Consideration of an alternative design for a Percutaneous Endoscopic Gastrostomy Tube
Santosh Rohit Yerrabolu¹, Dr. Joseph Mollendorf¹, Dr. Robert Baier¹,² & Dr. Michael Caty³
1. Mechanical and Aerospace Engineering, University at Buffalo 2. Industry/University Center for Biosurfaces, University at Buffalo 3. Surgery and Pediatrics, University at Buffalo

OBJECTIVE:
This investigation proposes an alternative percutaneous endoscopic gastrostomy feeding tube design with optimized materials selection to be used for its construction. The candidate materials were chosen from 18 commercial catheters and 2 reference grade polymers, using tissue-catheter-friction testing and surface chemistry characterization (infrared spectroscopy and Critical surface tension approximation).

1. INTRODUCTION:

1) WHO uses these [1]? The inability of certain persons to chew or swallow food (but can digest them) leads to malnutrition and decline in the quality of life. Some of the indications include
   - Oesophageal or oropharyngeal cancer
   - Neurological diseases
   - Injuries
   - Physiological disorders

2) HOW is this treated?

- Nasogastric feeding tube, 2) Gastrostomy feeding tube and 3) Jejunostomy feeding tube, are inserted with the aid of an endoscopic visualization

3) Motor and location of tube placements [2,3].

Figure 1: Food is directly injected/infused into the stomach.

- Nasogastric feeding tube. 2) Gastrostomy feeding tube and 3) Jejunostomy feeding tube based on mode and location of tube placements [2,3].

- Surgical Procedures: ‘Push’ and the ‘Pull’ techniques

- Perioperative Endoscopic Gastrostomy (PEG) feeding tubes

- Surgical Procedures: ‘Push’ and ‘Pull’ techniques

Table 1: Reported Complications

<table>
<thead>
<tr>
<th>Length of tube &amp; diameter</th>
<th>Bladder &amp; external leakage [2] (a)</th>
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</thead>
<tbody>
<tr>
<td>Tube migration &amp; subsequent medical obstruction</td>
<td>Granulation tissue</td>
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<tr>
<td>Ulceration of tube [2] &amp; a</td>
<td>Stomal infections</td>
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<td>Tube clogging</td>
<td>Pressure necrosis</td>
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<tr>
<td>Tube degradation</td>
<td>Skin or gastric ulceration</td>
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<tr>
<td>Buried bumper syndrome</td>
<td></td>
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</table>

**Pursued in this investigation**

2. MATERIALS:

- 18 commercial catheters and 2 Reference grade polymeric tubings were evaluated
- Freshly cut beef tripe was used to replicate soft tissues in the human stomach

3. METHODS:

(a) My conceptual design

(b) Estimation of tissue holding force against catheter/tubing simulating slipping/redislocation of tube:

Objective: To determine the various Coefficient of Friction (CoF) values corresponding to the holding force between the tissue and the catheter/tube surfaces.

(c) Infrared Spectroscopic analysis:

Objective: Approximate the bulk materials and/or any additional coatings or contaminations on the catheter/tube samples.

4. RESULTS and DISCUSSIONS:

- Traditional Nylon with an undetermined filler material and Reference grade Polyethylene have been found to have higher holding force/coefficient of friction with tripe tissue.
- Most of the catheters had a critical surface tension between 20-30 dynes/cm. However, Coefficient of Friction was found to be a weakly increasing function of Critical Surface Tension.
- Coefficient of friction decreased with increasing water contact angle with surface

5. CONCLUSION

The optimum materials of construction are Nylon with an undetermined (as yet) filler material or/and Reference grade Polyethylene to minimize slipping/redislocation of gastrostomy tube/seal & subsequent peristomal leakage. Fused Deposit Moulding/3-D printing are sought for manufacturing of the product. Radio Frequency Glow Discharge Treatment (RFGDT) is proposed as a sterilizing technique.

6. FUTURE WORK:

- To determine any correlation between Coefficient of Friction and Contact angle data through various interpretations

REFERENCES: