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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.[1] 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.[2]

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 µm) (Fig 1a) were filled with amorphous sodium salt of furosemide (ASSF), subsequently, the cavity was spray coated with Eudragit® 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® 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±0.6·10^{-5} cm/s and 1.8±1.0·10^{-5} cm/s (mean±SD n=11), respectively (Fig 1b). The relative oral bioavailability of ASSF in microcontainers was found to be 220±43% (mean±SEM, n=6) when compared to drug-filled capsules coated with Eudragit® which was reflected by a larger AUC for the ASSF in microcontainers (Fig 1c).

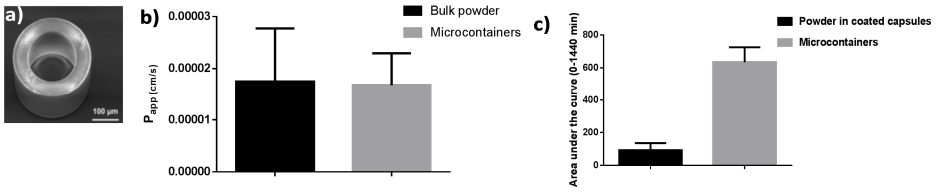

Fig. 1 *a) A microcontainer, inner diameter of 223 µm, b) intestinal permeability of ASSF filled into microcontainers in comparison with bulk powder, c) $AUC_{0\text{-}1440\ min}$ for the plasma concentration of ASSF dosed in microcontainers and in Eudragit-coated capsules after oral administration to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