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Systematic Review
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Systematic review of the incidence of inferior alveolar nerve injury in bilateral sagittal split osteotomy and the assessment of neurosensory disturbances

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Abstract. Extreme variation in the reported incidence of inferior alveolar nerve (IAN) disturbances suggests that neurosensory disturbances after orthognathic surgery have not been evaluated adequately. Here we review the reported incidence of IAN injury after orthognathic surgery and assess recently reported methods for evaluating sensory disturbances. A search was conducted of the English-language scientific literature published between 1 January 1990 and 31 December 2013 using the Limo KU Leuven search platform. Information on various aspects of assessing IAN injury was extracted from 61 reports. In 16 reports (26%), the incidence of injury was not indicated. Preoperative IAN status was not assessed in 22 reports (36%). The IAN assessor was described in detail in 21 reports (34%), while information on the training of the assessors was mentioned in only two reports (3%). Subjective evaluation was the most common method for assessing neurosensory deficit. We conclude that the observed wide variation in the reported incidence of IAN injury is due to a lack of standardized assessment procedures and reporting. Thus, an international consensus meeting on this subject is needed in order to establish a standard-of-care method.

Key words: incidence; inferior alveolar nerve; bilateral sagittal split osteotomy; neurosensory disturbance.

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The bilateral sagittal split osteotomy (BSSO) is a common procedure for treating mandibular deformity. The benefits of BSSO include better masticatory function,[1–3] reduced temporomandibular joint pain,[4,5] and improved facial aesthetics.[6,7] BSSO is also increasingly indicated in the treatment of obstructive sleep apnoea. The osteotomy in BSSO is performed in close proximity to the inferior alveolar nerve (IAN), and thus IAN damage often results.[8] The incidence of IAN

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deficits after mandibular osteotomies varies from 0% to 100%.[9,10] Deficits include numbness or unusual sensations in the lower lip, chin, teeth, and gingiva. Paresthesia is usually transient, but may be permanent.

IAN damage accounts for the majority of postoperative complications of BSSO.[11–13] IAN injury during surgery largely results from manipulation of the nerve or structures surrounding the nerve, or from direct injury to the nerve during the operation.[14–16] IAN damage can consist of complete or partial transection, extension, compression, crushing, or ischaemia. Damaged nerve fibres can be categorized as neuropraxia, axonotmesis, or neurotmesis depending on the extent of the damage.[17] In clinical settings, various combinations of nerve damage co-exist, which give rise to a variety of sensory dysfunctions.

Damage to the myelin sheath of neurons results in demyelination, which impairs the conduction of signals in affected nerves. In turn, the reduction in conduction ability causes deficiencies in sensation. Varying degrees of demyelination occur in neuropraxia and axonotmesis and lead to a variety of symptoms depending on the damage. The main symptoms of IAN injury are loss of sensory function of the lower lip on the affected side and in the mental region and the gingiva. Persistent pain or neuropathic pain such as allodynia and pain and discomfort with occlusion can occur.[18,13] These complications have a severe effect on quality of daily life and often lead to litigation and patient complaints about their treatment.[19]

There is wide variation in the reporting of the incidence of IAN disturbances after orthognathic surgery. The incidence of nerve damage apparent at operation during BSSO has been reported to vary from 1.3% to 18%,[20] while postoperative sensory disturbances in the lower lip and chin have been reported to occur in 9–85% of operated sides.[21] This extreme variation suggests that neurosensory disturbances after orthognathic surgery are difficult to assess in a standardized fashion that is easily applicable in daily surgical practice. However, in order to assess the impact of IAN injury after orthognathic surgery and to evaluate the needs of affected patients, it is important to determine the true incidence of IAN disturbance after orthognathic surgery.

The aim of the present investigation was to review the reported incidence of IAN injury after orthognathic surgery and to assess the methods used to evaluate IAN sensory disturbances in reports published between 1990 and 2013. Both the frequency of reporting and the type of information provided were examined. In addition, we propose several recommendations that may improve the assessment and reporting of IAN disturbances.

Methods

A search was conducted of the English-language scientific literature published between 1 January 1990 and 31 December 2013 using the Limo KU Leuven search platform, which retrieves data from sources including MEDLINE, Web of Knowledge, OneFile, and online platforms of various publishers. The following search terms were used: incidence, inferior alveolar nerve, sensory disturbance, and mandibular osteotomy. The aim of this survey was not to review all available reports, but rather to focus on the aspects of methods of assessment of the incidence of IAN damage after BSSO in a relevant sample of reports. Reports in the grey literature (information not appearing in the periodic scientific literature obtained from a library, the Internet, or by ordering) were not pursued. The criteria for retention of reports for further processing were the following: reports written in the English language; study carried out in humans; original study (randomized, non-randomized clinical trial, cohort studies, case–control studies, case reports); full text or abstract of the report available for assessment; study related to BSSO as the type of orthognathic surgery; publication date from 1990 to 2013; report assessing IAN sensory disturbances. All reports that met the above criteria were retained for further processing.

An independent duplicate review of titles, abstracts, and full-text versions (where necessary) was performed by two researchers (JOA and ASS). During the selection process, reports for which neither the abstract nor the full text could be obtained were eliminated, as were reports not related to IAN sensory disturbance in humans. Duplicate reports were also excluded.

Instances of disagreement in the study selection process were resolved by discussion between the two researchers. The following information was extracted from the reports: incidence of IAN injury, types of IAN injury, methods of assessing IAN injury, and period of follow-up. Scoring was performed independently by two researchers (JOA and ASS). In the case of disagreement, a final conclusion was reached by consensus.

Results

The initial search identified 150 reports. A first step excluded reports for which neither the abstract nor the full text could be retrieved (46 reports). Based on the abstracts, reports not related to IAN sensory disturbance in humans were eliminated (23 abstracts), leaving 81 abstracts eligible for inclusion. Based on the full-text reports, an additional 20 papers were excluded because they were duplicates. Sixty-one reports remained for final inclusion in the review and encompassed investigations that were carried out between 1994 and 2012. Table 1 summarizes the frequency of reporting of the different items considered.

In 16 reports (26.0%), the incidence of IAN injury was not indicated (Table 1). The preoperative status of the IAN was also not assessed in 22 reports (36.1%; Table 1). Details of the IAN assessor were mentioned in only 21 (34.4%) of the reports included, while information on the training of the assessors was mentioned in only two reports (3.3%). The type of IAN injury was not indicated in approximately half of the reports evaluated (45.9%).

IAN neurosensory disturbance was assessed subjectively in 47 papers (77.0%), while objective methods of assessment were reported in only 14 of the papers evaluated (23.0%) (objective method alone in seven reports (11.5%) and both

Table 1. Frequency of reporting of items considered.

Items	Articles reporting the item		Articles not reporting the item	
	Number	Percentage	Number	Percentage
Preoperative assessment	39	63.9	22	36.1
Incidence	45	73.8	16	26.2
Type of injury (specific)	33	54.1	28	45.9
Method of assessment	61	100.0	0	0.0
Follow-up period	58	95.1	3	4.9
Information about assessor given	21	34.4	40	65.6
Assessor training	2	3.3	59	96.7