

Nerve injury associated with orthognathic surgery. Part 2: inferior alveolar nerve

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Abstract

The inferior alveolar nerve (IAN) is the most commonly injured structure during mandibular osteotomies. The prevalence of temporary injury has been reported as 70/100 patients (95% CI 67 to 73/100) or 56/100 nerves (95% CI 46 to 65/100), and the prevalence of permanent alteration in sensation was 33/100 patients (95% CI 30 to 35/100) or 20/100 nerves (95% CI 18 to 21/100) when assessed subjectively. The prevalence varied significantly between different operations ($p < 0.0001$). It was significantly higher for sagittal split osteotomy (SSO) combined with genioplasty than for SSO alone ($p < 0.0001$) or vertical ramus osteotomy (VRO) ($p < 0.0001$). Injury may result from traction during stripping or manipulation of the distal fragment, incorrect placement of the cuts, or misjudged placement of fixation in ramus osteotomy. During SSO, they can occur during retraction to make cuts in the medial ramus, when the bone is cut or split, and on fixation. The impact of injury is generally said to be low as it does not seem to affect patients' opinions about the operation.

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Introduction

A number of sensory nerves are at risk during orthognathic and other operations, and it is important that patients are fully informed during the consent process of common problems such as altered sensation, which can be permanent.

In Part 1 we reviewed injuries to motor nerves during orthognathic operations, and showed that oral and maxillofacial surgeons in the UK quote different prevalences of nerve injuries to their patients during the consent process.¹ In Part 2 we review injuries to the inferior alveolar nerve and methods of sensory testing. In Part 3 we will review injuries to other sensory nerves.²

Methods

We searched Medline and PubMed using the terms orthognathic surgery, maxillary osteotomy, mandibular osteotomy, complications, morbidity, and nerve injury. References were identified and these and textbooks hand-searched for further references. Searches were limited to papers in the English language.

Retrospective and prospective case series of orthognathic operations were excluded if they did not give sufficient details about the operation, the number of patients or nerves assessed, the time at which patients were assessed postoperatively, the type of assessment, and the number of patients or nerves with altered sensation or function. They were also excluded if the amount of time between the operation and the final assessment was not clear. Short-term injury was taken to be that assessed within 6 weeks of operation. Dysfunction

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Table 1
Subjective assessment of temporary injury to the inferior alveolar nerve.

First author, year of publication, and reference	Operation	Follow up	Nerves				Patients			
			Total	No. affected	Prevalence / 100	95% CI	Total	No. affected	Prevalence/ 100	95% CI
Massey 1974 ⁴	Intraoral VRO	2-3 weeks	-	-	-	-	14	1	7.14	0.18 to 33.87
Hall 1975 ⁵	Intraoral VRO	1 day	83	21	25.30	16.39 to 36.04	-	-	-	-
Brusati 1981 ⁶	SSO	1 day	40	18	45.00	29.26 to 61.51	20	12	60.00	36.05 to 80.88
Coghlan 1986 ⁷	SSO	1 day	38	38	100.00	90.75 to 100.00	19	19	100.00	82.35 to 100.00
Yoshida 1989 ⁸	SSO	1 week	46	31	67.39	51.98 to 80.47	-	-	-	-
Leira 1991 ⁹	SSO	4 days	50	27	54.00	39.32 to 68.19	25	18	72.00	50.61 to 87.93
Ylikontiola 2000 ¹⁰	SSO	3 weeks	60	26	43.33	30.59 to 56.76	-	-	-	-
Yip 2001 ¹¹	SSO	1 day	44	34	77.27	62.16 to 88.53	-	-	-	-
Becelli 2004 ¹²	SSO	1 day	482	396	82.16	78.44 to 85.47	-	-	-	-
Seo 2005 ¹³	Mix	6 weeks	-	-	-	-	30	10	33.33	17.29 to 52.81
Total			843	591	70.11	66.89 to 73.18	108	60	55.56	45.68 to 65.12

VRO: vertical ramus osteotomy
SSO: sagittal split osteotomy

that had persisted for more than 12 months after the operation was considered permanent.

Whilst maxillary osteotomies are bilateral, mandibular osteotomies can be bilateral, or less commonly, unilateral (or with different procedures done on each side). Similarly, neurosensory disturbance in most patients is unilateral, but in some it is bilateral. When details about the nerves affected and the sides operated on were included, the data were included in both columns of the results table, but in many cases this was not possible, so the affected nerves and effects on the patients have been presented separately. There are therefore differences in the numbers and prevalences reported between nerves and patients.³

Data were collected on a Microsoft Excel® spreadsheet, and statistical analysis was done with the help of StatsDirect® (StatsDirect Ltd, Altrincham, UK).

Results

Studies that give details of subjective assessment of temporary injury to the IAN are shown in Table 1.⁴⁻¹³ All operations were included because of the small number of studies. The

prevalence of injury when assessed within the first 6 weeks was 70/100 patients (95% CI 67 to 73/100) or 56/100 nerves (95% CI 46 to 65/100).

Table 2 shows the results by type of operation.^{6-8,10-12,14-28} Beyond 12 months, subjective alteration in sensation was 33/100 patients (95% CI 30 to 35/100) or 20/100 nerves (95% CI 18 to 21/100).

Further analysis showed that there were significant differences in the prevalence of injury to the IAN between operations (p<0.0001). Significantly more injuries occurred when sagittal split osteotomies (SSO) were combined with genioplasty than when done alone (p<0.0001) or during vertical ramus osteotomies (VRO) (p<0.0001) or genioplasty alone (p<0.0001).

Studies on the objective assessment of short-term injury to the IAN are shown in Table 3.^{8,9,29-31} A prevalence of 70/100 patients (95% CI 64 to 74/100) or 63/100 nerves (95% CI 60 to 66/100).

More studies examined objective tests of IAN deficit beyond 12 months (Table 4).^{7,8,15-17,30-34} The order of prevalence was similar whether assessed subjectively or objectively.

Table 2
Subjective assessment of long-term injury to the inferior alveolar nerve by type of operation.

Operation	Nerves				Patients			
	Total	No. affected	Prevalence /100	95% CI	Total	No. affected	Prevalence /100	95% CI
Extraoral VRO	190	29	15.26	10.47 to 21.18	102	9	8.82	4.11 to 16.09
Intraoral VRO	733	61	8.32	6.43 to 10.56	42	1	2.38	0.06 to 12.57
SSO	2778	647	23.29	21.73 to 24.91	1596	546	34.21	31.88 to 36.60
SSO + genioplasty	-	-	-	-	45	32	71.11	55.69 to 83.63
Genioplasty	102	12	11.76	6.23 to 19.65	60	14	23.33	13.38 to 36.04
MDO	70	2	2.86	0.35 to 9.94	-	-	-	-
Total	3873	751	19.70	18.44 to 21.00	1845	602	32.63	30.49 to 34.82

VRO: vertical ramus osteotomy.
SSO: sagittal split osteotomy.
MDO: mandibular distraction osteogenesis.

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