



# Deployer Device for Endo retractor

# INTRODUCTION



# LAPAROSCOPIC SURGERY

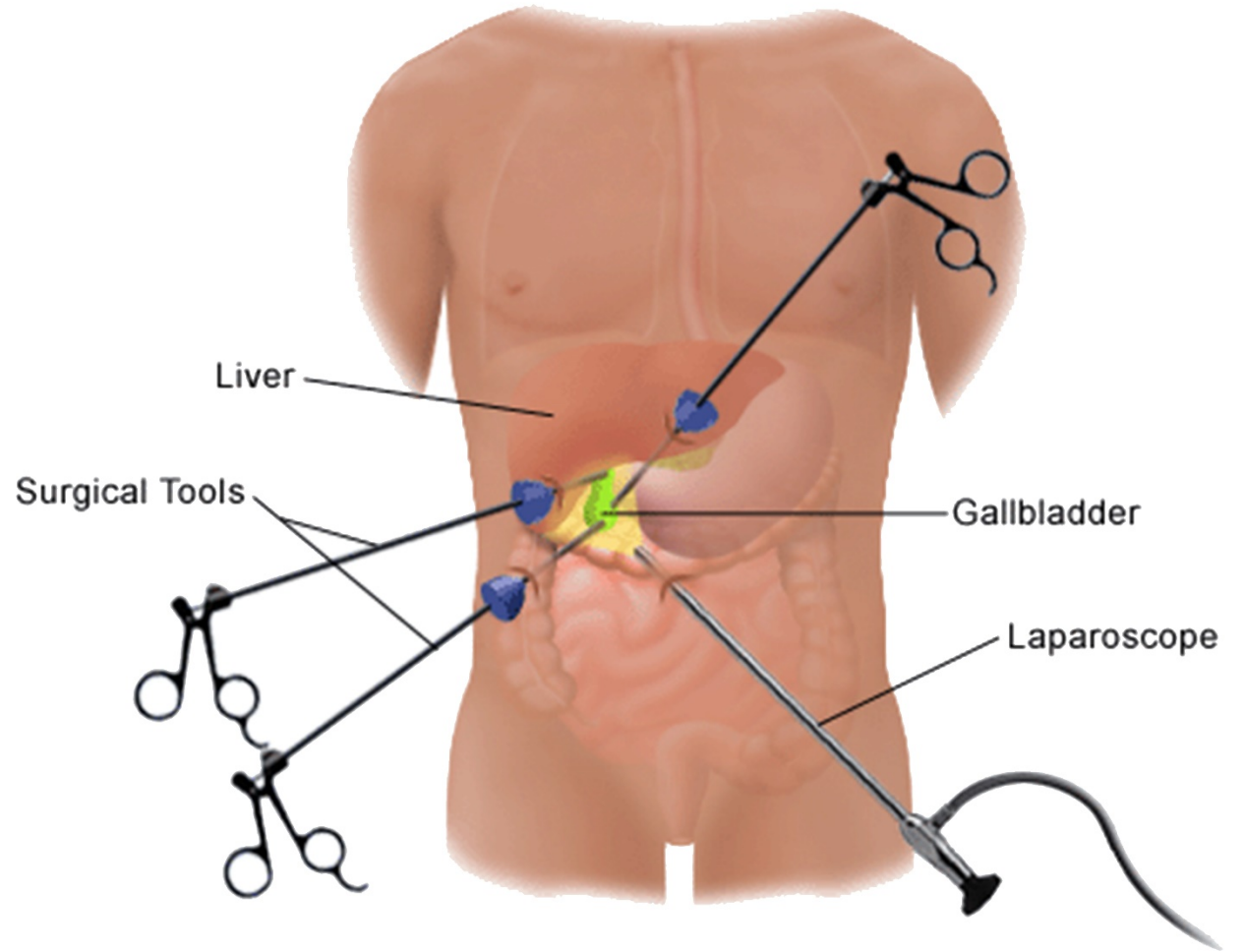
Minimally invasive or keyhole surgery



# LAPAROSCOPIC SURGERY

It is a **minimally invasive surgery** performed through **small incisions** made in the abdominal wall.

The inner organs are viewed by inserting a **fibre-optic instrument**.







# GALLBLADDER

Storing and pumping the bile into the intestine



# GALLBLADDER

Gallbladder is a **pear sized organ** situated beneath the liver. It is responsible for **storing the bile** secreted by the liver.

Removal of gallbladder is necessary in case of **bile stone or cancer** of the gallbladder.

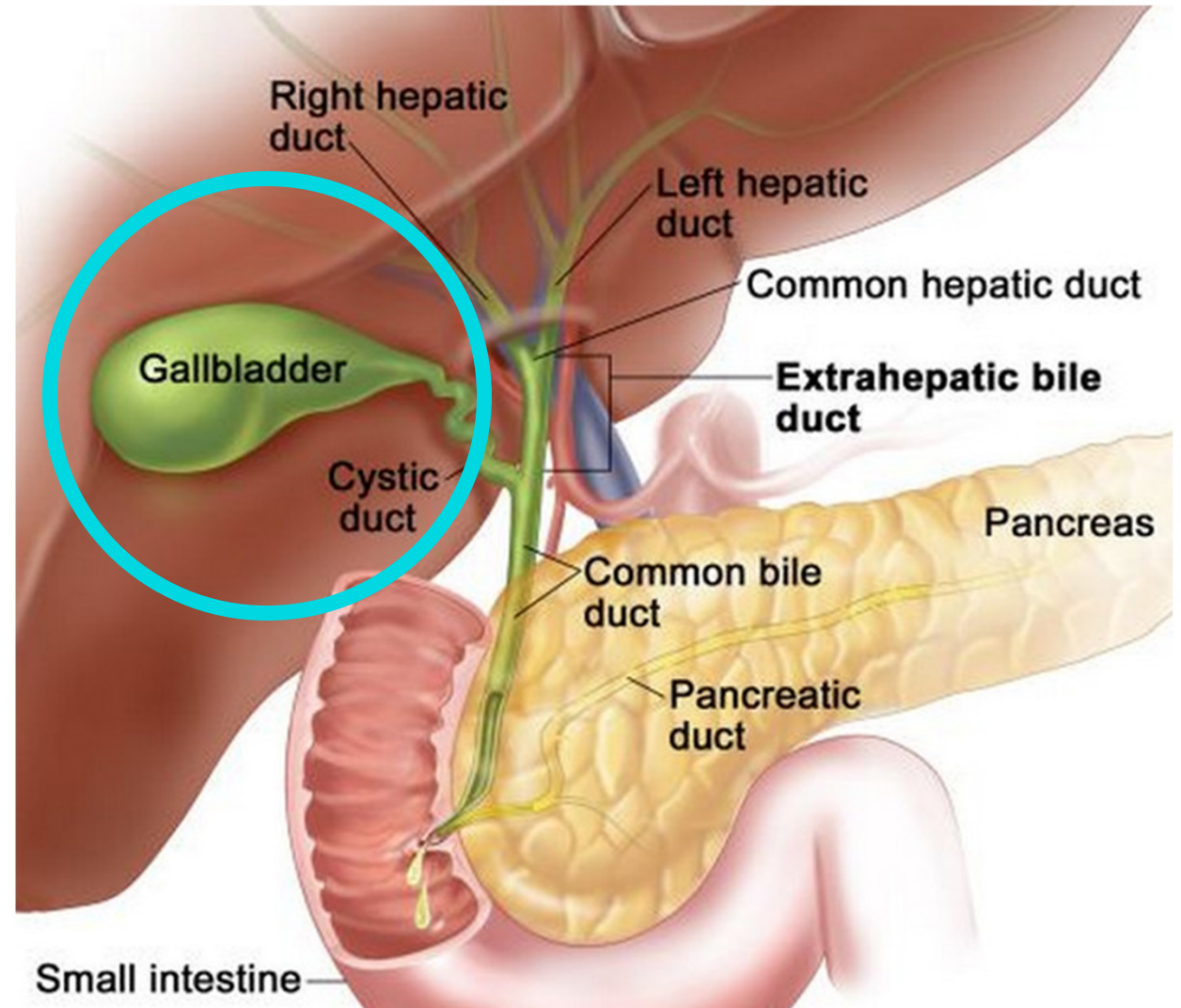


IMAGE SOURCE: [http://anatomy-medicine.com/uploads/posts/2015-07/1436269423\\_gall-bladder.jpg](http://anatomy-medicine.com/uploads/posts/2015-07/1436269423_gall-bladder.jpg)



# CHOLECYSTECTOMY

Surgical removal of Gallbladder



# CHOLECYSTECTOMY

Surgical **removal of gallbladder.**

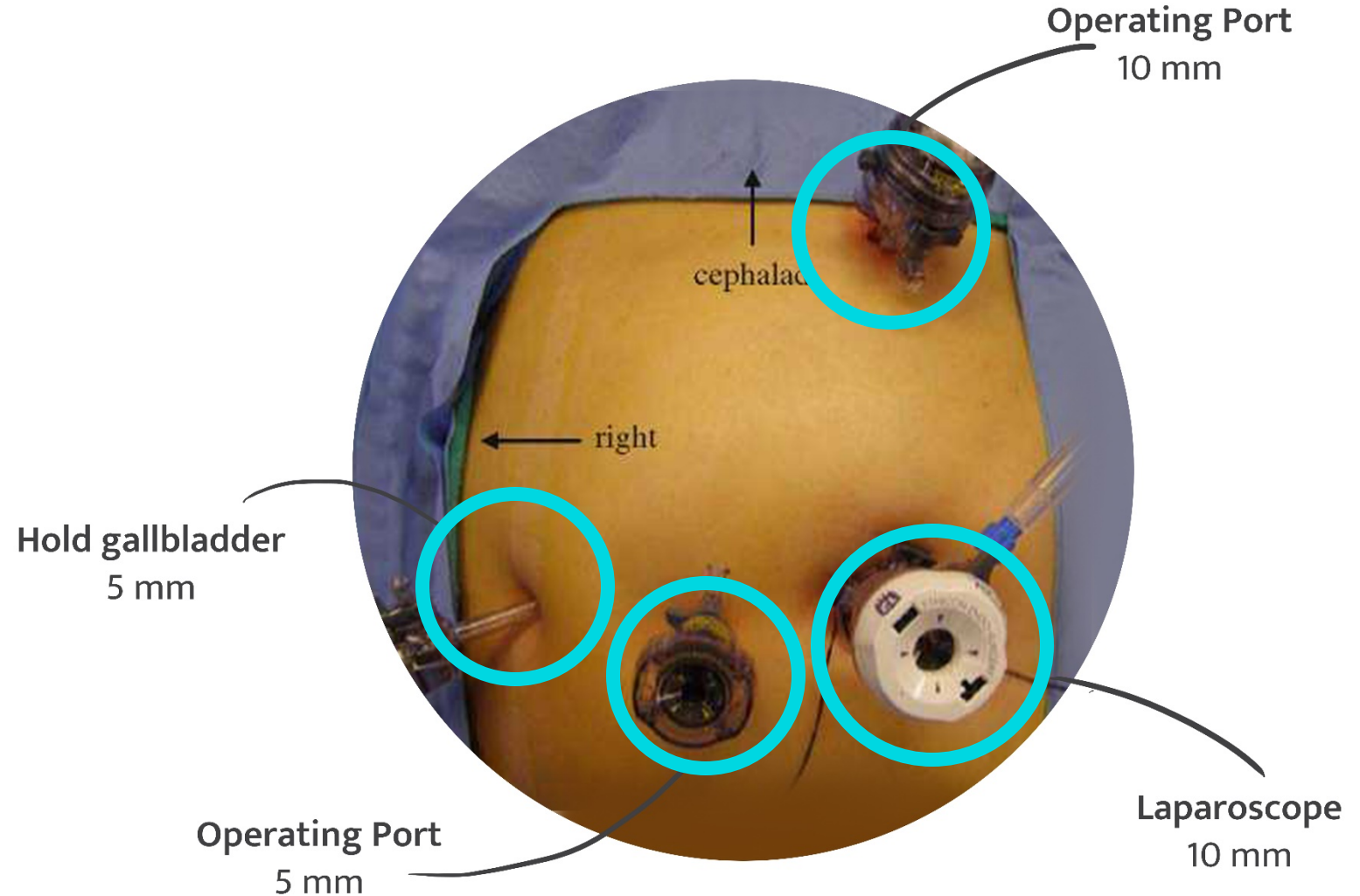
Procedure can be performed by the **laparoscopic method.**

**4 incisions are required**

1 port: Laparoscope

2 ports: Operating ports

1 port: Holding the gallbladder





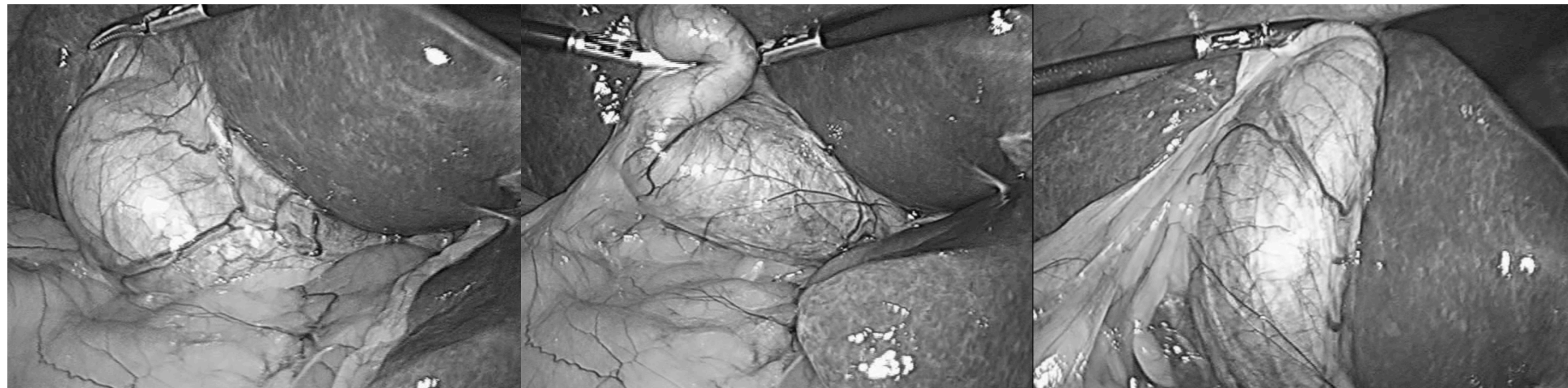


2 assistants involved in the surgery

1 assistant is engaged throughout the surgery to hold the gallbladder

Hand position and port use

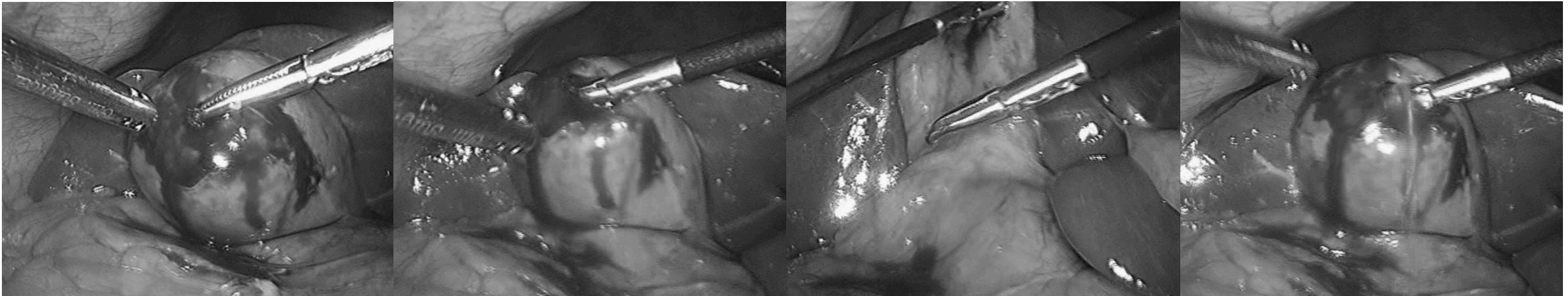
Pre preparation, equipment placement and operation theater layout



## Grasping the gallbladder

Grasper can cause damage to the gallbladder if the wall thickness is less.





## Grasping the gallbladder

The gallbladder is difficult to grasp if it is swollen.



# ENDO RETRACTOR

Designed by Lata Chawla

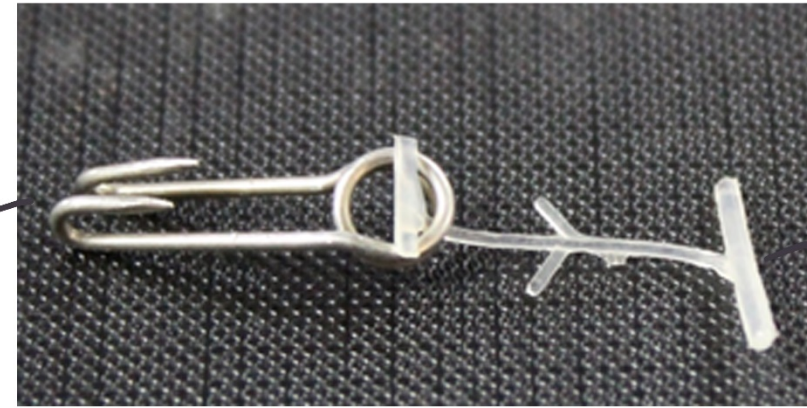


# ENDO RETRACTOR

A device to **hold the gallbladder** to **expose the Calot's triangle**

**Eliminates one port**  
**Reduces human assistance**  
**Reduces chance of contamination**

Hook

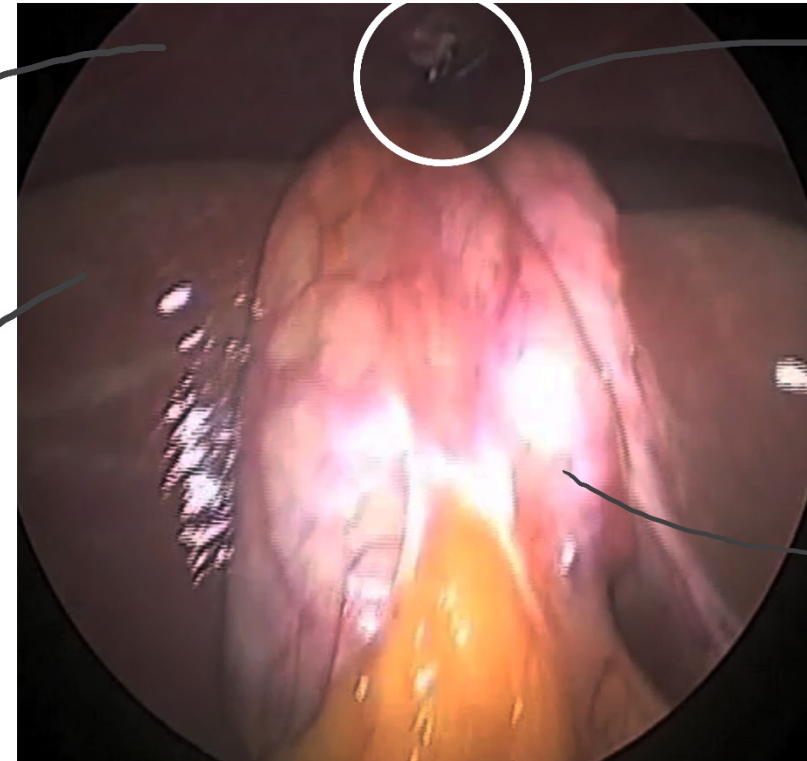


Tag

Peritoneum

Inner wall of the abdomen

Liver



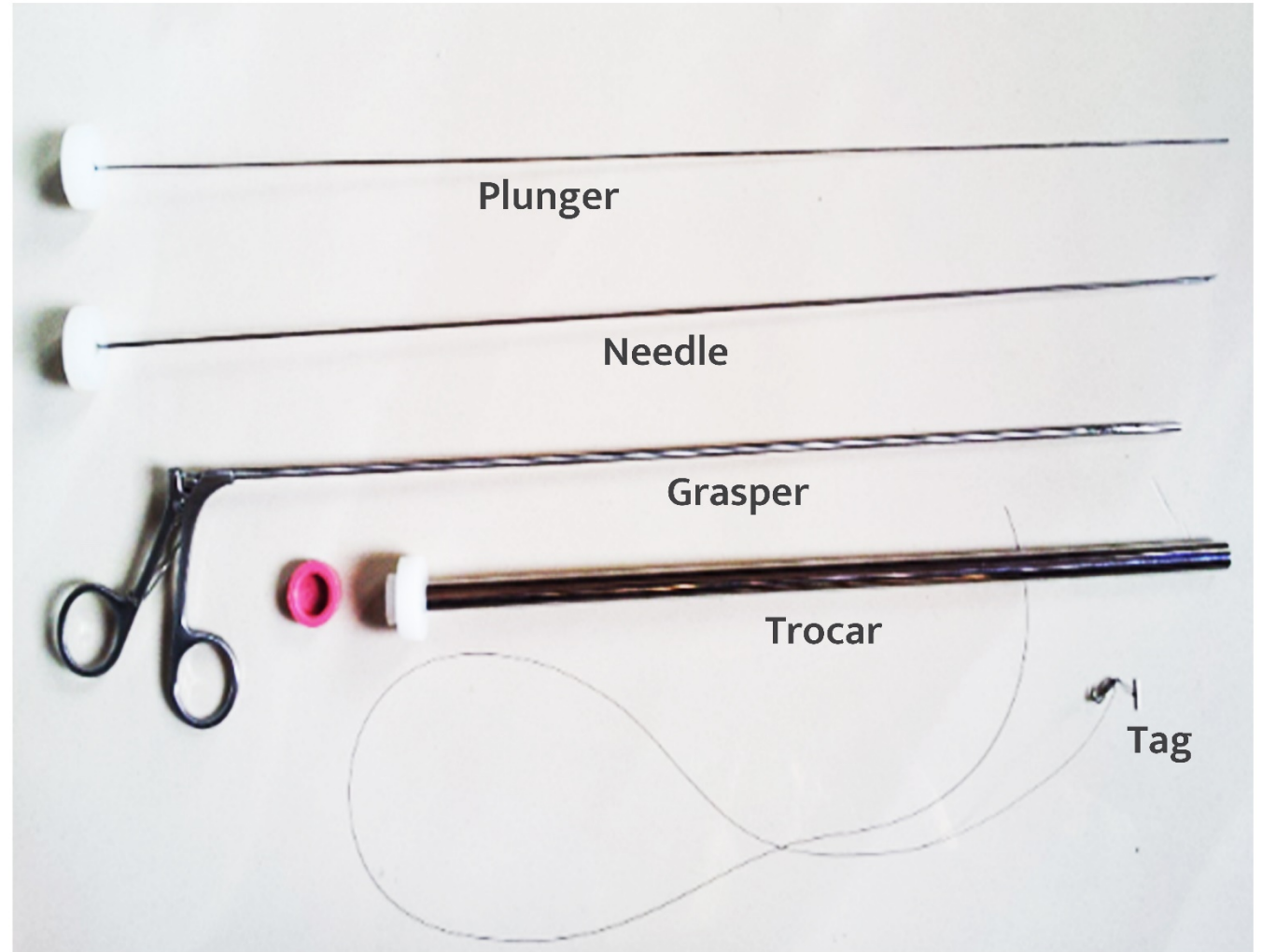
Endoretractor

Gallbladder



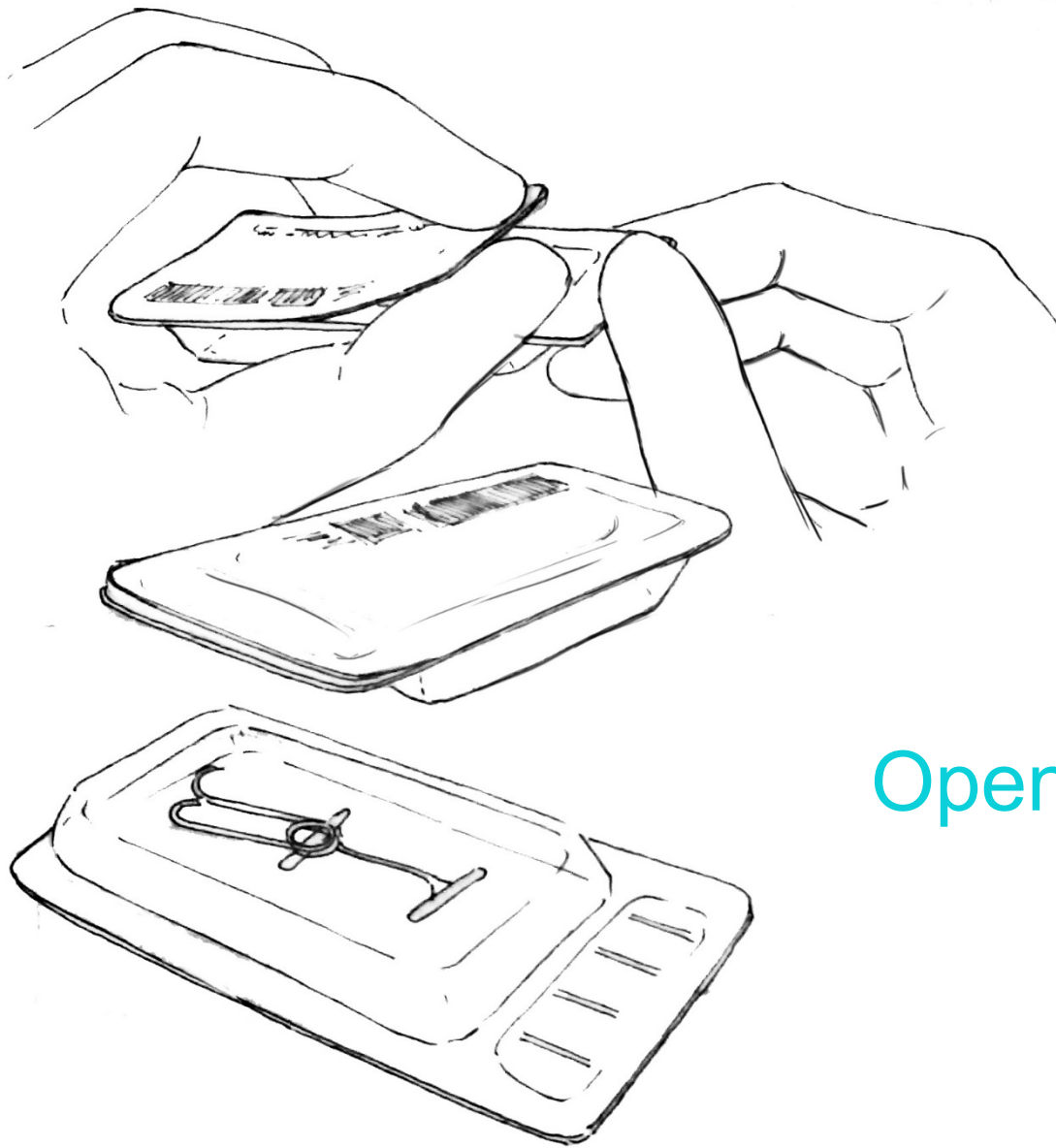
## ENDO RETRACTOR

Current instruments used for  
deployment



# TASK ANALYSIS





Opening the sterile packaging

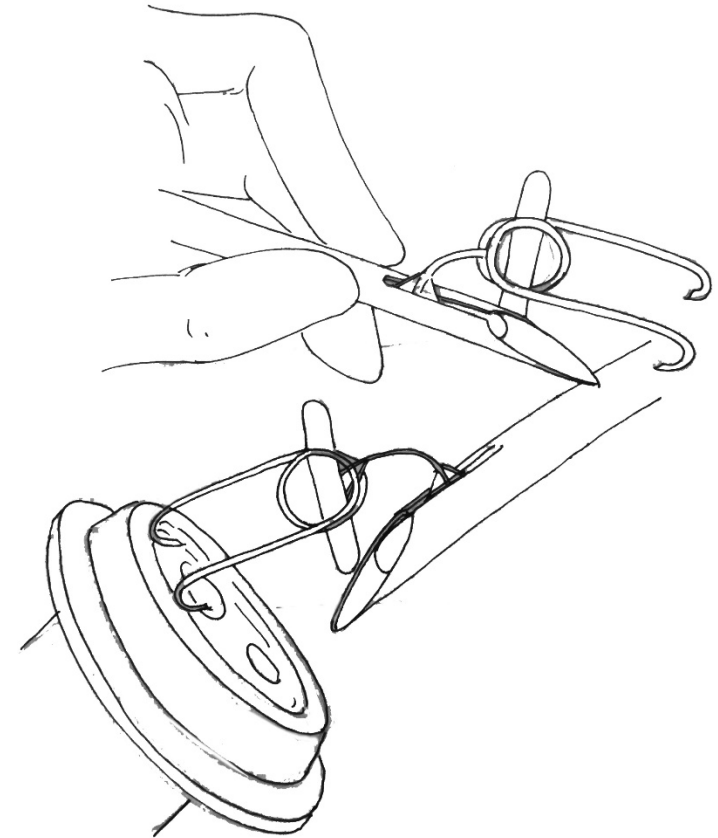
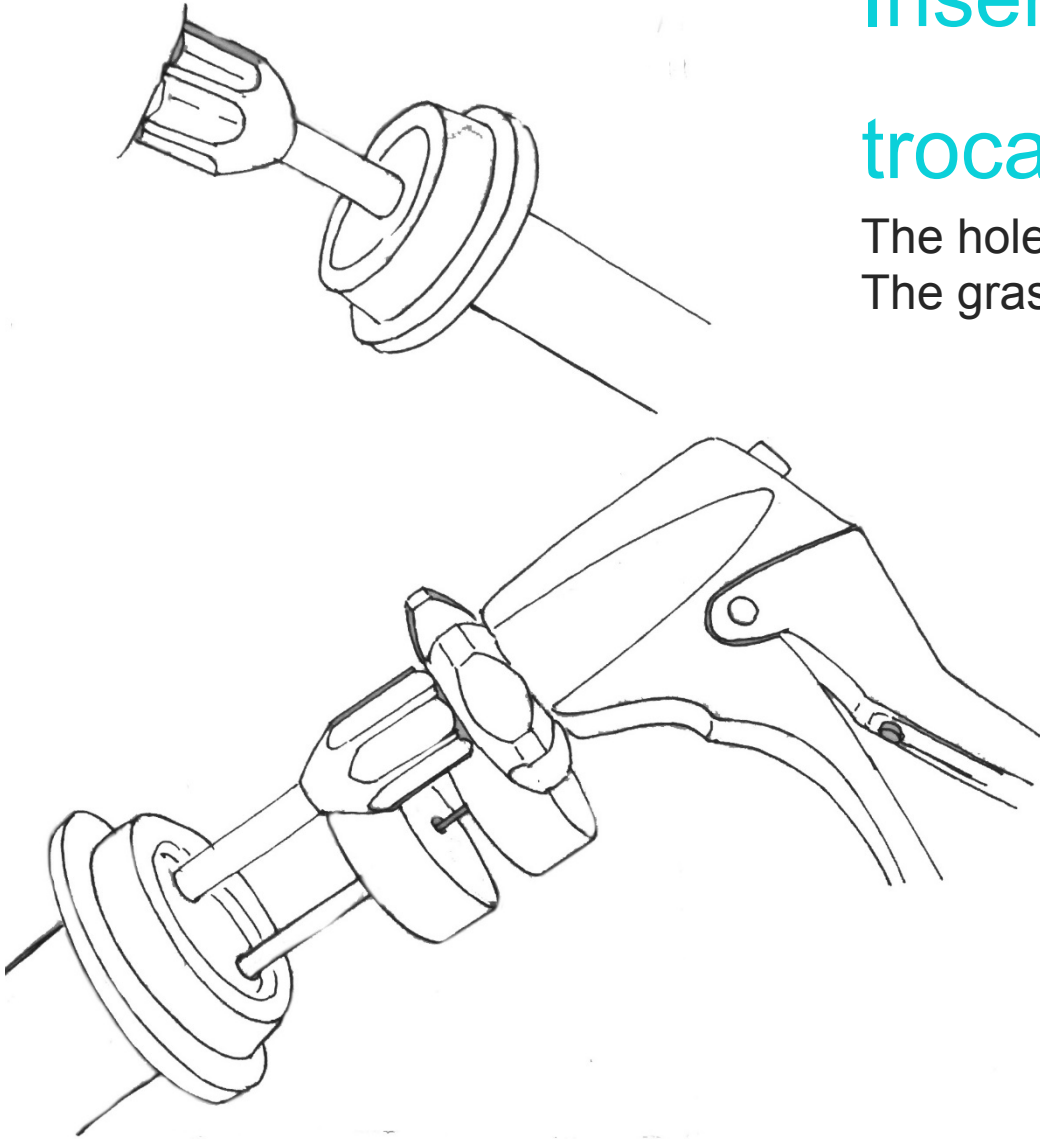


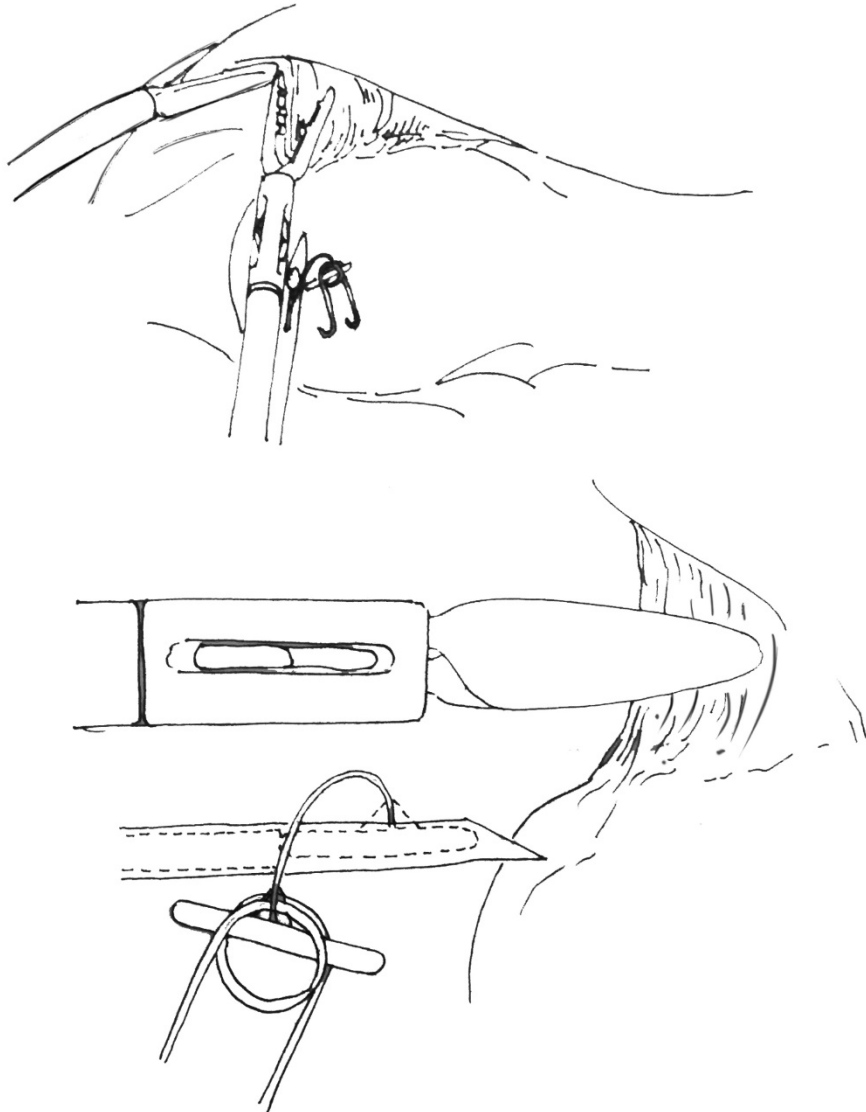
Attaching the tag to the needle

# Inserting the needle through the trocar

The hole is on 1 mm diameter

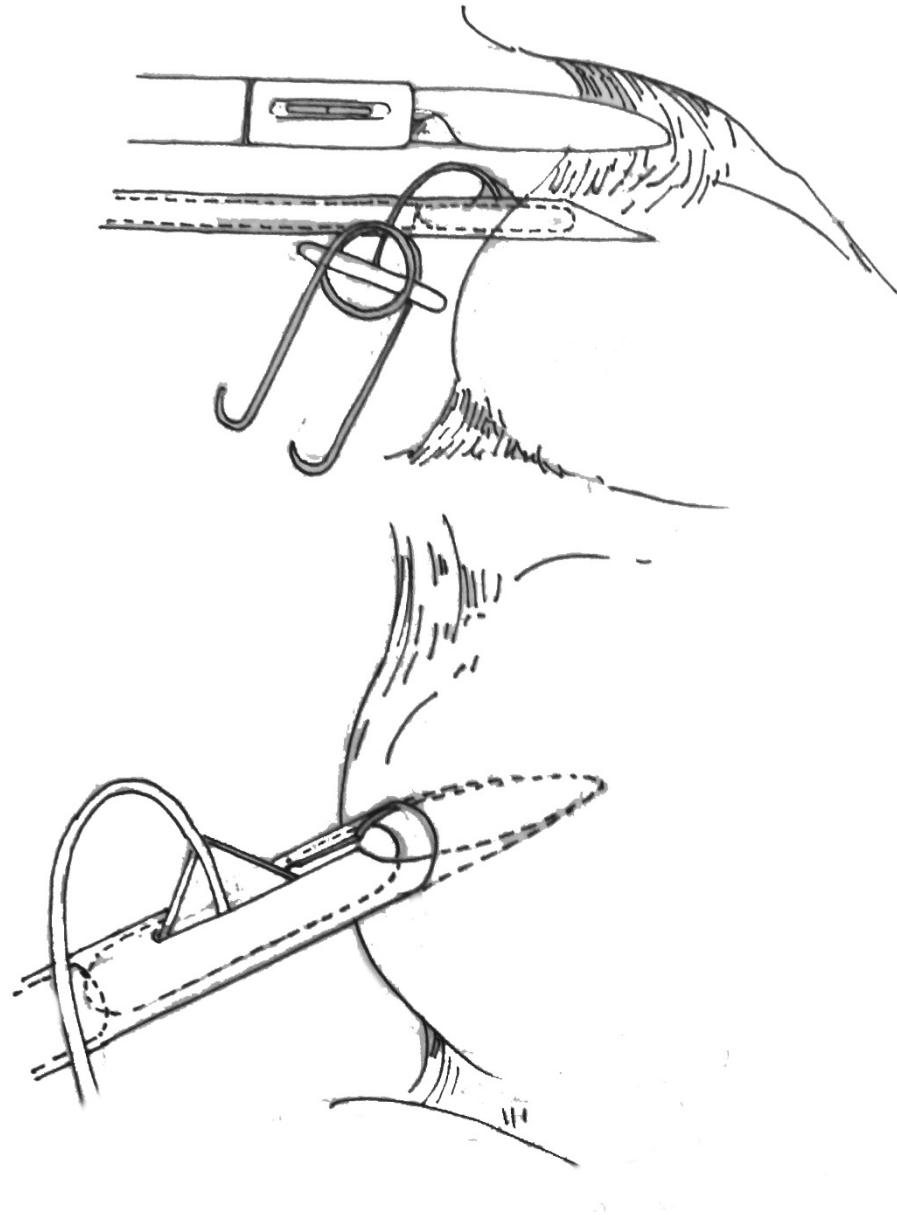
The grasper and the trocar controls clash with each other





## Holding the gallbladder using a grasper

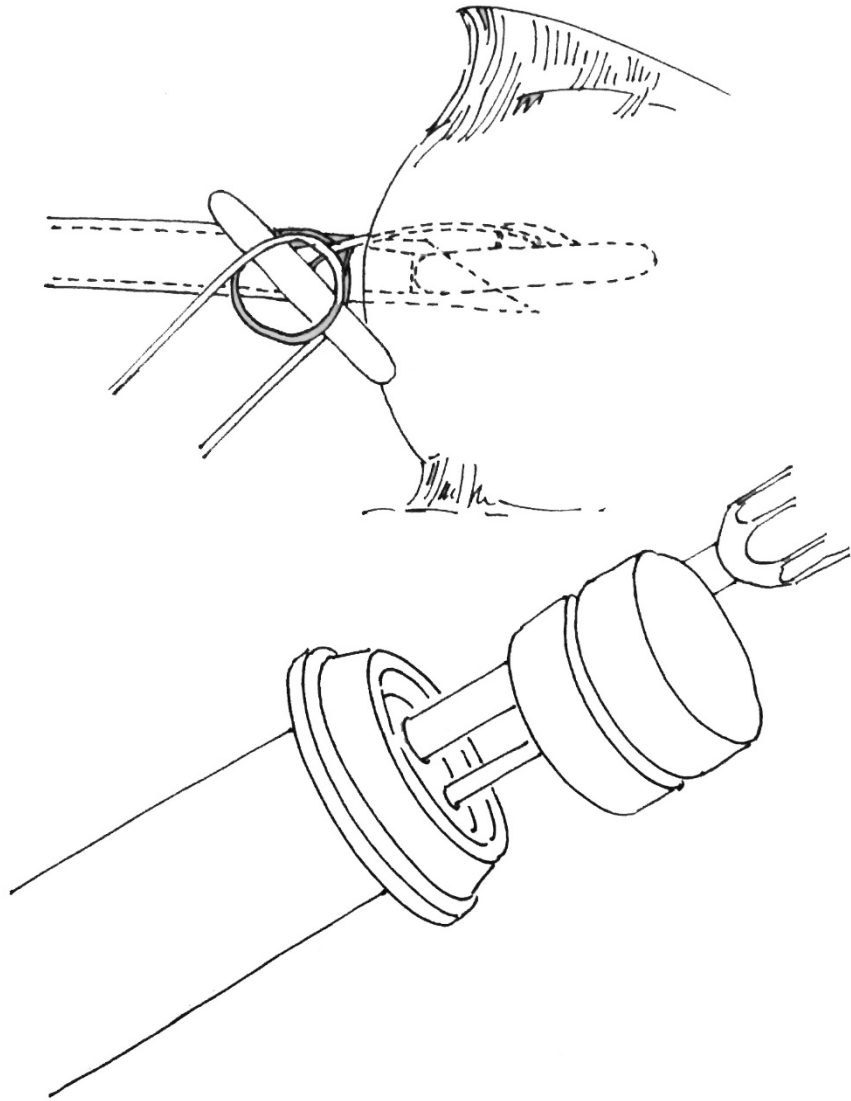
The hook dangles from the needle tip  
Two graspers are needed to hold the gallbladder



## Piercing the gallbladder

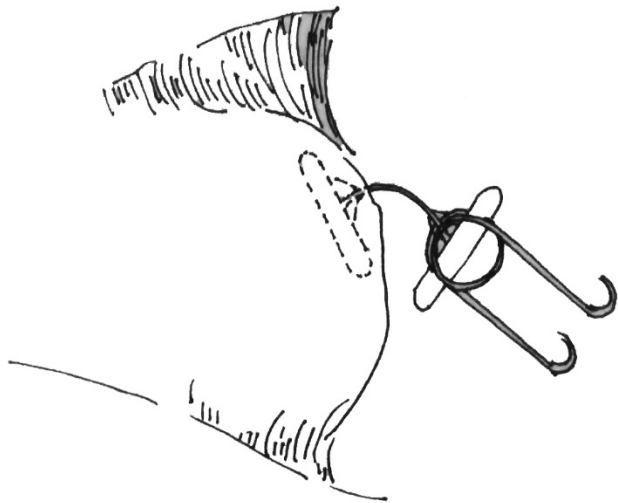
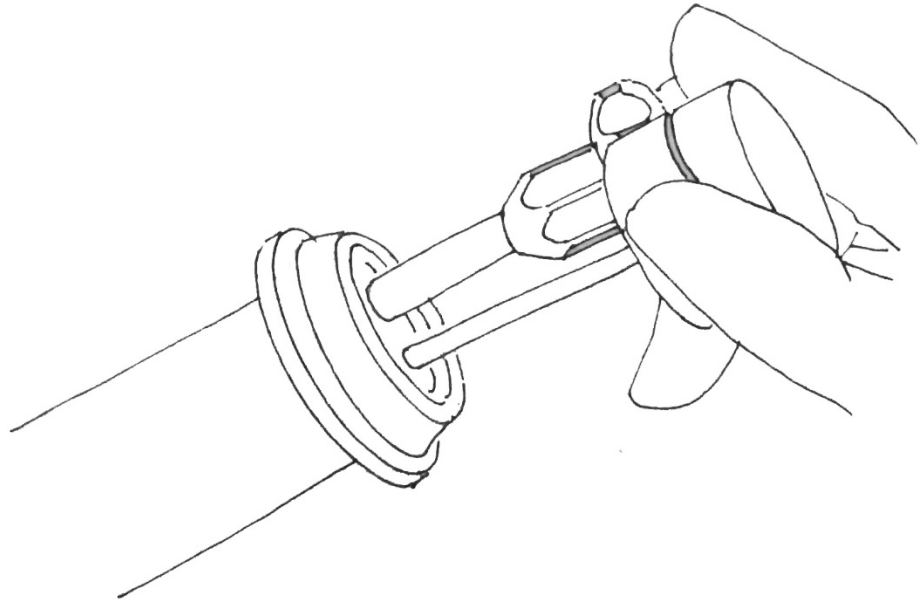
The gallbladder shifts



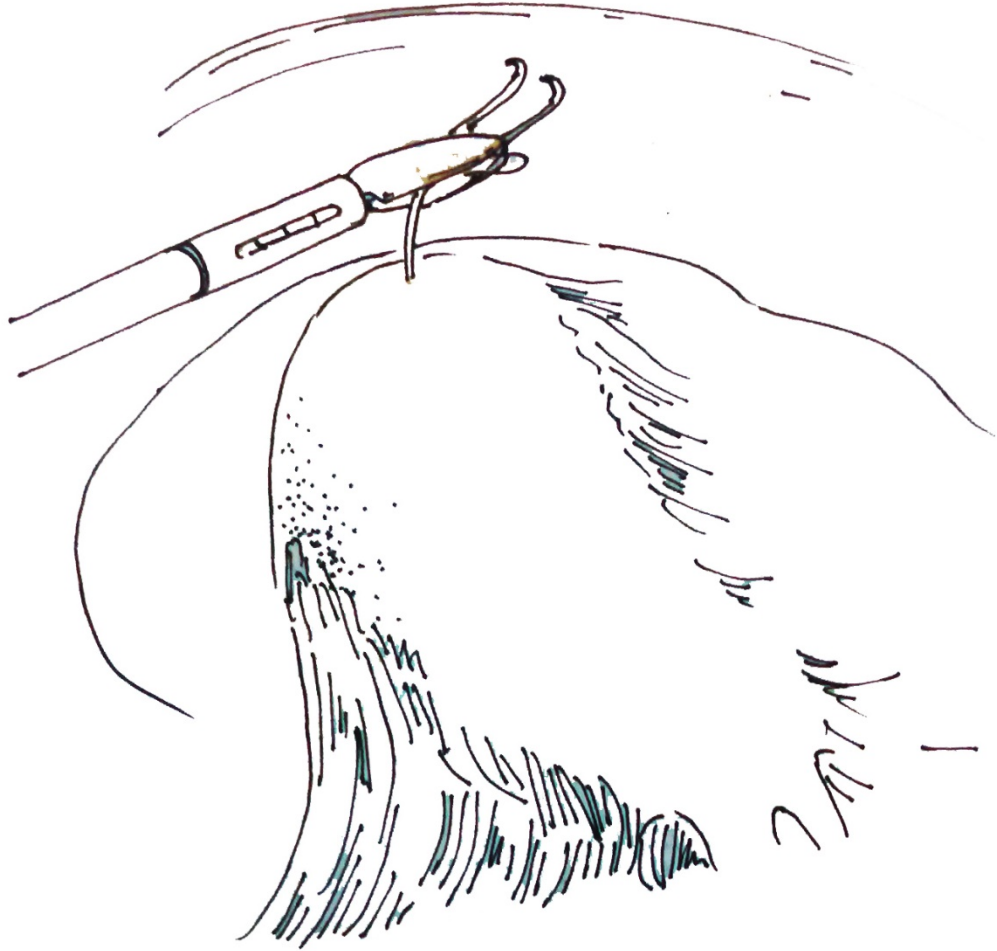


## Deploying the tag

Difficult to operate the needle and the plunger



Removing the needle from the  
trocar



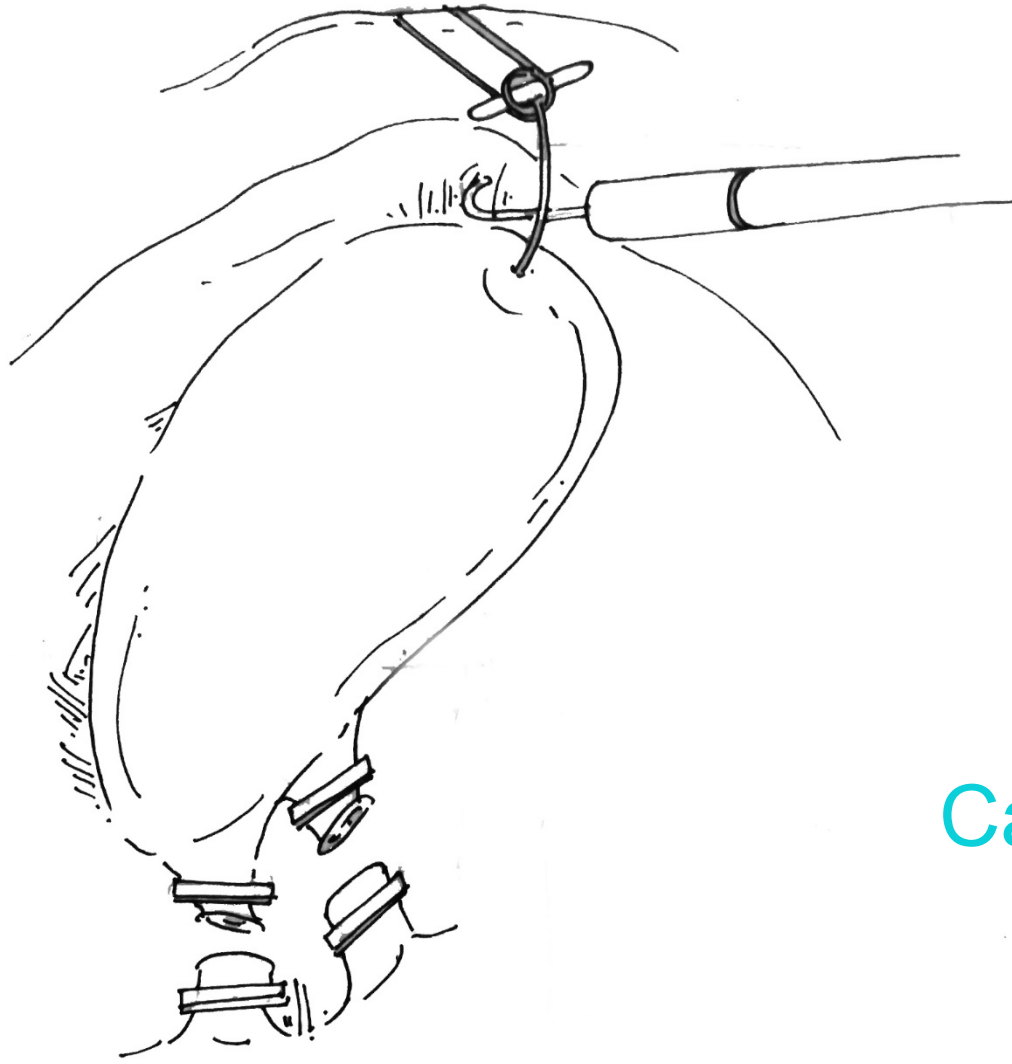
## Attaching the hook to the peritoneum

A separate grasper needs to be inserted.



Cauterizing the tissue

Clamping and separating the  
cystic duct and artery



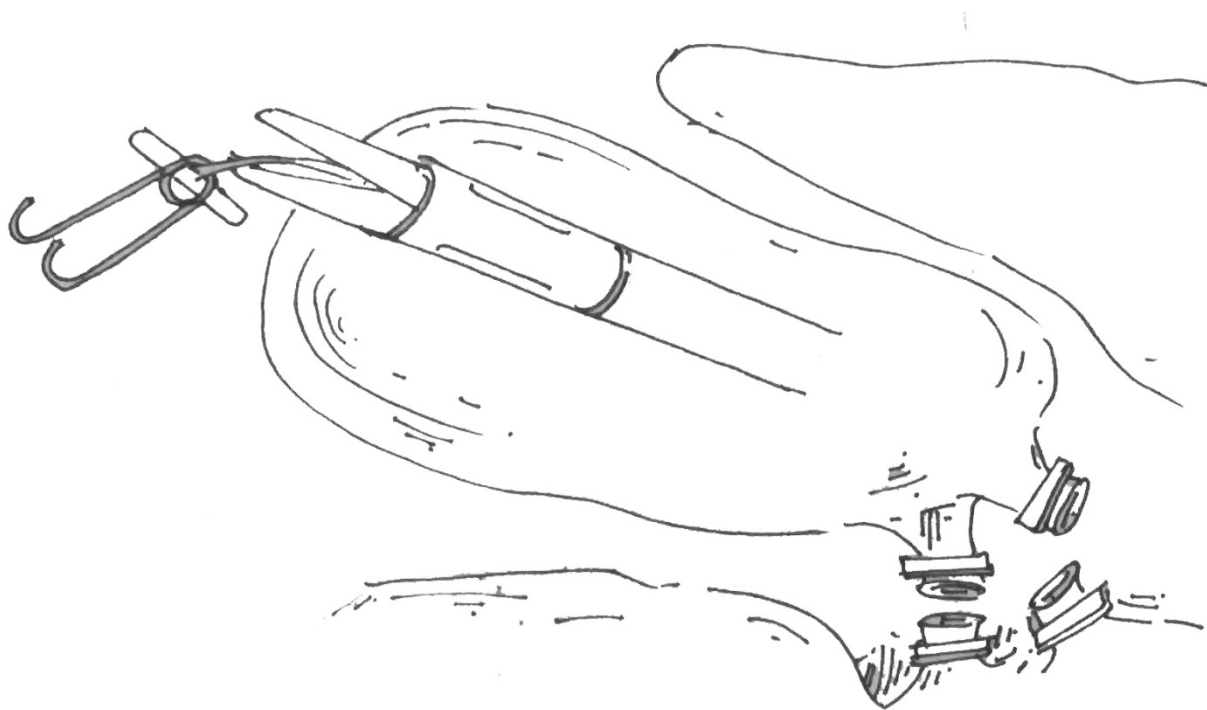
Cauterizing the tissue



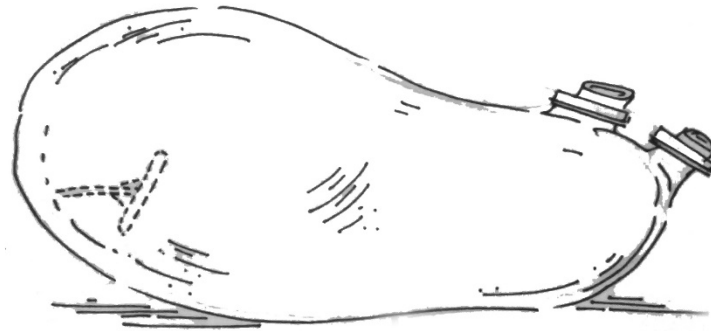
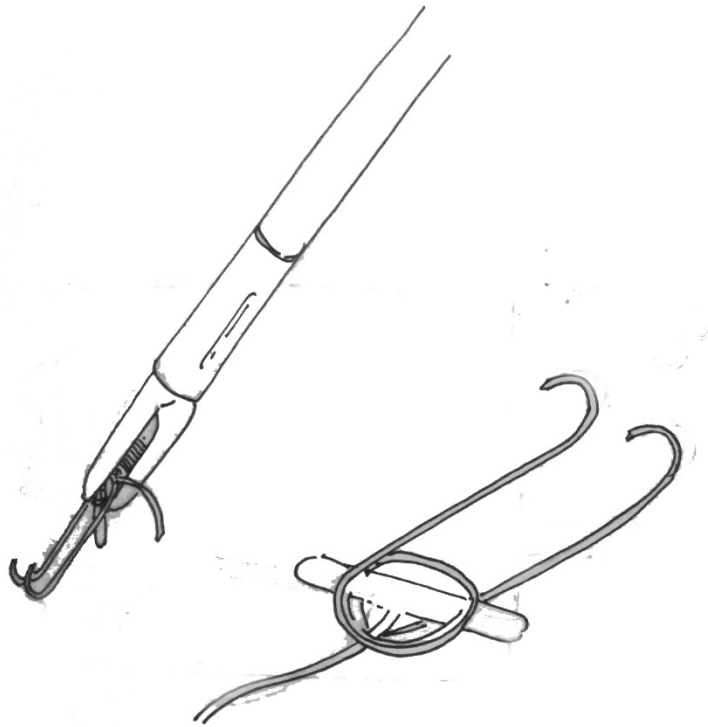
Removing the hook



## Cutting the tag



## Extracting the gallbladder and the tag





## ENDO RETRACTOR

Why is a new deployer required?

Using a **grasper and needle simultaneously** is very difficult

The instruments need to be changed **5 times for deployment and removal** of the tag

**Grasping the gallbladder** is difficult

Increased **Surgery time**

# DESIGN BRIEF

**To design an ergonomic laparoscopic device  
for deployment of the endo retractor.**

# PRIMARY NEEDS

1. Ergonomically comfortable.
2. All integrated design
3. Withstand autoclave temperatures.
4. Biocompatible material
5. Not cause any accidental damage to the surrounding organs.
6. The device should be usable through a 10 mm port.

# SECONDARY NEEDS

1. The retractor should be easy to load and deploy.
2. Reduced interaction time with device.



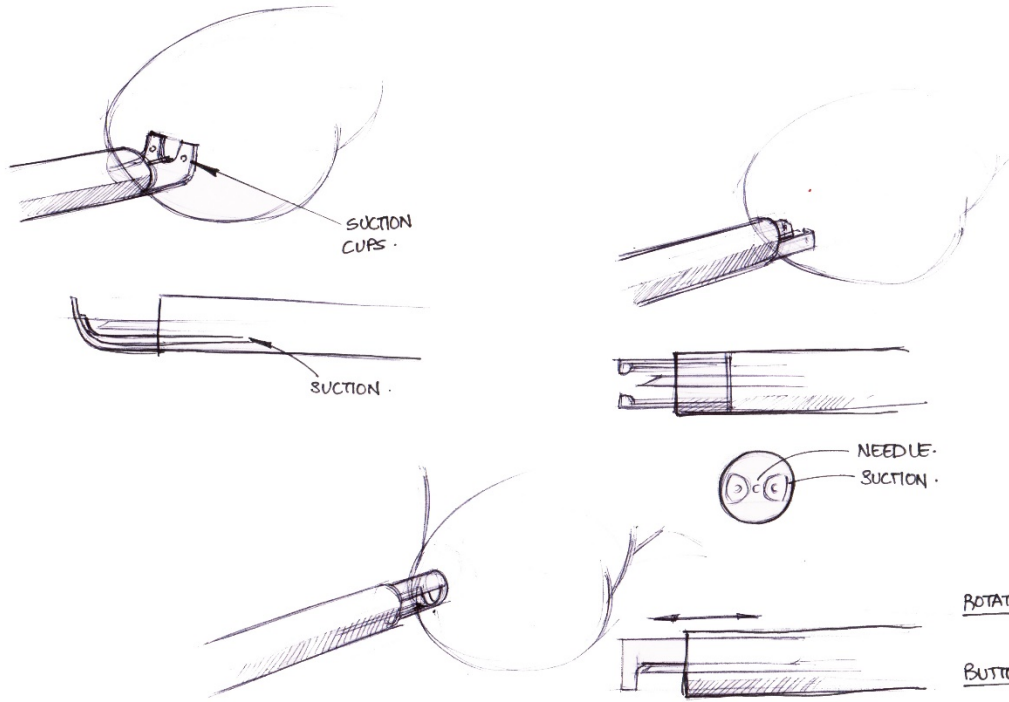
1. PINCH
2. CLAMP
3. STRETCH
4. PULL
5. STICK
6. FRICTION
7. VELCRO
8. MICRONEEDLES
9. FORCEPS
10. HOOKS
11. SILICON MAT
12. INTERLOCKING TEXTURES
13. ROLLERS IN OPPOSITE DIRECTION
14. VACCUUM CUPS
15. RINGS THAT GROW OR TRANSFORM
16. HAIR MASSAGER

1. SEPERABLE-DEPLOYED BY A SEPARATE HOLDER
2. TAG PACKED WITH A HOLDER
3. SNAP AND TURN NEEDLE
4. LOADED FROM THE BACK
5. NAIL GUN
6. SPRING LOADED
7. RECOIL
8. HALF TRIGGER FOR PIERCING AND FULL FOR DEPLOYMENT
9. DISPOSABLE DEVICE
10. GRASPER IS DISPOABLE ATTACHED TO THE HOOK
11. SMALLER NEEDLE ATTACHMENT IN THE TIP

1. SHEAR
2. BLADE
3. SHARP HOOK
4. BURN IT
5. SMALL CUTTING ROLLER
6. SAWING MOVEMENT
7. TWIST AND BEND
8. STRETCH TO BREAKING POINT
9. LASER
10. TRIM
11. MELT
12. SHAVE
13. BLADE ANVIL

# BRAINSTORMING

# IDEATION FOR STABILIZING

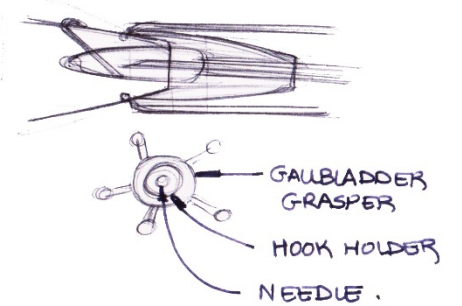
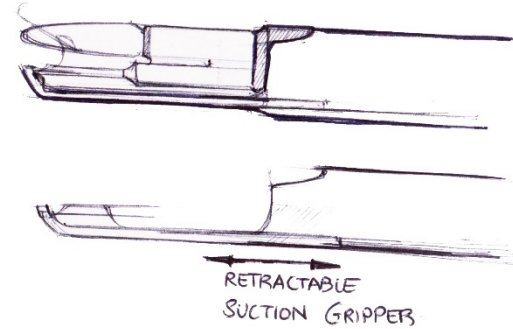


ROTATE: FOR ADJUSTING THE SUCTION ARM.

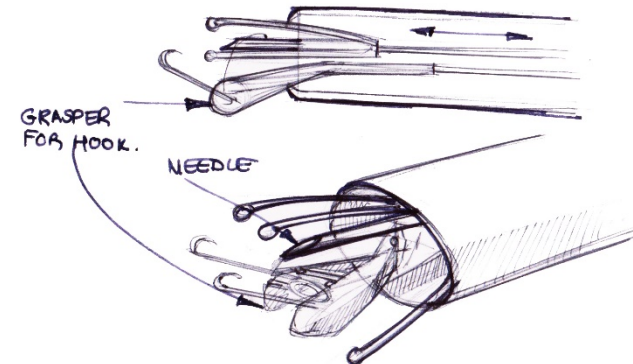
BUTTON: FOR GENERATING SUCTION.

HALF TRIGGER: FIRE THE NEEDLE.

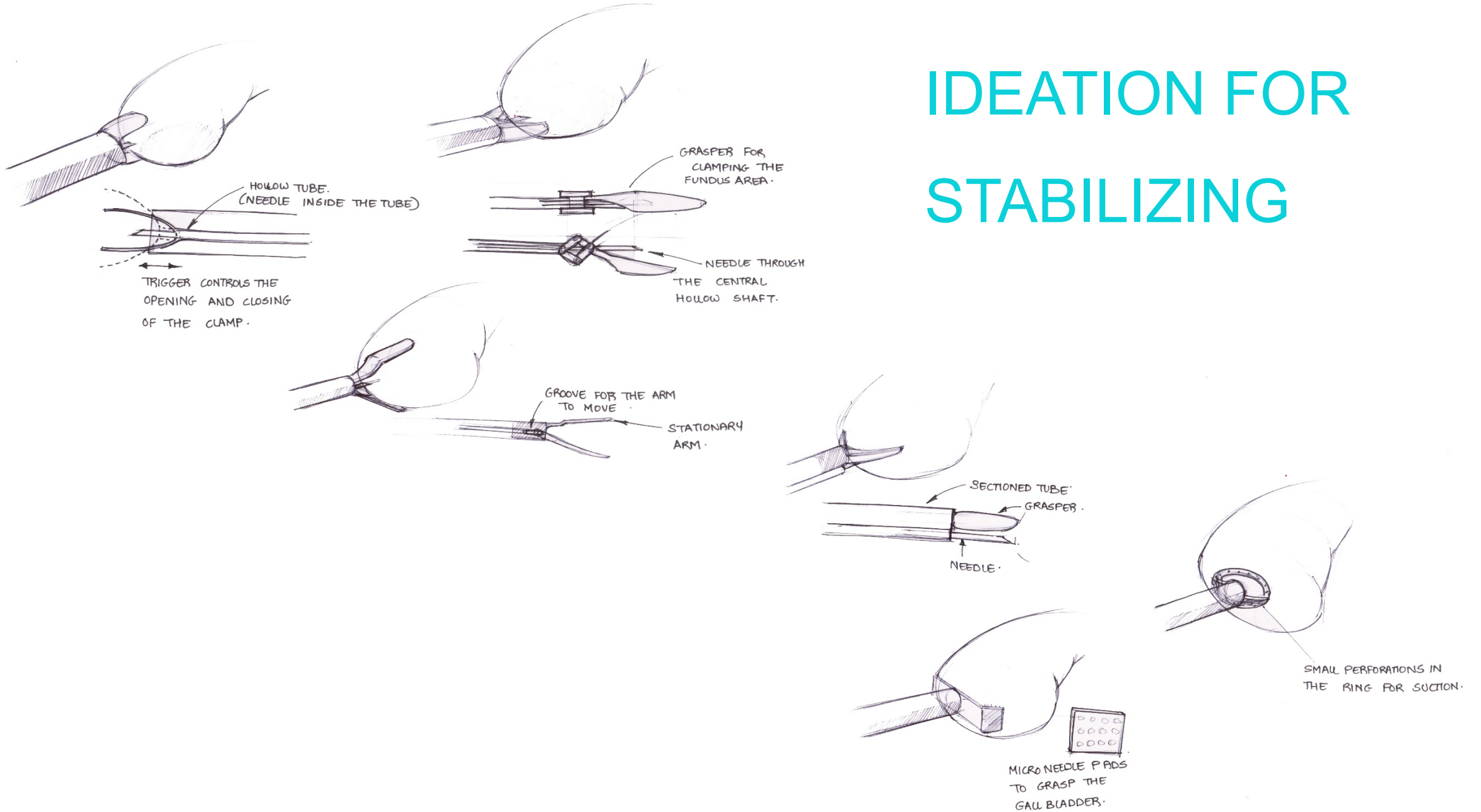
FULL TRIGGER: DEPLOY THE TAG.



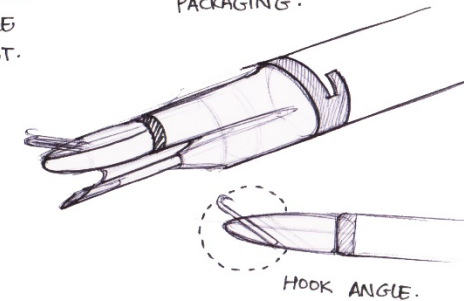
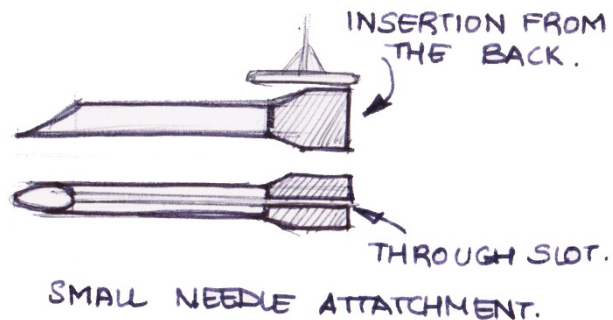
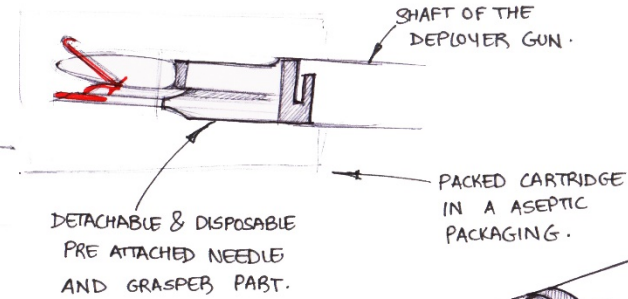
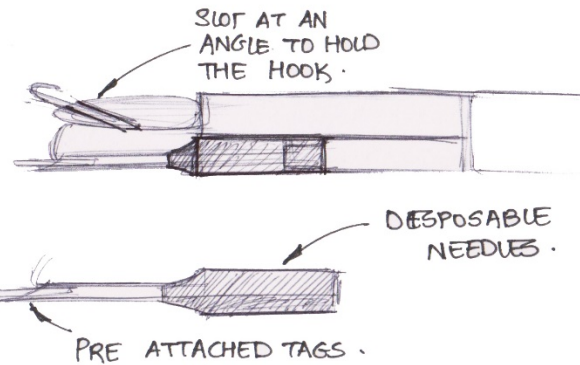
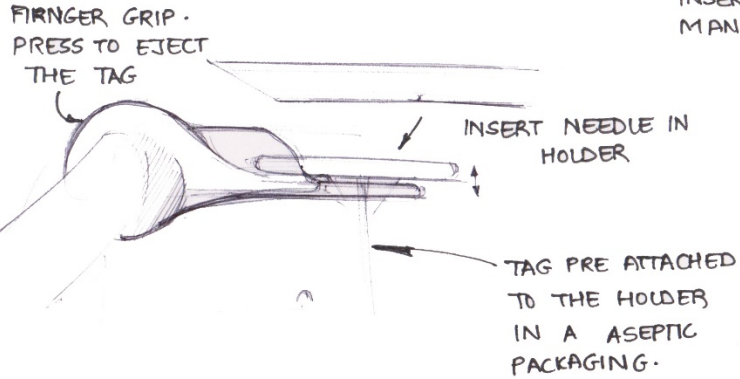
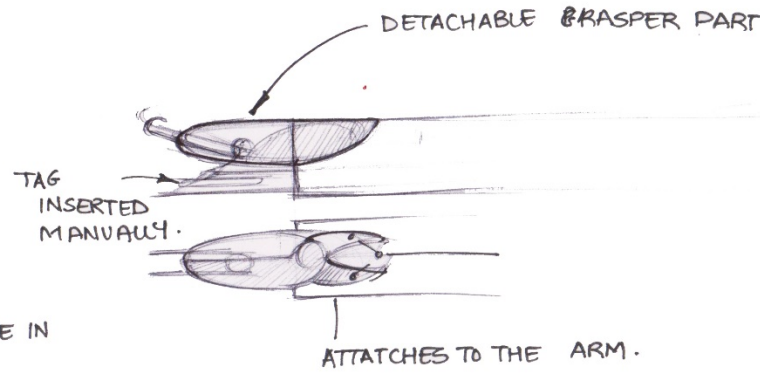
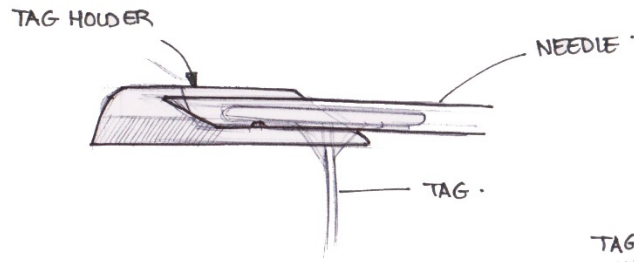
Stabilizing the gallbladder is a crucial step in the entire process as it facilitates easy and effective deployment of tag



# IDEATION FOR STABILIZING



# IDEATION FOR HOOK & TAG

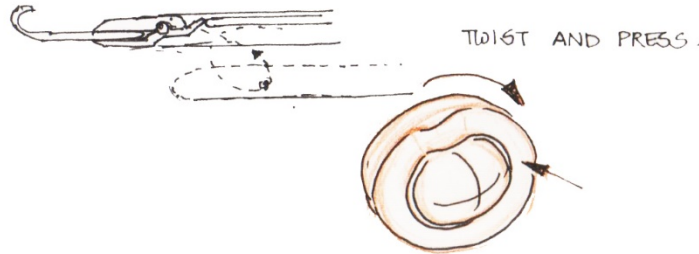
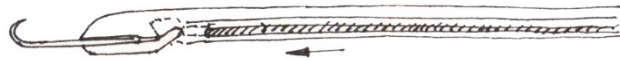
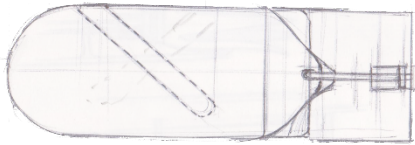
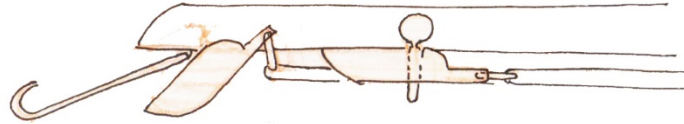
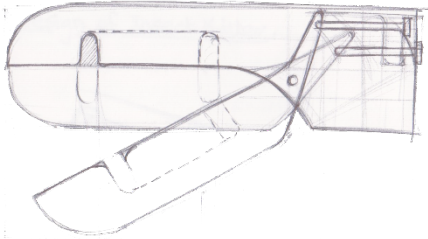
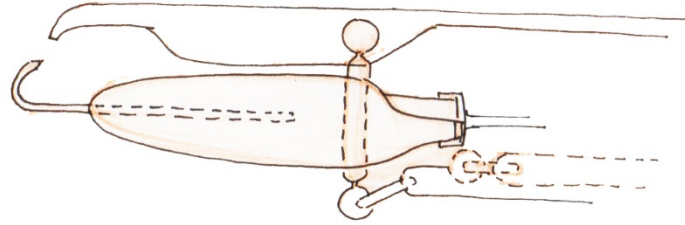
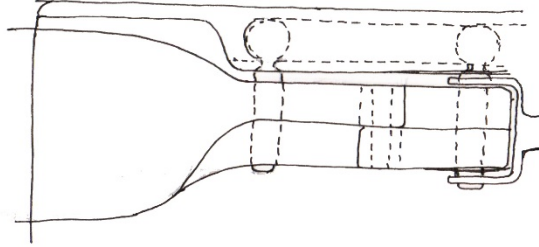
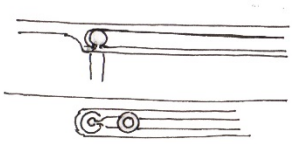


## NO. OF STEPS/MOTIONS REQUIRED:

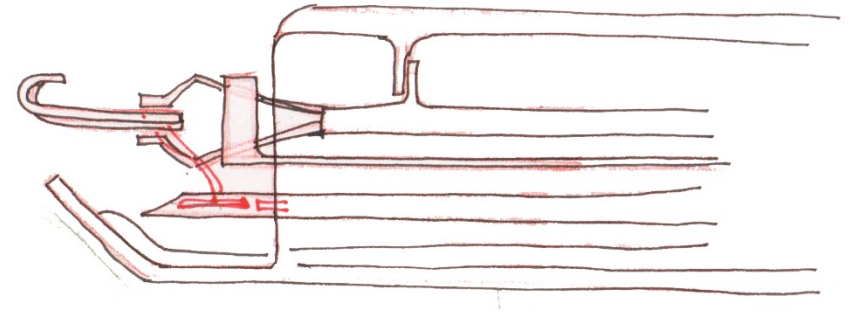
1. ATTACHING THE TIP.
2. GRASPING (THINK OF A SOL.)
3. DEPLOYING PIERCING THE GALLBLADDER. (LINEAR).
4. DEPLOYING THE TAG. (CAN BE RECOIL OR SPRING LOADED).
5. REMOVING THE NEEDLE
6. ATTACHING THE HOOK TO THE PERICARDIUM.



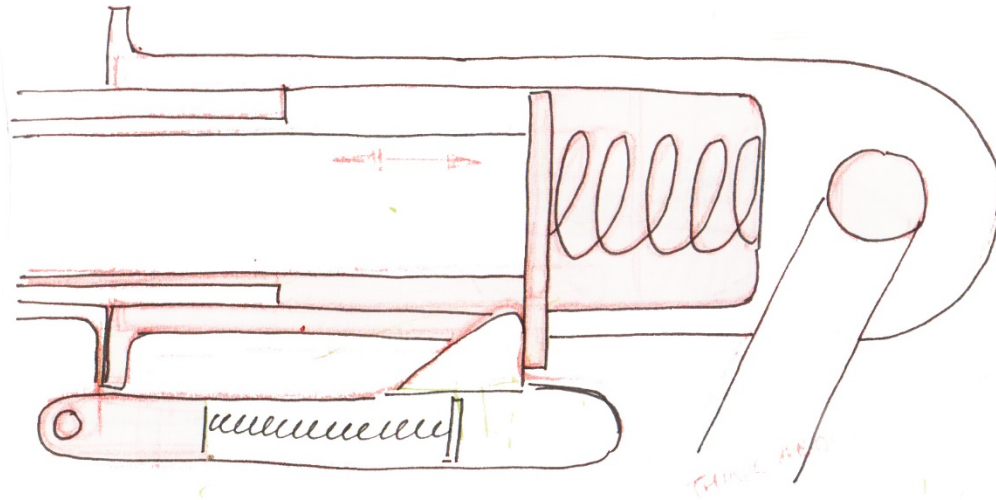
# IDEATION FOR HOOK PLACEMENT



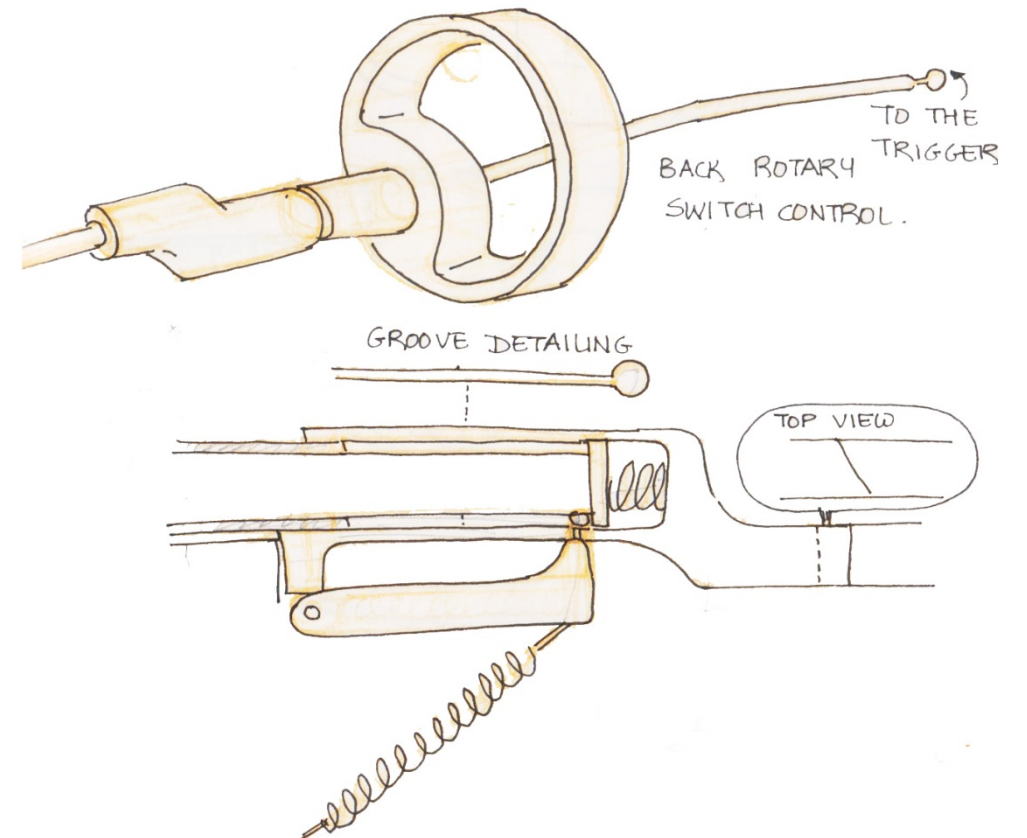
The grasper will have two sleeves that will open in succession to expose the grasper tip and to release the hook

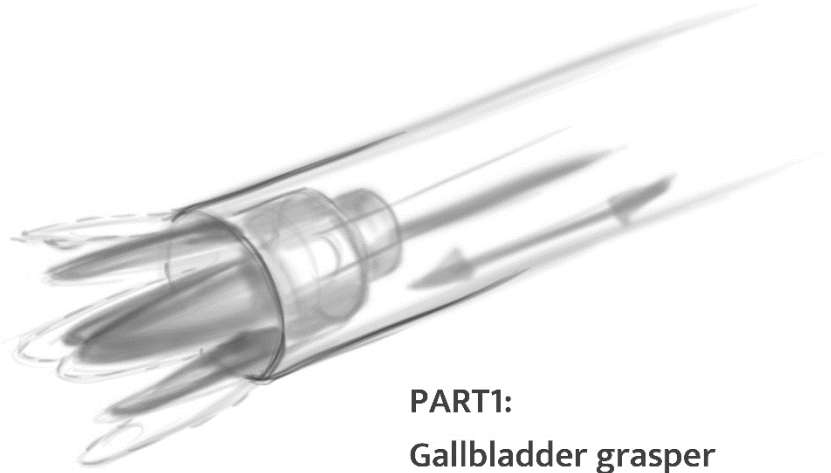


# IDEATION FOR NEEDLE & PLUNGER

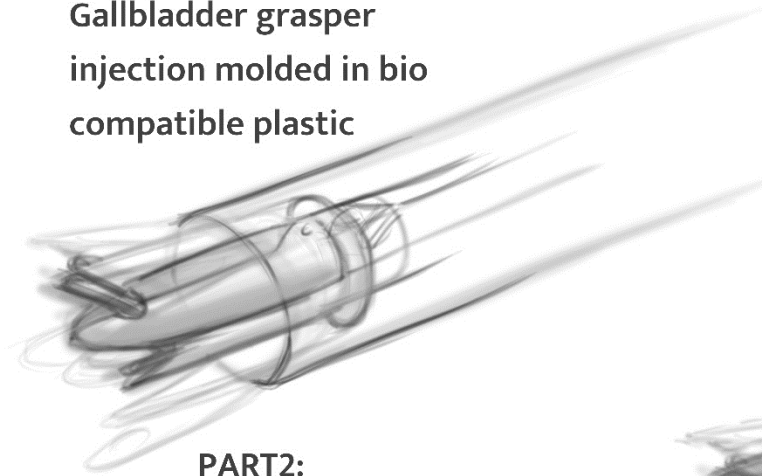


The needle and plunger require a successive movement.

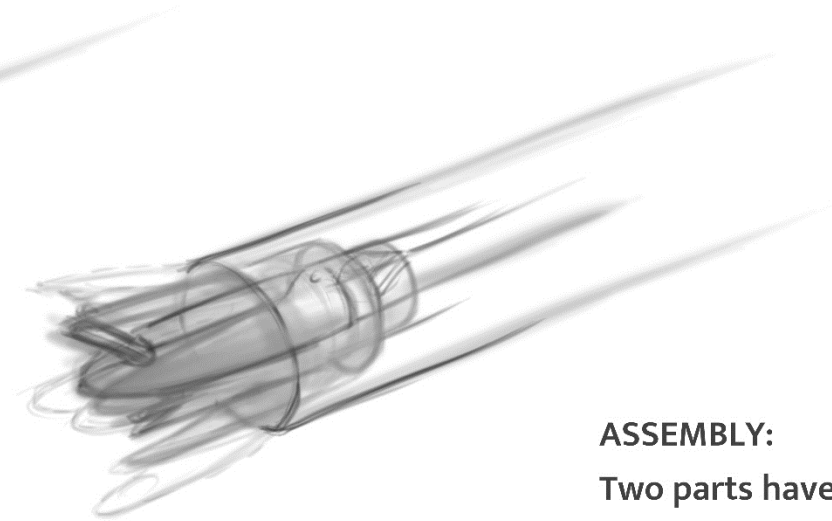




**PART1:**  
Gallbladder grasper  
injection molded in bio  
compatible plastic



**PART2:**  
Hook and tag preattached  
to a disposable tip



**ASSEMBLY:**  
Two parts have to be attached.  
Prepacked in a aseptics packaging

# CONCEPT 1

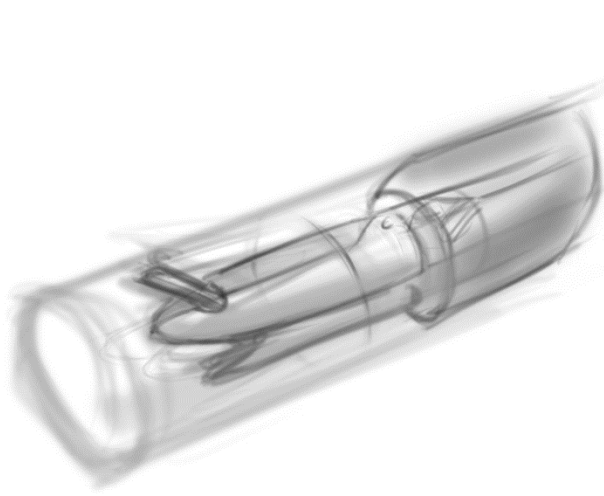
Linear movement for the gallbladder grasper.

Linear movement for the hook deployer

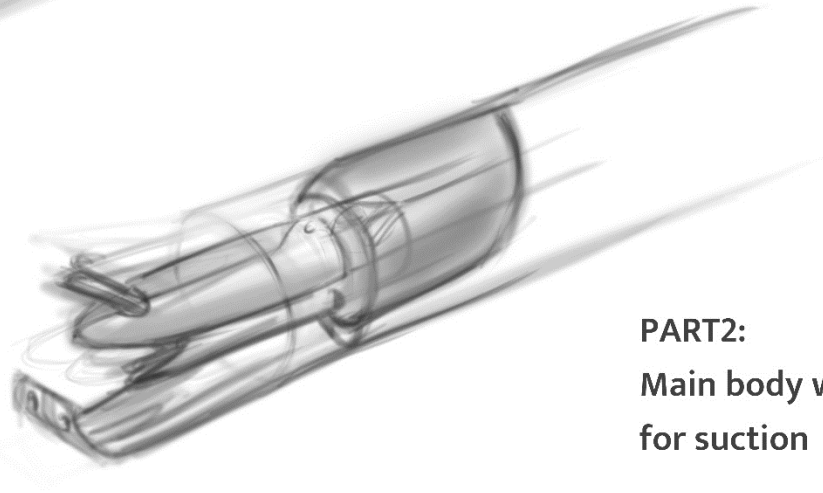
Half trigger press for the needle to pierce

Full trigger press for the deployment of the tag





**PART1:**  
Cartridge with a pre attached  
tag and hook in a aseptic packaging



**PART2:**  
Main body with an attachment  
for suction

## CONCEPT 2

Suction generation, pneumatic  
Linear movement for the hook deployer  
Half trigger press for the needle to pierce  
Full trigger press for the deployment of the tag

|                                 | Flower Grasper                                                                                                                                                                                                           | Suction                                                                                                                                                                                                                                                      |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Mechanism control               | Linkages, other mechanical mediums can be used                                                                                                                                                                           | Controlled by Suction machine or inbuilt chamber in the device                                                                                                                                                                                               |
| Movement required for operation | Linear                                                                                                                                                                                                                   | Linear                                                                                                                                                                                                                                                       |
| Components                      | Grasper, shaft, control                                                                                                                                                                                                  | Suction head, tube, chamber, control                                                                                                                                                                                                                         |
| Precision                       | Focused precise movement                                                                                                                                                                                                 | Focused movement required to locate the gallbladder                                                                                                                                                                                                          |
| Advantages                      | <ol style="list-style-type: none"> <li>1. Easier to clean and maintain</li> <li>2. Less number of components</li> <li>3. Requires light pressure</li> </ol>                                                              | <ol style="list-style-type: none"> <li>1. Less possibility of damage as the head is made from silicone</li> <li>2. Very little pressure is required</li> <li>3. Possibility to develop similar devices</li> <li>4. Easier to operate individually</li> </ol> |
| Disadvantages                   | <ol style="list-style-type: none"> <li>1. Can puncture the gallbladder</li> <li>2. The grip is not that good</li> <li>3. Requires more space</li> <li>4. Will require a grasper from port 3 to hold the liver</li> </ol> | <ol style="list-style-type: none"> <li>1. Has multiple components</li> <li>2. Validation is essential for suction and to check the pressure required to hold it</li> </ol>                                                                                   |

SUCTION TESTING ON A  
GOAT'S GALLBLADDER



Displacement of the Plunger: 10ml  
Syringe with dia. 16 mm is 1.5-2  
mm for holding the goat's  
gallbladder with a wall thickness of  
0.5-1 mm.

# **Deployer testing for Suction**

P2 | Pooja Kulkarni | 156130008

1.

SUCTION

2.

TAG DEPLOYMENT

NEEDLE AND PLUNGER

3.

HOOK GRASPER

# TASK ANALYSIS

NEW CONCEPT

1.

Stabilizing the  
gallbladder using suction

2.

Piercing the gallbladder

3.

Deploying the tag

4.

Releasing the suction

5.

Retracting the needle  
and the plunger

6.

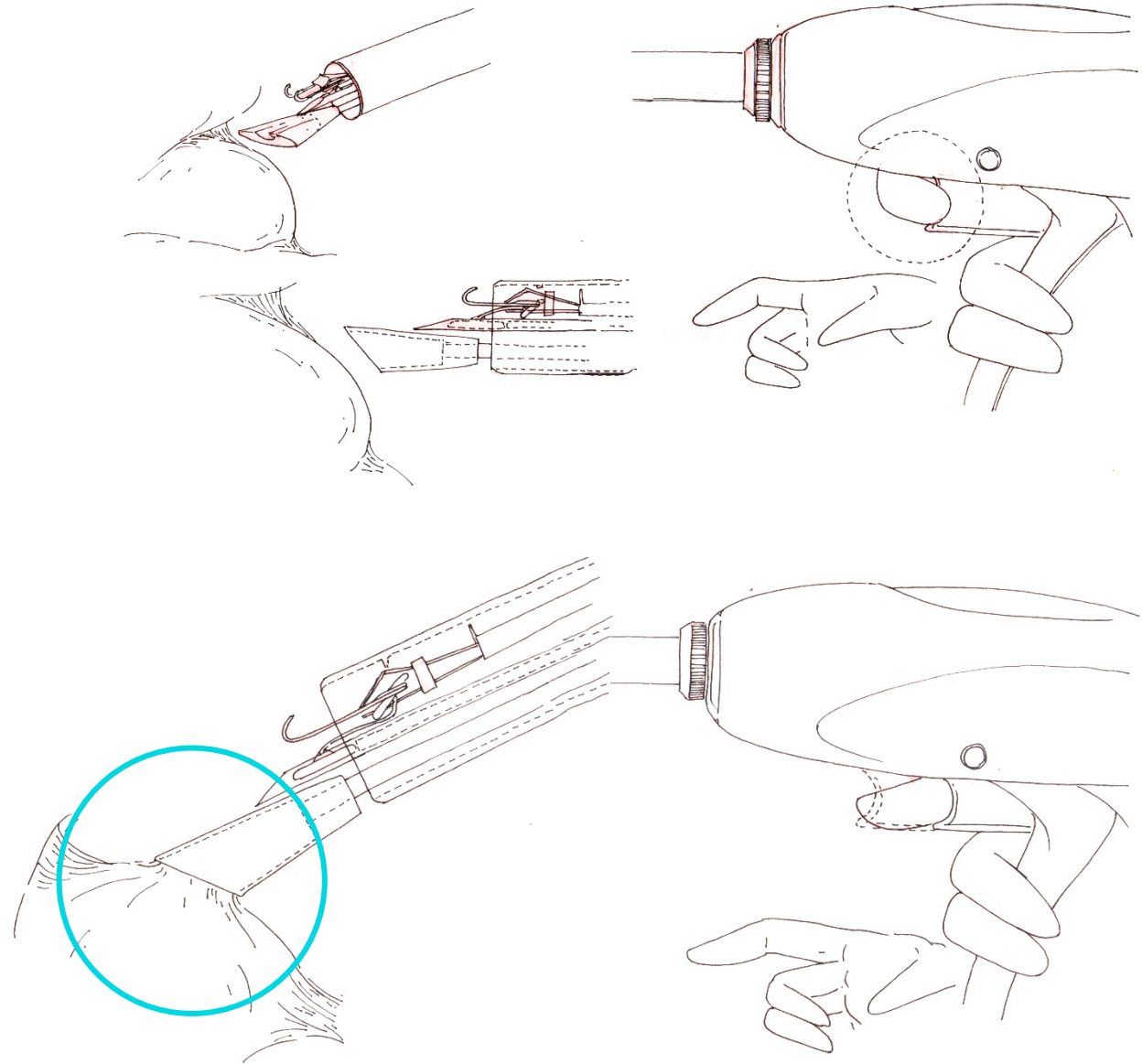
Exposing the grasper

7.

Releasing the hook

8.

Retracting the grasper





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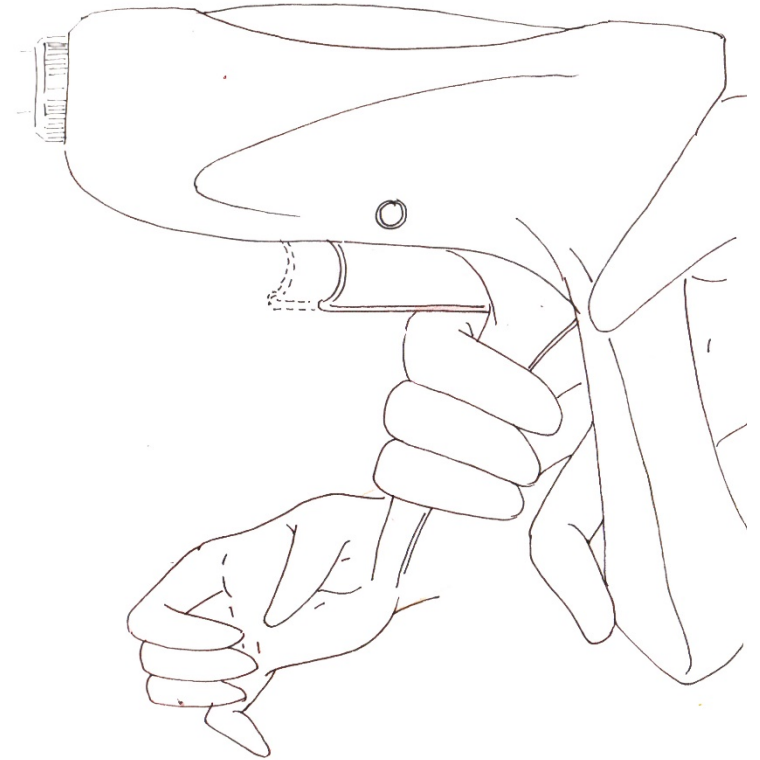
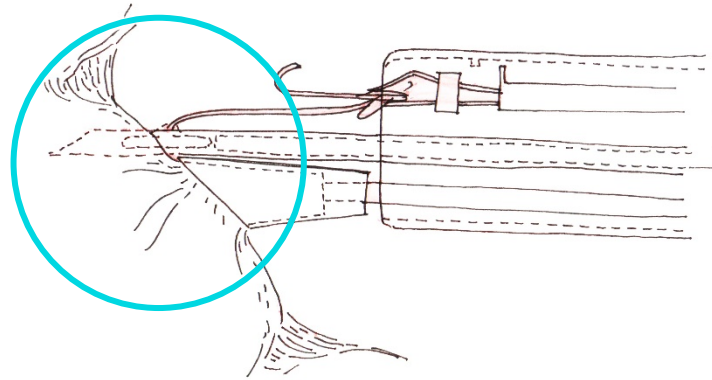
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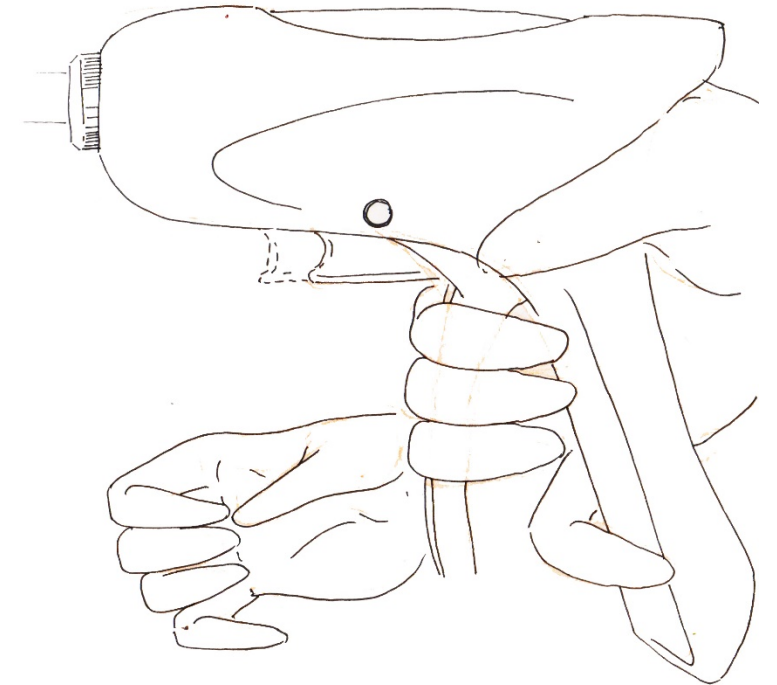
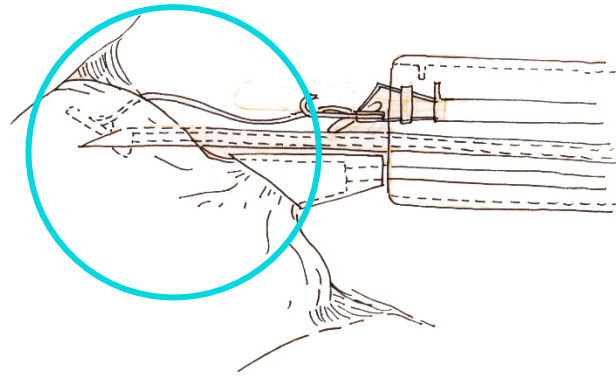
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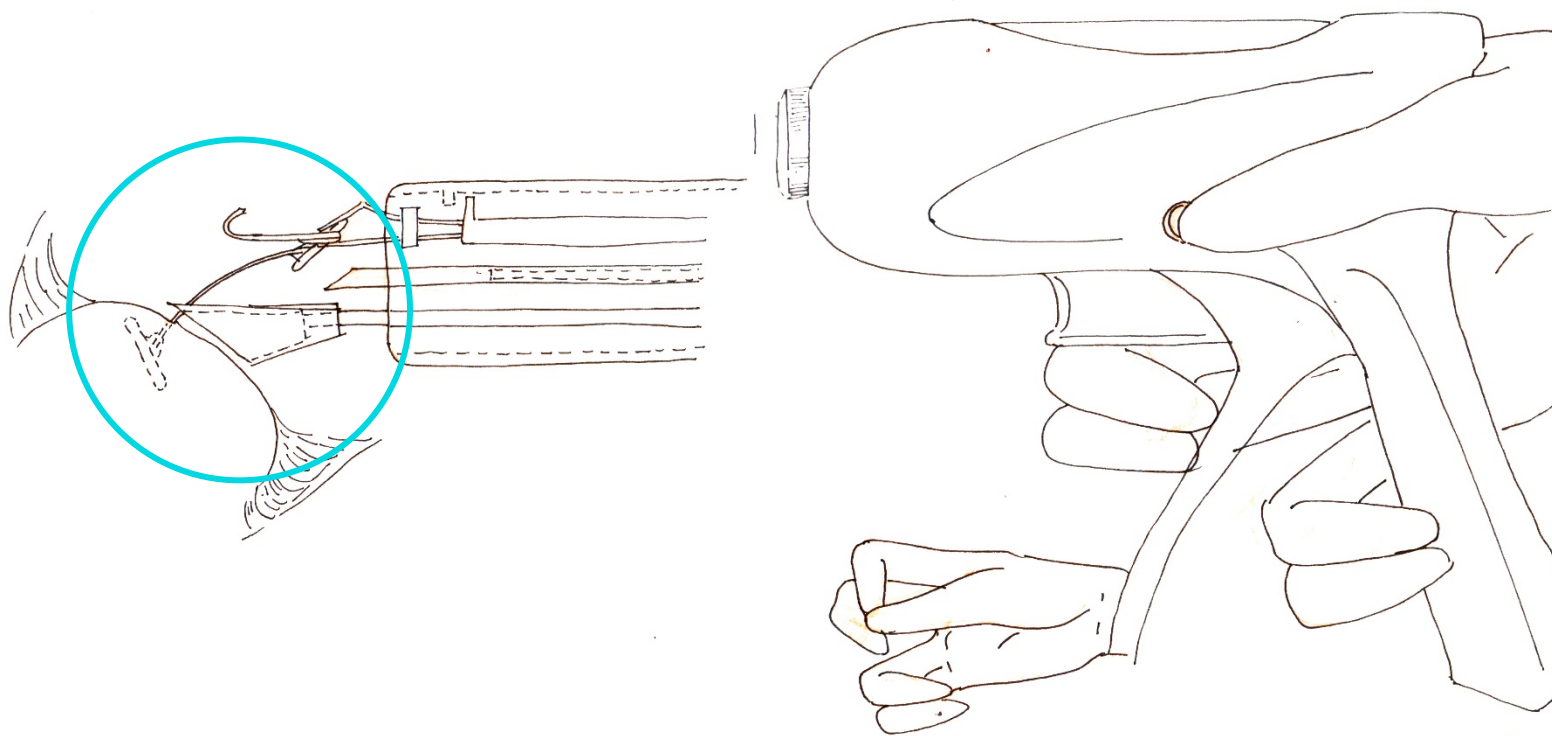
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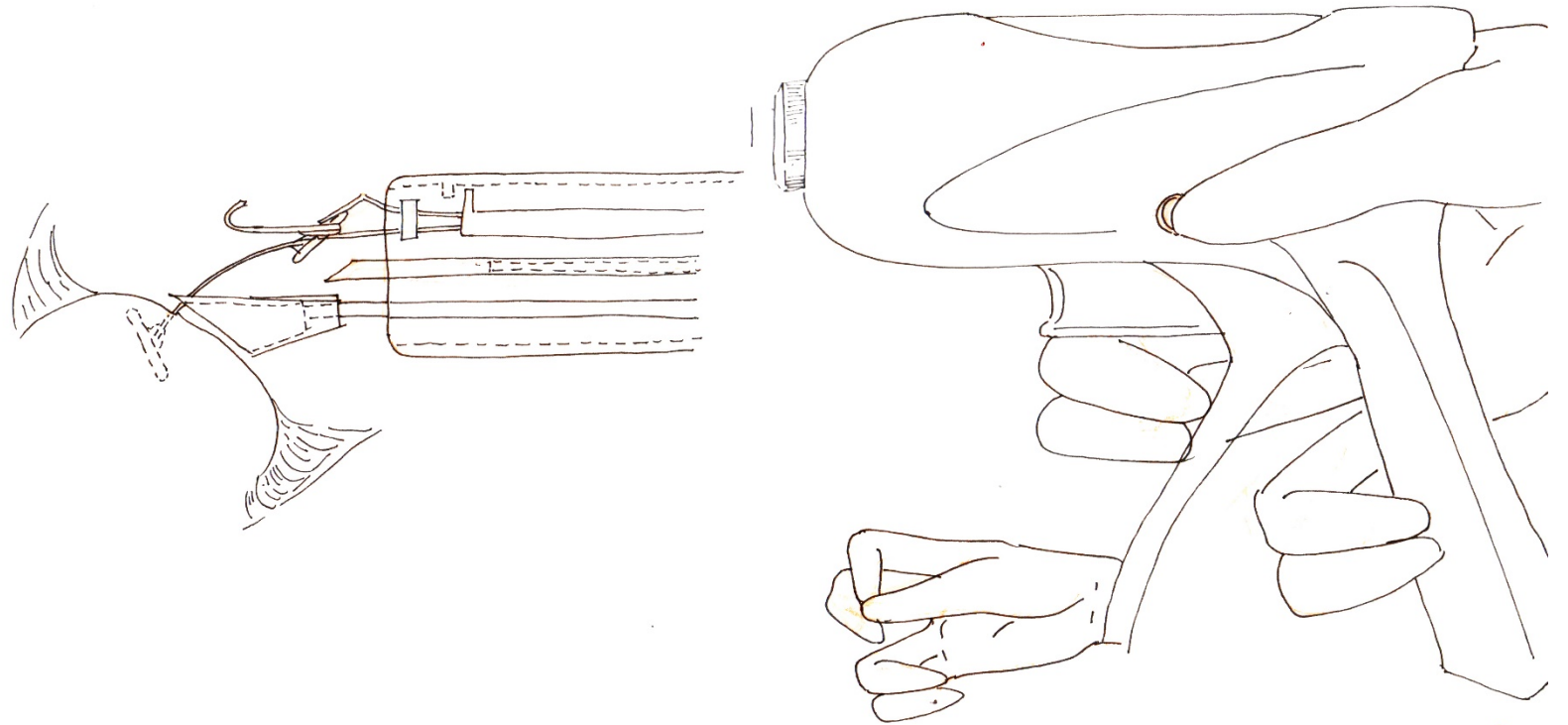
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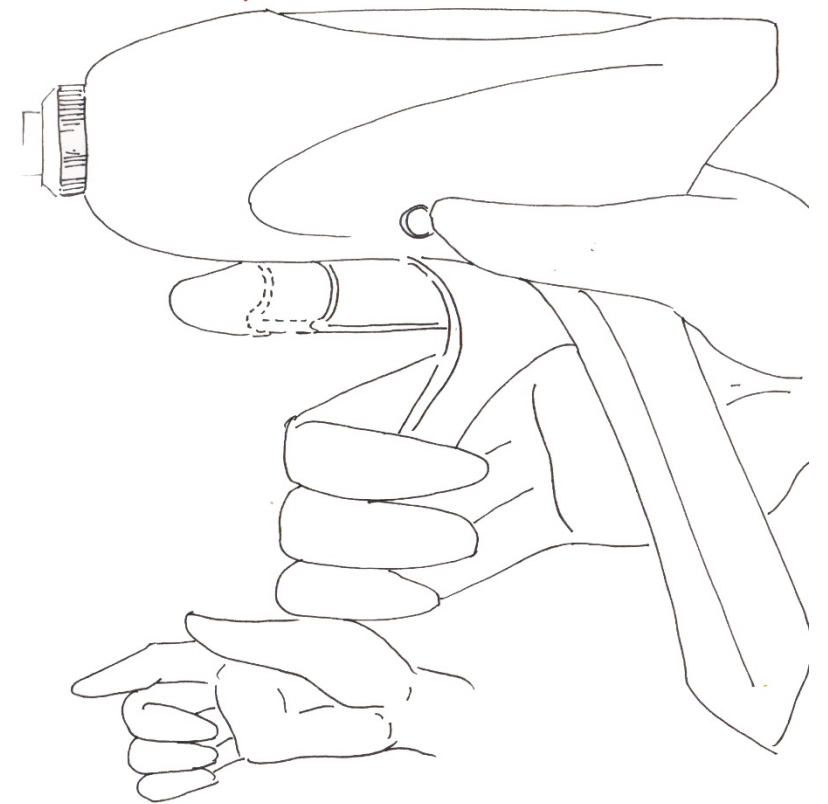
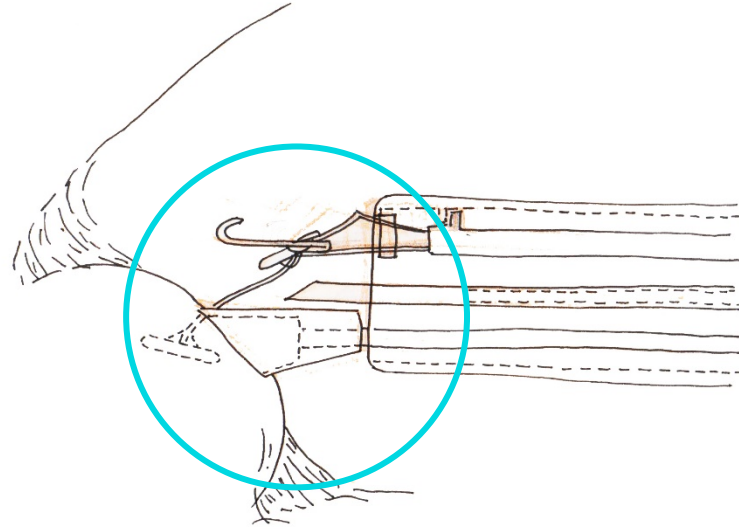
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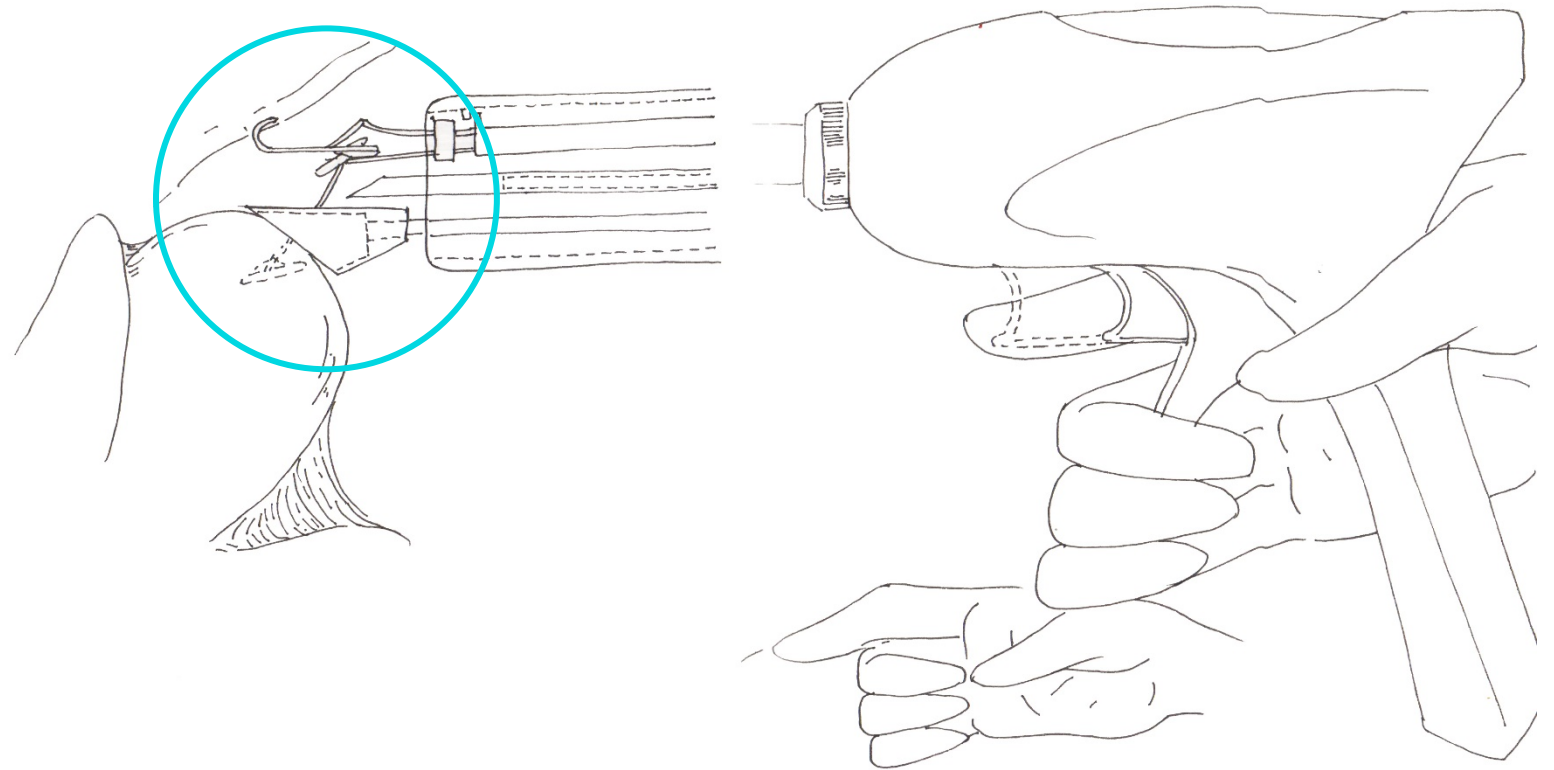
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and the plunger

6.

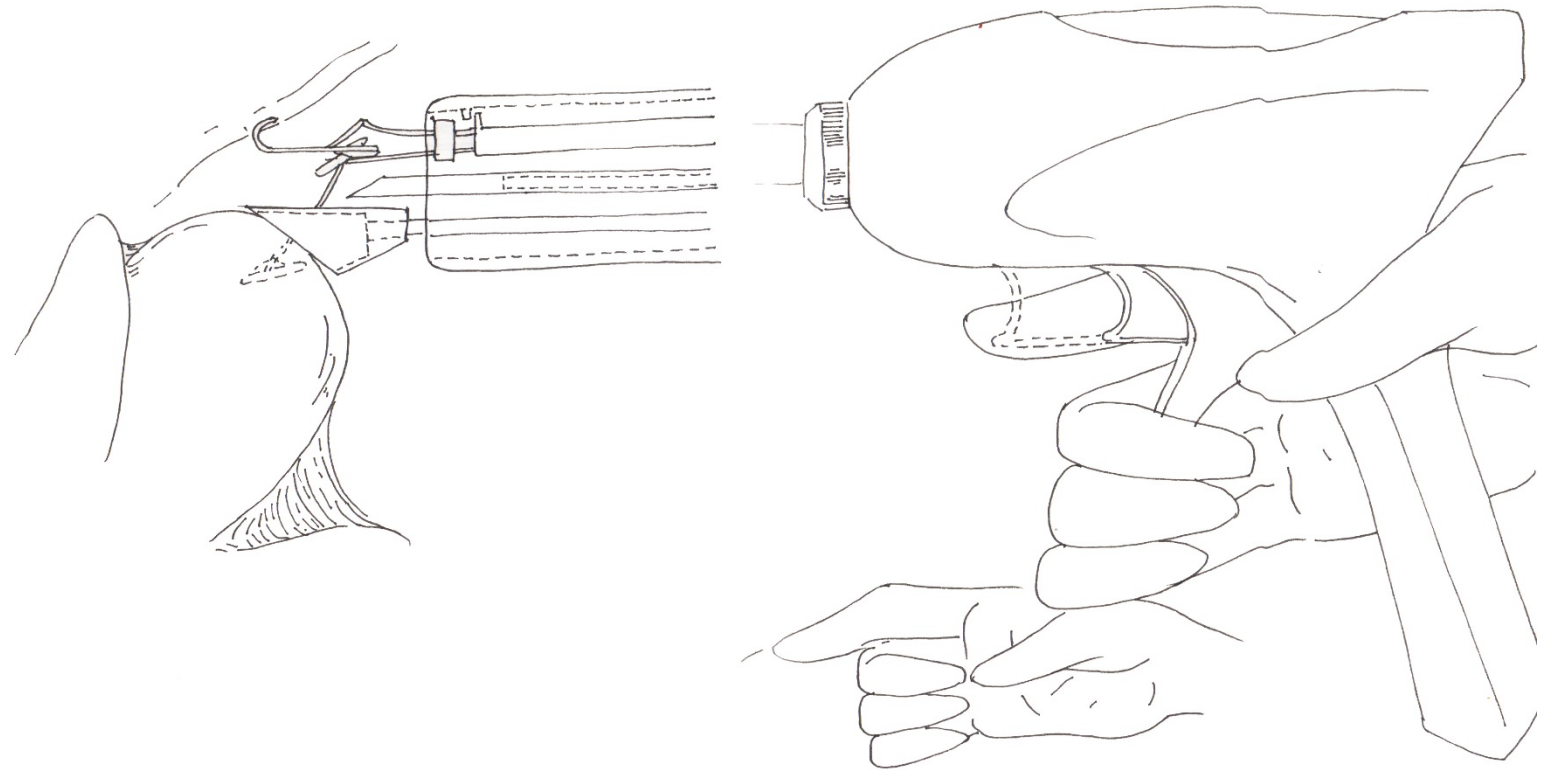
Exposing the grasper

7.

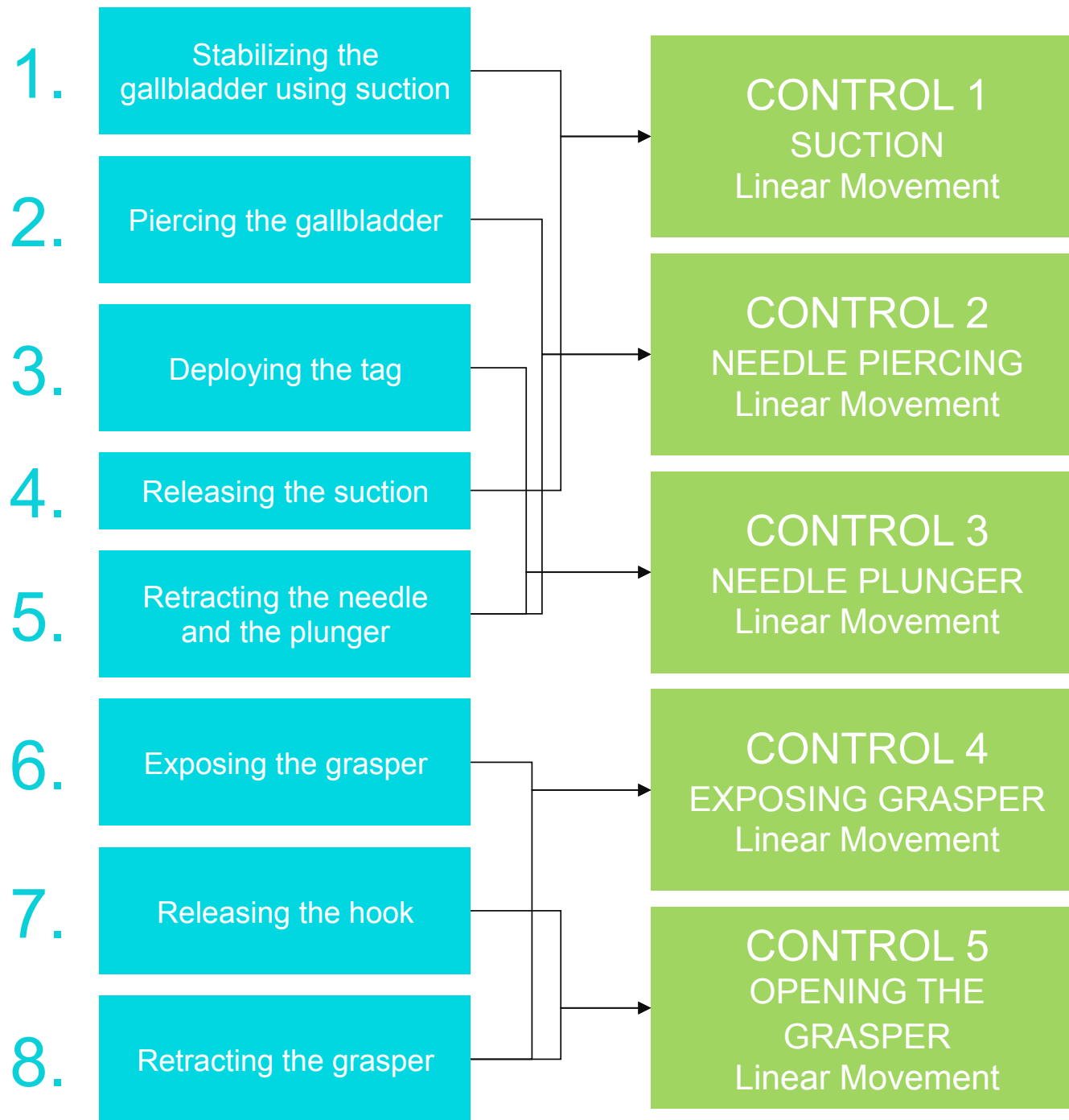
Releasing the hook

8.

Retracting the grasper

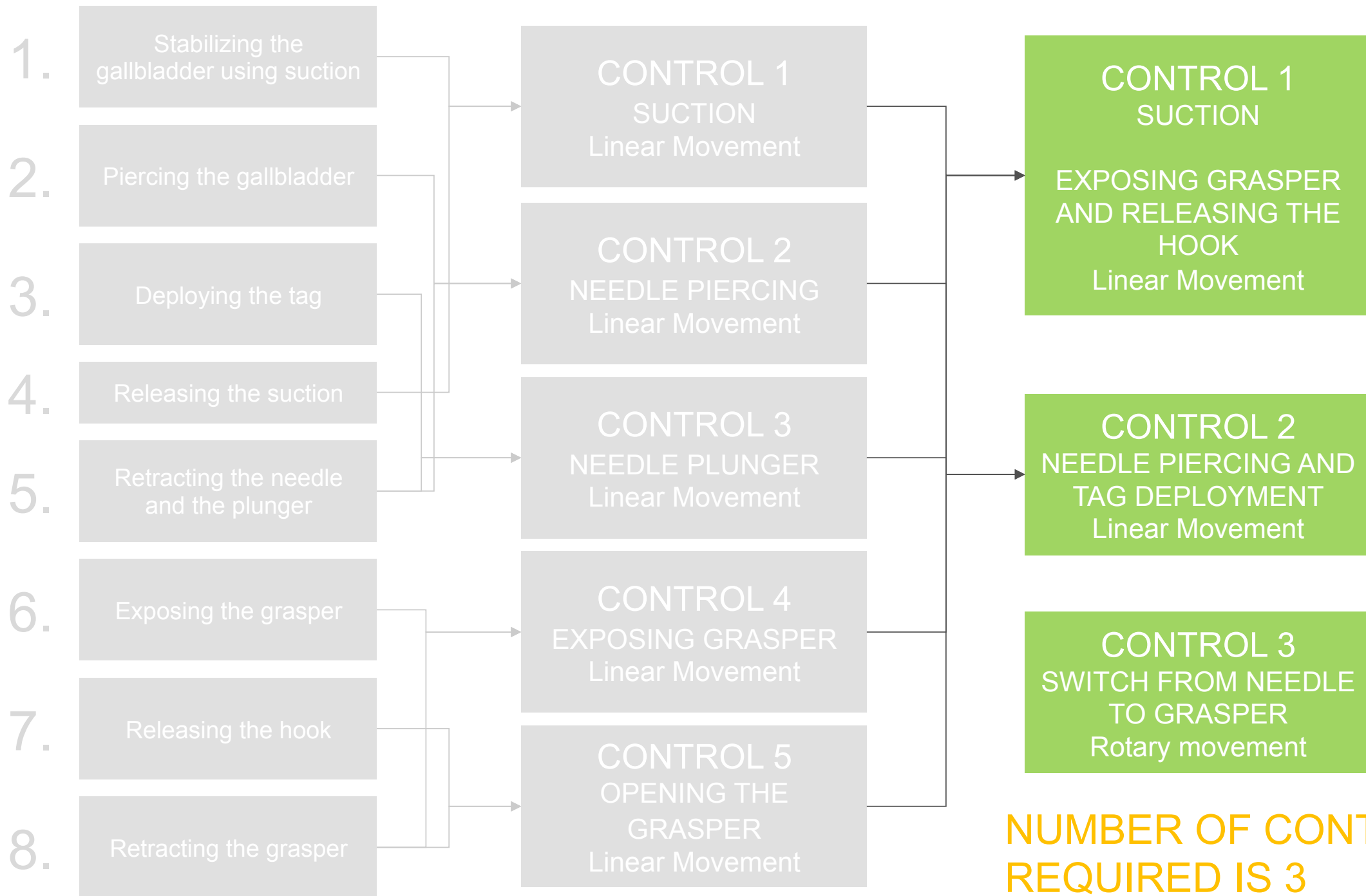






NUMBER OF  
CONTROLS  
REQUIRED IS 5.

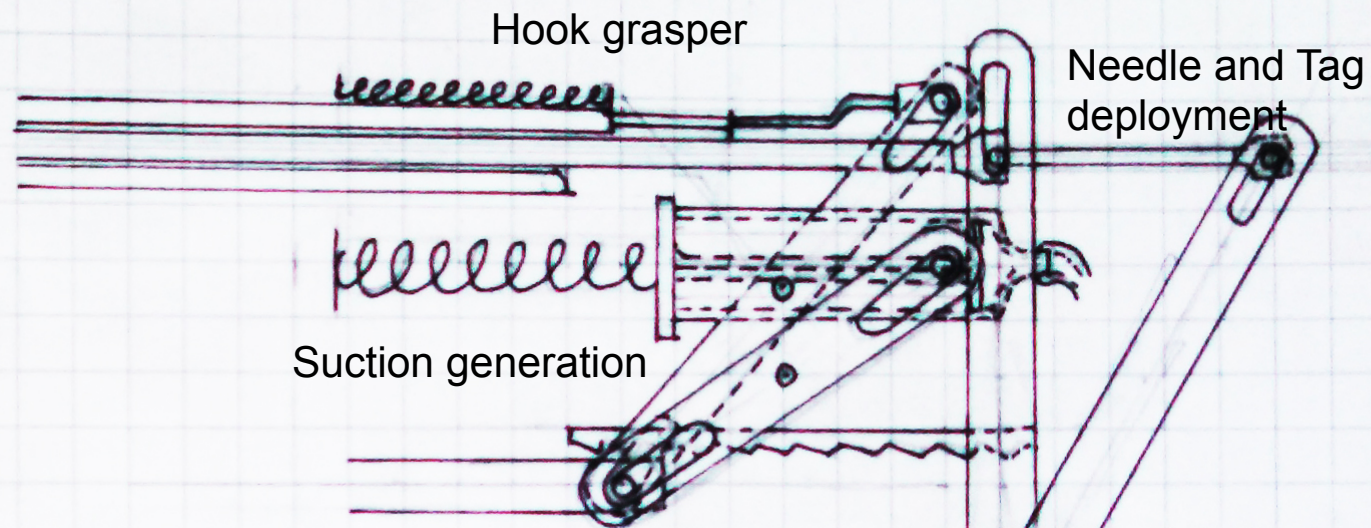
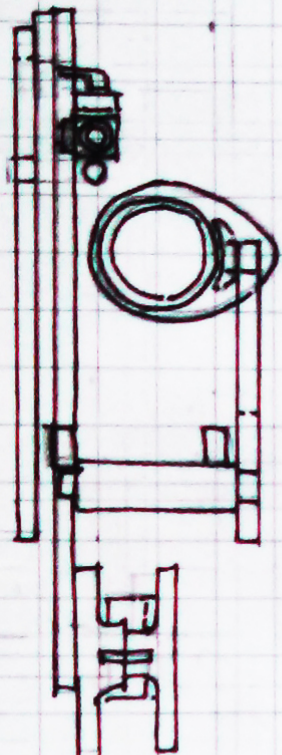
Can this be reduced?



NUMBER OF CONTROLS  
REQUIRED IS 3

# MECHANISM

## CONCEPT



# MECHANISM CONCEPT



SUCTION

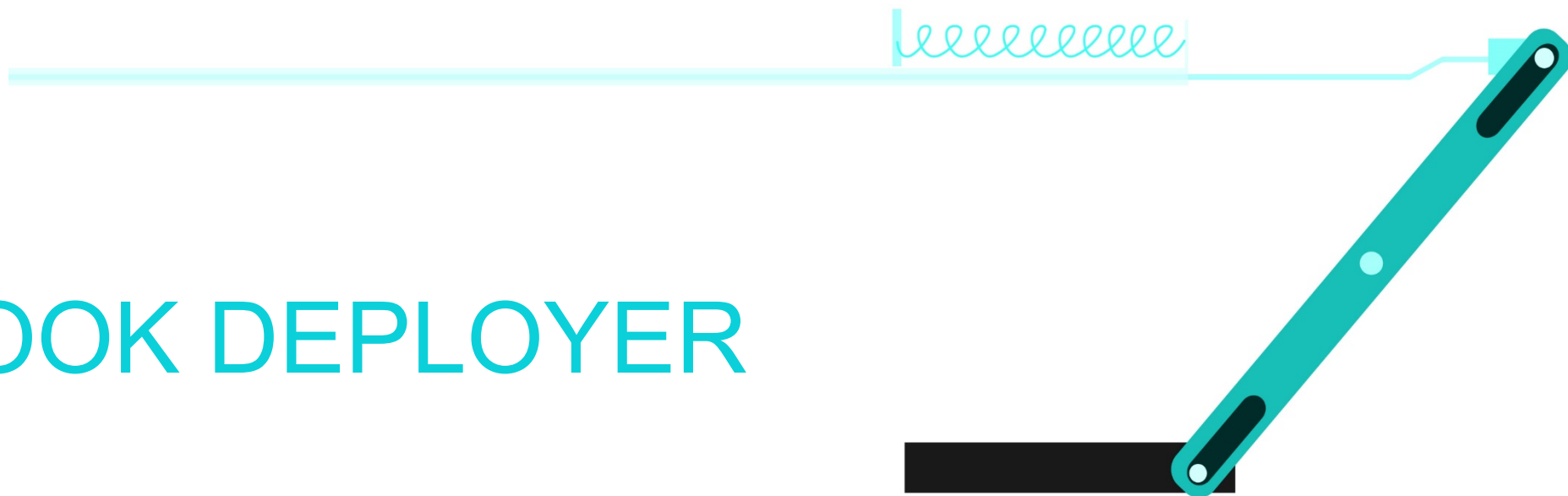
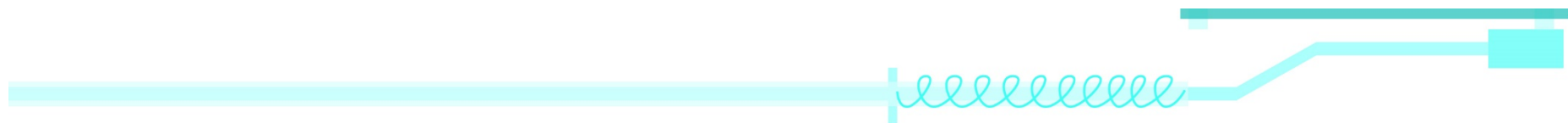




Syringe and Plunger: Polypropylene  
injection molded

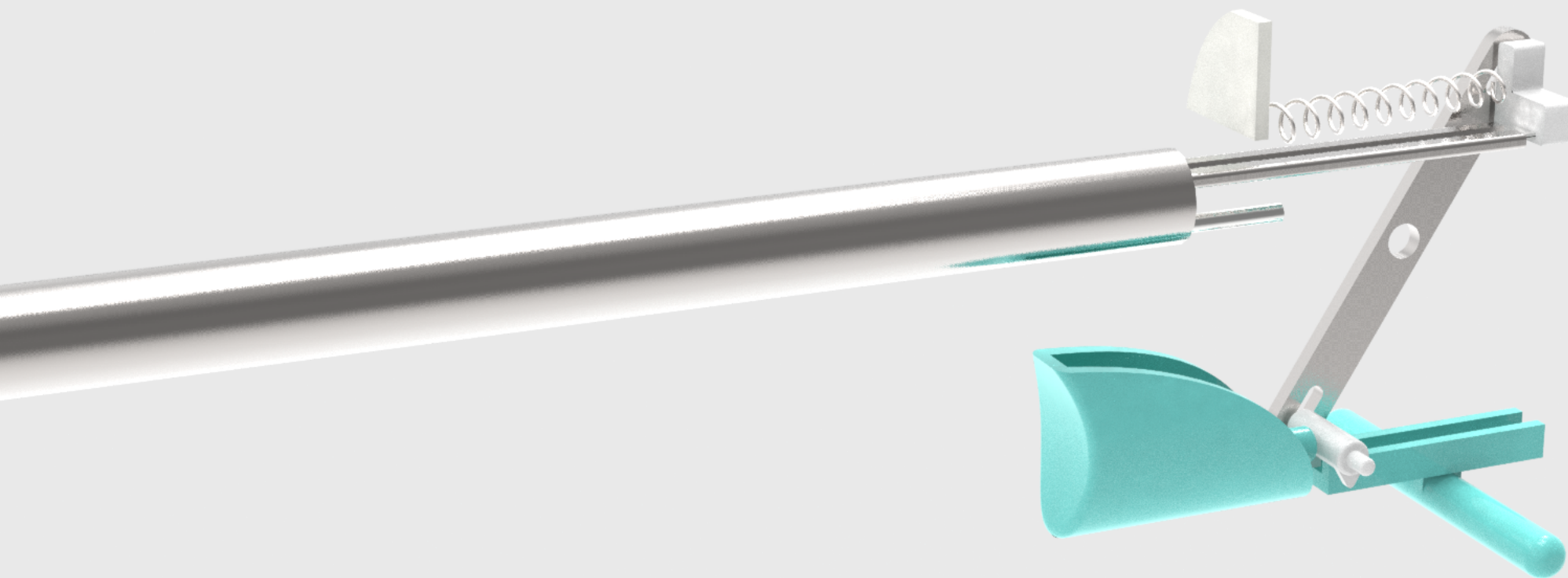
Switch: ABS, injection molded

DISPLACEMENT: 25 MM



HOOK DEPLOYER





Grasper inner strips: Spring steel

Grasper outer casing: Stainless  
steel 316L

Switch: ABS, injection molded

DISPLACEMENT: 20MM + 5 MM

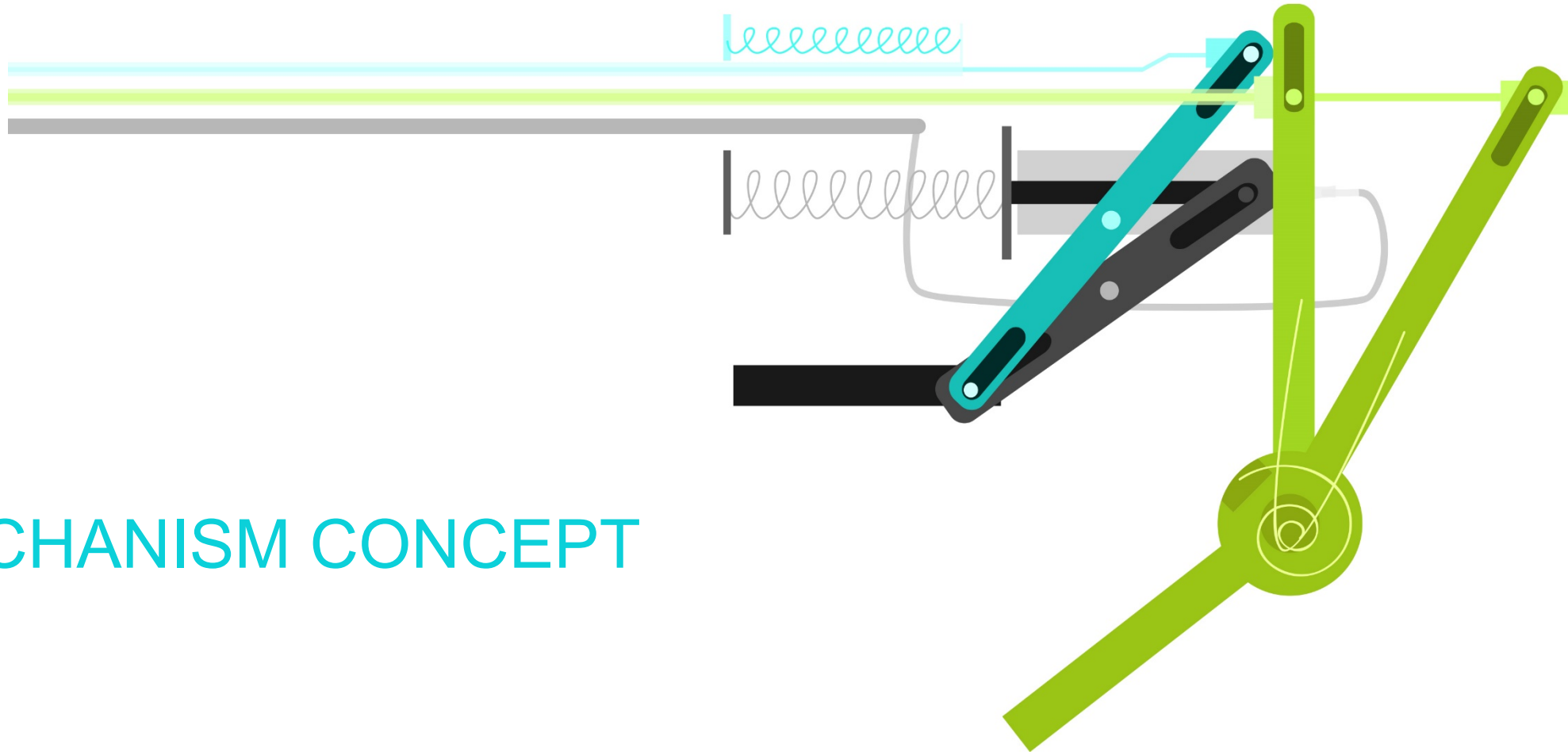
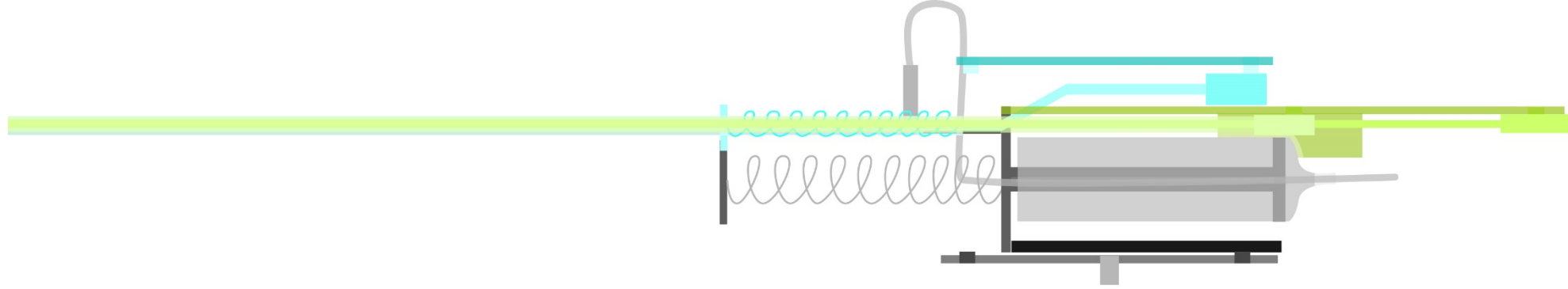


NEEDLE AND PLUNGER

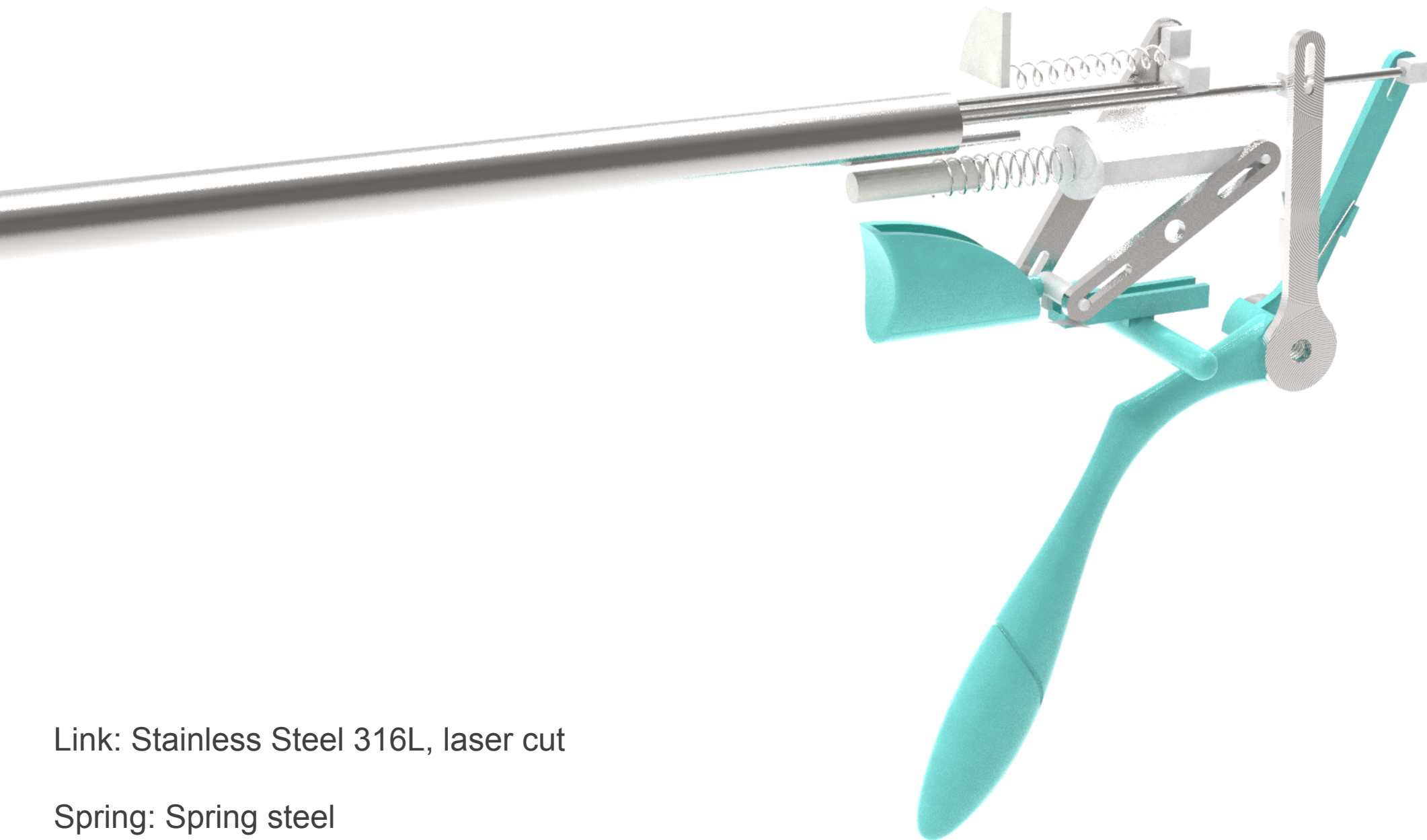


Needle and Plunger: Stainless Steel  
316L

DISPLACEMENT: 20MM + 20MM



MECHANISM CONCEPT

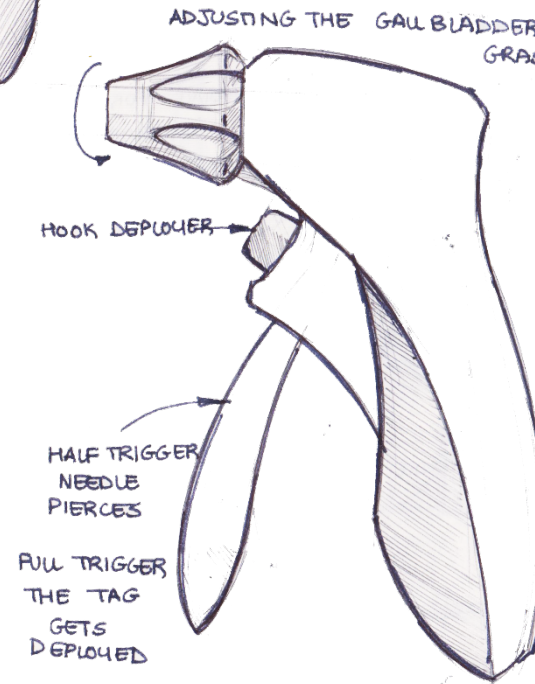
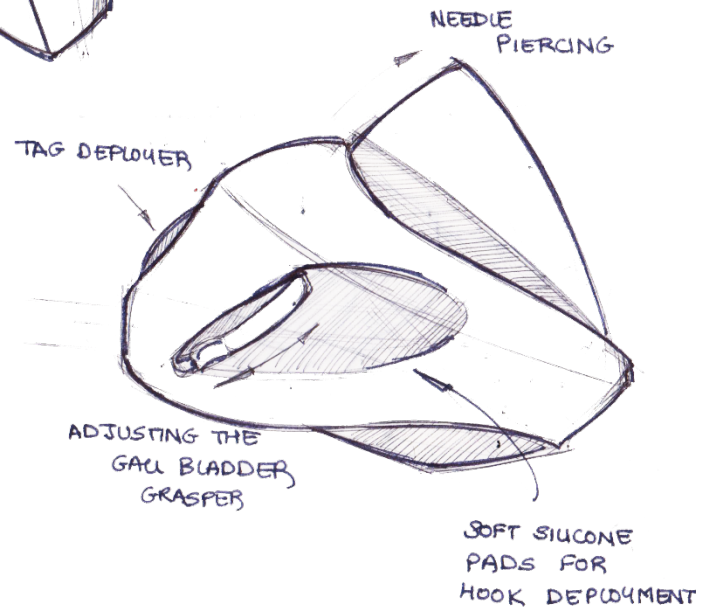
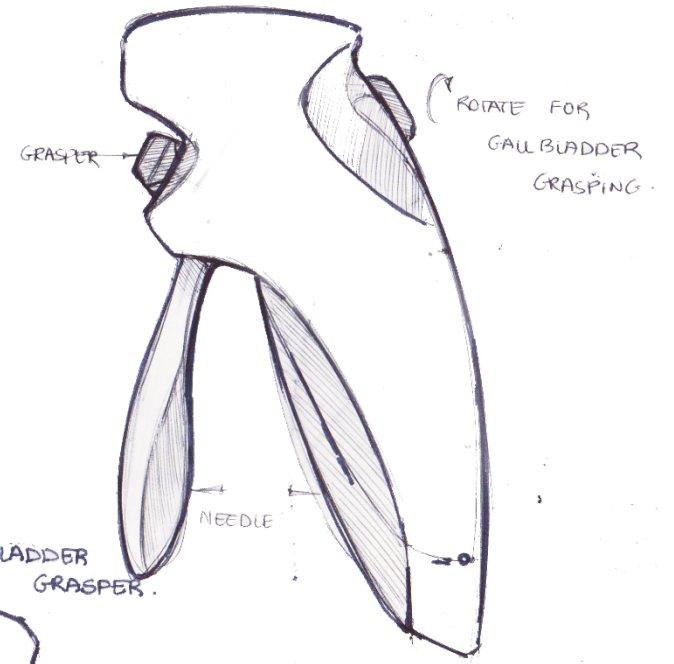
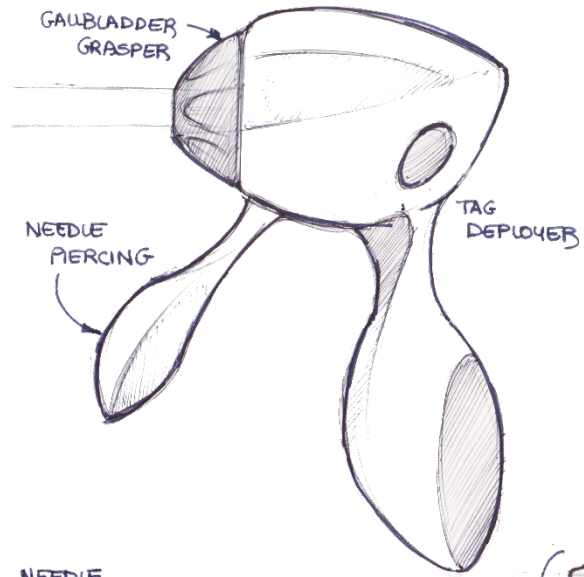
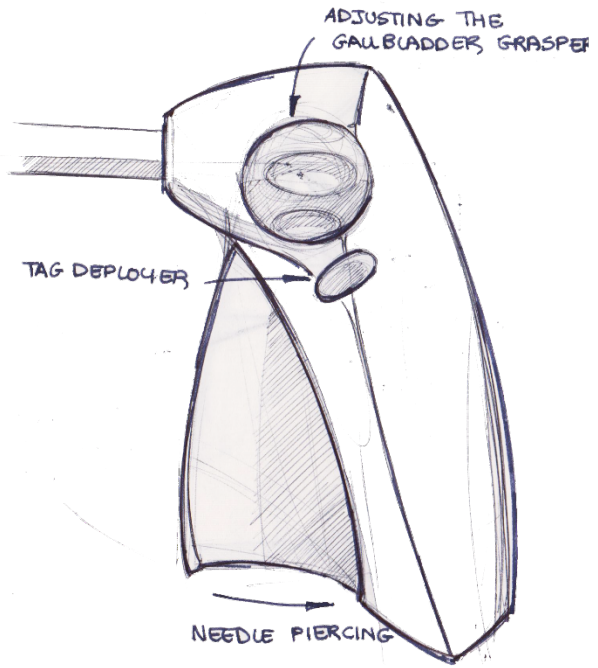


Link: Stainless Steel 316L, laser cut

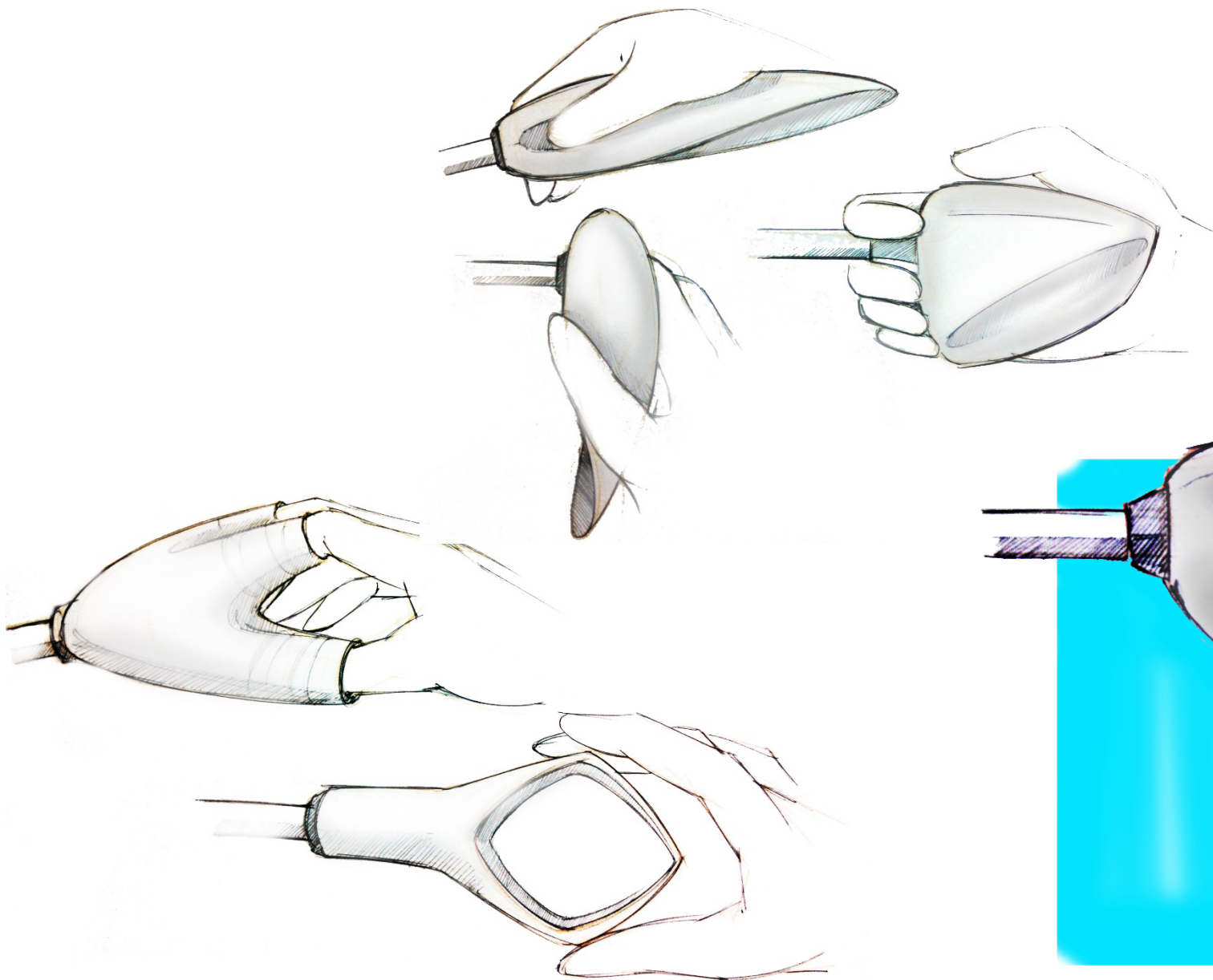
Spring: Spring steel

# IDEATION

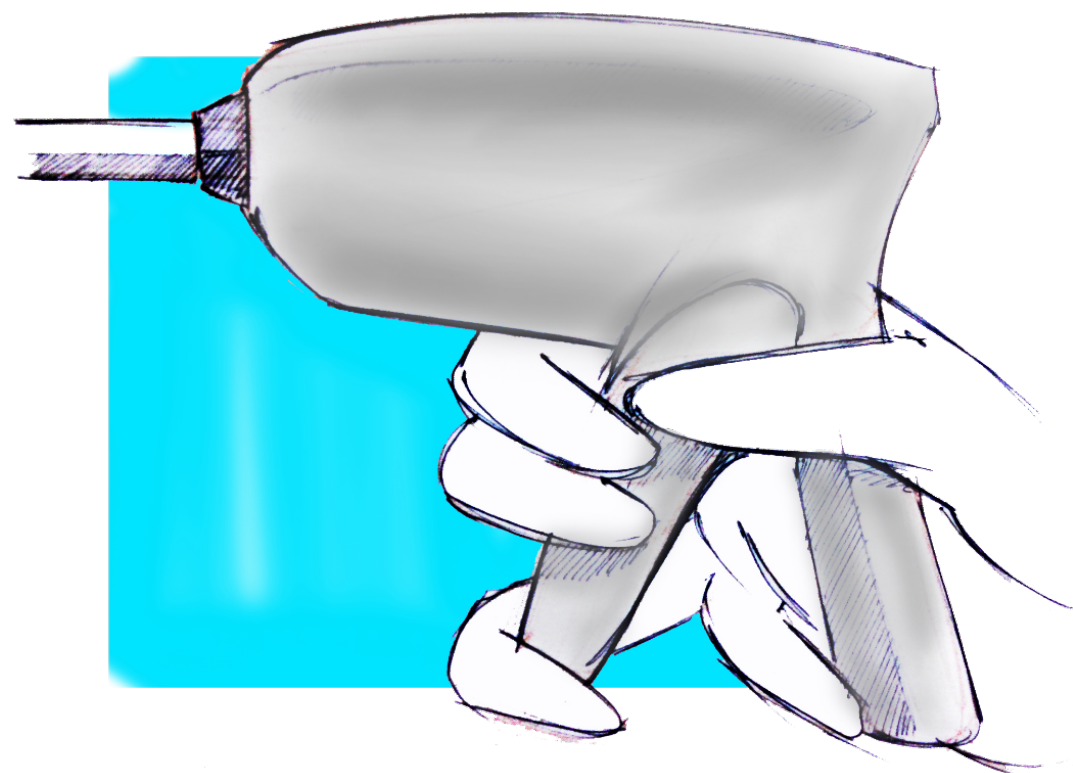
FOR GRIP



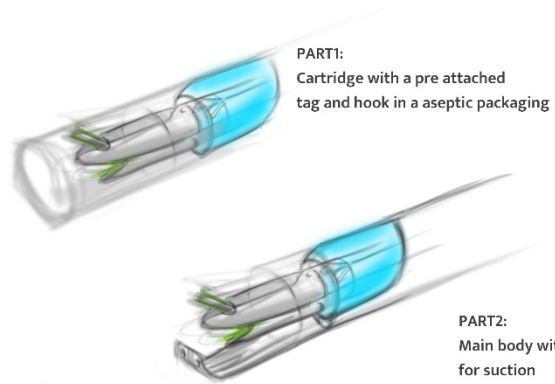




Operate 3 different controls  
Precision movement  
Stable grip  
Ease of use





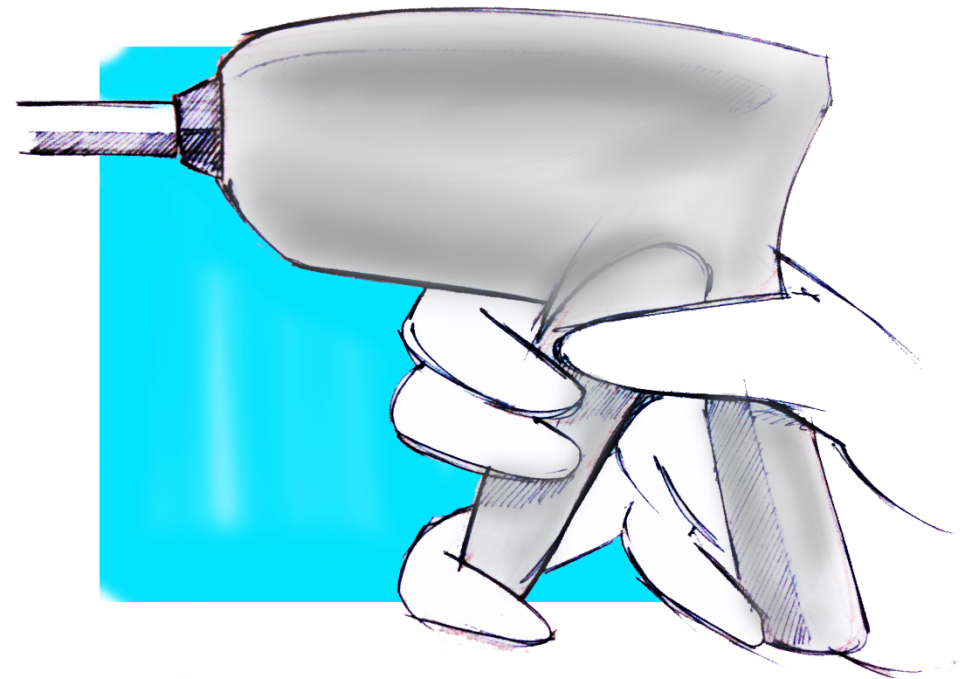


PART1:  
Cartridge with a pre attached  
tag and hook in a aseptic packaging

PART2:  
Main body with an attachment  
for suction

Suction generation, pneumatic  
Linear movement for the hook deployer  
Half trigger press for the needle to pierce  
Full trigger press for the deployment of the tag

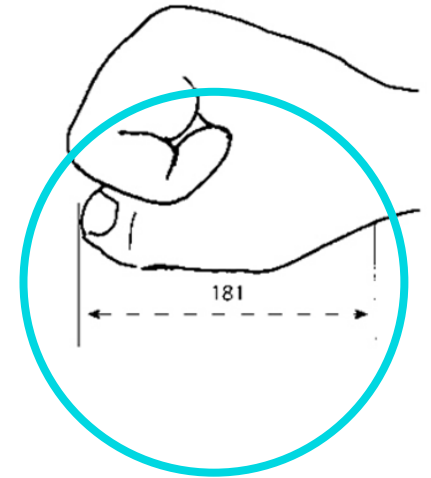
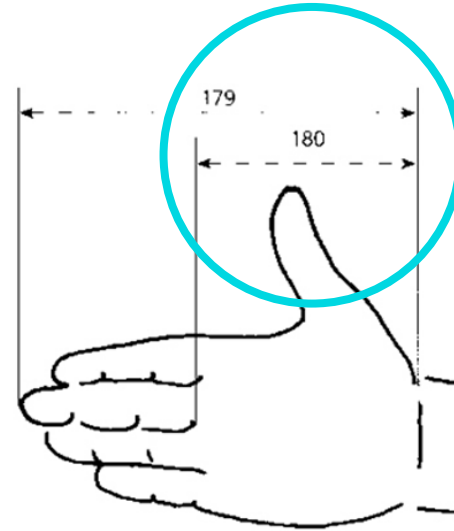
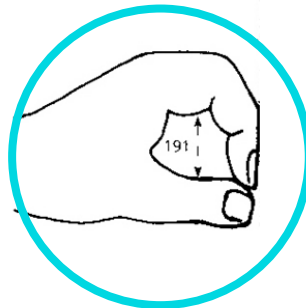
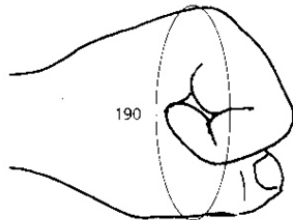
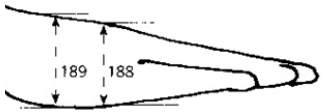
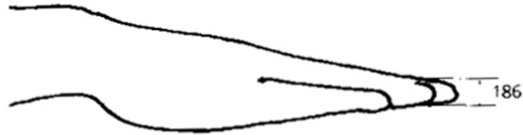
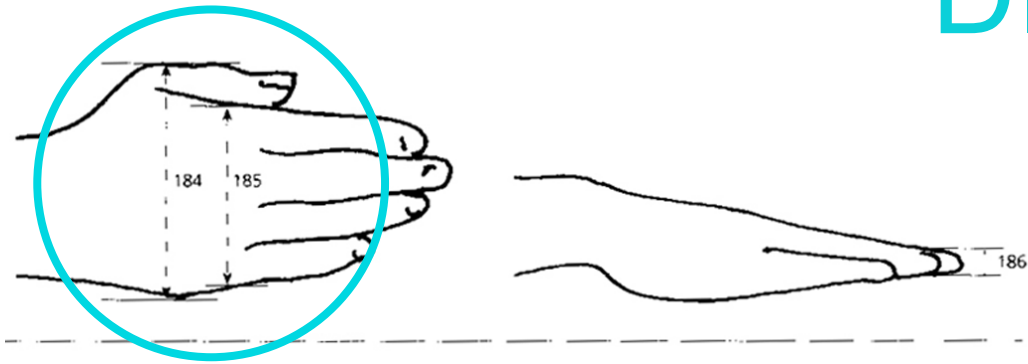
## CONCEPT 2



SUCTION

PISTOL GRIP

# ANTHRHROPOMETRIC DIMENSIONS



THUMB FOR SWITCH  
AND GRIPPING THE  
DEVICE.  
- LARGER AREA CAN BE  
REACHED.

TRIGGER FOR SUCTION & GRASPER.

- FINGERS WITH MOST  
STRENGTH.
- EASY FOR REPEATED  
MOVEMENT.

TRIGGER FOR NEEDLE.

- LONGER REACH SCOPE.
- TWO FINGERS FOR ADDITIONAL  
STRENGTH.



# FORM

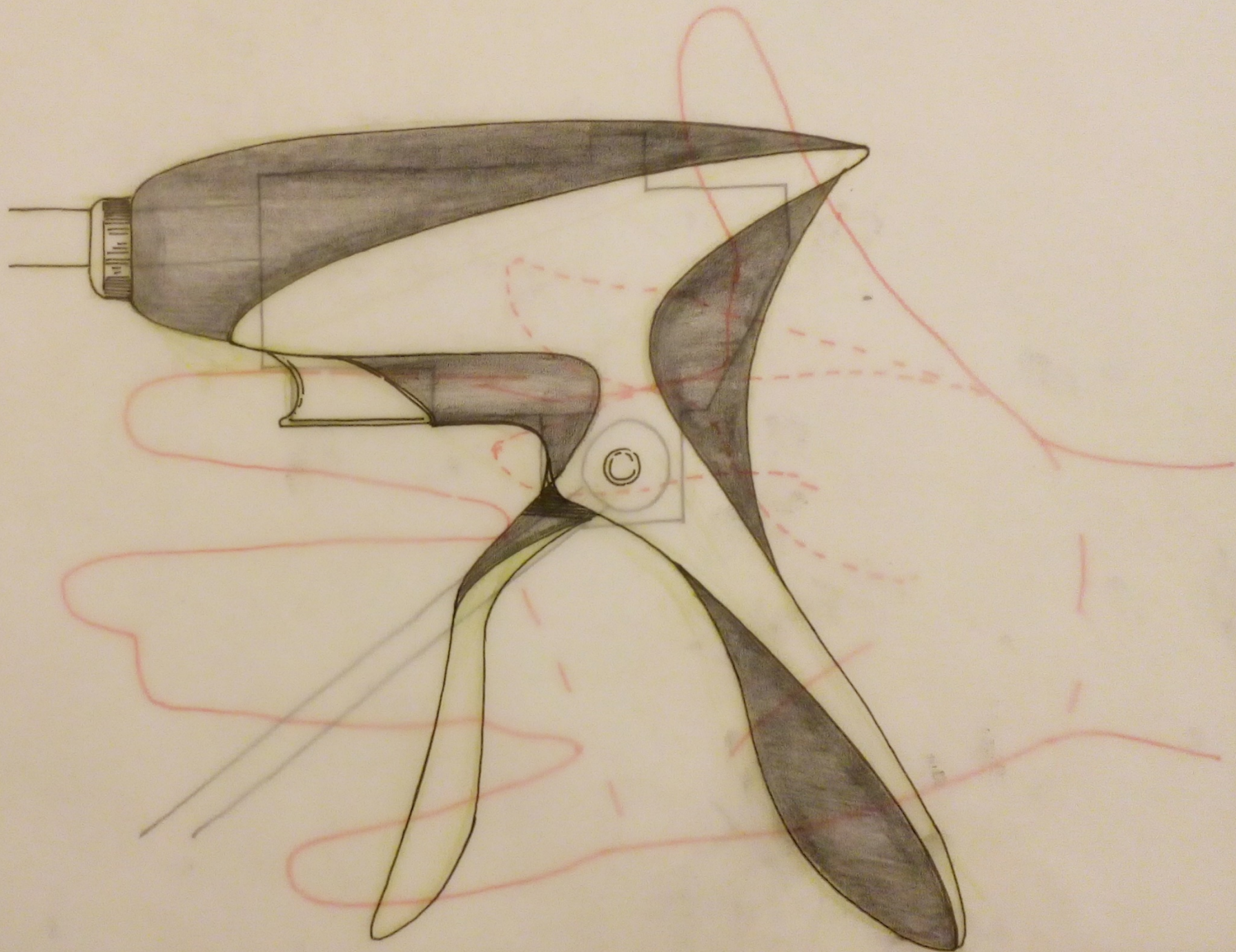
## EXPLORATION



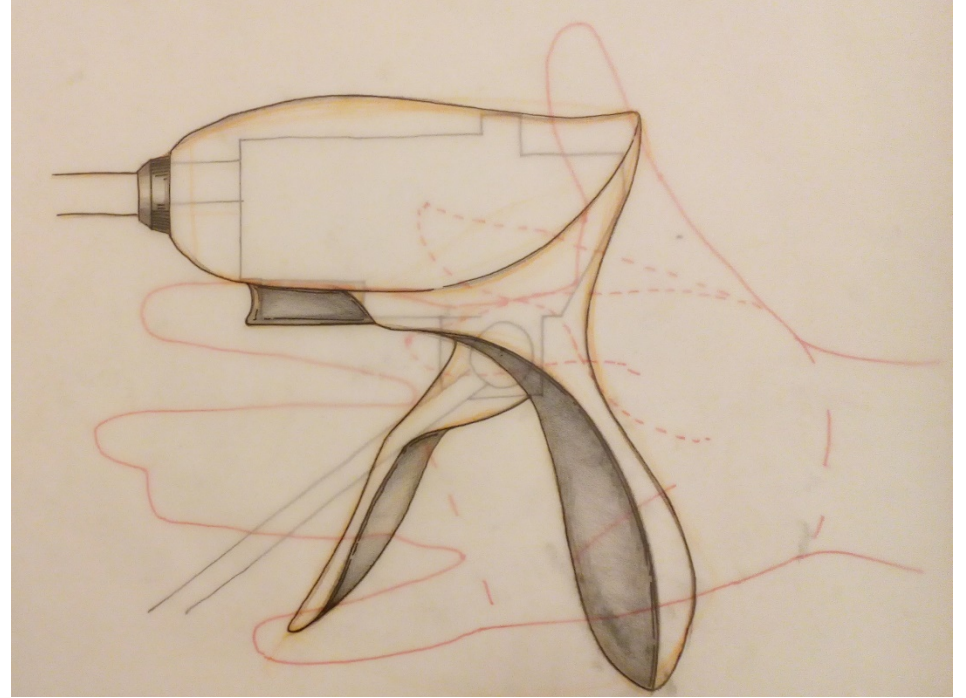
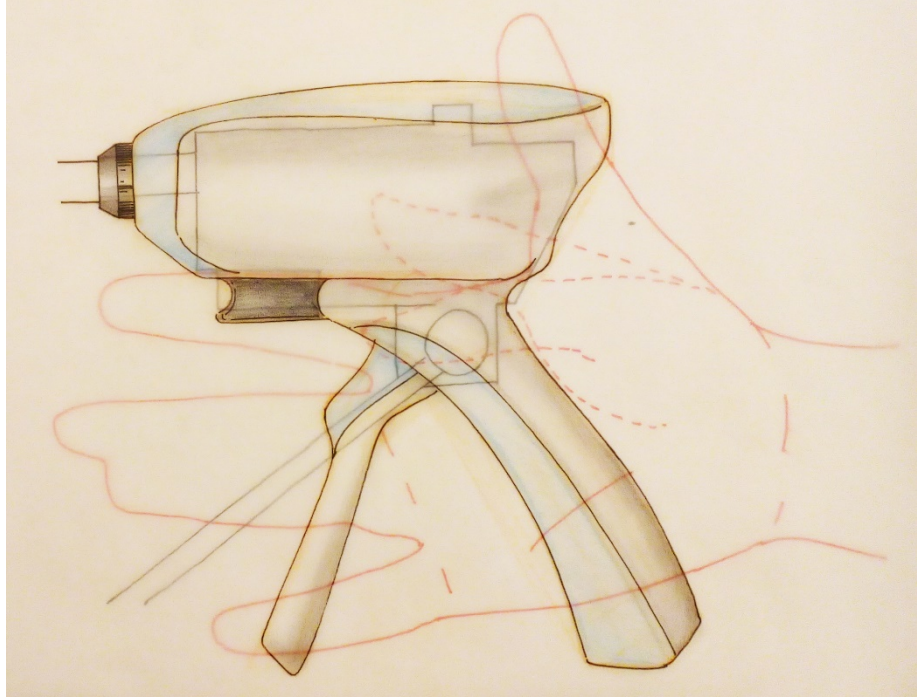


COMFOR  
T  
ORGANIC





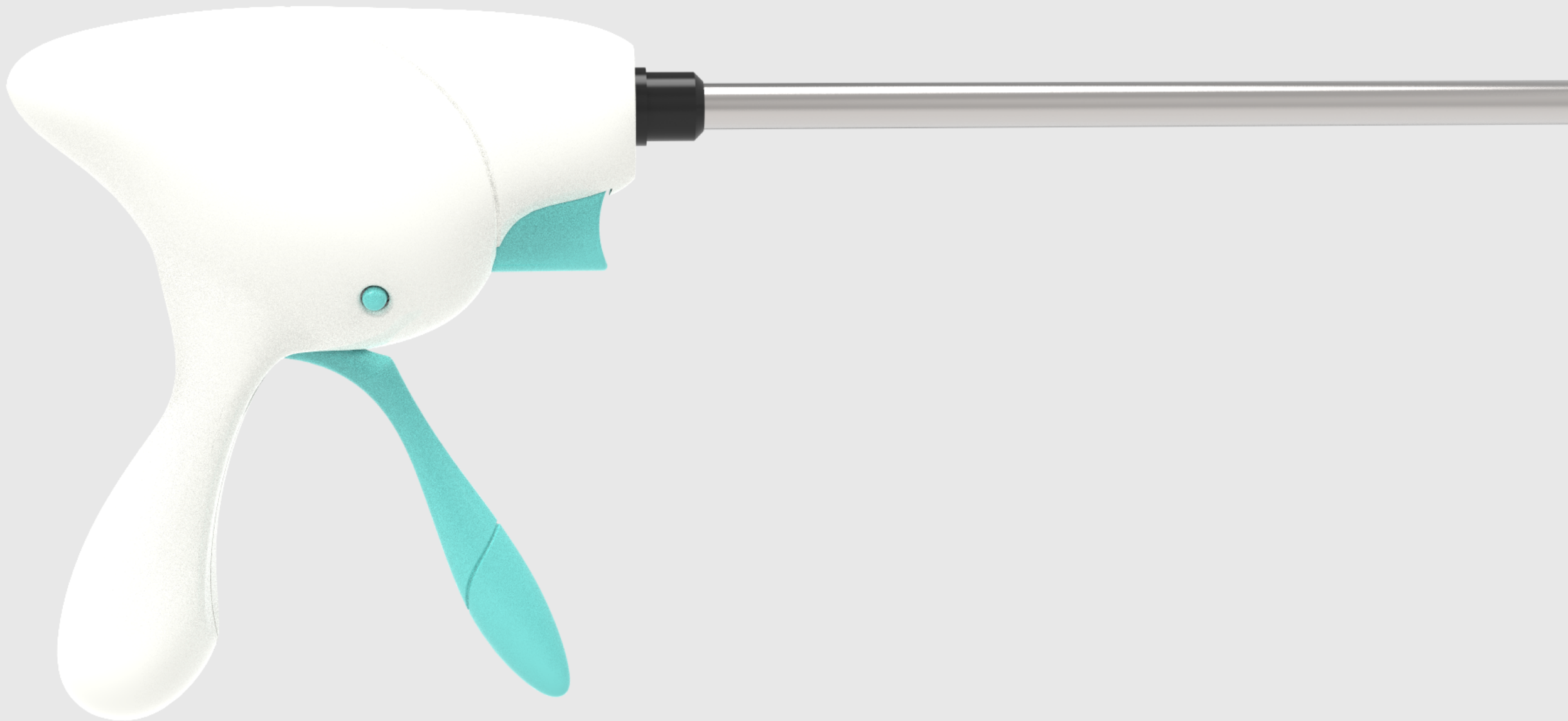


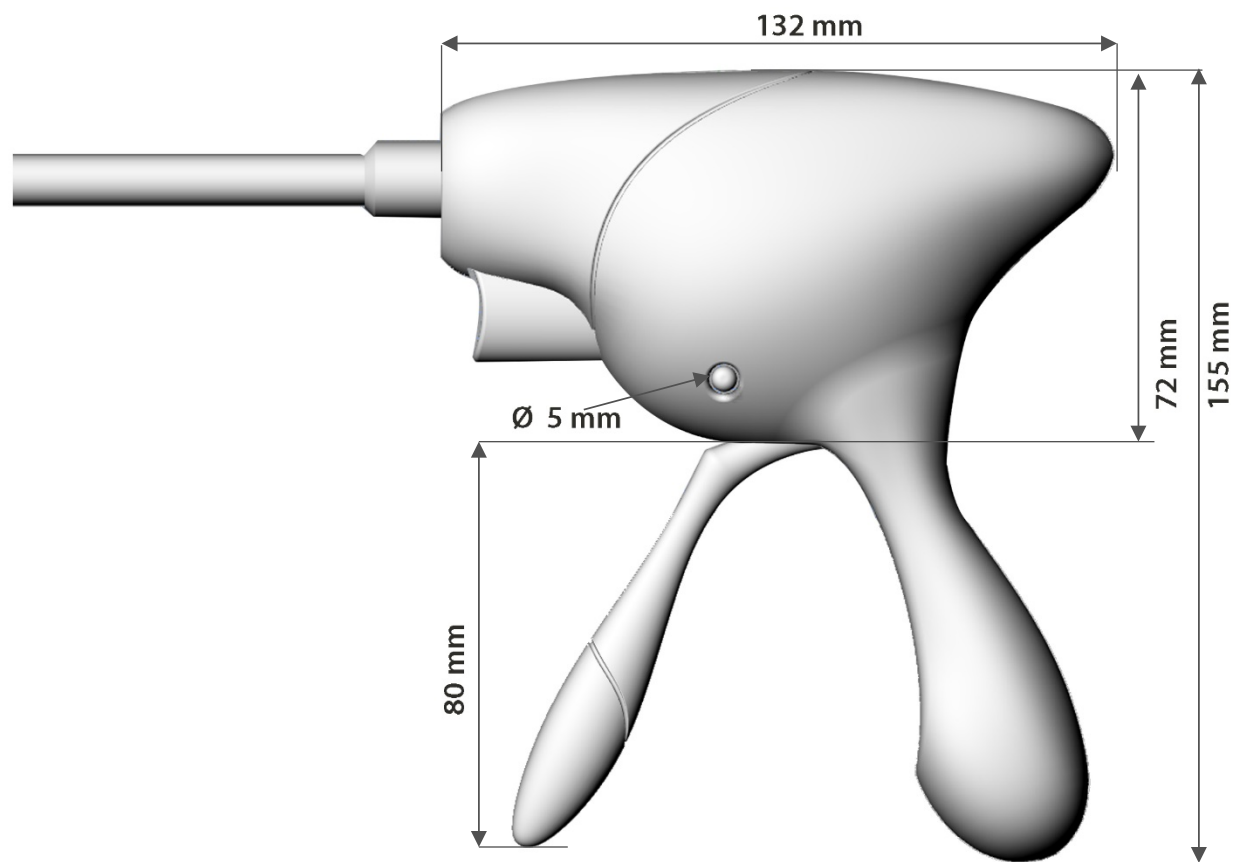
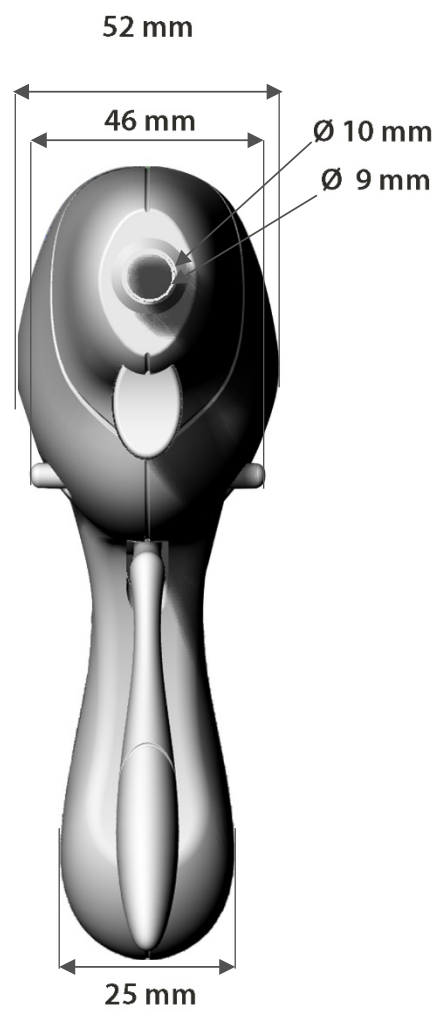


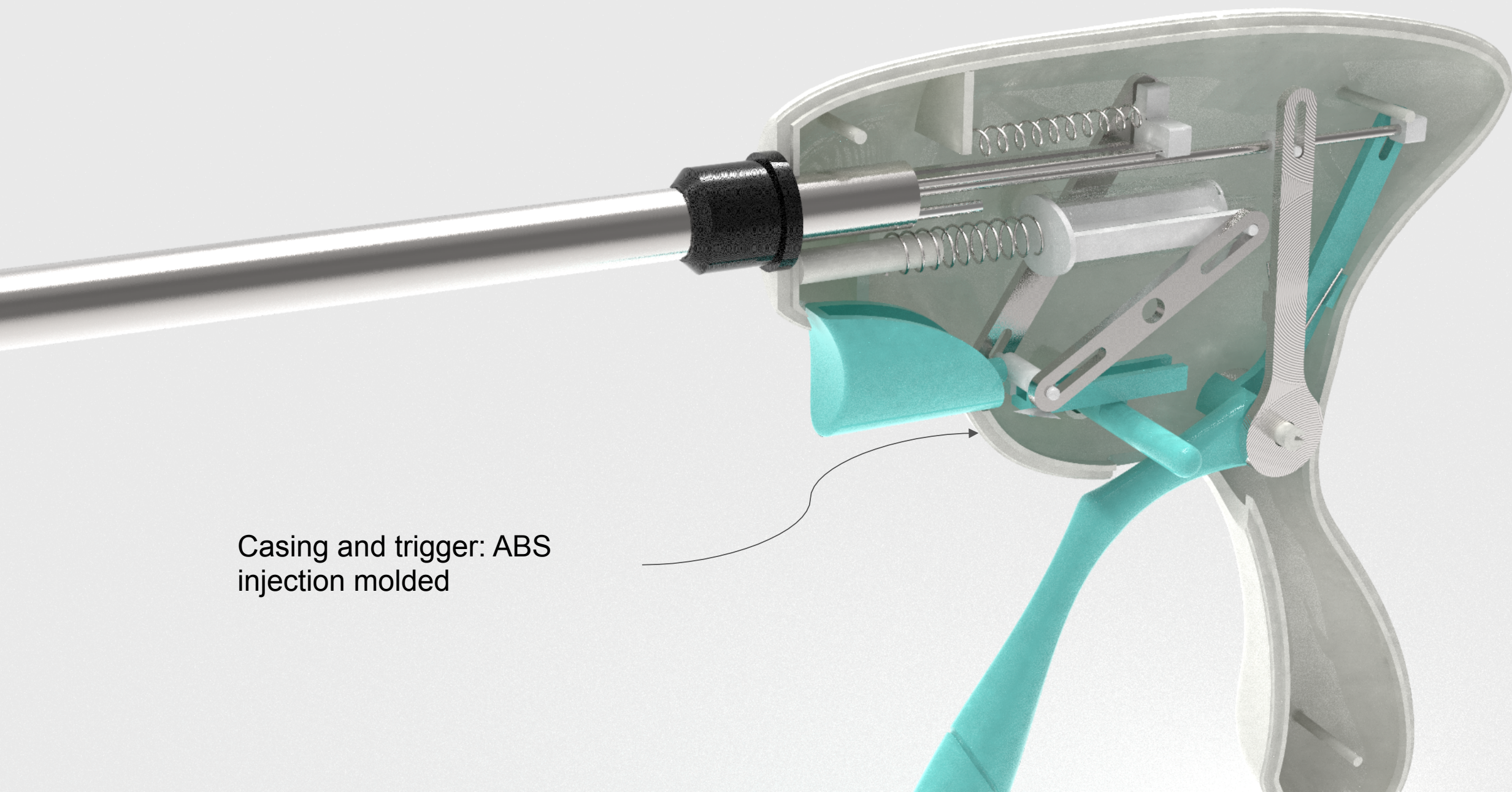






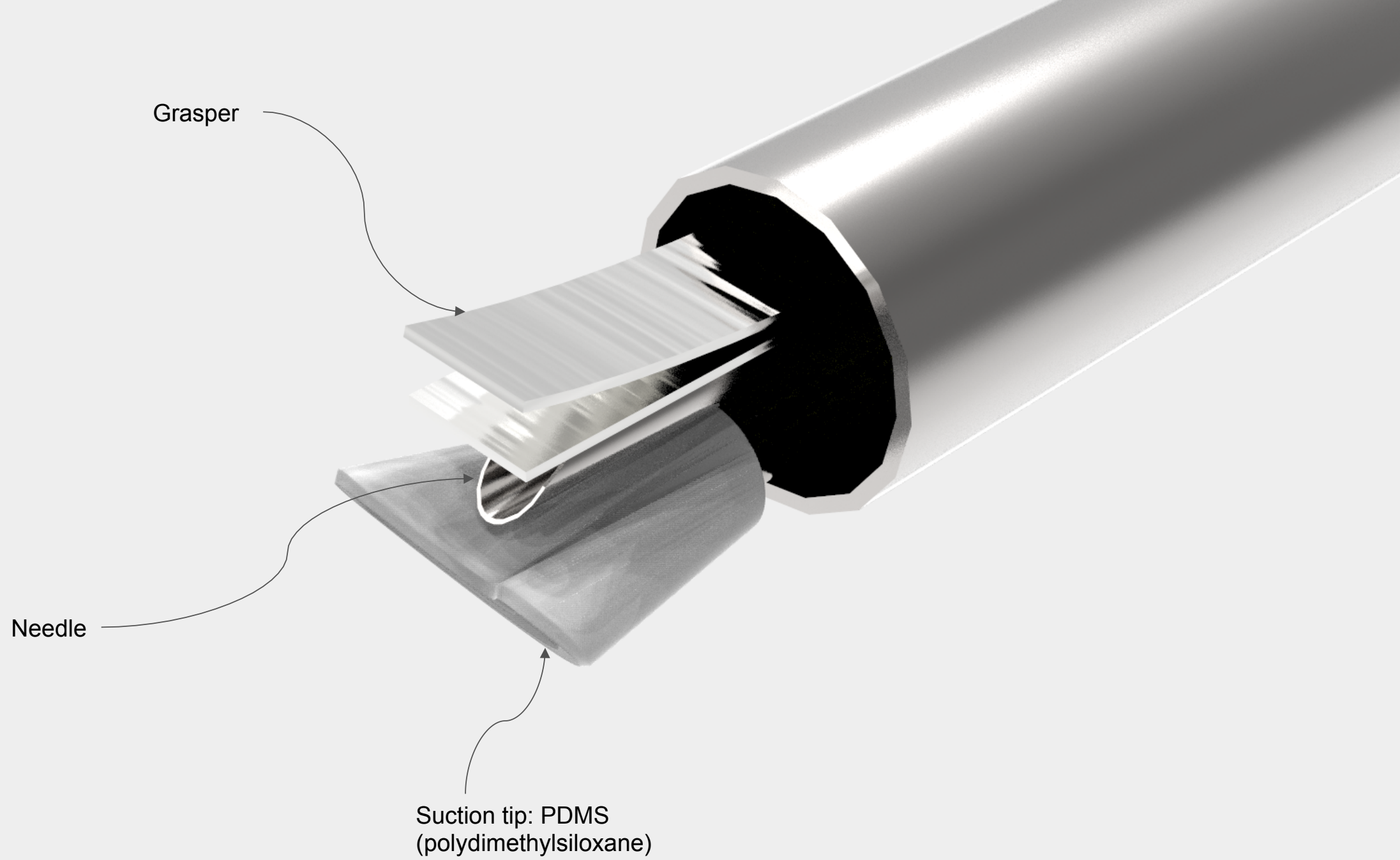






Casing and trigger: ABS  
injection molded





# VALUE PROPOSITION PRIMARY USER SURGEON

- Reduces incision, reduces chance of infection
- Quick installation
- Easy to prepare and saves time while installing
- Reduces human assistance

# VALUE PROPOSITION PRIMARY USER PATIENT

- Reduces one incision
- Reduces surgery cost

# VALUE PROPOSITION SECONDARY USER HOSPITAL MANAGEMENT

- Reduces cost
- Device is reusable and thus the recurring cost is of the endo retractor
- Increases productivity
- Aid for single port surgeries thus encouraging research and development in surgical techniques.

# FUTURE SCOPE

- Design of a tray which will facilitate storage and gripping of the device during surgery.

THANK YOU