Clinical Trial of KoCarbonAg® Antimicrobial Dressing

Healing Effect of Silver Impregnated Activated Carbon Wound Dressing on Deep Dermal Burn

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I. Summary of proposal

1. Study objective

To investigate wound healing effects of BCT Antimicrobial Dressing on deep dermal burn.

2. Number of subjects

30 eligible subjects

3. Criteria

Inclusion Criteria	Exclusion Criteria
1. The total burn area is between 5% to 30% 2. Male/Female of any race aged between 20 - 80 years old 3. Non taking any medicine containing steroid 4. No allergy to activated carbon fiber and silver 5. No history of cardiovascular diseases, diabetes mellitus, immune system-related diseases, hepatic disease, hematic diseases, renal diseases, and cancer	1. Wounds located on the scalp, external genital organs, joint, fingers or toes. 2. If development of fever or suspected symptoms of sepsis were observed, the patient should be excluded immediately and given appropriate treatment.

4. Study design

(1) After hospitalized patients are diagnosed as deep dermal burn, the procedure of Informed Consent is conducted by the project investigator.

(2) As long as the patient agrees to join this clinical trial and signs the Informed Consent, two separate areas of 25 cm^2 in the same anatomic site are chosen and distributed to the control and research groups respectively by coin flipping.

(3) The wound in the research group is first cleansed with normal saline and then applied with BCT Antimicrobial Dressing and covered by sterile gauze, and dressings will be changed every 3 days (counting from the day applied BCT dressings: Day0, 3, 6, 9, 12, 15……etc.) until the wound is healed.

(4) Flamazine is applied on the wound in the control group instead and then covered with sterile gauze, and the frequency of dressing change is daily until the wound is recovered.

(5) The healed and non-healed area of wound is recorded and photographed every 3 days, and the wound color and infection are also evaluated. The ending point is set on the 21st day.

(6) Efficacy Measurements

Healing Percentage =[(The initial wound area-wound area measured on Day N)/the initial wound area]x100%. N means the number of days counting from the first day initiating this clinical trial

Graft area: Comparison graft area of A_E with A_C (cm^2)

A_E: area of experiment ; A_C: area of control

Wound Color Parameters: Use colorimeter to measure five areas on the wound surface

Infection: With the record of “positive” or “negative” diagnosed by project investigator.

Frequency of Dressing Change: Record the total number of dressing changes during hospitalization.

5. Statistics Analysis

McNemar’s test、Wilcoxonsigned rank test and paired Student's t-test will be performed to analyze the clinical data by comparing the difference of the healing percentage, the healing rate, the infection rate, and the frequency of dressing change. It is statistically significant when $P<0.05$

II. Close Report of Clinical Trial

1. Date of Close Report: 2014/3/27

2. Study Duration: 2012/5/31~2014/2/26

3. Outcome Analysis

(1) Patient Profile

N = 30	
Sex ratio (female : male)	7 : 23
Age	46.70 ± 17.18
Total body surface area of burn	15.29 ± 7.85
Types of burn	
Scald	11
Flame	14
Electrical	3
Chemical	1
Friction	1
Burn location	
Lower extremities	8
Upper extremities	12
Main trunk	10
Time from the beginning of the study to the ending point	10.27 ± 4.45
Disease under control (diabetes mellitus, hypertension)	3

Note: Ddb-16 and Ddb-30 patients have history of diabetes, Ddb-29 patient has history of hypertension. They were included because their conditions were under good control.

(2) Spontaneous Healing vs. Graft

End point for Ddb (N = 30)				
Patient numbers (%)		A_C (Area of Control)		*P*
		Spontaneous healing	Graft	
A_E (Area of experiment)	Spontaneous healing	6 (20.00)	4 (13.33)	1.000
	Grafting	4 (13.33)	16 (53.33)	

McNemar's Test

6 subjects (20%) were spontaneous healed for both experimental and control areas. 16 subjects (53.33%) were grafted for both experimental and control areas. 4 subjects were spontaneous healed for

experimental area but grafted for control areas. 4 subject was grafted for experimental area but spontaneous healed for control areas.

(3) Spontaneous Healing Time

Terminal of healing time (days) mean ± sd	Ddb (N = 6)		
	A_E	A_C	*P* value
	11.83 ± 3.06	13.83 ± 3.71	0.2500

Wilcoxon signed rank test

There were 3 subjects who have healing time of experimental area shorter than that of control area, 2 subjects who have same healing time for experimental and control areas, 1 subjects who have healing time of experimental area longer than that of control area.

(4) Percentage of Spontaneous Healing Area

Ddb (N = 6)	Mean healing percentage (%)		Δ E-C	*P* value
Day	A_E	A_C		
0	0.00	0.00	0.00	-
3	5.02	20.12	-15.09	0.5000
6	50.76	73.28	-22.52	0.3125
9	75.20	82.03	-6.83	0.8438
12	98.66	92.13	6.53	0.5000
15	100.00	95.75	4.25	1.0000
18	100.00	98.52	1.48	1.0000
21	100.00	98.95	1.05	1.0000

Wilcoxon signed rank test

In general, the healing percentage of both experimental and control areas were increased along with time. The healing percentage was increased most dramatically during 3rd to 6th day, with more than 50% increase in both areas.

(5) Graft area

	A_E	A_C	*P* value
Area numbers	16	16	
Graft area (cm^2)	21.37 ± 5.02	21.77 ± 4.82	0.7906

* Wilcoxon signed rank test

For 4 other subjects (Ddb-1, Ddb-3, Ddb-9 and Ddb-29) who have spontaneous healing in experimental area but graft in control area, the graft area were 19.20, 7.65, 25.00 and 18.50 (cm^2), respectively. For 4 subjects who obtained graft in experimental area but spontaneous healing in control area (Ddb-8, Ddb-15, Ddb-16 and Ddb-20), the graft area were 7.62, 25.00, 4.20, 25.00 (cm^2), respectively.

(6) Wound Color Analysis

Wound color parameters (N = 6)							
Mean ± SD	A_E			A_C			
	D_0	D_H	*p* value	D_0	D_H	*p* value	
L*	32.83 ± 6.19	30.26 ± 5.86	0.515	30.61 ± 7.54	32.67 ± 6.76	0.670	
a*	20.00 ± 2.49	22.49 ± 2.45	0.184	19.76 ± 3.69	21.03 ± 4.84	0.679	
b*	11.43 ± 4.83	11.48 ± 5.37	0.910	11.88 ± 5.54	10.28 ± 2.84	0.505	
E	16.40 ± 3.27	19.19 ± 2.58	0.196	17.53 ± 5.94	17.30 ± 4.36	0.949	
M	36.78 ± 5.98	33.43 ± 12.89	0.460	39.87 ± 8.20	38.39 ± 7.10	0.654	Paired t test

D_o: The day the patient was included in the trail D_H: The day the wound was healed
lightness (L*), redness (a*), yellowness, (b*), erythema (E), melanin (M)

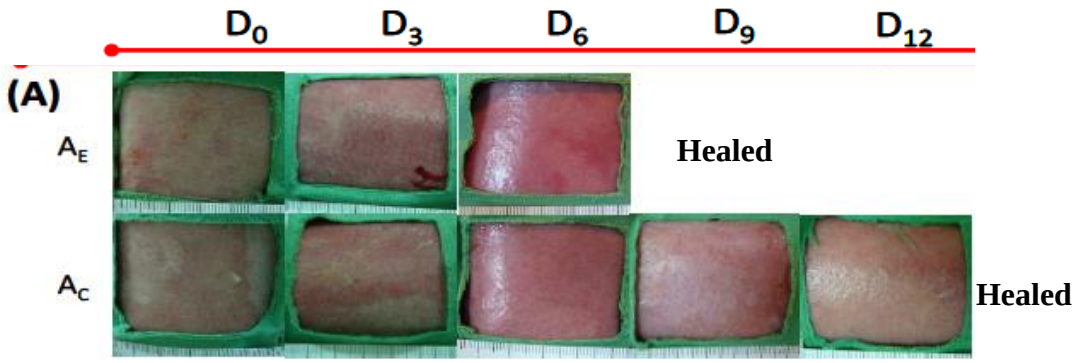
(7) Frequency of Dressing Change

Dressing change in Ddb (Average ± SD ,N = 30)		
Experiment (piece of BCT)	Control (times of Flamazine)	p Value
4.00 ± 1.8	10.37 ± 4.75	0.0000***

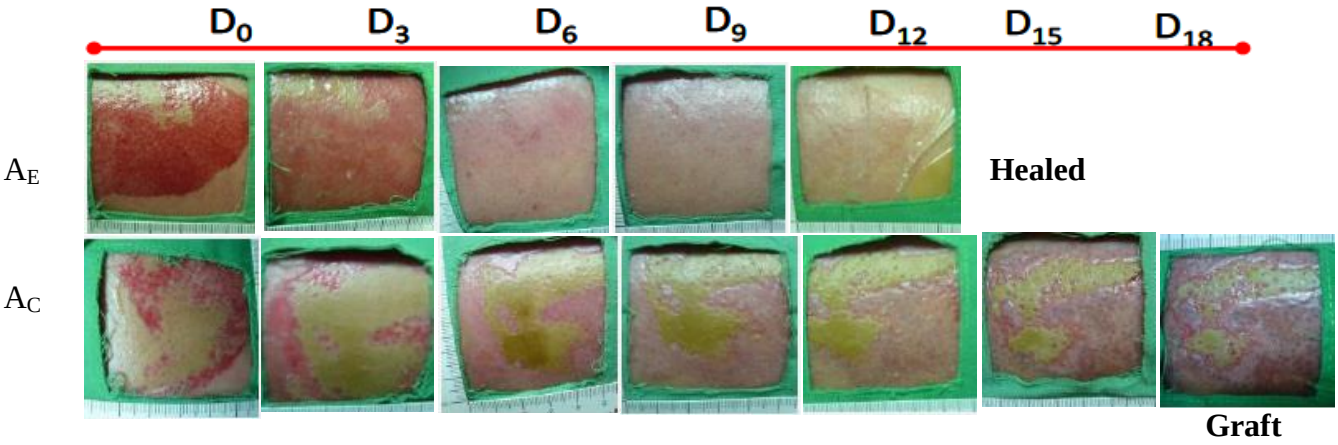
Experimental group (KoCarbonAg®) were designed for changing every 3 days, whereas control group (Flamazine + gauze) changed daily. The result indicated that experimental group changed 4 times in average and control group changed 10 times in average. The frequency of dressing change in experimental group is significantly less than that in control group ($p < 0.001$). In order to understand whether the frequency of dressing change matched the trail design, we defined expecting change as changing KoCarbonAg® once for 3 days, whereas change KoCarbonAg® less than 3 days defined as un-expecting change. 15 subjects (50%) obtained dressing change in accordance with the protocol (i.e. once every three days), while others did not (unexpected dressing change. Among the un-expecting change, 8 subjects obtained un-expecting change in first 5 days and the most frequent un-expecting change occurred on day 1.

4. Representative case photographs

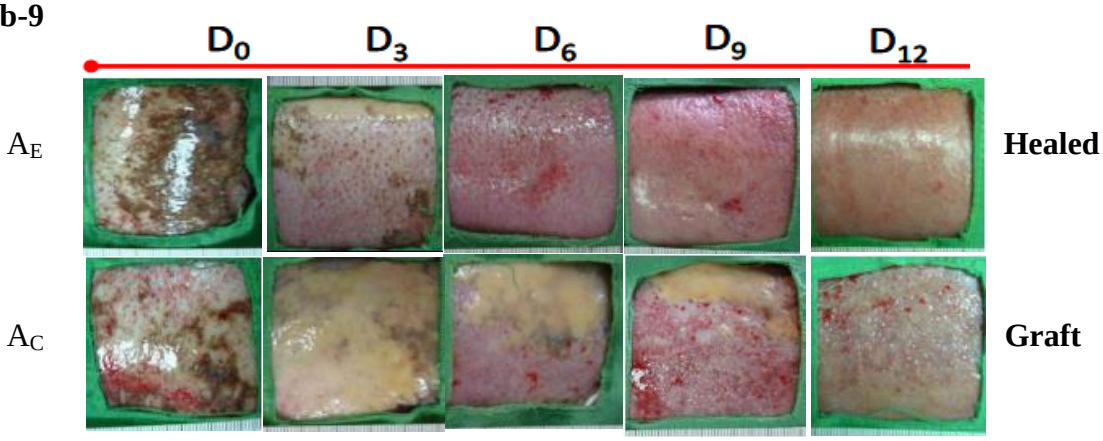
Ddb-5



Ddb-3



Ddb-9



5. Conclusion

The healing time for KoCarbonAg® group (11.83 ± 3.06 days) is shorter than that for Flamazine group (13.83 ± 3.7 days); the number of wounds required skin graft is the same in KoCarbonAg® group and Flamazine group. There was no significant difference between these two groups after statistical analysis in terms of healing percentage, graft area and wound color analysis. However, for the frequency of dressing change, KoCarbonAg® is significantly less than Flamazine, this indicated that KoCarbonAg® can avoid the pain and discomfort derived from dressing change and also reduce the cost of medication and manpower.

Supplement Table:

Expense analysis

If the patient is 1.6m height, 50 kg and 9% TBSA, the expense for three days are:		
For three days care	**Flamazine Cream**	**KoCarbonAg®**
Price of cream or dressing	NTD 2637 (Three bottles)	NTD 500 (One piece)
Expense for wound management	NTD 7251 (Three times)	NTD 2417 (One time)
Total	NTD 9888	NTD 2917
For three days care, the expense of KoCarbonAg® is 0.3 of that of flamazine cream.		