Jellagen

NEXT GENERATION COLLAGEN

CASE STUDY

Collagen Type 0 in the treatment of wounds

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THE PROBLEM:

Chronic wounds pose a significant health-care burden, with 1-2% of the global population experiencing a chronic wound during their lifetime. Currently, the annual UK NHS cost of wound care is estimated at £5.3bn, forecast to rise dramatically due to several causative factors including the increasing aging population, diabetes incidence and sedentary lifestyles.

In acute wounds, there is a shift from M1 to M2 macrophages over time (and a corresponding shift from inflammation and tissue removal to tissue repair). However, in chronic wounds, the development of mostly M1 macrophages results in dysregulated inflammation and poor wound healing and closure. This can lead to potential infections and more severe conditions such as amputation.

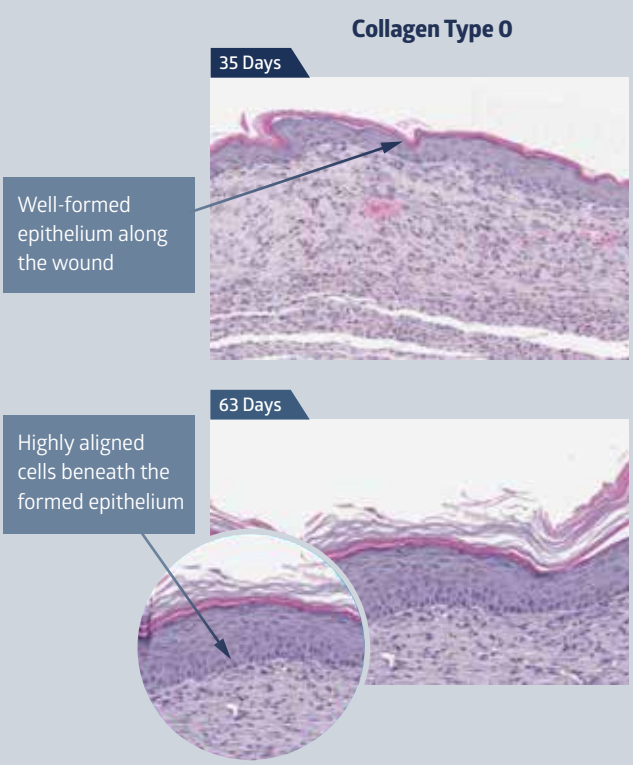
Current wound care products (synthetic hydrogels, hydrocolloids, alginate dressings or collagen dressings) have significant limitations including safety concerns due to adverse tissue reactions and, ultimately, ineffectively stimulating the wound healing process. Many wound care products are considered 'over-the-counter' (OTC) with un-reliant efficacy profiles.

THE SOLUTION:

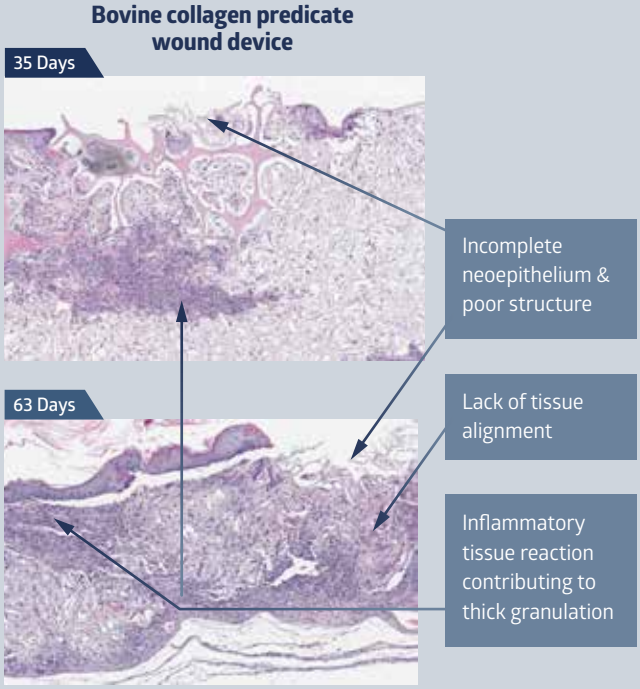
Collagen is the most abundant protein in the extracellular matrix of connective tissue and has roles in signalling new tissue formation. Jellagen collagen is extracted from Rhizostoma Pulmo (the 'barrel jellyfish') and is processed for medical applications. It has been defined as Collagen Type 0 due to its ancient origin. Collagen Type 0 has proven biocompatibility, biodegradability, low immunogenicity, and cell-adhesive properties. Therefore, Collagen Type 0 is an ideal biomaterial for the reconstruction of tissue *in vivo*, without the drawbacks of mammalian-sourced collagens.

Study. Wound healing ability in an impaired wound

Collagen Type 0: robust, organized and mature and well vascularized tissue with highly aligned cells and little evidence of unfavourable inflammatory



Bovine collagen predicate wound device: weak, disorganized and poorly developed tissue reactions



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CASE STUDY

1. Biocompatibility and anti-inflammatory properties of Collagen Type 0 *(in vitro)*

In this *in vitro* study, the effect of Collagen Type 0 on differentiated THP-1 cells, a type of cell associated with wound development. THP-1 cells are used as models for a type of white blood cell (monocyte), the move to an infection site and affect the immune response.

The results:

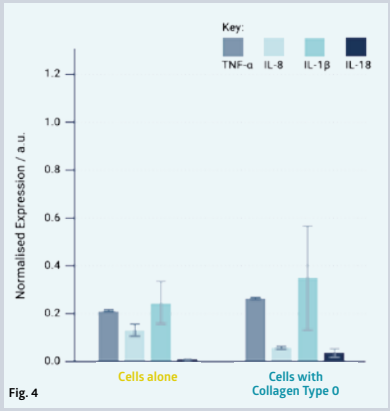

Fig. 4

Collagen Type 0 did not induce significant changes in the secretion of pro-inflammatory cytokines (Fig. 4).

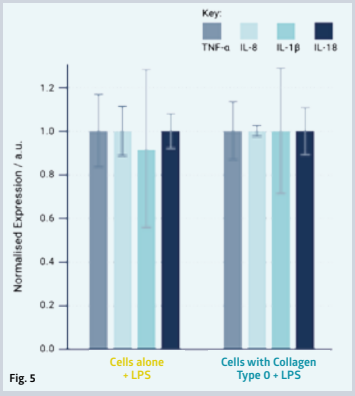

Fig. 5

Introduction of Lipopolysaccharide LPS led to a marked inflammatory response, but the presence of Collagen Type 0 did not alter this is any way (Fig. 5).

2. Are the anti-inflammatory properties of Collagen Type 0 also seen *in vivo?*

In the *in vivo* study the macrophage response to Collagen Type 0 implanted subcutaneously in Wistar rats. A control group of rats implanted with porcine pericardium collagen (PPC) was used to compare.

The results:

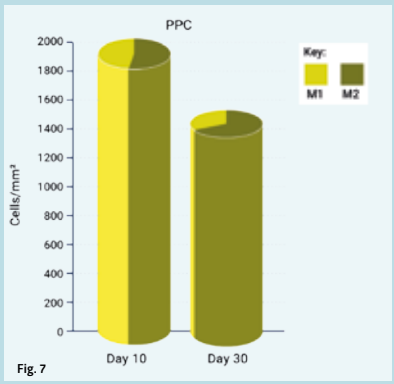

Fig. 7

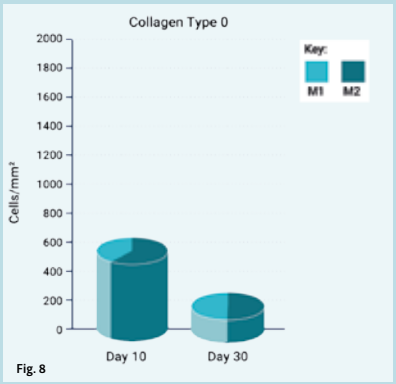

Fig. 8

There were significantly more M2 macrophages than M1 at day 10 with Collagen Type 0 (Fig. 7). By day 30, total macrophages had decreased and there was no significant difference between the two types present in the wound bed. With PPC, there was only a shift to predominantly M2 macrophages after 30 days. Typically, in a wound, most healing occurs by day 30 and the body will go into an equilibrium state.

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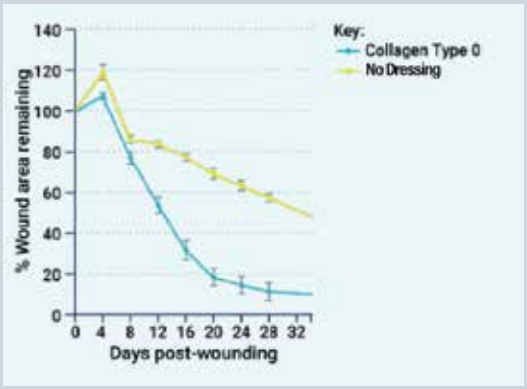
3. Wound healing ability in an impaired wound model

In this *in vivo* study, we looked at whether Collagen Type 0 can close and heal full-thickness excisional wounds where there is impaired healing. A diabetic mouse model was used to simulate impaired wound healing.

The results:



The bovine collagen predicate wound device gave similar initial results. However, it gave large variability and poor performance in the final 20% of closure, with many wounds failing to close. Collagen Type 0 resulted in superior uniformity and complete wound closure.

FUTURE OPPORTUNITIES

Due to the unique properties of Collagen Type 0 described, we are investigating its potential in several clinical areas. Firstly, and as described in this paper, in the treatment of chronic wounds to provide enhanced healing, prevent infections and protect patients from further complications (e.g., amputations). Secondly, we are looking at how the unique biocompatible and regenerative properties of Collagen Type 0 can be utilized for other medical treatments. These include in the treatment of osteoarthritis with cartilage repair strategies and for the treatment of vocal cord paralysis.

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