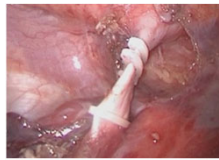


Motivation

- Da Vinci robot-assisted surgery system is currently only capable of single clip application during surgery
- Each tool insertion increases the likelihood of infection and breaks surgery workflow
- Manual laparoscopic surgery already utilizes multi-fire clip applicator



Innovative Concept



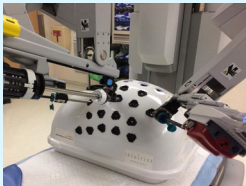
A clip depot is held by a forceps inside the body. Da Vinci clip applicator is refilled without removing it from the body.

The design takes inspiration from the standard Large Hem-o-lok Clip depot and StitchKit robotic suturing aid device



Design Evolution

Design Constraints:



Da Vinci Laparoscopic Simulator



Standard Trocar Sizes

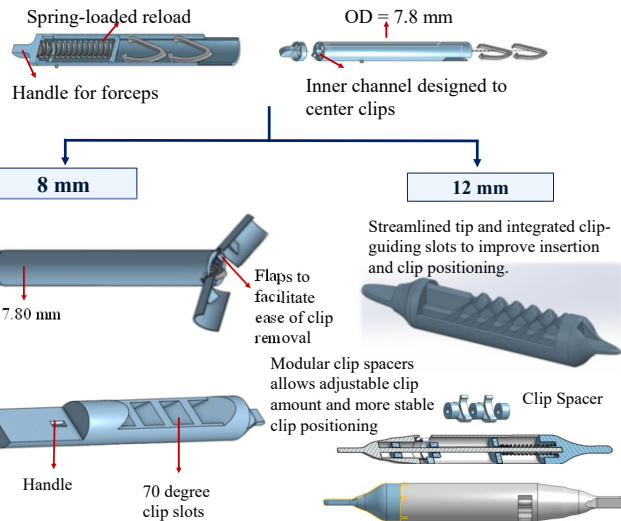


Hem-o-lock Dimensions



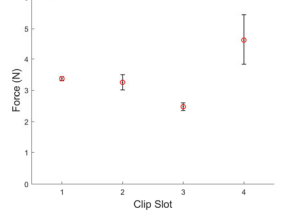
prototype

Delivery Load

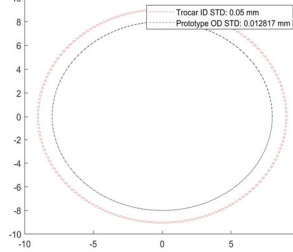


Results

Average Force for Clip Removal From 8mm Prototype



8mm Prototype and 8mm Trocar Measurements



Design Verification:

- Clips are securely retained within the depot.
- The depot outer diameter remained below the trocar inner diameter, allowing sufficient insertion clearance.

User Testing Results:

- Clip loading into the depot was successful.
- Clips were delivered and removed smoothly.
- Transfer of clips from the depot to the applicator still requires refinement.

Testing Videos:



Scan Me

Conclusion

- Demonstrates a proof-of-concept secondary tool for multiple clip application in robot-assisted surgery.
- Reduces the need for repeated tool exchanges.
- Improves surgical workflow efficiency.
- Bridges the gap between the dexterity of surgical robotics and the efficiency of multi-fire manual laparoscopic tools.

Further Work

- Refine the design to enable easier loading into the clip applicator.
- Adapt the design for medium and small clip sizes.
- Conduct user studies with medical students and surgeons.
- Validate device performance in more realistic surgical environments.

Acknowledgments

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