

Submission ID #: 71306

Scriptwriter Name: Pallavi Sharma

Project Page Link: https://review.jove.com/files_upload.php?src=21748378

Title: A Rat Surgical Skin Wound Model: An Approach for Wound Healing Studies and Biomaterial Evaluation

Authors and Affiliations:

Michelle Lessa da Silva¹, Wagner Ferreira De Carvalho¹, Marianna Gabrielle Almeida Galvão¹

Dallyne Beatriz Duarte Souza¹, Jeane Martinha Dos Anjos Cordeiro¹, Janaina Maria Xavier Corrêa², Tania Barth¹, Elisângela Barboza da Silva², David A. Stevens³, Adriana Bozzi¹

¹Department of Biological Sciences, State University of Santa Cruz, Ilhéus, Bahia, Brazil.

²Department of Agricultural and Environmental Sciences, State University of Santa Cruz, Ilhéus, Bahia, Brazil.

³Division of Infectious Diseases and Geographic Medicine, Department of Medicine, Stanford University School of Medicine, Stanford, California, USA.

Corresponding Authors:

David A. Stevens

stevens@stanford.edu

Email Addresses for All Authors:

Michelle Lessa da Silva	mlsilva.ppgbbm@uesc.br
Wagner Ferreira De Carvalho	wcarvalho.ppgbbm@uesc.br
Marianna Gabrielle Almeida Galvão	mgagalvao@uesc.br
Dallyne Beatriz Duarte Souza	dbdsouza.bio@uesc.br
Jeane Martinha Dos Anjos Cordeiro	jmacordeiro@uesc.br
Janaina Maria Xavier Corrêa	jmcorrea@uesc.br
Tania Barth	tanbarth@uesc.br
Elisângela Barboza da Silva	ebsilva@uesc.br
Adriana Bozzi	adriana.bozzi@gmail.com

David A. Stevens

stevens@stanford.edu

Author Questionnaire

1. We have marked your project as author-provided footage, meaning you film the video yourself and provide JoVE with the footage to edit. JoVE will not send the videographer. Please confirm that this is correct.

✓ Correct

2. Interview statements: Which interview statement filming option is the most appropriate for your group? **Please select one.**



Interview Statements are read by JoVE's voiceover talent.

3. Proposed interview filming date: Please indicate the proposed date that your group will self-film interviews: **07/01/2026**

When you are ready to submit your video files, please contact our Content Manager, [Utkarsh Khare](#).

Current Protocol Length

Number of Steps: 09

Number of Shots: 12

Interviews

NOTE to VO: Please record the interview and conclusion statements

INTRODUCTION:

REQUIRED: Summarize your research focus and the main questions it aims to answer.

- 1.1. This research focuses on identifying and evaluating novel therapeutic approaches that improve cutaneous wound healing outcomes using rat experimental models.

- 1.1.1. 2.8.1.

~~Describe the research gap or limitation in existing methods and how this protocol addresses them.~~

- 1.2. The proposed model is an alternative to punch biopsies, enabling standardized wounds with variable shapes and sizes, increasing experimental flexibility and applicability.

- 1.2.1. 2.4.1.

CONCLUSION:

~~What does this protocol allow researchers to study or measure?~~

- 1.3. This protocol enables evaluation of wound healing dynamics, including contraction rate, tissue repair progression, and therapeutic effects in standardized rat excisional wound models.

- 1.3.1. *Figure 3*

Describe the most important consideration or challenge when performing this protocol.

- 1.4. The main challenge is to minimize experimental bias by ensuring consistent wound induction and avoiding skin overstretching during planimetry for reliable measurements.

- 1.4.1. 2.8.2

Ethics Title Card

This research has been approved by the Ethics Committee on Animal Use (CEUA) at the Universidade Estadual de Santa Cruz

Protocol

Video editor: Please use a title card to show the following information

Perform the following pre-surgical steps

- Pre-Anesthetic Sedation
- Anesthesia Induction and Maintenance
- Surgical Site Preparation

2. Cutaneous Wound Preparation and Planimetric Analysis

Demonstrators: Elisângela Barboza da Silva and Michelle Lessa

- 2.1. Prepare a caliper, a fine-tip permanent marker, gauze, and sterile surgical instruments, including a number 23 scalpel blade, Mayo scissors, and anatomic forceps [1].

2.1.1. LAB MEDIA: 01 IMAGE (1).jpeg

- 2.2. Using the caliper, mark 4 equidistant points on the skin with a fine-tip permanent marker to outline a 1 by 1 centimeter square [1].

2.2.1. LAB MEDIA: IMG_02.MOV: 00:00-00:21.

- 2.3. Using a sterile number 23 scalpel blade, create the surgical wound by removing the skin within the demarcated area [1]. Using Mayo scissors and sterile anatomic forceps, complete the skin removal to expose the subcutaneous tissue and the underlying musculature [2].

2.3.1. LAB MEDIA: IMG_02.MOV: 00:23-00:44

2.3.2. LAB MEDIA: IMG_02.MOV: 00:56-01:10

- 2.4. Achieve hemostasis at the site by applying gentle pressure directly to the wound with sterile gauze until the bleeding ceases [1].

2.4.1. LAB MEDIA: IMG_02.MOV: 01:10-01:17

- 2.5. For planimetry, prepare a transparent film dressing, a white paper sheet, a fine-tip permanent marker, and transparent adhesive tape [1].

2.5.1. LAB MEDIA: 02 IMAGE.jpeg

- 2.6. Cut rectangles of the transparent film dressing measuring 5 by 3.5 centimeters and cover the entire wound [1].

2.6.1. LAB MEDIA: 03 IMAGE.jpeg

- 2.7. On the white paper, note the group, animal, and date for wound planimetry. Use "Day 0" for the induction day and "Day X" for the euthanasia day [1].

2.7.1. LAB MEDIA: 04 IMAGE.jpeg

2.8. Next, position the transparent film dressing over the wound [1]. Using a fine-tip permanent marker, trace the entire wound outline on the adhesive backing paper of the transparent film dressing to record the wound area [2]. Transfer the recorded planimetry to the white paper sheet [3].

2.8.1. LAB MEDIA: IMG_06.MOV: 00:02-00:13

2.8.2. LAB MEDIA: IMG_06.MOV: 00:19-00:30

2.8.3. LAB MEDIA: IMG_06.MOV: 00:32-00:45

2.9. Using transparent adhesive tape, attach the obtained planimetry to the white paper sheet according to the corresponding group, animal, and day identification [1].

2.9.1. LAB MEDIA: IMG_06.MOV: 00:50-00:54

Video editor: Please use a title card to show the following information

- Provide postoperative analgesia and wound protection
- Initiate experimental treatments and change dressings daily
- Perform euthanasia and obtain final wound planimetry
- Measure wound area using digital image analysis software
- Calculate the wound contraction rate from wound area measurements

Results

3. Results

- 3.1. At day 0, the lesion displayed an exposed wound bed with bloody exudate [1]. By day 3, the wound had slightly decreased in size, with a visible scab and the onset of wound-edge contraction [2]. By day 7, there was a significant decrease in the wound's size, with margin retraction and no visible exudate [3].
 - 3.1.1. LAB MEDIA: Figure 3A. *Video editor: Highlight the image labeled "D0"*
 - 3.1.2. LAB MEDIA: *Figure 3A. Video editor: Highlight the image labeled "D3"* showing the dark scab covering the wound.
 - 3.1.3. LAB MEDIA: Figure 3A. *Video editor: Highlight the image labeled "D7"*.
- 3.2. At day 14, notable hair growth and marked wound reduction with advanced re-epithelialization were observed [1]. At day 21, complete wound closure with a pale pink linear scar was observed [2].
 - 3.2.1. LAB MEDIA: Figure 3A. *Video editor: Highlight the image labeled "D14"*
 - 3.2.2. LAB MEDIA: Figure 3A. *Video editor: Highlight the image labeled "D21"*
- 3.3. Wound contraction progressively increased from 56% at day 3 [1] to 82% at day 7 [2], 93% at day 14 [3], and 99% at day 21 [4].
 - 3.3.1. LAB MEDIA: Figure 3B. *Video editor: Highlight the bar labelled "D3"*.
 - 3.3.2. LAB MEDIA: Figure 3B. *Video editor: Highlight the bar labelled "D7"*.
 - 3.3.3. LAB MEDIA: Figure 3B. *Video editor: Highlight the bar labelled "D14"*.
 - 3.3.4. LAB MEDIA: Figure 3B. *Video editor: Highlight the bar labelled "D21"*.
- 3.4. At day 3, dermal tissue discontinuity, an open wound area, blood vessels, and an initial inflammatory infiltrate were observed [1].
 - 3.4.1. LAB MEDIA: Figure 4. *Video editor: Highlight 4A.*
- 3.5. On day 7, a scab with granulation tissue [1] and an epithelial tongue were observed [2]. By day 14, there was advanced re-epithelialization, with reduced inflammatory infiltrate and connective tissue deposition [3].
 - 3.5.1. LAB MEDIA: Figure 4B. *Video editor: Highlight the labelled "Scab" and the labelled "Granulation tissue"*.
 - 3.5.2. LAB MEDIA: Figure 4B. *Video editor: Highlight the labelled "Epithelial tongue"*.
 - 3.5.3. LAB MEDIA: Figure 4C. *Video editor: Highlight the labelled "Regenerated epidermis"*.

3.6. At day 21, complete re-epithelialization [1] and the presence of cutaneous appendages were observed [2].

3.6.1. LAB MEDIA: Figure 4D. *Video editor: Highlight the labelled "Regenerated epidermis".*

3.6.2. LAB MEDIA: Figure 4D. *Video editor: Highlight the labelled "Hair follicle" and "Sebaceous gland".*

1. Cutaneous
Pronunciation link: <https://www.merriam-webster.com/dictionary/cutaneous>
IPA: /kjuːˈteɪ.ni.əs/
Phonetic Spelling: kyoo·tay·nee·uhs
2. Therapeutic
Pronunciation link: <https://www.merriam-webster.com/dictionary/therapeutic>
IPA: /ˌθer.əˈpjʊː.tɪk/
Phonetic Spelling: thair·uh·pyoo·tik
3. Excisional
Pronunciation link: <https://www.merriam-webster.com/medical/excision>
IPA: /ɪkˈsɪʒ.ən.əl/
Phonetic Spelling: ik·sizh·uh·nuhl
4. Planimetry
Pronunciation link: <https://www.merriam-webster.com/dictionary/planimetry>
IPA: /pləˈnɪm.ə.tri/
Phonetic Spelling: pluh·nim·uh·tree
5. Pre-anesthetic
Pronunciation link: <https://www.merriam-webster.com/dictionary/anesthetic>
IPA: /ˌpriː.æn.əsˈθet.ɪk/
Phonetic Spelling: pree·an·uhs·thet·ik
6. Caliper
Pronunciation link: <https://www.merriam-webster.com/dictionary/caliper>
IPA: /ˈkæl.ə.pə/
Phonetic Spelling: kal·uh·per
7. Equidistant
Pronunciation link: <https://www.merriam-webster.com/dictionary/equidistant>
IPA: /ˌiː.kwəˈdɪs.tənt/
Phonetic Spelling: ee·kwuh·dis·tuht
8. Demarcated
Pronunciation link: <https://www.merriam-webster.com/dictionary/demarcate>
IPA: /ˈdiː.mɑːrˌkeɪ.tɪd/ ; /dɪˈmɑːrˌkeɪ.tɪd/
Phonetic Spelling: dee·mar·kay·tid; dih·mar·kay·tid
9. Subcutaneous
Pronunciation link: <https://www.merriam-webster.com/dictionary/subcutaneous>
IPA: /ˌsʌb.kjuːˈteɪ.ni.əs/
Phonetic Spelling: sub·kyoo·tay·nee·uhs
10. Musculature
Pronunciation link: <https://www.merriam-webster.com/dictionary/musculature>
IPA: /ˈmʌs.kjə.ləˌtʃʊr/
Phonetic Spelling: mus·kyuh·luh·choor
11. Hemostasis
Pronunciation link: <https://www.merriam-webster.com/dictionary/hemostasis>

- IPA: /hi:.moʊ'steɪ.sɪs/
Phonetic Spelling: hee·moh·stay·sis
12. Euthanasia
Pronunciation link: <https://www.merriam-webster.com/dictionary/euthanasia>
IPA: /ju:.θə'nei.zə/ ; /ju:.θə'nei.zi.ə/
Phonetic Spelling: yoo·thuh·nay·zhuh; yoo·thuh·nay·zhee·uh
13. Exudate
Pronunciation link: <https://www.merriam-webster.com/dictionary/exudate>
IPA: /'ek.sjə,deɪt/
Phonetic Spelling: ek·syuh·dayt
14. Re-epithelialization
Pronunciation link: <https://www.merriam-webster.com/dictionary/epithelialization>
IPA: /ri:,ep.ə,θi:.li.ə.lə'zeɪ.fən/
Phonetic Spelling: ree·ep·uh·thee·lee·uh·luh·zay·shuhn
15. Dermal
Pronunciation link: <https://www.merriam-webster.com/dictionary/dermal>
IPA: /'dɜ:.mə/ /
Phonetic Spelling: dur·muhl
16. Inflammatory
Pronunciation link: <https://www.merriam-webster.com/dictionary/inflammatory>
IPA: /ɪn'flæm.ə,tɔ:r.i/
Phonetic Spelling: in·flam·uh·tor·ee
17. Infiltrate
Pronunciation link: <https://www.merriam-webster.com/dictionary/infiltrate>
IPA: /'m.fil,treɪt/
Phonetic Spelling: in·fil·trayt
18. Granulation
Pronunciation link: <https://www.merriam-webster.com/dictionary/granulation>
IPA: /,græn.jə'leɪ.fən/
Phonetic Spelling: gran·yuh·lay·shuhn
19. Epidermis
Pronunciation link: <https://www.merriam-webster.com/dictionary/epidermis>
IPA: /,ep.ə'dɜ:.mɪs/
Phonetic Spelling: ep·uh·dur·mis
20. Sebaceous
Pronunciation link: <https://www.merriam-webster.com/dictionary/sebaceous>
IPA: /sɪ'beɪ.fəs/
Phonetic Spelling: sih·bay·shuhs