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A comparative study to evaluate the efficiency of two different chemical solvents used in softening gutta-percha.

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Abstract

Conventional root canal treatment despite having a reported high success rate may not invariably lead to the desired healing response in clinical practice because of shortcoming in the treatment. Different criteria have been used to define success and failure; mostly dependent on both clinical and radio-graphic findings and therefore sometimes there is a need to re-treat the root canal treated teeth.

This study was done on twenty single rooted teeth, which divided equally and randomly into two groups depending on the solvent used, the first group was tested with the use of chloroform and the second group was tested with the use of eucalyptol oil.

The chloroform showed the lowest mean of penetration time and was more efficient in softening the gutta-percha than the eucalyptol oil.

Chloroform softened gutta-percha and ZOE sealer more statistically efficient than the eucalyptol oil.

Keywords: chemical solvents, retreatment of root canal treated teeth.

Introduction

The main objective of endodontic treatment is the restoration of the treated tooth to its proper form and function in the masticatory apparatus in a healthy state[(1)].

The success of endodontic treatment depends on several preoperative factors, as well as on the results of the root canal preparation and filling. Good access to all root canals is a prerequisite to good preparation and obturation; consequently ,poor access preparation raises questions about canal preparation and obturation[(2)] .

The success failure rate is not dependent only on the proper case selection but also upon treatment itself. Endodontic treatment is essentially a debridement procedure that requires the removal of the pulp tissues, and the ability to prepare the canal in a continuously tapering funnel shape from the coronal access to the apex without weakening the remaining dentine, and without any percolation, ledge, zipping which are the main causes for improper root canal obturation, and subsequently failure of endodontic treatment[(3)] .

The debridement procedure is accomplished by using a thorough chemomechanical root canal preparation composed of mechanical debridement combined with chemical irrigation.

The chemical debridement assist in reducing the microbial population of

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infected root canals and facilitates instrumentation through lubrication[4].

So the endodontic treatment may not, however invariably lead to desirable results; as with other root canal procedures, root canal treatment may fail and the dental procedures face failure during re-evaluation of the endodontically treated patients. Several explanations for the root canal treatment have been proposed including apical percolation, root perforation, unfilled canal and gross over and under extension of filling materials[5].

Re-treatment of failure is necessitated by an increasing demand to preserve teeth. It's distinguished from initial root canal treatment by unique consideration related both to the existing restoration and to canal obstruction [6].

Some failures require surgery whereas other merely need removal of the old root canal filling followed by re-preparation and refilling .Various methods for removal of root canal filling are available, including the use of solvents, heat and mechanical instrumentation, alone or in combination[7].

The choice of removal method is dependent on the endodontic technique used and the material used for obturation. Endodontic treatment is not free of failures, and it is often necessary to retreat root canals. Thus, it may be necessary to remove an old obturation; this fundamental step is often difficult[8].

Currently root canals are filled with endodontic cement and gutta-percha cones. These cones are composed mainly of a vegetable resin, from which comes their name, and are softened using chemical solvents. Since 1833 when Bowman proposed the use of gutta-percha in Dentistry and chloroform as an excellent solvent, much has been written concerning the use of chemical solvents for the softening of gutta-percha cones[9].

Callahan recommended a technique of filling root canals which used gutta-percha dissolved in chloroform, known as Chloropercha. Buckley recommended the use of chloroform and eucalyptol as solvents for gutta-percha. However, more recently, Sommer, Ostrander and Grossman recommended the use of xylol as the best solvent[10].

Figueiras emphasized the use of the combination of two chemical solvents, chloroform and eucalyptol, for the softening of gutta-percha[11].

In an investigation designed to clarify which solvent was the best to soften gutta-percha cones, Della Nina concluded that xylol was the most effective. Kaplowitz compared the effect of 18 essential oils in relation to gutta-percha. He observed that only chloroform and purified oil of turpentine completely dissolved gutta-percha and proposed the use of this oil to remove root canal fillings, since it was biocompatible and non-carcinogenic[12].

Pécora presented oil obtained from the exocarp of the sweet orange as a dissolving agent of zinc oxide-eugenol cement. This oil is obtained by soaking the exocarp in hexane and distilling at low pressure in a double-boiler[13].

Aim of study

The aim of this study was to compare and evaluate the efficiency of two different types of solvents in softening gutta-percha root canal filling material.

Specimen preparation

Twenty single rooted extracted permanent teeth with single straight canal(lower premolars),and with completely formed apices were selected and stored in normal saline until use. Using a diamond disc bur with straight hand piece and water

coolant, the coronal portion of teeth were removed to standardize the length of the root(which should be 15 mm. from the apex to the coronal end).The coronal portion was removed to eliminate the variables in the access preparation, as well as to permit an ideal access to the root canals, and to facilitates canal instrumentation and obturation.

Canal preparation

The pulpal tissue was removed by using barbed broaches. Canal potency was determined by passing a no.10 file 1 mm. through the apical foramen. To determine and establish the working length of the root canal, a 15 #k-file was passed into the root canal until it was visible at the apical foramen, one millimeter was subtracted from this length. Each root canal was serially prepared to a minimal size of a 45#k-file at the apical seat and the rest of the canal was flared to a 70#k-file using a conventional step back technique. During the progression from one file to the next size, the potency of the apical foramen was maintained by passing the tip of 15#k-file through the foramen. Circumferential filing action using step back filing in 1mm.increments with the next larger sizes of files. Through out instrumentation procedure 2.5%NaOCl irrigating solution was used between file sizes to flush out debris.

Canal obturation

The canal of each tooth was dried with paper points. A master gutta-percha cone corresponding to the last size at working length was selected. Dorifill sealer cement was mixed on a clean and dry slab and according to the manufacturer instructions the mixture should have a homogenous creamy consistency .One drop of the mix carried to the canal on a file, one size smaller than the master apical file used for enlargement. The file, which set one millimeter short of the working length was rotated counter-clockwise as it withdrawn from the canal, spinning the sealer into the canal. The apical third of the master cone was coated with sealer and inserted slowly and gently into the canal to the working length. An endodontic spreader was inserted apically along the primary cone and displaced it laterally to create space for additional cone; the spreader was penetrated epically within 2 mm. from the estimated working length. Lateral and apical pressure was applied by revolving the spreader through half and arc. The spreading was repeated several times until the wedged cones block further access to the canal[14].The access of gutta-percha points was removed with a heated instrument, and vertically condensed with root canal plugger. All obturated teeth were radiographed to determine if they were properly condensed. Then 2 mm. of the gutta-percha was removed with a heated endodontic plugger to create a reservoir for the solvent. The access openings were sealed with temporary filling material, and the teeth were stored for 7 days to allow the sealer to set. After that the coronal temporary fillings were removed using handinstrument. The obturated teeth were randomly divided into two groups based on the solvent to be applied to soften gutta-percha. Hand instrumentation with a hedstrom file #30,was used to penetrate root canal filling material in a push-pull action. The addition of solvent in 0.02 ml increments was used when resistance to penetration was detected in order to continue penetration. The time required to penetrate to full working length was recorded. If penetration was not achieved after 30 min. the test was terminated, because it is not practical clinically since it will take a long time and more effort[14].

Results

The summary of the mean values and the standard deviation with maximum and minimum time in minutes of penetration for each solvent are presented in Table-1.

From this table it's clear that the chloroform was faster in penetration and showed the lowest mean of penetration time (5.58 min.),then the Eucalyptol oil with a mean value of penetration time(11.45 min.).

Statistical analysis of data by using analysis of variance (ANOVA) was done which showed that there was a very high statistically significant difference between the two groups.

The least significant difference test (LCD) revealed that the Eucalyptol oil had a very highly significant difference compared to Chloroform.

Discussion

Re-treatment of endodontic failure has been considered as a valid alternative to extraction. A greater desire of patients to retain their natural teeth and advances in endodontic treatment have resulted in endodontists becoming more aggressive in re-treatment procedures[15].

Although there has been increased interest in the use of implants, it can be observed that endodontic re-treatments are more biocompatible, less expensive, and offer a reasonable prognosis[16].

In this study a hedstrom file was used to penetrate the canal with forth and back motion. The mean times for penetration of gutta-percha were different in the two groups. All the readings recorded were less than 30min.

The results have indicated that the chloroform showed the lowest mean of penetration time s a group in comparison with the other group tested by Eucalyptol oil.This agrees with the finding of Djalma and Umeura [17].

The difference between the efficiency of the two solvents due to that the olume of chloroform was used to achieve the apex was more in all the samples. Another factor was beyond the difference in the results that the eucalyptol must be heated to solubilize the gutta percha[18].

References

1- Omer M.,Tasman F.,Tuncer S.(1997):Solubilizing efficiency of different gutta- percha solvents:A comparative study.J.Nihon Univ.Sch.Dent.;39(3):133-135.
2- Maalouf E.M.,Ounsi H.F.,Gutmann J.L.,(1998):Re-treatment in endodontics :the deepstar technique .Arab Dent.J.;3(6):44-47.
3- Kvist T.,Reit C.(1999):Results of endodontic re-treatment :clinical study comparing surgical and non surgical procedures.J.of Endod.:25(12):703-705
4- Djalma J.,Spano E.(1993):In vitro study on the softening of gutta percha cones in endodontic re-treatment.Brazil.Dent.J;4(1):43-47.
5- Saunders W.P.,Chestnutt I.G.,Saunders E.M.(1999):Factors influencing the diagnosis and management of teeth with pulpal and periradicular disease by general dental practitioners.Part 1.Brit.Dent.J.,178(9):492-497.
6- Chong B.S.,Pitt Ford T.R.,(1996):Endodontic retreatment methods .Dent.Nove.384-387.
7- Kaplowitz GJ(1991): Evaluation of the ability of essential oils to dissolve gutta-porcha. J Endod 17: 448-449.
8- Weine F.S.(1995):Endodontic therapy .St.Louis CV Mosby Co. St. Louis, Misso.63146.P.(2,302,426).
9- Walton R.,Torabinejad M.(1996):Principles and practice of endodontics .Philadelphia:WB Saunders CO.Chap.(14)P.(245-247).
10- Barbosa S.V.,Burkard D.H.,Spangberg L.S.,(1994):Cytotoxic effects of gutta-percha solvents.J.of Endod.;20(1):6-8.
11- Nekoofar MH, Sadeghi K (2002):The accuracy of the Neosono Ultima Ez apex locator using files of different alloys ; Journal of California Dental Association 23:12.
12- Bertrand M.F.,Pellegrino J.C.,Rocca

J.P.,Klinghfer A.,(1997):Removal of thermofil root canal filling material.J.of Endod.;23:54-57.
13- Ingle JI,Backland L(2002):.Endodontics 5th ed.London ,BC Decker Inc.,p.22,24,and 711.
14- Uemura M.,Hata Gl.,Toda T.,Weine F.S.(1997):Effectiveness of Eucalyptol and d-Limonene as gutta-percha solvents.J.of Endod.;23(12):739-741.
15- Tinaz AC, Alacam T, Topaz O. (2002):A simple model to demonstrate the electronic apex locator.Int. endod J.35(11):5-11.
16- Tinaz AC , Maden M ,Ayden C ,?Turkoz E (2003):The accuracy of three different electronic root canal measuring devices;an in vitro evaluation .J Oral Sci.44(2):5-91.
17- Saad AY,Al-Nazhan S.(2000):Radiation dose reduction during endodontic therapy;a new technique combining an apex locator (Root Zx)and a digital imaging system,J Endod 26(3):7-144.
18- Wein FS(1996):Endodontic Therapy ,Calculation of working length ,Fifth edition,page 36,216-219.

Table-1: Descriptive statistics of penetration time

Max.time	Min.time	S.D.	Mean time for penetration	No.of teeth	Solvent	Groups
6.17	5.00	0.401	5.58	10	chloroform	1
12.08	10.01	0.644	11.45	10	Eucalyptol oil	2

Table-2: Anova Test

Sig	F	MS	D.F.	S.S	Source of variation
***	161.9	54.46	3	163.40	**Between groups**
		33638	36	12.10986	**Within groups**