

A HISTOLOGIC COMPARISON OF DOG TEETH OVERFILLED WITH THREE MATERIALS

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ABSTRACT: Sixty root canals of 3 adult dogs were instrumented one millimeter beyond the apex and overfilled with Calcium hydroxide-iodoform/distilled water-Mixture, Grossman's Sealer and Maisto antiseptic Paste. Periapical tissues were examined histologically after eighteen months. The best results were observed in the specimens treated with Calcium hydroxide-iodoform and Maisto antiseptic Paste. With those filling materials some cases exhibited closure of the apical foramen by cementum deposition and the periapical inflammatory reaction was not so frequently observed as it was with Grossman cement.

KEY-WORDS: Overfilling; Grossman's Sealer; Maisto antiseptic Paste; Calcium hydroxide-iodoform.

INTRODUCTION

All the root canal filling materials, when in contact with periapical connective tissue, act at least as foreign bodies, and should be eliminated by the organism. The rate at which they are resorbed varies according to the composition of each material and sometimes lasts for years^{2,13}.

Another factor that should appear is the frequent irritative action of these materials that can become more significant upon slower elimination by the macrophages.

When the material is practically nonresorbable, in the best of the cases, it may be surrounded by a fibrous capsule. In other instances the persistence of periapical chronic inflammatory reaction is observed.

The purpose of this investigation was to study periapical repair after instrumentation of root canals beyond the apices and overfilling with 3 materials of different rates of resorption. The difference in the resorption rates of the studied material was reported in a previous paper².

MATERIAL AND METHODS

Sixty tooth roots from three mongrel dogs, each 2 years old, were used in this study.

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

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The canals were instrumented 1mm beyond the apices, as confirmed by radiograms with files in the root canals. The apices were perforated and enlarged up to the No. 40 Kerr file.

The canals were irrigated thoroughly with sterile saline during and following instrumentation. After final irrigation, all the root canals were carefully dried with paper points, dressed with a corticoid-antibiotic solution⁶, and sealed off for 1 week with gutta-percha and zinc oxide-eugenol cement.

During the second treatment, the root canals were irrigated again with sterile saline, dried with paper points and overfilled with the following materials: Maisto antiseptic paste (zinc oxide, iodoform, thymol, camphorated chlorophenol and anhydrous lanoline), calcium hydroxide-iodoform (in equal shares, mixed in distilled water) and Grossman cement.

All the canals were filled by the single cone technique. The gutta-percha points were first selected according to their best adaptation to the apical third of each root canal, at a level 2 or 3mm short of the radiographic apex. The canals were filled with the pastes or cement with the aid of Lentulo's spirals and root canal pluggers. After that, the selected points were carefully taken to the predetermined positions and an x-ray examination was carried out in order to see the quality of the filling and also the intentional overfilling. If the goal was not achieved, the gutta-percha point was taken out and the filling procedure repeated. When the filling was completed, the coronal openings were closed with gutta-percha and amalgam (Fig. 1).

Eighteen months after the treatment, the animals were killed by administration of excessive amounts of anaesthetic. The pieces were fixed in 10 percent neutral buffered formalin solution and decalcified in formic acid-sodium citrate.

Segments of the jaws, each containing one root, were prepared for histologic examination upon the usual manner. The specimens were embedded in paraffin and serially sectioned to an average thickness of 6 microns, and the sections were stained with hematoxylin and eosin.

RESULTS

Maisto antiseptic Paste

In 7 instances total closure of the apical foramen by deposition of cementum was observed. This hard tissue bridge was placed at the level of the apical foramen (Figs. 2 and 3) or entering a short distance into the root canal (Fig. 4). In most cases the periodontal membrane was normal with an absence of inflammatory cells (Fig. 3). In two cases a few chronic inflammatory cells could be visualized (Fig. 4).

In 3 cases the closure by cementum deposition was partial, as shown by the serial sections. In spite of the cementum deposition at the level of the apical foramen, a small opening allowed communication between the filling material and the periodontal ligament. In these cases, a mild chronic inflammatory reaction was always present (Fig. 5).

Half of the cases showed no closure and was usually associated to resorption of the filling material within the canal. In no cases the invagination of the tissue goes beyond the limit determined by the apical portion of the gutta-percha point. In 5 of these cases a mild to moderate chronic inflammatory reaction was observed in the periodontal ligament (Fig. 6). In the other 2 specimens the inflammatory reaction was restricted to the invaginated connective tissue.

The complete resorption of the material in the periapical tissues was seen in almost all of the cases (85% of the cases). Only 3 specimens had small residues of the filling material surrounded by a fibrous capsule.

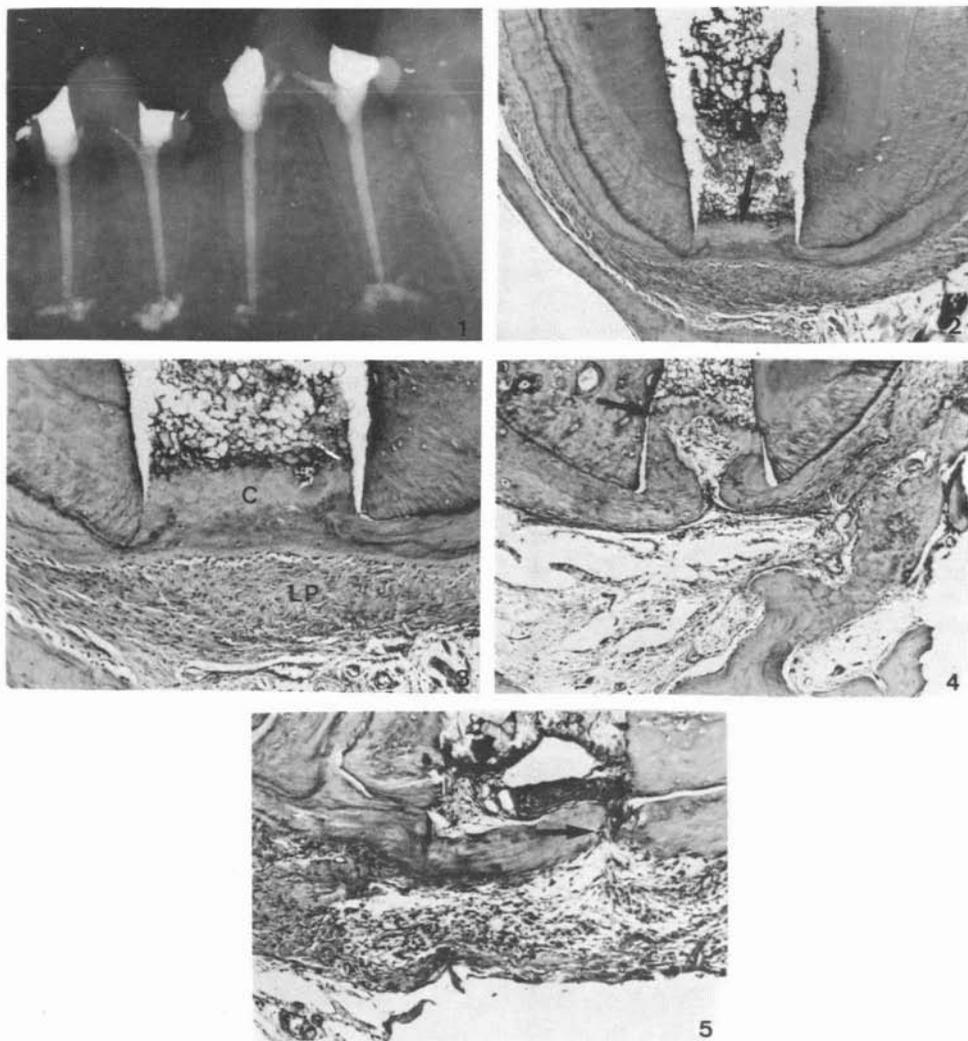


FIG. 1 - Radiograph taken after root canal overfilling.

FIG. 2 - Maisto antiseptic paste. Note closure of the apical foramen by cementum deposition (arrow). (Hematoxylin and eosin; original magnification X 50).

FIG. 3 - Higher magnification of figure 4 showing details of the newly formed cementum (c) and the periodontal ligament (LP). (Hematoxylin and eosin; original magnification X 100).

FIG. 4 - Maisto antiseptic paste. Note the small invagination of tissue and closure within the canal (arrow). There is a mild chronic inflammatory reaction in the periodontal ligament. (Hematoxylin and eosin; original magnification X 50).

FIG. 5 - Maisto antiseptic paste. Closure is partial (arrow) and the periodontal ligament shows a chronic inflammatory reaction. (Hematoxylin and eosin; original magnification X 50).

Calcium hydroxide - iodoform/distilled water - Mixture

There was closure by cementum deposition in 4 cases. The periodontal ligament showed a normal thickness and no inflammatory reaction was observed (Fig. 7).

In the other cases, the main characteristic was the invagination of the connective tissue within the canal, almost always reaching the tip of the gutta-percha point. In 4 of these cases a partial closure was seen. In the remaining specimens there were invagination of connective tissue and cementum deposition on the walls of the root canals, sometimes repairing small areas of previous resorption (Fig. 8). In these cases, a chronic inflammatory reaction was observed in the invaginated tissue, generally extensively to the periodontal ligament.

In 5 cases, the invaginated tissue was partially necrosed, but a cementum deposition within the canals could be observed. In these specimens a moderate to severe chronic inflammatory reaction was seen in the periodontal ligament.

At no time it was possible to observe particles or residues of the filling material in the periapical tissues.

Resorption of the material from within the canal took place in 80% of the cases.

Grossman's Sealer

Four root canals showed partial closure of the apical foramen by cementum deposition, whereas in the other cases no closure was observed. In 90% of the cases there were particles or residues of the filling material in the periapical tissues. A periapical chronic inflammatory reaction was observed in all the studied specimens (Figs. 9 to 11).

The overfilled material was surrounded by a fibrous capsule, which in some areas was discontinuous, allowing an intense chronic inflammatory reaction (Figs. 9 and 10). In other instances the filling material was very fragmented and surrounded by a severe chronic inflammatory reaction. In this area many macrophages with cytoplasmic inclusions were observed (Fig. 11).

In 30% of the cases a small amount of resorption of the filling material within the canal was seen. In those cases there were invagination of connective tissue and cementum deposition on the walls of the root canals (Fig. 9). The invaginated tissue showed chronic inflammatory cells, mainly lymphocytes and macrophages with cytoplasmic inclusions.

The main results observed with the 3 types of filling materials are summarized in Figs. 12 and 13.

DISCUSSION

In order to ensure periapical contact with the material deposited in the root canal, intentional apical perforation was necessary, since dog teeth normally do not terminate in one apical foramen, they arborize. This same model was employed in several other experimentations, where a great contact of the periapical tissues with the filling material was the subject of the study^{4,9,13}.

In this paper we observed 35% of closure with the use of Maisto Paste. In a previous report, with a period of experimentation of 6 months, no case of closure was seen and the inflammatory reaction of the periapical tissues were more severe, more extensive and more frequently observed². This fact suggests that time would be a decisive factor, both for the decrease and the disappearance of the inflammatory reaction and for the establishment of favorable conditions for biologic closure to take place. It is possible that with a longer post-operative period, even a larger number of closure than the observed in this paper could take place, which is in agreement with the clinical data reported by Maisto¹¹.

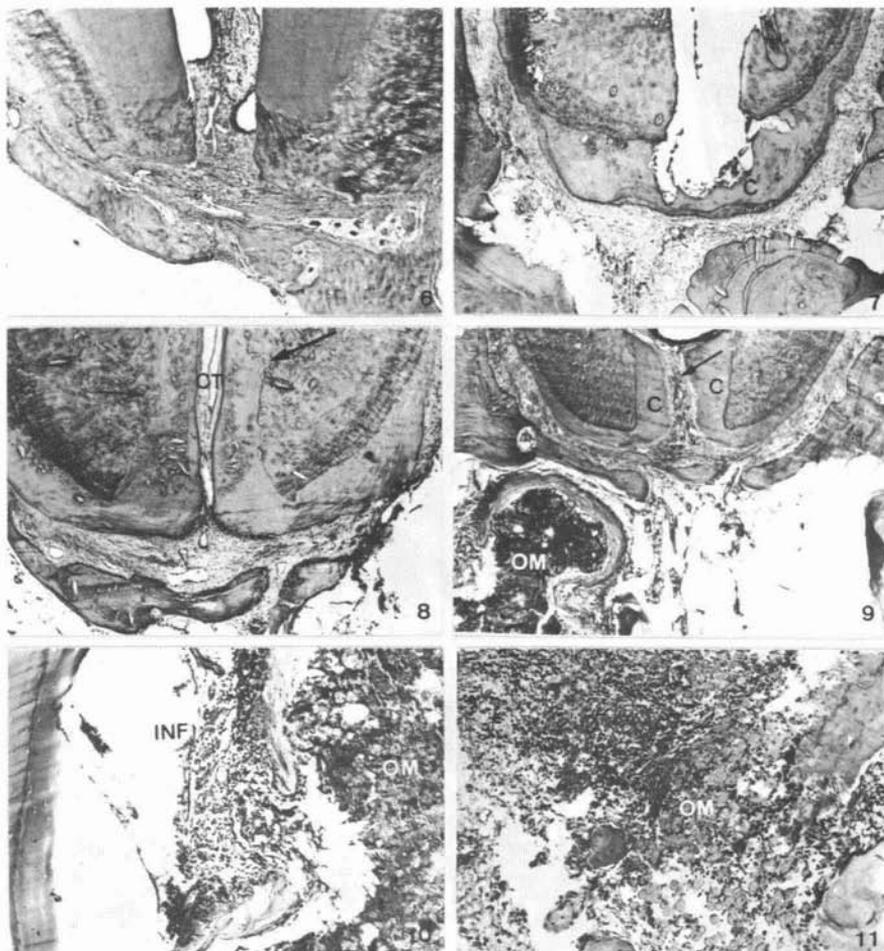


FIG. 6 - Maisto antiseptic paste. Note invagination of connective tissue into the root canal. (Hematoxylin and eosin; original magnification X 50).

FIG. 7 - Calcium hydroxide-iodoform. The newly-formed cementum (c) covered all the apical part of the root, providing a biologic closure. (Hematoxylin and eosin; original magnification X 40).

FIG. 8 - Calcium hydroxide-iodoform. Note invagination of connective tissue (CT) and cementum deposition (arrows) on the walls of the root canal. (Hematoxylin eosin; original magnification X 40).

FIG. 9 - Grossman's Sealer. The overfilling material (OM) is surrounded by a discontinuous fibrous capsule. Note connective tissue invagination (arrow) and cementum deposition (C) on the walls of the root canal. (Hematoxylin and eosin; original magnification X 40).

FIG. 10 - Higher magnification of figure 11 showing a severe chronic inflammatory reaction (INF) next to the overfilled material (OM). (Hematoxylin and eosin; original magnification X 100).

FIG. 11 - Grossman's Sealer. Note particles of the filling material (OM) surrounded by a severe chronic inflammatory reaction. (Hematoxylin and eosin; original magnification X 100).

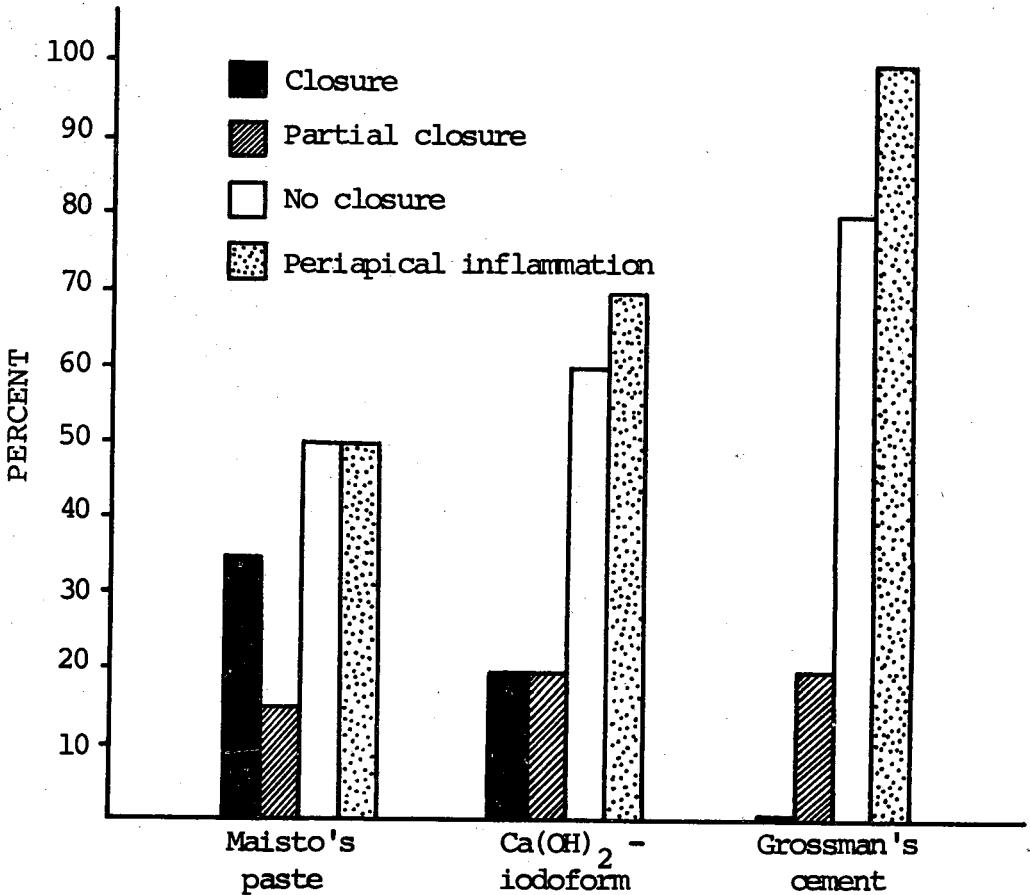


FIG. 12 - Incidence of closure and periapical inflammatory reaction with the different filling materials.

In 85% of the cases all the Maisto Paste within the periapical tissues was resorbed. The resorption took place within the root canal but in no case coronally to the tip of the gutta-percha point.

The results observed with calcium hydroxide-iodoform were similar to the ones reported when that material was employed alone and with the same methodology of treatment^{3,7}. However, it was also observed that overfilling elicits calcium hydroxide resorption^{3,7}, and the healing process is more unfavorable than in those cases where instrumentation and filling were restricted to the root canal^{5,8,14}.

The use of iodoform renders the filling material radiopaque and one can better control the quality and level of the filling. Apparently, iodoform does not disturb the biological properties of calcium hydroxide. It was reported similar histologic results after root canal filling of immature dog teeth with calcium hydroxide associated or not to iodoform¹⁰.

The results obtained with Grossman cement demonstrated that this material is irritant, mainly when it goes into the periapical tissues. The inflammatory reaction observed is in agreement with other data found in literature^{1,12}.

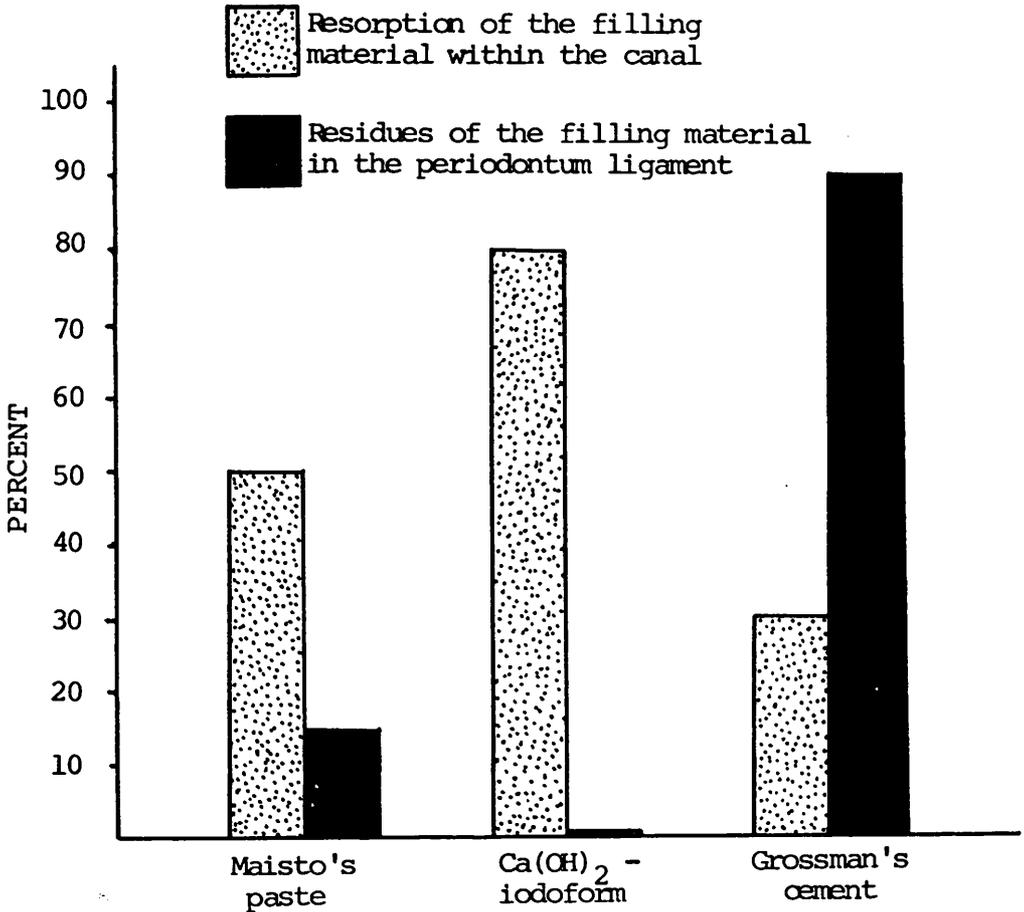


FIG. 13 – Different degrees of resorption of the studied filling materials.

In 90% of the cases it was possible to see particles of the Grossman filling material within periapical tissues, a fact that shows the apparent difficulty in its resorption. In 30% of the cases a small amount of resorption of the material from within the canal was seen, resulting in a small invagination of connective tissue without closure. Obviously, this would not mean that closure could not be observed in a period longer than the one analysed here.

CONCLUSIONS

Based on our experiment, we may conclude that: 1 – Grossman Cement was the least resorbable filling material, calcium hydroxide-iodoform the most resorbable, with Maisto antiseptic paste in an intermediate position; 2 – In 50% of the cases there was some resorption of Maisto antiseptic paste within the root canal, but never coronal to the apical

end of the gutta-percha point. The same happened with calcium hydroxide-iodoform in 80% of the cases. Resorption within the canal of Grossman cement was of small depth and occurred only in 30% of the cases; 3 – Residues of the filling material were observed in the periapical connective tissues in 15% of the cases filled with Maisto antiseptic paste and in 90% of the specimens filled with Grossman cement. No residues of calcium hydroxide-iodoform could be detected in the periapical tissues; 4 – Closure by cementum deposition was found in 35% of the canals filled with Maisto antiseptic paste and in 15% of the cases treated with calcium hydroxide-iodoform. Closure was not observed in teeth filled with Grossman cement; 5 – A chronic periapical inflammatory reaction of different intensities was observed in 50% of the cases filled with Maisto antiseptic paste, in 70% of the specimens treated with calcium hydroxide-iodoform and in 100% of the teeth filled with Grossman cement.

HOLLAND, R. *et alii* – Estudo histológico comparativo de dentes de cães com canais radiculares sobreobturados com três diferentes materiais. **Rev. Odont. UNESP**, São Paulo, **15/16**: 13-21, 1986/87.

RESUMO: Sessenta canais radiculares de 3 cães adultos jovens foram instrumentados um milímetro além do ápice e sobreobturados com pasta de hidróxido de cálcio-iodofórmio e água destilada, cimento de Grossman e pasta antisséptica de Maisto. A análise histológica dos resultados foi efetuada após um período de dezoito meses. Os melhores resultados foram observados nos espécimes tratados com a pasta de hidróxido de cálcio-iodofórmio e água destilada e com a pasta antisséptica de Maisto. Com estes materiais obturadores, alguns casos exibiram selamento do forame apical por deposição de cimento e a reação inflamatória periapical não foi constatada com a mesma frequência observada com o cimento de Grossman.

UNITERMOS: Sobreobturaç o; cimento de Grossman; pasta antiss ptica de Maisto; hidr xido de c lcio-iodof rmio.

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