Reviewer’s report

Title: Extubation Force Depends Upon Angle of Force Application and Fixation Technique: A Study of 7 Methods

Version: 3 Date: 4 April 2014

Reviewer: Thomas Kiss

Reviewer’s report:

Wagner et al present the results of a small comparative experimental study to assess extubation forces with respect to the angle of force application. 13 different angles forming nearly a full hemisphere on the plane of the face have been tested. Combinations of seven different tube fixation techniques with two different endotracheal (ET) tubes have been compared, namely: SolidAIRity system, Thomas Tube Holder, Anchor Fast device, adhesive Tape and non-adhesive cotton tie. A Laerdal intubation mannequin in a load frame was used to measure the prevalent extubation forces with a load cell. Extubation forces were recorded at 2cm and 5cm tube displacement, respectively.

The authors measured three values per tube – angle - restraint combination for a 2 cm and 5 cm tube displacement, in total 546 single values. New tubes and devices were used for every pull test.

Measurements for each tube-angle-restraint combination were converted to means and averaged to allow for comparison across all different fixation methods.

The SolidAIRity system required the highest force to displace the tube. The performance of the other tube restraints is not summarized in the text.

The posed question of this study is well defined; the methods seem to be appropriate. The raw data looks reasonable. The introduction is well written except of some difficult sentences. The statistical analysis needs major revision also to corresponding figures/tables. The authors should revise this part on the basis of consultation with a local statistician. The Material & Methods section needs some minor revisions for better readability. The Results section should contain data and should be readable and understandable without the figures/tables. The Discussion section would benefit from a clear structure. I would like to evaluate this manuscript again after the revision.

Major Compulsory Revisions

1) During my reading I noticed that none of the figures and tables has a legend. This makes it extremely difficult to understand the results and to follow the statistics. Please try to include all facts that are important to understand the figure in the legend. Generally speaking, a figure should be understandable without reading the full text and the full text should be understandable without looking at the figures. Figure 1, 2, 3 and 4 are essential and beneficial for the article. Figure 5 doesn’t give me much more information than Figure 4. Figure 6
is not understandable for me at the moment - does the Boxplot show median, interquartile range with minimum and maximum? Please revise this for a better understanding. Table 1 is not labelled and the text states 95% confidence intervals – but usually confidence intervals are reported as [x;y] and not x±y.

2) The statistical analysis is based on raw data that is shown in Figure 4. I agree, it makes sense to transform all values of a restraint method to a mean that can be compared with one of the other restraint types. To my understanding there are 7 different groups of tube restraints that have to be compared. Assuming that the data fulfill the criteria for a parametric test, a comparison of means for more than two groups would be done by ANOVA.

With the current description in the full text and the tables/figures I cannot follow your statistics. The full text states „mean force and standard deviation at each test point“, in the table you depict confidence intervals and in Figure 6 you show a Boxplot that normally shows a median. I recommend consulting a local statistician to clarify these points.

Minor Essential Revisions
• Results: Can you please describe your results in the text and not only refer to the figures/table. You should not only refer to the SolidAIRity System but compare all of the tested systems with each other.
• Discussion: I recommend to have a clear structure in the discussions section:
  1. summary of the results
  2. comparison with other literature
  3. limitations
  4. conclusion - summary of the results in context of the discussion and clinical routine
• Methods, paragraph 1, sentence „...a series of discrete angles covering a hemisphere on the plane of the face...“. Can you please try to describe the angles in the text and not only refer to the figure?
• Methods, paragraph 5, sentence „Forces were compared at each of the 13 test points“ Can you please define test point in the first paragraph of the methods section - together with the description of the tested angles “test point” is described quite late in the text, although you refer to it much earlier (same in the abstract).
• Material and Methods, first paragraph, sentence "Angles were chosen to simulate possible extubation scenarios while balancing material costs and statistical requirements." I don't understand the meaning of this sentence. Can you please explain more?
• Introduction, last paragraph, sentence „This study is comparative in nature with precedence given to maintaining consistency across force tests as opposed to replication of clinical conditions.“ Too complicated – can you please write simpler?
• Introduction, last paragraph, sentence „A quantitative framework for analysis of
current ET tube restraint methods, along with qualitative observations of fixation performance when subjected to different force vectors, may aid in the reducing unplanned extubation.” Too complicated – can you please write simpler?

- Material and Methods, second paragraph sentence „All testing was performed on a Laderal intubation mannequin.“. It is called „Laerdal“.
- If you use the MATLAB program you should state the software producer and the program version.

**Level of interest:** An article of limited interest

**Quality of written English:** Acceptable

**Statistical review:** Yes, and I have assessed the statistics in my report.

**Declaration of competing interests:**

I declare that I have no competing interests