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## Presence of mandibular third molars during bilateral sagittal split osteotomy increases the possibility of bad split but not the risk of other post-operative complications

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## ABSTRACT

Timing of third molar removal in relation to bilateral sagittal split osteotomy (BSSO) is controversial, especially with regard to post-operative complications. We investigated the influence of mandibular third molar presence on complications after BSSO with sagittal splitters and separators, by a retrospective record review of 251 patients (502 surgical sites). Mandibular third molars were present during surgery at 169 sites and removed at least 6 months preoperatively in 333 sites. Bad splits occurred at 3.0% (5/169) and 1.5% (5/333) of the respective sites. Presence of mandibular third molars significantly increased the risk of bad splits (OR 1.08, CI 1.02–1.13,  $p < 0.01$ ). The mean incidences of permanent neurosensory disturbances, post-operative infection, and symptomatic removal of the osteosynthesis material were 5.4% (OR, 0.89; 95% CI, 0.79–1.00;  $p = 0.06$ ), 8.2% (OR, 1.09; 95% CI, 0.99–1.20;  $p = 0.63$ ), and 3.4% (OR, 0.97; 95% CI, .92–1.03;  $p = 0.35$ ) per site, respectively, without a significant influence of mandibular third molar status. In conclusion, the presence of mandibular third molars during surgery increases the possibility of bad split but does not affect the risk of other complications. Therefore, third molars can be removed concomitantly with BSSO using sagittal splitters and separators.

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### 1. Introduction

Bilateral sagittal split osteotomy (BSSO) is one of the most popular techniques in orthognathic surgery. Since it was first described by Trauner and Obwegeser (1957), many attempts have been made to improve this technique in order to minimise post-operative complications (Trauner and Obwegeser, 1957; Dal Pont, 1961; Hunsuck, 1968; Epker, 1977; Mensink et al., 2012; Al-Nawas et al., 2013). The most common complications associated with BSSO are: an unfavourable fracture pattern during osteotomy, termed 'bad split'; neurosensory disturbances of the inferior alveolar nerve (IAN), resulting in altered sensation of the lower lip; infection at the surgical site; and symptomatic removal of the osteosynthesis material (Guernsey and DeChamplain, 1971).

BSSO is often performed to correct malocclusion in relatively young patients (Weaver et al., 1998; den Besten et al., 2013). These patients generally have third molars at the first consultation. If indicated, mandibular third molar removal is recommended at least 6 months before BSSO (Reyneke et al., 2002). Although concomitant removal with BSSO is also possible, the influence of this procedure on the incidence of post-operative complications is still under debate (Doucet et al., 2012a; Mehra et al., 2001). Therefore, timing of third molar removal in relation to BSSO is controversial (Precious, 2004; Schwartz, 2004).

The aim of this retrospective study was to investigate the association between third molar status and common complications after BSSO with sagittal splitters and separators.

### 2. Material and methods

#### 2.1. Patients and surgical procedures

We reviewed the medical files and radiographs of 259 consecutive patients who had undergone BSSO at our centre between

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2004 and 2011. Eight patients were excluded from this study due to incomplete records, so data concerning 251 patients were analysed.

BSSO was performed according to the Hunsuck modification with sagittal splitters and separators, without using chisels (van Merkesteyn et al., 2007; Mensink et al., 2012). Additional procedures included Le Fort I osteotomy and/or genioplasty. Maxillary third molars were removed if indicated. Mandibular third molars were left in situ if they occluded with maxillary second molars, because of absent mandibular premolars or second molars. If mandibular third molar removal was indicated, the patients could choose removal at least 6 months before or concomitant with BSSO. The possibility of bad splits due to the presence of third molars during BSSO was explained (Mensink et al., 2013).

All the patients were discharged within a week after surgery. Follow-up examinations were performed at 1, 2, and 3 weeks and 3, 6, and 12 months. The patients were instructed to return to the clinic if they had any complaints.

## 2.2. Outcomes

The primary outcome variables were complications of BSSO: bad split, neurosensory disturbances of the IAN, infection at the surgical site, and symptomatic removal of the osteosynthesis material. The secondary outcome variables were intra-operative factors: IAN status, operative time, and blood loss. Independent variables were third molar status during BSSO, patient age and sex, and preoperative malocclusion class.

A bad split was defined as an irregular or unfavourable fracture pattern in the distal or proximal part of the mandible after osteotomy; it was recorded as present or absent. Neurosensory disturbances of the IAN were evaluated by objective tests and subjective assessment. The disturbances were considered permanent if they were present one year after BSSO. IAN status during BSSO was recorded as not visible in the distal segment, less than half visible in the distal segment, more than half visible in the distal segment, dissected out of the proximal segment with blunt instruments, or dissected out of the proximal segment with a burr. Infection at the surgical site was defined as infectious symptoms (swelling with granulation tissue, pus, or intraoral fistula) treated with antibiotics. Osteosynthesis material was removed because of infection, wound dehiscence, or irritation/tenderness at the osteosynthesis site.

## 2.3. Statistical analysis

Statistical analyses were performed with SPSS version 20.0 for Windows (IBM, Armonk, NY, USA). Descriptive analyses concerning the study population were performed at first. To study the effect of mandibular third molar status on bad splits, neurosensory disturbances, infection and removal of osteosynthesis material, respectively, a multivariate generalised linear mixed model had been employed to account for information on the left and right sides within the same patient. Sex, age at surgery and occlusion class had been incorporated in the mixed model. Linear regression models, adjusting for sex and age at surgery, were used to investigate the association of mandibular third molar status with operative time and blood loss.

## 3. Results

### 3.1. General findings

In total, 502 sagittal split osteotomies (sites) were performed in 251 patients. The study population consisted of 90 male and 161 female patients, with a mean age of 27.7 years (SD, 10.8 years; range,

13.8–55.6 years). The surgical indications were mandibular advancement and setback for class II and III malocclusions in 219 and 32 patients, respectively. BSSO was performed singly in 146 patients and combined with a genioplasty, Le Fort I osteotomy, or Le Fort I osteotomy and genioplasty in 11, 74, and 20 patients, respectively. Mandibular third molars were present during surgery at 169 sites (Fig. 1); they were congenitally absent or removed at least 6 months preoperatively at 333 sites (Table 1). The mean follow-up duration was 432 days (SD, 172 days; range, 163–1465 days).

The mean incidence (per site) of the complications of BSSO were as follows: bad splits, 2.0%; permanent neurosensory disturbances of the IAN, 5.4%; infection at the surgical site, 8.2%; and symptomatic removal of the osteosynthesis material, 3.4%.

### 3.2. Group characteristics

Groups with and without mandibular third molars during BSSO were compared. The only significant differences were the patients' age (Table 2). Patients with mandibular third molars during BSSO were significantly younger. Table 3 shows the incidences of the complications in both groups, with and without third molars.

### 3.3. Bad split

Bad splits occurred at five of the 169 sites with mandibular third molars (3.0%) and five of the 333 sites (1.5%) without mandibular third molars. Bilateral bad splits did not occur. A generalized mixed model had been employed to account for patient's information on the right and left side, adjusting for age and sex. Presence of mandibular third molars significantly increased the risk of bad splits (OR, 1.08; 95% CI, 1.02–1.13;  $p < 0.01$ ). Age (OR, 1.03; 95% CI, 0.98–1.09;  $p = 0.22$ ) and sex (OR, 1.01; 95% CI, 0.97–1.05;  $p = 0.61$ ) did not significantly influence the occurrence of bad splits.

### 3.4. IAN status and neurosensory disturbances

The IAN was visibly damaged unilaterally in seven patients; bilateral damage did not occur (Table 4). No significant association was present between mandibular third molar status and IAN status (OR, 1.00; 95% CI, 0.68–1.48;  $p = 0.98$ ), with adjustment for age and sex.

Permanent neurosensory disturbances were present at six of the 169 sites (3.6%) with mandibular third molars and 21 of the 333

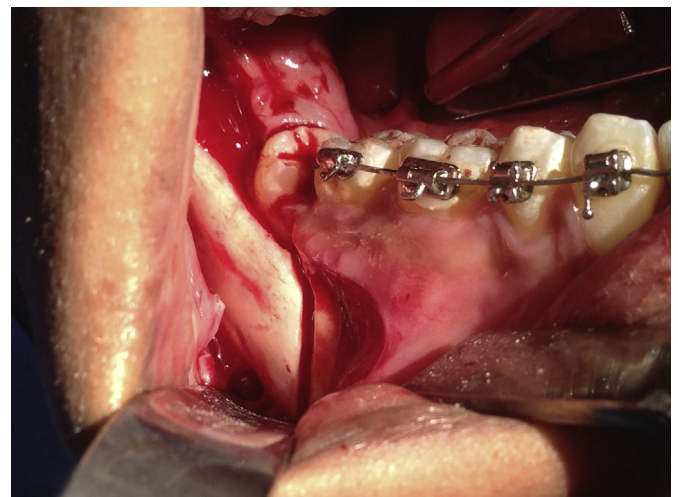


Fig. 1. Intra-operative photograph of a sagittal split osteotomy with the third molar present during the split.

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