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 Bluth

**Reviewer's report:**

This prospective study of Wagner and colleagues aims at comparing seven endotracheal tube–restraint combinations with regard to mechanical forces needed for tube removal in an ex-vivo model of unplanned extubation. The strength of their work derives from the standardization of 13 different tube removal directions, covering a hemisphere on the plane of the face and reflecting typical clinical scenarios. The authors found relevant differences in the efficacies of these fixation techniques, particularly depending on the angle of force application.

The scientific question and hypothesis is well defined and might be of importance for both clinicians and manufacturers. However, due to the use of an intubation mannequin at room temperature without salivation transfer of these data to the clinical setting might be done cautiously.

**Major compulsory revisions:**

1) Seven tube-restraint combinations were analyzed to allow for a broad view on currently available devices. As the authors state, the use of adhesive tape following the Lillehei method and umbilical cotton twill is common. However, the authors may provide a rationale for investigation of advanced tube restraint devices like Thomas™ tube holders, Anchor fast devices (please provide the manufacturer for clarity) and the newly introduced SolidAIRity® system. Moreover, one might wonder if the combination of adhesive tape and the Securisyn endotracheal tube, although designed for use with a special fixation device is of interest from a practical point of view.

2) The authors may provide a rationale for performing 3 attempts at each angle and each tube restraint combination. Was any calculation of sample size done before conducting the experiments?

3) With regard to data presentation, the primary outcome of this investigation was the mechanical force needed to remove an endotracheal tube by 2 and 5 cm, respectively. Secondary endpoints are not presented systematically in the results section but could be of special interest. The authors state, that tube occlusion or device failure occurred during some experiments. These outcomes may be even more important considering clinical practice, since they could occur earlier and probably easier than the tube removal itself. The authors are kindly asked to first provide a more detailed description of each device failure. Second, device failure
and airway occlusion should be reported systematically for each position and device by providing the force needed to provoke this event, e.g. by using a table if appropriate.

4) Please consider revision of the statistical part of the study. For statistical analysis fixation methods were compared using t-test. This would require 21 possible comparisons. However, there are no p-values presented on the graphs or within the text. I recommend using ANOVA test for seven groups and possible post hoc analysis, together with adequate presentation of the statistical results. Furthermore, presentation of the force data (table 1, figure 4, 5 and 6) seems to be redundant. I recommend to show mean + standard deviation values of forces at each position for each device and to present mean + standard deviation for each device independent of the position. Be careful not to mix usual parametric (mean ± standard deviation) and nonparametric (box plot) means of data presentation. Please provide adequate description of the figures and tables to ensure understanding without reading the text.

5) The study is supported financially by Securisyn Medical, LLC. Against this background, the authors must take care to avoid selective outcome reporting. This includes aiming at a well-balanced presentation and discussion of the results between the several tube-restraint combinations, as is not yet the case. I further recommend not to mention the SolidAIRity® system in the abstract but to write the abstract more universal, for example by comparing conventional vs. device fixation techniques.

6) The authors are kindly asked to revise the manuscript regarding typos and to streamline the text. The discussion section might be structured to first provide the main results. Second, the results should be discussed concerning previously published studies. At least, limitations of the study should be addressed and implications for clinical users might be drawn.

Minor Essential Revisions
At this time there are no minor essential revisions. Please respond to major compulsory revisions until minor issues will be discussed.

Level of interest: An article whose findings are important to those with closely related research interests

Quality of written English: Needs some language corrections before being published

Statistical review: No, the manuscript does not need to be seen by a statistician.

Declaration of competing interests:
I declare that I have no competing interests