Clinical Studies on Fibrin-Chitosan Composite Bio casings for Cutaneous Wound Healing in Dogs

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Abstract

Twelve dogs presented with different types of cutaneous wounds were divided into two groups of six animals each. Group I animals were kept as control and wounds in Group II animals were applied with Fibrin – Chitosan composite biomaterial. The efficacy of the biocasings was evaluated clinically based on appearance, granulation tissue, infection, extent of cicatrization, percentage of wound contraction and physiological parameters. The study proved that the Fibrin – Chitosan composite biomaterial if efficient in wound healing.

Key words: Fibrin – Chitosan Bio casings, Wound Healing, Dogs, Clinical Studies

Introduction

Cutaneous wounds may occur due to automobile accidents, burns, corrosive chemicals and infighting with the tear or loss of skin, which may not be suitable for suturing. In such circumstances use of gelatin sheets, amniotic membrane, fibrin, fibrin ease Ist Edn. Blackwell Science ltd, Oxford press. glue, collagen and chitosan (Ueno et al., 2001) are indicated for wound healing. A fibrin clot is a cross linked fibrinogen which in conjunction with platelets and other wound factors acts as a good haemostat, provides favorable environment for wound healing, acts as a scaffold for migrating fibroblasts and hastens the healing process (Michel and Harmand, 1990). Chitosan, a deacetylated product of chitin obtained from crustacean shells was used in wound healing (Kohr and Lim, 2003). The present study was aimed at evaluating the efficacy of fibrin-chitosan bio casings on cutaneous wound healing in dogs.
Materials and Methods

The present study was conducted on twelve apparently healthy dogs presented to the clinic with cutaneous wounds. These were divided into two groups of six animals each, to study the efficacy of the biomaterial on wounds of 2 X 1 inch area.

In group I, six animals that were having cutaneous wounds of around 2 X 1 inch size were randomly selected. The wounds were cleaned with normal saline solution and Lorexane ointment was applied. The wounds were covered with steripad and protected by external gauze bandage. The same procedure was followed on every alternate day till the wound healed.

In group II also, the skin defect was left unsutured and cleaned with normal saline. The fibrin-chitosan composite films (Biomaterials division, CLRI, Chennai) (Fig 1) were cut to the size of wound and soaked in Gentamicin solution for 5 min. and then applied on the wound (Fig 2). Such wound was covered with steripad and protected by external gauze bandage. This procedure was repeated on every alternate day till the wound healed except that the biocasing application was done for three alternate days only. The area of wound contraction was determined following the procedure of Ram Kumar and Tyagi (1972). Healing process was evaluated by observing for the presence of discharges, granulation tissue, scar formation, wound contraction; wound healing and other complications if any.

![Figure 1: Fibrin – Chitosan composite bio casing.](image1)
![Figure 2: Application of bio casing on the wound](image2)

Results and Discussion

The healing was judged clinically daily by observing the appearance of wound and extent of cicatrisation and determination of area of wound healing. The wound area was measured on 0th, 7th, 14th and 28th days after surgery. Percentage of wound contraction was measured to find the extent of reduction in wound
area at different periods of treatment by graphical method wound area was calculated by counting no. of squares of retracted wound area on graph area from the original wound using a formula.

\[ \% \text{ of closure} = 1 - \left( \frac{A_d}{A_0} \right) \times 100. \]

\( A_0 \) – wound area on day 0, \( A_d \) – wound area on corresponding day.

Blood clots and more amount of wound fluid post operatively in control animals were observed due to the hemorrhage at the wound area. Fibrin-chitosan treated wounds showed neither hemorrhage nor adverse inflammatory reaction by the host tissue, which might be due to sealant and haemostatic activity of the bio casing (Bold et al., 1996). This gross finding not only explains the tolerance of the host tissue to the foreign material and also safety of the fibrin-chitosan biomaterial.

In group I percent of wound contraction was 21.42 on 7th day (Fig 3,4), 48.1 on 14th day (Fig 5,6) and 81.33 on day 21, whereas it was 28.33, 62.22 and 100% respectively in group II. Wound healing was complete by the end of 25th day (25.33±0.49) in control group (Fig 7), whereas it was on 18th day itself (Fig 8) in biomaterial treated group (18.00 ±0.36). The biomaterial was found to adhere very firmly due to property of adherence prevented the oozing of fluids from the site. Infection is a great deterrent to wound healing. In the present study fibrin-chitosan biocasings showed antibacterial property by providing a sterile atmosphere of the wound area as reported by Qi et al. (2004).

**Figure 3**: Control wound on seventh day. Note granulation tissue

**Figure 4**: Fibrin – Chitosan Bio casing applied wound on seventh day. Note dense granulation tissue
One animal in each group showed infection, which might be due to subsequent contamination of wound and disruption of bio casings. Fibrin-chitosan bio casing could produce early wound healing with maximum wound contraction and similar results were reported by Ishihara et al. (2002). The bio casings were non-antigenic, nontoxic and did not elicit any adverse reaction.

Physiological parameters like temperature, respiration and pulse rates showed either increase or decrease which however fluctuated within the normal physiological limits in both the groups suggesting its safety in clinical usage.

Based on the above observations, it was concluded that, fibrin chitosan treated wounds showed early wound healing and the biomaterial can be safely be applied for cutaneous wound healing in canines.

References