International Journal of Medical Science and Clinical Research Studies

ISSN (print): 2767-8326, ISSN (online): 2767-8342

Volume 04 Issue 12 December 2024

Page No: 2432-2434

DOI: https://doi.org/10.47191/ijmscrs/v4-i12-55, Impact Factor: 7.949

# Ophthalmic Complications Associated with the Inferior Alveolar Nerve Block: The Cases of Diplopia, Amaurosis, Mydriasis, and Ptosis

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**ABSTRACT**

Inferior alveolar nerve block (IANB) is widely used for performing painless intraoral treatments. In rare cases, ophthalmic complications (OCs) such as diplopia, amaurosis, mydriasis, ptosis, etc., may occur. Despite being uncommon and usually transient, OCs may lead to stressful situations, and dentists should be aware of them in order to prevent them. The aim of this review is to highlight these OCs related to the IANB.

**KEYWORDS:** Inferior alveolar nerve, anesthesia, diplopia, amaurosis, mydriasis, ptosis, ophthalmic complication.

**ARTICLE DETAILS**

**Published On:**
**30 December 2024**

**Available on:**
**https://ijmscr.org/**

## I. INTRODUCTION

Inferior alveolar nerve block (IANB) is essential for pain suppression during dental mandibular treatments such as posterior extraction or implant placement, root canals on molars, etc.

After IANB, rare ophthalmic complications (OCs) may occur [1-3]; they represent 0.04 to 0.1% of the cases [4,5]. Diplopia (double vision), amaurosis (blindness), mydriasis (pupil dilatation), ptosis (upper eyelid drooping), and lack of accommodation are usual OCs associated with IANB [1-6]. OCs are mostly attributed to the anesthetic solution getting to the orbit or adjacent structures [7,8]. Although the majority of these OCs are transitory and last until the anesthesia subsides [1,3,6], in some cases they can persist for 3 to 4 months [9,10]. The aim of this paper is to review the cases of diplopia, amaurosis, mydriasis, and ptosis that may occur after IANB.

## II. OPHTHALMIC COMPLICATIONS

In their analysis of 65 case reports of intraoral anesthesia followed by OCs, Von Arx et al. [11] found that diplopia was the most frequent OC (39.8%), followed by ptosis (16.7%), mydriasis (14.8%), and amaurosis (13.0%). Other OCs, such as accommodation disorder, enophthalmos, miosis, and ophthalmoplegia, were less reported. 45.8% of the cases were associated with the IANB. Likewise, in a study investigating published reports of OCs related to intraoral anesthesia from 1957 to 2010, Boynes et al. [7] found a total of 48 cases, among which 21 were linked to IANB.

The precise physiopathology of OCs is still controversial. However, it is generally accepted, therefore, that the anesthetic solution reaches the orbit mainly by diffusion or via vascular and neurologic routes [12,13].

### A. OCs Physiopathology Associated with IANB

Many theories of OCs physiopathology have been proposed.

**Accidental Intra-arterial Injection**

This hypothesis is based on the intravascular insertion of the needle tip, which is always possible, particularly in the case of locoregional anesthesia without aspiration. According to research by Mohan et al. (2014) [14], Taghavi Zenouz et al. (2008) [15], and Malamed (2004) [16], the percentage of cases with positive aspiration tests was 20%, 15.3%, and 10–15%, respectively.

During the IANB, the anesthetic solution may accidentally be injected into the inferior alveolar artery located in close proximity to the nerve, and as a result, under pressure, it may be forced back into the maxillary artery and after that into the middle meningeal artery, which anastomoses with the ophthalmic artery. The ophthalmic artery may occasionally even emerge as a branch of the middle meningeal artery. The lateral rectus muscle, which is supplied by the muscular branches of the ophthalmic artery and one or two branches of the inferior muscular artery and the lacrimal artery, is thus paralyzed, causing diplopia [1,3,17,18].

Furthermore, the ophthalmic artery gives rise to the central retinal artery, which could be responsible for the temporary blindness that occurs after the anesthetic enters this vessel [2]. In rare cases, blindness was permanent, and although the mechanism of permanence is unknown, many researchers believe it may be the result of retinal tissue ischemia caused by the central retinal artery reactive vasospasm [19]. Furthermore, there have been reports that the cavernous sinus receives intracranial branches from the accessory meningeal artery, a branch of either the maxillary artery or the middle meningeal artery [20,21]. Consequently, all of the nerves located within the sinus (the oculomotor nerve, CN III; the trochlear nerve, CN IV; and the abducens nerve, CN VI) may be anesthetized by the anesthetic reaching the cavernous sinus, leading to mydriasis, ptosis, and loss of accommodation [18].

**Accidental Intravenous Injection**

The accidental injection in the inferior alveolar vein while performing an IANB may disseminate the anesthetic solution into the pterygoid venous plexus and thus into the cavernous sinus, anesthetizing the 3rd, 4th, and 6th cranial nerves as already detailed [18].

**Accidental Trauma to the Inferior Alveolar Nerve Wall**

As several cases of OCs occur despite negative aspiration, Kronman et al. [22] proposed an alternative theory about the physiopathology of OCs. For them, a simple trauma caused by the anesthesia syringe needle scraping against the wall of the inferior alveolar artery (each artery is surrounded by a delicate sympathetic plexus) may lead to an impulse that travels through the plexus on the maxillary artery, via the deep petrosal nerve and internal carotid plexus to the ophthalmic artery [18].

### B. Prevention and Treatment

It is generally agreed that the intravascular injections are the main reasons for OCs related to IANB. Thus, to avoid these stressful situations, aspiration must be performed prior to every injection to ensure that the anesthetic solution is not administered into a vessel. Besides, injections need to be done slowly and without pressure [7,18,23].

As for OCs management, each situation should be assessed separately and treated appropriately. The patient should always be referred to a specialist if the doctor is unsure of the nature of the clinical picture or its underlying cause [24]. The recommended step-by-step protocol for patient management is summarized in Table 1.

**Table 1: Recommended step-by-step protocol for patient management [8,24].**

| | |
|---|---|
| 1. | Interruption of the dental procedure and reassuring the patient |
| 2. | Monitoring the patient's vital signs |
| 3. | Protecting the cornea by covering the affected eye with a gauze dressing |
| 4. | Safely sending home the patient |
| 5. | Referring the patient to an ophthalmologist for case evaluation, especially for cases lasting for minutes |
| 6. | Following up on the case |

## III. CONCLUSION

IANB-related OCs are uncommon and transient, but they shouldn't be underestimated. Knowledge of potential difficulties, their causes, and primarily their preventive actions (patient history, aspiration test, slow and with no pressure injection) are necessary to produce a safe and successful anesthesia.

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