodies in the head and neck area[2-5]. A review of the literature of fluoroscopy use to detect foreign bodies in the oral and maxillofacial area is presented in Table 1.

In the present case, the lost micro-screw apparently penetrated the periosteum of the lingual flap and migrated into the deeper site due to repeated manual palpations during initial attempts to detect it. This small soft tissue-embedded metal item was easily located and successfully re-

moved under the guidance of real-time imaging by fluoroscopy. The C-arm fluoroscopy used in this case emits radiation as 1,600 mR/min (26.6 mR/s). One exposure lasts less than one second and we used about six exposures during surgery to localize the lost micro-screw, so the total exposure was less than 160 mR. This amount of radiation is minor compared to those for other routine radiographs or CT. A portable chest X-ray would emit 10 to 20 mR for one exposure and a CT of head and neck would emit approximately 1,200 to 1,300 mR[3]. Therefore, the restricted use of C-arm fluoroscopy to define foreign bodies in the oral and maxillofacial area exposes patients and operators to radiation within the commonly used radiation limits.

In conclusion, we recommend C-arm fluoroscopy for exact localization of lost foreign bodies in the oral and maxillofacial area, as a safe and readily available procedure that can provide intraoperative real-time information, especially in cases in which the object is embedded in soft tissue.

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