

Analysis of clinical application of arsenic-free deactivating agent-Depulpin

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Abstract: Objective: To investigate the clinical application effect and adverse reaction of arsenic-free deactivating agent-Depulpin. **Methods:** 536 teeth of 536 patients are divided into different groups according to admission order, they are Group A covering 180 cases and 180 teeth, Group B covering 178 cases and 178 teeth, Group C covering 178 cases and 178 teeth. They are administered with arsenic-free deactivating agent (Depulpin), arsenic deactivating agent and paraformaldehyde devitalizing agent respectively, then the results of them will be compared and analysed.

Results : The results show that the effective rate for Depulpin group is 88.9%, that for arsenic deactivating agent group is 84.8%, that for paraformaldehyde devitalizing agent group is 78.7%. Upon chi-squared test, the comparison of ache effect between Group A and Group C is of non-statistical significance [$P = 0.066$], the differences between group A and group B ($P = 0.033$) and group B and group C are of statistical significance ($P = 0.038$), which show that the application of arsenic inactivating agent may enhance pain response. **Conclusion:** Depulpin as a new arsenic-free deactivating agent is a kind of favorable pulp devitalizer due to its inactivation action and little toxicity.

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Acute attack of acute pulpitis or chronic pulpitis will cause severe pain, thus becomes the main reason for patient visits. How to effectively control pains are an important issue each dental physician faces. Traditional anodynia methods include pulp devitalizer and marrow extraction under local anesthesia. The pulp inactivation surgery will apply chemical pharmaceutical preparation over the surface of wound of dental pulp, causing obstacle in pulpal blood flow, thus resulting in losing its vitality due to pulp tissue necrosis [1], in this way, it can effectively achieve painless operation, at the same time relieving toothache of patients. The key to inactivation treatment is the application of the deactivator. In this group, we have an analysis of clinical application of three kinds of deactivating agents including Depulpin deactivator, arsenic preparation and paraformaldehyde, aims to explore the merits and demerits of arsenic-free deactivator Depulpin in clinical application in such a way to provide a reference for a wider range of clinical applications.

1 Material and methods:

1.1 Object of study: We select 536 patients (male 270, female 266) who visited this hospital from July 2010 to March 2012 and suffered from the acute attack of acute pulpitis or chronic pulpitis, without periodontal diseases, aged from 28 to 65, on average 40.5 ± 6.5 years old. Of them, there are 274 left mandibular molars and 262 right mandibular molars. They are divided into three groups by random by the admission order: Group A covering 180 patients and 180 teeth, Group B covering 178 patients and 178 teeth, Group covering 178 patients and 178 teeth.

1.2 Experimental drugs:

Depulpin pulp devitalizer (Germany VOCO, batch number: 021579). Arsenicals: arsenic trioxide, cocaine, and excipients. Paraformaldehyde preparation: paraformaldehyde, cocaine, liquid paraffin, etc.

1.3 Treatment methods:

Remove the pulp from the teeth to expose the point of puncture, wipe off bloodstain before inset rice-sized deactivators on which dry cotton balls are placed, then sealed temporarily with zinc phosphate cementum, of which Group A is inset with Depulpin deactivator Depulpin, return visit after 7 to 10 days; Group B is inset with arsenic preparations, return visit after 24 to 48 hours; Group C is inset with paraformaldehyde, return visit after 5 to 7. At return visit, all patients are removed deactivator, completely take off the pulp top, then follow the pulp extraction before root canal treatment.

1.4 Curative effect judgement:

Clinical criteria [2] excellent: It is painless at taking off pulp top, removing coronal pulp or pulp extraction before root canal therapy. Good: It is painless at taking off pulp top, painless or slight pain at removing coronal pulp, but obvious pain at removing root pulp. Poor: It is obvious pain at removing pulp top or removing coronal pulp.

1.5 Statistical analysis:

Use SPSS14.0 statistical package for statistical analysis of group data, use t test for group comparison, use chi-square test to compare the rates, in case of $P < 0.05$, the difference is of statistical significance.

2 Results

2.1 Comparison of inactivating effect of three groups of patients:

Upon X2 test, it shows that the efficiency in group

A and group B is not of statistical significance ($P = 0.067$), the differences between group A and group C ($P = 0.034$), Group B and Group C are of statistical significance ($P = 0.045$), as shown in Table 1.

Table 1 Comparison of Clinical Curative Effect of Three Groups of Patients [n (%)]

Group	Cases	Excellent	Good	Poor	total efficiency(%)
A	180	130(72.2)	30(16.7)	20(11.1)	88.9
B	178	115(64.6)	36(20.2)	27(15.2)	84.8
C	178	101(56.7)	39(21.9)	38(21.3)	78.7

2.2 Pain response for three groups of patients on the drug sealing day and (or) the second days:

X2 test shows that the comparison of pain effects between Group A and Group C is not of statistical significance ($P = 0.066$), the differences between Group

A and Group B ($P = 0.033$), Group B and Group C are of statistical significance ($P = 0.038$). It shows that pain response after sealing arsenic deactivator is more obvious, as shown in Table 2.

Table 2 Comparison of pain response of three groups of patients on drug sealing day and (or) on the second day [n (%)]

Group	Cases	Painless	Slight pain	Obvious pain	Percussion pain
A	180	168(93.3)	7(3.9)	4(2.2)	1(0.6)
B	178	155(87.1)	11(6.2)	8(4.5)	4(2.2)
C	178	166(93.3)	7(3.9)	3(1.7)	2(1.1)

2.3 Bleeding status of two groups of patients in the process of inactivation :

The data shows that of three groups of patients, Group C is obvious in bleeding at cutting coronal pulp and removing root pulp, the X2 test shows that the comparison of bleeding status

between Group A and Group B is not of statistical significance ($P = 0.069$), the differences between Group A and Group B C ($P = 0.037$), Group B and Group C are of statistical significance ($P = 0.034$), as shown in Table 3.

Table 3 Comparison of bleeding status of two groups of patients in inactivation process [n (%)]

Group	Cases	No bleeding	Slight bleeding	Obvious bleeding
A	180	167(92.8)	10(5.6)	3(1.7)
B	178	151(84.8)	27(15.2)	0(0.0)
C	178	134(75.3)	29(16.3)	15(8.4)

3 Discussion

Pulp devitalization is a painless operative technique commonly used in the treatment of various pulpitis, so the efficacy and security of deactivating agents have direct impact on subsequent treatment. The main ingredient of traditional arsenical is arsenic trioxide, it has a strong toxicity to cell protoplasts, nerve fibers, blood vessels when acting on the pulp. Through the paralysis of the nerve fibers, the destruction and decomposition of axon of medullary sheath agents, it causes vasodilation, hyperemia and hemorrhage, thus resulting in circulatory disturbance, then acting on mitochondrion to destroy cellular respiration through cell membrane such that it loses vital function or even death by poisoning [3]. The arsenical features vascular toxicity, neurotoxicity, and cytotoxic, used in clinical as a pulp devitalizer, its inactivation function is exact, less bleeding at cutting

pulp. However, arsenic deactivator has some drawback, for example, some patients have obvious pain response after sealing the drug, the reason for it may lie in that its vascular toxicity may lead to the rupture of blood vessels in pulp cavity, so at pulp necrosis, the cavity pressure rises further, which induces pain response significantly. This paper also shows that after sealing the arsenic deactivator, the pain response is significantly higher than the other two groups, four patients suffering from percussion pain, which may be caused by the drug-induced periapical inflammation caused by arsenical. In addition, toxic action of arsenical is not self-limited, therefore it requires strict sealing time, currently, the clinical patients has no strong concept on the time of return visit, it is easy to cause periapical [4]. To abandon the adverse side effects of arsenic deactivator, it is proposed to use paraformaldehyde as the deactivator, which has

achieved some clinical effectiveness [5]. This paper shows that adverse reactions of paraformaldehyde devitalizing agent is indeed smaller than arsenicals, with light pain response after drug sealed, low incidence. However, it is poor in inactivation function compared with the arsenical, the difference between them is of statistical significance. In this study, it also shows another drawback of the paraformaldehyde deactivator, namely obvious bleeding and pain response at cutting pulp and extirpation of pulp. The reason may lie in that paraformaldehyde acts on the coagulation of proteins, causing tissue necrosis, always stimulant in the early stage, subsequent congestion and swelling occur between adjacent uninjured tissue, naturally resulting in pain. More bleeding at cutting pulp occurs due to its relative slow function [6]. Depulpin as a pulp deactivator has main components including paraformaldehyde, lidocaine hydrochloride, and monochlorothymol, etc. [7]. Paraformaldehyde when acting on the pulp may cause paralysis of vessel wall and vascular bleeding to form thrombosis, resulting in disturbance of blood circulation such that the pulp is gradually subject to anhydration and necrosis, and its role is more moderate; lidocaine hydrochloride and monochlorothymol may narcotize pulp, so it is painless or slight pain at inactivation. In addition, paraformaldehyde is self-limited, little destructive effect on tissue, difficult to produce chemical periapical inflammation. From this paper, we can see that its inactivation is exact, has no significant difference in inactivation effect compared with arsenical. But its toxicity and side effects are significantly reduced compared with the arsenic, only obvious pain after drug sealed occurring in tiny cases, only percussion pain occurring in 1 case. The security of clinical use is similar to paraformaldehyde, the difference is not of statistical significance. After Depulpin inactivation, the pulp is able to maintain a more complete status, less bleeding at cutting coronal pulp and removing root pulp, which is conducive to further clinical clean-up, expanding the root pulp and coronal pulp. another advantage of Depulpin lies in the more relaxed time of drug sealed [8]. After inactivation for 4 days, it may achieve painless at coronal pulp, for 7 days, achieving painless at root pulp, and the return visit time may be relaxed to 14 days in such a way to facilitate patients to select good

return visit time. At the same time, our clinical experience also shows that the security of Depulpin is good, even if individual teeth suffers from imprecise drug sealing due to open hole, even temporarily subjecting to obssession, it does not result in erosion or necrosis in the gums or alveolar bone, only slight reactions occurring in individual cases, for example pale in gums. Many reports have confirmed that in case of improper use of arsenical, the jumped seam may result in gum erosion, alveolar bone necrosis, and even subjecting to damage in inferior alveolar nerve and other serious consequences in individual cases'.

In summary, Depulpin as a new type of pulp deactivator features exact inactivation, less toxicity, safe, easy to use, combine with the advantages of both arsenic deactivator and paraformaldehyde devitalizing agent, so worthy of clinical application.

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