

Clinical Paper
Cosmetic Surgery

A safe and accurate method to perform esthetic mandibular contouring surgery for Far Eastern Asians

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Abstract. A tapered mandibular contour is popular with Far Eastern Asians. This study describes a safe and accurate method of using preoperative virtual surgical planning (VSP) and an intraoperative osteotomy guide to maximize the esthetic outcomes of mandibular symmetry and tapering while mitigating injury to the inferior alveolar nerve (IAN). Twelve subjects with chief complaints of a wide and square lower face underwent this protocol from January to June 2015. VSP was used to confirm symmetry and preserve the IAN while maximizing the surgeon's ability to taper the lower face via mandibular inferior border osteotomy. The accuracy of this method was confirmed by superimposition of the perioperative computed tomography scans in all subjects. No subjects complained of prolonged paresthesia after 3 months. A safe and accurate protocol for achieving an esthetic lower face in indicated Far Eastern individuals is described.

Key words: virtual surgical planning; mandibular contouring; mandibular tapering; esthetic facial surgery; V-line surgery.

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In Far East Asia, a wide lower face resulting from skeletal or masseteric hypertrophy is generally considered unesthetic, particularly in females.¹ A tapered and oval-shaped face, accentuated with a lower jaw contour frequently referred to as the 'V-line', is particularly popular with Far Eastern Asians. Mandibular tapering and contouring surgery has become one of the most popular facial esthetic procedures in recent years.^{2,3}

There are generally two ways to achieve a desirable tapered lower face via skeletal surgery: (1) mandibular inferior border

osteotomy (the V-line procedure), and (2) mandibular outer cortex splitting osteotomy. Both can be combined with narrowing and lengthening genioplasties. These procedures are highly effective in achieving the desired lower facial contour. However, avoiding injury to the neurovascular bundle and achieving symmetry of the facial skeleton during this process remain challenging even for the most skilled surgeons.

While virtual surgical planning (VSP) and the use of intraoperative guides have been popularized in reconstructive surgery,

their uses in esthetic procedures are less discussed. A safe and accurate protocol of using VSP and an intraoperative osteotomy guide that is specific to mandibular tapering and contouring surgery for esthetic indications is described herein.

Patients and methods

Twelve subjects attending an aesthetic surgery center in Taipei, Taiwan, who ranged in age from 19 to 43 years, underwent the study protocol for mandibular tapering and contouring surgery from

January to June 2015. There were two male and 10 female subjects. Subjects were ASA physical status I or II (American Society of Anesthesiologists) and devoid of any concurrent congenital or acquired dentofacial deformity. Subjective complaints included a wide lower face, a ‘square’ look, an ‘angry look,’ and inadequacy of botulinum A toxin tapering of the lower face. Mandibular angle hypertrophy was the diagnosis for the subjects. In addition to mandibular tapering and contouring, nine subjects also underwent unilateral angle sagittal osteotomy, five underwent malar reduction, and seven underwent narrowing and lengthening genioplasties. The reason for the additional procedures was to further taper the mandibular contour while maintaining the overall facial balance. The study protocol was approved by the Institutional Review Board of Cathay General Hospital, and signed informed consent was obtained from all subjects.

Virtual surgical planning

Image acquisition

Facial scans were acquired by cone beam computed tomography (CBCT) (i-CAT; Imaging Sciences International, Hatfield, PA, USA) and were performed with patients in natural head position (NHP).⁴ NHP was ascertained by asking the patient to look themselves in the eye in a mirror positioned 1.5 m in front of the scanner. NHP was adjusted and confirmed by the surgeon.⁵⁻⁷ DICOM files of the facial skeleton (0.25 mm in thickness) were then imported into Simplant software (Materialise, Leuven, Belgium) for processing.

Design of the osteotomy guide

Mimics software (Materialise, Leuven, Belgium) was used to design the virtual osteotomy. First, the inferior alveolar

nerve (IAN) canal was traced from the lingula to the mental foramen, and then reconstructed in three dimensions (Fig. 1a). The osteotomy border was designed by the surgeon virtually while maintaining a minimum distance of 2.0 mm from the neurovascular bundle (Fig. 1b). The side of the mandible with the IAN canal closer to the lateral bony cortex dictated the maximum extent of the osteotomy bilaterally. The mandibular contour was then examined in all orientations to ensure symmetry. An osteotomy guide was designed with the superior edge following the virtually designed osteotomy and the inferior edge cupping the mandibular body and ramus. The virtual osteotomy guide was exported as stereolithography files and fabricated by a rapid prototyping machine (Formiga P110; EOS, Munich, Germany) (Fig. 1c).

Intraoperative use of the osteotomy guide

The esthetic mandibular tapering and contouring operations were performed under general anesthesia via intraoral approach. A stable and accurate fit of the osteotomy guides at the mandibular angle was achieved after sub-periosteal dissection; these were secured with 2.0 × 6.0 mm screws via trocar access (Fig. 2a). The anterior part of the osteotomy was performed with a reciprocating saw, while the posterior osteotomy with its acute curvature at the angle region was performed with an oscillating saw. Neither saw by itself will adequately complete the osteotomy due to surgical access and mandibular contour. The bone specimen was removed together with the osteotomy guide (Fig. 2b).

Postoperative assessment

Postoperative i-CAT scans of the subjects at 1 week were imported into 3-matic

software (Materialise, Leuven, Belgium) to overlay with the preoperative i-CAT scans to assess the accuracy of the actual osteotomy as compared to the virtual osteotomy. Mandibular nerve (V₃) function was assessed at 1 week, 1 month, 3 months, and 6 months postoperatively. Subjective sensation of numbness was inquired. An objective directional sense examination was performed.

Results

Superimposition of the perioperative CBCT scans showed little discrepancy in all subjects. The IAN canal was observed in all postoperative scans. Patients reported high subjective satisfaction rates for the esthetic results. A representative clinical case is shown in Fig. 3. By 3 months postoperative, all subjects demonstrated intact V₃ sensation without prolonged paresthesia. There were no reports of chronic pain or dysesthesia.

Discussion

Esthetic mandibular tapering and contouring surgery has been popularized to modify a wide lower face due to skeletal hypertrophy. Subjectively, for Far Eastern Asians, this procedure transforms a masculine and stern appearance to a more feminine and approachable one.^{2,8} The mandibular angle osteotomy and angle splitting osteotomy have become the primary surgical options in the esthetic correction of mandibular angle osteohypertrophy.⁹

Baek et al. first reported the use of mandibular angle osteotomies in 1989; the procedure was performed for 42 Korean patients who wished to achieve a tapered lower face.¹⁰ Yang and Park reported a modified three-arc osteotomy that included splitting of the outer cortex of the mandibular angle to achieve tapering.¹¹

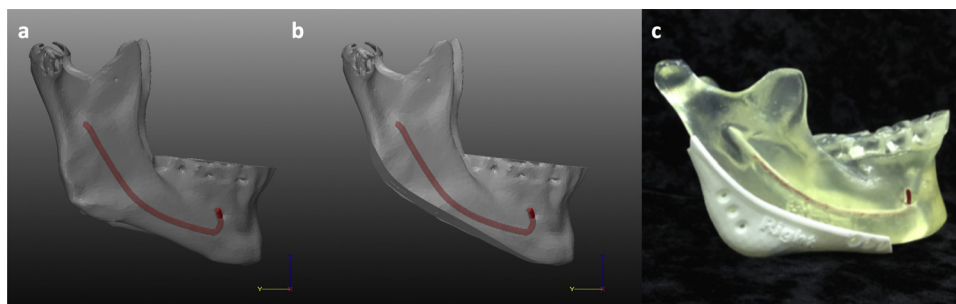


Fig. 1. (a) The inferior alveolar nerve canal is traced from the lingula to the mental foramen, and then reconstructed in three dimensions. (b) The designed osteotomy margin must be at least 2 mm away from the inferior alveolar nerve canal. (c) The virtual osteotomy guide is exported as stereolithography files and fabricated by a rapid prototyping machine for intraoperative use.

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