AN UNUSUAL, DECEPTIVE DELAYED OF PROFUSE HAEMORRHAGE AFTER MANDIBULAR IMPLANT DENTISTRY: RISK PLANNING AND MEDICO-LEGAL INSTRUCTION

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SUMMARY
Mandibular implant placement (MIP) has been accepted and widely used for decades all over the world, and has reached a very high level of therapeutic reliability. MIP is used mostly in elderly edentulous patients who lost their teeth when dentistry was not oriented to fixed or removable prosthetic. Notwithstanding this, every year cases of severe complications during MIP due to haemorrhage causing life-threatening airway's obstruction are reported. These severe complications of MIP need immediate therapy, usually with hospitalization, and may be potentially fatal.
A 56-year-old man presented to the private practice requesting the placement of two dental implants at 41 and 31 previously lost for periodontal disease. Two implants of 3.3 mm of diameter, and 10 mm of length were inserted replacing teeth 31 and 41. Two hours after surgery and home delivery, the patient came to the emergency room complaining of dyspnoea and edema at the floor of the mouth. The maxillo-facial surgeon decided to perform tracheostomy and haemostasis under general anaesthesia. Two weeks after demission a complete healing was performed.
This is important for dental practitioners to avoid severe bleeding complications during the MIP in the interforaminal region, especially on the midline. Moreover, when mandibles are severely atrophic, practitioners should be aware of this fact and the possible implications. The evaluation of these data is essential in the correct preoperative planning of implant procedures in the mandible, and with the increasing demand for MIP, the variations of the lingual foramen of the mandible should receive more attention.

Key words: acute floor of mouth hematoma, airway management, airway obstruction, dental implant complications, haemorrhage, edema.

Introduction

Mandibular Implant Placement (MIP) as a practice has been accepted and widely used for decades all over the world and has reached a very high level of therapeutic reliability. The increasing trend to use MIP is constant and solid, and we can foresee that it will continue this way (1-5).
MIP is usually used in elderly edentulous patients who lost their teeth when dentistry was not oriented to fixed or removable prosthetic. Today the use of MIP to retain mobile overdentures has become a routine practice in dental care. MIP is often used in dealing with edentulous patients

who have complete overdentures in order to improve their general life quality. Therefore implant-supported prostheses in totally edentulous patients may be considered a social therapy because the maintenance of a complete dentition with implant-retained prostheses improves the function and thus the self-esteem of the patients (2, 6-18).

However, many patients report more problems with the lower removable overdentures than the upper removable ones, and the most frequent reasons for dissatisfaction are pain, an unstable denture and difficult eating resulting in a reduction of comfort. Besides the success rate of MIP is above 80%, peri-implantitis is the most important delayed complication of implant dentistry (19-24). Peri-implantitis and periodontal disease spring from bacterial infection that activates a cytokines cascade leading to inflammation and bone loss (25-28). In addiction, the patient-related susceptibility is a critical factor for disease onset. So, every factor favouring oral biofilm formation (poor oral hygiene), host defence capability (smoking habit, excessive alcohol consumption, genetic traits, history of periodontitis, use of bisphosphonates), might favour developing of peri-implantis and periodontal disease, which diagnosis and treatment require dentist's engagement (29-31).

The delayed complication of MIP is peri-implantitis, while the immediate one is profuse bleeding caused by vascular trauma. In fact, MIP allows inserting a variable number of fixtures in the edentulous interforaminal mandibular area, which is usually considered safe, thanks to a good bone quality and lack of important neurovascular structures. Generally, the delayed complications of MIP are considered to be rare, and surgical risks very low, while the reported percentage of success is very high.

Notwithstanding this, every year cases of severe acute complications during or immediately afterwards MIP in the anterior mandible due to vascular trauma causing bleeding and a consequent formation of massive lingual, sublingual and submandibular hematomas are reported (23). These severe complications of MIP with haemorrhage of the floor of the mouth need immediate therapy, usually with hospitalization because, though this complication is rare, it may be potentially fatal. These complications are due either to wrong surgery or to a lack of knowledge about the anatomy of the neurovascular bundle and the one or more foramina on the lingual side of the mandibula. More precisely, the presence of lingual foramina at the midline level and of the adjoining vessels is often undervalued, with very dangerous clinical consequences especially in completely edentulous patients with severe atrophy of the mandibular ridge.

The success of MIP can depend on the pre-surgical radiological examination, which helps to determine the parameters of implant placement by revealing the structure of the mandible, alveolar bone shape, and volume. Panoramic and tomographic radiograms are used to carry out these analyses. Recently, cone-beam computed tomography (CBCT) has begun to be widely used prior to implant surgeries. Multi-planar slices of CBCT, which has fixed magnification, is clinically useful for planning MIP and preventing damage to vulnerable structures, such as the inferior alveolar neural tubes and maxillary antrum.

The most common complications of MIP are paraesthesia caused by damage to inferior alveolar nerves. Since the alveolar and basal bone areas between the mandibular mental foramina are relatively safe areas during MIP, the lingual aspect of the mandible has been viewed as less clinically significant. Even in cases of alveolar bone atrophy, penetration of lingual cortical bone is recommended for MIP. Mandible presents structures that could be involved in MIP complications: the anterior dilation of inferior alveolar neural tubes, concavity of lingual bones, lingual foramina, and lingual tubes. Moreover, many cases of haemorrhage during MIP have been caused by lingual plate perforation.

The sublingual and submental arteries run under the lingual aspect of the mandible, spraying blood to the mylohyoid muscle, peripheral muscles, mucous membrane, and gingiva. These mu-

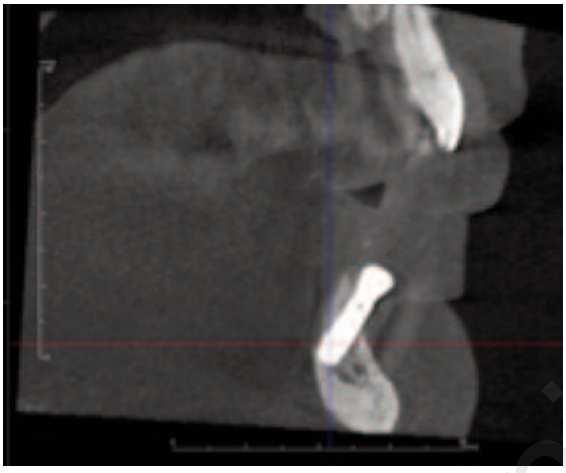
cosal branches settle along the lingual aspect of the mandible and may require special care prior to MIP since they are known to deposit lingual cortical bone into the mandible.
The sublingual and submental arteries of the mandible run adjacent to the lingual cortical bone. This implies an increased risk of bleeding if the lingual cortical bone is damaged during MIP. Adequate planning of MIP is required, with thorough knowledge of the anatomical features of the surgical zone, and the use of complementary techniques such as cone-beam computed tomography (CBCT), in order to avoid possible risk situations. Despite such precautions, however, some patients are at an increased risk of bleeding during MIP due to physiological anatomical variants. Some studies indicate that despite its apparent simplicity, MIP is not without risks, which in some cases may prove serious.
MIP in canine region, followed by the incisors and first premolar zone are reported to cause important bleeding complications. Such bleeding during or immediately afterwards MIP is explained by the presence of the sublingual and submental arteries in these areas.

Case report

A 50-year-old man presented at the private practise requesting the insertion of two dental implants replacing the two inferior central incisors previously lost for periodontal disease (Figures 1, 2). The medical history wasn't remarkable for any disease. At the local examination the residual bone crest was eligible to receive the implants. A panoramic radiography was performed showing a sufficient amount of bone for positioning the two implants. Two implants of 3.3 mm of diameter, and 10 mm of length were inserted replacing the two inferior central incisors. At the end of the surgery, the patient did not show edema or bleeding in the oral floor. An orthopanthomography and a latero-lateral teleradiography were performed to control the correct

Figures 1, 2
Partial mandibular edentulism for teeth loss (31- 41).

implant's position (Figures 3, 4). After surgery the patient has been complained of profuse haemorrhage, dyspnoea and edema at the floor of the month. Then the patient was referred to emergency room. According to the patient's history of chief complaint, there was continuous oozing around the surgical site after the MIP that day. The patient said his symptoms of haemorrhage, edema and dyspnoea had begun after the MIP. Clinical examination in the emergency room showed profuse haemorrhage, severe edema of the floor of the mouth. The patient was referred to the oral and maxillofacial surgery department for surgical site management. The maxillo-facial surgeon decided to perform tracheostomy under general anaesthesia. The hematomas under the mouth floor was reduced thank to a drainage tube inserted through the neck. The patient was hospitalized for 4 days in intensive care, then the drainage tube was removed and the edema of the mouth floor was



Figures 3, 4
Ortopantomography and latero-lateral teleradiography performed after the placement of the implant in mandibula. No evidence of bone or vascular damage.

markedly reduced. The mouth floor and tongue reduced their swollen three days after recovery, and the tracheal intubation was removed. One week after tracheostomy a complete healing was performed (Figure 5).

Discussion

Most complications of MIP are caused by perforations to the lingual cortical bone in the canine area, which contains the sublingual arteries of the inferior alveolar artery (32).
According to these cases, immediate bleeding and severe edema during MIP are due mostly to direct damage of the sublingual arteries, as a consequence of lingual cortical bone perforation. If bleeding is delayed after MIP, the perforation of sublingual artery must be considered. Moreover, bleeding risk must be taken into consideration if the patient has been treated with antihypertensive or anticoagulant drugs. Surgical risk of profuse bleeding during or after MIP should also be considered if the diameter of the foramen is greater than 1 mm on CT scan. Elderly patients who need alveoloplasty for den-

Figure 5
Complete healing two weeks after tracheostomy.

ture procedures and patients who have severe alveolar bone atrophy are at increased risk, as their lingual foramina are close to the alveolar ridge; the appearance frequency of lingual foramina in these patients is also high. Edema after MIP must be recognized as a key indicator of surgical bleeding. In case of damage to the perforating artery, edema can occur, and pressure should be applied to the lingual face of the mandible, and anti-haemorrhagic emergently administered. When the bleeding ceases, antibiotics and steroids should be administered.

Mandibular lingual foramina are difficult to identify on a panoramic X-ray before MIP, because the cervical vertebrae overlap with the beam's trajectory. CT scans are thus indispensable before MIP, particularly if they are preceded by mandibular augmentation, and genioplasty. Pre-surgical scans should be used to evaluate volume, width, and shape of the mandible, as well as other anatomical structures.

Bleeding complications after MIP are infrequent but can be serious, particularly in the anterior mandibular region. Profuse bleeding during MIP usually is due to lingual cortical bone perforation. It occurs when long implants are placed along cortical plate. In this case the use of short implants is advised to prevent bleeding and edema.

This case report aimed to describe atypical haemorrhage and edema resulting from MIP between the mental foramen, an area known to be 'safe' due to its lack of anatomically vulnerable structures. In this paper we reported a case of near-fatal airway obstruction secondary to sublingual bleeding and hematoma after MIP. In fact, the floor of the mouth contains branches of the submental, sublingual and mylohyoid arteries that may lead to life-threatening complications.

Practitioners who perform MIP should notify patients of the potential risk of sublingual hematoma formation, and be able to manage acute airway that may result from this complication. Depending on the clinical situation, haemorrhage may commence immediately after MIP or with some delay after the vascular insult. The progressively expanding lingual, sublingual, submandibular, and submental hematomas have the tendency of displacing the tongue and floor of the mouth to obstruct the airway.

All over the world there are millions of patients wearing overdentures or using implants to retain and stabilize mandibular overdentures and improve the comfort and quality of life. In fact, the use of implants to retain and support the denture improves comfort, since MIP gives the patients more self-confidence and thus improve social interaction.

There are many possibilities regarding the number of implants; four implants supporting an overdenture is considered the best option for the stabilization of removable prostheses because it is a valid compromise of stability and economy (all in four). To retain the overdentures, a variable number of implants is necessary, however, the use of implants along the midline adds a risk factor during MIP; in fact at least one lingual foramen is present on the midline compared to tubercoli genieni with relative neurovascular bundles. Therefore the MIP along the midline should be avoided because the risk of severe complications due to vascular lesion is possible. Furthermore, this highly vascularized region is vulnerable, and bleeding can be induced easily by MIP, causing a vascular trauma, usually following the perforation of the lingual periostium with an injury of the lingual arterio-venous plexus of the mouth floor. In addiction the effect of the vasoconstrictive agent present in the local anaesthetic can determine a successive bleeding after MIP, which can be even more dangerous since the patient is no longer under the surgeon's observation (33).

In this case report, a man who had undergone MIP developed severe arterial bleeding. The bleeding was caused by an accidental perforation of the lingual cortical plate of the lower jaw. This area (between the two mental foramina in the mandible) is commonly used to place two dental implants in partially or totally edentulous patients (13-18, 34, 35). Implatologists performing MIP should have a thorough understanding of the vascular structures in the surgical field

and constantly be aware of circumstances that can induce iatrogenic vascular injuries. In these cases, severe bleeding can occur during MIP and clinicians should therefore make every attempt to avoid lingual cortical plate perforations.
There are preventive measures to be considered before MIP. For example, palpating the lingual surface to determine the possibility of perforation potential is a simple method; in addiction a lingual subperiosteal flap will ensure direct observation and protection of the lingual structures during MIP. Ortomantomography is not sufficient to determinate the presence of lingual foramen, so that it is recommended to use computed tomography that shows the mandibular anatomy in a sagittal plane. Such radiographic exams would be preferable in the pre-assessment of the dental implants particularly in the mandible anterior area.

Conclusion

The knowledge of these facts is fundamental for surgeons who must take care to use MIP of a certain length carefully and to absolutely avoid the midline. This is important for dental practitioners to avoid severe bleeding complications during the MIP in the interforaminal region, especially on the midline. Moreover, when mandibles are severely atrophic, practitioners should be aware of this fact and the possible implications. The evaluation of these data is essential in the correct preoperative planning of implant procedures in the mandible, and with the increasing demand for MIP, the variations of the lingual foramen of the mandible should receive more attention.

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