

pH of the periapical environment after applying Calcium Hydroxide into root canals in vitro

Hoque ANMN¹, Hussain MA², Alam MS³, Howlader MMR⁴, Zaman R⁵, Ferdousi M⁶

Abstract:

The purpose of this study was to determine pH in the periapical region after application of calcium hydroxide containing sealer into experimental root canals. After cleaning and shaping root canals in 10 recently extracted, single rooted human teeth, was obturated with calcium hydroxide containing sealer (sealapex). The remaining group was served as control. In group A1 nothing was added to the vial of saline solution. In group A2 canal has been instrumented and obturated with sealapex. The pH of saline solutions was determined at intervals of 1 hour, 1 day, 1 week and 4 weeks after teeth were placed in them. The pH levels of two solutions were compared with each others to that of saline solution only.

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Introduction:

Calcium hydroxide has been widely used in endodontics since Hermann introduced it to dentistry in 1920. Particular attention has focused on the effect calcium hydroxide has on the facilitation of the formation of hard tissue^{1,2} and is frequently used in treatments such as pulp capping^{3,4} pulp amputation⁵, and as a root canal filling material.^{6,7} Its usage has recently been on the increase due to the expectation that calcium hydroxide would be less detrimental to tissue than either phenol or formaldehyde,⁸⁻¹¹ that it would provide excellent bactericidal and sedative effects,^{10,11} and that it prevents exudation.¹¹

The high pH level of calcium hydroxide in root canal fillings promotes a state of alkalinity in tissues immediately adjacent to the compound. When dissolved in water, calcium hydroxide dissociates into hydroxide ions in a solution makes it alkaline, and thus antibacterial.¹⁰

The purpose of the study was to compare the surface pH level of sealapex sealer at various time intervals in vitro study.

Materials and methods:

Thirty extracted human permanent teeth with single root canals were stored in 10% formaldehyde solution. All of the teeth are cleaned and all root canals shaped to a minimum of a #40 k-files 1 mm from the anatomical apex. Irrigation during cleaning and shaping was accomplished using a 5.25% sodium hypochlorite solution.

Thirty (10 ml of each) aliquots of normal saline solution were placed in screw capped glass vials, and the pH level of the solution in each vial was determined with a pH meter. The pH meter has been previously calibrated with solution with known pH. Groups A1 and A2 served as control groups. The experimental group (B1) of solution received roots obturated with laterally condensed gutta-percha and sealapex sealer.

The pH level of solution in each vial was determined with the pH meter at 1 hour, 1 day, 1 week and 4 weeks following placement of the tooth in vials.

After the pH levels of the solutions in the control and experimental groups were determined at the various time intervals, mean and standard deviation were calculated. The significance of difference was determined with one way ANOVA and Hochberg, post hoc multiple comparison tests, p-value < 0.05 was considered as significant.

Results:

The present study was concerned about the potency of different types of root canal sealers in terms of pH level. The results of this study was presented on tables and graphs.

1. Dr. ANM Nazmul Hoque BDS, MS, MCPS, MPH, Assistant Professor (Conservative Dentistry), Sylhet MAG Osmani Medical College.
2. Professor Dr. Md. Ashraf Hussain, BDS, MSc (Eng) FCPS.
3. Professor Dr. Md. Shamsul Alam, BDS, Dip (Conservative Dentistry), Dean, Department of Conservative Dentistry, Faculty of Dentistry, BSMMU.
4. Dr. Md. Mujibur Rahman Howlader, BDS, DDS, FCPS, MS, Associate Professor, Department of Conservative Dentistry, Faculty of Dentistry, BSMMU.
5. Dr. Rokeya Zaman, BDS, MS, Assistant Professor, Comilla Medical College.
6. Dr. Munira Ferdousi, BDS, MS, Assistant Professor, Department of Conservative Dentistry, Dhaka Dental College.

Address of Correspondence: Dr. A. N. M Nazmul Hoque, Assistant Professor (Conservative Dentistry), Sylhet MAG Osmani Medical College. E-mail: mn.kodalia@gmail.com Mob:01712242260

Table-I*Distribution of groups by pH changes after 1 hour: (N =30)*

Group	N	Mean	SD	Minimum	Maximum
A1	10	7.4930	25087	7.17	7.88
A2	10	7.7190	24732	7.35	8.25
B1	10	8.0070	56358	7.08	8.79

Table-II*ANOVA: pH between groups after 1 hour*

Group	P Value	Significant
A1 Vs A2	.057	NS
A1 Vs B1	.000	S
A2 Vs B1	.006	S

Table-III*Distribution of groups by pH changes after 24 hours. (N = 30)*

Group	N	Mean	SD	Minimum	Maximum
A1	10	7.550	18698	7.28	7.89
A2	10	8.1540	.21598	7.86	8.59
B1	10	8.5600	.33513	7.87	8.96

Table-IV*ANOVA: pH between groups after 24 hours*

Group	P Value	Significant
A1 Vs A2	.002	S
A1 Vs B1	.000	S
A2 Vs B1	.097	NS

Table-V*Distribution of groups by pH changes after 1 week. (N= 30)*

Group	N	Mean	SD	Minimum	Maximum
A1	10	7.5440	.18698	7.28	7.89
A2	10	7.7190	.24732	7.35	8.25
B1	10	8.0070	.56358	7.08	8.79

Table-VI*ANOVA: pH between groups after 1 week*

Group	P Value	Significant
A1 Vs A2	.780	NS
A1 Vs B1	.000	S
A2 Vs B1	.001	S

Table-VII
Distribution of groups by pH changes after 4 weeks (N= 30).

Group	N	Mean	SD	Minimum	Maximum
A1	10	7.4930	.25087	7.17	7.88
A2	10	7.7190	.24732	7.35	8.25
B1	10	8.0070	.56358	7.08	8.79

Table-VIII
ANOVA: pH after 4 week

Group	P Value	Significant
A1 Vs A2	.875	NS
A1 Vs B1	.046	S
A2 Vs B1	.641	NS

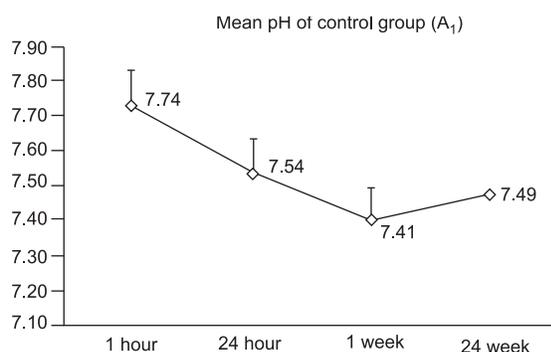


Fig.-1: Mean pH of control group.

Figure-1 shows the distribution of the mean pH of group (A1) for control groups at four points of time.

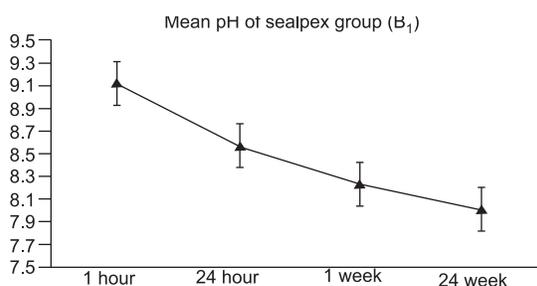


Fig.- 2: Mean pH of Sealapex group (B2).

Figure shows the among experimental group (B2) the average pH of sealapex was highly alkaline at 1 hour (9.13).

Discussion:

In present study, regular observations were made over an extended period on how calcium ions released through

the apex into distilled water affected the pH in the periapical area.

Calcium ion release and an alkaline pH for a material that contains calcium hydroxide important for good biological and microbiological performance of the material¹¹.

In the present study, it was found that average pH of sealapex was found highly alkaline at one hour. In course of time a trend of uniform decline in evident over time. Trusted et. al. suggested calcium hydroxide placement in the root canal elevates the pH producing an alkaline environment in the surrounding tissues by the diffusion of hydroxyl ions through the dentinal tubules. Increased pH is bactericidal and diffusion of hydroxyl ions through dentinal tubules into the periradicular tissues neutralizes the acid pH.

Conclusion:

The pH of the root canal sealer has a very important role in prognosis of endodontic treatment. Considering the results of the present vitro study, it can be concluded that calcium hydroxide containing sealer can maintain alkaline with high pH.

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