CRD summary
This review investigated the use of drug therapy and surgical methods for the relief of pain associated with toothache. The authors concluded that there is good evidence to support the use of non-steroidal inflammatory drugs in combination with pulpectomy. This conclusion was derived from a subgroup analysis and should, therefore, be treated with some caution.

Authors' objectives
To determine the effectiveness of interventions used in the emergency management of acute apical periodontitis (AAP) in the permanent dentition.

Searching
The authors searched MEDLINE, EMBASE and the Cochrane Controlled Trials Register from their inception to August 2001, and also the clinical trials register of the Cochrane Oral Health Group. The search strategy used was reported. The searches were not limited by language, but only items published in English or French were retrieved as full texts. The reference lists of retrieved articles were checked and endodontic experts and authors of published studies were contacted. Searches were conducted throughout the study to identify new publications. Unpublished studies were not sought.

Study selection
Study designs of evaluations included in the review
Randomised controlled trials (RCTs) and other controlled trials were eligible for inclusion. All of the included studies were RCTs.

Specific interventions included in the review
Studies of systemic or local drug therapy, local surgical measures, no treatment, or extraction were eligible for inclusion. Studies of systemic drug therapy (based on ketorolac, flurbiprofen, dexamethasone, or penicillin), local drug therapy (with dexamethasone, ketoprofen or diclofenac, or a corticosteroid-antibiotic solution), occlusal reduction and trephination were included. For extraction, occlusal adjustment and no treatment, either no studies were found, the outcomes did not meet the eligibility criteria, or the data were unsuitable for analysis.

Participants included in the review
The participants were patients with AAP resulting from non-vital pulp in the permanent dentition. AAP was defined as constant, dull, throbbing pain; no swelling; a negative or delayed positive result on vitality testing; the absence of thermal sensitivity; pain on biting or percussion; and specific radiographic findings.

Outcomes assessed in the review
The outcomes of interest were measures of pain relief or change in pain intensity, as measured by patients or clinicians. The included studies measured pain on visual analogue scales (VAS; 100 mm or 10 cm), categorical scales (9-point or 4-point), or on a 100-point scale. The pain scale used in two included studies was described as unclear.

How were decisions on the relevance of primary studies made?
Two reviewers independently assessed studies for relevance. Any disagreements were resolved by consensus.

Assessment of study quality
Validity was assessed using a checklist to indicate whether the study design, population, intervention(s) and outcomes were described clearly. A modified version of the quality assessment scale of Jadad et al. was used to grade each study on a scale of 0 to 5. Two reviewers independently assessed studies for validity. Any disagreements were resolved by consensus.

Data extraction
The authors did not state how the data were extracted for the review, or how many reviewers performed the data extraction.

For pain relief, the mean and standard deviation of the pain score in the treatment and control groups were used to calculate a weighted mean difference (WMD) and 95% confidence interval (CI) for each study. Data from different numeric scales were transformed to a common percentage scale (reference and formula given). For pain intensity, the proportion of patients achieving no or mild pain in each group was used to calculate the odds ratios (ORs) of response to treatment and their associated 95% CIs.

Methods of synthesis
How were the studies combined?
The studies were combined in a meta-analysis using a random-effects model (DerSimonian and Laird). Five trials provided continuous data that could be analysed for the outcome mean pain relief, while 8 trials provided binary data for the outcome intensity of pain. The studies varied in their schedules for patient evaluation and the authors selected the most comparable timeframes for the analysis, taking into account the pharmacokinetics of the drug used and the timing of local anaesthetic (if used).

The authors did not formally assess publication or language bias. The search identified 1,097 items, of which 92 in English or French were retrieved for further review; 21 items in other languages were retrieved but not reviewed.

How were differences between studies investigated?
Heterogeneity was assessed using a chi-squared test with the level of significance set at 0.1. Possible sources of heterogeneity were considered a priori. A separate analysis was proposed for each intervention, provided two or more studies were available for pooling. Subgroup analyses were also planned for studies of analgesics given to relieve pain in the pre-operative period; analgesics given to relieve pain in the post-operative period; and analgesics given in the pre-operative period to relieve post-operative pain. A sensitivity analysis was planned to assess the effect of methodological quality (score of 3 or more versus less than 3).

Results of the review
Fifteen RCTs were included in the review. Thirteen studies involved a total of 1,078 patients, one study analysed 60 teeth from 48 patients, and one analysed 53 teeth from an unspecified number of patients.

The median quality score was 3 (range: 1 to 5). Only 3 studies described the method of randomisation and 4 studies provided information on withdrawals. Twelve studies were described as double-blind; the method of blinding was considered appropriate in 11 of these.

Pain relief.
For mean pain relief, there was a significant positive effect of the included treatments compared with their respective controls (WMD -22.7, 95% CI: -36.20, -9.21). There was significant heterogeneity between the studies. When one study with a quality score of 2 was excluded, the benefit of treatment remained significant (WMD -13.17, 95% CI: -23.26, -2.74). Treatments involving pre-emptive analgesia (i.e. non-steroidal anti-inflammatory drugs, NSAIDs) in conjunction with pulpectomy showed a statistically significant effect (WMD -11.70, 95% CI: -22.84, -0.56), whereas the effect of pre-operative analgesia was not significant (WMD -38.69, 95% CI: -104.5, 27.07).

Pain intensity.
There was no significant difference between treatment and control groups for the proportion of patients achieving no or mild pain status (OR 0.48, 95% CI: 0.18, 1.27). Heterogeneity was significant. None of the different interventions examined (anti-inflammatory drugs, intracanal medication or trephination) showed a significant positive effect.

**Authors' conclusions**

There was strong evidence to support the use of systemic NSAIDs in conjunction with non-surgical endodontic therapy. The use of antibiotics was not recommended.

**CRD commentary**

The review addressed a clear question and the inclusion and exclusion criteria were clear. The authors searched a range of relevant sources, although they did not attempt to locate unpublished studies. The limitation of the search to items in English and French meant that relevant studies in other languages could have been missed. Two reviewers independently selected studies and assessed validity, thus reducing the risk of bias and errors during the review process. Aspects of validity were assessed using a standard scale and the results were taken into account in the data analysis.

Relevant details of the included studies were summarised in tabular format, although there was little information on the participants. The results were synthesised in a meta-analysis. The results for pain relief were difficult to interpret because they involved transforming data measured on different scales onto a single scale. Significant heterogeneity was present for the main outcomes, and this was investigated using pre-specified subgroup analyses for different types of intervention. The authors' conclusions were derived from the subgroup analyses and were thus based on relatively small numbers of studies and participants. Furthermore, it was unclear whether heterogeneity remained within the subgroups. This should be kept in mind when assessing the reliability of the conclusions.

**Implications of the review for practice and research**

Practice: The authors stated that there was good evidence to support the use of NSAIDs for pain relief and pain control; some evidence to support the use of an NSAID solution as an intracanal medicament; and weak evidence for the use of steroidal anti-inflammatory drugs. Trephination through bone in the peri-apical region may be useful, but entry through attached gingival was not recommended. The use of antibiotics was not recommended.

Research: The authors stated that there was a need for rigorous research in several areas, including drug effectiveness and route of administration, dosage and timing of administration.

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