Intraoral technique for locking reconstruction plate fixation using an implant handpiece with adapted drills

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Accepted 14 March 2016
Published online 00 Month 2016 in Wiley Online Library (wileyonlinelibrary.com). DOI 10.1002/hed.24474

ABSTRACT: *Background.* Locking reconstruction plates are used in the treatment of jaw trauma and diseases if there is a need for surgical resection and to prevent pathologic fracture after tumor excision. Fixation is typically performed using an extraoral approach.

Methods. This article describes a technique for the intraoral fixation of locking reconstruction plates that uses prototyping to model the plate before the procedure as well as an implant handpiece with adapted drills for bone drilling and the insertion of screws into relatively inaccessible areas.

Conclusion. Intraoral fixation not only prevents nerve damage and facial scarring but also minimizes the plate's risk of extraoral exposure and reduces surgical morbidity. © 2016 Wiley Periodicals, Inc. *Head Neck* 00: 000–000, 2016

KEY WORDS: locking reconstruction plate, pathologic fracture, implant handpiece, odontogenic tumor, cryotherapy

INTRODUCTION

Reconstruction plates are used in cases involving atrophic or comminuted mandibular fractures or tumor progression that requires surgical resection and to prevent pathologic fracture after lesion removal.[1,2] The purpose of this type of rigid internal fixation is to reestablish masticatory function. However, to successfully achieve this objective, the plate material must exhibit 2 basic characteristics: it must fully support its functional load and maintain stability at the site to allow the bone to heal without the risk of infection.[3] These prerequisites are most successfully fulfilled via the use of locking reconstruction plates.[4]

Approaches used to position these plates have evolved over time, with extraoral access increasingly being supplanted by intraoral techniques.[5] Intraoral fixation avoids damage to the marginal mandibular branch of the facial nerve, prevents the formation of external scars, and minimizes the plate's risk of transcutaneous exposure.[6] Intraoral access techniques allow for direct visualization and confirmation of the desired occlusion during fixation of the reconstruction plate.[6]

The purpose of this study was to describe the fixation of locking reconstruction plates via intraoral access using an implant handpiece with adapted drills for bone drilling and the insertion of screws into relatively inaccessible areas.

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Operative technique

A prototype of the jaw is created using a CT scan of the face, allowing the locking reconstruction plate to be adapted to the biomodel before surgery. This CT scan is used for preoperative diagnosis (see Figure 1).

The intraoral approach involves creating a wide incision in the margin between the free and attached gingiva (see Figure 2), with attention devoted to preserving the mental nerve (see Figure 3). Subsequently, intermaxillary fixation is performed, using intermaxillary fixation screws and elastic bands between the dental arches to maintain stable occlusion. The previously adapted plate is definitively adjusted along the bone edge during the surgical procedure (see Figure 4). Drilling and screw insertion for fixation are performed using an implant handpiece with adapted drills (see Figure 5), as previously described in the literature,[7] adhering to accepted guidelines specifying a maximum angle of 20° for the locking plates. A 1.6- × 17-mm bur is used at 2000 rpm in the implant handpiece (20:1) for bicortical drilling. Screws are inserted into the mandibular angle and ramus region using a cross drive hand key adapted to the implant handpiece (20:1) at 60 rpm and with a torque of 50 N (see Figure 6). When conducting this technique on mandibles at imminent risk of fracture after tumor removal and cryotherapy or the extraction of impacted teeth, the first step is to attach the screws at the extremities of the plate in areas that are free of pathology.

Once the locking reconstruction plate is attached, intermaxillary fixation is removed to facilitate osteotomies to access the surgical site, tumor resection with (see Figure 7) or without the aid of cryotherapy (see Figure 8) and the

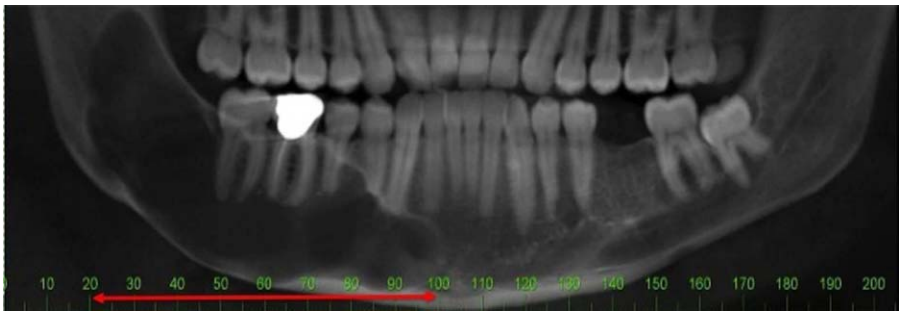

FIGURE 1. Preoperative CT scan, panoramic view of an 8-cm tumor that compromises the mandibular ramus and body (red arrow). [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com]

extraction of associated teeth. After lesion excision, screws relevant to the segment of the plate in contact with the surgical site are inserted when sufficient cortical bone is present on the buccal or lingual sides; in extreme cases, grafting is performed using bone substitutes (see Figure 9).

DISCUSSION

The development of reconstruction plates was one of the most significant advances in rigid internal fixation of the mandible. Such plates provide an efficient, predictable, and safe means for surgeons to maintain jaw stability. However, the adaptation of this material during surgery requires time and surgical skill,[1] even when fixation is performed using an extraoral approach and with direct access to the surgical site. Thus, the application of the technique described in this article is based on the use of plates shaped before the surgical procedure using a biomodel. This tool reduces surgery time by up to 60 minutes and ensures correct anatomic positioning of the plate even with the intraoral approach and limited visual access. Correct positioning of the plate is possible because of folds created before surgery in accordance with anatomic references of the bone surface.

Another complicating factor in fixation is the angle required for accurate screw placement,[8] particularly when locking plates and an intraoral approach are used. The use of an implant handpiece with adapted drills consistent with the technique described by this team[7] is vital for overcoming restrictions that limit access for screw insertion into the mandibular angle and ramus. This type of handpiece facilitates drilling and screw insertion without requiring an extraoral approach, ensuring that the entire surgical procedure can be conducted via intraoral access. With respect to the angle required for the use of screws in the locking plates, the ideal plates are those that allow a specific angle for drilling and insertion. As such, the described technique uses a material that allows for an inclination of up to 20°.

The technique described here is recommended for situations in which the excision of extensive intraosseous lesions with or without cryotherapy and/or the surgical removal of impacted teeth generate an imminent risk of jaw fracture via masticatory force during the postoperative phase and via mandible manipulation by the surgeon during the surgical process. The use of cryotherapy as an adjuvant therapy to the excision of odontogenic tumors dramatically reduces the potential for relapse. However, the freezing of bone tissue weakens its structure, increasing the risk of pathologic fracture.[9]

This team's protocol[10] is to always use cryotherapy when faced with an odontogenic tumor. Thus, the locking reconstruction plate is placed with the patient's consent to avoid maxillomandibular block and diet restrictions during the postoperative period. The main advantage of using a load-bearing fixation system is that it becomes unnecessary to treat a pathologic fracture and expose the patient to a second intervention; in particular, even if such a

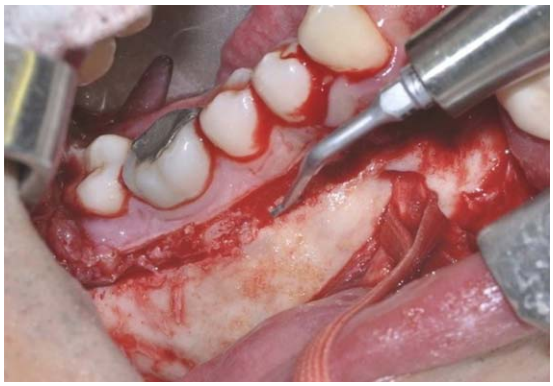

FIGURE 2. Intraoral access with a wide incision in the transitional region between the free and attached gingiva. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com]

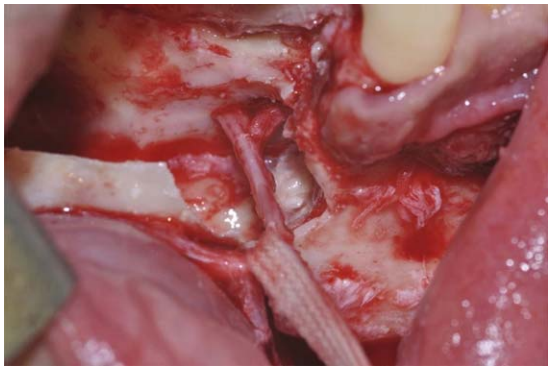

FIGURE 3. Mental nerve preservation during gingiva incision and tumor resection. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com]

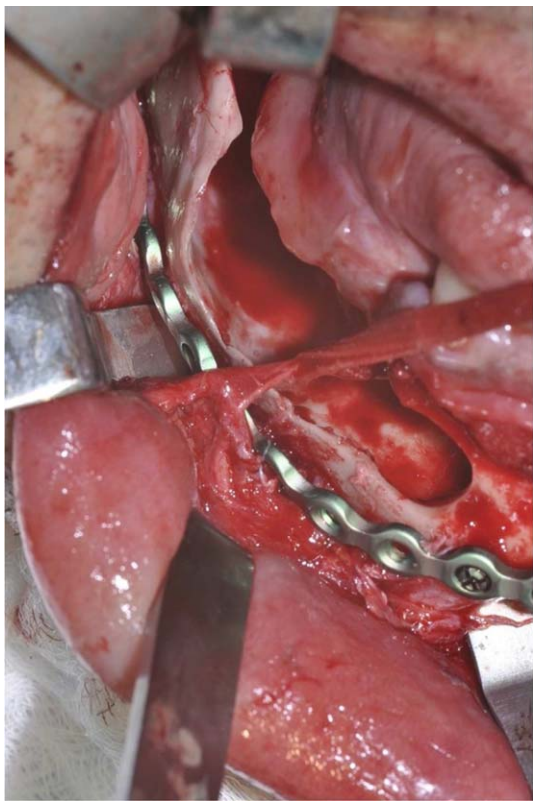

FIGURE 4. Locking reconstruction plate fixation only in areas free of pathology is important before cryotherapy. This step avoids mandibular fracture during surgery. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com]

fracture occurs, the patient usually presents with no clinical signs or symptoms because there is no displacement of bone segments. Such mandibular fractures are diagnosed only via radiographic findings (see Figure 10).

Generally, the rigid internal fixation system is not removed after the bone has healed because, to date, there have been no patient complaints and no inflammatory or infectious complications. The absence of postoperative

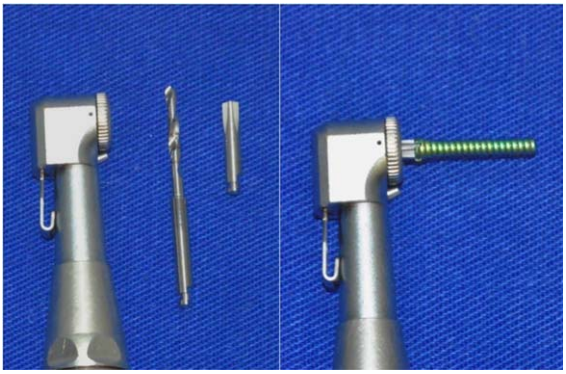

FIGURE 5. Implant handpiece (20:1) with adapted drills for bone drilling (1.6 mm × 17 mm) and screw insertion (adapted cross drive hand key). A screw in position for insertion at a 90° angle. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com]

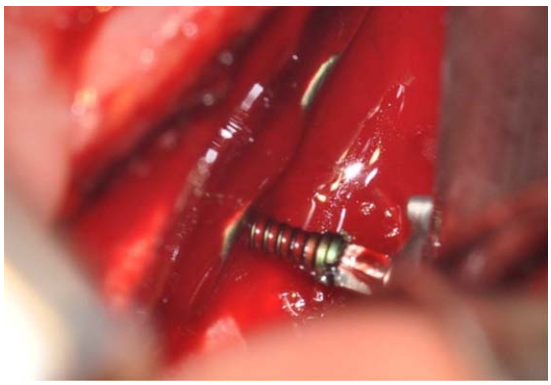

FIGURE 6. Screws are inserted into the mandibular angle and ramus region using a cross drive hand key adapted to the implant handpiece (20:1) at 60 rpm and with a torque of 50 N, adhering to the accepted guidelines specifying a maximum angle of 20° for the locking plates. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com]

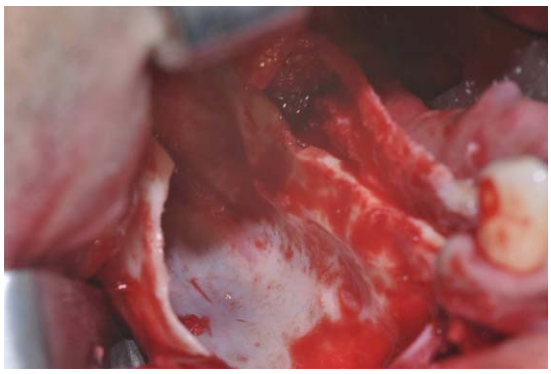

FIGURE 7. Intraosseous area susceptible to pathologic fracture after tumor resection and cryotherapy. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com]

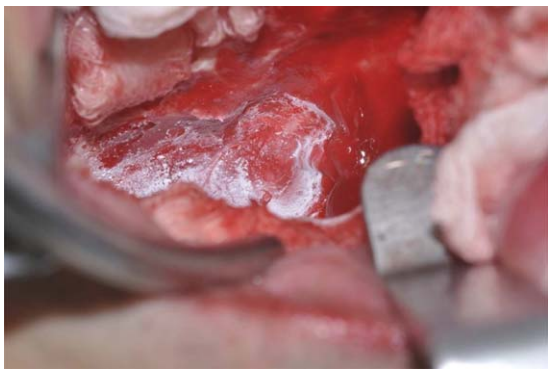

FIGURE 8. Cryotherapy in the surgical area. This step reduces relapse chances but increases the probability of pathologic fracture in cortical bones, such as the mandible. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com]

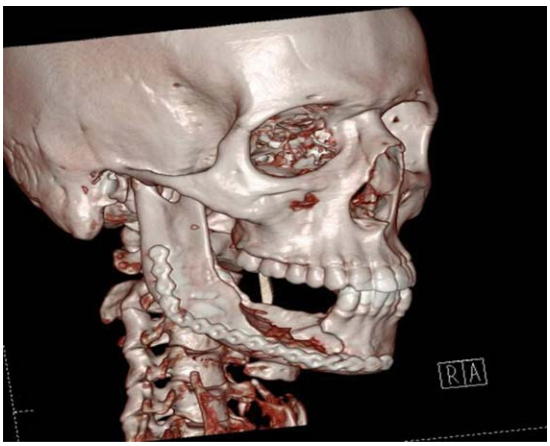

FIGURE 9. CT scan with 3D reconstruction during the immediate postoperative period. The plate was adapted to and fixed in an area with margins that are free of pathology. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com]

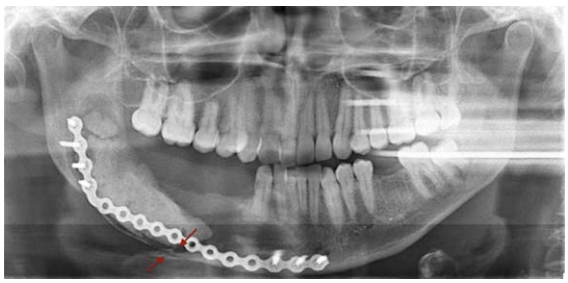

FIGURE 10. Panoramic radiograph 4 weeks after surgery indicating a pathologic mandibular fracture (red arrows) without displacement and stable occlusion provided by the locking reconstruction plate. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com]

inflammation is likely attributable to the use of locking plates, for which the screws remain adapted to the plate even after the bone at the site of the pathology has healed.

The implant handpiece with adapted drills is widely used by the authors in most cases involving mandibular fractures and in all cases involving orthognathic surgery for fixation of the mandible osteotomy with 2.0-mm plates, monocortical screws, and a bicortical screw at the ramus.[7] There are certain comminutive mandibular fractures for which this technique cannot be used due to the difficulty of reducing bone segments with this intraoral approach. In cases for which the surgeon can plan the osteotomy, such as cases involving certain pathologies and/or orthognathic surgery, this technique using an implant handpiece is strongly indicated.

Although difficult, an intraoral approach eradicates the need for large incisions in the skin, thereby preventing hypertrophic scars, transcutaneous exposure of the plate, and damage to the marginal mandibular branch of the facial nerve.[6] Thus, the technique reported here not only facilitates surgical procedures but also reduces surgical morbidity and provides aesthetic benefits to the patient.

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