HEALING PROCESS OF DOGS' DENTAL PULP AFTER PULPOTOMY AND PROTECTION WITH CALCIUM HYDROXIDE OR DYCAL

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HOLLAND, R., SOUZA, V., MELLO W., NERY, M. J., BERNABÉ, P.F.E. & OTOBONI FILHO, J.A. — Healing process of dogs' dental pulp after pulpotomy and protection with calcium hydroxide or dycal. **Rev. Odont. UNESP, 8/9:** 67-73, 1979/1980.

SUMMARY: The histological results of this work suggested that the mechanism of repair is the same in the pulps protected with calcium hydroxide or Dycal. The percentage of sucess, however, was smaller in the group of teeth treated with Dycal.

KEY WORDS: Pulpotomy, calcium hydroxide, dycal, healing process.

The healing process of the dental pulp after pulpotomy and pulp capping with calcium hydroxide is well known through numerous histological and histochemical studies (GLASS and ZANDER, 1949; SELTZER and BENDER, 1958; YOSHIDA, 1959; CABRINI et al, 1960; EDA, 1961; HOLLAND and SOUZA, 1977). A few minutes after the contact of pulp tissue with calcium hydroxide , the formation of a necrotic area begins (EDA, 1961). Right at the limit between the live and the necrotic tissue there is a calcium salts deposition, whereas dentine is observed about 15 days after the treatment (EDA, 1961; HOLLAND, 1971).

Dycal, which is a calcium hydroxide cement, also stimulantes the deposition of a hard tissue bridge, but the healing process with Dycal was described in a different way than that admited for calcium hydroxide. STANLEY and LUNDY (1972) reported that when Dycal is used as a capping material the necrotic tissue is

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removed by the macrophages and replaced by granulation tissue, which differentiates new odontotblasts that deposit dentine directly over the capping material. TRONSTAD (1974) observed that Dycal produced only a chronic inflammatory reaction but no necrosis. As the time goes by, the inflammatory reaction disappears, showing cell differentiation and dentine deposition over the Dycal.

In this study, Dycal and calcium hydroxide are compared as capping agents after pulpotomy in dog's teeth in order to observe if the healing process is altered according to the capping material.

Material and Method

Eighty single root teeth of 6 young mongrel dogs were employed in this work. The animals were anesthetized with pentobarbital sodium using 3 mg per 1 kg body weight. With rubber dam in place, access to the pulp chamber was achieved throught the cervical third of the tooth's labial face. The coronal portion of the pulp was removed with a sterile cotton pellets. After this, 40 and the bleeding controlled washing the pulp chamber throughly with saline and pressing the pulp stump with sterile cotton pellets. After this, 40 specimens were protected with a layer of Dycal, manipulated in accordance to the manufacturer's instructions. The other 40 specimens were protected by calcium hydroxide and destilled water. All the crown openings were sealed with zinc oxide-engenol cement.

The animals were sacrificied in order to permit the obtention of 40 specimens with a 24 hour post operative period and 40 with a 30 day period.

The teeth of the 24 hour period were extracted and the pulps removed by the method described by ENGSTRÖN and ÖHMAN (1960). The pulps were fixed in 16 per cent neutral buffered formalin, embedded in paraffin and serially sectioned at 6 micrometers. The sections were stained with hematoxylin and eosin, von Kossa's method for calcium salts identification, and later examined under polarized light.

The teeth extracted after 30 days were similarly processed but they were decalcified in formic acid-sodium citrate before the paraffin embedding. Serial sections with 6 micrometers were stained only with hematoxylin and eosin.

Results

After 24 hours, the specimens treated with calcium hydroxide showed a superficial necrotic area followed by a layer of larger von Kossa positive granulations, birrefringent to polarized light and tinny granulations, more positive to von Kossa's technique and not birrefrigent to polarized light (fig. 1). The vital pulp tissue under these granulations presented a mild acute inflammatory reaction.

When Dycal was employed as pulp capping for 24 hours, the necrotic area was observed in 9 specimens. The histopathological features of these cases were exatly the same as those described for calcium hydroxide (fig. 2). However, in eleven specimens, no necrotic area was observed. When this occurred, the large birrefrigent granulations were located close to the capping material (fig. 3). Under these granulations, the same details described for calcium hydroxide were observed.

After 30 days, 18 specimens that had pulps capped with calcium hydroxide showed repair. There was a presence of a total hard tissue bridge, which protected the remaining pulp stump free of inflammation (fig. 4). In 2 specimens the hard tissue bridge was partial and contained many dentin chips in its structures. In these case a moderate chronic inflammatory reaction was observed.

Thirty days after capping with Dycal, there was a total hard tissue bridge in 10 specimens. Out of these 10 cases, 4 showed no necrotic areas, but only a deposition of hard tissue in direct contact with the capping material (fig. 5). Six specimens showed necrotic areas, its thickness being somewhat lesser than that observed with calcium hydroxide (figs. 6 - 7). In one of these cases, a necrotic area was noticed, but there was a small area free of it. The pulp stump of these 10 specimens were free of inflammation. The remaining 10 specimens showed partial bridge or even the absence of hard tissue deposition and their pulps presented severe chronic inflammatory reaction (fig. 8).

Discussion

The absence of necrotic areas in some cases or a somewhat smaller dimmension of it in others was the only morphological difference observed in the healing process as related to the capping material.

It is possible that there are some problems in the diffusion of the calcium ions into the pulp tissue being that Dycal is a quick hardening material. That fact can make the chemical reaction between the capping material and pulp tissue to occur next to the material's surface. In these cases the large granulation deposition is observed in contact with the capping material.

It is admitted that these granulations birrefringent to polarized light result from the reaction of the calcium ions that come from the calcium hydroxide with the carbonic gas that is in the pulp tissue (EDA, 1961), forming calcium carbonate granulations in the form of calcite (HOLLAND, 1971). These granulations seem to stimulate the pulp tissue for calcium salts depposition right under the necrotic area, before the appearance of the odontoblasts, which will then form dentine. Therefore, when the large granulations are deposited in contact with Dycal, the necrotic area is not observed, but only the hard tissue bridge. Under certain circustances, however, the large granulations are deposited farther from the capping material. In such cases, it is possible to detect the presence of the necrotic area between the Dycal and the hard tissue bridge.

It is possible that one or another of these occurrences had some relation with time elapsed between the materials adaptation on the pulp surface and its hardening.

The results of the present work do not support the data presented by STANLEY and LUNDY (1972) and TRONSTAD (1974). As it can be seen, the mechanism of the healing process with Dycal is identical to the one with calcium hydroxide, therefore not admitting as constant the absence of necrotic areas after healing or even the resorption of necrotic areas by macrophages as a normal occurrence in the healing process.

This work also showed higher percentage of sucess with calcium hydroxide as compared to Dycal, suggesting that Dycal should be used only in

cases of indirect pulp capping. However, in cases of pulp exposures the material to be chosen for pulp capping should be a paste of calcium hydroxide and destilled water.

Summary

This investigation was carried out with the aim of clarifying some doubts about the dental pulp healing process after direct pulp capping with Dycal. The obtained results showed that the mechanism of the dental pulp repair after capping with Dycal was the same as that of the dental pulp capped with calcium hydroxide, but nevertheless the percentage of success was smaller.

HOLLAND, R. SOUZA, V., MELLO, W., NERY, M.J., BERNABÉ, P.F.E. & OTOBONI FILHO, J.A. — Processo de reparo da polpa dental de dentes de cães após pulpotomia e proteção pulpar com hidróxido de cálcio ou Dycal. **Rev. Odont. UNESP.**, 8/9:67-73, 1979/1980.

Polpas de dentes de cães foram submetidas à pulpotomia e os remanescentes pulpares protegidos com hidróxido de calcio ou Dycal. Decorridos 24 horas ou 30 dias os espécimes foram removidos e preparados para análise histológica com microscopia ótica comum ou com luz polarizada. A análise dos resultados mostrou que o mecanismo do processo de reparo da polpa dental protegida com o Dycal é semelhante ao daquela protegida com hidróxido de cálcio, sendo, no entanto, menor a porcentagem de sucesso com o emprego do primeiro material.

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ILLUSTRATIONS

LEGENDS

Fig. 1. Twenty fours hours postoperatively. Pulp treated with calcium hydroxide. Necrotic area (N), granulations birrefrigent to polarized light (arrows), thin granulations von kossa positive (G) and vital pulp tissue (VT). Von kossa stain and polarized light, 40 X.

Fig. 2 Twenty four hours postoperatively. Pulp treated with Dycal. Capping material (M), necrotic tissue (N) and granulations birrefrigent to polarized light (Arrows). Polarized light, 40X.

Fig. 3. Twenty four hours postoperatively. Pulp treated with Dycal. Capping material (M) and vital pulp tissue (VT). The large birrefrigent granulations (Arrows) are localized close to the capping material. Polarized light, 60 X.

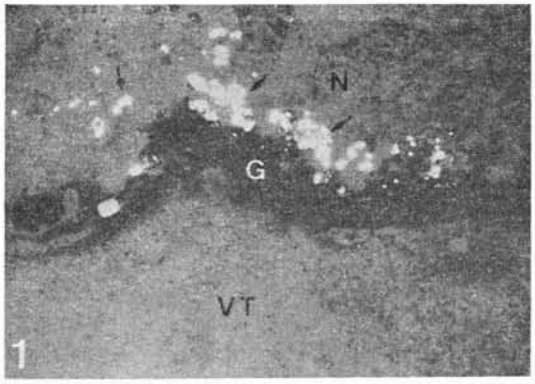
Fig. 4. Thirty days postoperatively. Pulp treated with calcium hydroxide. Necrotic tissue (N), hard tissue bridge (HB) and vital pulp tissue (VT). H.E. 40 X.

Fig. 5. Thirty days postoperatively. Pulp treated with Dycal. The hard tissue bridge (HB) is deposited in direct contact with the capping material (M). Odontoblastic layer (OL). H.E. 200 X.

Fig. 6. Thirty days postoperatively. Pulp treated with Dycal. Capping material (M), necrotic tissue (N), hard tissue bridge (HB) and vital pulp tissue (VT). H.E. 40 X.

Fig. 7. Thirty days postoperatively. Pulp treated with Dycal. Capping material (M), necrotic tissue (N) and hard tissue bridge (HB). H.E. 200 X.

Fig. 8. Thirty days postoperatively. Pulp treated with Dycal. Presence of severe chronic inflammatory reaction. H.E. 400 X.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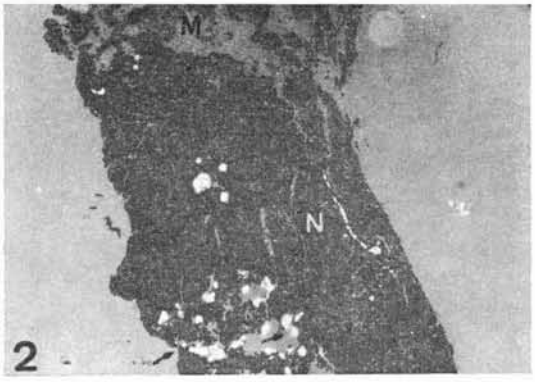
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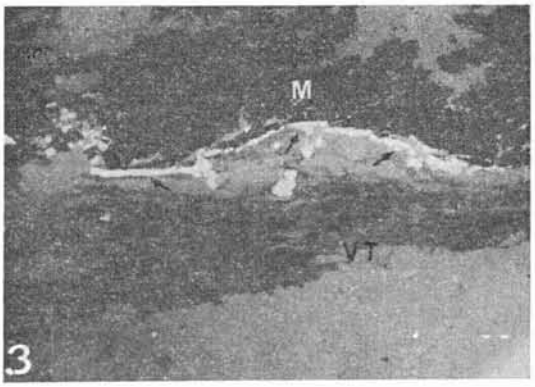
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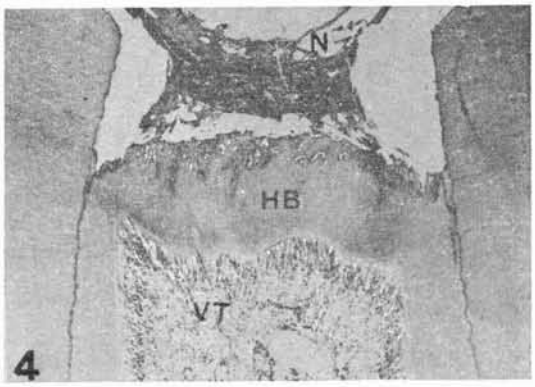
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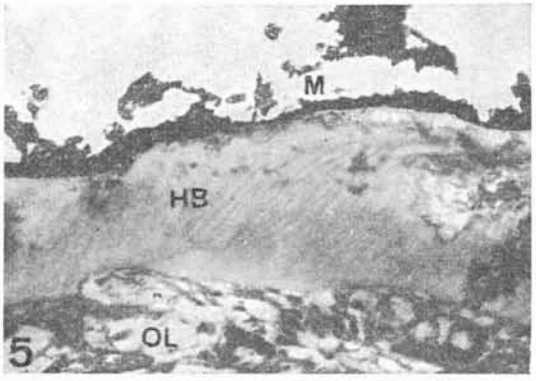
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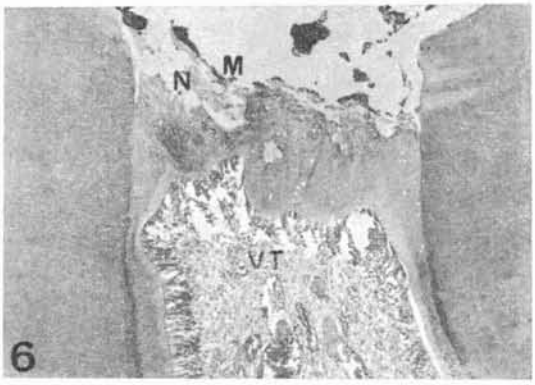
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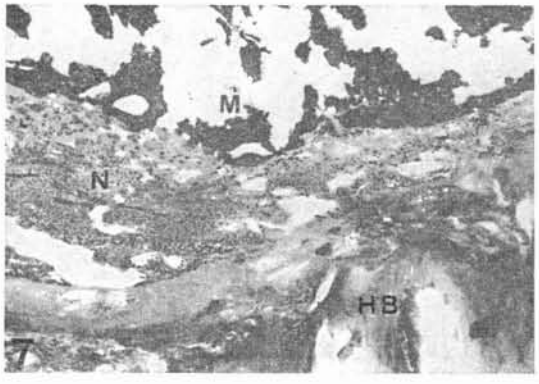
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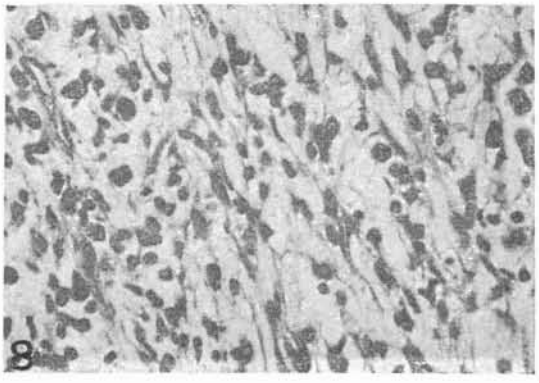
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