

A TEXTILE SENSOR

USING PIEZOELECTRIC FIBRES TO MEASURE DYNAMIC COMPRESSION IN A BOWEL STENT

Anna Vahlberg¹, Anja Lund¹, Maria Bergström², Per-Ola Park², Erik Nilsson³, Bengt Hagström³

¹ University of Borås, Borås, Sweden. ² Södra Älvsborgs Sjukhus, Borås, Sweden. ³ Swerea IVF, Mölndal, Sweden

Contact: anja.lund@hb.se

A recently introduced indication for stent treatment is covering of postoperative or ulcer-caused gastrointestinal perforations and leaks [1].

Spontaneous stent migration is a frequently occurring problem in gastrointestinal stent treatment. It may be assumed that the bowel simply tries to pass a stent forward down the gut, and further that the mechanical properties and the geometric shape of the stent affect the probability of migration. These factors are not yet scientifically studied.



Figure 1 A stent with integrated piezoelectric fibres

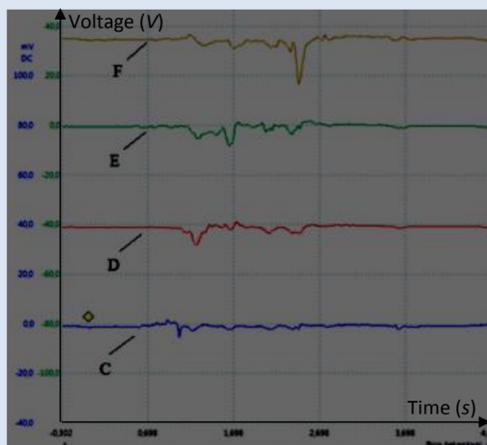


Figure 2 Voltage outputs as a function of time. The stent is subjected to a constriction moving from left (C) to right (F)

We integrated novel piezoelectric textile fibres in a stent, as shown in **Figure 1**, and evaluated their functionality as non-intrusive sensors for bowel movements. Compressing the stent caused the piezoelectric fibres to generate an electric signal.

Figure 2 shows the piezoelectric voltage signals from a sensor-stent that was pulled through a constricting passage. As the point of compression shifted (with time) from fibre C, over D and E to F, the fibre's respective output signals reached their respective maxima.

The results indicate that piezoelectric fibres, integrated in a stent for gastrointestinal use, can sense bowel movements. The fibres generated output signals, the amplitudes of which could be correlated to the amplitude and the position of compression.

The proposed sensor-stent is expected to be useful as a tool to study the effect of stents on intestinal motility, and to evaluate this effect as a function of the geometry and mechanical properties of the stent.

References

- [1] Bergstrom M., Arroyo Vazquez J.A., Park P.O. "Self-expandable metal stents as a new treatment option for perforated duodenal ulcer" *Endoscopy*, **45**, p 222, 2013.
- [2] Nilsson, E., Lund, A., Jonasson, C., Johansson, C. and Hagström B. "Poling and characterization of piezoelectric polymer fibers for use in textile sensors" *Sensors and Actuators A: Physical*, **201**, p 477, 2013.



UNIVERSITY OF BORÅS
SCIENCE FOR THE PROFESSIONS



VÄSTRA
GÖTALANDSREGIONEN
SÖDRA ÄLVSBERGS SJUKHUS

swerea|IVF