ORIGINAL RESEARCH

A Scanning Electron Microscope Analysis of Sealing Potential and Marginal Adaptation of Different Root Canal Sealers to Dentin: An *In Vitro* study

GauravPatri[1] U W Pl `[2] Ud E vi P}ùµ Z [3] U ^µ }[4] U :]u<oµvi [5] µ ^Z Z ^ Z sı µ [6]]v

Abstract

Aim: The present study aimed to evaluate the sealing potential and marginal adaptation of di□erent root canal sealers to dentin.

Materials and methods: A total of sixty human lower premolars of the permanent dentition that were extracted were used for this study. The visible debris and calculus were removed from the extracted teeth ultrasonically and were kept for 2 hours in 2.5% sodium hypochlorite and stored in normal saline till next use. A low-speed diamond disc was used to section all the teeth samples at the cementoenamel junction. Later, cleaning and shaping of the canals was done. Based on the sealer used, the samples (each group consisting of 20 samples) were divided randomly into three groups: group I—bioceramic sealer, group II—resin-based sealer, group III—MTA-based sealer. All split samples were visualized under scanning electron microscope (SEM) at apical and coronal thirds of root canal, the marginal gap at root dentin and sealer interface were assessed.

Results: The highest marginal adaptation (5.60 ± 0.12) was demonstrated by EndoSequence BC sealer, followed immediately by ProRoot MTA sealer (4.48 ± 0.12) and EndoREZ sealer (2.10 ± 0.54). A statistically signi□cant di□erence ($p = 0.001$) was seen between the EndoSequence BC and ProRoot MTA sealer for apical and coronal marginal adaptation. Also, a statistically signi□cant di□erence ($p < 0.05$) was found between EndoSequence BC sealer vs EndoREZ sealer at coronal and EndoSequence BC sealer vs EndoREZ sealer and EndoREZ sealer vs ProRoot MTA sealer at apical third.

Conclusion: The present study concluded that signi□cant and better sealing ability and marginal adaptation was demonstrated by EndoSequence BC (bioceramic sealer) when compared to ProRoot MTA sealer (MTA-based sealer) and EndoREZ sealer (resin-based sealer).

Clinical signi□cance: Numerous endodontic sealers enter the market with various factors to attain acceptable seal. According to current study bioceramic sealer, is the appropriate sealer that hermetically seals all the margins.

Keywords: Dentinal tubule penetration, Marginal adaptation, Root canal sealer, Scanning electron microscope.

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Introducton

Restorations are intended for carious teeth, crowns are made to preserve damaged teeth, and endodontic treatment aims at treatment of pulpally involved teeth. The optimal endodontic obturation technique should essentially offer a dimensionally stable and tight apical seal without □uid leakage so as to avoid any communication between the root canals and the adjoining periapical tissues via the apical foramen. The conventional endodontic treatment is reported to be successful in 79–96% of all the cases.[1]

The root canals that are not obturated completely contribute to 58% of endodontic failures. The causes for incomplete obturation may be inappropriate obturation technique or incomplete instrumentation. The root canal sealers that are used during obturation technique should function as a lubricant; seal the minuscule gap between the gutta-percha and the canal wall, and support the seating of gutta-percha cones. The root canal sealers should also seal the patent lateral and accessory canals, bury the bacteria within the tubules of dentin and permit repair of the damaged periapical tissue.[2]

Previously too much unnecessary emphasis has been placed on whether the □lling has reached the radiographic apex or not. Nevertheless, enduring success of root canal treatment (RCT) relies on three-dimensional obturation of root canal. The chief factors responsible for successful RCT are lack of apical and coronal micro leakage, extent of penetration of sealers in to the tubules and sealing o□ the minute gap between canal wall and sealers. In order to minimize micro leakage, the adaptations between root canal wall and sealer has to be excellent which would further increase the root canal breaking strength meaningfully.[3]

[1,2]Department of Conservative Dentistry and Endodontics, Kalinga Institute of Dental Sciences, KIIT Deemed to be University, Bhubaneswar, Odisha, India

[3]Department of Oral and Maxillofacial Surgery, Subbaiah Institute of Dental Sciences, Shivamogga, Karnataka, India

[4]Department of Restorative Dental Sciences, College of Dentistry, King Khalid University, Abha, Kingdom of Saudi Arabia

[5]Department of Periodontics, College of Dentistry, King Khalid University, Abha, Kingdom of Saudi Arabia

[6]Department of Pediatric Dentistry and Orthodontics, College of Dentistry, Division of Orthodontics, King Khalid University, Abha, Kingdom of Saudi Arabia

Corresponding Author: Gaurav Patri, Department of Conservative Dentistry and Endodontics, Kalinga Institute of Dental Sciences, KIIT Deemed to be University, Bhubaneswar, Odisha, India, Phone: +91 9437962964, e-mail: patrigaurav@gmail.com

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Con□ict of interest: None

Figs 1A to C: Scanning electron microscope images of: (A) EndoSequence BC sealer; (B) EndoREZ sealer; (C) ProRoot MTA sealer at coronal third

Figs 2A to C: Scanning electron microscope images of: (A) EndoSequence BC sealer; (B) EndoREZ sealer; (C) ProRoot MTA sealer at apical third

Table 1: Statistical analysis of mean and standard deviation of three different sealer's marginal adaptations

Sealer s group	n	Mean ± (SD)
Group I: EndoSequence BC sealer	20	5.60 ± 0.12
Group II: EndoREZ sealer	20	2.10 ± 0.54
Group III: ProRoot MTA sealer	20	4.48 ± 0.12

Table 2: Sealing potential and marginal adaptation of different sealers at coronal and apical levels

Type of sealer	Coronal (mean ± SD)	Apical (mean ± SD)	K ANOVA value	p value
EndoSequence BC sealer	2.30 ± 0.01	3.30 ± 0.11	26.00	0.001
EndoREZ sealer	0.96 ± 0.04	1.14 ± 0.50	24.80	0.084
ProRoot MTA sealer	1.68 ± 0.09	2.80 ± 0.03	25.44	0.001

Table 3: Intergroup comparison at coronal third

Inter groups	Mean rank	Mann Whitney U test	p value
EndoSequence BC sealer vs EndoREZ sealer	22.80–6.20	40.20	0.001
EndoSequence BC sealer vs ProRoot MTA sealer	17.58–8.24	14.00	0.38
EndoREZ sealer vs ProRoot MTA sealer	20.03–9.88	37.50	0.06

Table 4: Intergroup comparison at apical third

Inter groups	Mean rank	Mann Whitney U test	p value
EndoSequence BC sealer vs EndoREZ sealer	24.18–8.30	42.76	0.001
EndoSequence BC sealer vs ProRoot MTA sealer	19.58–8.96	16.10	0.46
EndoREZ sealer vs Pro-Root MTA sealer	22.48–1.88	40.88	0.001

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