ISSN: 0975-833X

Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 11, Issue, 08, pp.6143-6145, August, 2019

DOI: https://doi.org/10.24941/ijcr.36123.08.2019

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

RESEARCH ARTICLE

A COMPARATIVE EVALUATION OF EFFECT OF THREE DRYING METHODS OF POST PREPARATION ON BOND STRENGTH USING HYDROPHILIC BONDING AGENTS

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ARTICLE INFO

Article History:
Received 12th May, 2019
Received in revised form
18th June, 2019
Accepted 20th July, 2019
Published online 31st August, 2019

Key Words:

Root canal,
Bonding effectiveness,
Tensile bond strength,
Hydrophobic,
Hydrophilic.

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ABSTRACT

Purpose: The purpose of this study was to evaluate the effect of different drying methods of the post space on dentin bonding in composite core build-up method by using hydrophilic and hydrophobic agents. ***Methods:*** Total 30 caries-free incisors and premolars were endodontically treated for post and core build up. After drying each post space using three drying methods (air drying, paper-point drying, or ethanol drying, which involves filling the space with 99.5 vol% ethanol followed by air drying) A dual-cure one-step self-etching adhesive system bonding agent (Prime and Bond universal™, Universal Adhesive) was coated in to the canals and filled with dual-cure resin composite. The bonded specimens were sectioned into square beams of approximately 1 mm square for microtensile bond strength (mTBS) testing. mTBS were analyzed using Scheffé multiple comparison. ***Results:*** The mTBS significantly decreased in the order of ethanol drying, paper-point drying, and air drying (air drying/ethanol drying: $p < 0.001$, air drying/paper- point drying: $p = 0.048$, ethanol drying/paper-point drying: $p = 0.032$). There were significant differences among the three drying methods (airdrying/ethanoldrying: $p < 0.001$). Similar tendencies were clearly observed with hydrophobic agents. But as compared to hydrophobic agent, hydrophilic shows higher strength. ***Conclusions:*** Ethanol drying was found to be an effective method for direct resin composite core build-up, as compared with two other methods, in terms of less residual liquid, less gap formation, and higher bond strength as compared to hydrophobic bonding agents.

Citation: Sagar Patil, Dange, S. P., Smita Khalikar and Kishore Mahale, **2019.** "A comparative evaluation of effect of three drying methods of post preparation on bond strength using hydrophilic bonding agents", *International Journal of Current Research*, 11, (08), 6143-6145

INTRODUCTION

Conventionally, the metal core build-up method has often been used in the treatment of non-vital teeth. Root fracture occurs as a result of the much higher elastic modulus of the metal core. The resin composite core build-up method, which has an elastic modulus similar to that of dentin, is widely accepted. The esthetically the resin composite core build-up method is better than that provided by the metal core. The goal of the present study was to evaluate the effect of different drying methods of the post space on dentin bonding in composite core build-up method by using hydrophilic and hydrophobic agents. Hence Study was conducted to measure microtensile bond strength (mTBS) to evaluate the bonding between the resin-core and the dentin. Rasimick *et al.* (2010) reported that the most common failure of this method was debonding.

There are a number of adhesion inhibitors, such as

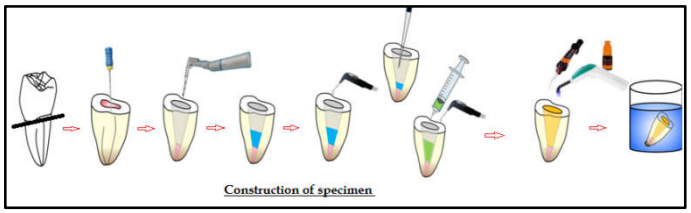
- High C-factor ,
- Limited visibility,
- Morphological characteristics
- An unfavorable condition regarding the application of the adhesive technique in the root canal space.

Moreover, since the root canal space is long and narrow, it is extremely difficult to completely remove residual liquid. Residual liquid in the post space was one reason for the reduced effectiveness of the adhesion between the resin and the root canal dentin. Taichi Iwashita[1] and et al studied similar study in which bonding agents used was hydrophobic in nature (Clearfil Bond SE ONE, Kuraray Noritake Dental).

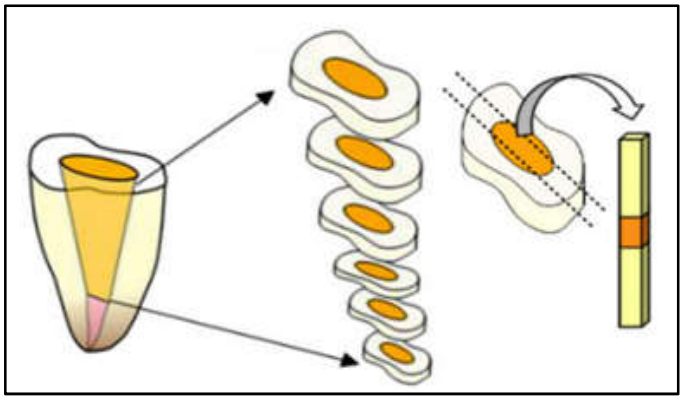
MATERIALS AND METHOD

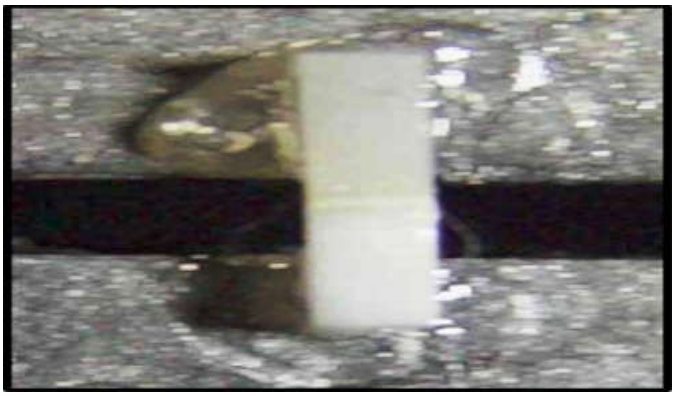
Tooth preparation and resin core build-up: Total 30 caries-free incisors and premolars were prepared. Which were stored in Hank's Balanced Salt Solution (HBSS) at 4° C. Each teeth were decoronated at cement-enamel junction. The canals were shaped with a size 60 K-file and were obturated by vertical condensation. Enlargement of canal was done by using low-speed preparation drills. Following preparation canals were Pre-treated with a 3 % EDTA solution for 2 min and with a sodium hypochlorite gel for 1min. The canals were irrigated with distilled water. All teeth were divided into three groups according to drying method (i.e., air drying, paper-point drying, and ethanol drying which involves filling the space with 99.5 vol% ethanol followed by air drying). A dual-cure one-step self-etching adhesive system bonding agent (Prime

and Bond universal™, Universal Adhesive) was used according to the manufacturer's instructions for bonding to root canal dentin. In present study, we evaluate bond strength by this hydrophilic bonding agent. Air drying was done for 10 s to remove excess adhesive resin at the bottom of the canal. The entire post space was filled with dual-cure resin composite core material. The specimens were light-cured for 40 s and then stored in water at 37° C for 24 hrs.



Microtensile bond strength (mTBS) test: The bonded specimens were cut using saw in to slabs under water-cooling. Each slab was then transversely sectioned through the middle part of the post into approximately 1-mm^2 beams. The end of the beam and the remaining interface were attached to a testing device in a table-top testing machine. The mTBS data were analyzed by Scheffé multiple comparison at a 95 % level of confidence. Pre-testing failure (PTF, i.e. fracture of the specimen before testing), samples were included as the 0-MPa data.





RESULTS

Bonding effectiveness between the resin-core material and the dentin mTBS test (in Mpa). The mTBS gradually decreased from the coronal side to the apical side. Section 1 indicates the edge of the coronal side, and Section 4 indicates the edge of the apical side. Section 1 was significantly different from Sections 2 through 4. The mTBS gradually decreased in the order of ethanol drying, paper-point drying, and air drying.

Drying method	Coronal side 1	2	3	Apical side 4
Air drying	11.3 ± 8.4	7.3±8.7	3.9±6.0	3.3±2.6
Paper point drying	12.3± 8.3	9.7± 3.9	6.4± 2.2	6.1. ±2.0
Ethanol drying	18.3±2.3	8.5±7.4	9.2±3.3	4.9±8.1

There were significant differences among the three drying methods (airdrying/ethanoldrying: $p < 0.001$). Similar tendencies were clearly observed with hydrophobic agents. But as compared to hydrophobic agent, hydrophilic shows higher strength.

DISCUSSION

Few reports have investigated that the dryness of the post space is important for the adhesion of the core and the post dentin. As a result, ethanol drying resulted in significantly less residual liquid than air drying. According to manufacturer, bonding agent being hydrophilic does not affect the adhesion because of residual liquid. Most adhesives are comparatively hydrophobic, tending to separate from water. Prime and Bond universal™ overcomes the surface tension of water and spreads across dentin and into dentinal tubules to form homogeneous layer. Thick adhesives can have a tendency to pool. These adhesive pools can show up as translucent areas on a radiograph, which can easily be misdiagnosed as a void, gap, or secondary decay, leading to unnecessary replacement. Prime and Bond universal™ self-levels to actively create a thin, uniform adhesive layer.

Dry spots that remain unbonded can weaken the restoration and may lead to post operative sensitivity and micro leakage. Prime and Bond universal™ is formulated to spread actively, minimizing the risk of inadvertently leaving dry spots. In the present study, the bond strength measured by the mTBS test decreased in the order of the Ethanol drying group > Paper point drying group > Air drying group. Ethanol drying evaporates residual liquid from complex shapes of extracted teeth. Although paper-point drying can only absorb water on the surface of post space dentin touched by the paper point. The advantage of the mTBS test is high sensitivity and the disadvantage of the mTBS test is that Pre-testing failures (PTFs) are easily produced. PTFs of 32 beams in the case of the air drying group, 14 beams in the case of the paper-point drying group, and 3 beams in the case of the ethanol drying group also occurred in the present study. Many commercially

available adhesives contain small amounts of ethanol. Sequential collagen denaturation may be a disadvantage of using ethanol on dentin. Moreover, the long-term prognosis of the ethanol-wet bonding system has been reported to be good. The ethanol concentration of ethanol-wet bonding, which is same from the. Therefore, it can be concluded that there are no adverse effects associated with the use of ethanol. In the present study, single-rooted human teeth were expanded concentrically, although clinically human teeth have complicated shapes, such as elliptical and flat shapes, isthmuses, and fins. Ethanol drying is considered to be especially effective for such shapes along with hydrophilic bonding agents.

Conclusion

The purpose of the present study was to improve the adhesion of resin composite core materials to post-space dentin. Three post space drying methods were evaluated multilaterally. Ethanol drying was found to be an effective method for direct resin composite core build-up, as compared with two other methods, in terms of less residual liquid, less gap formation, and higher bond strength as compared to hydrophobic bonding agents.

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