Does 3-dimensional imaging of the third molar reduce the risk of experiencing inferior alveolar nerve injury owing to extraction?

A meta-analysis

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nferior alveolar nerve (IAN) injuries are 1 of the most critical complications that can occur as a result of mandibular third-molar (M3M) extraction[1-5]; IAN injuries can cause neurosensory impairment of the lower lip and chin area, which clearly affects the patient's quality of life.[1] This complication, which affects from 0.4% to 5.5%[6] of patients, is usually temporary, but on occasion, it also can lead to permanent symptoms. The risk of experiencing nerve injury is higher in cases in which the neurovascular bundle is exposed during surgery.[3,7]

Some factors related to the surgical technique and the surgeon's experience could have an impact on the patient's risk of experiencing IAN injuries.[3,7] In addition, some investigators have described radiographic warning signs.[2] The most important predictor seems to be the proximity of the M3M roots to the mandibular canal (MC).[1,6]

Traditionally, clinicians have used panoramic radiographic (PR) images to assess the relationship between a patient's M3M roots and the MC. In patients who have a high risk of experiencing IAN injuries, owing to the M3M being in close proximity with the MC, clinicians usually recommend obtaining computed tomographic (CT) images so that the surgeon can have a preoperative, 3-dimensional (3D)

ABSTRACT

Background. Clinicians generally use panoramic radiographic (PR) images to assess the proximity of the mandibular third molar to the inferior alveolar nerve (IAN). However, in cases in which a patient needs to undergo a third-molar extraction, many clinicians also assess computed tomographic (CT) images to prevent nerve damage.

Types of Studies Reviewed. Two of the authors independently searched MEDLINE (through PubMed), Cochrane Library, Scopus, and Ovid. The authors included randomized or nonrandomized longitudinal studies whose investigators had compared the number of IAN injuries after third-molar extraction in patients who had undergone preoperative CT with patients who had undergone only PR.

Results. The authors analyzed the full text of 26 of the 745 articles they initially selected. They included 6 studies in the meta-analysis. Four of the studies had a high risk of bias, and the investigators of only 1 study had used blinding with the patients. The authors observed no statistically significant differences between groups related to the total number of nerve injuries (risk ratio, 0.96; 95% confidence interval, 0.50 to 1.85; $P = .91$). The prognosis of the injuries was similar for both groups.

Conclusions and Practical Implications. Although having preoperative CT images might be useful for clinicians in terms of diagnosing and extracting mandibular third molars, having these CT images does not reduce patients' risk of experiencing IAN injuries nor does it affect their prognosis.

Key Words. Third molar; computed tomography; panoramic radiography; mandibular nerve; alveolar nerve.
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view of the area.[1] Nevertheless, the investigators of some studies have concluded that the use of 3D imaging does not seem to reduce the number of nerve injuries.[1-4,6] In addition, 3D imaging is associated with higher costs[1,6] and higher levels of radiation exposure compared with PR.[1,4] In spite of these facts, some clinicians systematically indicate obtaining preoperative CTs before performing M3M extraction to avoid legal issues. Therefore, a meta-analysis of the published data would be of great interest to clinicians. Consequently, the aim of this study was to determine whether obtaining preoperative CT images reduces either the risk of experiencing or the severity of IAN injuries after M3M extraction in comparison with obtaining PR images.

METHODS

We ensured that the methodology of our study adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement.[8]

Study selection criteria. We included randomized and nonrandomized controlled trials and prospective and retrospective cohort studies whose investigators had compared the number of IAN injuries that patients had experienced after undergoing M3M extraction with whether the patients had undergone preoperative CT or whether they had undergone only preoperative PR. We applied no restrictions regarding language or publication date. We excluded all of the articles that did not meet these criteria.

The main outcome variable was the number of IAN injuries for each group; we defined an IAN injury as a loss of sensation in the lower lip or chin areas, either subjectively reported by the patient or assessed by means of clinical testing.

The secondary variables were:
- type of lesion: We considered the lesion to be persistent if the symptoms lasted longer than 6 months;
- risk of experiencing nerve injury, estimated by using a previously obtained radiographic assessment: We classified the level of risk of experiencing IAN injury as being moderate if there was a superimposition of the M3M root and the MC, if there was at least 1 radiographic warning sign (according to Rood and Shehab's criteria[9]), or both. If we noted that there was more than 1 radiographic warning sign, we considered that the patient had a high risk of experiencing IAN injury as a result of undergoing M3M extraction.

Search strategy. We conducted an electronic search of articles published up to March 12, 2017, in MEDLINE (PubMed), Cochrane Library, Scopus, and Ovid databases.

We used the following search strategies for each database: (((("Tomography, X-Ray Computed"[Mesh] OR "Cone-Beam Computed Tomography"[Mesh]) AND ("Molar, Third"[Mesh]) OR "Mandibular Nerve/

injuries"[Mesh]) for MEDLINE (PubMed), ("X Ray Computed Tomography Scanner" OR "Cone Beam Computed Tomography") AND ("Third Molar" OR "Mandibular Nerve") for the Cochrane Library, ("Computed Tomography, X Ray" OR "Cone Beam Computed Tomography") AND ("Third Molar" OR "Mandibular Nerve") for Scopus, and (X Ray computed tomography or Cone Beam computed tomography) and (Third Molar or Mandibular nerve injury) for Ovid.

We completed the search by manually screening the references cited in the selected articles and reviews.

Selection of studies. Two reviewers (A.C.-O., A.S.-T.) independently screened the title and abstract of each article to decide its eligibility. They then assessed the full text of the selected articles. Figure 1[8] lists the studies we removed at this stage and the reasons for exclusion. A third reviewer (O.C.-F.) resolved any disagreements. We calculated the κ statistic to measure the reviewers' level of agreement.

In situations in which the reviewers identified multiple reports with the same sets of patients, they included only the study with the longest follow-up time.

Data extraction and method of analysis. Two reviewers (A.C.-O., A.S.-T.) independently extracted the data using data extraction tables. Whenever possible, they retrieved the following information from the selected articles: names of authors, year of publication, country in which the study was conducted, study design, and details associated with the participants, interventions, and outcomes.

We considered the number of IAN injuries to be the primary outcome variable. The secondary outcomes comprised the type of lesion and the preoperative estimation of the risk of experiencing nerve injury.

Risk of bias assessment. We assessed the risk of bias according to the guidelines provided in the Cochrane Handbook for Systematic Reviews of Interventions, Version 5.1.0,[10] and we performed the data extraction and meta-analysis with Review Manager software, Version 5.3 (Cochrane Collaboration). We used the Newcastle-Ottawa Scale[11] to assess the cohort studies.

Statistical analysis. We carried out the statistical analysis using Review Manager software. For dichotomous outcomes, we used risk ratios (RR) with 95% confidence intervals (CI) to estimate the effect of the operation. We used parametric and nonparametric tests (Pearson χ^2 test and Fisher exact test) to compare the groups. We set the level of significance at a P value of less than .05.

ABBREVIATION KEY. 3D: 3-dimensional. **CT:** Computed tomographic. **IAN:** Inferior alveolar nerve. **M3M:** Mandibular third molar. **MC:** Mandibular canal. **NR:** Not reported. **PR:** Panoramic radiographic. **RCT:** Randomized controlled trial.