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Evaluation of Chemical Components Changes in Radicular Dentin After Different Final Surface Treatments

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INTRODUCTION

Sodium hypochlorite (NaOCl) is frequently used as a chemical irrigant for endodontic therapy due to its antibacterial and organic tissue dissolution properties. Its remnants and by-products adversely affect the polymerization of dental adhesive systems (1). Researchers had stated that the bulk of dentin properties could be repaired by more than 60 seconds of application of antioxidant solution before the adhesive procedure, since it can neutralize and reverse oxidizing effect of the NaOCl-treated dentin surface (2).This study aimed to evaluate the effect of varying post-space dentin surface treatment methods by using citric acid CA, sodium ascorbate SA solutions and 970 diode laser DL on the energy-dispersive X-ray (EDX) spectroscopy of dentin composition after surface treatments.

METHODOLOGY

Thirty-six mandibular second premolars were selected; endodontically treated and post-spaces were prepared. The root specimens were divided into four groups n=9/gp according to post-space dentin surface treatments performed; Control group (CL) received 5ml saline; Group (CA) citric acid was treated for 15s with 10%CA then 30s with distilled water; Group (SA) sodium ascorbate was treated with 20ml 10%SA for 10min then washed 30s with distilled water; Group (DL) 970 nm diode laser were irradiated to the specimens in continuous mode, spiral motion for 20s: 1.5W output power, 20 Hz frequency, 238.85 J/cm2 (3). Each specimen was sectioned longitudinally in a bucco-lingual direction into two halves (4). For each half, the elemental analysis of the following elements: C, O, Mg, Ca, and P were conducted on three points along the root canal . (Figure 1)

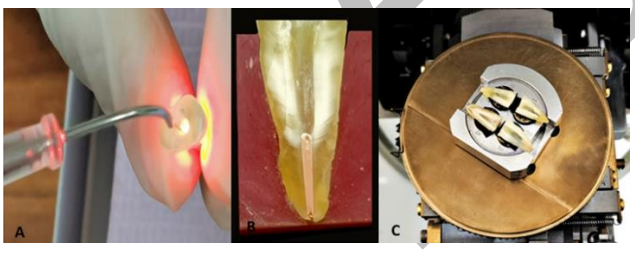

Figure 1:A :Diode laser used for dentin surface treatment B:after sectioning of specimen C:specimens placed in EDX test machine

RESULTS AND DISCUSSION

The comparison of mean difference in mineral levels in the coronal, middle and apical aspect between each group using one-way ANOVA the post hoc Tukey test($P<0.05$). (Table 1). The EDX analysis revealed that the carbon level of citric acid treated root dentin at the three root regions showed statistically significant increase in comparing to other groups. While the calcium, phosphorus and oxygen levels showed statistically significant decrease in comparing to other groups.

These findings were supported by Bosaid et al (5).While for Ca/P there was no significant changes in comparing to other groups, due to the decrease of both Ca, P content. The calcium and phosphorus level of radicular dentin treated with sodium ascorbate solution showed a statistically significant decrease than the CL and DL group. While the level of oxygen and magnesium content, was statistically significant increased in comparing to CA and DL group due to its action as a scavenger to the free radicals. There was no significance difference in Ca/P in comparing with control group. Sodium ascorbate is not a source of Phosphorus ions and causes a decrease in calcium content of tooth as a result there was no change in Ca/ P ratio (6). The radicular dentin treated with diode laser was unable to elicit significant changes in C, O, P, and Ca levels comparing to CL group. These results are in agreement with F.C Lopes, et al showed that laser didn't change the inorganic compounds of root dentin (7). The mineral content at different root regions in each group didn't show statistically significance difference except the SA group apical and middle thirds revealed higher oxygen content in comparing to the coronal third. Also, apical and middle thirds of CA group showed higher phosphorus level in comparing to the coronal third.

*Table (1): Comparison analysis of means and standard deviations of each mineral levels detected at different root regions of dentin in each group (n= 9) P was significant if < 0.05 **

Element		*Group I Control*	*Group II Citric Acid*	*Group III Sodium ascorbate*	*Group IV Diode laser*	*Anova*	*Pvalue*
Carbon	C	19.99 ±1.50	43.73± 4.64	25.90± 4.87	18.55 ±1.11	141.42	0.0001*
	M	19.79±1.00	44.00 ±4.59	22.69± 2.81	21.22± 3.49	162.95	0.0001*
	A	19.35±0.97	43.38 ±2.43	23.61± 4.95	20.37± 4.09	144.39	0.0001*
Anova		1.151	0.090	2.191	2.768		
Pvalue		0.326	0.914	0.124	0.074		
Oxygen	C	43.63± 0.94	32.79± 2.02	41.41± 2.04	44.18± 2.62	90.96	0.0001*
	M	39.05± 14.44	31.40± 9.48	44.02± 1.58	42.85± 2.62	7.953	0.0001*
	A	45.11± 2.59	34.38± 3.01	44.00± 2.33	43.92± 2.34	53.14	0.0001*
Anova		1.244	0.967	8.388	1.179		
Pvalue		0.305	0.388	0.0001*	0.317		
Magnesium	C	0.66± 0.09	0.35± 0.12	0.49± 0.13	0.39± 0.16	11.895	0.0001*
	M	0.61± 0.14	0.38± 0.09	0.55± 0.11	0.41± 0.10	13.22	0.0001*
	A	0.65± 0.12	0.35± 0.05	0.53± 0.13	0.45± 0.22	8.176	0.0001*
Anova		0.424	0.477	1.039	0.605		
Pvalue		0.658	0.623	0.362	0.550		
Phosphorus	C	12.24± 0.54	6.60± 0.51	10.57± 1.01	11.60± 0.89	138.58	0.0001*
	M	12.24± 0.42	7.45± 0.77	10.97± 0.98	11.15± 1.21	66.53	0.0001*
	A	11.84± 0.57	7.50± 0.60	10.89± 1.73	11.24± 1.36	34.64	0.0001*
Anova		1.839	9.485	0.398	0.621		
Pvalue		0.180	0.0001*	0.673	0.541		
Calcium	C	22.57 ± 0.86	13.05 ±1.14	19.75± 2.19	22.25± 2.92	64.23	0.0001*
	M	22.43 ±1.28	14.06± 1.45	21.08± 1.26	21.61± 2.12	81.63	0.0001*
	A	23.05 ±2.41	13.95± 1.35	20.59 ±3.27	21.19 ±2.06	37.77	0.0001*
Anova		0.350	2.626	1.208	0.742		
Pvalue		0.707	0.841	0.308	0.482		
Ca/Ph.	C	1.85± 0.04	1.98± 0.12	1.87 ±0.10	1.91 ±0.17	2.917	0.044
	M	1.83± 0.06	1.90± 0.11	1.93± 0.11	1.94 ±0.14	2.318	0.086
	A	1.95± 0.26	1.86± 0.08	1.89± 0.05	1.89± 0.11	0.977	0.413
Anova		1.770	4.880	1.772	0.483		
Pvalue		0.191	0.124	0.182	0.620		

CONCLUSION

Within the limitations of this in-vitro study, the use of citric acid, sodium ascorbate and diode laser as a surface treatment for post space showed changes in the mineral content of radicular dentin but didn't elicit significant changes in Ca /P ratio .Further studies could be carried out to determine whether theses alterations would affect bond strength of fiber posts to root dentin.

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