Journal of Cranio-Maxillo-Facial Surgery 42 (2014) 1735–1741

Contents lists available at ScienceDirect

Journal of Cranio-Maxillo-Facial Surgery

journal homepage: www.jcmfs.com

Asymmetric mandibular prognathism: Outcome, stability and patient satisfaction after BSSO surgery. A retrospective study

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ARTICLE INFO

Article history:
Paper received 8 January 2014
Accepted 5 June 2014
Available online 14 June 2014

Keywords:
Orthognathic surgery
Mandibular prognathism
Facial asymmetry
Sagittal split osteotomy
Sensory impairment

ABSTRACT

Purpose: To investigate surgical outcome, long-term stability, the time course of relapse, neurosensory disturbances, and patient satisfaction after BSSO for correction of mandibular asymmetry. Another objective was to examine whether osteotomies for transverse rotation of the distal segment represent an increased risk for nerve injury.

Subjects and methods: In a retrospective study lateral and postero-anterior cephalograms, information from patient files and questionnaires were analysed for 38 patients having more than 4 mm asymmetry at the chin pre-treatment (mean 8.4 mm). The radiographs were analysed preoperatively, post-operatively, after 6 months and 3 years.

Results: Asymmetry of the chin to the facial midline improved on average by 56%. Skeletal relapse was about the same for transverse and antero-posterior surgical changes (10–15%). 58% of the patients had asymmetry of more than 3 mm at menton 3 years post-surgery. Discrepancy between upper and lower dental midlines improved on average 80%. Normal or near normal sensation to the lower lip/chin was reported by 44% of the patients which is similar to sensory disturbances after BSSO straight set-back performed by the same surgical team. A difference in the incidence of neurosensory disturbance between the two osteotomy sides was observed. Satisfaction with the treatment result was reported by all patients except for two.

Conclusion: Correction of mandibular asymmetry by BSSO is fairly stable. Although the risk for sensory impairment for the individual patient was similar to impairment in a sample having straight setback, rotation of the distal segment during surgery may represent an increased risk for sensory impairment on the deviating side ($P = 0.06$). Three years after surgery patients were generally satisfied with the result even if more than 3 mm of asymmetry at the chin remained for 58%. The findings have implications for treatment planning and the decision to elect one-jaw, bimaxillary surgery and/or additional genioplasty.

1. Introduction

Asymmetry of the face is a common complaint among patients with maxillofacial deformities, even if the asymmetry may be combined with other deviations (Severt and Proffit, 1997). Usually the mandible is more asymmetric than the maxilla (Haraguchi et al., 2002).

Bilateral sagittal split osteotomies (BSSO) allow the distal segment of the mandible to be repositioned in the three planes of space, and transverse deviation from the facial midline may thus be corrected. There is a greater displacement between the distal and proximal segments takes place on the longer side of the mandible. Furthermore adaptation of the segments to obtain optimal bony contact may be necessary. This is one of the most challenging orthognathic procedures to plan and carry out which may have implications for long-term post-treatment stability and iatrogenic effects like sensory impairment.

Few reports on the stability of transverse mandibular corrections are available. Severt and Proffit (1997) observed about 40 per cent relapse after correction of the chin by both BSSO-only and bimaxillary procedures one year postoperatively. Ko et al. (2009),

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http://dx.doi.org/10.1016/j.jcms.2014.06.008
1010-5182/

on the other hand, reported stability after transverse correction of the chin by bimaxillary surgery. Correction of the mandibular skeletal midline by BSSO has been reported by Yamashita et al. (2009). No information about the follow-up period was presented in these studies. So far, no studies have examined whether rotation of the mandibular distal segment in the horizontal plane is associated with an increased risk of sensory alterations. Patients' satisfaction with outcome of treatment for mandibular asymmetry remains to be investigated.

The aim of the study was therefore to investigate long-term stability after transverse mandibular correction by BSSO and if/when relapse occurs. Additional objectives were to examine whether osteotomies for rotation of the distal segment represent an increased risk for nerve injury, and if patients are satisfied with the overall result.

2. Subjects and methods

Patients treated orthodontically and surgically for skeletal Class III malocclusion with mandibular asymmetry were retrieved from the archives at the Department of Orthodontics, University of Oslo. Between 1993 and 2005 38 consecutive patients (26 females and 12 males) who had BSSO and rigid fixation as the only surgical procedure were identified and represented the study sample according to the following inclusion criteria: 1) patients with mandibular prognathism and Class III malocclusion at least on one side, 2) clinically diagnosed asymmetry of the lower face with a mandibular midline deviation of at least 4 mm at menton, 3) an orthognathic maxilla with no or only slight asymmetry, 4) a post-surgery observation period of 3 years, and 5) complete records of lateral and posterior–anterior (PA) cephalograms of good quality presurgery (T1), postoperatively (T2), 6 months (T3), and 3 years after surgery (T4). Patients with craniofacial anomalies (i.e. hemifacial microsomia and syndromes) and fracture of facial bones were excluded. A sample of 65 Cl III patients operated by BSSO for straight mandibular set-back served as reference for assessment of sensory impairment and patient satisfaction, and the data for this group has been presented previously (Hågensli et al., 2013).

All patients had pre- and postoperative orthodontic treatment. No physiotherapy or speech therapy was part of the treatment. If patients had third molars in the mandible, they were removed at least 6 months prior to surgery. A surgical treatment plan was established with a surgical planning program (Dentofacial Software inc., Toronto, Canada) serving as an asset to the clinical evaluation. Sagittal relation was evaluated from lateral and transverse relation from posterio–anterior cephalograms, respectively. An occlusal splint was used for two patients during surgery. For the remaining 36 patients the upper dentition was used as a guide for positioning of the lower jaw. Intermaxillary fixation with 3 steel-wires around the orthodontic archwires of the upper and lower jaw was used during fixation of the fragments to ensure the best possible occlusion, and the fixation was released after the osteosynthesis had been performed. Intermaxillary fixation was not used postoperatively, except for 2 patients. The patients were instructed to have a soft diet for 6 weeks postoperatively. Preoperative patient characteristics appear from Table 1.

A modified procedure for BSSO described by Epker (1977) was used. Osteosynthesis was made with three 2.0 bicortical threaded position screws with washers (Salzburg, Normed Medizin-Technik GMBH®, Tüttlingen, Germany) on each side. Two screws were placed superior and one screw inferior to the mandibular canal.

To reduce swelling and pain 125 mg methylprednisolone (Solumedrol, Pfizer®, NY, USA) iv was administered peroperatively. Additionally 40 mg methylprednisolone × 7 iv was given during a period of 48 h. Subsequently 40 mg slow releasing methylprednisolone (Depo-medrol, Pfizer®, NY, USA) was given intra muscularly. Prophylactic antibiotics were given with benzylpenicillin (Penicillin, Actavis®, Oslo, Norway) 5 mill IE × 8 iv during the same period of 48 h. The first dosage of antibiotics was given peroperatively. Postoperative pain was treated with a combination of paracetamol and codeine (Pinex Forte, Actavis®, Oslo, Norway).

Information about the surgery and subsequent observations was extracted from the patients' files. Alterations in sensibility to the lower lip/chin were investigated by a combination of questionnaires and clinical examination (light touch by cotton swabs). Data related to the patients' opinions about the treatment outcome was collected from questionnaires distributed at the 3-year review.

The outline of the stable structures in the cranial base from both the lateral and PA cephalograms was transferred on acetate paper from the X-ray of best quality to the other X-rays. The tracings were scanned and the magnification was adjusted by 5.6% to the actual size and digitized with a software program (Facad, Ilexis AB, Linköping, Sweden).

On the PA cephalograms a coordinate system was constructed through the orbital roofs (*x*-axis) and a perpendicular through 'the best fit' upper facial midline (*y*-axis). Best fit midline was determined by a combination of crista galli and the midpoint between the medial orbital walls as reference landmarks (Fig. 1). On the lateral cephalograms a coordinate system was constructed through the sella with a horizontal reference line (*x*-axis) rotated 7° down from the sella–nasion line. The *y*-axis was perpendicular to the *x*-axis through sella (Fig. 2).

For reliability analysis 20 lateral and 20 PA cephalograms were retraced after 3 weeks by the same person (NH) and intraclass correlation coefficient (ICC) values were calculated. To test for statistical significance of changes in cephalometric variables between different stages, Student's *t*-test for paired data was performed. All statistical analysis was made with SPSS (IBM Corporation, Armonk, New York, USA).

The study was approved by the Norwegian Social Science Data Services (Project no. 29918).

3. Results

The reliability analysis for the lateral cephalometric variables gave ICC-values between 0.94 and 0.99. For the PA cephalograms the ICC values varied between 0.85 and 0.99.

3.1. Surgery

Four patients had macroscopic partial injury to the inferior alveolar nerve of which one was bilateral. In none of the patients the nerve was completely severed. The alveolar nerve bundle was

Table 1
Patient characteristics.

	Mean	SD	Range
Age at surgery (yr)	25.3	10.3	16.7–55.5
SNA angle	81.1	4.0	72.1–95.1
SNB angle	83.8	4.4	74.6–96.0
ANB angle	−2.7	2.5	−8.8–2.3
Overjet (mm)	−1.9	2.3	−7.9–3.2
Overbite (mm)	0.3	1.5	−3.5–4.3
Asymmetry of upper dental midline (mm)[a]	1.8	1.4	0.1–5.5
Asymmetry of lower dental midline (mm)[a]	6.8	2.1	3.2–13.9
Asymmetry at menton (mm)[a]	8.4	3.1	4.4–20.0
Discrepancy between upper and lower dental midline (mm)	5.1	1.7	2.4–9.2

[a] Asymmetry measured relative to the facial midline (for definition see text and Fig. 1).