

Designing a Drip-Free Injector Spike for Contrast Media Transfer in CT/MRI Suites



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Introduction

- In the U.S., there are over 34 million MRI and 80 million CT scans performed annually
- Prior to imaging, contrast media is injected into the patient to enhance the contrast of the images
- Bayer sells 40 million DP-1000 spikes per year to transfer the contrast media from stock bottles to the injector system



Figure 1: Image before (left) and after (right) contrast media injection



Figure 2: Bayer's Stellant Injector System

Problem

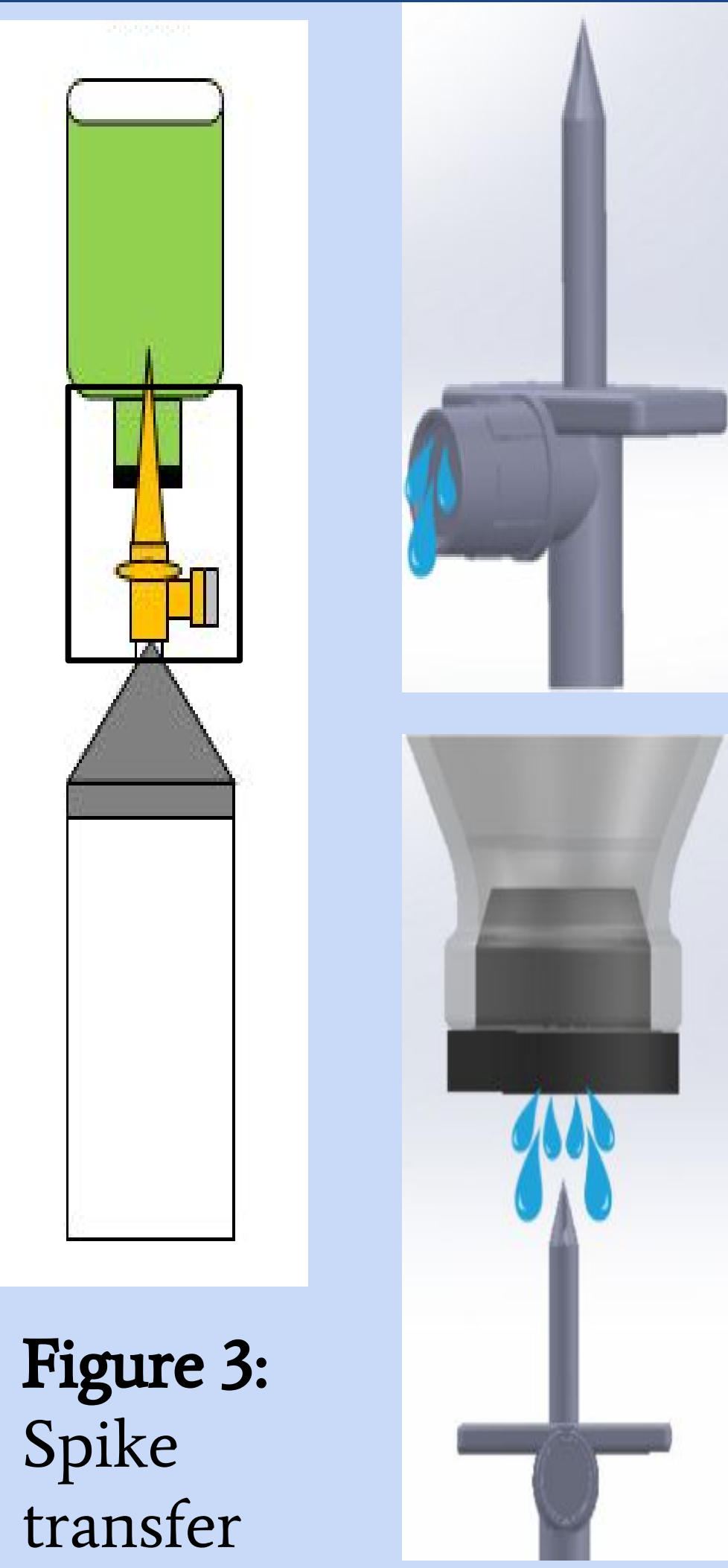


Figure 3: Spike transfer contrast media (green) to the injector system (white)

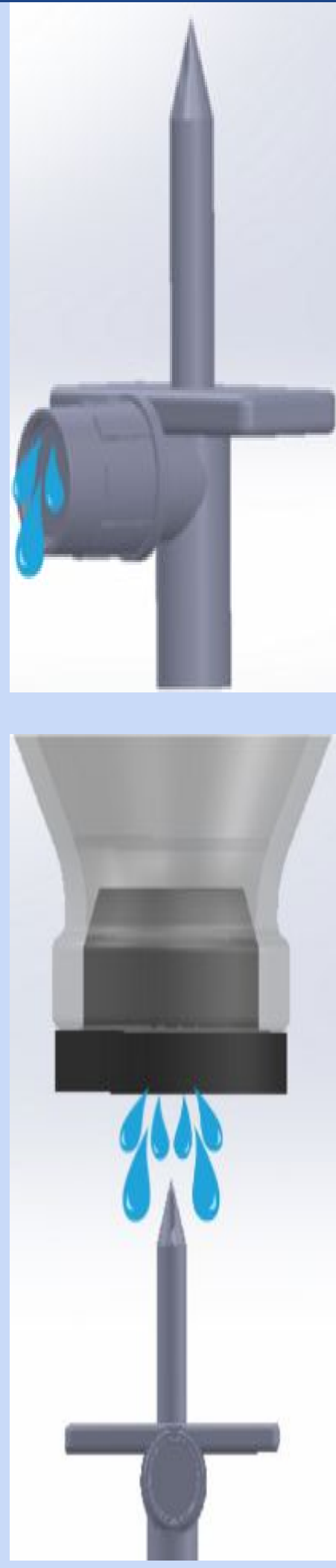


Figure 4: Leaks from the air vent (above) and spike tip (below)

The DP-1000 Bayer Spike leaks from the contrast bottle

- Approximately 90% of filling sequences from the vent filter
- Approximately 25% of filling sequences (>20 mL purge volume)

Leaks are the #1 customer complaint because they waste media, hinder workflow, and damage injector systems.

Prototyping

- Our team assisted Bayer in development of a **proprietary spike design to reduce leaks** from the air vent and the contrast bottle during removal
- Prototype parts were **3-D printed** for feasibility testing, and then **injection molded** for the final design

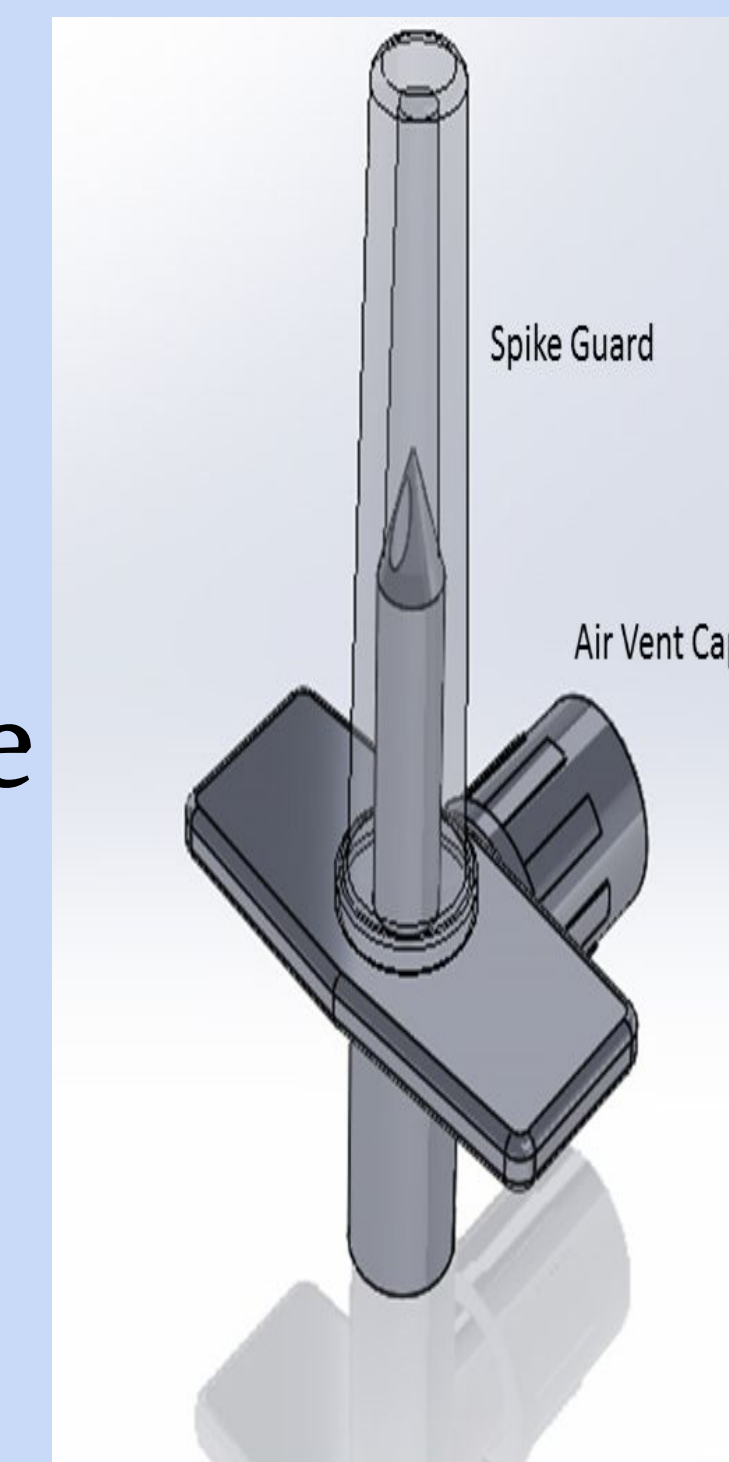


Figure 5: DP-1000 Spike

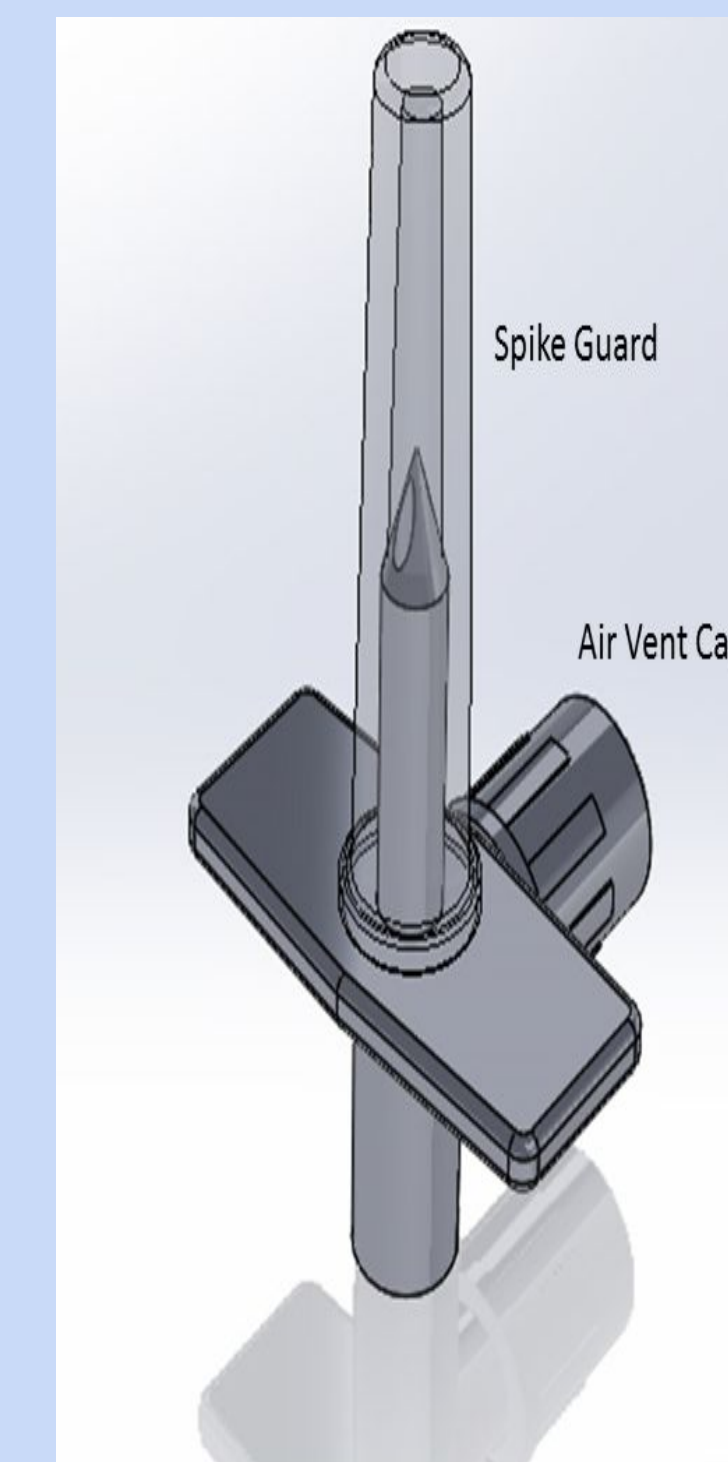


Figure 6: New Prototype

Testing

- The efficacy of the new spike design and its ability to transfer contrast were investigated
- The new prototype spike was compared with the original DP-1000 spike on the Stellant injector system
- Filling sequences using flow rates (1-10 mL/s), purge volumes (10-30 mL), and glycerine water were utilized
- **Qualitative observations and quantitative measurements** determined if spikes were leaking fluid from the vent port or upon removal of the bottle from the spike
- Quantitative measurements not shown for IP protection.

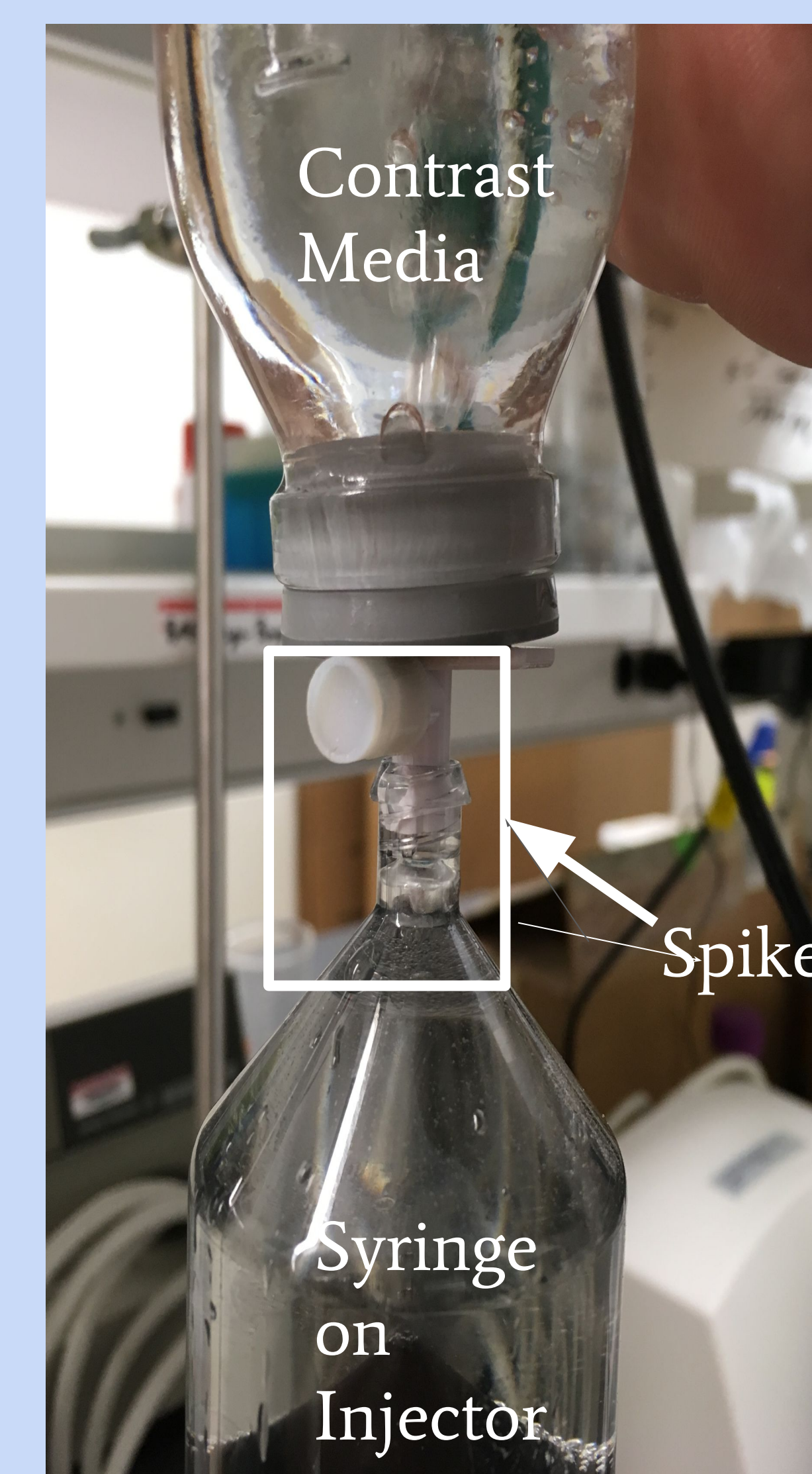


Figure 7: Testing set-up

Results

Compared to the DP-1000 spike, our prototype:

- Prevents 100% of leaks from air vent and contrast bottle.
- Costs no more to manufacture
- Requires no additional procedures and training
- Maintains form factor
- Received positive feedback from experienced CT technologists

Conclusion & Future Directions

Our prototype features a disposable spike that prevents all leaks and spillage during use and disposal.

Future directions:

- Finalize design details to ensure manufacturing feasibility
- Establish quality control system with supplier
- Build a business case and explore possible price increase options

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