

An Electrochemical Study of the Effect of Partial Removal of the Root Canal Filling Material on the Periapical Seal Prior to Post and Core Preparation

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ABSTRACT

Endodontically treated teeth often require a post-and-core build-up for restoring the teeth to optimum health and function. The removal of gutta percha from the root canal filling, to prepare the post space is most critical in success of the endodontic and prosthodontic treatment. A 4 mm remaining length of root canal filling, after post space preparation, is commonly assumed to maintain sealing ability similar to that of the intact filling. Post space may be prepared either immediately using hot pluggers, or later, using mechanical drills, thermal or chemical means. The purpose of this study was to investigate the effect of immediate and delayed post space preparation on the integrity of the apical seal along with the techniques of obturation of root canal and the method of gutta percha removal for post space preparation.

Keywords: Periapical seal, Root canal filling leakage, Electrochemical evaluation, Post space

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INTRODUCTION

Save a Tooth is a key phrase in dentistry today. Modern concept of dentistry has changed since last few decades & the dentists continue to strive to conserve more and more teeth (1). This change in trend has been due to the realisation of the fact that natural teeth function more efficiently than any artificial replacement in dental arches.

The success of root canal therapy depends upon the ability to establish and maintain an apical seal (2). After endodontic treatment of a decayed tooth, there is an additional need to restore tooth structure with a post to retain the core, followed by a crown. During removal of coronal 2/3 rd of gutta percha, apical seal may be disturbed. This disturbed apical seal means failure of the endodontic procedure along with the post and core & crown treatment in due course of time (3).

PURPOSE OF THE STUDY

The purpose of this in vitro study was to

assess the effect of partial removal of root canal filling on peri-apical seal by an electrochemical method because of clinical bearing of the procedure.

Sample selection

Forty extracted maxillary and mandibular anterior teeth were collected for this study. Teeth that were carious, fractured or exhibited cracks or curvatures, discolorations or any resorption, were excluded from the samples. The samples were cleaned free of any attached bone or soft tissue tags and calculus and washed with tap water. Thus, the selected teeth were stored in normal saline.

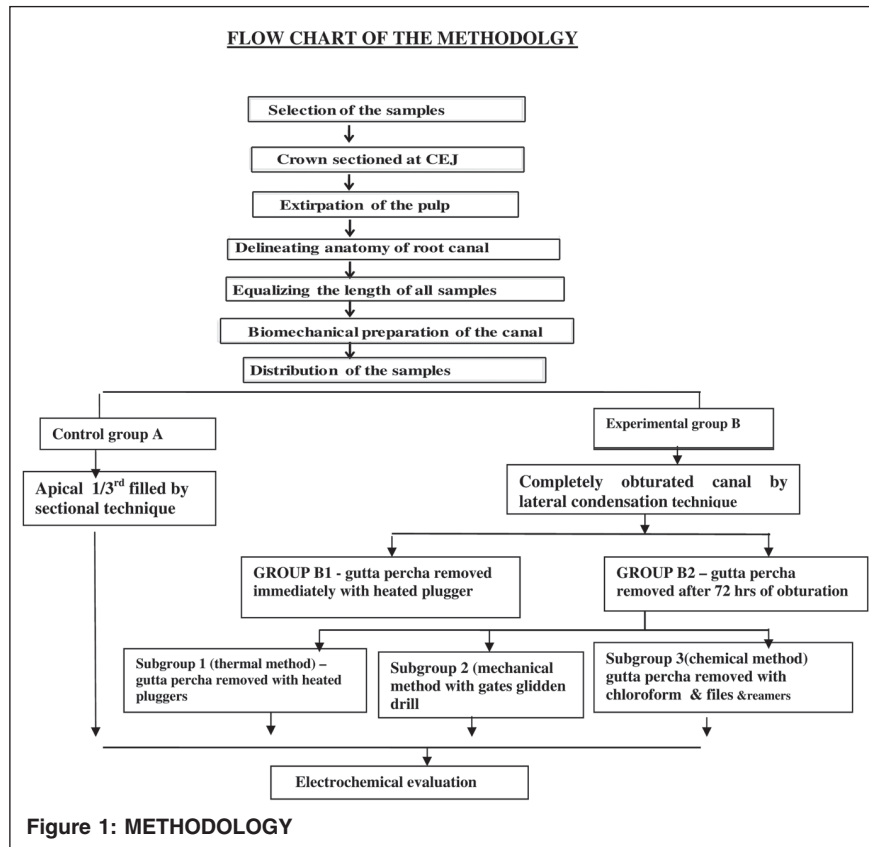
Preparation of the sample

The anatomical crowns of all selected samples were cut at cemento-enamel junction and were decoronated to a length of 12 mm. The root canals of all the samples were biomechanically prepared with K-reamers and K-files following Step-back technique. The canal of all the samples was prepared in a standard manner. The

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apical third of the canal was prepared upto 40 number file and the coronal third of the canal was enlarged up to 80 number file. After the completion of endodontic part of the study procedure, the distribution of the samples was done (Figure 2).

The teeth were randomly divided into two main groups:

- **Control group A:** Apical 1/3rd of the canal filled by sectional technique)
- **Experimental group B:** Complete obturation of canal filled with lateral condensation technique.

Thirty two samples under experimental group B were divided into:

- **Group 1** (gutta percha removed immediately after obturation)
- **Group 2** (delayed removal of gutta percha after 72 hours) with eight samples under each group.

The group 2 was consisted of further three subgroups depending upon the method of gutta percha removal for post space preparation.

For the samples under **Subgroup 1**, thermal method of gutta percha removal with heated root canal pluggers was used.

For **subgroups 2 and 3**, mechanical method with Gates Glidden drills and chemical methods with chloroform were used, respectively.

Preparation of electrochemical cell

All samples were subjected to microleakage assessment with the electrochemical method (Figure 4).

The electrochemical cell was prepared with dissolution of 1gm of potassium chloride powder into 1 litre of water to make 1% solution of potassium chloride. It acted as an electrolyte that provided cations and anions (4,5) .

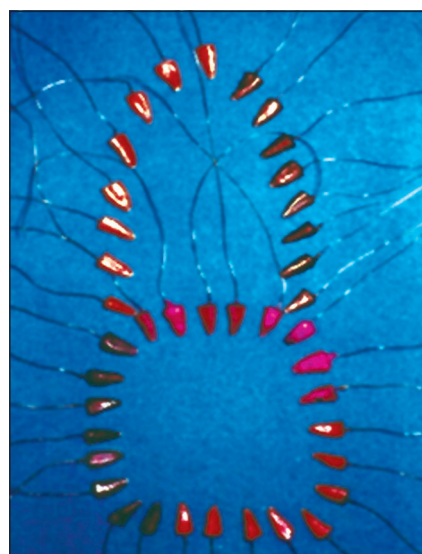
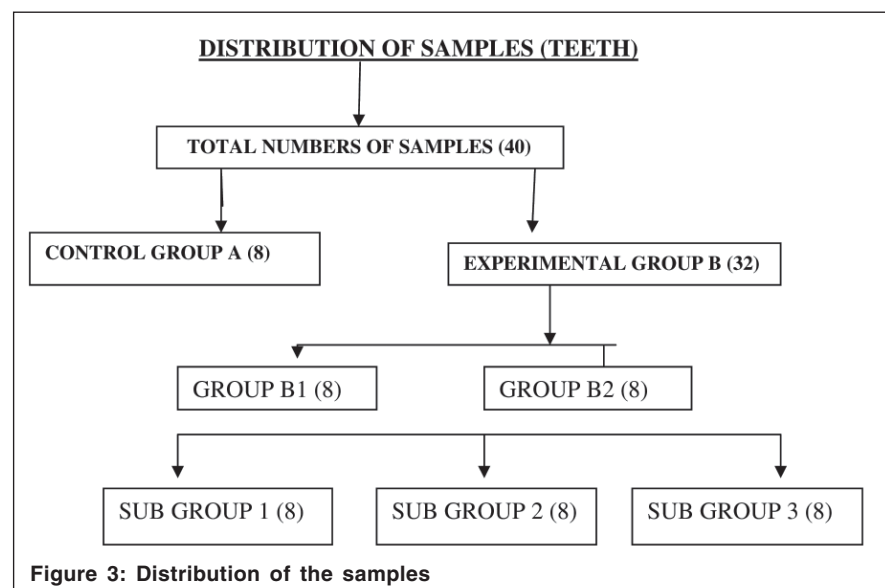


Figure 2: sample with copper wires



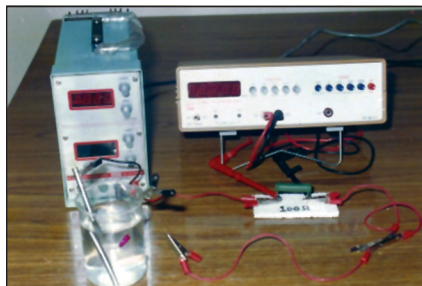


Figure 4: Complete Electrochemical Circuit

A copper wire of six inches long was used to connect the samples which were immersed into electrochemical cell, to the cell circuit. When there was leakage into root canal and the solution, the galvanic corrosion current that was flowing through circuit, was measured as voltage drop by digital voltmeter. The observations were recorded at 24 hour intervals for 7 days and statistically analyzed (6,7).

RESULTS

The data obtained from continuous 7 days of observation, was recorded and subjected to statistical analysis. Table-I is showing the mean values of standard deviation of mean of all the groups at all time intervals.

DISCUSSION

It was observed that the highest mean value in group A was 1.926 on 7th day and lowest value was 0.747 on the first day, with standard deviation being 0.023 and 0.022 on 7th and 1st day respectively.

Group B1 showed the highest mean value

of 3.075 On 7th day and lowest, 0.441, on the 1st day respectively.

It was seen that mean values in all other groups were highest on 7th day, the value being 0.376, 0.217 and 9.03 in subgroup 1, 2 and 3 respectively where as the lowest mean value was 0.05 in subgroup 3 on 1st day.

The sequence of microleakage between various groups were as follow:

Subgroup 3 > Group B1 > Group A > Subgroup 1 > subgroup 2
Chemical method > Immediate removal > Sectional filling > thermal method > mechanical method.

CONCLUSION

On the basis of the data collected, the following conclusions were drawn:

- With respect to **method of removal of root canal filling** (gutta percha)-
 - ◆ **Mechanical method** of gutta percha removal by using gates glidden drills is the best followed very closely by thermal method (using heated root canal pluggers).
- **Chemical removal of gutta percha** by using chloroform was the worst method; it disturbs the integrity of the apical seal, most, and is very cumbersome and time consuming method. Chemical method is even worse than sectional filling group and immediate removal group.
- With respect to **time of removal of gutta percha** after obturation:

- ◆ Delayed removal of gutta percha (after 72 hours) had less disruptive effect on the apical seal than immediate removal of gutta percha.

- With respect to the **technique of obturation**:

- ◆ It is better to obturate the canal by lateral condensation method and then remove the coronal 2/3rd of root canal filling by mechanical method or thermal method(but not by chemical method), than doing sectional filling and leaving coronal 2/3rd of the canal empty for post and core preparation.

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