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Intraoral extra-mucosal fixation of fractures in the atrophic edentulous mandible

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Abstract. Atrophy of the mandible leads to a decrease in the bone mass, making it more vulnerable to fractures. A direct relationship has been demonstrated between the height of the bone in the area of the fracture and the incidence of postoperative complications of bone healing. Basic principles of fracture management in both edentulous and non edentulous patients are open reduction and internal fixation with osteosynthesis of the fracture to achieve restoration in terms of aesthetics and functionality. Several authors have discussed the advantages and disadvantages of the transoral and extraoral approaches. Between January 2007 and June 2011, 13 patients affected by bilateral fractures of atrophic mandibles were treated by extra-mucosal intraoral stabilization with satisfactory results. This approach reduces the risks of damage of the marginalis mandibulae nerve with low operation time, while avoiding unsightly scars.

Key words: extramucosal osteosynthesis; mandibular fracture; atrophic edentulous mandible.

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Atrophy of the mandible leads to a decrease in the bone mass, making it more vulnerable to fractures. Maxillary atrophy can be considered as the end stage of edentulism (total teeth loss). Treatment of fractures in old patients with bone atrophy are characterized by high morbidity due to local and general factors. A direct relationship between the height of the bone in the area of the fracture and the incidence of postoperative complications of bone healing has been demonstrated.[1]

The most common site of fracture in the edentulous mandibles is the mandibular body. Fibrous union or non union occurs most frequently at this site, especially when the amount of the residual mandible is less than 20 mm (particularly <10 mm).[2]

Basic principles of fracture management in both edentulous and non edentulous patients are open reduction and internal fixation with osteosynthesis of the fracture to achieve restoration in terms of aesthetics and functionality. Several authors have discussed the advantages and disadvantages of the transoral and extraoral approaches. The purpose of this study was to introduce the authors' approach to fractures occurring in atrophic mandibles. Their preoperative hypothesis was that extra-mucosal intraoral osteosynthesis can achieve adequate mandibular restoration in terms of aesthetics and functionality. The specific aims were to review the surgical outcomes of this approach.

Materials and methods

A case series study was designed and a sample of patients affected by fractures of the atrophic mandible was enrolled. Inclusion criteria were bilateral fracture of atrophic mandibular body, edentulism, and bone height less than 20 mm. Patients were excluded if they had previously treated or untreated mandibular fractures.

Causes of fractures included accidental falls in six cases; three patients had fallen to the ground after a syncope; and four

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patients had been involved in a motor vehicle accident. Two patients had no associated systemic comorbidities, eight had hypertension, two had diabetes associated with hypertension, and one patient reported hypertension and a previous transient ischaemic attack. Despite these comorbidities, all patients were able to undergo general anaesthesia (Table 1).

All patients had edentulous and atrophic mandibles. The maximum height of the mandibular body, measured on computed tomography (CT) scan slides, was 16 mm. The average height was 11.5 mm (min 8.5 mm; max 14 mm) at the site of fracture. The time of surgical treatment after injury ranged from 1 to 6 days, with an average time of 3.5 days. Orthopantomography was the first level diagnostic imaging technique. The second level investigation was a mandibular CT scan to analyse the degree of fracture displacement and the height of the atrophic body (Fig. 1).

Patients who underwent surgery were discharged from the maxillofacial department on the second postoperative day with 6 days' antibiotic therapy (amoxicillin 875 mg plus clavulanic acid 125 mg) twice a day and pain medication if needed. During the postoperative follow-up, which lasted 40 days or more, the patient was checked once a week. 8 weeks after surgery the patients underwent orthopantomography to verify the stability of osteosynthesis after the formation of primary callus. Once it had been confirmed that bony union had occurred, the plate was removed from each patient under local anaesthesia (optocain 20 mg/ml plus adrenalin 1:100,000).

Surgical technique

The osteosynthesis proposed is based on the application of a preformed extra-mucosal reconstruction plate. The operation is performed under general anaesthesia following the usual procedure of induction. The steps of the operation are simple and easily repeatable. In the first step, a short (about 3 cm) bilateral mucosal incision is performed, followed by subperiosteal dissection of the lateral aspect of the mandibular angles to allow insertion of the end portions of the osteosynthesis plate previously modelled on the shape of the mandibular arch. The plate is fixed to the mandibular angles by one bicortical screw on each side. The plate used belongs to a locking system 2 mm in diameter (Fig. 2).

The second step is the manual reduction of the fractured body and its stabilization.

Table 1. Characteristics of the patients who underwent extra-mucosal intraoral osteosynthesis.

Patients	Gender	Age	Causes of fractures	Comorbidities	Complications
A.P.	M	78	Accidental fall	No	None
B.B.	F	80	Motor accident	Hypertension plus diabetes	None
D.V.	M	84	Accidental fall	Hypertension	Pseudarthrosis
F.A.	M	74	Syncope	No	None
B.F.	F	79	Motor accident	Hypertension.	None
B.C.	M	82	Accidental fall	Hypertension	None
C.N.	F	76	Accidental fall	Hypertension	None
L.P.	M	72	Motor accident	Hypertension	None
O.D.	F	86	Motor accident	Hypertension	None
G.Z	M	82	Accidental fall	Hypertension	None
D.U.	F	76	Accidental fall	Diabetes	None

Fig. 1. CT scan. 3D reconstruction of a double fracture in an atrophic mandible.

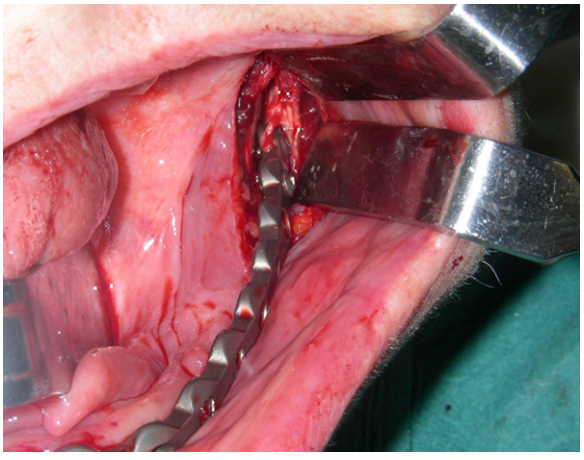

Fig. 2. Intraoperative view showing subperiosteal insertion of the terminal portion of the plate.

The accuracy of the reduction is verified by intraoperative radiography. If doubts remain, a small mucosal window can be produced to examine the alignment of bone fragments. Once the correct reduction is obtained, the bone fragments are locked to the plate by one or two transmucosal titanium screws at the symphysis and two additional screws at the mandibular angles (Fig. 3). The surgical incisions are sutured. The operative time usually ranges from 35 to 75 min.

The removal of the plate is usually performed at postoperative week 9. Lateral screws are removed with an angulated screwdriver after subperiosteal dissection along the terminal part of the plate. Anterior extramucosal screws are easily removed by the appropriate screwdriver (Fig. 4a and b).

Results

13 patients (8 males; 5 females) with a mean age of 79 years (range 72–86 years)