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Management of comminuted mandible fractures

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Comminuted mandible fractures generally are the result of a significant impact on a localized area of the oromandibular complex and are defined as multiple lines of fracture in one region of the mandible. These complex cases require careful diagnostic and radiographic workup, proper preoperative planning, and technically excellent execution of fracture reduction and fixation. Treatment principles include restoration of proper occlusion with maxillo-mandibular fixation, exposure and alignment of the fracture segments, and ultimate fixation with a load-bearing locking reconstruction plate. Properly executed rigid internal fixation is a great advance in the management of comminuted mandibular fractures with reliable outcomes. The course of treatment is also significantly shortened and leads to more rapid resumption of normal function.

Comminuted mandible fractures generally are the result of a significant impact on a localized area of the oromandibular complex. Most of these fractures are open. Under any circumstances, these fractures are difficult to treat and have a greater complication rate than more simple ones. Traditional treatment of comminuted mandibular fractures has involved closed techniques in an effort to avoid stripping periosteum from the comminuted bony segments. This would avoid potentially devitalizing the bone fragments with resulting sequestration. Closed reduction was performed with a variety of techniques, including maxillomandibular fixation (MMF), splints, and extraoral skeletal pins. In many cases, infection still ensued resulting in significant bone loss and associated morbidity.

However, this theory was challenged more than 60 years ago by Kazanjian, based on his treatment of war injuries.[1,2] Concerning the management of mandibular gunshot wounds, he stated that "the majority of nonunited fractures are due to inadequate immobilization of comminuted fragments of bone, and subsequent infection, rather than to initial loss of bone."[2] To Kazanjian, it was clear. Stabilization of the fragments was the most important requirement to obtain osseous union of comminuted fragments. He developed elaborate techniques for maintaining the reduced fracture fragments in position during healing. Other investigators then recommended open reduction of comminuted mandibular fractures. Bromiage[3] described a technique for open reduction with internal fixation of the comminuted segments using a threaded Kirschner wire placed near the inferior border via an extraoral approach. Coniglio and Norante[4] later demonstrated good results in several cases using a modification of this technique, placing a K-wire at the inferior border of the mandible and securing it to the stable segments with wire. Cohen and coworkers[5] discussed management of comminuted mandibular fractures by extraoral open reduction, with removal of the comminuted segments, stripping them of soft tissue, crushing them into chips, and then replacing them in the wound as a free graft.

More recently, open reduction and stable internal fixation with plates and/or screws has been advocated for comminuted fractures.[6-12] The aforementioned authors suggest that stripping some of the blood supply does not lead to increased incidence of infection as long as stabilization of the bony fragments is achieved. Rigid fixation of the fragments minimizes sequestration. Further, open reduction and internal fixation of these comminuted mandible fractures with load bearing osteosynthesis allows for rapid healing and reduces the risk of nonunion and mal-union.[13] Spiessl and Prein stressed 2 fundamental principles to obtain adequate rigid internal fixation for comminuted mandibular frac-

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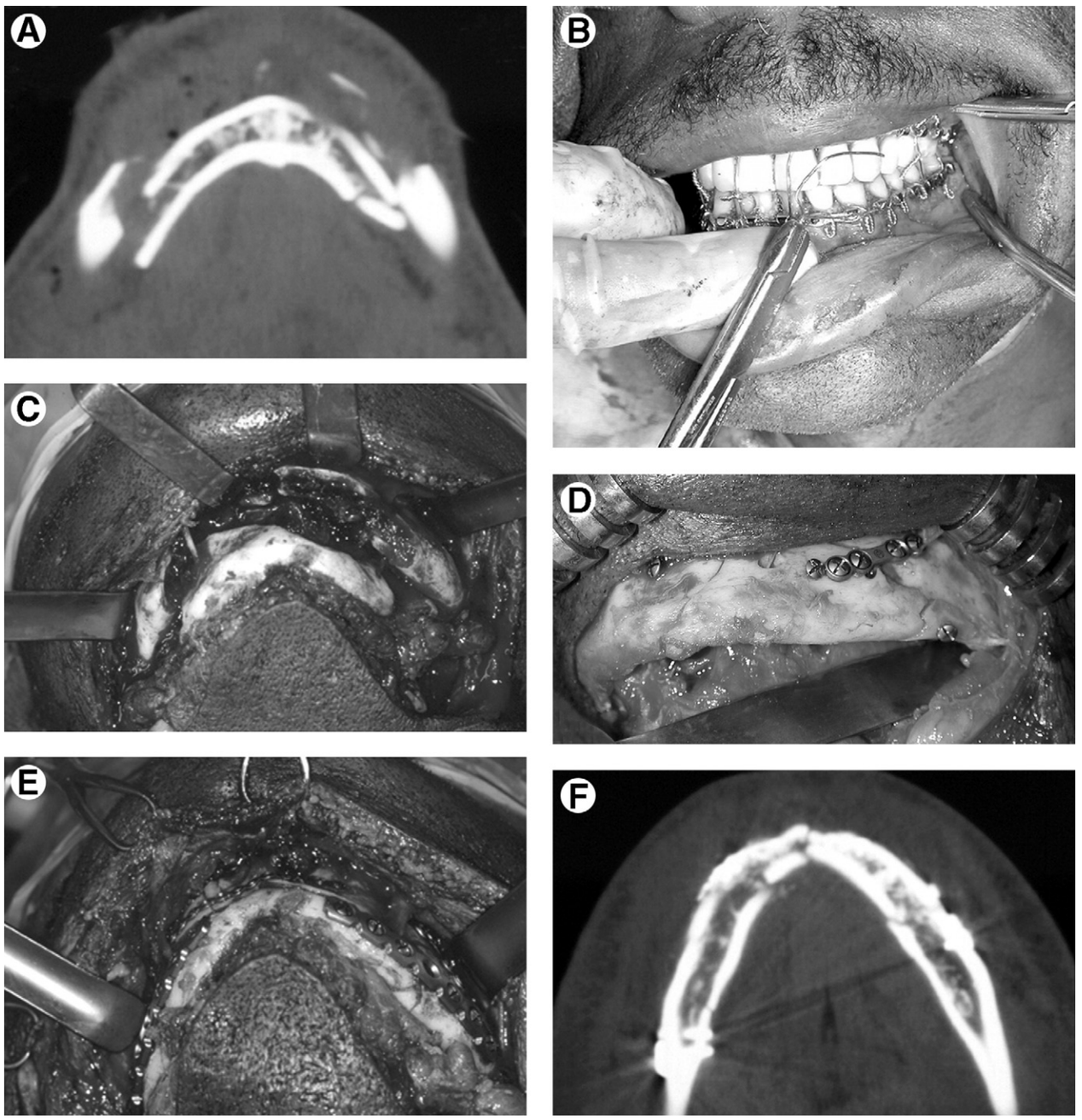

Figure 1 (A) Axial computed tomography scan of a comminuted anterior mandible fracture. (B) Fixation of dento-alveolar segments with wiring and arch bars. (C) Exposure of the entire fracture through a submandibular extra-oral approach before plating. (D) Simplification of the fracture by plating larger fragments together with 2.0 miniplates with monocortical fixation. (E) Application of a load bearing 2.4 locking reconstruction plate to bridge and fixate the entire fracture. (F) Postoperative axial computed tomography scan confirming accurate anatomic reduction of the fracture.

tures.[7,8] First, the fixation needs to support the full functional loads (load-bearing osteosynthesis). Second, absolute stability of the fracture construct must be achieved. This is the prerequisite for sound bone healing and a low rate of infection. These principles can be adhered to using titanium reconstruction plates. In comminuted fractures, the bone fragments cannot take part in the functional load, and therefore load-sharing osteosynthesis between implant and bone is not possible, so a load-bearing plate must be used.

Preoperative planning

Comminution is defined as multiple lines of fracture in one region of the mandible.[9,11] The mechanism of injury should be determined as impacts, such as gunshot wounds, can create additional soft tissue damage and contamination than blunt trauma.

After assessment and stabilization of any life-threatening or critical systemic conditions, careful clinical assessment of the oromandibular complex is mandatory. Particular at-