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Research Report

Effect of various temperature and storage duration on setting time of OREGA sealer

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ABSTRACT

***Background**: Choosing the right rigid material and root canal paste are crucial in the success of root canal obturation. N_2 is a root canal paste containing formaldehyde, which is toxic and carcinogenic. Whilst zinc oxide, resorcin, eugenol, glycerin, and hydrochloric acid, abbreviated as OREGA, are considered a safer root canal paste. In order to perform good obturation, root canal paste's setting time plays an important role. This is connected with how long and in what temperature the paste's substances are stored. **Purpose**: This experiment was performed to find out the effect of various temperature and storage duration on the setting time of OREGA sealer. **Method**: OREGA and N_2 sealers were used as samples. Eighty sealer samples were produced for both sealers providing 10 samples foe each testing category. Each of these samples were stored in 27°C room temperature, 4°C refrigerator temperature, and put into storage for the duration of 0, 1, 2, and 3 months. After these treatments, the samples were tested and analyzed. **Result**: Data collected were analyzed by two-way ANOVA, showing no significant difference of the setting time among temperature and storage duration ($p > 0.05$). **Conclusion**: Temperature and storage duration do not affect the setting time of OREGA root canal paste.*

***Key words**: OREGA new sealer, setting time, temperature and storage*

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INTRODUCTION

There are two types of root canal treatments, pulpectomy and intracanal endodontic. Pulpectomy is root canal treatment followed by removing of either healthy or unhealthy vital pulp tissue. Pulpectomy requires local anesthesia to relief the pain during treatment. Intracanal endodontic is a root canal treatment performed in non vital teeth and called pulp cavity debridement.

The main treatment of pulpectomy and intracanal endodontics are preparation, sterilization and obturation (root canal filling).[1] Root canal preparation cleans pulp tissue, bacteria, infected dentinal tissue and widen root canals to make sterilization and obturation easy. Root canal sterilization releases root canals and pulp chambers from micro organisms. The purpose of root canal filling is to close and fill root canals tightly especially in one third of apical regions. Solid and soft root canal filler materials are needed to fill the root canal. Silver point, acrylic point, amalgam and guttap point are solid materials. Root canal paste is the soft material, which is used to fill apical loopholes, additional root canals and ramifications.[2] Theoretically, root canal paste could manage root canal treatment either on vital or non vital teeth with or without periapical impairment, however in reality, the treatment evaluation still has various results.

The formulation of root canal paste is created in consideration that root canal paste will not contain formaldehyde, has setting time equal the working time of root canal filling and safe. Formaldehyde is a gas material, soluble either in water or fluid at body temperature, relatively stable, toxic, but carcinogenic if used in high concentrations; therefore it is not recommended.[3,4] The material discuss in this study has proven to be appropriate in setting time and working time, effective and safe.[5] The formulation of root canal paste consist of zinc oxide powder

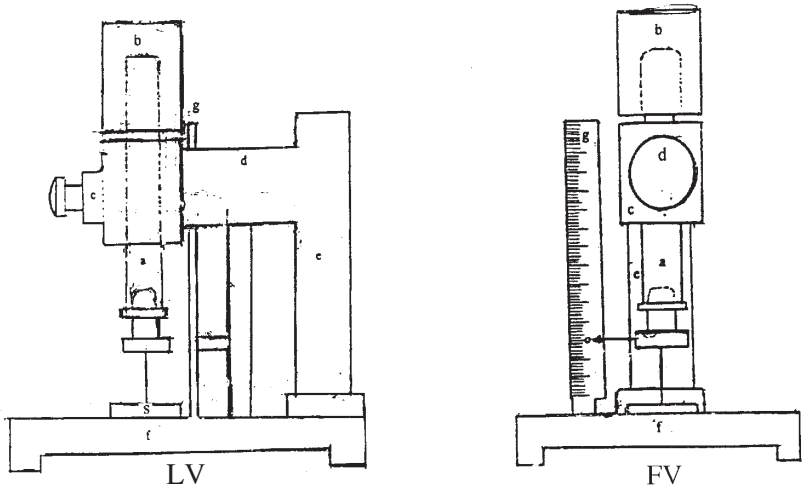

Figure 1. Laterel View (LV) and Front View (FV) of the setting time instrument (ISO 4823. 1984).
Note: a : Gillmore nedle, b : Load, c : Sliding place for Gillmore nedle, d : c Support, e : d Support, f : Buttom of the instrument, g : Scale, h : Indicator and s = sample.

and solutions containing resorcin, eugenol, glycerin, and hydrochloride acid. This mixture identified by layer chromatography and called OREGA. This material is easily obtained in Indonesia, cheaper than N_2 containing formaldehyde which was usually used in Faculty of Dentistry Airlangga University since 1997.

In one visit root canal treatment, Spad root canal paste was used. This material has resin content and mutagenic.[6] Powder and liquid mixing is always done in manipulation of OREGA and N_2. The most determining factor is setting time which has measured since initial mixing until the hardening period that shown by Gillmore time indicator set in zero position.[7] Root canal paste was stored in room temperature (27° C) or in refrigerator (4° C). Other component which could be affected by different temperature were materials containing zinc oxide. At lower temperature zinc oxide would easily bind oxygen from the air, oxidation would occur and changed into zinc dioxide. Both materials observed consist of zinc oxide, therefore, they are both strongly affected by temperature and storage. The purpose of this study is to find the effect of temperature and storage on setting time of OREGA sealer. It is hoped the achieved root canal paste which has been proven to be effective on temperature and storage will to support better treatment result.

MATERIAL AND METHOD

The composition of OREGA root canal paste are 0.2 gr ZnO powder, liquid mixture; 0.03 gr : resorcin, 0.032 gr : eugenol, 0.042 gr: glycerin, 0.025 gr hydrochloride acid. The composition of N_2 root canal paste is: paraformaldehyde, bismuth salt, ZnO, eugenol, rose oil and the other percentage is not mentioned by manufacturer AGSA Japan Co. Ltd. The applied instrument is: Gillmore indicator, glass lab, cement spatula, time recorder (Seiko Japan), plastic ring, refrigerator. The sample test used the instrument schematically shown on figure 1.

Sample preparation, fabrication of OREGA root canal paste using thin layer chromatography to obtain formulation of OREGA root canal paste fulfilling setting time, methanol-acetone were used as eluent with ratio 1:1, chloroform-methanol 2:1, methanol-water1:2, acetone-water 1:1. methanol has boiling point 64.6° C/760 torr, acetone is 56.5° C/ 760 torr, chloroform is 61.3°C/760 torr and water has boiling point 100° C/760 torr.[8,9,10] The test was coroucted seventeen times to achieve the composition appropriate to the composition of OREGA root canal paste i.e: 0.2 gr Zinc Oxide; 0.03gr resorcin fluid; 0.032 gr eugenol, 0.042 gr glycerin; 0.025gr hydrochloride acid.

Setting time test on samples were classified into two groups: OREGA or N_2 root canal paste at 27° C and 4° C and storage is 0, 1, 2, 3 months. The procedure: powder and liquid of OREGA and N_2 root canal paste with ratio between powder and liquid volume: 60 gr : 60 ml was stirred, using cement spatula and put into ten plastic rings on glass plate. Sample(s) put at the bottom of the instrument (f) Gillmore indicator was pressed on the sample surface repeatedly on different places, setting time was considered complete after Gillmore indicator could not penetrate sample surface. This procedure was conducted 10 times to examine setting time of OREGA and N_2 root canal paste at room temperature and refrigerator in 0, 1, 2, 3 months.

RESULT

The mean setting time in 0 month at 27° C for OREGA root canal paste is 3610.8 second and N_2 is 5419.7 score, indicate that: setting time in 0 month at 27° C is faster compared to N_2, while setting time in 0 month at 4° C

Table 1. Mean and standard deviation of OREGA and N_2 paste setting time (second)

RCP	Temperature	N	Month 0 $\overline{X}$ + SD	Month 1 $\overline{X}$ + SD	Month 2 $\overline{X}$ + SD	Month 3 $\overline{X}$ + SD
OREGA	27° C	10	3610.8 + 1.3166	3610.9 + 1.6633	3611.1 + 1.1972	3611.4 + 0.9661
	4° C	10	3610.7 + 2.4518	3614.8 + 2.2509	3614.8 + 1.7512	3622.9 + 2.1833
N_2	27° C	10	5419.7 + 6.2370	5419.8 + 8.4696	5420.0 + 7.9722	5420.1 + 7.9722
	4° C	10	5419.6 + 6.9314	5421.6 + 8.3160	5427.2 + 9.1141	5434.6 + 9.1141

Note: RCP = Root Canal Paste; $\overline{X}$ = Mean; SD = Standard Deviation

OREGA was 3610.7 score and N_2 is 5419.6 second, setting time in 0 month at 4° C OREGA is faster compared to N_2.

The mean setting time in the 1st month at 27° C: OREGA is faster than N_2, while setting time in the 1st month at 4° C, OREGA is 3614.8 second and N_2 was 5421.6 second, showing month 1, at 4° C setting time, OREGA is faster than N_2.

The mean setting time in the 2nd month at 27° C, OREGA: 3611.1 second and N_2: 5420 second showing OREGA setting time at 27° C is faster compared to N_2, while setting time in the 2nd month at refrigerator temperature, OREGA setting time: 3614.8 second and N_2: 54127.2 second, showing setting time in the 2nd month at 4° C, OREGA is faster compared to N_2. the mean setting time in the 3rd month at 27° C OREGA: 3611,4 second and N_2: 5420.1 second showing OREGA setting time in the 3rd month at 4° C is faster compared to N_2 while setting time in month 3 at refrigerator temperature OREGA: 3622.9 second N_2: 5434.6 second showing OREGA setting time is faster than to N_2. Two Way ANOVA test was performed to know the effect of temperature and storage on setting time of OREGA root canal paste, showing that there was no significant difference between temperature and storage in the setting time of the root canal paste ($p>0.05$).

DISCUSSION

Formula of OREGA root canal paste is similar to the criteria of root canal paste, resorcin, eugenol, glycerin, with exact amount bound by zinc oxide. Resorcin less than 0.030 gram. The hardness is 30 Newton, hydrochloride acid is less than 0.025 the setting time is 50000 second. The use Gillmore test is applied in setting time based on the appropriate standard.

In this study, the method of factorial experiment with perfect random design was used and in this method three factors are considered to affect the accuracy of variable i.e.: temperature, storage, the type of root canal paste. Room temperature (27° C) and refrigerator temperature (4° C) were the temperature factor which is the normal temperature for the existence of a material. Zinc oxide is a component material which could be affected by different temperature. Both materials which would be compared: OREGA and N_2 containing zinc dioxide therefore temperature could be reasonably applied as definitive variable. Storage is a definitive variable correlated with the storage temperature, it is assumed that the longer the material is kept at a certain temperature, the more the chemical binding would be affected if the material is not stable. OREGA root canal paste consist of ZnO powder and liquid containing resorcin, eugenol, glycerin and hydrochloride acid; eugenol was mixed with resorcin in an untransparent bottle, glycerin was mixed with hydrochloride acid placed in an untransparent bottle. N_2root canal paste consists of powder and liquid containing paraformaldehyde, bismuth salt, zinc oxide, eugenol, reso oil and so on.

Data analysis found that there was no effect of temperature and storage on setting time of the OREGA and N_2 new sealer. Mean setting time of OREGA new sealer compared to N_2 found that OREGA new sealer setting time is faster. However, there is still enough time to do root canal filling, so it fulfills to the requirement of root canal paste[11,12] due to the effect of hydrochloride acid on setting time is 5000 second, 250 gr the setting time is 5 second. The requirement of root canal paste and material in medical field should be biocompatible.[13,14,15] The setting of root canal paste is highly correlated with the following antibacterial trait, completeness of apex closing and reaction with periapical tissue, while restorative material correlated with the strength on abrasion during clinical use.[16,17]

The conclusion is that the temperature and storage will not affect the setting time of OREGA root canal paste.

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