Droplet-based real-time detection of amylase in patients undergoing pancreatic surgery

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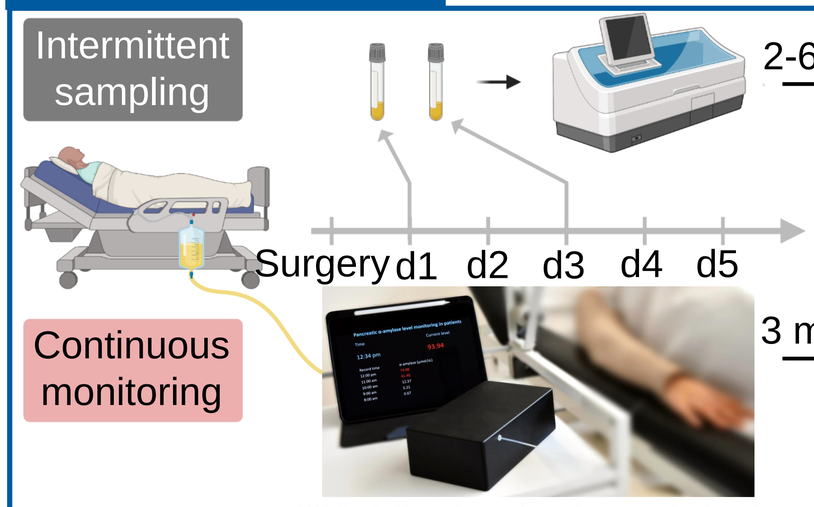
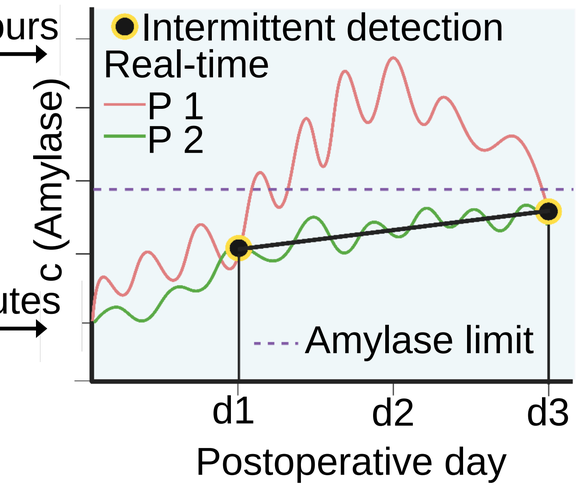
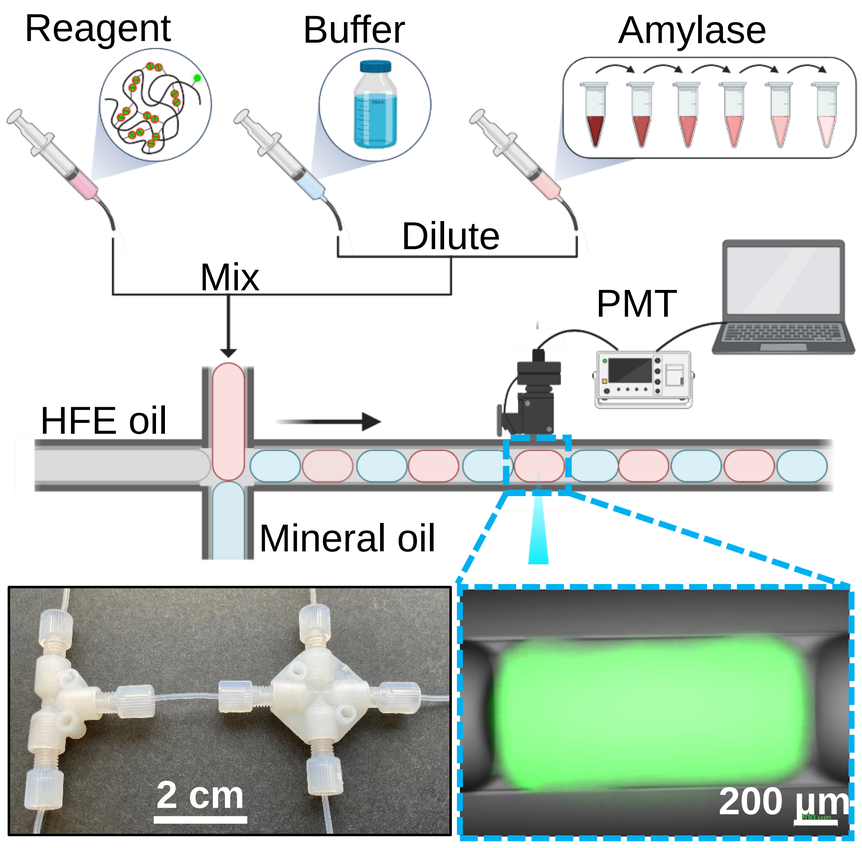
Introduction





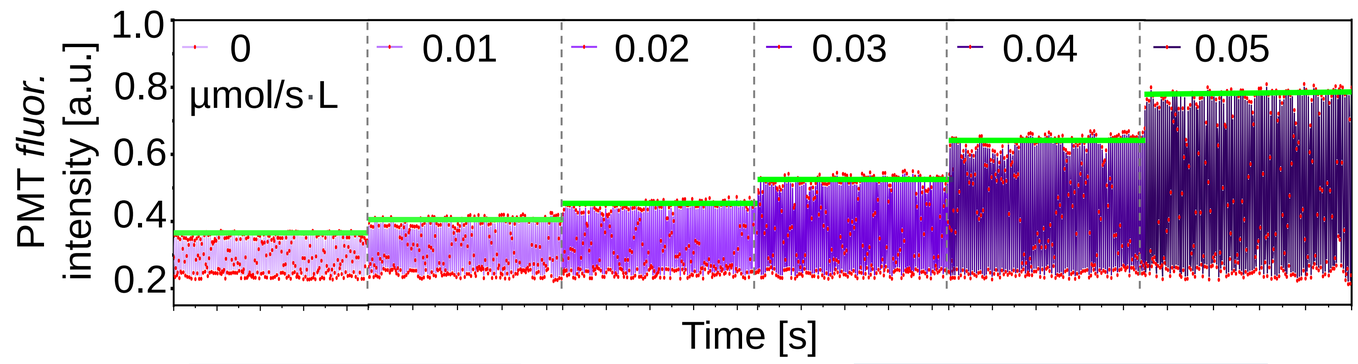
- Pancreatic surgery complications influence cure. Current clinical strategies quantify α-amylase activity intermittently, resulting in delayed treatment.
- The **portable droplet-based microfluidic** device is capable of **real-time monitoring** α-amylase activity.
- This strategy significantly improves the determination time (**3 min)** and detection limit (**7 nmol/s·L**) and reduces material requirement (**10 µL)** and wastes.

Detection Principle

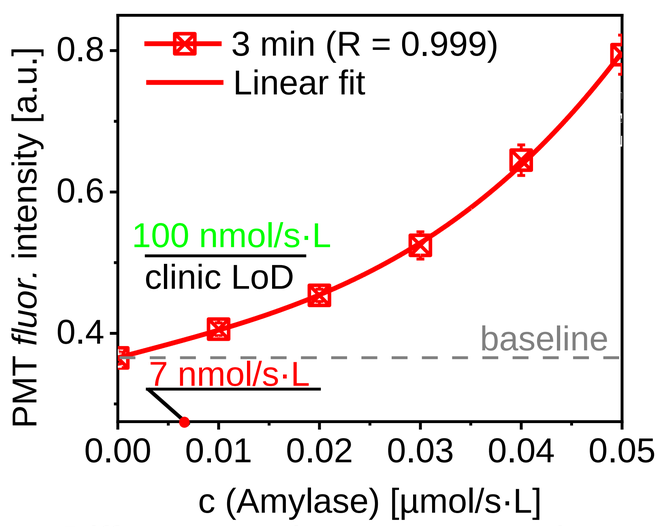


- Reagent, amylase, and buffer are mixed as an aqueous phase through T-junctions.
- Droplets formed at cross-junction after meeting HFE oil and mineral oil (spacer).
- Amylase reacts with the reagent, resulting in cleavage products emitting fluorescence.

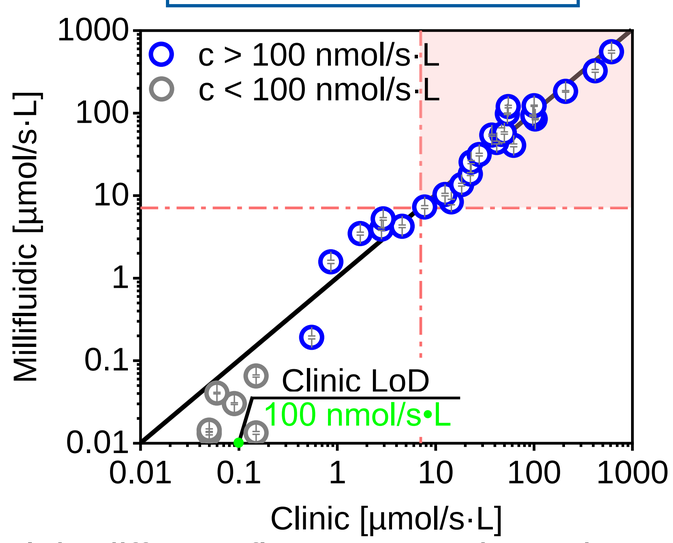
Calibration Curve & Patient Sample Test



Calibration curve

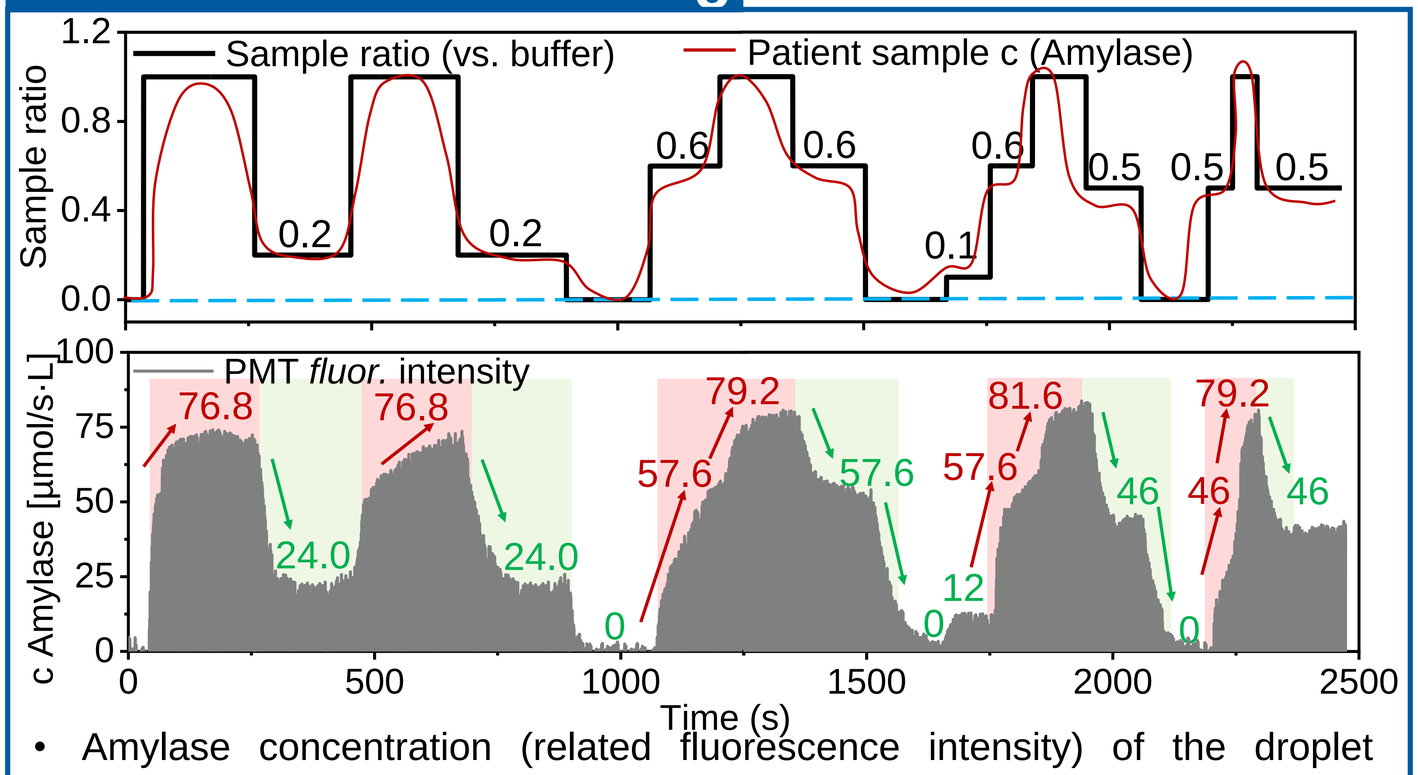


Correlation results



- Different amylase concentrations result in different fluorescence intensity
- Calibration curve determined at **3 min** with LoD of **7 nmol/s·L**
- Results of the clinical and millifluidic methods have a great linear correlation in a total of **32 patient samples**.

Continuous monitoring



- Amylase concentration (related fluorescence intensity) of the droplet sequence shows a quick response in amylase concentration fluctuations

X. Zhao *et. al.,* Portable droplet-based real-time monitoring of pancreatic α-amylase in postoperative patients, submitted

Conclusion

- Droplet-based real-time detection of amylase offers improvement in LoD, detection time, and reagent requirements.
- All 32 samples measured with the millifluidic method matched well with clinical measurements
- Rapid response of fluorescence intensity to sample concentration fluctuations indicates the method can be implemented to continuously monitor drain α-amylase activity of patients.

Outlook

- We expect this concept could be transferred to further relevant analytes, setting new standards of diagnostics, monitoring, and surgical care.
- We envision the potential utility of our technique in other clinical scenarios, *e.g.*, detecting "anastomotic leakage in colorectal surgery" or "bile leaks in liver surgery" where our droplet-based analysis technique could be explored.

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DRESDEN concept