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# Microcontainers as an oral drug delivery system

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## Introduction

For oral drug delivery of BCS class 2 and 4 drugs, it may be necessary to introduce innovative drug delivery systems to improve bioavailability. Micro fabricated devices have been proposed as promising oral drug delivery systems.<sup>1</sup> Microcontainers consist of a walled reservoir extending from a flat base where size and shape easily can be controlled and also allowing for unidirectional drug release.<sup>2</sup>

## Aim

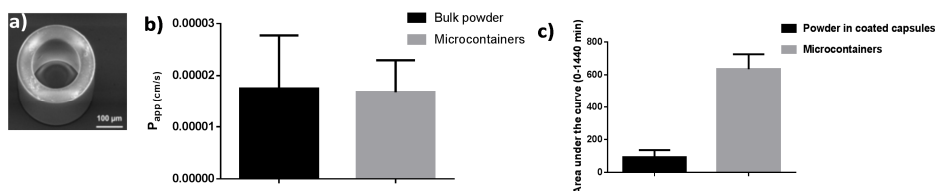
The purpose of this study was to evaluate microcontainers *in vitro* and *in vivo* as an innovative oral drug delivery system for the poorly water-soluble drug, furosemide.

## Method

SU-8 microcontainers (inner diameter of 223  $\mu\text{m}$ ) (Fig 1a) were filled with amorphous sodium salt of furosemide (ASSF), subsequently, the cavity was spray coated with Eudragit<sup>®</sup> L100. The release of ASSF from the microcontainers was examined in biorelevant gastric and intestinal media and the intestinal permeability of ASSF dosed in microcontainers was evaluated using a Caco-2 cell culture model. Furthermore, the oral bioavailability of ASSF in microcontainers and in capsules coated with Eudragit<sup>®</sup> L100 were assessed.

## Results

Drug release from microcontainers was prevented in the gastric medium, while an immediate release of ASSF was seen in the intestinal medium. The cell studies showed a fast permeability of ASSF with no significant differences between the microcontainers and bulk powder,  $P_{app}$ :  $1.7 \pm 0.6 \cdot 10^{-5}$  cm/s and  $1.8 \pm 1.0 \cdot 10^{-5}$  cm/s (mean  $\pm$  SD n=11), respectively (Fig 1b). The relative oral bioavailability of ASSF in microcontainers was found to be  $220 \pm 43\%$  (mean  $\pm$  SEM, n=6) when compared to drug-filled capsules coated with Eudragit<sup>®</sup> which was reflected by a larger AUC for the ASSF in microcontainers (Fig 1c).



**Fig. 1** a) A microcontainer, inner diameter of 223  $\mu\text{m}$ , b) intestinal permeability of ASSF filled into microcontainers in comparison with bulk powder, c)  $AUC_{0-1440 \text{ min}}$  for the plasma concentration of ASSF dosed in microcontainers and in Eudragit-coated capsules after oral administration to rats.

## Conclusion

Microcontainers show considerable potential as a future oral drug delivery system.

## References

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2. Ainslie K.M. *et al.* Small (2009) 5: 2857-2863