The Effect of Co-Axial Incisions on the Traction Removal Force of Mushroom-Retained Gastrostomy Tubes

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Introduction

Removal of mushroom-retained tubes is associated with trauma along the stoma tract producing pain, bleeding, and site infection. We aim to provide proof-of-concept data for an alternative removal technique by evaluating the effect of co-axial incisions of the mushroom-retention gastrostomy tube on the required force for removal.

Design/Sample

An ex-vivo model of the gastrostomy stoma was fabricated with a polyethylene plate through which a mushroom-retained gastrostomy tubes may be introduced. Three tube sample groups were created representing unmodified 20 Fr tubes, and 20 Fr tubes with one, or two co-axial cuts extending though the mushroom retention feature. The maximum force required for tube removal via traction was measured with a digital force sensor.

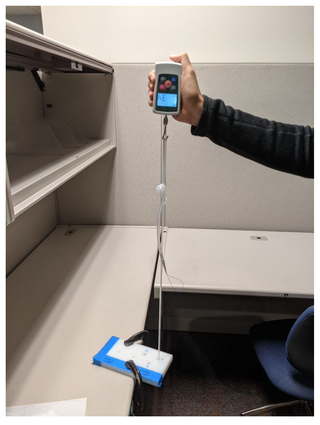

Figure 1. A secured polyethylene plate through which a mushroom-retained gastrostomy tube is pulled, attached to a digital force sensor

Analysis

The required forces of removal for each sample group were compared using the Kruskal-Wallis test. Pairwise comparisons were completed using the Wilcoxon rank test.

Results

A total of 70 traction removal procedures of mushroom-retained gastrostomy tubes were conducted. In comparison to an unmodified tube, reduction in the mean force required for removal was statistically significant in both the single axial cut group ($p < 0.05$) and the two co-axial cut group ($p \ll 0.05$). The addition of co-axial incisions facilitated the folding of the mushroom-retention mechanism and reduced the amount of deformation required to fold through the tract.

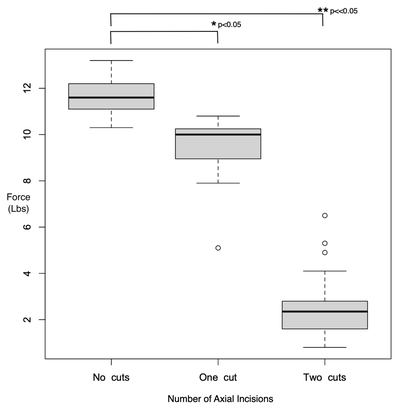

Figure 2. Box plot representation of the force of gastrostomy tube removal in the three tube groups. Reduction in the mean force required for removal was statistically significant in both axial cut groups.

Figure 3. Images depicting gastrostomy tube mushroom retention discs with no incisions, one axial incision, and two axial incisions.

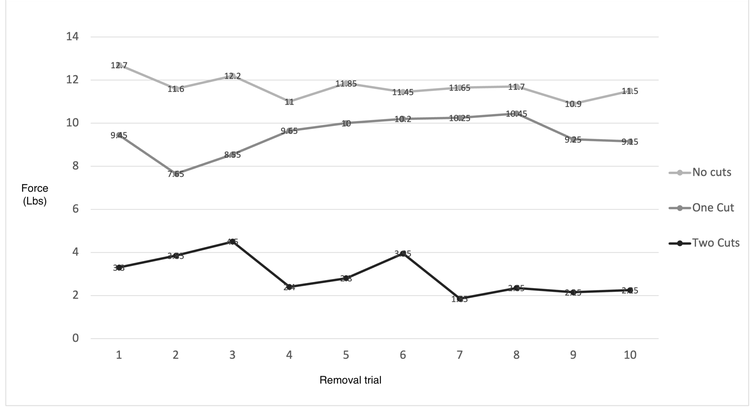

Figure 4. Line graph representation of the force of gastrostomy tube removals, by traction removal procedure trial. A downward trend is noted in some groups, likely related to plastic deformation of the retention discs over 10 removals.

Summary

Axial incisions of a mushroom-retained gastrostomy tube result in statistically significant reduction in the traction force required for removal in our benchtop model. The current study supports the development of an instrument that may safely and efficaciously create co-axial incisions in an in-situ mushroom-retained gastrostomy tube.

Conclusions/Further Study

An instrument that creates axial incisions of a mushroom-retained gastrostomy tube would result in a decrease in the required force for removal and theoretically decreased trauma to the stoma tract.

Figure 5. The "Davis Knife" is a prototype instrument used for the creation of co-axial incisions of the mushroom retention disc.

Acknowledgements

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