Histological Evaluation the effectiveness of Aloe Vera oral gel Application on Gingiva Subjected to Dental Light –emitting Diodes

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Abstract

Background: Aloe Vera (AV) is a medical plant used in dentistry with multiple uses proved as antiseptic, antifungal, antiviral and anti-inflammatory and very good in building the immune system with a natural compound that has no side effect, for that reason we use it as protective layer from the heat that generated from LED light cure during the filling or cementation procedure or others.

Materials and method: Thirty-five male New Zealand rabbits of weight 1.5 –2kg were used in this study; they were divided into three groups. First group (5 rabbits) the gingiva of upper incisors is not exposed to dental LED light cure (control group), Second group (15 rabbits) which the cervical gingiva of upper incisors which is separated from light source by double transparent celluloid strips, cervical gingiva is exposed to LED curing light 6 seconds three times with 20 seconds interval. Third group (15 rabbits) same as 2nd group but gingiva covered by Aloe Vera oral gel. Animals' scarifications were done at (0 day) immediately after exposure to curing light ,3 days,7 days healing intervals. Routine processing and sectioning technique was performed for histological evaluation.

Results: Histological findings indicated variation in epithelial thickness, irregularity in basal cells layer and number of blood vessels of 2nd & 3rd experimental groups from 1st control group. The highest mean values of all measured Histomorphometrical parameters were observed in 2nd group 3 days after dental LED light cure exposure.

Conclusion: Aloe Vera oral gel may be used on gingiva as a protective layer to decrease side effects of LED light cure on gingiva.

Key words: *Aloe Vera, gingiva, Light –emitting Diodes, rabbit*

Introduction

Aloe vera(AV) is a medical plant used in dentistry and proved as antiseptic, antifungal, antiviral and anti-inflammatory properties [1] . The magical healing property of Aloe Vera is due to a compound called glucomannans, Glucomannans enhances fibroblast growth factor and encourages the proliferation and activity of these cells result in more number of collagen and elastic fibers. Low molecular weight compounds present in aloe inhibit the production of reactive oxygen free radicals from activated human neutrophils [2] Because of the effect of LED light cure with high intensity of 1500-2000mw\watt, and the heat generated during the procedure of filing or cementation. This high intensity can damage nearby tissue like oral mucosa Although this temperature range depends on LED type, radiant emittance, and tooth characteristics, [3] there is a consensus that the use of some LED because of the high temperature generated to approximately 41°C. Although the temperature increase that cause severe thermal damage on the gingival tissue is still unknown, approximately 67 % and 77 % of the tissues exposed to light for 40 and 60 seconds,

respectively, developed a gingival lesion [4] For that reason AV was used in this study as a protective layer on the gingiva because of anti-oxidant effect also, and it act as moisturizer, soothing and cooling agent.

Materials and Method

The materials used in the present study were dental diode curing light 1800 mW/cm2 (China), Aloe vera oral gel (Drwolfe, New México), transparent celluloid strips (PD,SWESS) anesthetic solution: Ketamine hydrochloride 50 mg and Xylazine 2%, formalin 10%,ethanol alcohol 96%,xylol, paraffin wax, and Hematoxylin and Eosin (H&E) stain. Thirty-five male New Zealand rabbits of weight 1.5 –2kg were used in this study, they were divided into three groups. First group (5 rabbits) the gingiva of upper incisors is not exposed to dental LED light cure (control group), Second group (15 rabbits) which the cervical gingiva of upper incisors which is separated from light source by double transparent celluloid strips. cervical gingiva is exposed to LED curing light 6 seconds three times with 20 seconds interval. Third group (15 rabbits) same as 2nd group but gingiva covered by Aloe Vera oral gel. Animals were scarified by an overdose of anesthetic solution at (immediately after exposure to curing light (0 day) ,3 days,7 days) intervals. The specimens were fixed in 10% buffered formalin for 24h, then gingival tissue dehydrated with alcohol and embedded in paraffin. Sections of 5µm were prepared in the usual fashion, and stained with hematoxylin and Eosin stain.

Histological evaluation was performed using light microscope (OpticaB-350,Italy). Histomorphomatrical parameters are measure the epithelial thickness (EP. TH.) [5] , percentage of basement membrane length to epithelial surface length (BML\EPSL) [6] and number of blood vessels (B.V). Measurements were performed by image processing software program (ImageJ.exe) [7] . Microphotographs were taken by a camera (AIPTEK HD 1080P, China) attached to the microscope at power X40.

Statistical Analysis

The data were entered and analyzed using SPSS 18.0. Mean ± SD Min. and Max. were given for quantitative variables. Tukey HSD test was applied to observe associations between groups and morphological changes. A P-value ≤0.05 was considered as statistically significant.

Results

Histological evaluation:

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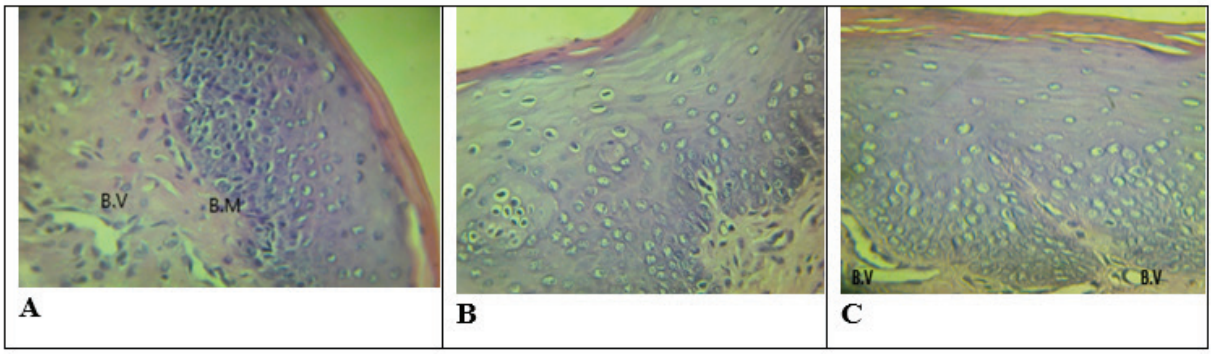

Fig. 1: Hematoxylin Eosin staining of the gingival tissue of rabbits in 0 day. (A) control

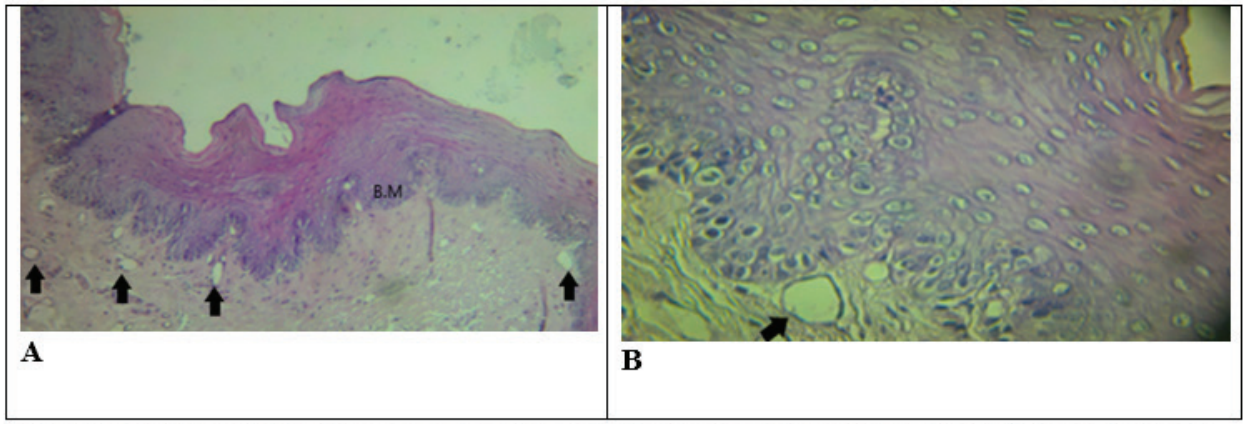

Fig. 2: Hematoxylin Eosin staining of the gingival tissue of rabbits in the 3 days interval (A) 2nd group show irregular both epithelium surface and basement membrane (B.M)

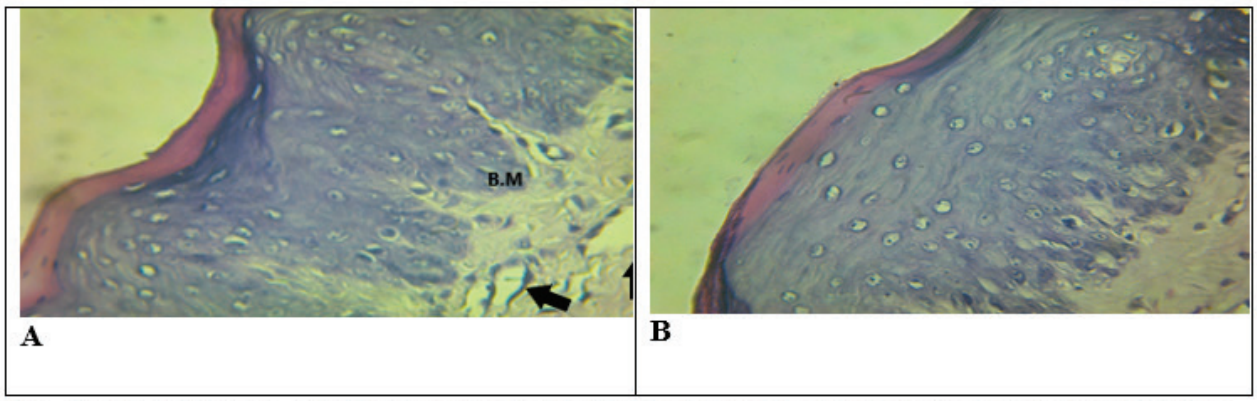

Fig. 3: Hematoxylin Eosin staining of the gingival tissue of rabbits in the 7 day healing

Histomorphometrical analysis

The highest mean values of all measured parameters were observed in 2nd group 3 days after dental LED light cure exposure (Table 1). While at 3 days healing interval: A high significant difference noticed in this healing period among all groups in all parameter, Highest mean value of all measured parameters recorded in 2nd group((EP.TH.) 0.586, Percentage of basement membrane\epithelial surfaces 361.8 and blood vessls number was 38.8. At 7 days, 3rd experimental group shows a normalcy gingival epithelium features when there are a non significant differences in(EP.TH.) and blood vessels number between 1st and 3rd group, But in 2nd experimental group still there are high significant differences from other groups.

Table 1: Descriptive statistics and group differences in 0 day duration of measured epithelial parameters.

Parameters	Groups	Descriptive statistics					Comparison			
							ANOVA test		Tukey HSD test	
		N	Mean	S.D.	Min.	Max.	F-test	p-value	Groups	p-value
Epithelial thickness	I	5	0.24	0.016	0.22	0.26	6.328	0.013	I-II	0.019
	II	5	0.29	0.025	0.26	0.32			I-III	0.031
	III	5	0.286	0.030	0.25	0.32			II-III	0.965
Percentage of basement membrane\epithelial surfaces	I	5	130.6	6.107	125	139	87.674	0.000	I-II	0.000
	II	5	167	2.739	164	171			I-III	0.000
	III	5	151.2	3.493	147	156			II-III	0.000
Numbers of blood vessels	I	5	20.2	1.924	18	23	0.361	0.704		
	II	5	21	2.550	18	24				
	III	5	21.4	2.302	18	24				

Discussion

Visible Light Cure (VLC), a blue light with a wavelength between 400-500 nm [8] . Its can cause thermal reaction**(5).** Complaints from patients in connection with light-curing procedures have been reported, including experience of Burning sensations in teeth and in oral tissue [9] We used rabbits of New Zealand breed, as morphological features of rabbits are closely similar to human gingival mucosa as well as ease of their availability.(Nanci,2008) This study showed histological changes induced by LED dental light cure (1800mW/cm2) can incite thermal energy in biological tissues which can cause burns. .Visible light cure absorbed by Cytochrome form excessive Reactive Oxygen Species (ROS) which can cause cell damage (Voskanyan KS. 2009)

Increase in (EP.TH.), (B.V) and (BML\EPSL) in response to elicit tissue damage this agree with Abdul khaliq in 2016 [10] observed Acanthosis and the hyperplasia of prickle cell layer. In present study increase in blood vessels in 3 days interval can attributed to increase blood supply to overcome oxidative stress. Regarding 3rd group, Using Aloe Vera gel protection shows non significant difference between 1st and 3rd groups in (EP. TH.)and (B.V) which resemble normal gingiva this may be due to anti-inflammatory effect and angiogenesis of Aloe Vera gel [11].

Conclusion

Aloe vera oral gel may be used on gingiva as a protective layer to decrease side effects of LED light cure on gingiva by decrease (EP.TH.), (B.V) and (BML\EPSL) changes and accelerates return to normal condition.

Financial Disclosure: There is no financial disclosure.

Conflict of Interest: None to declare.

Ethical Clearance: All experimental protocols were approved under the AL-Rafidain University Collage, Baghdad-Iraq and all experiments were carried out in accordance with approved guidelines.

References

1. Gao Y, Kuok KI, Jin Y, Wang R. Biomedical applications of Aloe vera. Critical reviews in food science and nutrition. 2019;59(sup1):S244-S56.

2. Nithin V, Krishnan AR, Raj SV, Thomas D, Gopinathan PA. “Aloevera” the herbal product in dentistry. President’s Message. 2018;8(2):43.

3. Zarpellon D, Runnacles P, Maucoski C, Coelho U, Rueggeberg F, Arrais C. Controlling In Vivo, Human Pulp Temperature Rise Caused by LED Curing Light Exposure. Operative dentistry. 2019;44(3):235-41.

4. Rueggeberg FA, Giannini M, Arrais CAG, Price RBT. Light curing in dentistry and clinical implications: a literature review. Brazilian oral research. 2017;31.

5. Murdiastuti K, Suryono S, Moeljono A, Sari MP, Gamawati R. The Effect of Visible Light Cure (VLC) Exposure to Gingival Tissue’s Sprague dawley Rats. The Indonesian Journal of Dental Research. 2011;1(2):78-83.

6. Stankovic ST, Cabunac J, Kanjevac T, Milosavljevic

Z. Differential histomorphometric changes in normal and inflamed gingival epithelium. Sanamed. 2016;11(3):197-201.

7. Razouki NA, Ghani BA. Histological Evaluation of Effect of beta-Tricalcium Phosphate on Bone healing in Alloxan-Induced diabetes. Journal of Baghdad College of Dentistry. 2016;325(3765):1-7.
8. Tokgoz SC, Anous N, Yarkan S, Khalil D, Qaraqe KA, editors. Performance Improvement of White LED-Based VLC Systems Using Blue and Flattening Filters. 2019 International Conference on Advanced Communication Technologies and Networking (CommNet); 2019: IEEE.
9. Mouhat M, Mercer J, Stangvaltaite L, Örtengren U. Light-curing units used in dentistry: factors associated with heat development—potential risk for patients. Clinical oral investigations. 2017;21(5):1687-96.
10. Khaliq A, Naseem N, Anjum R, Nagi A. MORPHOLOGICAL CHANGES IN ORAL MUCOSA OF RABBITS INDUCED BY LIGHT EMITTING DIODE (LED) USED AS DENTAL CURING LIGHT. Pakistan Oral & Dental Journal. 2016;36(1).
11. Yos Adi Prakoso K. The Effects of Aloe vera Cream on the Expression of CD4+ and CD8+ Lymphocytes in Skin Wound Healing. Journal of Tropical Medicine. 2018;2018.