Characterization and application of adipose-derived mesenchymal stem cells for treatment of suture-material–induced wound in cats: A preliminary study

Ruttachuk Rungsiwiwut[1,2]*, Sasipat Teerawongsuwan[3], Wipawadee Phathomrapeepong[4]

[1] Department of Anatomy, Faculty of Medicine, Srinakharinwirot University, Bangkok, Thailand.

[2] Research Unit in Stem Cell Innovation and Tissue Engineering, Srinakharinwirot University, Bangkok, Thailand

[3] Graduate Program, Faculty of Medicine, Srinakharinwirot University, Bangkok, Thailand.

[4] Wipawadee Animal Clinic, Bangkok, Thailand.

Corresponding author: ruttachuk@g.swu.ac.th

Introduction

- Non-healing surgical wounds remain a major challenge in feline practice, particularly when hypersensitivity to suture materials triggers chronic inflammation, delays epithelialization, and disrupts normal tissue repair.
- Mesenchymal stem cells (MSCs), especially those derived from adipose tissue, provide immunomodulatory and regenerative effects that may mitigate suture-related wound complications.

Objectives

- To isolate and characterize feline adipose-derived MSCs (fAD-MSCs).
- To evaluate their preclinical efficacy in managing non-healing wounds associated with suspected suture hypersensitivity.

Methods

- Feline allogeneic ADMSCs were isolated, cultured, and characterized as part of other research projects. Protocols for deriving the feline MSCs were approved by the Institutional Review Board of Srinakharinwirot University (COA/AE-017-2563).
- Adipose tissue samples were collected from healthy donor cats during routine ovariohysterectomy.
- The tissue was enzymatically digested with collagenase IV, filtered, and centrifuged.
- Cells were cultured in α-MEM supplemented with 10% fetal bovine serum and 5 ng/mL basic fibroblast growth factor and maintained at 37 °C in a 5% CO_2 incubator.
- Isolated cells were assessed for MSC surface marker expression by flow cytometry, and multipotency was confirmed through osteogenic, adipogenic, and chondrogenic differentiation assays.

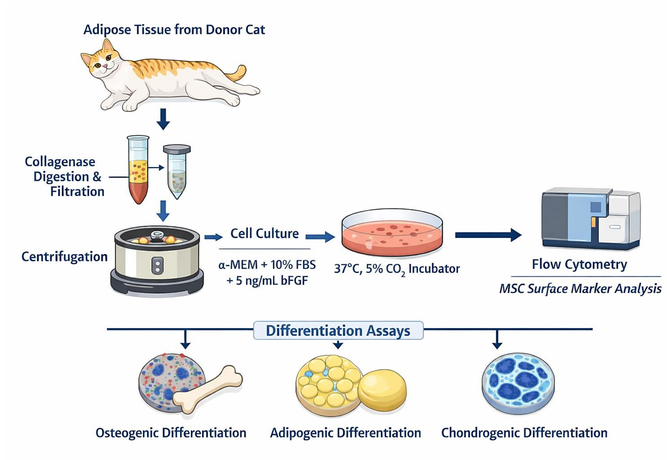


Figure 1. The schematic procedure illustrates the isolation and characterization of mesenchymal stem cells from feline adipose tissue

- Prior to injection of fAD-MSCs, cells were subjected for testing mycoplasma and endotoxin contamination.
- Two cats (age between 2-3 years-old) with chronic non-healing wounds and suspected suture hypersensitivity received a single subcutaneous injection of mycoplasma- and endotoxin-free fAD-MSCs (1×10^6 cells/kg), administered 1 cm from the wound margin, with 0.1 ml of cell suspension injected at each site around the wound.
- The MSC injection was administered to the cat while fully conscious and without anesthesia.
- Wound healing was evaluated over 5 weeks using daily photographs.

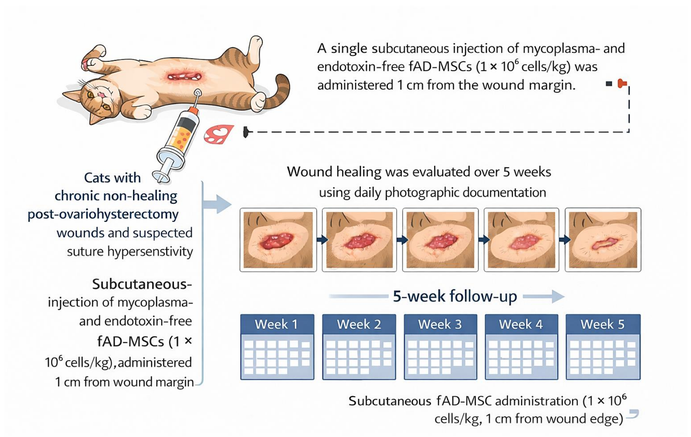


Figure 2. The schematic procedure illustrates the administration of allogeneic MSCs administration.

Results

- The isolated fAD-MSCs exhibited fibroblast-like morphology and expressed more than 90% of CD44, CD90, and CD105, with minimal to no expression of CD35 or MHC II.
- The cells successfully underwent osteogenic, adipogenic, and chondrogenic differentiation, confirming trilineage potential.

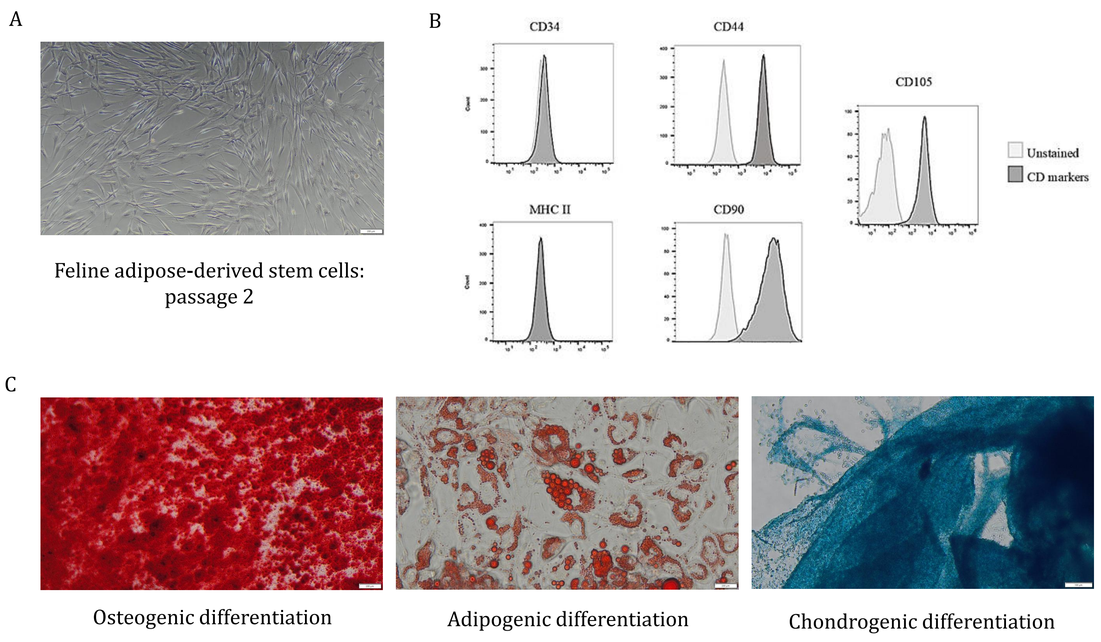
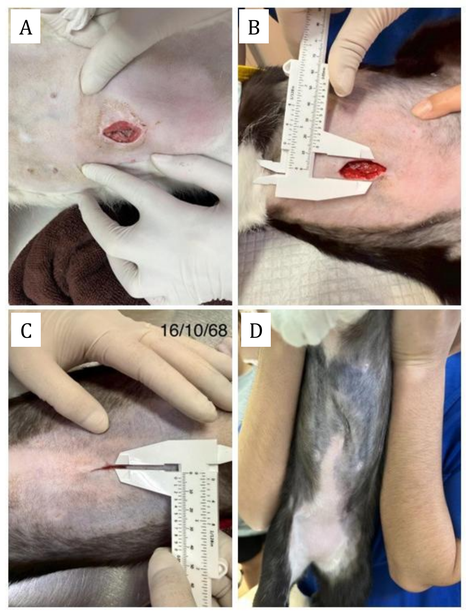


Figure 3. Feline MSCs were derived from the adipose tissue of cats that had undergone ovariohysterectomy. The isolated cells exhibited key characteristics of MSCs, including adherence to plastic surfaces and fibroblast-like morphology (A), high expression of surface markers CD44, CD90, and CD105, and lack of expression of CD34 and MHC II (B). The cells could differentiate into (C) osteoblast stained with Alizarin red, chondrocytes stained with Alcian blue, and adipocytes stained with Oil Red O. Scale bars = 200 µm CD = cluster of differentiation; MHC = major histocompatibility complex; MSCs = mesenchymal stem cells



- The cat showed no signs of allergic reactions and no notable negative signs 24 hours after the MSC injection.
- In clinical cases, fAD-MSC treatment accelerated wound closure, decreased erythema and edema, and promoted granulation tissue formation.
- Inflammatory and hypersensitivity signs markedly improved within 5 weeks, and no adverse effects were noted.

Figure 4. Sequential macroscopic progression of wound healing following administration of adipose-derived mesenchymal stem cells .

(A) Baseline appearance of the non-healing wound prior to treatment, showing an open lesion with exposed granulation tissue and minimal epithelial coverage. (B) Early post-treatment stage demonstrating reduction in wound diameter, improved granulation tissue quality, and initial contraction of wound margins, as measured using a digital caliper.
(C) Intermediate healing phase, showing marked wound contraction with significant reduction in lesion length and progressive epithelialization across the wound surface.
(D) Late stage of healing with complete closure, restoration of skin integrity, and minimal residual scarring, indicating effective tissue regeneration following stem cell therapy.

Conclusions

- Application of fAD-MSCs in suture-related non-healing wounds enhanced tissue regeneration, suggesting that these cells may provide a safe and effective regenerative therapy.
- Further controlled studies are warranted to validate these findings and better define their clinical applicability.

Acknowledgements

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