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Long term stability of mandibular advancement procedures: bilateral sagittal split osteotomy versus distraction osteogenesis

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Abstract. The aim of this study was to compare the postoperative stability of the mandible after a bilateral lengthening procedure, either by bilateral sagittal split osteotomy (BSSO) or distraction osteogenesis (DO). All patients who underwent mandibular advancement surgery between March 2001 and June 2004 were evaluated. There were 17 patients in the BSSO group and 18 patients in the DO group. The decision to use intra-oral distraction or BSSO for mandibular advancement primarily depended on the choice of the patient and their parents. In both groups, standardized cephalometric radiographs were taken preoperatively, postoperatively (BSSO group) or directly post-distraction (DO group) and during the last study measurement in May 2008. Cephalometric analysis was performed using the following measurements: sella/nasion-mandibular point B and sella/nasion-mandibular plane. Point B was used to estimate relapse. This study showed no significant difference in relapse between the BSSO and the DO groups measured 46–95 months after advancement of the mandible ($P > .05$). It can be concluded from this study that there is no postoperative difference in the stability between BSSO and DO after mandibular advancement after 4 years.

Key words: relapse; mandibular advancement; distraction osteogenesis; mandibular distraction; sagittal split osteotomy; mandibular retrognathia.

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Mandibular hypoplasia is a common dentofacial deformity requiring a combination of orthodontic and surgical treatment. The most frequently used surgical technique for advancement of the mandible is bilateral sagittal split osteotomy (BSSO)[12,14]. In patients with normal or decreased facial height, BSSO is considered a very stable procedure for mandibular advancement[10,12]. Distraction osteogenesis (DO) of the human mandible has evolved since 1992 and, at present, intra-oral distraction osteogenesis for lengthening the mandible is proposed as an alternative to BSSO[15,16].

In an earlier study by Vos et al.[18], the stability of mandibular lengthening, either by BSSO or DO, was reported after a follow up of at least 10 months. There was no difference between the two groups. The same group of patients was evaluated 3 years later to assess the long-term stability.

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Materials and methods

In this retrospective study, all patients with surgical lengthening of the mandible for correction of a mandibular retrognathia treated between March 2001 and June 2004 were evaluated. All patients included were treated in The Isala Clinics, Zwolle, The Netherlands, which is a training facility for oral and maxillofacial (OMF) surgeons, so every patient was treated by an OMF surgeon (in total 3) and a resident. All possible advantages and risks of both procedures were extensively explained to the patients and their parents. The decision to use intra-oral distraction or BSSO for mandibular advancement was finally made by the patient and their parents, together with the surgeon.

The patients were divided into two groups. In 2005, the DO group consisted of 27 subjects and the BSSO group 26 subjects. In 2008, sufficient data could be obtained from 18 patients in the DO group of whom 10 were male and eight were female. The mean age at the time of surgery was 20 years (range 14–41 years). In the BSSO group, nine patients were excluded because of insufficient data, leaving 17 patients for evaluation; three men and 14 women. The mean age at time of surgery was 28 years (range 17–50 years). All patients, in both groups, had orthodontic appliances in place at the time of surgical treatment.

In both groups, clinical measurements and cephalometric radiographs were taken preoperatively, postoperatively or in the DO group directly post-distraction (T1) and during the earlier study measurement in 2005 (T2) and the last measurement (T3) in 2008. As a basis for the cephalometric measurements, an *x*–*y* cranial base coordinate system was constructed. For the *x*-axis the sella-nasion line was used. A constructed vertical reference line was drawn perpendicular to this line at sella (*y*-axis). Analysis was performed using the following measurements: sella/nasion-mandibular point B (SNB), sella/nasion-mandibular plane (SN-MP), X-B and Y-B. Point B was used to estimate relapse (Fig. 1).

All the cephalographs were traced by one person, by hand. Superimposition of the radiographs was performed using the 'manual geometric superimposition' method[4]. The follow-up period varied from 46 to 95 months.

Surgical procedure

In both groups, the surgery[18] was performed under general anaesthesia. Preoperatively 2 g cefazoline and .5 mg/kg dexamethasone were given intravenously. Eight and sixteen hours postoperatively another 10 mg dexamethasone was given intravenously.

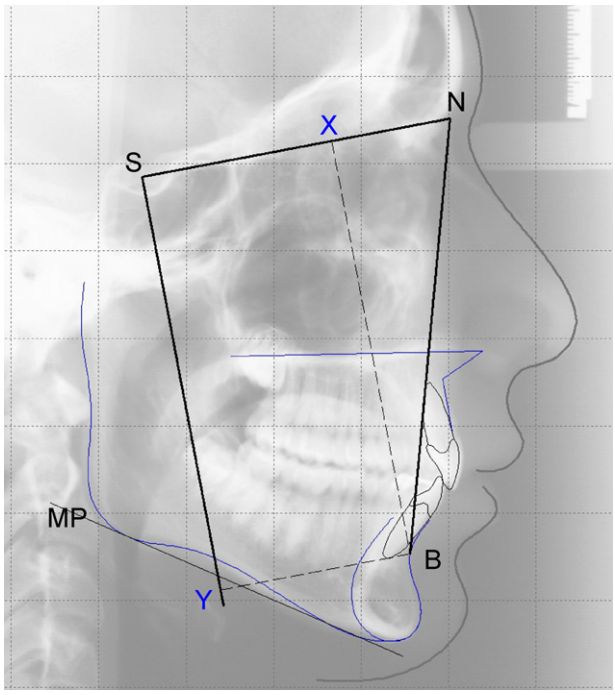

Fig. 1. Landmarks and measurements used for the cephalometric analysis.

BSSO

BSSO was carried out according to Obwegeser and Dal Pont modified by Hunsuck. After infiltration of the mucosa with ultracaine DS forte (articaine), an intra-oral vestibular incision and mucoperiosteal flap was made in the region of the planned osteotomy. Following stripping of the temporalis muscle insertion, the soft tissues were retracted. A periosteal elevator was introduced subperiosteally on the medial aspect of the ramus, above the foramen. The inferior alveolar nerve was identified at the lingula. With a Lindemann bur the medial horizontal osteotomy cut was made just above the lingula and parallel with the occlusal plane. The oblique, buccal and finally the lower border of the mandible was cut with the Lindemann bur. The osteotomy of the mandible was performed.

After advancement, the desired occlusion was fixed with stainless steel intermaxillary wires with a thin interocclusal acrylic splint (wafer) in place. Titanium miniplates (2.0 plates Synthes GmbH, Solothurn, Switzerland) were used for fixation of the fragments. The proximal fragments were positioned into the proper position in the fossa. The miniplates were bent, positioned passively against the bone fragments and fixed with at least two monocortical 5 or 7 mm screws on each side of the osteotomy. The intermaxillary fixation was then released and the occlusion was checked.

DO

The mucosa was infiltrated with ultracaine DS forte (articaine). After exposing the mandibular body and angle, the buccal vertical cut was made with the Lindemann bur just behind the second molar. The lower border of the mandible was cut. If the third molar was still *in situ*, it was removed. With a fissure bur, a cut was made distal of the second molar from buccal to lingual. The mono-directional distractor device (Zurich Distractor, Martin GmbH & Co, Tuttlingen, Germany) was adapted and placed with at least two monocortical screws on each side of the distractor device. It was placed parallel to the occlusal plane. After removing the screws and the distractor device, a complete osteotomy was performed. The distractor device was again placed in the marked position and fixed with three monocortical screws. The most dorsal screws were placed transcutaneously. Before closure of the wounds, the functioning of the distractor device was checked.