Review Article

EMERGENCY TREATMENT OF IRREVERSIBLE ACUTE PULPITIS

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ABSTRACT

The conventional image associated with acute irreversible pulpitis is spontaneous, violent and radiated pain. Pain ranges from short, acute flare-ups to a dull, continuous pain that progresses to severe, throbbing pain. The number of patients consulting for this type of pathology, motivated by pain, is increasing and often disrupts the dentist's routine because they are not scheduled and must be managed. The objective of this article is to describe the specificity of pain associated with acute irreversible pulpitis and to report the results of the literature on conventional emergency treatment and periapical corticosteroid injection.

KEY WORDS: Emergency treatment, endodontics, pain management, pulpitis

INTRODUCTION

Irreversible acute pulpitis is an inflammatory state of the pulp whose clinical and histological signs cannot return to their original healthy state regardless of the therapy used [1]. The image classically associated with this pathology is spontaneous, violent and radiated pain. The pain ranges from a short, acute flare, to a dull, continuous pain, progressing to severe, throbbing pain [2]. The number of patients consulting for this type of pathology, motivated by pain, is increasing and often disrupts the dentist's routine because they are not scheduled and must be managed [3].

In the absence of emergency treatment, it progresses to necrosis where microorganisms invade the periapex, leading to periapical diseases considered as risk factors for general health [4]. However, the choice of this treatment is not simple:

- purely medical treatment (opioid analgesics or non-steroidal anti-inflammatory drugs) is not very effective;

- the prescription of major analgesics (morphine and related), while generally reducing the intensity of chronic pain, is less effective in cases of severe acute pain and is not indicated for endodontic conditions.

Classical symptomatic treatment is the combination of: eviction of the cameral content (or pulpotomy in pluriradiculated teeth) or cameral and root content (or pulpectomy in monoradiculated teeth) (figure 1), under-occlusion of the tooth and prescription of analgesics [5].

However, it should be noted that this symptomatic treatment itself is quite resource consuming. It should also be noted that, while the short-term results of this procedure (patient relief) are good (about 98% success according to Tronstad [6]), the technique used has a fairly strong influence on the medium-term result of

endodontic treatment: accidental bacterial contamination of the canals during the emergency procedure can promote, if not cause, a periapical infection.

Another possibility has been suggested by Gallatin and al [7] : the periradicular injection of a synthetic glucocorticoid to relieve the painful symptom, and of which Isset and al [8], have shown that it has a biochemically demonstrable anti-inflammatory action on the pulp itself (figure 2). The latest study on the subject is that of Bane and al [9] who formally compared, through a randomized clinical trial, this new therapeutic approach to the conventional procedure.

The objective of this article is to describe the specificity of pain related to acute irreversible pulpitis and to report the results of the literature on conventional emergency treatment and periapical corticosteroid injection.

I. SYMPTOMOLOGY

It is a severe inflammation that does not regress if the root cause is removed. The pulp evolves more or less rapidly towards necrosis [10]. Irreversible pulpitis does not necessarily lead to symptomatology and can progress to necrosis at low noise. The patient may report slight pain. The image classically associated with irreversible pulpitis, however, is spontaneous, violent and radiated pain. Pain ranges from short, acute flare-ups to a dull, continuous pain that progresses to severe, throbbing pain. Pain may appear following stimuli such as the absorption of a cold or hot liquid, or it may be spontaneous. The characteristics and frequency change over time as the pulp lesion progresses.

The application of heat to a tooth with irreversible pulpitis can induce an immediate and intense response. Cold can cause prolonged pain. It can also have the opposite effect and relieve a patient during episodes of spontaneous pain. The location of the causal tooth can sometimes be difficult, especially when the pain increases. It is only when the inflammation extends to the periodontal ligament that the tooth clearly responds to pressure and percussion [6].

II. RESULTS OF PULPO-PLUPECTOMY

The objective of endodontic treatment is to prevent, or treat apical periodontitis already present, or more precisely, to prevent or eliminate microbial infection of the root canal system [6].

It is currently accepted that cleaning and shaping the root canal system are the crucial steps leading to endodontic sterility. The three-dimensional, waterproof and durable filling of the root canal system completes the result obtained previously and prevents reinfection. Successful treatment is closely linked to infection control. From this, the technical and biological objectives of canal shaping are derived.

Technically, the purpose of root canal shaping is to remove all inflamed or necrotic organic tissue and part of the hard tissues of the root canal system, to allow complete debridement and the placement of pharmacological agents

with essentially antiseptic local action, followed by permanent sealing of the root endodontic volume in a completely sealed manner.

Microbiologically, the purpose of shaping associated with antiseptic irrigation is to remove and/or eliminate all microorganisms present in the canal system, and to neutralize the antigenic potential of inaccessible microbial components that persist in the canals.

If this result could be achieved from the first intervention, most endodontic treatments would be completed in a single step, depending on the availability of the technical platform. If this is not possible (complete eradication of microorganisms from the canal system), the shaping and antiseptic irrigation must create optimal conditions to allow the installation of a temporary antibacterial agent to increase disinfection of the canal system.

For this reason, recent Endodontics manuals [6, 11, 12, 12, 13, 14, 15], based on an often ancient literature of low probative value, designate complete endodontic treatment as the ideal treatment for irreversible acute pulpitis; however, they note all the practical difficulties of its use (several hours of unplanned work, considerable disruption of a practice or department's work plan). They recommend pulpo-pulpectomy as the alternative of choice.

Medical treatment is not currently considered a valid alternative. However, the literature review shows that these therapies have never been the subject of valid randomized comparisons. The effectiveness of pulpo-pulpectomy is therefore only known to us through case series.

The first formalized study found on the subject is that of Hasselgren and Reit [16]: the authors wanted to compare in terms of analgesic efficacy the results of dressings with camphorated phenol, eugenol, creatine, zinc oxide/eugenol, physiological serum and the absence of a drug after pulpotomy. The primary endpoint was the existence at D0 after the procedure, D1, D7 and D30 of severe pain, "sensitivity" or absence of symptoms.

Of 73 patients included and randomized, 3 had clear pain at D0, but after treatment of pain requiring immediate complete endodontic treatment (failures), and 33 had "sensitivity". At D1, no patient had any clear pain, and only 8 patients had "sensitivity"; effective to 5 at D7 and 1 at D30. No significant difference in efficacy appears between the different dressings compared. The authors do not report any complications.

If the study methodology is correct, although briefly reported, the definition of the judgement criterion, strictly subjective and poorly reported (the questionnaire is not described), limits the transposability of the results; moreover, the study, due to its limited size, lacks power, and the result only makes it possible to exclude very large differences in efficacy between drugs. Its conclusion is therefore not fully justified.

On the other hand, a relatively precise evaluation of the effectiveness of the

pulpotomy (symptomatic treatment) in pragmatic terms is retained: relief of 70 of the 73 patients treated and sufficient to delay the curative procedure, namely endodontic treatment (etiological treatment).

Oguntebi and al [17] report the results obtained by the emergency management of 1763 patients consulting the emergency department of the University of Missouri dental clinic for pulp pain (irreversible acute pulpitis and acute apical periodontitis); the results obtained on 956 molars are detailed. In this institution, the first-line treatment was the total pulpectomy for all monoradiculated teeth and premolars; a partial pulpectomy was indicated for molars with intra-canal calcifications when a time constraint existed, and a pulpotomy for molars with a root canal curvature greater than 30°, the other molars benefiting from a pulpectomy.

In all cases, the access cavities were sealed after the procedure. One hundred and twenty-six of the 1,723 patients (7.14%) had more postoperative pain than preoperative pain and not controlled by prescribed analgesics; of 956 molars, 394 had a pulpotomy, of which 30 (8%) had increased postoperative pain, compared to 44 (13%) of 346 patients with partial pulpectomy and 14 (6%) of 216 patients with total pulpectomy.

This publication raises several problems: confusion of pulpitis and acute apical periodontitis treatments, confusedly defined endpoint, and most importantly, restriction of pulpotomy to potentially the most difficult cases. However, we retain a failure rate close to that reported by Hasselgren and Reit [16].

Tronstad [6] reports in its manual the relief of 1848 patients out of 1884 emergency pulpotomies (98% success), while 52 of 57 patients (91%) who received a total pulpectomy without root canal filling were relieved, and 257 of 259 patients (99%) who received a total pulpectomy with temporary root canal filling with calcium hydroxide. However, the total lack of information on the patient population, the indications and methods used and the definition of "relief" obtained make these data unusable.

McDougall and al [18] compare the medium-term performance of two temporary reconstitution materials (IRM and Glass Cement Ionomer) after pulpotomy (first-line treatment proposed as an alternative to extraction in patients with irreversible acute pulpitis but lacking the financial means to consider endodontic treatment in the short term). Out of 73 patients included, 52 could be found at 6 months, of which 5 (10%) were then symptomatic; at one year, 9 of the 44 patients found were symptomatic. The authors show no difference in terms of failure (clinical criteria: symptomatology and radiography: appearance of a periradicular lesion indicating infection of the canal system), or material degradation (indicating a loss of watertightness of the temporary coronary obturation and constituting a risk of canal infection).

It is also for economic reasons that DeRosa [19] performed pulpotomies and amalgam reconstitutions on 33 teeth (29 patients), as an alternative to extraction. Follow-up of 26 of these teeth (22 patients) was reconstructed: 5

of them presented a new symptomatic episode without the patient being able to finance endodontic treatment and they were extracted (mean survival: 35 months), four other teeth had recurrences but they could be treated endodontically successfully after an average of three years, and 17 are still untreated, asymptomatic and functional. The authors conclude that it is worth delaying extraction by means of a pulpotomy.

As in the previous study, the alternative pulpotomy-extraction for economic reasons is questionable; one can also question the real economic interest of an amalgam restoration, relatively complex according to the author's description, as an economic alternative to endodontic treatment. However, we will retain a presumption of the relatively stable nature of the result of a pulpotomy on the molar.

Finally, it is also for economic reasons, but in a completely different economic and social context, that a Tanzanian team developed a protocol for pulpotomy of teeth with acute irreversible pulpitis for deferred endodontic treatment. Nyerere and al [20] report results at 6 weeks of treatment of 180 premolars and molars. The pulpotomy was followed by hemostasis, and patients were given an eugenol dressing sealed with an eugenate and "occlusion control". Pain outcomes were assessed one, three and 6 weeks after treatment (no pain, discomfort not requiring analgesics or severe pain), and endodontic treatments and permanent restorations were planned afterwards. After treatment, 81 teeth (45%) remained asymptomatic, 95 caused only mild pain at most and four experienced severe pain.

Despite the imprecision of the wording of the results, this study confirms the possibility of obtaining effective pain relief from a pulpotomy for pain caused by an acute irreversible pulpitis in almost all cases.

In summary: the available studies are too heterogeneous in their populations, methods and judgement criteria to be formally aggregated. However, they provide the following assumptions:

- a properly performed pulpo/pulpectomy of a tooth with irreversible acute pulpitis provides sufficient relief to allow the patient to go about his or her business;

- a tooth treated in this way can remain asymptomatic for a period of at least one month, and may exceed 6 months;

- there is no mention of any particular difficulties in treatment or poor prognosis of the treatments thus carried out.

However, it should be noted that this last point is less well established than the previous ones, as no study has formalized a medium-term follow-up of the patients thus treated.

III. RESULTS ON THE USE OF CORTICOSTEROIDS

In the recent literature, we have found only three articles from an American and a Franco-Senegalese team focusing on various aspects of the results of the use of a topical corticosteroid in endodontics.

The protocol and results of a small randomized therapeutic trial are published by Gallatin and al [7]. This trial included patients with moderate to severe spontaneous pain due to irreversible acute pulpitis in teeth whose vitality was demonstrated by the cold (prolonged pain) and electrical tests, and who had sensitivity to percussion and an enlarged radiological desmodontal space. The study excluded patients with contraindications to corticosteroids or intraosseous injection techniques.

After the survey of inclusion criteria and the semi-quantitative evaluation of pain (four-level scale: no pain, low, medium or severe pain), patients were given periradicular (intraosseous) injection under local or locoregional anesthesia of the contents of a numbered pre-prepared cartridge containing 1 ml of prednisolone 40 mg/ml (treated group) or 1 ml of saline solution (control group).

Randomization was therefore carried out during the preparation of the cartridges and allowed double blinding. Patients in whom this injection failed (reflux of the solution into the oral cavity) were excluded from the study.

Patients assessed the pain caused by the gestures (bone trepanation and injection itself), then had a prescription (ibuprofen 600 mg x 4/d in case of pain, paracetamol 300 mg + codeine 30 mg + caffeine 15 mg x 2 x 4-6/d if ibuprofen insufficient) and a form for daily assessment of spontaneous pain and percussion pain (same four-level scale).

Endodontic treatment was started on D7 after evaluation of pulp vitality. The judging criteria were variations in spontaneous and percussion pain after treatment (summed over 7 days, integrating analgesic efficacy over time: SPID), and analgesic consumption.

At least 47 patients were included: 19 received methyl-prednisolone injection and 21 received saline injection; four were excluded for failure of the injection (the injected product is not reported) and three patients who received saline injection are excluded from the study (which is only announced in the discussion...) for pain requiring immediate treatment. The groups were comparable before treatment. Bone trepanation was painless in 96% of cases and painless injection in 71% of cases, with no differences between the groups. From D1 to D7, spontaneous pain and percussion scores are lower in the treated group than in the control group, resulting in significant differences in SPID: for spontaneous pain, 14.0 ± 8.0 in the treated group versus 8.0 ± 11.0 in the control group ($p < 10\text{-}4$); for percussion pain, 14.0 ± 7.0 in the treated group versus 4.0 ± 6.0 in the control group ($p < 10\text{-}4$).

The use of non-steroidal anti-inflammatory drugs and analgesics also reflects this difference in efficacy: for ibuprofen, 2.89 ± 4.84 in the treated group versus 13.0 ± 10.0 in the control group ($p < 10\text{-}3$) and for analgesics, 1.84 ± 3.29 in the treated group versus 6.0 ± 10.0 in the control group ($p \leq 4.7.10\text{-}4$). The authors also report that the proportion of patients without any medication ranged from

69% to 74% in the treated group but was still less than or equal to 29% in the control group.

The authors recommend the feasibility of methyl-prednisolone treatment on a temporary basis for the management of irreversible pulpitis awaiting final treatment.

It should be noted that the data show that medical treatment alone is somewhat effective (reduction in severe spontaneous pain), but that it is still insufficient. It should also be noted that a non-steroidal anti-inflammatory drug is present in this treatment, whose authors do not discuss the "risk factor of an infectious outbreak" aspect. Similarly, it should be noted that the protocol does not include under occlusion of the treated tooth, which is however a very effective way to relieve pain of desmodontal origin, without influencing the fate of the treated tooth. But the most important limitations of this publication are:

- its imprecision (in particular on the choice of study size, which is not justified, and on the fate of the patients included, which is poorly explained),

- on the failure to take into account the three patients excluded from the study for failure of medical treatment, on the brevity of the follow-up (the results of the etiological treatment are not available),

- on the "non-ideal" nature of the reference treatment and the scope of the conclusions: the feasibility of the treatment is good, but imperfect (8.5% of injection failures are reported, but not discussed).

In summary, the feasibility and a very interesting description of the first short-term results, which are however not demonstrative, will be retained, with the comparison with the reference treatments still to be done.

The same team (Isset and al [8]) publishes data from a randomized trial in patients who received identical treatment (methyl-prednisolone or placebo by juxtaradicular intraosseous injection) before extraction of the treated tooth: it shows that intrapulpair concentrations of prostaglandin E2 are significantly lower at D1 in patients who received an injection of synthetic glucocorticoid than in patients who received a placebo, while at D3, these differences do not appear.

Similar results, but not reaching the statistical significance level, are observed for interleukin 8. These results suggest a classical anti-inflammatory mechanism of action as a mode of action of synthetic glucocorticoid on inflamed dental pulp, but cannot be corroborated with clinical results.

The latest study on the subject is that of Bane and al [9]. A randomized clinical trial involving 94 patients was conducted with the objectives of comparing periradicular injection of prednisolone with the reference procedure in terms of efficacy, safety, time and resources required. This study showed that periradicular injection of prednisolone, like pulpo-pulpectomy, reduces the compression of nerve in endodontic space; in addition, it reduces the compression of nerve endings at the desmodontal space with a simple technical

platform, a minimum of products and a relatively short time.

CONCLUSION

All available studies, although too heterogeneous in their population, methods and judgement criteria provide as a presumption effective relief of patients suffering from pain related to irreversible acute pulpitis in the case of pulpo-pulpectomy or periradicular prednisolone injection.

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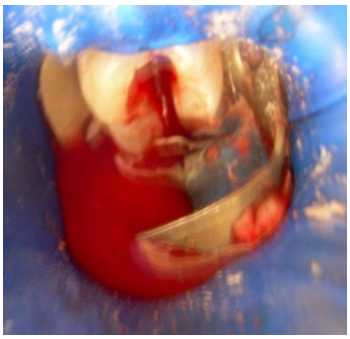
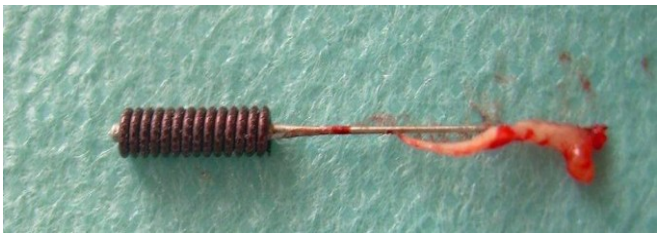
LIST OF FIGURES

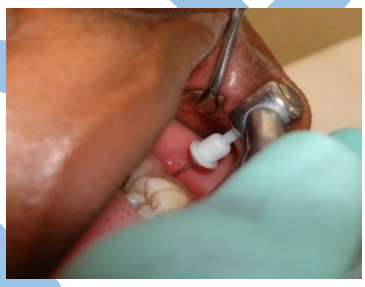


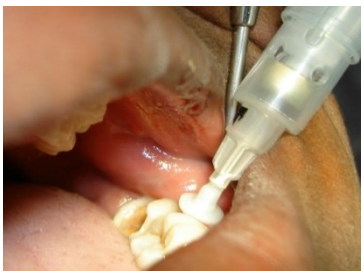
a. b.



c.

Figure 1 : Opening of the pulpal chamber of a maxillary molar presenting acute irreversible pulpitis with significant bleeding (a) which persisted despite a few minutes of haemostasis (b); which necessitated the pulpectomy of the palatal canal (c).





a. b.

Figure 2: Periradicular injection of methyl prednisolone acetate

a: Transcortical perforation

b: Injection of the product