Reviewer Recommendation and Comments for Manuscript Number AB-15-2111

Strain-softening during uniaxial stretching of human skin: is it permanent damage or recoverable deformation?

Original Submission
Cormac Flynn, PhD (Reviewer 2)

Back | Edit Review | Print | Submit Review To Journal Office

Recommendation: Reject **Overall Manuscript Rating (1-100):** 60

Manuscript Question(s):	**Scale**	**Rating**
Please rate on a scale of 1-3 whether the Graphical Abstract is a meaningful and an accurate representation of the article. 1 = Meaningful; 2 = Not Meaningful; 3 = Not Provided. For more information, see www.elsevier.com/graphicalabstracts.	[1-3]	2

Reviewer Blind Comments to Author:
Summary
This manuscript presents a study on uniaxial tension tests of in vitro skin samples from breast surgery. Material parameters of a Fung exponential model were fit to the preconditioned unloading part of the experimental data. Results indicate that samples subject to multiple tests completely recover after a short period of time (~ 2 hours). The authors suggest that this is evidence that the observed strain softening is not due to damage (Mullin's effect). Tests performed on irradiated and scarred skin samples indicate a much stiffer response than normal skin.
The study is an interesting one and the large experimental data set will be of interest to most in the field. However, I do have concerns with many aspects of the approach. These are detailed below.

Specific comments:
1. The Abstract would be improved with the addition of quantitative results

2. The Introduction is too long. The detail on the micro-structure and mechanical properties of skin can be significantly shortened with appropriate references provided. Also, the first paragraph contains only one reference - more should be provided to support several statements

3. The references are very dated. Asides from a 2015 book chapter, the latest journal article referred to is from 2008. There has been a lot of work done since then on characterising the mechanical properties of human skin. I suggest the authors review more recent literature

4. Line 8, Page 5: Avoid the use of "etc."

5. What was the orientation of each excised skin sample? This will have a very significant effect on the mechanical response. It is essential that this is recorded and reported as it may explain differences seen in the response of irradiated, scarred, and normal skin samples (Figure 6 and Figure 7)

6. How was it ensured that there was no slippage of the specimen during a test? You explain some anomalies in results being due to slippage. How do you know it did not occur in others?

7. Why was a displacement rate of 0.4 mm/s chosen?

8. Explain what λ_c is in equation (4)

9. Labels in figure 2 are too small

10. Label the figures (a), (b), (c), and (d) as appropriate in Figure 3, Figure 4, and Figure 5

11. What is loading protocol i referred to in Figure 3(a)?

12. The authors say that below tension values of 0.1 MPa, the tangent modulus approaches a constant value. I do not see this in Figure 3(b). I see a vertical line below 0.1 MPa. Can the authors clarify? Similar comments apply to Figure 4(c)

13. The red line in Figure 4(d) is very hard to see. Similarly, the black dashed line in Figure 4(d) is difficult to see

14. The authors state that the fit in Figure 3(c) is extremely good. Can the authors quantify this fit?

15. Can the authors explicitly explain how the "similarity is quite evident" in Figure 4(b)?

16. Do Figures 4(c) and (d) show the tangent moduli for all the unloading curves shown in Figure 4(b)? If so, it might be better to use different symbols for each curve

17. It is difficult to read the graph in Figure 5(a). Perhaps limiting the x-axis between 1.4 and 1.6 might make this clearer

18. In Figure 5(b), I only see good similarity between the 15 mm displacement of samples US3-P6-May-0000 and US3-P6-1808. Due to the graph scale, it is too hard to tell how good the match is at lower displacements and for larger displacements, there was slippage. The authors need to present this result more clearly to support their claim

19. In Figure 5(c), I only see load-unload cycles at 6 displacements for US2-P5_Apr-1235. In the text you refer to 8 displacements in the protocol. Also, I only see six displacements for US2-P5-Apr-1040 with 7 displacements referred to in the text. The authors need to clarify this. It is very difficult to see the result that the authors describe. They should consider revising how they are presenting the results

20. The authors state that "the time scale of recovery [] to be rather short". Can you be specific and quantify this?

21. Figure 6 shows load-unload curves with very different nominal stress levels. why do the authors say they are "almost the same"?

22. What is the suction cup method?

23. The authors do not detail any limitations in their study. Specifically, no mention is made of the anisotropic properties of skin.

24. Reference [13] does not contain a year

Reviewer Confidential Comments to Editor:
INSTRUCTIONS FOR REVIEWER BLIND COMMENTS TO THE AUTHOR:

* Please do not comment specifically on the acceptability of the manuscript or provide any information that may serve to identify you.

* Please number your comments.

COMMENTS TO THE EDITOR:

1) General Assessment:

Please rate as: Excellent/Good/Fair/Poor

Fair- Originality
Poor- Technical quality
Fair- Clarity of presentation
Fair- Contribution to the field

2) Please briefly indicate the primary reason(s) for your overall recommendation regarding this paper. Comments regarding perceived strengths and weaknesses are appropriate.
Strengths: The experimental data is useful although if the orientation of the samples was not recorded then its use is seriously diminished
Weaknesses: Literature review is far from current; Presentation of results is unclear; model is very simple and ignores the anisotropy of skin

3) Please select your recommendation regarding publication from the drop down list, and rate the paper on a scale 0-100 (optional), with 100 being the best, 90-100 very minor revisions, 80-90 minor, 70-80 major, 60-70 marginal potential if seriously revised, 60 and below unpublishable.

Back | Edit Review | Print | Submit Review To Journal Office