Int. J. Oral Maxillofac. Surg. 2006; 35: 961–964
doi:10.1016/j.ijom.2006.03.020, available online at http://www.sciencedirect.com

International Journal of
Oral & Maxillofacial Surgery

Case Report
Dental Implants

Floor of mouth haemorrhage and life-threatening airway obstruction during immediate implant placement in the anterior mandible

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B. M. Woo, S. Al-Bustani, B. A. Ueeck: Floor of mouth haemorrhage and life-threatening airway obstruction during immediate implant placement in the anterior mandible. Int. J. Oral Maxillofac. Surg. 2006; 35: 961–964.

Abstract. A majority of the procedures performed in the dental office setting are considered safe and minimally invasive. Despite this fact, as healthcare providers it is our responsibility to be able to anticipate, recognize and manage life-threatening emergencies that may occur. In the following report, the authors will describe a life-threatening complication that resulted from the placement of mandibular implants.

Accepted for publication 21 March 2006
Available online 7 July 2006

Report of case

A 47-year-old female presented to her dentist for extraction of her remaining mandibular teeth (#s 21–28) and placement of 4 immediate endosseous implants. The patient's past medical history was significant only for gastroesophageal reflux disease and negative for hypertension and coagulopathies. Prevacid (lansoprazole) was the only medication the patient was taking. The dentist performed simple extraction of teeth #s 21–28 and then made a crestal incision from just distal of tooth 21 to just distal of tooth 28. A minimal subperiosteol dissection was made to expose the alveolar crest only. Three immediate implants were placed into the extraction sites of teeth #s 21, 23 and 28 without incident. Next, an osteotomy was prepared in the extraction site of tooth #25. While preparing this site he felt himself perforate through the lingual cortex of the anterior mandible (Fig. 1). He noticed some bleeding from the site and packed the site initially. He then prepared site #26 for an implant. After the implants were placed there was continued bleeding from the extraction site of tooth #25. He attempted pressure for control and again added gelfoam packing to the site. The bleeding continued and a haematoma began to form in the patient's floor of mouth. Her tongue also began to swell, protrude and become elevated. The patient soon began to have difficulty breathing, swallowing and managing her secretions. The dentist then rushed her to a nearby hospital emergency room across the street where her airway was secured via an awake fibreoptic nasal intubation. The patient was then transferred to Oregon Health & Science University for further management by the Department of Oral and Maxillofacial Surgery (Figs 2 and 3).

At OHSU the patient was taken to the operating room where a tracheostomy, evacuation of the haematoma and exploration of the floor of mouth were performed. After the tracheostomy was performed, an incision was made in the patient's lingual vestibule just posterior to the lingual surface of the anterior mandible. Most of the

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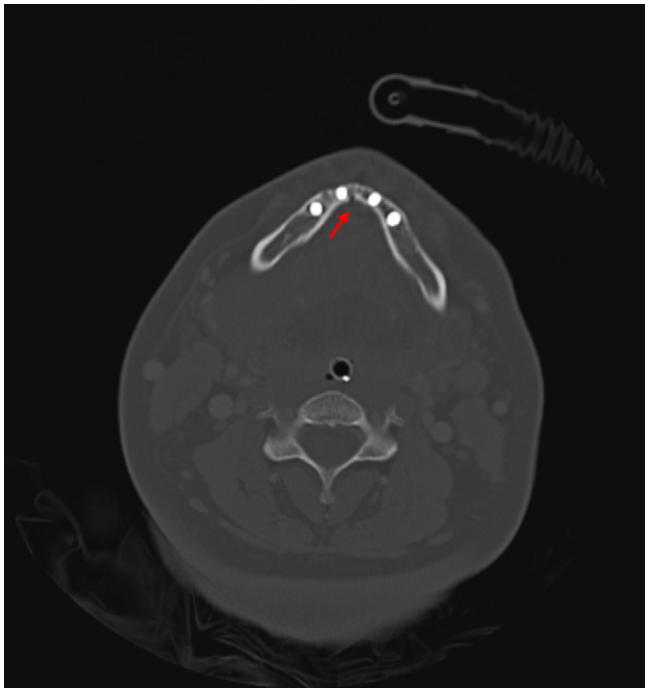

Fig. 1. Bony window resolution of the anterior mandible that demonstrates the site of perforation lingual to site number 25.

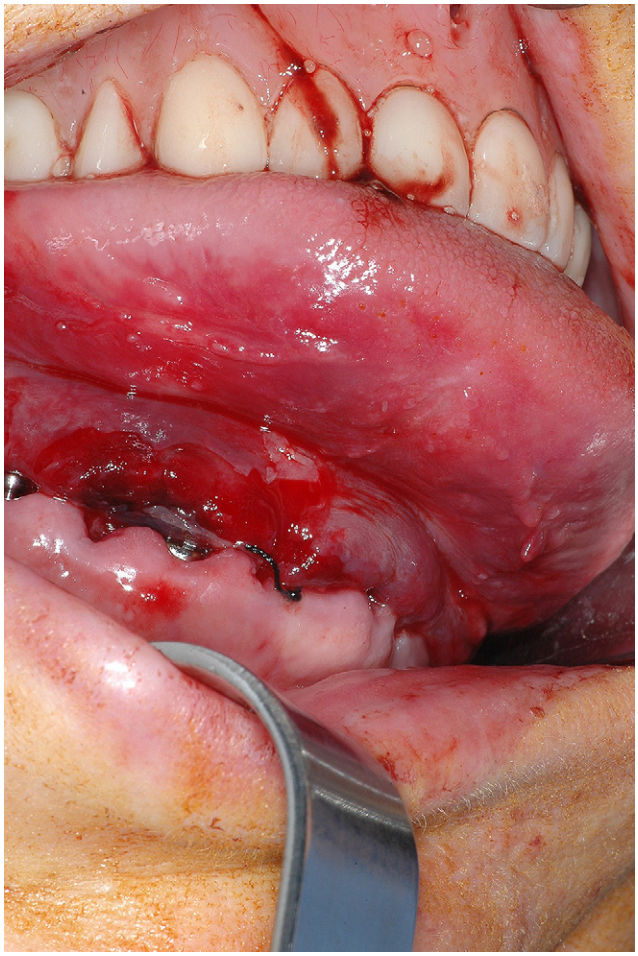

Fig. 2. Seen here is the large expanding haematoma in the floor of the mouth resulting in elevation and protrusion of the tongue.

haemorrhage was diffusely infiltrating the floor of mouth and lingual soft tissue. A small 2 cm × 3 cm haematoma was evacuated. The sublingual artery was identified between the genioglossus and geniohyoid muscles and was found to be transected. Both ends of the sublingual artery were identified and ligated. The incision in the lingual vestibule was left open to heal secondarily. The patient was transferred back to the ICU where she recovered uneventfully overnight and was transferred to the ward the next day. A day later she was discharged home with the tracheostomy. By her follow-up appointment on postoperative day 10, the oedema and ecchymosis of her floor of mouth, tongue and neck was almost completely resolved. The patient's trachea was decannulated at this time.

Relevant anatomy

Perforating the lingual cortex of the anterior mandible invades the floor of the mouth, and creates opportunity to damage structures in the sublingual space. The sublingual space is bound by the mandible laterally and anteriorly, the base of the tongue medially and posteriorly, by mucosa superiorly and the mylohyoid muscle inferiorly. Among the contents of this space are the following: the sublingual artery and vein, the perforating submental artery and vein, the submandibular ganglion, the lingual nerve, the hypoglossal nerve, the sublingual gland, the deep lip of the submandibular gland and submandibular duct.

As Gray's anatomy describes it, the lingual artery arises in the carotid triangle of the neck, deep to platysma, and lateral to (and *on*) medial pharyngeal constrictor and stylohyoid ligament. It starts upward and medial, and it loops downward to the hyoid bone. At which the loop is crossed by the hypoglossal nerve. It then crosses the upper border of the hyoid bone, runs anteriorly with its vein and deep to the tendon of the digastrics, the stylohyoid, the hyoglossus and part of the submandibular gland. The hyoglossus separates it from the hypoglossal nerve and its vena comitans, while the sublingual branch starts at the anterior margin of the hyoglossus.

The sublingual artery runs anterior between the genioglossus and the mylohyoid, supplying the sublingual gland. It gives branches to the mylohyoid, the sublingual mucosa and the lingual gingiva. It anastomoses with the same artery from the opposite side at the anterior lingual alveolar mucosa. The perforating branch to the

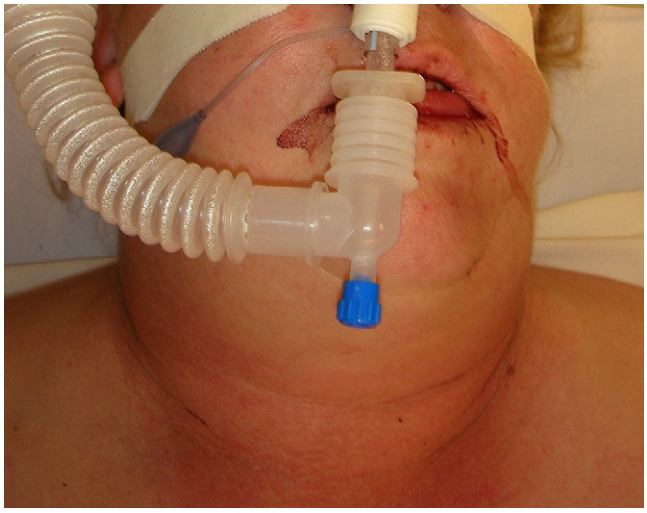

Fig. 3. Significant soft tissue oedema of the neck.

mylohyoid anastomoses with the submental branch of the facial artery.

The submental artery is the largest cervical branch of the facial artery, and it appears as the facial artery leaves the submandibular gland. It courses anteriorly on the mylohyoid muscle, and it branches to anastomose with the sublingual artery and with the mylohyoid artery, deep to the muscle. At the chin, it divides into deep and superficial branches, anastomosing with the inferior labial and mental arteries.

In their human cadaver study, HOFSCHNEIDER et al.[7] showed that 70% of specimens had a sublingual artery in the mandibular anterior region, while 41% had a branch of the submental artery perforating the mylohyoid muscle into the same region. About 53% had the sublingual artery entering the lingual cortex of the anterior mandible. It is interesting to note that 29% had a perforating submental, but no sublingual artery. BAVITZ et al.[1], however, found that a perforating submental artery was present in 60% of the cases, while the sublingual artery was small or missing in 53% of the cases, highlighting the significance of the perforating submental.

Discussion

Past reports of life-threatening haemorrhage and haematoma formation in the floor of mouth secondary to dental procedures such as extractions, tori removal, biopsies and osteotomies have been reported[8]. The population at increased risk for this include: patients with hypertension, coagulopathies, on anticoagulants, vascular malformations and malignant invasion[9]. Our patient's past medical history was not significant for any of these risk factors.

A review of the literature shows 14 previous cases of life-threatening haemorrhage into the floor of mouth secondary to the placement of implants into the mandible, not including our case[1,2,4–15]. Majority of the cases involved the placement of an implant into the mandibular canine region and were the result of perforation of the mandibular lingual cortex[9]. There was one case report of the haemorrhage resulting from an incision that was made too lingual to the alveolar crest and the dissection being carried out supraperiosteally resulting in laceration of the sublingual artery and hypoglossal nerve[4]. Our case is unique as the haemorrhage was the result of perforation of the lingual cortex in the region of the mandibular central incisor with resulting injury to the sublingual artery.

Perforation of the mandibular lingual cortex can result in laceration or transection of the sublingual or submental arteries, both of which can lie adjacent to the periosteum of the mandibular lingual cortex. This can result in immediate or delayed haemorrhaging. Delayed haemorrhaging is often due to vessel transection, where the vessel is completely severed and initially retracts thus stopping the haemorrhage. Later with reflex dilation or with rebound dilation after the vasoconstrictors wear off, bleeding resumes[3,8]. An incomplete tear or laceration of the vessel may result in continued intermittent bleeding[3].

Initial attempt to control the haemorrhaging should be the application of bimanual pressure to the floor of mouth and lingual surface of the mandible. In addition to bimanual pressure/compression, haemostatic packing agents may also be used. In some case reports the bleeding was self-limiting and tamponaded as a result of compression from the pooling blood and pressure from the adjacent muscles and soft tissue[6,8,9,13]. If the bleeding fails to tamponade and becomes a dissecting haematoma then the source of bleeding must be identified surgically and definitively controlled by tying or clipping the vessels responsible. This can be a very difficult task secondary to distortion of the anatomy from extensive oedema/swelling and from vessel retraction, especially in an awake patient. If the bleeding cannot be identified from an intraoral approach, then it must be controlled via external ligation. It is still controversial as to whether external ligation of the lingual or facial artery is more likely to be needed[1,7]. Manual compression on the antegonial notch of the inferior border of the mandible may help distinguish whether the facial or lingual artery is the feeder vessel[9]. If compression on the antegonial notch ceases bleeding then the facial artery/submental artery is the likely source. Another option is embolization of the damaged vessels via angiography/interventional radiology.

In majority of the case reports, the haemorrhaging led to significant swelling and oedema of the floor of mouth and tongue, resulting in respiratory distress and airway obstruction from elevation of the tongue against the palatal vault. If this happens attempts should be made to secure the patient's airway with direct laryngoscopy and intubation or with fibreoptic intubation. In one case report they were not able to obtain intubation with direct laryngoscopy but were able to secure the airway with the use of a laryngeal mask airway that was forced past the elevated tongue[13]. In cases where the patient was not able to be intubated, emergent tracheostomy had to be performed to secure the airway[4,5]. Cricothyrotomies were not able to be performed because of neck swelling and oedema making it impossible to identify the anatomical landmarks.

Antibiotics should be used to prevent infection in extensive haematomas especially with intraoral communication. There is the potential for organisms to cause clot dissolution as well as infection of the deeper spaces because of blood being a favourable culture medium[6]. The administration of steroids should also be considered to help reduce swelling.

To prevent perforation of the lingual cortex during implant placement in the anterior mandible, some surgeons have advocated ordering additional radiological studies such as a lateral cephalogram or

sagittal CT scans[5,13]. A lateral cephalogram, however, would only show the mandibular configuration at the midline while most of the lingual perorations reported in the literature have occurred in the mandibular canine region[2,9]. Another option would be to directly observe the lingual aspect of the mandible to fully visualize the lingual cortex, during implant placement. This also allows retraction of the contents of the floor of mouth away from the lingual cortex, thus protecting the contents from being damaged from a bur should perforation of the lingual cortex occur. The length of the implants being placed into the anterior mandible must also be taken into consideration. It is no longer necessary to try and achieve bicortical anchorage and careful consideration must be given to using implants longer than 14 mm in the anterior mandible[5].

In summary, as healthcare providers it is our duty to first do no harm. It is, however, inevitable that even with the most minor invasive interventions will come complications that may result in life-threatening emergencies. It is the ethical duty of each practitioner to be prepared to anticipate, recognize and manage these situations.

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