Research Article

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Scanning Electron Microscopic Assessment of Dentinal Changes during Endodontic Therapy

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ABSTRACT

Background: When the root canals are instrumented during endodontic therapy, a layer of material composed of dentine, remnants of pulp tissue and odontoblastic processes, and sometimes bacteria, is always formed on the canal walls. Hence; the present study was undertaken for assessing dentinal changes during endodontic therapy.

Materials & Methods: A total of 20 freshly extracted mandibular first premolar were obtained. Group A in which root was prepared with K-type files with conventional step back technique, while group B included root specimens were prepared with NiTi files with conventional step back technique. Biomechanical preparation was done followed by irrigation. Visualization of all specimens was done using scanning electron microscope. All the results were recorded in Microsoft excel sheet and were analysed by SPSS software.

Results: Significant results were obtained while comparing the smear layer grading score among both the study groups. Mean microleakage among specimens of Group A was 3.85 while mean microleakage among specimens of Group B was 2.94. Mean microleakage was higher among specimens of Group A, the results of which were found to be statistically significant.

Conclusion: NiTi files exhibit lesser microleakage.

Keywords: Dentinal Changes, Endodontic Therapy.

INTRODUCTION

When the root canals are instrumented during endodontic therapy, a layer of material composed of dentine, remnants of pulp tissue and odontoblastic processes, and sometimes bacteria, is always formed on the canal walls.[1] This layer has been called the smear layer. It has an amorphous, irregular and granular appearance under the scanning electron microscope.[2-4] The advantages and disadvantages of the presence of smear layer, and whether it should be removed or not from the instrumented root canals, are still controversial. It has been shown that this layer is not a complete barrier to bacteria and it delays but does not abolish the action of endodontic disinfectants. Endodontic smear layer also acts as a physical barrier interfering with adhesion and penetration of sealers into dentinal tubules.[5- 8] Hence; the present study was undertaken for assessing dentinal changes during endodontic therapy.

MATERIALS & METHODS

The present study was conducted with the aim of assessing the dentinal changes during undergoing endodontic therapy under scanning electron microscope. Ethical approval was obtained from the ethical committee of the institutional ethical committee after explaining in detail the entire research protocol. A total of 20 freshly extracted

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mandibular first premolar were obtained. Cutting of all the teeth specimens was done at cemetoenamel junction. The teeth were cleaned and stored in normal saline for 1 week. Working length was determined using # 15 K file. All the root specimens were divided into two study groups: Group A in which root was prepared with K-type files with conventional step back technique, while group B included root specimens were prepared with NiTi files with conventional step back technique. Biomechanical preparation was done followed by irrigation. Visualization of all specimens was done using scanning electron microscope. Scoring system used was as follows:

0- No smear layer with all tubules opened.

1- Little smear layer with more than 50% tubules opened.

2- Moderate smear layer, with less than 50% tubules opened.

3- Heavy smear layer with outline of tubules obliterated.

All the results were recorded in Microsoft excel sheet and were analysed by SPSS software.

RESULTS

In the present study, among the specimens of group A, 3 specimens had grade two while 7 specimens had grade three. Among the specimens of group A, 7 specimens had grade two while 3 specimens had grade three. Significant results were obtained while comparing the smear layer grading score among both the study groups.

Mean microleakage among specimens of Group A was 3.85 while mean microleakage among specimens of Group B was 2.94. Mean microleakage was higher among specimens of Group A, the results of which were found to be statistically significant.

DISCUSSION

Many *in vitro* studies have been performed on evaluation of different adhesive systems and also post and dentine pretreatments for increasing the bond strength, and have shown that the cause of most failures is the bond failure between post and dentine. Another study has stated that debonding of resin and dentine interface in consequence of dentine hybridization´s problems is the cause of the most common post failures. Therefore, achieving an effective bonding to root canal walls is challenging, according to undesirable geometry of root canal and limitation of adhesive´s physical properties. In addition, root dentine treatments during root canal therapy might interfere with adhesion to the root dentine.

Table 1: Comparison of smear layer scoring

Group	Grade				Total
	Zero	One	Two	Three	
A	0	0	3	7	10
B	0	0	7	3	10
Chi- square value	7.84				
p- value	0.00 (Significant)				

Table 2: Mean microleakage

Group	Mean	S.D.	p-value
A	3.85	1.71	0.00
E	2.94	1.80	

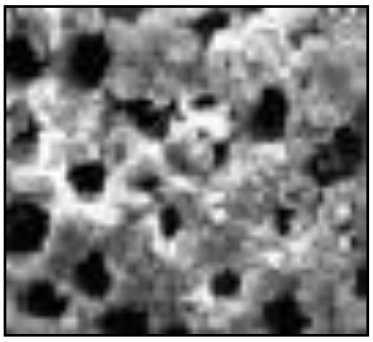

Fig 1: Scanning electron microscopic image among specimens of Group A

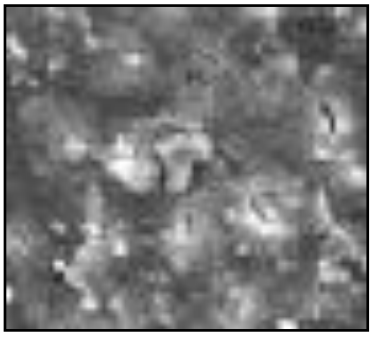

Fig 2: Scanning electron microscopic image among specimens of Group B.

In the present study, among the specimens of group A, 3 specimens had grade two while 7 specimens had grade three. Among the specimens of group A, 7 specimens had grade two while 3 specimens had grade three. Significant results were obtained while comparing the smear layer grading score among both the study groups. Tabrizizadeh M et al compared SL removal following canal preparation with two different sizes/tapers by means of scanning electron microscopy (SEM). A total of 50 extracted human mandibular premolars were decoronated. The teeth were randomly divided into two experimental groups (n=20) and two negative control groups. In groups 1 and 2 the sizes of master apical file (MAF) were #25 and 40, respectively. Coronal part of the canals were flared with #2 Piezo drills in group 1 and sizes #2 to 6 in group 2. Finally FlexMaster NiTi rotary instruments were used to complete canal preparation (25/0.04 and 35/0.06 in groups 1 and 2, respectively). The irrigation protocol consisted of 10 mL of 17% ethylenediaminetetraacetic acid (EDTA) for 1 min followed by 10 mL of 5.25% NaOCl for 3 min. The number of patent dentinal tubules in coronal third of the group 1 was significantly more than group 2 ($P<0.001$). However, this difference was not significant for the middle and apical segments. There was a significant difference in the number of patent dentinal tubules between coronal, middle and apical thirds ($P<0.05$). Increasing the canal preparation size did not lead to better cleanliness of the canal walls and more efficient smear layer removal.[10]

In the present study, mean microleakage among specimens of Group A was 3.85 while mean microleakage among specimens of Group B was 2.94. Mean microleakage was higher among specimens of Group A, the results of which were found to be statistically significant. For SL removal according to the standard protocol, canal rinsing with EDTA was followed by NaOCl rinse, as EDTA may leave the organic components of SL untouched; moreover, NaOCl can also neutralizes any remaining EDTA. According to Moodnik et al, NaOCl is beneficial in debris removal in the middle and coronal thirds but it cannot detach SL and smear plugs inside the dentinal tubules.[11, 12]

CONCLUSION

From the above results, the authors conclude that NiTi files exhibit lesser microleakage. However; further studies are recommended.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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