Comparative Study between Chitin/Polyacrylic Acid (PAA) Dressing, Lipido-Colloid Absorbent Dressing and Alginate Wound Dressing: A Pilot Study in the Treatment of Partial-Thickness Wound

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Background: Polyacrylic acid grafted chitin (Chitin-PAA) contains a hydrogel characteristic that makes it more suitable for wound dressing application. In animal models, Chitin-PAA dressing exhibited properties as a promising dressing. Epithelization promotion, rapid reduction of wound size, reduction of inflammatory cell response, and less toxicity had been noted.

Objective: Carry out a pilot clinical comparative study of Chitin-PAA dressing, lipido-colloid absorbent dressing, and alginate wound dressing in the treatment of partial-thickness wound.

Material and Method: Between June 2006 and March 2007, 36 partial-thickness wounds were randomized into three groups and three different types of dressing were used. Each wound was treated until it was completely healed, and a visual analogue scale was used for the pain evaluation.

Result: The present study shows the visual analogue pain score in the Chitin-PAA group seems to be a bit higher than the Urgocell® group but not statistically different. The completely healed day is not significantly different. Three patients in the lipido-colloid absorbent dressing groups had wound infection but eventually healed after treatment.

Conclusion: There was no statistical difference in terms of visual analogue pain score and healing time between the lipido-colloid absorbent dressing, alginate dressing, and chitin-PAA dressing.

Keywords: Polyacrylic acid, Chitin, Chitin PAA, Alginate dressing, Lipido-colloid absorbent dressing, Wound healing, Partial-thickness wound

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Wound healing is a complex process that includes inflammatory proliferation and remodeling phase. Nowadays, there are many wound dressing materials commercially available for treatment for all different types of wound.

Chitin is an organic material easily prepared from the shells of crab, shrimp, and squid. Chitin, grafted with polyacrylic acid [chitin-PAA], was prepared with the aim of obtaining a hydrogel characteristic for wound dressing application[1-3]. The physiochemical properties of chitin-PAA were previously investigated and have shown a capability of absorbing water 30-60 times of their original weights while maintaining their integrity[1].

Previous animal study had shown that Chitin-PAA had expressed a biocompatible property in the rat model. Normal liver and kidney function tests and normal organ’s weight after topical application of these biomaterials indicated that neither local nor systemic effect from these materials interfered with vital organ function. The other animal study had
demonstrated that the Chitin-PAA dressings exhibited suitable properties of ideal dressing such as rapid re-epithelialization, increased wound healing rate by showing rapid reduction of the wound size, reduced inflammatory cells, and less toxicity.

The present pilot study was to compare Chitin-PAA dressing, lipido-colloid absorbent dressing, and alginate wound dressing in the treatment of partial-thickness wound.

Material and Method

After obtaining informed consent and approval from King Chulalongkorn Memorial Hospital Ethic Committee, between June 2006 and March 2007, 36 partial-thickness wounds were enrolled in the present study. The enrolled patients had an average age between 20 and 70 years. Exclusion criteria were allergy to seafood, DM, and other dermatologic and chronic diseases.

Patients were randomized to one of the three groups, using three different types of dressing materials. Group 1 was treated with lipido-colloid absorbent dressing (Urgocell®), group 2 with alginate wound dressing (Algisite M®), and group 3 with Chitin-PAA dressing, which is developed by National Metal and Materials Technology Center (MTEC), Thailand. After the partial-thickness skin graft was harvested with 10-12/1000 inches thickness from the donor site on the anterior surface of the thigh, the material was applied over the wound. The outer layer was dressed as needed.

Patients were asked to assess their pain score at the first, second, and third postoperative day. The score was based on the visual analog score scale from 1 to 10 points. The completely healed day and other adverse events were recorded. The completely healed wound was recorded on the day that the dressing material was easily removed.

Data from the three groups were compared by using the Kruskal Wallis test and a p-value < 0.05 is statistically significant.

Result

The demographic data of the three groups were similar as shown in Table 1.

Pain scores at the first, second and third postoperative day among the three groups were not significantly different (Fig. 1).

The completely healed days were not significantly different among the three groups (p = 0.149), the mean is 12.18 days (Fig. 2).

Discussion

The present study was to compare the efficacy of alginate and chitin grafted with polyarylic (chitin PAA), which are both bioactive products. The
allows the fibers to absorb the exudates and become a gel.

The biocompatible chitin and its derivatives have been used worldwide for a variety of applications such as paper, food, cosmetics\(^{(3,4,6-8)}\). Many types of chitin-based materials have been used for wound dressing application\(^{(10-12)}\). However, low water absorption ability of chitin yields an inefficient exudates removal from the wound surface. Grafting of various monomers containing hydrophilic groups onto chitin chains is the method to enhance its water absorption ability\(^{(1,2,5)}\).

Chitin grafted with polyacrylic acid (Chitin-PAA) has been developed to improve this disadvantage. It has increased the absorption ability to 30-60 times of its original weight while maintaining integrity. Chitin-PAA has shown no signs of allergenicity or any high inflammatory response in wound study using a rat model\(^{(1)}\).

The Urgocell\(^{®}\) and Algisite M\(^{®}\) are both commercial products. The Chitin-PAA is not commercially available.

The present study shows that the pain score were not statistically different among these three groups. However, the visual analogue pain score in the Chitin-PAA group seems to be a bit higher than the Urgocell\(^{®}\) group. The completely healed day is not significantly different. Three patients in the lipido-colloid absorbent dressing groups had wound infection but eventually healed after treatment.

In summary, there was no statistical difference in terms of visual analogue pain score and healing time among the lipido-colloid absorbent dressing, alginate dressing and chitin-PAA dressing.

**References**


