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## Audit

# Neurosensory deficit following mandibular sagittal split osteotomy: A comparative study between positional screws and miniplates fixation

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## ABSTRACT

This retrospective study compared the incidence of long-term inferior alveolar nerve injury for positional screws and miniplate fixation of bilateral sagittal split osteotomies carried out in 2 hospitals in Scotland. The study involved a mixture of mandibular setback and advancement surgery. The outcome of neurosensory deficit (NSD) was solely based on subjective assessment by the surgeons and patients' reported alteration in sensation. Numbness, tingling and any alterations in sensation beyond 6 months were considered long-term inferior alveolar nerve injury. This study was conducted on 28 sagittal split osteotomies (group 1) which were fixed with three upper border fixation screws and 36 sagittal split osteotomies (group 2) which were fixed with upper border sliding plate. The reported and documented neurosensory deficits were analysed. The difference in the number of cases of long-term inferior alveolar nerve injury between the 2 methods was 10.3%; the 95% confidence interval for the difference was [−2.94 to 23.5],  $p = 0.1612$ . Upper border plate was associated with more long-term NSD but there is insufficient evidence to prove that one method was more superior to the other. The need for a prospective randomized trial was highlighted.

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## Introduction

Sagittal split osteotomy of the ramus of the mandible was first introduced by Schuchardt<sup>1</sup> in 1942, then modified by Trauner

and Obwegeser<sup>2</sup> in 1957 and Dal Pont<sup>3</sup> in 1961 to increase the percentage of uncomplicated bone split and reduce the associated inferior alveolar nerve damage. Internal (skeletal) fixation is the method of choice today compared to wire intermaxillary fixation due to the limitations and

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complications caused by the latter including the impaired functions, delayed healing, difficulty in maintaining oral hygiene and increased risk of airway complications.<sup>4,5</sup> Bicortical screws and upper border miniplates with monocortical screws are the two most commonly used methods for internal fixation of the sagittal split osteotomies. To date, there is insufficient clinical evidence to support the advantage of one method over the other regarding the associated inferior alveolar nerve damage.

One of the common complications of mandibular sagittal split osteotomies which all patients are warned of is inferior alveolar nerve (IAN) injury due to the close proximity of the inferior alveolar nerve to the surgical site. IAN injury results in neurosensory deficits (NSD) in the ipsilateral areas of the chin and lower lip, amongst which numbness is the worst. Numbness may resolve spontaneously or remain as a permanent dysfunction in some cases.<sup>6</sup> Despite the fact that IAN deficit only affects the senses of a small area of the face, this altered sensation is reported by many as the most distressing complication following mandibular osteotomies.<sup>7</sup> It may affect daily functioning such as speech, shaving and even kissing in some patients.<sup>8</sup> IAN injury may also give rise to continuous, unbearable pain in the lower face and have reported psychosocial implications.<sup>9</sup> On the other end of the spectrum, patients may not be bothered by this sensory deficit. It is often difficult to identify the cause and prognosis of nerve injuries due to the multifactorial aetiology and complexity of nerve injury and its associated repair mechanism. In addition, perception of pain and pain threshold vary from one patient to another.

Karas et al.<sup>10</sup> showed that SSRO has the highest risk of NSD beyond 6 months when compared to other types of orthognathic surgery. They also suggested that the method of fixation may have an effect on nerve damage. Previous studies showed that bicortical screw fixation caused compression of the inferior alveolar nerve which led to nerve injury and post-operative NSD, especially when screws were overtightened.<sup>4,5,11–15</sup> In an intra-operative study carried out by Jääskeläinen SK et al.,<sup>16</sup> the sensory nerve action potential (SNAP) disappeared in four cases during fixation with positional screws when the first screw was tightened and the compression between the fragments increased even though sharp bony interferences had been removed. Comparisons between bicortical and monocortical screw fixation are limited. Fujioka compared lag screws with positional (non-compression) screws for bicortical osteosynthesis, the latter was associated with less nerve injury.<sup>14</sup> It is well documented that combining genioplasty with BSSO further increases the risk of NSD in these areas.<sup>17,18</sup>

The purpose of this study is to determine whether there is a difference in the incidence of inferior alveolar nerve injury between positional screws and upper border plates for fixation of sagittal split ramus osteotomy.

## Method

This study was conducted on 28 sagittal split osteotomies (group 1) which were fixed with three upper border fixation screws and 36 sagittal split osteotomies (group 2) which were

fixed with upper border sliding plate. The reported and documented neurosensory deficits were analysed. Patients who had undergone BSSO with genioplasty in the same surgery were excluded from this study as genioplasty in itself may be associated with mental nerve damage which may lead to neurosensory deficit (NSD) of the lower lip and chin. The BSSO carried out were to deal with ramus deformities including mandibular deficiency, mandibular prognathism and asymmetry. The procedure was carried out at each centre by one surgeon.

There was no objective evaluation of NSD in both hospitals; it was solely based on the subjective assessment by the surgeons and the patients' expressed concerns during follow-up appointments. Patients who reported numbness or altered sensation to the chin and lower lip after surgery were followed up by the respective unit and progress was recorded in the patients' notes. If NSD was resolved within 6 months, the injury was classified as temporary and NSD beyond 6 months was classified as long-term nerve injury.

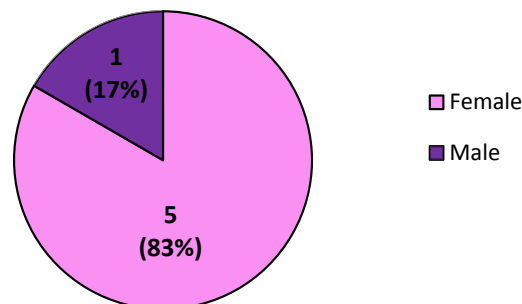
## Results

Table 1 and Pie chart 1 show the demographic distribution of the collected data. In group 1, 16 out of 28 osteotomies were associated with altered sensation following surgery; only 1

**Table 1 – Demographic distribution of patients. Data are mean (SD) or number (%).**

Variable	Glasgow Southern General (n = 14)	University Hospital Crosshouse (n = 18)
Age (years)	23.1 (6.22)	24.2 (8.71)
Sex:		
Male	4 (29%)	6 (33%)
Female	10 (71%)	12 (67%)
Manipulation:		
Advancement	8 (57%)	11 (61%)
Setback	5 (36%)	5 (28%)
Plating system:		
Split fix	N/A	4 (22.2%)
Non split fix		13 (72.2%)
Open		1 (5.6%)

**Gender Distribution of Patients with Long - term NSD**



**Pie chart 1 – Showing gender distribution of the 6 patients with long-term NSD.**

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