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Extraoral vertical subcondylar osteotomy with rigid fixation for correction of mandibular prognathism. Comparison with bilateral sagittal split osteotomy and surgical technique

Niels Hågensli [a,b,*], Arild Stenvik [b], Lisen Espeland [b]

[a] Department of Maxillofacial Surgery, Oslo University Hospital (Head: Prof. P. Skjelbred), P.O. Box 4956, Nydalen, N-0424 Oslo, Norway
[b] Department of Orthodontics, University of Oslo (Head: Prof. L. Espeland), Faculty of Dentistry, P.O. Box 1109, Blindern, N-0317 Oslo, Norway

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ABSTRACT

Purpose: The aim was to compare outcome after extraoral vertical subcondylar osteotomy (EVSO) with rigid fixation and bilateral sagittal split osteotomy (BSSO) for correction of mandibular prognathism. The objectives were to examine treatment factors, postoperative results, and long-term stability. The surgical technique for EVSO is presented in detail.

Subjects and methods: Lateral cephalograms and information from patient files of 65 consecutively operated patients with EVSO and 65 matching patients operated with BSSO were analyzed preoperatively, postoperatively, after 6 months and 3 years.

Results: No clinically significant differences were observed in long-term stability. The retromandibular scar inferior to the earlobe after EVSO was on average 25 mm long and 1 mm wide, and was of no concern for most of the patients. Normal or near normal sensation to the lower lip/chin was reported by half of the BSSO patients at the 3-year follow-up.

Conclusion: Because no major differences in outcome were observed, EVSO with rigid fixation may be considered as a viable alternative if it is important to avoid alterations in sensation, whereas BSSO may be preferred if retromandibular scar is of concern.

1. Introduction

Two commonly used methods for correction of mandibular prognathism are extraoral vertical subcondylar osteotomy (EVSO) (Robinson, 1958) and bilateral sagittal split osteotomy (BSSO) (Trauner and Obwegeser, 1957). BSSO has later been modified (Dal Pont, 1961; Hunsuck, 1968; Epker, 1977). Rigid fixation with lag screws was described in 1974 (Spiessl, 1974) to stabilize segments after BSSO. BSSO is the most frequently used osteotomy for correction of mandibular deformities.

Various ramus osteotomies were proposed in 1909 (Babcock, 1909), and EVSO was used to close an open bite in 1925 (Limberg, 1925). Before BSSO was introduced extraoral vertical and horizontal ramus osteotomies were the treatments most frequently applied for mandibular prognathism. The risk for neurosensory disturbances to the lower lip/chin is low after these osteotomies. Extraoral approaches, however, generally cause retromandibular scars.

Intraoral vertical ramus osteotomy has the advantage of causing less frequent neurosensory disturbances without implicating scars, but has generally the same disadvantages as traditional extraoral procedures by representing a need for intermaxillary fixation for 6–8 weeks and skeletal instability. Posterior movement, clockwise rotation of the distal segment with concomitant dental compensation have been demonstrated (Mobarak et al., 2000; Kitahara et al., 2009). Anterior relapse has also been observed (Chen et al., 2011).

Rigid fixation after vertical ramus osteotomy (VRO) has been described for both extra- and intraoral procedures (Paulus and Steinhäuser, 1982; Kraut, 1988). Functionally stable osteosynthesis for intraoral vertical ramus osteotomy (IVRO) and intraoral subcondylar osteotomies (ISO) is rarely performed probably due to technical challenges related to the osteosynthesis. There are few publications examining rigid fixation after EVSO (Mobarak et al., 2000; Høgevold et al., 2001; Abeltins et al., 2011). EVSO has an easy access and good visibility compared to IVRO. Since 1995 plate fixation has routinely been used for EVSO at Oslo University

* Corresponding author. Department of Maxillofacial Surgery, Oslo University Hospital, P.O. Box 4956, Nydalen, N-0424 Oslo, Norway. Tel.: +47 90678926; fax: +47 22852346.
E-mail addresses: n.f.hagensli@odont.uio.no, niels_hagensli@yahoo.com (N. Hågensli).

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Hospital. The main morphologic indication for applying EVSO has been a moderate and straight setback of the mandible.

The risk of injury to the inferior alveolar nerve after BSSO (Westermark et al., 1998a) represents the rationale for exploring other treatment options. This study compares BSSO and EVSO with rigid fixation for mandibular setback. The aim of the study was to analyze peroperative factors, long-term dental and skeletal stability, neurosensory disturbances, retromandibular scar and patient satisfaction. The surgical technique for EVSO used at Oslo University Hospital is described.

2. Material and methods

The EVSO sample comprised 65 patients (29 females and 36 males) with a mean age of 26.6 years (SD 10.1) consecutively operated from 1998 to 2004 and having complete files. The patients were monitored for 3 years after surgery. No additional procedures were performed. The particular time period was defined according to a revision of the surgical protocol in 1997 and a limitation of the follow-up period to 1 year after 2005. This sample was compared to a sample of 65 patients (31 females and 34 males) with a mean age of 24.4 years (SD 7.8) having had mandibular setback with BSSO from 1992 to 2000 and followed for 3 years after surgery. In order to match the EVSO sample, BSSO patients with mandibular asymmetry and/or open bite exceeding 3 mm were excluded. All patients had pre- and postoperative orthodontic treatment. Occlusal splints and postoperative intermaxillary fixation were not used. The patients were instructed to eat soft food for 6 weeks postoperatively. Preoperative patient characteristics appear from Table 1.

The surgical protocol used at Oslo University Hospital for EVSO with rigid fixation is presented below. The technique resembles the method described by Hinds and Girotti (1967), with the exception that the osteotomy has an inverted L-shape and two titanium 2.0 miniplates with 8 monocortical 5 mm screws (2.0 system, Biomet®, Jacksonville, FL, USA) are used for fixation on each side. A modified procedure for BSSO as 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 given preoperatively. Additionally 40 mg methylprednisolone × 5 iv was given during a period of 48 h. Subsequently 40 mg slow releasing methylprednisolone (Depomedrol, Pfizer®, NY, USA) was given im. Prophylactic antibiotics were given with cefalotin (Keflin, Eurocept®, Ankeveen, The Netherlands) 2 g × 6 iv for the EVSO group and benzylpenicillin (Penicillin, Actavis®, Oslo, Norway) 5 mill IE × 6 iv for the BSSO group 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 duration of the operation, surgical details, hospitalization, and subsequent observations was extracted from the patients' files. Alterations in sensitivity to the lower lip/chin after BSSO were investigated by questionnaire, light touch by cotton swabs, sharp/blunt discrimination and two-point discrimination. The recordings also included the assessment of retromandibular scars after EVSO. Data related to the patients' opinions about the treatment outcome was collected from questionnaires distributed at the 3-year review.

The cephalometric measurements (Fig. 1) were obtained from lateral radiographs taken preoperatively (T1), postoperatively within 1 week (T2), after 6 months (T3) and 3 years (T4). The outline of the stable structures in the cranial base 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). 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 the sella (Fig. 1).

Independent sample *t*-tests were used to analyze differences between the two groups. For analysis of reliability 20 cephalograms were retraced after 3 weeks by the same person and intraclass correlation coefficient (ICC) values were calculated. All statistical analyzes were performed with SPSS (IBM Corporation, Armonk, New York, USA).

2.1. The surgical technique for EVSO described in detail

2.1.1. Step 1: working position

The surgical procedure is preferably performed in a sitting position with a headlamp.

2.1.2. Step 2: skin incision

With the patient in general anaesthesia with nasal intubation, 5–10 ml lidocaine (10 mg/ml) with adrenaline (5 μg/ml) (Xylocain-Adrenalin, AstraZeneca®, London, UK) is injected in the operation

Table 1
Preoperative occlusion and skeletal characteristics (T1).

Variables	EVSO	BSSO	*p*-Value
	$n = 65$	$n = 65$	
	Mean ± SD	Mean ± SD	
Anterior occlusion			
Overjet (mm)	−4.0 ± 1.7	−4.4 ± 1.7	0.21
Overbite (mm)	0.8 ± 1.6	0.5 ± 1.6	0.27
Skeletal values			
SNA angle (°)	81.6 ± 3.6	82.2 ± 4.6	0.48
SNB angle (°)	86.0 ± 3.5	86.3 ± 4.6	0.68
ANB angle (°)	−4.4 ± 2.7	−4.1 ± 2.0	0.61
ML/SNL angle (°)	29.8 ± 5.9	32.6 ± 5.8	<0.01

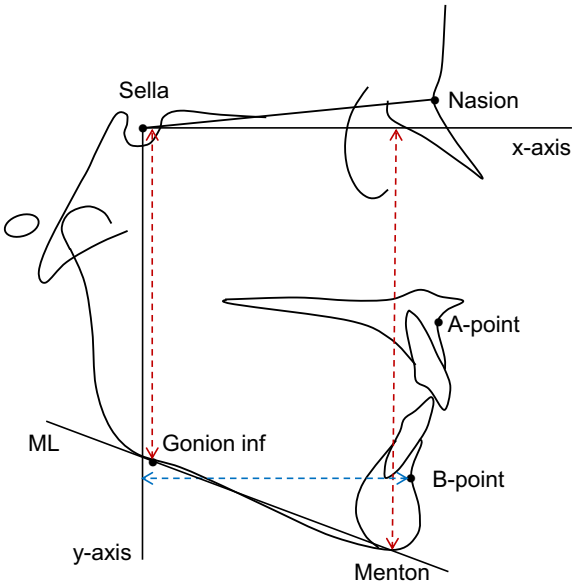

Fig. 1. Landmarks and coordinate system used in the cephalometric analysis.