An In Vitro Assessment of Iodoform Gutta-Percha

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Abstract

The purpose of this study was to test the ability of a commercially available iodoform gutta-percha, to delay infiltration of Enterococcus faecalis using a microleakage model. Seventy extracted single-rooted teeth were decoronated and biomechanically prepared using hand and rotary instruments. Thirty roots were obturated laterally with iodoform gutta-percha and another 30 with regular gutta-percha. Both groups were suspended in sterile BHI broth. An inoculum of E. faecalis suspension was placed at the coronal end of each root, incubated and replenished daily. The apical broth was observed for turbidity, indicating bacterial microleakage. Samples were observed for 32 days, and data was analyzed to compare microleakage between the two groups. The results showed no significant difference between the iodoform and regular gutta-percha samples in delaying microleakage of E. faecalis (p > 0.05).

Key Words

Iodoform GP

Materials and Methods

Seventy extracted, single-rooted teeth were decoronated, leaving 12 mm of apical root. Roots were then observed under the surgical microscope to obtain actual working lengths within 0.5 mm. The canals were prepared to an apical size of 40 using .06 taper Profiles (Tulsa dental). After autoclaving the root samples, 30 were obturated laterally with iodoform gutta-percha, and another 30 with regular gutta-percha. Roth sealer was used to obturate all canals. The remaining 10 roots were used for positive and negative controls. Penrose tubing was attached to the cervical 5 mm of the roots and then bonded with cyanoacrylate to the root surface. Orthodontic wire was then twisted tightly around the bonded penrose tubing so as not to allow apical movement of any bacteria except through the root canal itself. Except for the apical 2 mm, the roots were then painted with fingernail polish to seal off any accessory canals. The apical 2 mm of the samples was to be suspended in BHI broth inside of 2 ml vials. To accomplish this, holes of the same diameter as the penrose tubing were drilled into the caps of the vials. The tubing was then pulled through the hole and the area immediately surrounding the tubing was sealed off with cyanoacrylate. The vials were then filled with approximately 1 ml of sterile broth and the root samples inserted into the vials. A sterile cotton point was inoculated with a suspension of E. faecalis and placed at the coronal end of each root inside of the penrose tubing. The samples were then incubated and replenished daily.
with a new inoculum. The apical broth was observed for turbidity, indicating bacterial microleakage.

**Results**

Samples were observed for 30 days, and data was analyzed using a proportionality z-test to compare microleakage between the two groups. The results showed no significant difference between the iodoform and regular gutta-percha samples ($p > 0.05$). It took an average of 16.8 days for the *E. faecalis* to reach the apex of the root samples containing regular gutta-percha and 19.8 days for the samples containing medicated gutta-percha (Fig. 1).

Results of a two-sample t-test showed that the three-day difference in results was not significant ($p > 0.05$) due to a large standard error. Seventy days after initial inoculation and incubation, there was still no significant difference between the two groups of root samples (Fig. 2).

**Discussion**

Various root canal preparation techniques as well as medications/irrigants used in endodontic therapy have been analyzed to understand their effect on *E. faecalis* infections. Although any mechanical debridement technique has shown to reduce bacterial counts (11), studies comparing intracanal medicaments show somewhat conflicting results. Lin et al. (12) reported better antibacterial activity with chlorhexidine compared to CaOH using the agar-diffusion test, while Evanov et al. (13) using infected bovine roots demonstrated almost equal efficacy of both solutions which was further improved by raising the temp of the solutions to 46°C. However, Lynne et al. (14) reported a significantly greater antimicrobial activity with CaOH compared to Peridex when placed in bovine roots. It is notable that none of the above mentioned solutions demonstrated complete elimination of *E. faecalis*.

The antimicrobial efficacy of endodontic sealers has shown varying results depending on the experiment technique and seems as yet to be inconclusive (15, 16). Cobankara et al. (16) demonstrated this variance when comparing different categories of sealers including ZOE, CaOH, and resin-based sealers using agar-diffusion and Direct-contact tests.

One of the possible mechanisms to kill *E. faecalis* has been attributed to a high pH. McHugh et al. (17) reported in an in vitro study to have eliminated *E. faecalis* in pH controlled NaOH solution with a pH of 11.5 or higher. Although CaOH may well surpass this pH in solution, the buffering capacity of dentin often lowers its pH that may reduce its antimicrobial efficacy in the root canal. Recently, Zehnder et al. (18) reported that bioactive glass S53P4, as an intracanal medication was able to completely eliminate *E. faecalis* from the canals in an in vitro setting. The mechanism of action was speculated to be the precipitation of Ca and P on the bacterial cell surface thereby disrupting the cellular integrity. Although these findings are very significant, follow-up studies are needed to rule out confounding factors.

Antimicrobial chemicals, such as iodoform, have been added to gutta-percha points with the intent that they will retard the growth of bacteria inside the “isolated environment” of the obturated root canal better than regular gutta-percha. Martin (10), in his 1999 article, promoted the use of gutta-percha points containing iodoform as an inhibitor of obligate and facultative anaerobic bacteria. Portenier et al., in their study demonstrated the antibacterial efficacy of an Iodide solution against *E. faecalis* (19).

In the present study, Iodoform Gutta-percha did not inhibit *E. faecalis* better than regular gutta-percha. These results are supported by the Shur et al. (20) study, which examined the antimicrobial effect of iodoform on aerobic and anaerobic bacteria. In their study, the growth of *Staphylococcus aureus* and *Fusobacterium nucleatum* was inhibited, while *E. faecalis*, *Escherichia coli*, and *Pseudomonas aeruginosa* showed resistance to iodoform. Silver et al. (21) showed that MGP had no inhibitory effect on *E. faecalis*, but did inhibit the growth of *Streptococcus sanguis*. Other studies using iodoform-containing obturating pastes have shown similar resistance of *E. faecalis* (22, 23).

One possible explanation for the results of this study is found in the patent for the MGP points, which says that iodoform is leached from the gutta-percha in the presence of saliva (24). The infected root canals in this study were never exposed to saliva, possibly preventing the iodoform from leaching out of the gutta-percha point.

In this in vitro model, extracted teeth were used to compare leakage. Portenier et al. demonstrated that the presence of dentin or dentin matrix inactivated the antimicrobial activity of potassium iodide solution against *E. faecalis* (19). However, in the same study when dentin was treated with EDTA, the antimicrobial activity was minimally inhibited. Because this study utilized EDTA to remove the smear layer while preparing the root canals, the inactivation of any iodoform in the canal is improbable.

In addition, the composition of the two types of gutta-percha is essentially the same. What makes the MGP different is the amount of zinc oxide present. Regular gutta-percha is made up of approximately 66% zinc oxide (25), MGP only 57% (10). The manufacturer has substituted triiodomethane (iodoform) for a portion of the zinc oxide. It can be inferred from the results of this study that zinc oxide and triiodomethane have virtually the same antimicrobial effect on *E. faecalis* and, thus, since one was substituted for the other, there was no difference in their effects.

In conclusion, this experiment showed that the iodoform containing gutta-percha did not delay microleakage of *E. faecalis* any better than regular gutta-percha. According to these results, iodoform gutta-percha may not present any advantage over regular gutta-percha in delaying microleakage in vivo. Longitudinal studies, however, are needed to substantiate this claim.

**References**