

## Innovation Session (cont.)

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### A NOVEL BIODEGRADABLE DEVICE FOR INTESTINAL LENGTHENING

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#### **Purpose:**

Previous studies demonstrated successful mechanical lengthening of rat jejunum using an encapsulated Nitinol spring device over a stabilizing guidewire. We sought to improve the applicability of intestinal lengthening by creating a biodegradable device.

#### **Methods:**

Using previously measured properties of the Nitinol spring device, we created biodegradable springs with similar outer diameter (3.4mm) and spring constant (0.0010 N/mm). Heat-set polycaprolactone (PCL, a polymer used in absorbable sutures) springs were created and tested in dry and hydrated environments for different durations to simulate *in vivo* conditions. The optimal PCL springs were placed into coated gelatin capsules. A 1-cm segment of rat jejunum was isolated and lengthened *in vivo* using the encapsulated PCL spring device. After a period of lengthening, the isolated segment of jejunum was measured, and tissue histology was analyzed.

#### **Results:**

The optimal PCL springs most closely resembling the Nitinol spring devices had an average spring constant of  $0.0018 \pm 0.00039$  N/mm, pitch (distance between coils)  $1.55 \pm 0.85$  mm and band width  $0.825 \pm 0.016$  mm. After hydration, the PCL springs maintained similar spring constants for two weeks *in vitro*. When tested *in vivo*, jejunal segments were lengthened from 1.0 cm to 2.8 cm without the need for a stabilizing guidewire. Lengthened segments had increased smooth muscle thickness and fewer ganglia compared to normal intestine. Lengthened jejunum was successfully restored back into intestinal continuity (Fig. 1) and possessed mucosa with crypts and villi. The restored segment demonstrated peristalsis under fluoroscopy and had normal orocecal transit time.

#### **Conclusions:**

A novel biodegradable encapsulated spring device was created and successfully used to mechanically lengthen intestinal segments. Use of a biodegradable device may obviate the need for retrieval after lengthening. This approach improves the applicability of the device and may be useful for the treatment of short bowel syndrome.