Modified Intraoral C-Osteotomy

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Abstract: Repeated sagittal split osteotomy might impose an increased risk for damage of the inferior alveolar nerve. Another contemporary orthognathic issue is surgical management of malocclusion following condylar resorption. Here we describe a modified C-osteotomy technique as a proposed solution for these difficulties in orthognathic surgery. The modified C-osteotomy might induce less stress on the condyles reducing the risk for relapse subsequent to condylar resorption, as well as reduce the risk of inferior alveolar nerve damage.

Key Words: Condylar resorption, inferior alveolar nerve, orthognathic surgery, sagittal split osteotomy, yaw surgery

Revisional sagittal split osteotomy (SSO) is a rarely described surgical technique that can be indicated in case of residual malocclusion or relapse following orthognathic surgery. This reoperation might impose an increased risk for inferior alveolar nerve (IAN) damage for multiple reasons. Iscan et al1 demonstrated that the mandibular canal is postoperatively repositioned more laterally. Multiple authors agree that a buccal position of the mandibular canal entails an increased risk of IAN damage following SSO.2,3 Secondly, it is hypothesized that reoperation can cause an added injury to a recovering nerve resulting in permanent damage. Wittwer et al4 suggested that a modification or a complete individualized osteotomy might be indicated in patients with increased risk of IAN damage due to its preoperative position.

Another contemporary orthognathic issue is the treatment of relapse following condylar resorption. Crawford et al5 reported 7 cases that were surgically treated following condylar resorption. All 7 patients underwent Bilateral Sagittal Split Osteotomy, with 2 patients undergoing an additional Le Fort I osteotomy and in 2 cases additional temporomandibular joint (TMJ) surgery. Five patients presented postoperatively with relapse, emphasizing the difficult treatment of this affliction. When orthognathic surgery is warranted to correct malocclusion, biomechanical strain on the TMJ should be avoided to prevent reinitiating condylar resorption and subsequent skeletal relapse.6,7

Here we describe a modified C-osteotomy technique with sufficient introral access for adequate rigid fixation. The modifications allow an introral approach and might reduce the risk of inferior alveolar nerve damage, as well as decrease biomechanical stress on the TMJ.

SURGICAL TECHNIQUE

In 1968, C-osteotomy was proposed for correcting micrognathic conditions of the mandible. The described surgical approach was through an external inframandibular incision, using a template to locate the mandibular canal level by tracing landmarks.8 This procedure enables good bone contact at the sliding osteotomy site along the lower mandible border, while avoiding IAN injury by making osteotomy cuts below the mandibular canal or posterior to the mandibular foramen in the ascending ramus. The upper horizontal osteotomy has the advantage of maintaining the original coronoid position, avoiding all muscular interference on the advanced fragment.

Here we present a modification of the original C-osteotomy (Fig. 1), which allows a safe and easy intra-oral approach, while providing sufficient access for rigid fixation and bone grafts. The modification comprises 2 parts, which have both been previously published for different purposes.9,10 The first modification involves displacing the mandibular foramen along the oblique anterior trajectory of the mandibular canal.1 The IAN entrance is displaced to a lower and more anterior position in the ascending ramus, at the occlusal level of the lower jaw, guaranteeing the intraoral accessibility of the ascending ramus (Fig. 2).

The second modification eliminates the need for a surgical template to locate the mandibular canal. The sliding bicortical osteotomy at the lower border is replaced by a modified SSO, using a piezotome to split the lower border of the mandible, as

FIGURE 1. Surgical technique of the modified C-osteotomy. Illustrations of the 3 steps of the modified C-osteotomy. Step 1: Displacement of the mandibular foramen. Step 2: Two frontal cross-sections of the mandible. Cross-section 1 is at the level of the second molar, and depicts the inferior border osteotomy using a hooked piezotome. Cross-section 2 is more posteriorly located, and presents a more superior position of the IAN and a more lingual and superior position of the osteotomy. Step 3: Rigid fixation of the displaced distal mandibular segment using an osteosynthesis miniplate.
buccal gap at the mandibular body on each side (Fig. 3). This can be
created by splitting the buccal and lingual parts of the ascending ramus. After approximation of the 2 segments, bony interference at the level of the osteotomy plane can introduce an anterior gap between the vestibular border of the proximal segment and the lingual side of the distal segment. Forced closing of this gap and fixation of the distal mandibular segment with lag screws, can lead to TMJ displacement and torque of the condyle.12,13 This in turn can attribute to TMJ dysfunction, condylar remodeling and in some cases condylar resorption with subsequent postoperative relapse.14,15 Yang et al16,17 reported a more pronounced torque of the condyles following SSO in comparison with vertical ramus osteotomy (VRO), based on bony interference at the level of the osteotomy plane. Drawbacks of VRO are a challenging intraoral approach and unavailability of rigid fixation, which are resolved with the described modified C-osteotomy. Similar to VRO, a C-osteotomy has a reduced risk of condyle displacement due to decreased bony interference, as the osteotomy plane is distinctly smaller, hence avoiding forced closing of the gap between the mandibular segments. This leads us to believe that the C-osteotomy could diminish condylar torque and therefore might prevent condylar resorption. These advantages make the modified C-osteotomy the preferred procedure in patients requiring repeated surgery after orthognathic surgery with consequent condylar resorption.7

Drawbacks of this technique include inevitable cortical bone loss due to the buccal “window,” and the requirement of an autologous bone graft. The C-osteotomy has so far been performed on 3 patients which resulted in adequate, stable occlusion without report of trigeminal or facial nerve injury. In conclusion, the modified C-osteotomy can offer a solution in patients in need of repeat orthognathic surgery and patients with malocclusion following condylar resorption. The proposed modifications might help prevent IAN damage and might lower the risk of reinitiating condylar resorption.

**REFERENCES**


