Randomized Clinical Trial of Intraosseous Methylprednisolone Injection for Acute Pulpitis Pain

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Abstract

Introduction: The present study reports the results of a randomized clinical trial comparing local intraosseous methylprednisolone injection and emergency pulpotomy in the management of acute pulpitis on efficacy, safety, and efficiency end points. **Methods:** After providing prior informed written consent, 94 patients consulting for acute irreversible pulpitis pain at university-affiliated teaching hospital dental clinics in Dakar, Senegal were randomly assigned to either the methylprednisolone treatment group ($n = 47$) or the pulpotomy treatment group ($n = 47$). Patients were followed up at 1 week and assessed 6 months later to evaluate the therapeutic outcome of their treatment. **Results:** At day 7 the patients in the methylprednisolone group reported less intense spontaneous and percussion pain in the day 0–day 7 period than the patients in the pulpotomy group. Methylprednisolone treatment took approximately 7 minutes (4.6–9.3) less to accomplish than pulpotomy (or about half the time). No difference in the therapeutic outcome was found between the 2 treatment groups at 6 months (all credible intervals span 0). **Conclusions:** This study establishes that methylprednisolone injection for acute pulpitis is relieved by a minimally invasive pharmacologic approach more effectively than by the reference pulpotomy and conserves scarce dental resources (ie, endodontic equipment and supplies, dental surgeon's time). *(J Endod 2016;42:2–7)*

Key Words

Emergency treatment, endodontics, pain management, pulpitis

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Although treatment of acute pulpitis is now well-managed, emergency management of this usually painful condition may constitute an unanticipated and significant workload that disrupts the normal workflow in a dental office or clinic. Emergency pulpotomy is widely recognized as either the reference procedure for managing of this type of emergency (1) or as an efficient alternative to impractical total pulpal extirpation (2).

However, the superiority of these 2 approaches appears to be based on insufficient evidence. Whereas some reference studies have compared various therapeutic pulpotomy modalities, we were unable to find a randomized comparison of this procedure with another emergency protocol in the literature. Furthermore, pulpotomy requires the collaboration of a dentist who is competent in endodontics as well as significant technical setup and sufficient time.

Previous studies have highlighted the possibility of obtaining mid-term (a few weeks) pain relief by using a pharmacologic approach, thereby allowing planned endodontic management of the causal disease. Among these studies, a double-blinded, randomized trial (versus a physiological serum placebo) demonstrated the anti-inflammatory effects of intraosseous glucocortocoid injection and suggested that clinically satisfactory pain relief could be obtained by using a pharmacologic approach (3). However, the cohort studied in this report was too small to assess the safety of this procedure. Furthermore, the control used in this study was a placebo, which did not permit evidence-based comparison of intraosseous glucocorticoid injection with the emergency pulpotomy reference procedure. Therefore, we designed a randomized clinical trial that was able to determine whether this pharmacologic approach was as effective as emergency pulpotomy in the management of acute pulpitis as well as assessing whether it was safe to use. Our study did not aim to explain the physiological and pharmacologic mechanism(s) of the use of methylprednisolone injection for acute pulpitis pain.

Materials and Methods

All adult patients consulting in the emergency department of 3 dental clinics at the Dental Schools of the University of Dakar (Senegal) who were complaining of pain that was due to acute irreversible pulpitis of a permanent premolar or molar during the study period (from April through September 2009) were assessed for inclusion criteria in a 1:1 parallel-group randomized clinical trial.

Population

Inclusion and exclusion criteria were applied to recruit patients for the trial who presented irreversible pulpitis as specified in Supplemental Materials S1, section 1. All patients enrolled in the study were considered to be in acceptable periodontal, regional, and general health to the exclusion of patients presenting local, regional, or general pathology that would counterindicate either pulpotomy or prednisolone injection. In particular, patients presenting pulpitis of possible non-carious origin and those of questionable local periodontal health were excluded. Patients unable to understand the written protocol or unwilling to provide written consent were also excluded from the study.

Patient Selection and Information

The trial protocol was presented orally and in writing to sequentially consulting patients in 3 Dakar University–affiliated dental clinics who had acute irreversible pulpitis of carious origin. Those who expressed interest in participating in the trial were screened according to the trial inclusion and exclusion criteria. Informed prior written consent was obtained from all patients enrolled in the study.

Treatment Allocation

A randomization list was established by a statistician who prepared sequentially labeled opaque numbered envelopes containing the treatment group assignment for each patient to permit *a posteriori* allocation checking. The envelopes were available to investigators at all times, who were blinded to the allocation table. Each newly enrolled patient was assigned to a treatment group by the investigator on opening the randomization envelope bearing the patient's inclusion number.

Initial (Emergency) Treatment and Discharge

Patients were randomly assigned to either the reference initial treatment group or the experimental initial treatment group, as described above. On discharge after initial treatment, patients were prescribed a standard analgesic prescription (systematic: ibuprofen 400 mg 3 times a day for 7 days; in case of need, acetaminophen 500 mg + codeine 30 mg as needed, maximum 6/day), a data-collection form for recording pain experienced during the 7-day waiting period before definitive treatment, and instructions to return to where they were treated in case of unexpected events.

Reference Emergency Treatment (Pulpotomy). Pulpotomy was performed according to a standard protocol, as described by Tronstad (1). The tooth was anesthetized (periapical local anesthesia or inferior alveolar nerve block, with either intraligament or intraseptal infiltration [decided by the operator]), isolated (rubber dam), and then disinfected with an antiseptic solution after pre-endontic restoration if required. All carious dentin was removed, and an access cavity was achieved to allow total pulp chamber tissue removal (excavator, long-neck round bur). After hemostasis (compression, sodium hypochlorite), a dry sterile cotton pellet was placed in the pulpal cavity, which was then hermetically sealed with temporary cement, followed by occlusal correction.

Experimental Emergency Treatment (Intraosseous Methylprednisolone Injection). The technique used for methylprednisolone injection was described by Gallatin et al (3). After anesthesia (intraligament and intraseptal infiltration was excluded in the experimental treatment group protocol), the tooth and adjacent gingiva were disinfected with an antiseptic, and an injection point was chosen (in attached gingiva, around 5 mm below the cervical line away from dental roots.) The cortical bone was then perforated by using a single-use intraosseous anesthesia device (X-tip; Dentsply Maillefer Instruments, Ballaigues, Switzerland), including a drill (run at 10,000 rpm) and a guide sleeve, which was left in place for injection of the drug. Methylprednisolone (Depo-Medrol, Pfizer, New York, NY; 40 mg/mL) was then slowly injected (1 mL in 1–2 minutes) by using a 27-gauge needle and a dental anesthetic syringe. After removal of the drill-perforator (and hemostasis if necessary), patients were prescribed the same standard analgesic and issued the same documents and instructions as patients in the control group.

Definitive Treatment and Follow-up

After the 7-day waiting period after initial treatment, patients received endodontic treatment and restoration of the affected tooth. Six months after definitive treatment, patients were recalled for mid-term assessment of the state of the affected tooth.

Data Collection

Data collection is described in Supplemental Materials S1, section 2 (available online at www.jendodon.com). Spontaneous and percussion pain intensity was assessed on the 4-point oral scale already used by Gallatin et al (3): "Zero indicated no pain. One indicated mild pain, pain that was recognizable but not discomforting. Two indicated moderate pain, pain that was discomforting but bearable. Three indicated severe pain, pain that caused considerable discom fort and was difficult to bear." These data were analyzed as an ordinal variable.

Power and Sample Size

The study was planned as a non-inferiority sequential trial on the basis of extrapolation of the results by Gallatin et al (3). The objective was to be able to detect non-inferiority with a margin representing a pain score (sum of pain intensities [SPI] during the day 0–day 7 interval) in one group double that of the pain score in the other group, with first-type and second-type error rates of 0.05 and 0.8, respectively, and 5 interim analyses. The latter requirement raised the necessary sample size to 47 patients per treatment group; the expectation of the number of subjects effectively then included was 31 subjects. This sample size also allowed for an initial safety assessment; an event with probability of 0.05 had to be observed at least once in each treatment group, with probability of 0.91.

Statistical Analysis

The data were analyzed by building a bayesian model along the lines suggested by Spiegelhalter et al (4). This model is discussed and described in Supplementary Materials S1, sections 3 and 4 (available online at www.jendodon.com).

Qualitative variables were analyzed by logistic regression, quantitative variables by regression (generalization of Student *t* test); the ordered (non-quantitative) variables (ie, the pain during the waiting period and the summarizing scores SPI and sum of pain intensity differences [SPID], main judgement criteria) were analyzed by polychoric ordered logistic regression.

The results are reported as raw numbers (qualitative and ordered variables) or mean and standard deviation (quantitative variables); the group comparison results are expressed by the median and the 95% highest posterior density credible interval of the regression coefficients representing the effect of treatment in the model (which coincides with mean differences for quantitative variables).

Ethical Considerations

The experimental protocol was approved by the Scientific Committee of Dakar University (Dakar, Senegal), serving as an Institutional Review Board. Patients were informed that even after having given their initial consent, they were free to withdraw from the study at any time with no effect on their clinical management.

Results

During the study period (from April through September 2009), 94 patients in 3 Dakar University–affiliated dental centers were included in the trial and treated by the same operator. Logistical problems precluded interim analyses, and the trial proceeded to its maximal planned size. One minor protocol deviation was recorded; a patient in the methylprednisolone group received a supplemental periapical infiltration as well as the mandibular nerve block necessary for treatment of his