

ROOT CANAL TREATMENT WITH CALCIUM HYDROXIDE EFFECT OF AN OILY OR A WATER SOLUBLE VEHICLE

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ABSTRACT: *This investigation was conducted to observe if an oily or a water soluble vehicle could influence the healing process of periapical tissues after root canal treatment with calcium hydroxide. The research was developed in dog's teeth and the histological results were analysed 90 days after the treatment. Healing with closure of the periapical foramina by hard tissue deposition was observed when the oily vehicle (Lipidiol) was employed. A resorption of the filling material and an ingrowth of a chronic inflammatory connective tissue were the histological features when calcium hydroxide prepared with a water soluble vehicle (Telebrix) was used. The results obtained suggest that the oily vehicle improved the properties of calcium hydroxide, encouraging calcium salts deposition after root canal treatment.*

KEY-WORDS: *Root canal treatment; calcium hydroxide; oily vehicle.*

INTRODUCTION

The capacity of stimulating the periapical hard tissue deposition has been attributed to calcium hydroxide^{6,8}. Nevertheless, in the literature there are favorable and unfavorable results when calcium hydroxide is employed in the root canal filling.^{2,9,13}

For the purpose of knowing this material better, of learning how to use it correctly and consequently achieving an apical biological filling, we began a series of research studies to determine the various factors that could in a negative or positive form affect root canal treatment with calcium hydroxide. One of the problems considered was to observe if the vehicle employed with calcium hydroxide would influence the results of root canal treatment.

Several vehicles have been used in the preparation of calcium hydroxide paste.

Among them we have metyl cellulose, propylene glycol and distilled water. The results of some research studies showed that referred vehicles do not disturb the biological calcium hydroxide properties.⁷

However, the calcium hydroxide pastes prepared only with these vehicles are radiolucent, making their clinical use difficult when other radiopaque substances are not added.

There are radiopaque solutions in the trad that are employed in radiodiagnoses that could serve simultaneously as a vehicle and a contrast medium during the calcium hydroxide preparation. For this purpose HAVERLA¹ suggested the use of Lipidiol.

Considering the clinical importance of the subject discussed, the purpose of this

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work is to study the behaviour of the periapical tissues in dogs' teeth, after pulpectomy and root canal treatment with calcium hydroxide, employing as a radiopaque contrast an oily or a water soluble vehicle.

MATERIAL AND METHOD

Root canals from 40 premolar teeth of three mongrel dogs, each one two years old, were used in this study.

Under general anesthesia, and with the rubber dam in place, the pulpal chamber of each tooth was opened and the pulps were removed.

The canals were instrumented one millimeter beyond the apices, as confirmed by roentgenograms. The apices were perforated and enlarged up to the number 60 Kerr file.

The canals were irrigated thoroughly with saline during and following instrumentation. After final irrigation, all the canals were carefully dried with paper points, dressed with a corticoid-antibiotic solution³ and sealed off for one week with paper points and a temporary filling of zinc oxide-eugenol and phosphate cement.

During the second treatment, the root canals were irrigated again with saline, dried with paper points and filled with the following calcium hydroxide pastes: calcium hydroxide plus Lipidiol-UF * or calcium hydroxide plus Telebrix 38 *. Attempts were made not to force the material beyond the root apices.

The floors of the pulp chambers of all the teeth treated were covered with a layer of zinc oxide-eugenol and the access openings were closed with amalgam.

Ninety days later, the animals were killed by administration of excessive amounts of anesthetic. The pieces were fixed in 10% neutral buffered formalin solution and decalcified in formic acid-sodium citrate.

Segments of the jaws, each containing one tooth were prepared for histological exa-

mination in the usual manner. The specimens were embedded in paraffin, serially sectioned to an average thickness of 6 micron and the sections stained with hematoxylin and eosin.

RESULTS

Root canals filled with calcium hydroxide - Telebrix

In the specimens of this group the closure was not observed. But in 12 cases there was a great ingrowth of connective tissue with chronic inflammatory cells into the root canal, some times reaching the coronally placed zinc oxide-eugenol. The reabsorption and deposition of cementum and bone tissue was also observed. The periodontal membrane was infiltrated by chronic inflammatory cells of various intensities, but severe infiltration was more frequently observed (Fig. 1).

There was a partial closure, by cementum deposition, in the apical foramen of 6 samples. The connective tissue, mainly the one near the areas of communication with the root canal, showed severe chronic inflammatory reaction. In these samples the inflammatory reaction of the periodontal membrane was less than the one observed in the cases with ingrowth of connective tissue and absence of closure. Besides this, areas of cementum and bone tissue reabsorption were less frequently observed (Fig. 2).

In two other samples, over and above the morphological aspects described for the cases of partial closure, ingrowth of severe inflamed connective tissue into the root canal was observed.

Root canals filled with calcium hydroxide - Lipidiol

In the experimental group closure was observed in 16 samples. The cases where communication between the root canal and periapical tissues in any of the serial sections

was not observed it was considered closure. The cementum bridge thickness varied, being thick in some cases and thin in others. The absence of cementum or bone tissue resorptions, and of inflammatory cells was characteristic in these samples. With the healing of the periodontal membrane, it was possible to observe the presence of collagen fibers, that starting from the hard tissue bridge, reached the bone tissue, which was at a normal distance from the apical cementum (Figs. 3 to 6).

A partial closure was observed in 2 samples. One of these specimens also showed a small ingrowth of connective tissue into the root canal. The principal difference between the results of these two samples and the similar ones of the Telebrix group was that the inflammatory reaction in the Lipidiol group was mild. In spite of the presence of partial closure, the morphological appearance of the cementum, periodontal membrane and bone tissue was similar to the one of the samples with total closure (Figs. 7 and 8).

In two other specimens, instead of a closure, an ingrowth of connective tissue was observed. However, this tissue invaded the root canals in small depths and exhibited mild chronic inflammatory reaction which also reached the periodontal membrane (See table).

themselves. If we admitted that favorable results were those with a closure and absence of inflammatory reaction, those with Telebrix, which is a water soluble vehicle, were not good. No case of total closure was observed with calcium hydroxide - Telebrix, but rather an ingrowth of connective tissue and the present of moderate or severe inflammatory reaction.

We believe that iodine was not responsible for the bad results because it was also present in the calcium hydroxide-Lipidiol group. Besides this, it is known that the iodoform, when added to calcium hydroxide, does not change its properties in the stimulation of hard tissue deposition in animal teeth^{5,10} and in rat subcutaneous connective tissue¹¹. Probably other substances in Telebrix could have changed the well known calcium hydroxide properties.

Another hypothesis that could explain the bad results would be the possibility that Telebrix renders the calcium hydroxide more soluble and consequently easily phagocitated by the macrophages.

When calcium hydroxide was employed with Lipidiol, the results were better. The incidence of material resorption was less and the presence of a biological filling was frequent. Similar results were observed by HAVERLA¹ who reported biological fillings in human teeth after root canal treatment with calcium hydroxide-Lipidiol.

However, why would the Lipidiol have made the attainment of better results possible whereas the Telebrix did not?

STRÖMBERG¹² filled dogs' root canals with calcium hydroxide paste prepared with Ringer's solution. He observed connective tissue ingrowth in almost all of the studied samples. This author reported that calcium hydroxide was phagocitated and dissolved in the periapical fluids. He also said that if phagocytosis takes place between pH 6.9 and pH 6.8, the pH of the calcium hydroxide (12.4) must have probably been drastically changed due to a buffering capacity of the tissue fluids. The results obtained with Telebrix, a water soluble vehicle, were similar to

TABLE — Summary of the histopathological findings.

Histologic Features	EXPERIMENTAL GROUPS	
	Calcium Hydroxide Telebrix	Calcium Hydroxide Lipidiol
Closure	—	16
Partial closure	6	1
Partial closure and connective tissue ingrowth	2	1
Connective tissue ingrowth	12	2
Number of cases	20	20

DISCUSSION

The results obtained with the two kinds of vehicles studied were distinct among

the ones related by STRÖMBERG¹² because ingrowth of connective tissue was observed in almost all of the samples studied.

Because Lipidiol is not a water soluble vehicle, it is very probable that it hampered or blocked the material phagocytosis and dissolution. We believe that for the calcium hydroxide an oily vehicle is better than a water soluble one. Probably the oily vehicle transforms the calcium hydroxide into a less soluble filling material in the organic fluids of the periapical region, making it almost

unabsorbable. Thus better conditions for the stimulation of hard tissue deposition are created without desintegrating or permitting the canal contents — (debris) to come into contact with the periapical tissues. This hypothesis is in agreement with the results of another research study in this series⁴ where we observed, among some studied formulas, that the calcium hydroxide associated with camphorated chlorophenol demonstrated better results. This probably occurred because the camphorated chlorophenol, an oily ve-

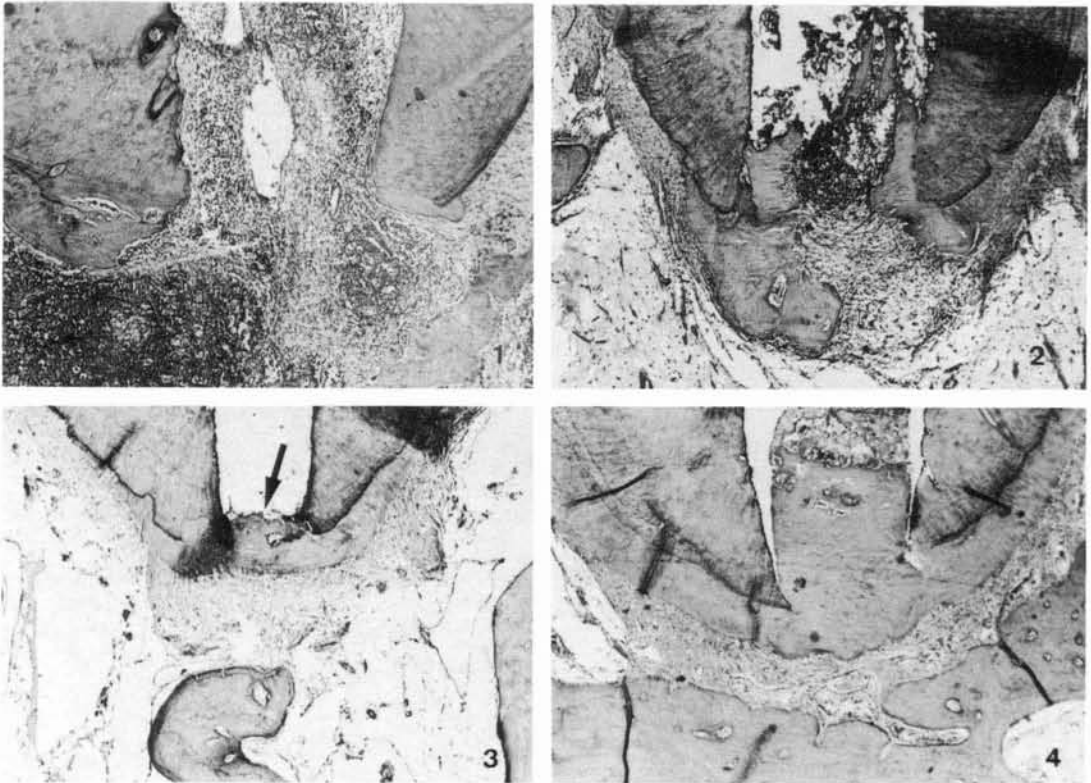


FIG. 1 — Calcium hydroxide — Telebrix group. The root filling has been totally resorbed and replaced by a connective tissue with a severe chronic inflammatory reaction. H.E. X 40.

FIG. 2 — Calcium hydroxide — Telebrix group. Partial closure by cementum deposition. The connective tissue inside the apical foramina is severely inflamed. H.E. X 40.

FIG. 3 — Calcium hydroxide — Lipidiol group. Closure of the apical foramina (arrow) by cementum deposition. H.E. X 30.

FIG. 4 — Calcium hydroxide — Lipidiol group. Closure of the apical foramina by cementum deposition. H.E. X 40.

hicle, created conditions of impermeability, similar to the ones observed with Lipidiol.

We believe that these observations open new perspectives to the study of the root canal filling with calcium hydroxide, sugges-

ting that other experiments should be made, with the purpose of selecting the oily vehicle that may have properties of improving the good biological properties of calcium hydroxide even more.

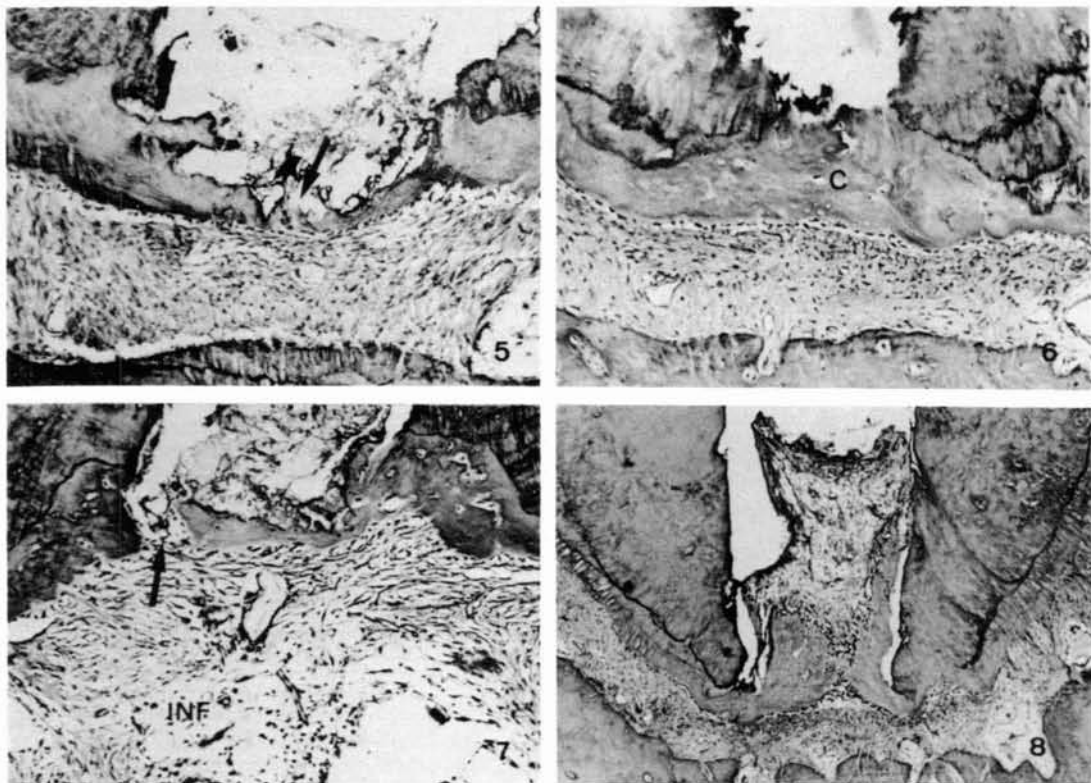


FIG. 5 — Calcium hydroxide — Lipidiol group. Closure of the apical foramina by a thin layer of cementum bridge (arrow). There are no inflammatory cells in the periodontal ligament. H.E. X 100.

FIG. 6 — Calcium hydroxide — Lipidiol group. A thick bridge of cementum (C) closed the apical foramina. There are no inflammatory cells in the periodontal ligament. H.E. X 100.

FIG. 7 — Calcium hydroxide — Lipidiol group. The partial closure (arrow) was observed during the examination of the serial section. Mild chronic inflammatory reaction (INF) is observed in the periodontal ligament. H.E. X 100.

FIG. 8 — Calcium hydroxide — Lipidiol group. Partial closure and ingrowth of a fibrous connective tissue with mild chronic inflammatory reaction. H.E. X 40.

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RESUMO: O objetivo do presente trabalho foi observar se um veículo oleoso ou aquoso pode influenciar o processo de reparo dos tecidos periapicais após o tratamento endodôntico com hidróxido de cálcio. A experimentação foi desenvolvida em dentes de cães e os resultados histológicos foram analisados 90 dias após o tratamento. Quando o veículo oleoso (Lipidiol) foi empregado, observou-se selamento biológico do forame apical pela deposição de tecido duro. Quando o hidróxido de cálcio foi preparado com um veículo aquoso (Telebrix), observou-se como característica histológica a reabsorção do material obturador e a invaginação de um tecido conjuntivo com infiltrado inflamatório crônico. Os resultados obtidos sugerem que o veículo oleoso (Lipidiol) melhorou as propriedades do hidróxido de cálcio, estimulando a deposição de sais de cálcio após o tratamento endodôntico.

UNITERMOS: Tratamento endodôntico; hidróxido de cálcio; veículo oleoso.

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