Journal of Dental Sciences (2014) 9, 272–276

Available online at www.sciencedirect.com

SciVerse ScienceDirect

journal homepage: www.e-jds.com

ORIGINAL ARTICLE

Influence of bone-cut position in intraoral vertical ramus osteotomy on skeletal stability after mandibular setback

Chun-Ming Chen [a], **Steven Lai** [a], **Kun-Rong Hsu** [b], **Shiu-Shiung Lin** [c*]

[a] *Department of Oral and Maxillofacial Surgery, Kaohsiung Medical University Hospital, Kaohsiung Medical University, Kaohsiung, Taiwan*
[b] *Department of Family Dentistry, Kaohsiung Medical University Hospital, Kaohsiung Medical University, Kaohsiung, Taiwan*
[c] *Orthodontic Department, Kaohsiung Chang Gung Memorial Hospital and Chang Gung University, College of Medicine, Kaohsiung, Taiwan*

Received 23 June 2012; Final revision received 9 August 2012
Available online 27 July 2013

KEYWORDS
bone-cut position;
intraoral vertical ramus osteotomy;
long-term stability;
mandibular prognathism;
sagittal split ramus osteotomy

Abstract *Background/purpose:* Postoperative skeletal stability is associated with osteotomy design of orthognathic surgery. The purpose of this study was to investigate osteotomy site-related factors of intraoral vertical ramus osteotomy (IVRO) related to skeletal relapse in a 2-year postoperative follow-up.
Materials and methods: Twenty-seven patients with mandibular prognathism underwent surgical mandibular setback with IVRO. Cephalometric radiographs of the patients were collected after completing preoperative orthodontic treatment (T1), at the stage immediately after surgery (T2), and in the 2-year postoperative follow-up (T3). Pir was located at the posterior most and inferior most ramus point. Io was the inferior most osteotomy point of the mandible. Relapse was defined as forward movement of menton (Me) in the 2-year follow-up. Hierarchical modeling analyses were used to assess changes in the variables, including the amount of postoperative relapse (MeT32), the quantity of surgical setback (MeT21), the available setback horizontal distance (Pir–Io), and the available setback ratio (MeT21/Pir–Io).
Results: The mean setback of Me was 12.6 mm, and the mean relapse was 0.9 mm (7.1% = 0.9/12.6). In the 1-by-1 and 1-by-2 models, there were no significant differences between the relapse and other variables. However, we found a significant difference in the 1-by-3 model. The MeT21 and MeT21/Pir–Io were significant factors in postoperative relapse.

* Corresponding author. Orthodontic Department, Kaohsiung Chang Gung Memorial Hospital and Chang Gung University, College of Medicine, Number 123, Da-Pi Road, Niaosong District, Kaohsiung City 83301, Taiwan.
E-mail address: glasgow1993@yahoo.com (S.-S. Lin).

http://dx.doi.org/10.1016/j.jds.2013.06.002

Conclusion: We found that multiple factors contributed to postoperative relapse of IVRO. Our study also confirmed the 2-year stability of IVRO in treating mandibular prognathism.

Introduction

In recent years, many operations were designed to address mandibular prognathism.[1,2] Early evolution of orthognathic surgical procedures, such as subcondylar osteotomy, ramus osteotomy, and mandibular body osteotomy or step osteotomy, were routinely used to address mandibular prognathism. Subcondylar osteotomy and horizontal osteotomy of the ramus resulted in significant postoperative relapse due to the deficiency in bone-adjoining sphere. Disadvantages of mandibular body osteotomy are potential damage to the inferior alveolar nerve and forfeiture of bilateral bony segments in molar areas. In addition, divergences in the cross-distance between the bilateral second molars and second premolars are inordinate. Therefore, mandibular body osteotomy is now rarely used to handle mandibular prognathism.

The blood supply to the mandible is one of the main problems during surgery. There has been concern regarding the safety of complex mandibular osteotomies because the inferior alveolar artery plays a predominant role. The work of Bell and Levy showed that blood flow through the mandibular periosteum tended to maintain a sufficient blood supply to the teeth in a mobile segment.[3] This even held true in cases where the labial periosteum was degloved. This phenomenon is well evidenced by the rapidly increasing applications of orthognathic surgery.

Over the years, many amendments have been applied to ameliorate postoperative stability, such as sagittal split ramus osteotomy (SSRO) and intraoral vertical ramus osteotomy (IVRO). The most crucial advantage of IVRO compared with SSRO is its much lower relative incidence of trauma to the inferior alveolar nerve.[4,5] Hence, we prefer using IVRO to correct mandibular prognathism. Our department formulated a modified IVRO procedure.[6] Therefore, the current research was to analyze the relationship between postoperative relapse and the osteotomy length achieved by the modified IVRO, as appraised by consecutive cephalograms in the 2-year follow-up.

Materials and methods

Twenty-seven patients with mandibular prognathism (22 females and 5 males) were treated with the modified IVRO procedure to correct their mandibular prognathism. Their mean age was 20.4 years (range: 17–27 years). All operations were carried out at the Department of Oral and Maxillofacial Surgery, Kaohsiung Medical University Hospital, from January 1991 to December 1998. The selection criteria for patients in this study satisfied the following standards: (1) all patients had skeletal Class III developmental malformations of mandibular prognathism with natural dentition; (2) patients with craniofacial anomalies were excluded from the analysis; (3) neither injuries nor acknowledged syndromes were etiologic factors; (4) none of the patients was in active development stage at the time of operation; (5) all patients accepted preoperative and postoperative orthodontic treatment; (6) all patients were surgically treated with modified IVRO technique by a single surgeon; and (7) an acrylic interocclusal splint and maxillomandibular fixation were used for 6 weeks postoperatively.

Cephalograms were collected and appraised at the following three intervals: preoperatively after completion of presurgical orthodontic movement (T1), immediately postoperatively (T2), and at 2 years postoperatively (T3). The following items were examined: sella (S), nasion (N), the posterior most and inferior most ramus point (Pir), the inferior most osteotomy point (Io), and menton (Me). Because of the magnification differences between the left and right sides of the mandible, intermediate outlines of bilateral projected images of mandibular contour were traced and identified. In our IVRO method, the lower portion of proximal segment was excised. The Io landmark on T2 cephalometric tracing was located and transferred onto T1 cephalogram by superimposing it between T1 and T2 cephalometric tracings. The Pir landmark was identified on T1 cephalogram as the intersection between the lower half portion of ramus contour and the longest projected line perpendicular from the vertical reference line described below. For analysis, an x–y coordinate axis was fabricated. The frame of reference was established with its source at nasion, and x axis was aligned at an angle of 7° upward to the source line (N–S) as the horizontal axis (Fig. 1). The vertical reference line (i.e., y axis) was aligned perpendicular to this line through sella. Cephalometric tracings of the preoperative stage (T1), changes immediately after surgery (T21), and at the 2-year postoperative stage (T32) were superimposed to assess differences. Changes in positions of the landmarks were compared with reference lines.

Relapse was specified as an advancing movement of Me during the 2-year follow-up period. All alterations of each measurement were examined by a paired t test. The Pir–Io (the available setback horizontal distance at T1) was measured between Pir and Io along the y axis. The available setback ratio was defined as MeT21/Pir–Io. Hierarchical modeling analyses were used to survey differences in variables (MeT32, MeT21, Pir–Io, and MeT21/Pir–Io) and investigate factors responsible for postoperative stability. Hierarchical modeling was composed of seven models at three levels (1-by-1, 1-by-2, and 1-by-3). Differences at a level of $P \leq 0.05$ were considered significant.