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The effects of steroids in preventing facial oedema, pain, and neurosensory disturbances after bilateral sagittal split osteotomy: a randomized controlled trial

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Abstract. A randomized, prospective, controlled trial was conducted to determine the efficacy of single and repeated betamethasone doses on facial oedema, pain, and neurosensory disturbances after bilateral sagittal split osteotomy. Thirty-seven patients (mean age 23.62 years, range 17–62 years) with either mandibular prognathism or retrognathism were enrolled consecutively into the study and divided into three groups: control ($n = 12$), repeated dose 4 + 8 + 4 mg betamethasone ($n = 14$), single dose 16 mg betamethasone ($n = 11$). The intake of diclofenac and paracetamol was assessed individually. Measurements of facial oedema, pain, and sensitivity in the lower lip/chin were obtained 1 day, 7 days, 2 months, and 6 months postoperatively. Furthermore, we investigated the possible influences of gender, age, total operating time, amount of bleeding, postoperative hospitalization, and advancement versus setback of the mandible. A significant difference ($P = 0.017$) was observed in percentage change between the two test groups and the control group regarding facial oedema (1 day postoperatively). Less bleeding was associated with improved pain recovery over time ($P = 0.043$). Patients who required higher postoperative dosages of analgesics due to pain had significantly delayed recovery of the inferior alveolar nerve at 6 months postoperatively ($P < 0.001$). Betamethasone did not reduce neurosensory disturbances over time.

Key words: Orthognathic surgery; Osteotomy; Sagittal split ramus; Inferior alveolar nerve; Hypoesthesia; Steroid; Prospective.

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Apart from the immediate postoperative discomfort of pain and oedema, the most common complication of bilateral sagittal split osteotomy (BSSO) is injury to the inferior alveolar nerve (IAN).[1] Mandibular osteotomies are performed with cutters, saws, chisels, and separators in close proximity to the mandibular canal and the neurovascular bundle, with a high risk of temporary or permanent damage to the IAN, particularly if the nerve is exposed through the cancellous part of the bone.[2]

Postoperative nerve function is influenced by multiple factors, such as the patient's gender and age, preoperative information, extension of the medial segment, position of the mandibular canal, morphology of the mandibular angle, the surgeon's technique and skills, compression of the nerve trunk, fixation methods, operating time, and complications such as 'bad split'.[3–7] Regardless of whether the nerve damage occurs at the mandibular foramen, along the mandibular canal, or at the mental foramen, the symptoms of nerve lesions usually consist of varying degrees of numbness in the lower lip and chin, corresponding to the distribution area of the mental nerve. This complication continues to constitute a major drawback, with patient discomfort occasionally lasting for several months postoperatively.[3] The vast majority of operated patients experience altered sensations and sensory impairment during the immediate postoperative period, but occasionally patients also report long-term permanent subjective sensory disturbances.[8] In the literature, the extent and course of nerve recovery have varied greatly because of the lack of a uniform testing methodology.[9]

Glucocorticoid administration in orthognathic surgery is recommended preoperatively to reduce postoperative pain, swelling, trismus, nausea, and vomiting and to promote nerve healing. However, there is a need for further clinical studies to support these statements.[10] The most common glucocorticoids are betamethasone, dexamethasone, and methylprednisolone. The aim of the present study was to test two betamethasone regimens against a control group and to evaluate possible effects on postoperative facial oedema, pain, and neurosensory disturbances.

Materials and methods

Subjects

Thirty-seven patients requiring treatment for mandibular prognathism or retrognathism with a BSSO were enrolled consecutively into this study between February 2006 and March 2011. Informed consent was obtained from all subjects. The Central Ethics Review Board in Gothenburg approved the investigation.

For inclusion, patients had to be healthy without any regular medication. Contraceptive agents were allowed. Patients requiring an additional genioplasty or maxillary osteotomy were excluded, as well as patients with contraindications to steroids. All patients received either penicillin G (3 g 3×) intravenously (IV), or clindamycin (600 mg 3×) IV in the case of allergy, immediately preoperatively and postoperatively. Penicillin V (1 g 3×, oral) or clindamycin (300 mg 2×, oral) was administered for the first postoperative week.

A randomized, double-blind protocol was used to assign patients prospectively and consecutively to one of three experimental groups. Support staff drew designations from sealed envelopes. The following groups and betamethasone regimens were used: control ($n = 12$), repeated dose (4 mg betamethasone administered orally 1 day prior to surgery, 8 mg betamethasone IV administered immediately preoperatively, and 4 mg betamethasone administered orally 1 day postoperatively; $n = 14$), and single dose (16 mg betamethasone IV administered immediately preoperatively; $n = 11$).

Facial oedema, pain, and sensitivity were recorded preoperatively and at 1 day, 7 days, 2 months, and 6 months postoperatively. Facial oedema was measured objectively as the distance between the earlobes and below the chin. Pain was estimated subjectively using a visual analogue scale (VAS) ranging from 0 to 10, with 0 indicating no pain and 10 indicating maximum pain. Sensitivity was evaluated subjectively in the lower lip, right and left side, using a VAS ranging from 0 to 10, with 0 indicating no sensitivity and 10 indicating maximum sensitivity. All measurements were obtained at the bedside or at scheduled return visits to the clinic.

All participating clinicians performed calibrated measurements. Furthermore, we investigated the possible influences of gender, age at the time of surgery, total operating time, amount of bleeding, postoperative hospitalization, and advancement versus setback of the mandible.

The primary hypothesis was that postoperative facial oedema is associated with neurosensory disturbances. The secondary hypothesis was that a repeated or single betamethasone regimen protects the nerve from surgical trauma and postoperative oedema and promotes nerve recovery.

Surgery

All patients were carefully assessed clinically and with radiographs. Cephalometric analysis and diagnostic imaging were performed using Facad software (Ilexes AB, Linköping, Sweden). Functional and aesthetic demands were discussed with the patient. Patients requiring an additional genioplasty or maxillary osteotomies were excluded from the study. The BSSO was performed with the Hunsuck modification of the basic Obwegeser–Dal Pont method (no attempt was made to dissect the IAN), and the position of the nerve was recorded, i.e. whether it was visible or hidden (embedded) in the cancellous bone.[11] At the time of fixation, a straight miniplate (four holes and four screws) was placed monocortically on each side of the mandible (MatrixORTHOGNATHIC Plating System, DePuy Synthes, Zuchwil, Switzerland, or 2.0-mm mini-system, KLS Martin, Tuttlingen, Germany). Passive adaptation, with the monocortical approach, was chosen to minimize the compression effects of the IAN during rigid fixation of the proximal and caudal segments. After surgery, frontal and lateral radiographs were obtained (Fig. 1). Bimaxillary postoperative elastics were positioned individually on the orthodontic appliances for approximately 2 months after surgery to correct occlusion and reduce muscular strain. Intraoperative complications (such as a 'bad split') and postoperative infections were noted. The first three authors of this study performed all surgeries.

All patients were offered diclofenac (50 mg 3×) and paracetamol (1000 mg 4×) postoperatively, depending on their individual requirements. If pain relief was insufficient, opioids were administered on an individual basis.

Statistical analysis

VAS values for sensitivity from the patient's left and right sides were combined to obtain a mean value, regardless of whether the nerve was visible or hidden. This combining of values was also performed for cases in whom the nerves on both sides were visible or hidden during surgery. Pairwise comparisons of the VAS values showed that there were no significant differences between the hidden and visible nerves (Table 1).

For each patient and each variable of the results (oedema, pain, and sensitivity), a linear regression coefficient was calculated to describe the trend over time from 1 day to 6 months postoperatively (Table 2).