Expression of Syndecan 1 on Periodontium treated with Topical Application of Aloe-Vera

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ABSTRACT

Background: Periodontium mainly exposed to injury by trauma or pathologic diseases, *Aloe vera* is a plant has many basic ingredients in its extracted gel that acts as wound healing accelerator in addition to that it's safe, and economical and without recordable of side effect. This study aimed is to evaluate the effect of topical application of *Aloe vera* on expression of syndecan -1 by periodontium tissue.

Materials and methods: Thirty six male Albino rats were subjected for periodontium defect by electric scaler on the distal sides of both lower anterior teeth. The animals divided into two groups; control group (without treatment) and the experimental group treated with 1µL*Aloe vera* gel/normal saline. Periodontal healing was examined at periods (3, 7, 14 days) for immunohistochemical localization of syndecan 1.

Results: Immunohistochemical examination of this study revealed that the aloe vera treatment increase expression of syndecan 1 by epithelial cell, osteoblasts, fibroblast, stromal cells and with highly significant differences in comparison with control and saline.

Conclusion: *Aloe vera* gel may affect the expression of syndecan 1 which seems to play a role in periodontium healing.

Key words: *Aloe vera*, periodontium, syndecans. (J Bagh Coll Dentistry 2016; 28(3):82-86).

INTRODUCTION

Periodontium injury healing is a series of biological processes; include migration, adhesion, proliferation, and differentiation of several cell types. All these activities are triggered by chemo-attraction of the cells; polypeptide mediators bind to their cell-surface receptors, integrins bind to extracellular matrix components, and different growth factors regulate different cell functions. The process is ending with the formation and maturation of a new extracellular matrix [(1-3)].

Syndecan 1 is type-I-transmembrane cell surface Heparansulphat proteoglycans (HSPGs) [(4)]. Syndecan -1 has an essential role in mediating cell proliferation, cell migration, and cell-matrix interactions by binding various extracellular matrix proteins via its heparansulphate chains during wound healing [(5-6)].

Aloe vera is a plant has many health benefits such as anti-inflammatory, antibacterial, antiviral, and wound healing acceleration, used in different fields like cosmetology, dermatology, and dentistry [(7)]. Aloe vera gel consists of many ingredients such as vitamins, enzymes, minerals, hormones and polysaccharides (acemannan),these contents play important roles in wound healing process. The present study has been prepared to illustrate the effect of local application of aloe vera gel on expression of syndecan -1 in periodontium wound healing.

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MATERIALS AND METHODS

Animals

Thirty six albino rats weighting (250-400) gram, aged (6-8) months were used in the present study, maintained under control conditions of temperature, drinking and food consumption. All experimental procedures were carried out in accordance with the ethical principles of animal experimentation.

The animals were divided into control and experimental group:

A. Control group the periodontium defect left without any treatment and its number represented the all number of the following experimental groups as the right side of each animal considered to be the control.

B. Experimental group was subdivided into following groups according to the applicable of biomaterials includes:

- **Group 1 contains (18) rats**, the periodontium defect treated with 1µL normal saline.
- **Group 2 contains (18) rats**, the periodontium defect treated with 1µL of A. *vera* gel.

Materials

- Aloe vera Gel 87.399%, Phytocare Company.
- Anti-Syndecan– 1 monoclonal from Abcamcompany UK (ab34164)

Methods

Immunohistochemical evaluation

The animals were sacrificed at 3,7,14 days (six rats for each period). The specimens were fixed by 10% buffered formalin for 3 days. The samples

then demineralized, dehydrated, and embedded in paraffin. Five µm thickness of section was prepared for localization of immune-reaction of syndecan 1.

Determination of immunohistochemical results for syndecan 1

For each specimen, the number of positive expression of syndecan 1 was determined by evaluating 100 cells for each slide in five high power fields (HPF) counting the positive one, then the mean of count for eight slides for each sample[8].

Statistic Analyses

A. Descriptive data analysis.
B. Inferential data analysis

RESULTS

Result for immunohistochemical findings of syndecan 1

Expression of syndecan 1for over all periods in each group was detected by cementoblast cell, osteoblast cell, and keratinocyte. Experimental group records a strong expression .Saline group shows a negative expression of Syndecan-1 in epithelial cell layers of gingivae, while a positive results was illustrated by lymphocyte in lamina properia. Some fibroblasts cell in periodontal ligament shows negative expression (figures1, 2, 3).

Table (1) shows that *A. vera* group records a highly significant differences for the expression of syndecan 1 in periodontium cells include epithelial cells, stromal cell, periodontal ligament cell, bone cells in comparison to control and saline groups.

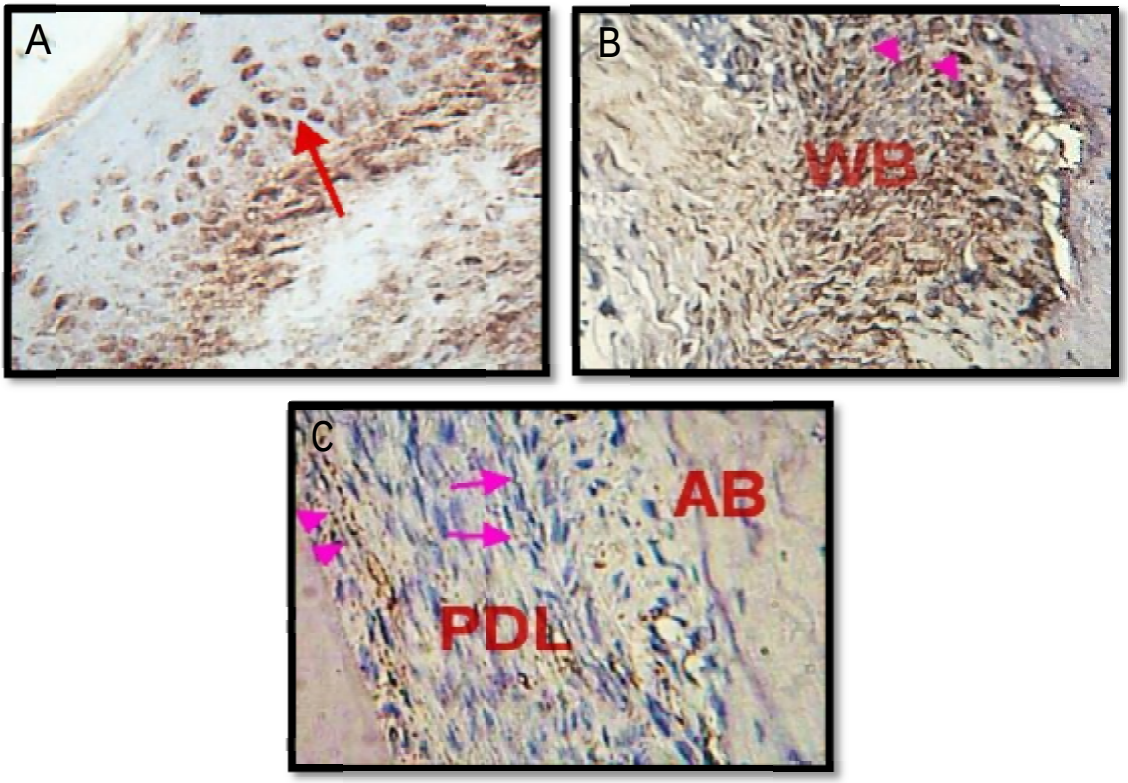

Figure 1: Control group with immunohistochemical expression of syndecan 1 (DAB Stain) (A) At 3rd day, Keratinocyte cell (arrow)expressed positive DAB stain for syndecan -1.DAB stain X20. (B) At 7th day, Woven bone (WB) shows positive expression of syndecan -1by osteoblast (arrow heads) .DAB stain X20. (C) At 14th day,View for periodontal ligament (PDL) , alveolar bone (AB) shows positive immune reaction for syndecan -1 by cementoblast (arrow heads) while fibroblast shows negative (arrows) .DAB stain X20.

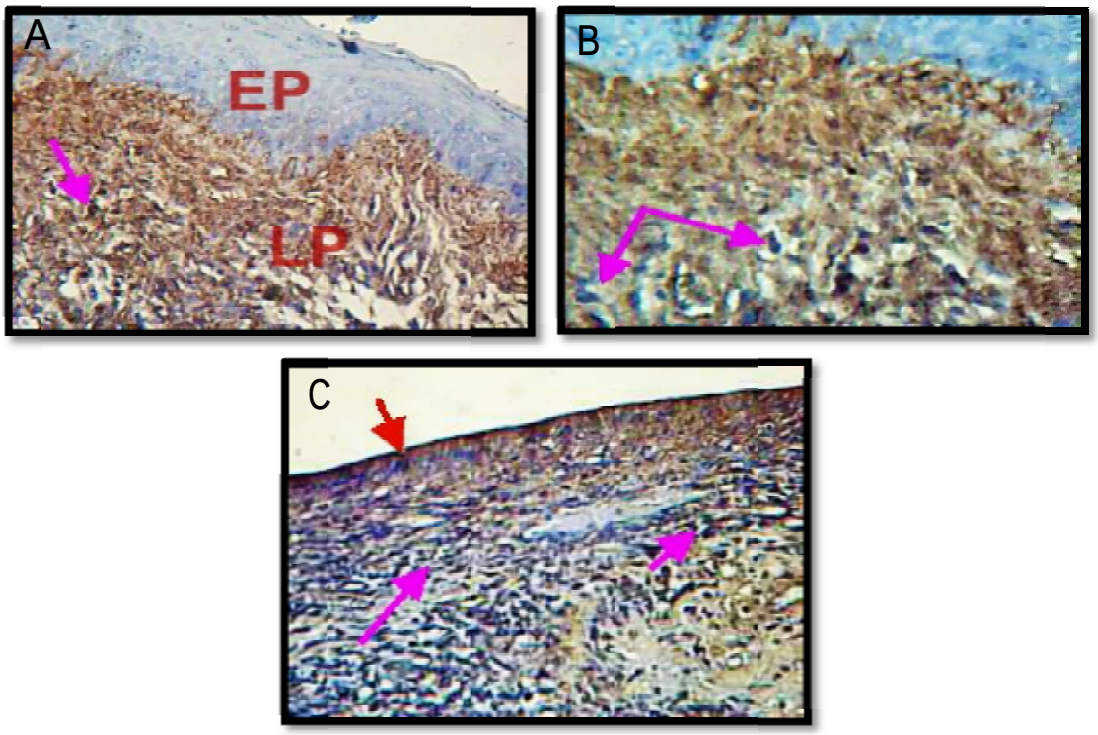

Figure 2: experimental group (normal saline) with immunohistochemical expression of syndecan 1 (DABStain). (A) At 3rd day, Epithelial cell (EP) of gingiva of saline group shows negative expression for syndecan -1 ,while lamina properia (LP) shows positive expression by lymphocyte (arrow).DAB stain X20. (B) Magnifying view for lymphocyte cell (arrows) with positive expression of syndecan -1 .DAB stain X40. (C) At 14th day, Positive expression of syndecan -1 in saline group by sulcular epithelia (red arrow) ,inflammatory cell (pink arrows).DAB stian X20

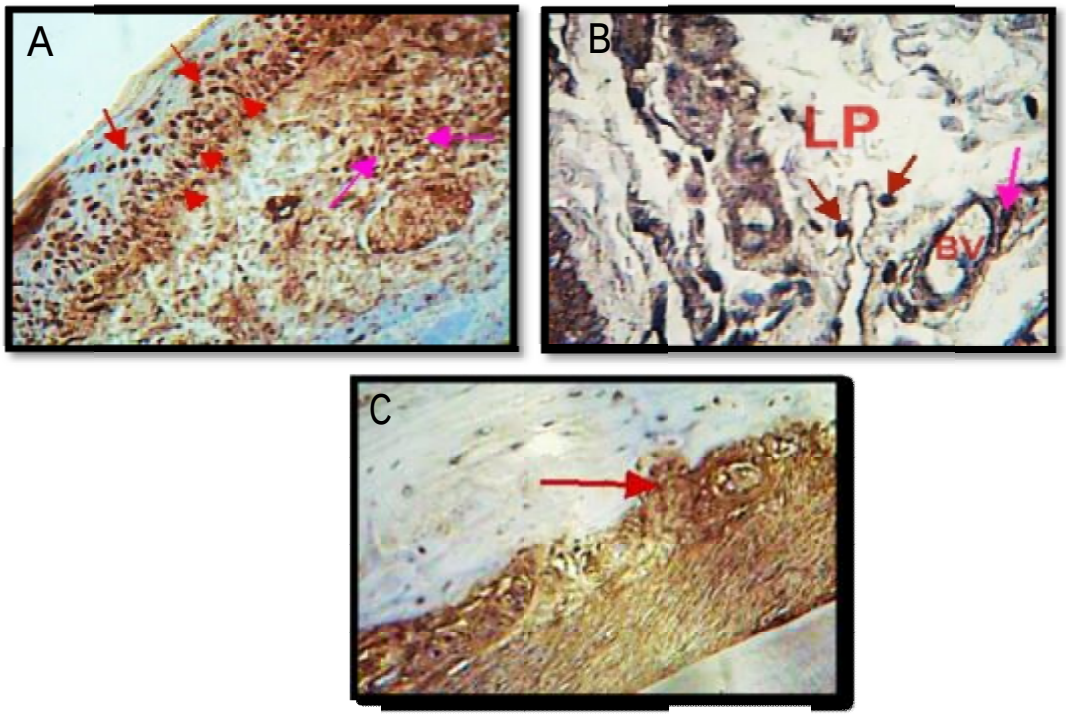

Figure 3: experimental group (Aloe vera) with immunohistochemical expression of syndecan 1 (DAB Stain). (A) At 3rd day, Positive expression of syndecan -1 by keratinocyte cells include basal cell (red arrow heads),prickle cell (redarrows),inflammatory cell (pink arrows).DAB stain X 10. (B) At 7th day, Lamina propria (LP) shows positive expression of syndecan -1 by plasma

cell (red arrows), endothelial cell (pink arrows), lining blood vessel (BV). DAB stain X40. (C) At 14th day, Osteoclast (arrow) illustrates positive. DAB stain X20

Table1: Statistic analysis of positive expressed cells for syndecan 1 in the studied groups with comparisons significant

Type of Pos.	Groups	No.	M	SD	SE	Min.	Max.	Levene's test		ANOVA test	
								L	P-value	F	P-value
Epithelial cell	Saline	6	2	0.52	0.21	1	2	0.308	0.740 NS	81.47	0.000 HS
	Control	6	4	0.89	0.37	3	5				
	Aloe Vera	6	8	1.10	0.45	6	9				
Stromal cells (Ging.)	Saline	6	4	0.98	0.40	3	5	4.308	0.033 S	20.21	0.000 HS
	Control	6	7	1.67	0.68	5	9				
	Aloe Vera	6	8	0.52	0.21	8	9				
Periodontal ligament	Saline	6	8	0.82	0.33	7	9	5.281	0.018 S	59.69	0.000 HS
	Control	6	9	0.41	0.17	8	9				
	Aloe Vera	6	13	1.37	0.56	12	15				
Bone cells	Saline	6	6	0.63	0.26	5	7	8.015	0.004 HS	74.31	0.000 HS
	Control	6	11	1.72	0.70	9	13				
	Aloe Vera	6	20	2.88	1.17	17	24				

(*) HS: Highly Sig. at P<0.01; S: Sig. at P<0.05; NS: Non Sig. at P>0.05

DISCUSSION

The present study used *Aloe vera* gel in periodontium defect related to its ability to accelerate wound healing. *Aloe vera* increased syndecan 1 expression in epithelial cells, precursor progenitor cells and in early stage of cell proliferation of mesenchymal cell, and in inflammatory cells, and cementoblast. These results were in agreement with Filatova *et al.* [9] study, who show that syndecan-1 is distributed in distinct areas of the epithelium and mesenchyme during the early and late stages of odontogenesis, and with Bernfield *et al.* [10] and Kero *et al.* [11] that reported syndecan-1 is the major syndecan in epithelial cells. Positive expression of syndecan-1 in keratinocyte was reported in the present study and this is in agreement with Stepp [12] who suggested that syndecan -1 has a role as a regulator of gene transcription in keratinocytes and keratinocyte activation after injury. The present results illustrates positive immune reaction for syndecan- 1 by osteoclast in their active stage, these results coincide with Pap and Bertrand [13] who found that syndecan-1 present in both osteoblasts and osteoclasts of the alveolar bone that make syndecan-1 may play a role in alveolar bone formation and remodeling. Present findings for saline group which associated with high inflammatory score, shows negative expression of Syndecan-1 in epithelial cell layers of gingiva, while lamina properia shows positive expression by lymphocyte.This result coincides with Götte *et al.*[14] who found that expression of syndecan-1 in suprabasal keratinocytes of the epithelium was weak or absent in inflamed tissue. Some fibroblast cells show negative expression of syndecan -1, these findings may explained by some cells have the same histological feature of fibroblast and could be myofibroblast cell that appeared mostly in wound tissue.

In conclusion, Aloe vera gel increased expression of syndecan -1 in periodontium wound as a result to its property in accelerating biological processes of wound healing.

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