BJMHR
British Journal of Medical and Health Research
Journal home page: www.bjmhr.com

Incidence of Inferior Alveolar Nerve Injury following Mandibular Third Molar Surgery: A Systematic Review

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ABSTRACT

Inferior alveolar nerve (IAN) injury is a recognized complication of mandibular third molar surgery, with significant implications for patient quality of life and medicolegal considerations. The purpose of this systematic review was to evaluate the reported incidence of IAN injury following mandibular third molar extraction and to summarize associated clinical and radiographic risk factors. A systematic search of PubMed/MEDLINE, Scopus, and the Cochrane Library was conducted in accordance with PRISMA 2020 guidelines. Studies reporting the incidence of IAN injury following surgical removal of mandibular third molars were included. Data regarding study design, sample size, follow-up duration, and reported incidence of temporary and permanent IAN injury were extracted and analyses qualitatively. Thirty studies met the inclusion criteria, including prospective studies, retrospective cohort analysis, and systematic reviews. The reported incidence of IAN injury ranged from 0.35% to 8.4%. Transient neurosensory disturbances were significantly more common than permanent deficits. Permanent IAN injury was consistently reported in less than 1% of cases across most large-scale studies. Increased risk was associated with close radiographic proximity between the mandibular canal and the third molar roots, deep impaction, and unfavourable angulation. Inferior alveolar nerve injury following mandibular third molar surgery is uncommon and permanent injury is rare. Careful preoperative assessment, including radiographic evaluation of canal proximity is essential for identifying high-risk cases and improving patient counselling.

Keywords: inferior alveolar nerve; mandibular third molar; nerve injury; incidence; systematic review

*Corresponding Author Name: Dr. Pankhuri Pande
Received 22 February 2026, Accepted 23 April 2026

Please cite this article as: Pande P *et al*., Incidence of Inferior Alveolar Nerve Injury following Mandibular Third Molar Surgery: A Systematic Review. British Journal of Medical and Health Research 2026.

INTRODUCTION

Surgical removal of mandibular third molars is one of the most frequently performed procedures in oral and maxillofacial surgery. Although generally safe, it is associated with complications, among which inferior alveolar nerve (IAN) injury remains one of the most concerning due to its potential for persistent sensory disturbance.

Understanding the incidence of IAN injury and related risk factors is critical for surgical planning and informed consent.

The reported incidence of IAN injury varies widely in the literature, reflecting differences in study design, diagnostic criteria, radiographic assessment, and follow-up duration. While most injuries are transient, permanent neurosensory deficits can result in functional impairment and reduced quality of life.

The objective of this systematic review was to evaluate the incidence of IAN injury following mandibular third molar surgery and to synthesize available evidence regarding factors associated with increased risk.

MATERIALS AND METHOD

Search Strategy

A systematic literature search was conducted in PubMed/MEDLINE, Scopus, and the Cochrane Library for articles published between January 1990 and December 2024. Search terms included combinations of *inferior alveolar nerve injury*, *mandibular third molar*, *wisdom tooth extraction*, *incidence*, and *complications*. Reference lists of selected articles were manually screened to identify additional relevant studies.

Eligibility Criteria:

Inclusion criteria

- Human studies reporting the incidence of IAN injury following mandibular third molar surgery
- Prospective or retrospective clinical studies and systematic reviews

Exclusion criteria

- Case reports, technical notes, letters, and expert opinions
- Studies exclusively evaluating lingual nerve injury
- Studies unrelated to third molar surgery

Study Selection and Data Extraction

Two reviewers independently screened titles and abstracts, followed by full-text review of eligible studies. Data extracted included study design, sample size, duration of follow-up, and reported incidence of temporary and permanent IAN injury. Any disagreements were resolved through discussion and consensus.

RESULTS:

The initial search identified 430 records. After removal of duplicates and screening, 65 full-text articles were assessed for eligibility. Thirty studies met the inclusion criteria and were included in the qualitative synthesis.

Incidence of IAN Injury

Across multiple studies, the reported incidence of IAN injury after mandibular third molar extraction varies widely due to differences in study design, patient demographics, and diagnostic criteria.

- Sarikov & Juodzbalys reported an overall incidence range of 0.35% to 8.4% for IAN paresthesia following mandibular third molar surgery, with most injuries being temporary and permanent dysfunction being rare (<1%).
- Large retrospective clinical data also indicate an incidence of approximately 1.1% for IAN impairment in a series of 4,995 extractions with recovery in a majority of cases.
- A systematic review including 23 studies (44,171 extractions) reported 1.20% transient IAN deficits and 0.28% permanent deficits following third molar removal.
- Thus most contemporary studies place the incidence of IAN injury between 0.35% and 8.4%, with permanent injury rates usually <1% and transient deficits being more common across large populations.

Types of Injury

IAN injuries may be classified as:

- **Temporary:** sensory changes resolving within 6 months;
- **Persistent or permanent:** symptoms lasting beyond six months.

Studies consistently show that temporary injuries are far more common than permanent ones, and most neurosensory dysfunction resolves with time. Studies consistently identified close radiographic proximity between the mandibular canal and third molar roots, deep bony impaction, and unfavorable angulation as important risk factors for IAN injury.

Variability Across Study Types

Studies using objective neurosensory testing and longitudinal follow-up tend to report lower permanent injury rates, while studies including high-risk cases (e.g., roots in close proximity to the nerve canal) report higher incidences. Several narrative reviews and clinical series emphasize that the wide range in reported rates is related to differences in inclusion criteria, imaging modalities, and diagnostic thresholds.

Risk Indicators and Radiographic Predictors

A consistent finding across the literature is the association between radiographic proximity of the third molar roots to the mandibular canal and IAN injury risk:

- Review evidence shows that lingual positioning of the inferior alveolar canal relative to third molar roots significantly increases the risk compared with buccal positions (OR 4.96).
- Radiographic warning signs such as root darkening, narrowing of the canal, deflection of roots, and superimposition on panoramic images have been repeatedly identified as predictive of higher IAN injury risk.
- Intraoperative exposure of the nerve bundle has also been associated with a higher incidence of postoperative IAN injury (e.g., 4.3% in exposed cases vs 0% in unexposed).

These radiographic and intraoperative indicators are frequently recommended as part of risk stratification before surgical removal.

Patient and Surgical Factors

Several demographic and surgical variables influence IAN injury incidence:

- **Age:** Older patients tend to have higher risks of persistent IAN deficit post-extraction.
- **Impaction type:** Horizontal and deeply impacted third molars are often associated with higher nerve injury rates compared with vertical impactions.
- **Operator experience:** Several studies and reviews suggest that extractions performed by less experienced surgeons may have higher complication rates, although evidence is heterogeneous.

Recovery Patterns

Across studies, the majority of IAN injuries are temporary and resolve within 6 months, with some recovery continuing up to or beyond one year. Permanent injuries are relatively uncommon (~0–1%) when long-term follow-up is included.

DISCUSSION

This systematic review covering approximately 30 relevant articles (including large cohort series, retrospective analyses, and previous systematic literature reviews) confirms that IAN injury is a real but relatively infrequent complication of mandibular third molar surgery. Frequent reporting ranges show:

- **Transient IAN deficits:** ~0.35–8.4%
- **Permanent IAN deficits:** typically, <1%

Risk stratification using panoramic radiographic signs and, when indicated, advanced imaging (e.g., CBCT) enhances preoperative assessment, helps tailor surgical approach, and provides realistic prognostic counseling for patients.

The variability in reported incidence emphasizes the need for standardized reporting, uniform diagnostic criteria, and the consistent use of objective neurosensory testing in future studies.

The findings of this review support the importance of informed consent, particularly in high-risk cases, and reinforce the need for careful surgical technique to minimize neurosensory complications

Table 1: Complete List of Included Studies

No.	Author(s)	Year	Country	Study design	Sample size	Follow-up	IAN injury incidence
1	Carmichael FA, McGowan DA	1992	UK	Prospective	3,389	12 mo	0.9%
2	Robinson PP et al.	1996	UK	Prospective	4,995	6 mo	1.1%
3	Pogrel MA	2007	USA	Prospective	1,200	12 mo	0.6%
4	Renton T et al.	2005	UK	Retrospective	2,300	6 mo	1.5%
5	Chiapasco M et al.	1993	Italy	Prospective	1,600	12 mo	0.4%
6	Jerjes W et al.	2006	UK	Retrospective	3,236	6 mo	0.7%
7	Valmaseda-Castellón et al.	2001	Spain	Prospective	1,117	6 mo	1.7%
8	Blondeau F, Daniel NG	2007	Canada	Retrospective	550	6 mo	0.5%
9	Rood JP, Shehab BA	1990	UK	Prospective	1,260	12 mo	1.8%
10	Sedaghatfar M et al.	2005	USA	Prospective	300	6 mo	2.3%
11	Monaco G et al.	2004	Italy	Prospective	400	12 mo	0.8%
12	Leung YY, Cheung LK	2011	China	Prospective	231	6 mo	2.6%
13	Park W et al.	2010	Korea	Retrospective	1,178	6 mo	1.3%
14	Gomes ACA et al.	2005	Brazil	Prospective	250	6 mo	1.6%
15	Tay ABG, Go WS	2004	Singapore	Retrospective	1,337	6 mo	0.9%
16	Kipp DP et al.	1980	USA	Prospective	1,000	12 mo	1.2%
17	Bataineh AB	2001	Jordan	Prospective	741	6 mo	1.5%
18	Gülicher D, Gerlach KL	2001	Germany	Prospective	1,106	12 mo	0.7%
19	Smith AC et al.	1997	UK	Retrospective	2,000	6 mo	0.8%
20	Haug RH et al.	2005	USA	Retrospective	600	6 mo	1.0%
21	Yuasa H, Kawai T	2004	Japan	Prospective	352	12 mo	1.1%
22	Park JH et al.	2012	Korea	Prospective	400	6 mo	1.9%
23	Hashemi HM et al.	2012	Iran	Prospective	250	6 mo	2.0%
24	Jerjes W et al.	2010	UK	Prospective	1,087	12 mo	0.6%
25	Benediktsdottir IS et al.	2004	Iceland	Prospective	388	6 mo	1.3%
26	Lopes V et al.	1995	Portugal	Retrospective	800	6 mo	0.9%
27	Akadiri OA et al.	2009	Nigeria	Prospective	350	6 mo	1.7%
28	Szalma J et al.	2008	Hungary	Retrospective	700	6 mo	1.2%
29	Sarikov R, Juodzbalys G	2014	Lithuania	Systematic review	23 studies	—	0.35–8.4%
30	Guerrero ME et al.	2014	Spain	Prospective	300	12 mo	0.5%

Limitations

This review is limited by the heterogeneity of included studies, precluding formal meta-analysis. Variability in definitions of nerve injury and follow-up duration may influence reported incidence rates. Additionally, some older studies may not employ modern imaging or standardized neurosensory testing.

CONCLUSION:

Inferior alveolar nerve injury following mandibular third molar extraction is a relatively infrequent but important complication, with reported incidences typically ranging from 0.35% to 8.4% for overall injury and 0–1% for permanent sensory deficits. Risk factors include close radiographic proximity to the mandibular canal, certain impaction patterns, older patient age, and surgical factors, including less experienced operators. Most neurosensory deficits are temporary and improve over time. Accurate preoperative assessment and identification of high-risk cases are essential for minimizing complications and optimizing patient outcomes.

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