

# Comparison of Efficacy of 1% Silver Sulfadiazine and Acticoat™ for Treatment of Partial-Thickness Burn Wounds

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**Background:** Acticoat (Smith & Nephew, Hull, UK) is a silver-coated dressing reported to reduce infection and exhibit antimicrobial activity in wounds.

**Objective:** The purpose of the present study was to compare the efficacy of acticoat and 1% silver sulfadiazine (1% AgSD) for treatment of partial thickness burn wounds.

**Material and Method:** The authors reviewed 50 patients who had partial thickness burn wounds less than 25% admitted to Siriraj Burn Unit from May 2002 to September 2005. All patients were divided into 2 groups: the acticoat treated group (25 patients) and the 1% silver sulfadiazine treated group (25 patients). The 2 groups were compared for the etiology of burn wound, demographic data including age, sex, % Total Body Surface Area burn (TBSA%), cultured organisms, wound infection and outcome of Length Of hospital Stay (LOS) and level of pain.

**Results:** The authors found no significant differences in age, TBSA(%) between both groups. 7 patients (28%) developed wound infection. There were no differences in wound infection and LOS between both groups ( $p > 0.05$ ). All of the patients who developed wound infection responded well to targeted topical and systemic antibiotic treatment. The 1% AgSD treated group (6 of 25, 24%) obtained more split thickness skin graft to close the granulation defects compared to patients who were treated with acticoat™ (4 of 25, 16%) but no statistical significance,  $p = 0.32$ ). Average pain scores in the acticoat™ treated groups were significantly lower than the 1% AgSD treated group (4.6 versus 5.7, respectively).

**Conclusion:** The present study confirms the efficacy of acticoat treatment in partial thickness burn wound. The authors conclude that acticoat has an advantage of limiting the frequency of replacement of the dressing and provides a less painful alternative to wound care with 1% AgSD with comparable incidence of burn wound infection. This is due to its long wear time and the ease of application and removal.

**Keywords:** Silver sulfadiazine, Silver-coated dressing, Burn

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Acticoat™ (Smith and Nephew USA, Largo, FL) is a non-adherent nanocrystalline silver coated material that has recently been introduced as a burn wound dressing. It is a three-poly gauze dressing that consists of a core made of absorbent rayon and

polyester coated and each side are made with a polyethylene mesh where silver has been deposited by physical vapor deposition<sup>(1)</sup>.

For standard burn wound care, Acticoat™ has a lower minimum inhibitory concentration, a lower minimum bactericidal concentration and faster bacterial killing capacity than a dressing with topical antibiotic silver nitrate or sulfadiazine<sup>(2)</sup>.

The purpose of the present study was to compare the efficacy of 1% silver sulfadiazine and silver-

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coated dressing acticoat™ for treatment of partial-thickness burn wounds.

## Material and Method

### Patient population

Fifty patients, with partial thickness burns of less than 25% Total Body Surface Area (TBSA) and admitted to Burn Unit at Siriraj Hospital between January 2002 and December 2004, were enrolled in the present study.

### Study design

Fifty patients were identified and randomized into 2 groups and given burn wound treatment with 1% silver sulfadiazine (25 patients) or acticoat™ (25 patients). Both groups were compared with regard to patient demographics including age, sex, type of burn, TBSA burn (%), Length Of hospital Stay LOS (days), day of first using acticoat™ or silver sulfadiazine. Patients were also reviewed for documentation of efficacy of treatment including day of burn wound closure, pain scores, type of cultured organisms, wound colonization and infection, surgical procedures and mortality between both groups.

### Wound dressing protocol

In the acticoat™ treated group, the experimental treatment consisted of the application of an acticoat™ moistened in sterile water, then a dry dressing. The inner gauze was moistened twice a day with sterile water and the acticoat™ was changed every three days. The other treatment was the application and removal of 1% silver sulfadiazine (AgSD) and dry gauze dressings twice daily. A swab of wounds was sent for routine culture and sensitivity twice a week. Wounds were observed daily by an experienced burn surgeon for signs of infection such as erythema, induration, purulent discharge and malodor. Swabs were

processed by the laboratory and returned results of 1+, 2+, or 3+bacterial growth, corresponding to light, medium, or heavy growth on the culture plate.

### Pain assessment

Pain scores on morning dressing changes were obtained during the initial application of either 1% AgSD or acticoat™. All patients were routinely given 2 tabs of acetaminophen (500mg/tab) before dressing changes. The pain score was assessed and reported by patients to determine if there was a difference between the two methods using the visual analog pain scale 1-10; 0 being no pain, 5 being moderate pain and 10, the severe pain (Fig. 1).

### Statistical analysis

Demographic predictors included age, TBSA burn (%), day of first using acticoat™ or silver sulfadiazine, outcome of LOS and pain scores were analyzed by two-tailed unpaired student t- test.

The authors compared the potential differences of wound infection and surgical procedures with both groups using Fisher's (two-tailed unpaired) Exact test. P value of less than 0.05 was considered to indicate statistical significance. Statistical analyses were performed with the use of Stata, v 6.0 software (StataCorp, College Station, TX 1999).

## Results

### Demographic

The authors found no significant differences in age, TBSA(%), LOS, between the two groups. Demographic data and type of burn in both groups are shown in Table 1 and 2.

### Infection

Thirty eight patients (76%) developed wound colonization, sixteen (64%) in the acticoat™ treated

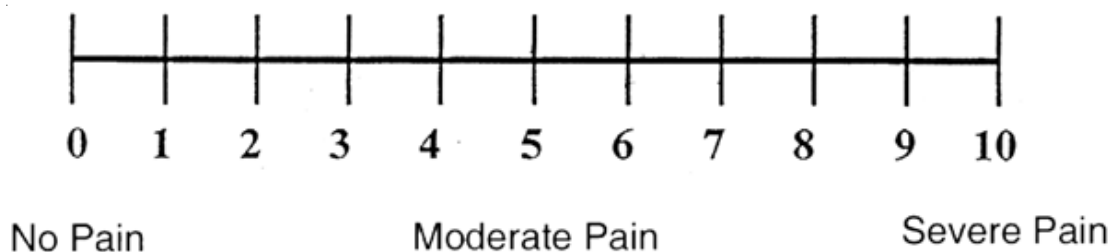


Fig. 1 Pain scores on morning dressing changes were evaluated by using the visual analog pain scale 1-10; 0 being no pain, 5 being moderate pain and 10, the severe pain

**Table 1.** Demographic data in both groups (n = 50)

Demographic data	Acticoat-treated group (n = 25)	1% AgSD-treated group (n = 25)	p value
Age (yr)	38±25	26±27	0.17
Burn area(%TBSA)	15±7	15±5	0.67
Length of hospital stay(LOS)	21±13	21±10	0.93

Data presented as mean ± SD

**Table 2.** Type of burn injury in both groups (n = 50)

Groups	Flame	Scald	Electrical	Chemical
Acticoat-treated group	14	9	1	1
1%AgSD-treated group	12	12	1	0

group and twenty-two (88%) in the 1% AgSD treated group. Type of cultured organisms in both groups is presented (Fig. 2). There were no differences in wound infection between both groups (seven patients developed wound infection; three in the acticoat™ group and four in the 1% AgSD group,  $p > 0.05$ ; Fig. 3a). All of the patients who developed wound infection responded well to targeted topical and systemic antibiotic treatment. Six Patients (24%) who received 1% AgSD treatment obtained split thickness skin graft to close the granulation defects compared to four patients (16%) who were treated with acticoat™. However, this does not achieve statistical significance,  $p = 0.32$  (Fig. 3b).

**Pain assessment**

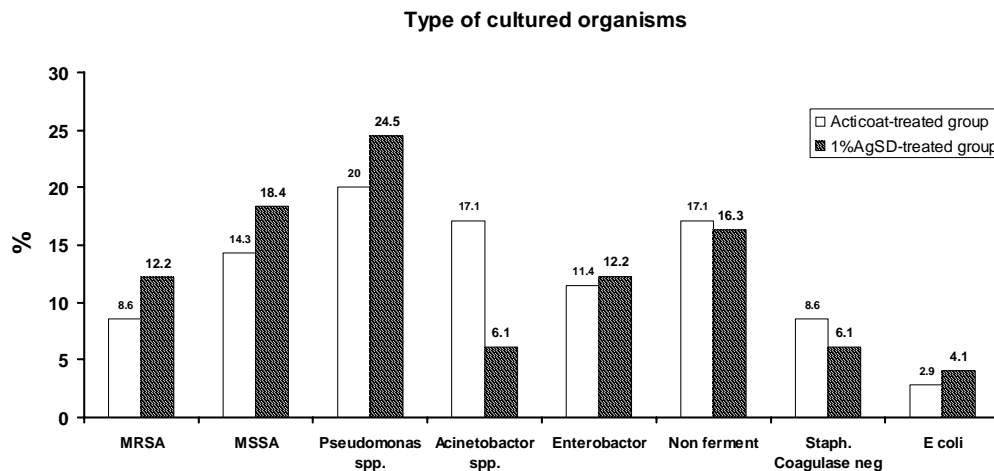
Mean background pain for the patients between dressings was  $4.5 \pm 1$ . The acticoat™ treated group had lower pain scores than the 1% AgSD treated group ( $4 \pm 0.6$  versus  $5 \pm 0.7$ ). No complaints of pain produced by the silver dressing or the antibacterial solution were noted.

**Mortality**

All patients in the present study survived.

**Discussion**

Mid to deep dermal burn wounds are challenging to manage. Silver in its numerous forms has been



**Fig. 2** Type of cultured wound organisms between 2 treatment groups

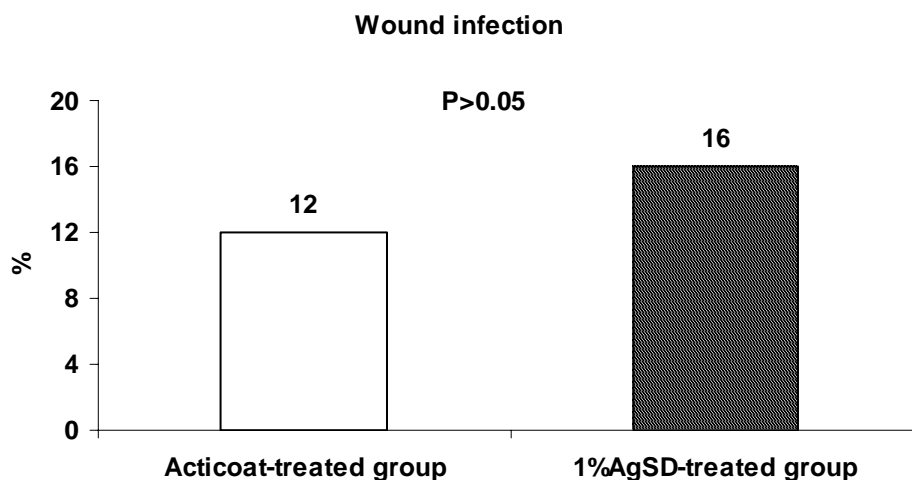


Fig. 3a No differences of % wound infection between 2 treatment groups

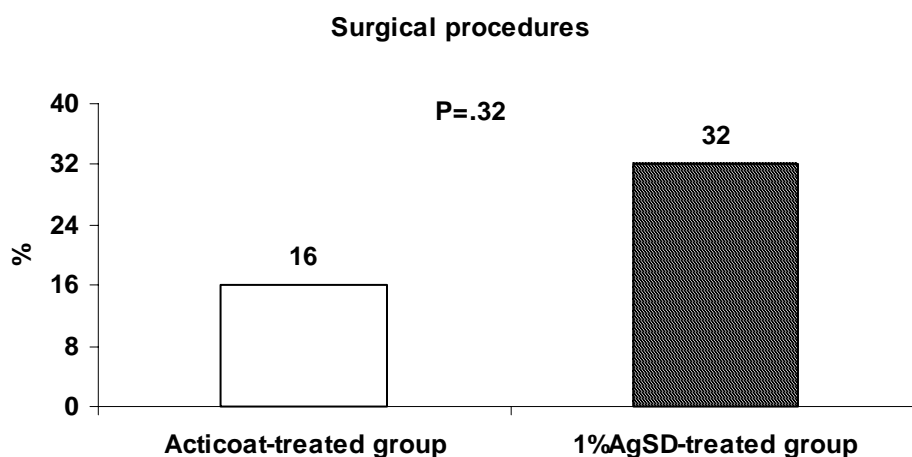


Fig. 3b Patients who treated with 1% silver sulfadiazine was obtained more split thickness skin graft procedures to close the granulation defects compared to patient who treated with acticoat™ but no statistically significance (p = 0.32)

used for over 200 years in the treatment of burn injury<sup>(3)</sup>. Tissue irritation by silver nitrate and inactivation of much of the silver by wound fluid and formation of a pseudo-eschar for silver sulfadiazine are some limitations for using silver products in topical burn treatment<sup>(4)</sup>. Acticoat™ is a new silver impregnated dressing designed to overcome these limitations.

Silver exerts its antimicrobial effects by interfering with the respiratory chain at the cytochrome level<sup>(5)</sup>, and interfering with components of the microbial electron transport system<sup>(6)</sup>. Silver is also effective against a broad range of aerobic, anaerobic, Gram negative and Gram-positive bacteria, yeast, filamentous

fungi, and viruses<sup>(7,8)</sup>. MRSA and pseudomonas-contaminated wounds have been a significant cause of morbidity and mortality among thermally injured patients since the 1980s<sup>(9)</sup>. Acticoat™ treated wounds had demonstrated lower MRSA and pseudomonas colonization compared to 1% AgSD treated wound. This correlates with previous literature reports that MRSA<sup>(9)</sup> and pseudomonas aeruginosa<sup>(10)</sup> are more susceptible to acticoat™ than the other silver-containing products. LOS is one important dependent variable outcome even if there was no difference between both groups. In the present study, wound colonization was quite high in both groups and fortunately, most patients had no

wound infection. The authors' clinical experience has suggested that burn depth estimations for indeterminate burns and full thickness burn can be misleading following injury. Ten patients (20%) required a later skin graft to close the granulation tissue and all other area healed without the need for re-grafting. Pain and infection control remain two of the biggest challenges facing medical professionals treating patients with burns. A previous study has also reported that the acticoat™ dressing causes less pain compared to silver nitrate dressings<sup>(11)</sup>. The authors found that the overall magnitude of pain in the wounds treated with acticoat™ was significantly lower than wounds treated with 1% AgSD. This might be due to its long lasting properties that reduce dressing changes frequency or the need for a high frequency of silver sulfadiazine application. Anxiety and fear related to a dressing change can also have a dramatic effect on patients, with pain being the most dreaded aspect. So acticoat™ is particularly beneficial to special groups of patients who suffered from partial thickness burn wound such as children and major burn patients.

#### Conclusion

The presented data suggest that acticoat™ is an effective antimicrobial barrier dressing managing partial thickness burn wounds. Due to its long wear time and the ease of application and removal, acticoat has an advantage of limiting the frequency of replacement of the dressing and provides a less painful alternative to wound care compared with 1% AgSD. Evidence is mounting to support the clinical value of acticoat™ in the management of burns.

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## การเปรียบเทียบประสิทธิภาพของตัวยา 1% ซิลเวอร์ซัลฟาไดอะซีน และแอกติโคท ในการรักษาแผลไฟไหม้น้ำร้อนลวกระดับสอง

พรพรม เมืองแมน, จอมจักร จันทรสกุล, สรנית ศิลธรรม, สมพล ฤกษ์สมถวิล, สุภาพรณ สุวรรณโชติ, รัชณี เบญจรัตน์, สุชาดา กิตติเดชา

Acticoat™ (Smith & Nephew, Hull, UK) เป็นวัสดุปิดแผลที่เคลือบด้วยโลหะเงินชนิดที่มีโมเลกุลอนุพันธ์ขนาดเล็กมากในระดับนาโน ซึ่งมีรายงานว่าสามารถลดการติดเชื้อและยับยั้งเชื้อโรคในแผลได้ จุดประสงค์ของการศึกษานี้เพื่อเปรียบเทียบประสิทธิภาพของ Acticoat™ และ 1% silver sulfadiazine ในการรักษาบาดแผลไฟไหม้น้ำร้อนลวกระดับสอง โดย การศึกษากับคนไข้จำนวน 50 ราย ซึ่งมีแผลไฟไหม้น้ำร้อนลวกระดับสองน้อยกว่า 25% ซึ่งได้รับการรักษาในหน่วยไฟไหม้น้ำร้อนลวก โรงพยาบาลศิริราช ช่วงระหว่างเดือนพฤษภาคม พ.ศ. 2545 - เดือนกันยายน พ.ศ. 2548 คนไข้ทั้งหมดถูกแบ่งเป็น 2 กลุ่ม : กลุ่มที่ได้รับการรักษาโดยใช้ Acticoat™ (25 คน) และกลุ่มที่ได้รับการรักษาด้วย 1% silver sulfadiazine (25 คน) ทั้ง 2 กลุ่ม ได้รับการเปรียบเทียบ ถึงสาเหตุของการเกิดบาดแผล, ข้อมูลทางสถิติซึ่งประกอบด้วย อายุ, เพศ, % total body surface area burn (TBSA), ระยะเวลาที่อยู่โรงพยาบาล (LOS), การเพาะเชื้อ, การติดเชื้อของบาดแผล และ ระดับความเจ็บปวด ทั้งสองกลุ่มพบว่าไม่มีความแตกต่างอย่างมีนัยสำคัญในเรื่องของอายุ, TBSA (%), LOS คนไข้ 7 คน บาดแผลมีการติดเชื้อ ซึ่งไม่มีความแตกต่างของการติดเชื้อในแผล ระหว่างคนไข้ทั้ง 2 กลุ่ม ( $p > 0.05$ ) คนไข้ทั้งหมดที่บาดแผลมีการติดเชื้อตอบสนองได้ดีต่อการรักษาด้วยยาฆ่าเชื้อทั้งแบบ topical และ systemic กลุ่มที่รักษาด้วย 1% AgSD (6 of 25, 24%) ต้องได้รับการทำ skin graft มากกว่ากลุ่ม Acticoat™ (4 of 25, 16%) แต่ไม่มีความแตกต่างอย่างมีนัยสำคัญ ระดับความเจ็บปวดในกลุ่มที่ใช้ Acticoat™ ต่ำกว่า กลุ่มที่ใช้ 1% AgSD อย่างมีนัยสำคัญ ( $4 \pm 0.6$  versus,  $5 \pm 0.7$  respectively,  $p < 0.05$ ) การศึกษานี้ยืนยันถึงประสิทธิภาพของ Acticoat™ ในการรักษาบาดแผลระดับสอง ซึ่งสรุปว่า Acticoat™ มีข้อดีในการช่วยลดจำนวนครั้งในการเปลี่ยนแผลและลดความเจ็บปวดในการดูแลบาดแผล และเมื่อเปรียบเทียบกับการใช้ 1% AgSD ในบาดแผลที่มีการติดเชื้อ เนื่องจากระยะเวลาในการออกฤทธิ์นาน สะดวกต่อการใส่ และการเปลี่ยนแผล

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