

## MP Penetration through Obturated Root Canals -A Basis for LSTR 3Mix-MP NIET retreatment-

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### Abstract

The ability of a mixture of macrogol and propylene glycol (MP) to penetrate through root canal obturation was tested using a total of 30 root canals of single-canal extracted teeth, being obturated using lateral condensation method. The obturation was judged to be good radiographically. The MP + dye (Red food dye) was placed at the orifices of root canals, and time that MP + dye exited to the root apex was measured. In all the samples, Dye + PM passed through obturation and exited to the root apex, while water + dye did not exit except for 3 cases. The penetration time of MP + dye was within 24 hours in 11 samples (37%), 48 hours in 8 samples (27%), 72 hours in 7 samples (23%), 96 hours in 2 samples (7%), and 112 hours in the remaining 2 samples (7%). This indicates that propylene glycol may be good vehicle to carry medicaments, such as 3Mix-MP, through root canal obturation without removal of previous root canal obturation.

### Key words:

propylene glycol, root canal obturation, root canal re-treatment

MP is the components of 3Mix-MP preparation (1-3), which consists of a combination of 3 antibacterial drugs (3Mix) mixed with macrogol and propylene glycol (3Mix-MP). LSTR (Lesion Sterilization and Tissue Repair) 3Mix-MP therapy has been reported to give good clinical outcomes in the treatment of root canals (1, 2), even without root canal preparation and root canal obturation (NIET: Non-instrumentation Endodontic Treatment). In some cases (1) endodontic treatment has been successful without removal of previous root canal obturation. This may indicate efficient penetration efficiency of 3Mix-MP through obturated root canals, but it is also probable that the obturation had not been done well and was not compactly obturated. In this report, MP penetration was tested using extracted teeth with well-obturated root canals.

A total of extracted 30 single-canal incisors with fully-formed roots was selected and each tooth after obturated using lateral condensation method as described elsewhere (1). The obturation was checked radiographically and judged to be good by 4 dentists.

Macrogol (Solbase®, Dainippon Pharmaceutical Co., Meiji, Tokyo, Japan) and propylene glycol were mixed at a 1:1 ratio (MP), and MP was further mixed with a food red dye (Tokyo Kasei Kogyo Co., Ltd., Tokyo, Japan; MP+dye). For a control, MP was replaced by water (water+dye). The MP-dye or water+dye was placed at the orifice of root canal, and, then, sealed with Cavition (GC Asahi Corp., Aichi, Japan). Each tooth was placed on separate tubes which had white paper packed at the bottom. Care was taken to ensure contact between the root tip and the paper so that any dye exiting from the apical foramen would be absorbed into the white paper. The time that elapsed from dye application until dye penetration through the apex was recorded. A pink color observed at the apical foramen was considered as positive dye penetration. Dye exit was checked every 15 minute for the first hour, every 60 minutes for the next 23 hours, and every 2-24 hours thereafter.

In all samples tested, the MP+dye mixture penetrated through the obturation and exited to the root apex (Table). However, the dye exited taking rather long time except for 4 cases, in which the dye exited within 2 hours. The mean time of dye-exit was 44 hours, ranging from 0.5 hour to 112 hours. Out of 30 cases, within 24 hours dye exited through the apical foramen in 11 cases (37%), within 25-48 hours in 8 cases (27%) and within 49-3 days in 7 cases (23%). Dye-exit was recognized in 2 cases (7%) after 4 days and in the remaining 2 cases (7%) before 5 days. On the contrast, when the dye was mixed with water (water+dye), dye did not exit to the apex in almost all (90%) cases except for 3 cases (Table).

The present result clearly demonstrated that MP carried dyes through root canal obturation and exited to apex foramen. The efficient penetration of propylene glycol within dentin through dentinal tubules has also been demonstrated by Cruz *et al* (4) who have shown when propylene glycol is applied at the orifices of unfilled root canal, it diffuses to entire dentin within a minute in most cases. In the present study, we use the root canals obturated well using lateral condensation technique, and the obturation was judged to be good radiographically. However, it has been demonstrated (5) that, even root canal obturation is evaluated will using X-ray photos two-dimensionally, defects/spaces between dentin surfaces and obturation materials, and within/between obturation materials, are easily hidden, but when the same obturation was observed 3-dimensionally using the micro-computed tomography, the hidden defects are recognized (Table) in all cases.

It was probable that such defects/spaces are generated because of minute air-bubbles formation within obturation, of the complicated root canal structures like fins and isthmuses, boundary problems between root canal wall dentin and obturation materials, etc, and they may further form channels or tunnels within obturation to allow MP penetration and exit.

Table. Penetration of Propylene Glycol through root canal Obturation

Sample Number	Dye Penetration Time	
	Dye + MP (hours)	Dye + water
1	0.5	-
2	2	-
3	2	-
4	2	-
5	15	-
6	19	-
7	22	-
8	22	-
9	23	-
10	23	-
11	24	-
12	36	-
13	39	-
14	40	-
15	48	-
16	48	-
17	48	-
18	48	-
19	48	-
20	55	-
21	56	+
22	60	-
23	60	+
24	64	-
25	64	-
26	72	-
27	96	-
28	96	-
29	104	+
30	112	-

6. Takushige T, Hataoka H, Ando M, Hoshino E: Endodontic Retreatment using 3Mix-MP without Removal of Previous Root Canal Obturation. J LSTR Ther 2009; 8: 3-7.

These may also indicate, when MP is used as 3Mix-MP in LSTR 3Mix-MP therapy, MP delivers 3Mix and kill bacterial in endodontic lesions. In fact, clinical studies have demonstrated that LSTR 3Mix-MP therapy has been highly successful in the re-treatment of root canals which had had been previously treated and obturated but failed (6).

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### References

1. Takushige T, Hoshino E: Clinical evaluation of 3Mix-MP method in endodontic treatment. Jap J Conserv Dent 1998; 41: 970-4 (In Japanese with English Abstract).
2. Takushige T, Cruz EV, M A. Asgor M, Hoshino E: Endodontic treatment of primary teeth using a combination of antibacterial drugs. Int Endod J 2004; 37: 132-8.
3. Takushige T, Cruz EV, M A. Asgor M, Hoshino E: Non-surgical treatment of pulpitis, including those with history of spontaneous pain, using a combination of antibacterial drugs. Journal of LSTR Therapy (International WEB version) 7: 1-5, 2008.
4. Cruz EV, Kota K, Huque J, Iwaku M, Hoshino E: Penetration of propylene glycol through dentine. Int Endod J 2002; 35: 330-6.
5. Phides NP, Hoshino E: Evaluation of Obturation by Image Analyses and Macrogol and Propylene Glycol Penetration. Journal of LSTR Therapy (International WEB version) VOL 7: 6-10, 2008

