

Ophthalmologic complications after administration of local anesthesia in dentistry: a systematic review



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Objective. The aim of this review was to investigate the association between the occurrence of ocular adverse events and dental local anesthesia, the most plausible anatomic mechanisms, and the measures that offer patients a *restitutio ad integrum*.

Study Design. This systematic review adopted a structured protocol to access available publications and followed the PRISMA statement.

Results. Eighty-nine cases of patients experiencing ocular adverse events after administration of dental local anesthesia have been reported in the literature. Most of the complications manifested as double vision. Only 8% of the complications caused permanent functional damage, either as vision deficit or anisocoria. Complete permanent blindness was not reported.

Conclusions. Ocular complications as a result of dental local anesthesia may be seen as rare occurrences with usually low intensity. However, visual function may become permanently impaired and serious medical conditions may obscure ocular dysfunction. (Oral Surg Oral Med Oral Pathol Oral Radiol 2016;121:e39-e50)

Dental local anesthesia is a very common and safe procedure. According to the literature, adverse phenomena specifically affecting vision have a prevalence rate of 1 in 1000 and are, thus, rather rare. Because such phenomena also seem to be underreported, information available on this subject is inadequate for clinicians.¹ Although ocular complications are mostly transient, permanent damage as a side effect of local anesthesia has also been described.²⁻⁶ Therefore, recognition of the problem and its severity is imperative, necessitating vigilance as well as a competent and systematic patient management.

The aim of this review was to present a comprehensive overview of the available evidence on the association between the occurrence of ocular adverse events and dental local anesthesia, the most plausible anatomic explanation for each type of ocular adverse events, and what measures, if any, may offer patients a *restitutio ad integrum*.

MATERIALS AND METHODS

Study design

This study used a structured protocol to access available publications with the scope to provide a contemporary overview of:

1. Possible ocular complications after dental anesthesia,
2. The potential anatomic basis of the respective complication, and
3. Protocols to treat complications and to prevent further damage to the ocular structures.

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Inclusion and exclusion criteria

Studies published in English or German were included. There were no restrictions with regard to the date of publication. No animal studies were included in this review. Published articles were considered eligible for this review when they had the characteristics presented in [Table I](#).

Search strategy

The search was conducted on December 20, 2013, using seven electronic databases (MEDLINE, Cochrane Central Register of Controlled Trials, Cochrane Database of Systematic Reviews, Database of Abstracts of Reviews of Effects, Embase, Embase Alert, and Science Citation Index Expanded) at the Deutsches Institut für Medizinische Dokumentation und Information (DIMDI)⁷ ([Table II](#)). The search strategy used for identifying studies followed the PRISMA statement.⁸ To frame and analyze the topic, a clearly stated research question amenable to literature review was generated. This key question was formulated according to the PICO format (Population, Intervention under investigation, Control or comparison of interest, and Outcome).⁹ Hence, in this specific study, a comprehensive question would be as follows: “What ophthalmologic complication or adverse event could occur after the administration of dental anesthetics?” Applying this question to the

Statement of Clinical Relevance

The incidence and morbidity rates of ophthalmologic mishaps after administration of dental local anesthesia are low, but such adverse events should be recognized and assessed because of their emergency in order to avoid permanent deficits and to avoid life-threatening conditions.

Table I. Databases introduced in the search process

Database key	Database name	Publishing company
CCTR93	Cochrane Central Register of Controlled Trials	The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.
CDSR93	Cochrane Database of Systematic Reviews	The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.
CDAR94	Database of Abstracts of Reviews of Effects	2013 University of York. Published by John Wiley & Sons, Ltd.
ME60	MEDLINE	NLM
EM47	EMBASE	2013 Elsevier B.V.
EA08	EMBASE	2013 Elsevier B.V.
IS74	SciSearch	Thomson Reuters

PICO model would not involve any limitations regarding population; intervention would be the application of dental anesthetics and outcome the ophthalmologic adverse events. The search strategy used relevant terms according to the DIMDI Classic Search query language⁷ (Table III).

Study selection

The search protocol produced 2311 hits. After the elimination of duplicates, results were reduced to 1448 hits: 402 were allocated to Cochrane databases, 711 to Medline, 286 to Embase databases, and 49 to Web of Science. The electronic search was followed by a screening process. To minimize the risk of bias, study selection was done independently by two reviewers (C.A. and P.R.). Consensus between the two parties was reached through discussion.¹⁰ The screening result is outlined in Figure 1. Initially, a title review (1448 records) was carried out, followed by an abstract assessment (161 records). This method yielded a set of 104 eligible studies for full-text analysis. Since electronic searches might still miss relevant studies, the search process was supplemented by a manual search of the bibliographies of all articles selected for full-text analysis. This manual search contributed 25 additional records, increasing the number of eligible papers for full-text review to 129. According to the predefined selection criteria (see Table I), the final number of papers to be included in this review was 66.

RESULTS

This review included 66 reports of 89 patients (65 case reports and 1 case series) published between 1954 and 2013. The majority of the reported cases (70%) refer to women (60 women and 26 men). In alphabetical order, the following ocular complications were identified:

- Amaurosis¹¹⁻¹⁷
- Blindness^{2,5,6,18}

- Diplopia (double vision)^{1,19-26}
- Endophthalmitis⁶
- Globe penetration^{27,28}
- Horner syndrome (cervical sympathetic block syndrome): blepharoptosis, miosis, anhidrosis, hemifacial flushing, conjunctival injection and enophthalmos²⁹⁻³²
- Impaired visual acuity (blurred vision)³³⁻³⁶
- Loss of accommodation (cycloplegia)^{24,33,37}
- Mydriasis (dilation of the pupil)^{4,11,38,39}
- Ophthalmoplegia (internal or external, partial or total)^{17,40-42}
- Ptosis⁴³
- Strabismus (convergent or divergent)^{11,44,45}

The frequency of the most common conditions is depicted in Figure 2.

Duration of complications

This review revealed that 92% of the complications reported in the literature, such as external ocular muscle palsies, were transient; therefore, the existing evidence supports the assumption that diplopia will resolve.^{1,20,46}

Four out of six patients with permanent complications (8%) developed vision impairment (permanent damage of the optic pathway) and the other two an isolated fixed pupil (iridoplegia) that manifested clinically as anisocoria.

In summary, external ophthalmoplegia seems to be a temporary condition, whereas internal ophthalmoplegia may not resolve completely. The time frame for the resolution of a transient complication was more than 6 hours in 25% of the patients.

Types of complications

Ophthalmoplegia (ophthalmoparesis). Ophthalmoplegia was the most prevalent condition (68 patients) in our study. Depending on the affected muscles, ophthalmoplegia is characterized as “partial” or “total” and “external” or “internal” (Figures 3 and 4).

External ophthalmoplegia. The external form of ophthalmoplegia is a prerequisite for *diplopia* (double vision) and is a symptom of underlying pathosis. We found that diplopia had been reported for almost 50% of patients in our review. Diplopia manifests in various patterns (horizontal, vertical, and combined), depending on the cranial nerves (CNs III, IV, and VI) affected. The most frequently reported type of ophthalmoplegia was the palsy of CN VI (N. abducens), resulting in an impaired abduction and consecutive esotropia (convergent strabismus).⁴³

Internal ophthalmoplegia. In contrast, autonomic pathway blocks manifest as internal ophthalmoplegia or *Horner syndrome* and affect about one-third of the patients. Internal ophthalmoplegia causes either blurred

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