

# Novel Insulin Infusion Catheter Provides Full Functionality in Clogged State – An Imaging Study

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## Introduction

- Kinking and clogging of the insulin infusion catheter (IIC) at the tip is a major issue in the daily use of insulin infusion catheters [1, 2, 3].
- Kinking or clogging occurs when tip of the catheter hits the abdominal muscle tissue or by silent occlusion due to tissue invasion.
- Flow interruption detection by insulin infusion pump may not be sufficient to detect silent occlusion and can lead to a life threatening situation.
- A novel IIC with additional longitudinal openings in the catheter wall (lantern design) has been designed to ensure efficient insulin infusion even if kinking/clogging of the catheter tip occurs.

## Materials and Methods

- Experiments were performed in fresh human skin explants obtained from Biobank Graz.
- 100 IU/ml insulin solution (ActRapid®, Novo Nordisk) were injected which included 10% contrast agent (Xenetics® 350, Guerbet) to enhance contrast between tissue and insulin solution.
- 6 IU bolus insulin were administered via an Animas® Vibe® insulin infusion pump at 1 IU/s bolus infusion rate.
- The volume of the injected insulin depot was assessed by  $\mu$ CT screening (Inveon Multimodality System, Siemens, Germany).

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## Aim

- Functionality of a novel IIC was compared to a standard IIC (Inset II®, Unomedical A/S).
- Differences in insulin absorption were assessed by calculating the Surface/Volume ratio [4].
- Flow interruption alerts were measured as an additional measure for functionality.

## Results

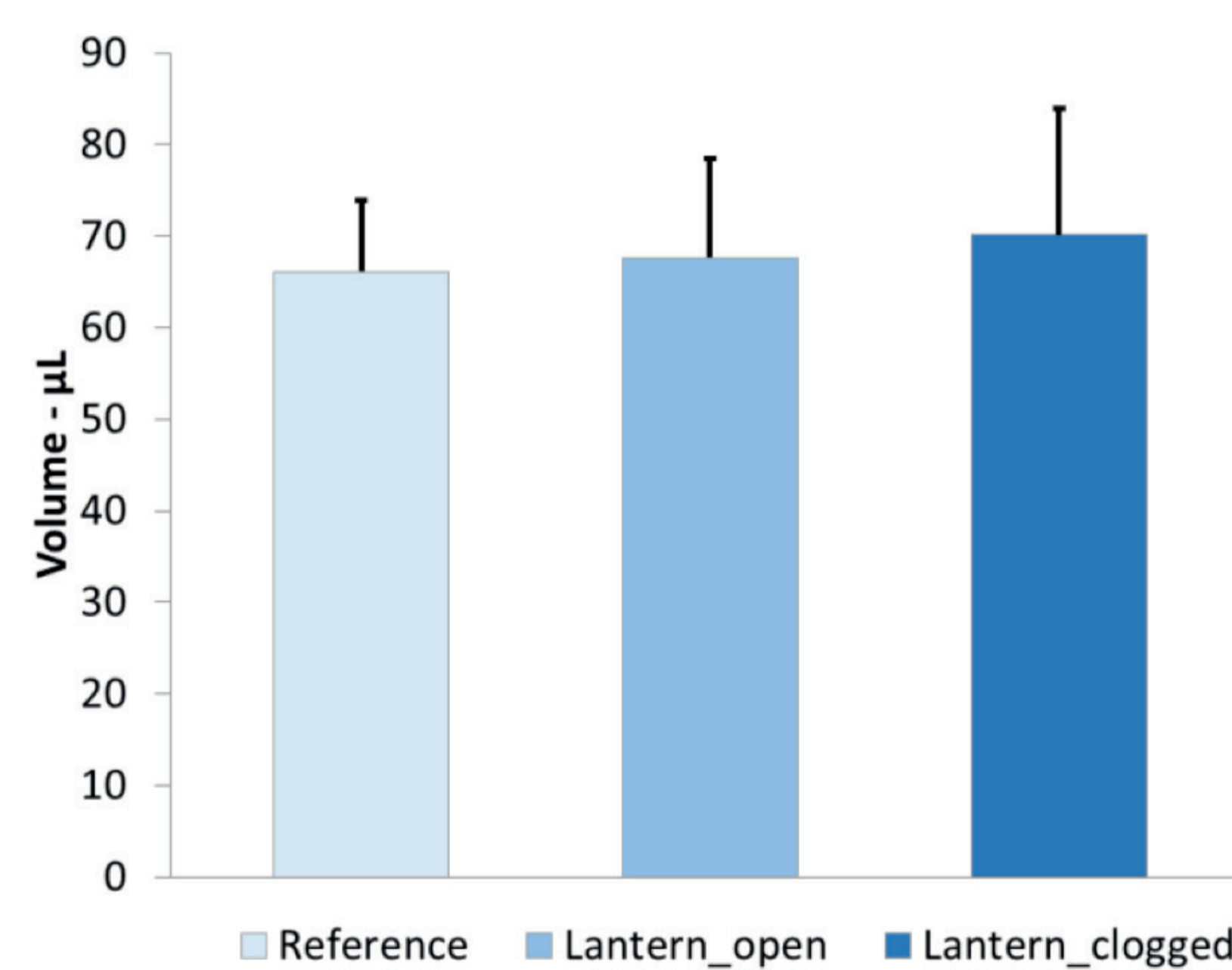


Figure 1: Mean insulin volume (error bars representing SD) per catheter type (N=30 each type).

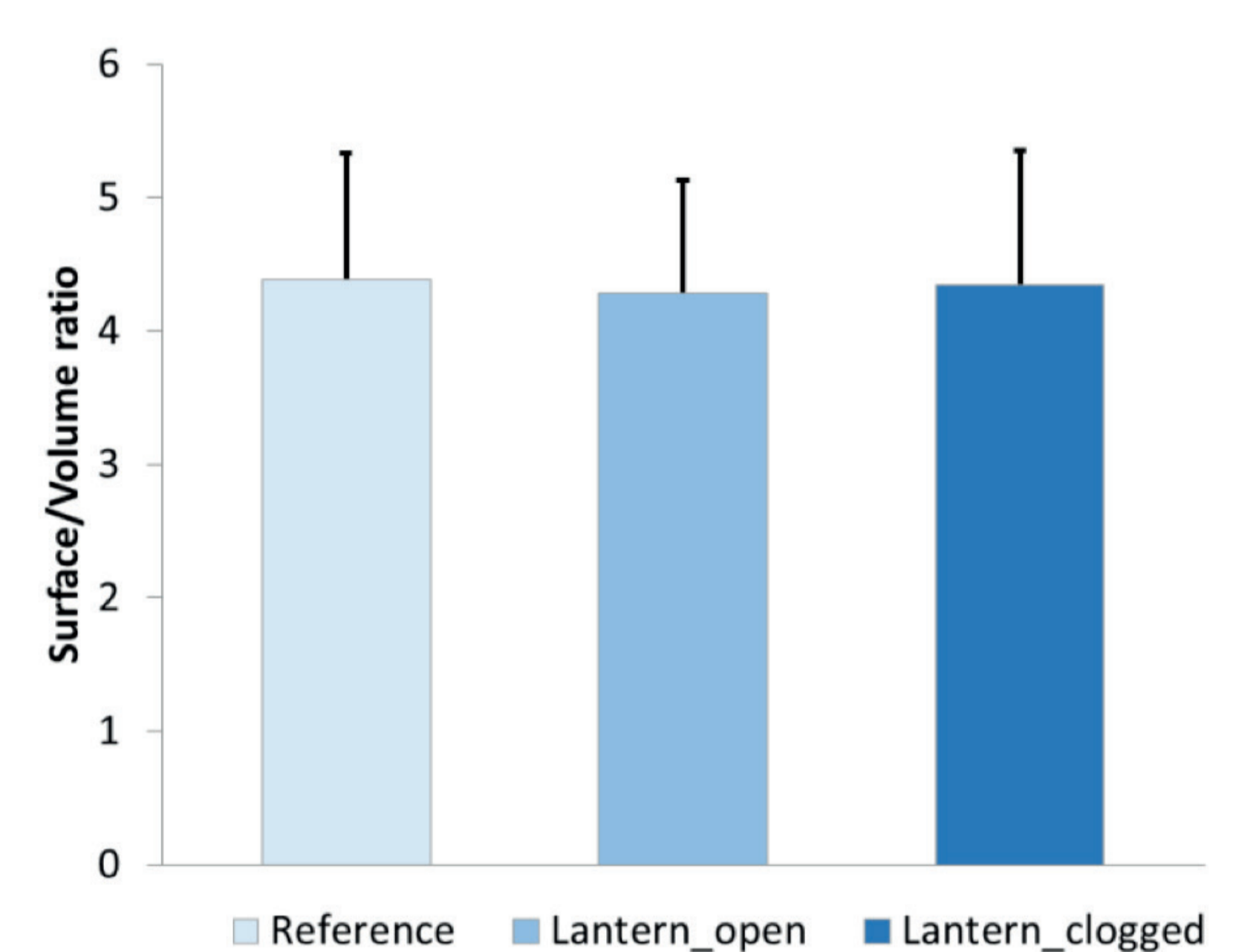


Figure 2: Mean surface/volume ratio (error bars representing SD) per catheter type (N=30 each type).

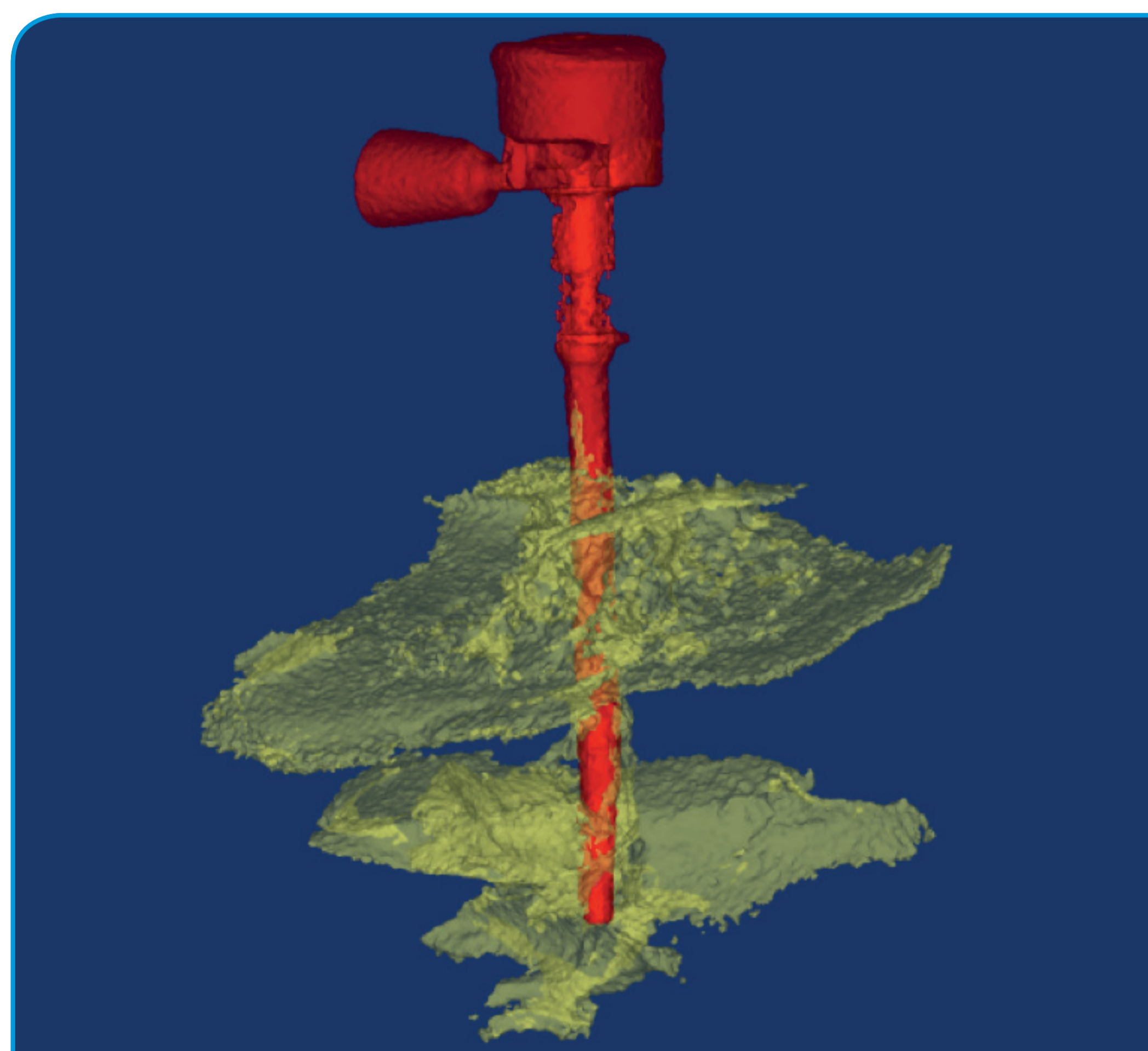


Figure 3: 3D-image of novel IIC (red) after insulin (yellow) infusion.

- There was no difference in the mean volume of the injected insulin depot among the tested catheters (Figure 1).
- There were no alerts for flow interruption even when the clogged novel IIC was used.
- There was no difference in Surface/Volume ratio between novel IIC and reference (Figure 2).

## Conclusion

- Additional openings are not influencing depot formation.
- Functionality of novel IIC is provided even in case of kinking or silent occlusion.
- We conclude that the novel IIC can provide a valuable contribution to patient well-being and safety.

## References

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- <sup>2</sup>Deiss et.al. 2016, Diabetes Technology & Therapeutics, Volume 18, Number 9, doi:10.1089/dia.2016.07281.sf
- <sup>3</sup>Klonoff et.al. 2017, Journal of Diabetes Science and Technology, Volume 11(3), 451-454, doi:10.1177/1932296817700545
- <sup>4</sup>Mader, J.K., Birngruber, T. et.al., 2013. Diabetes Care 36, 780-5, doi:10.2337/dc12-1319