

Deployer Device for Endo retractor

INTRODUCTION



LAPAROSCOPIC SURGERY

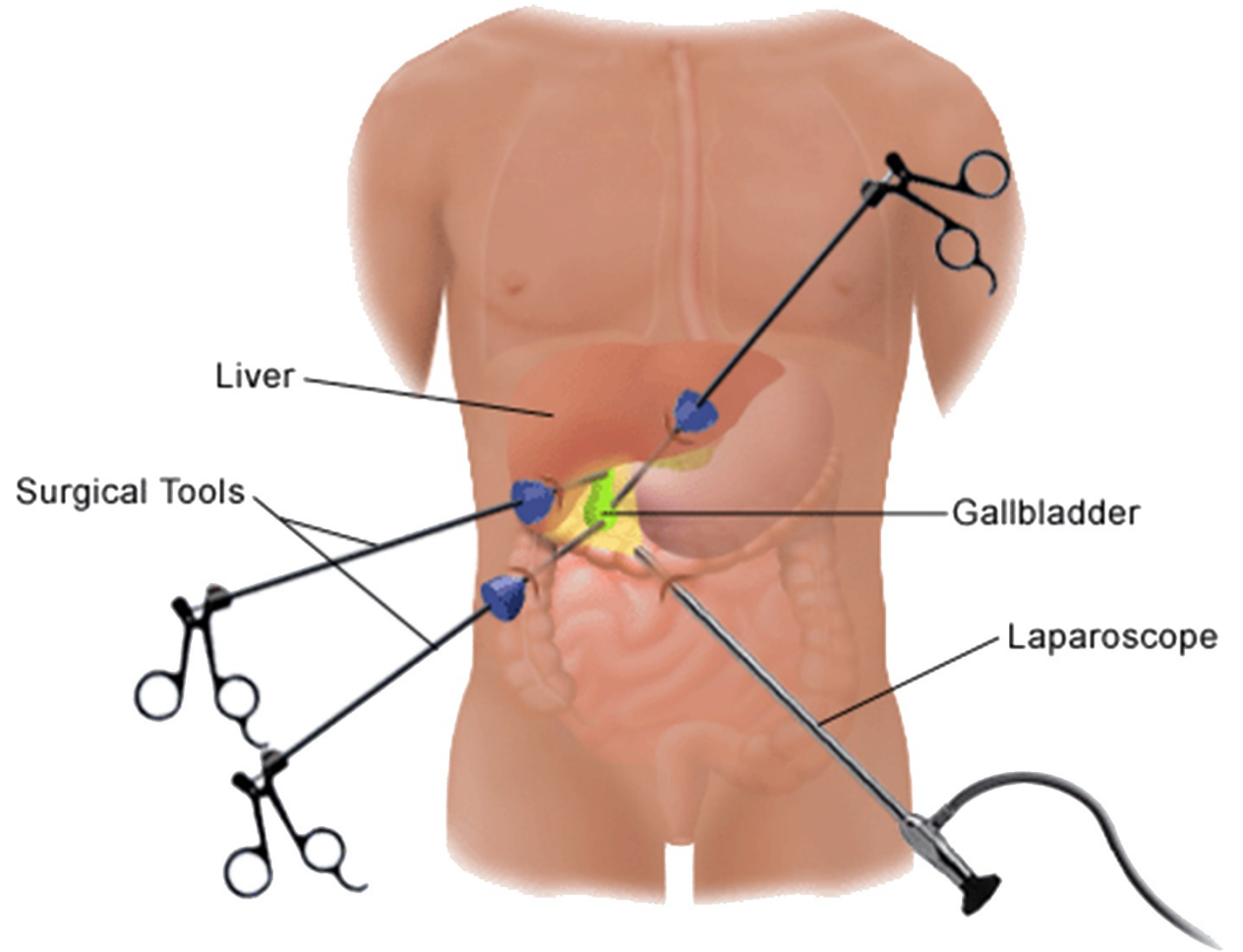
Minimally invasive or keyhole surgery



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.

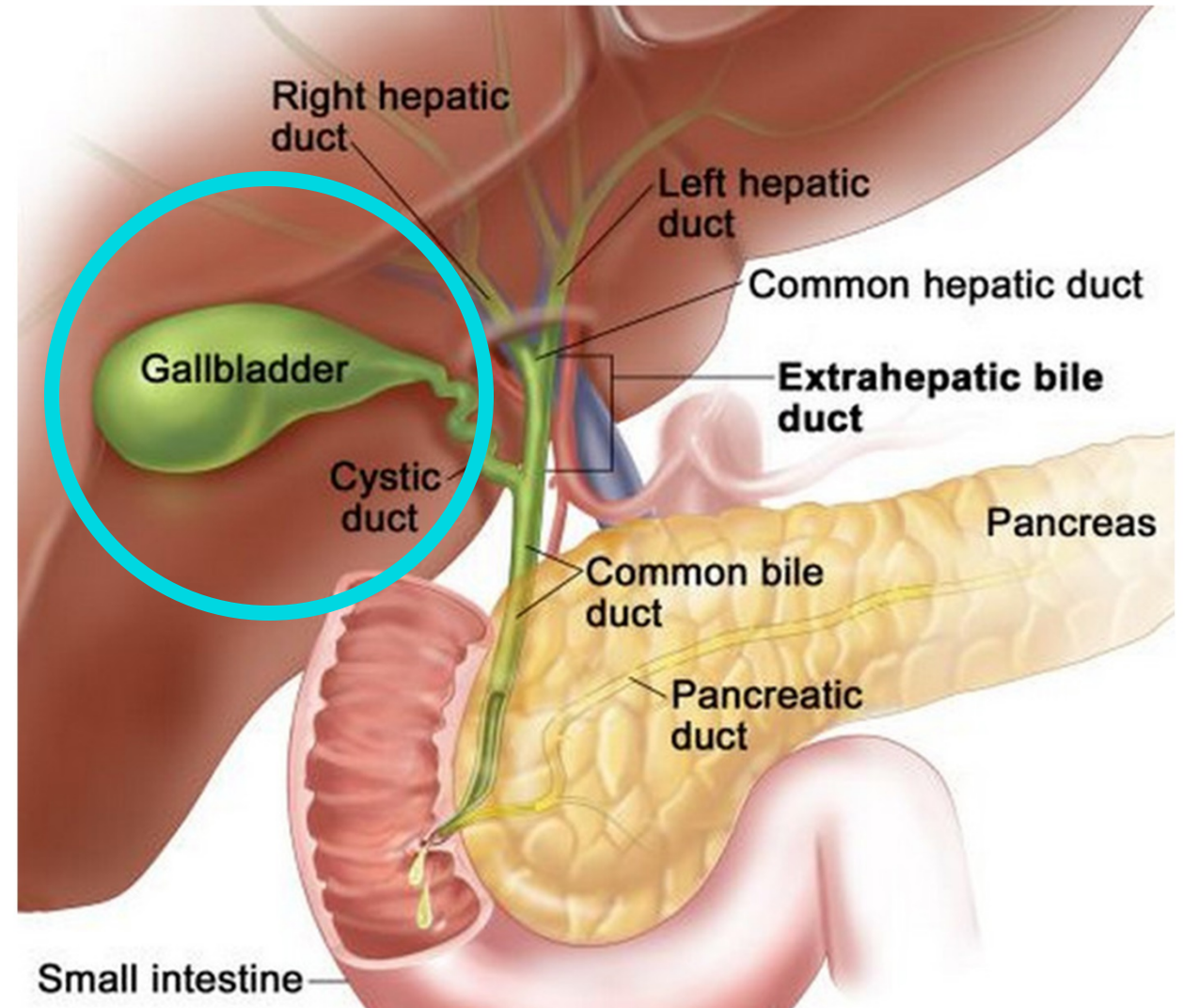


IMAGE SOURCE: http://anatomy-medicine.com/uploads/posts/2015-07/1436269423_gall-bladder.jpg



CHOLECYSTECTOMY

Surgical removal of Gallbladder



CHOLECYSTECTOMY

Surgical **removal of gallbladder.**

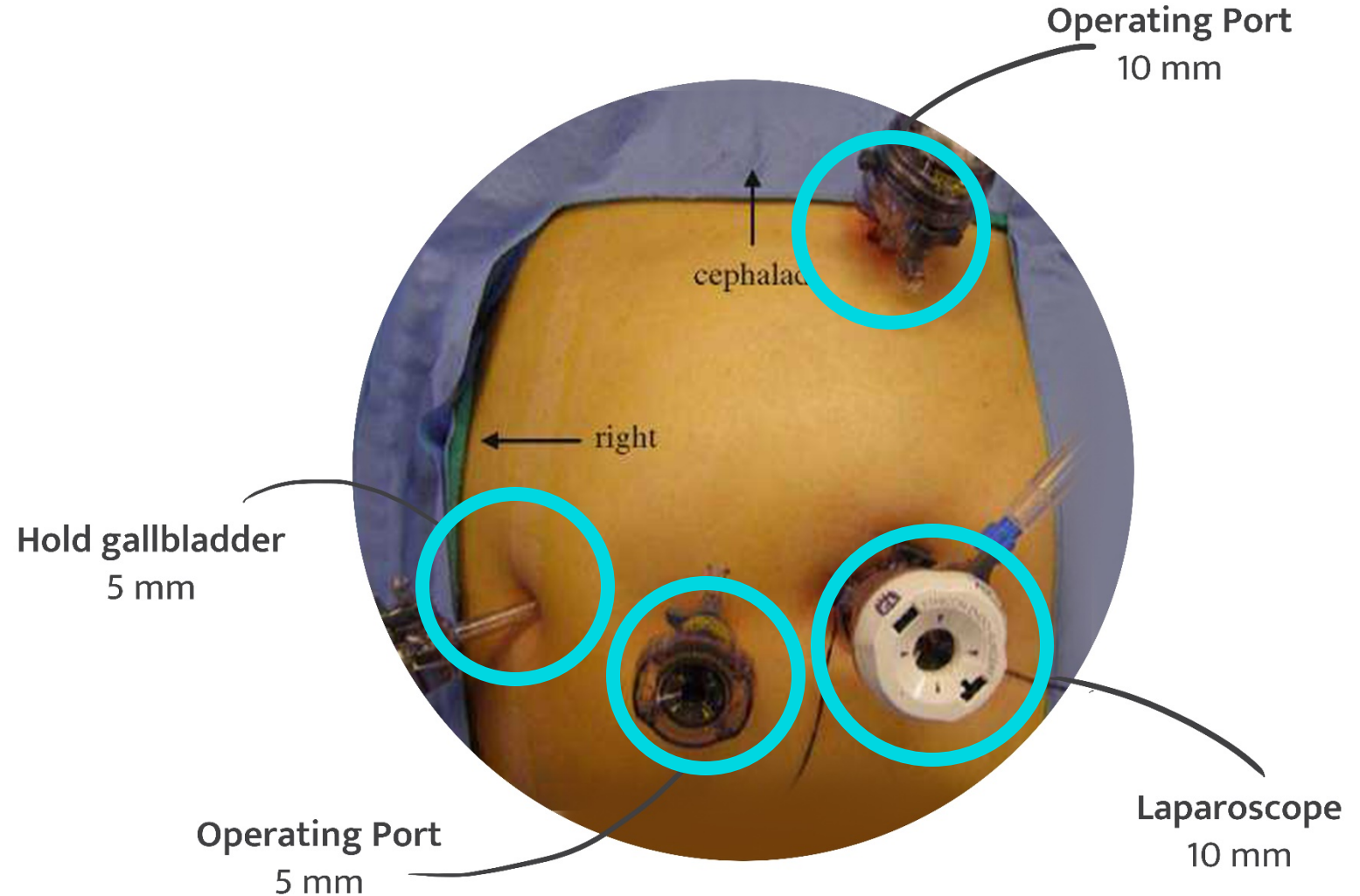
Procedure can be performed by the **laparoscopic method.**

4 incisions are required

1 port: Laparoscope

2 ports: Operating ports

1 port: Holding the gallbladder



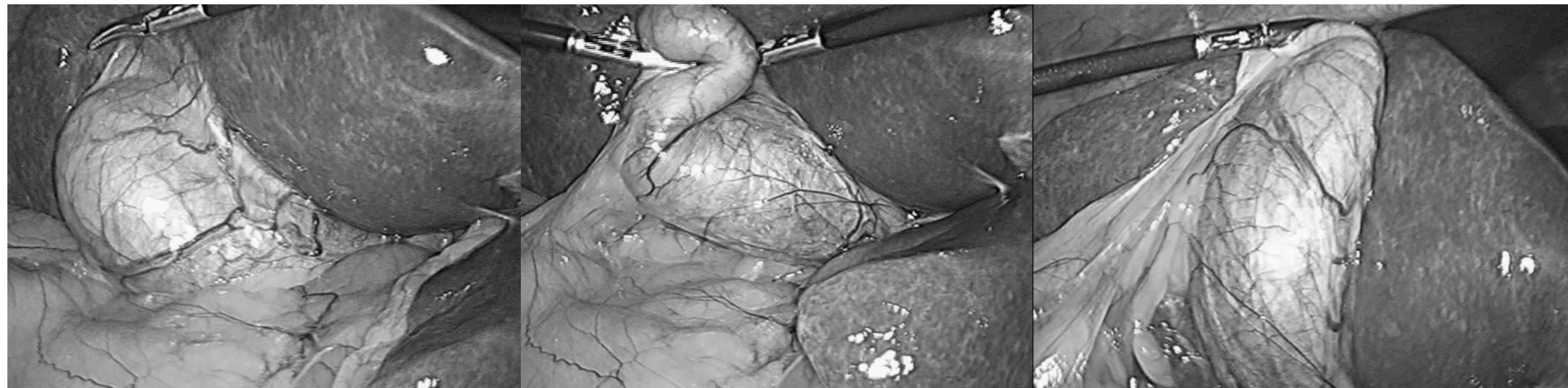


2 assistants involved in the surgery

1 assistant is engaged throughout the surgery to hold the gallbladder

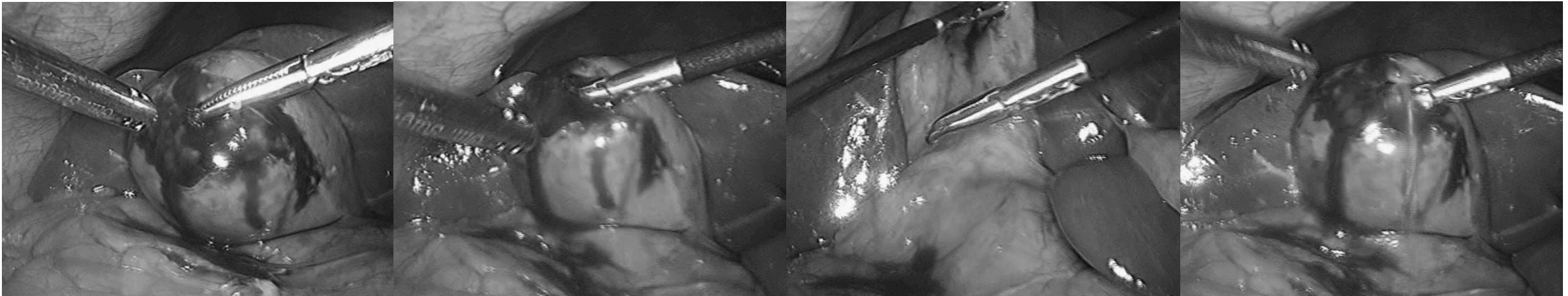
Hand position and port use

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

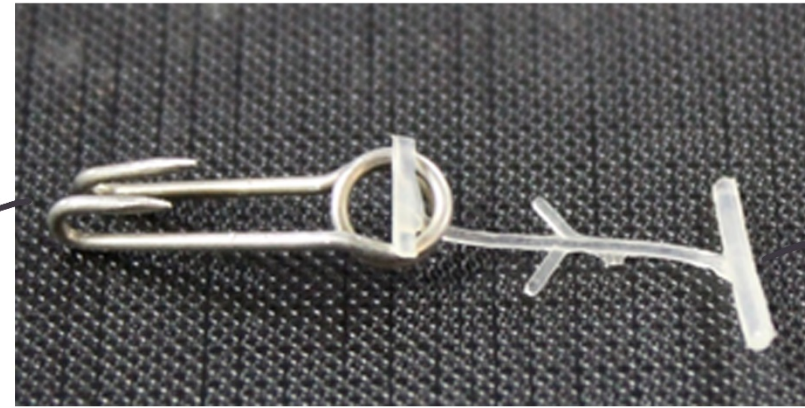


ENDO RETRACTOR

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

Eliminates one port
Reduces human assistance
Reduces chance of contamination

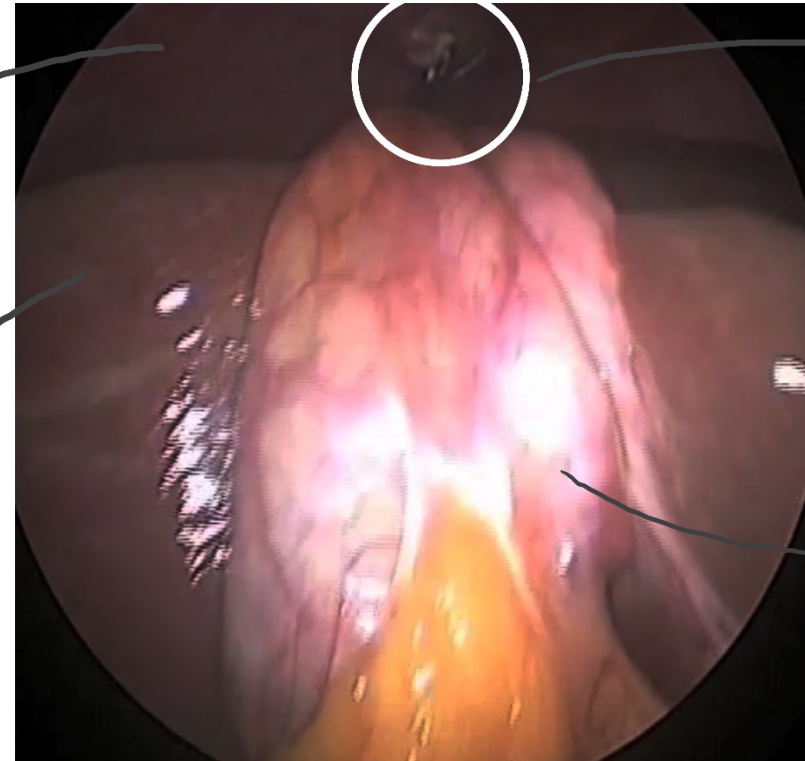
Hook



Tag

Peritoneum
Inner wall of the abdomen

Liver



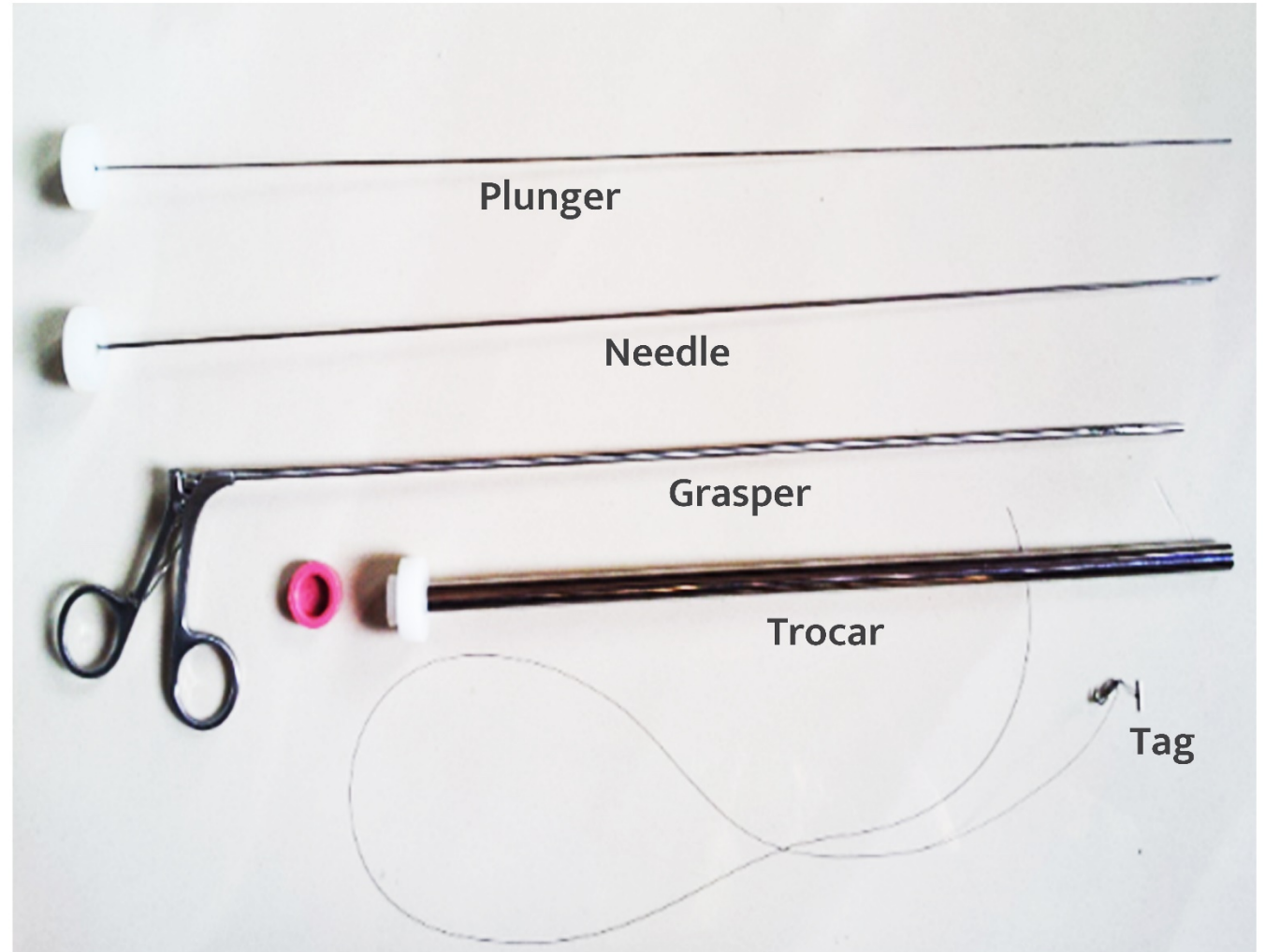
Endoretractor

Gallbladder

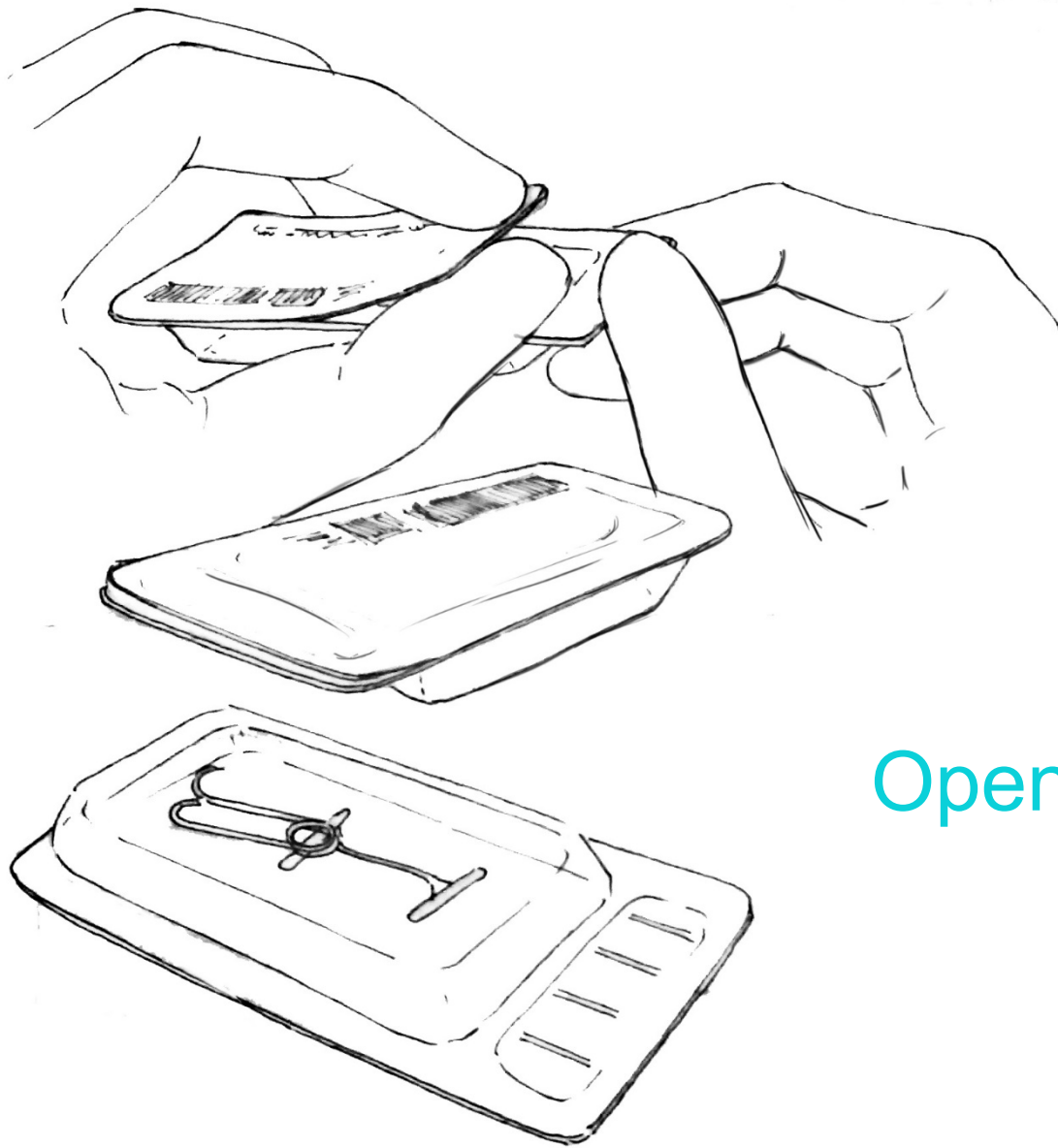


ENDO RETRACTOR

Current instruments used for
deployment



TASK ANALYSIS



Opening the sterile packaging

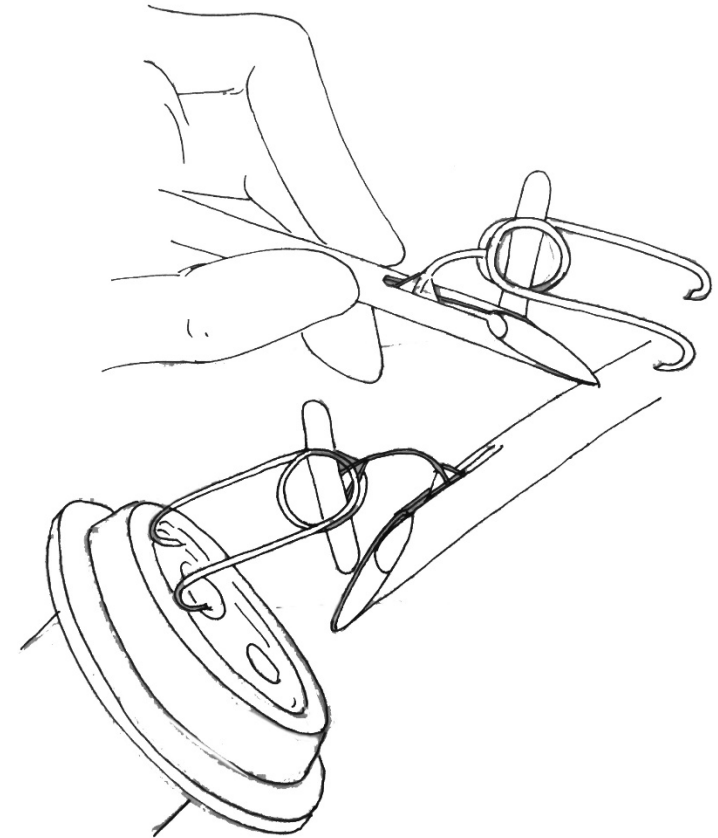
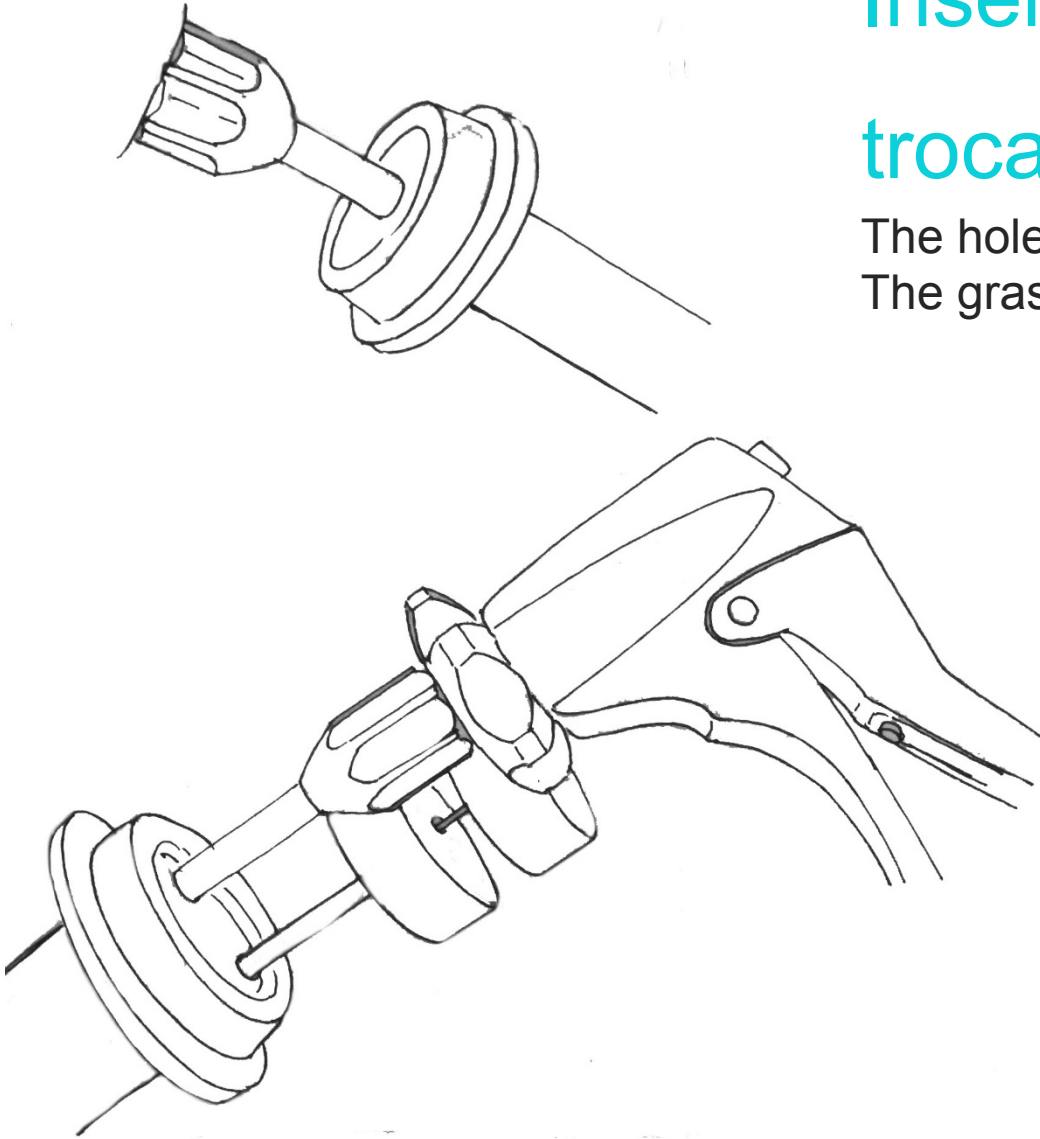


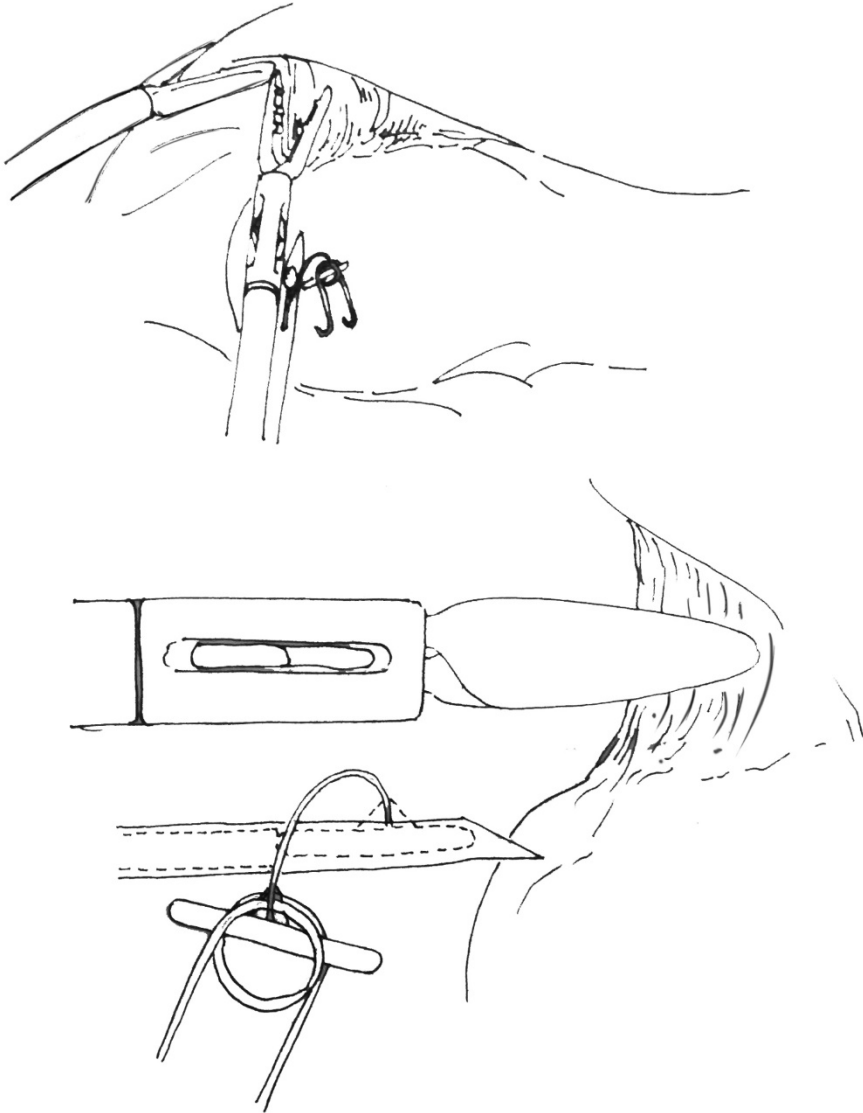
Attaching the tag to the needle

Inserting the needle through the trocar

The hole is on 1 mm diameter

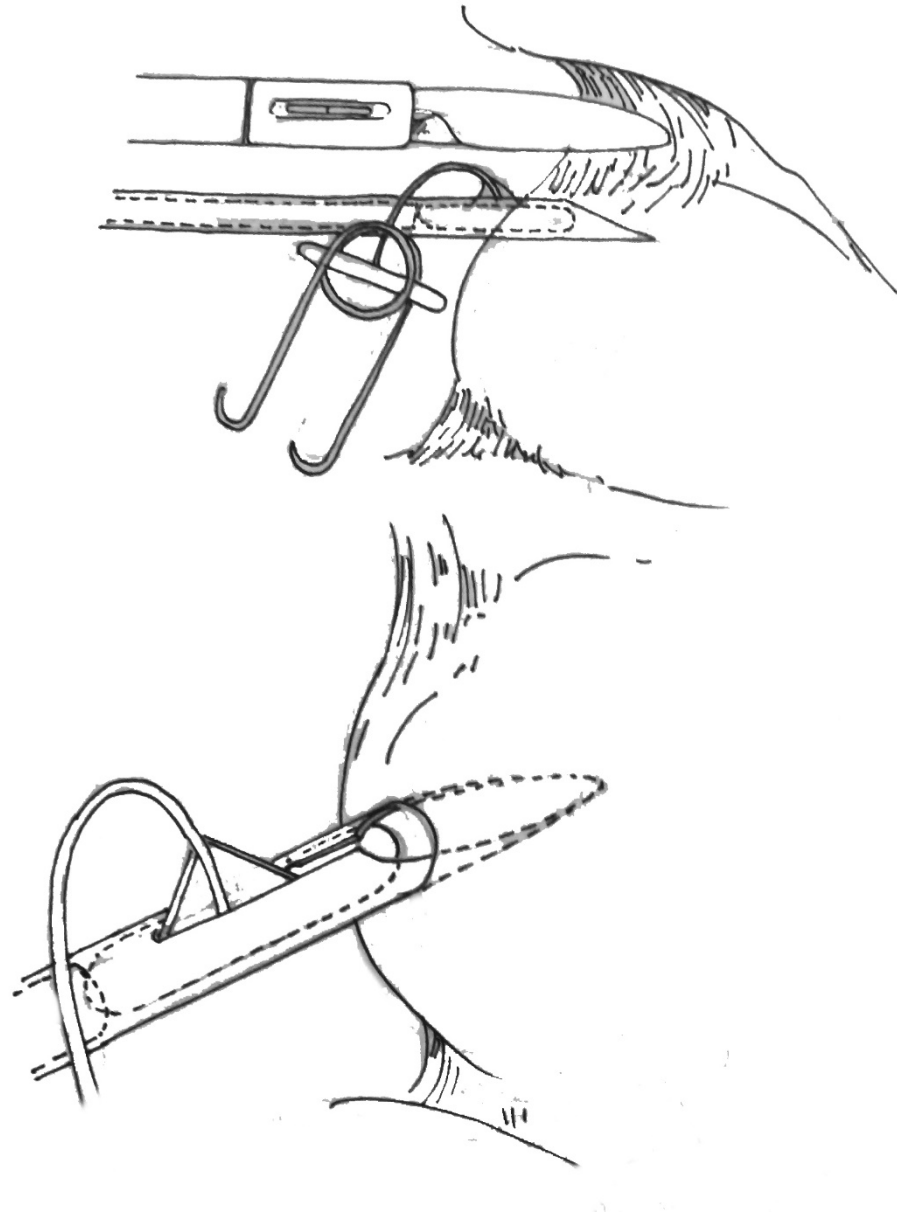
The grasper and the trocar controls clash with each other





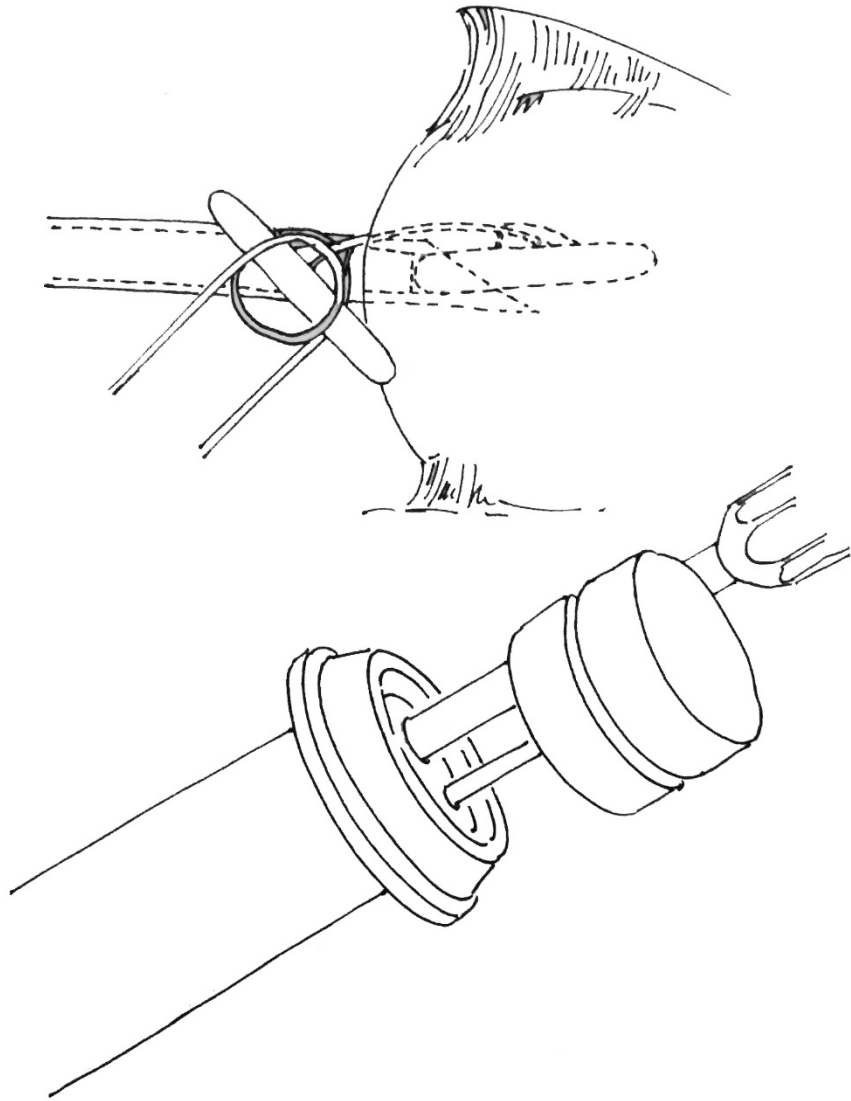
Holding the gallbladder using a grasper

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



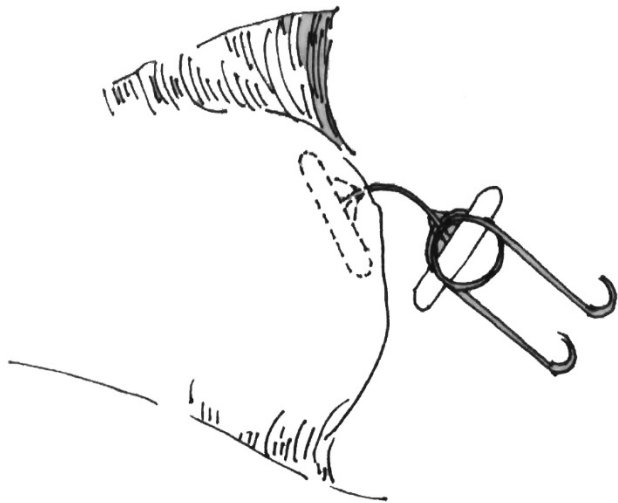
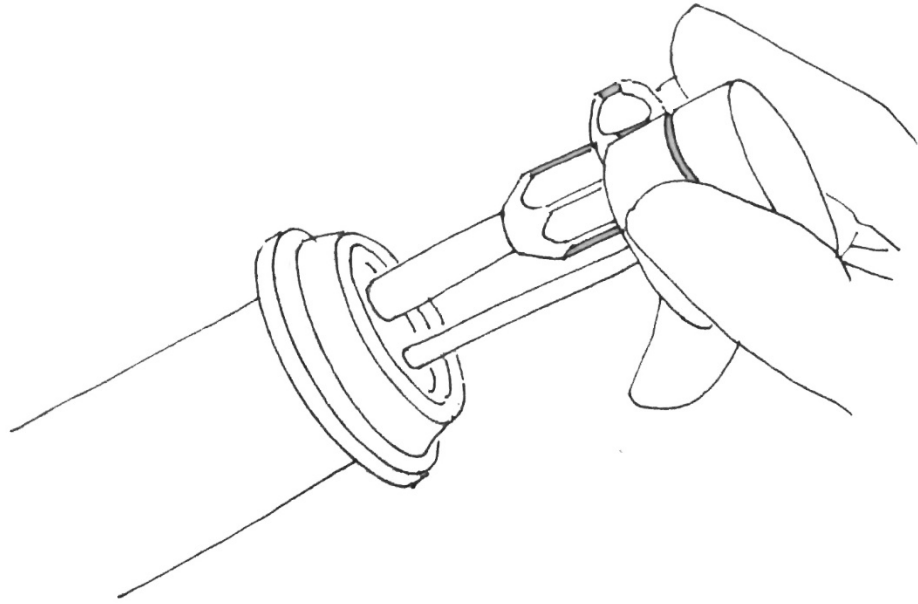
Piercing the gallbladder

The gallbladder shifts

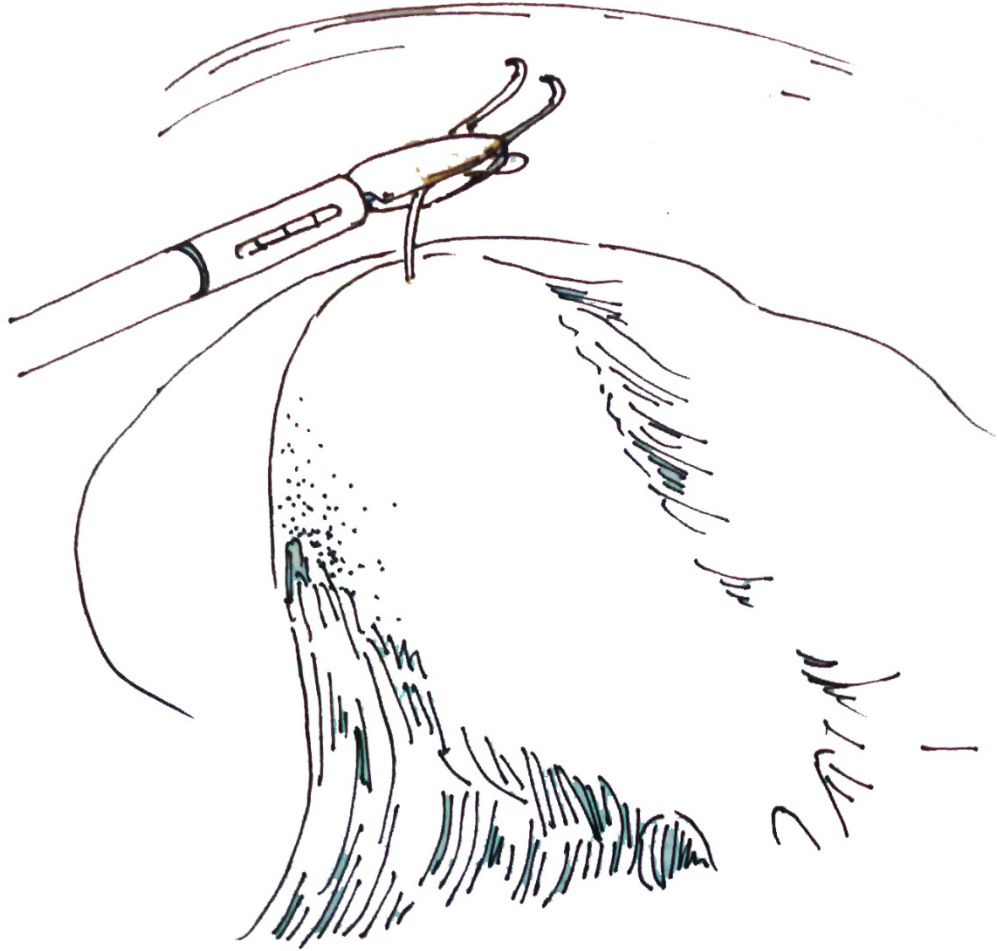


Deploying the tag

Difficult to operate the needle and the plunger



Removing the needle from the
trocar



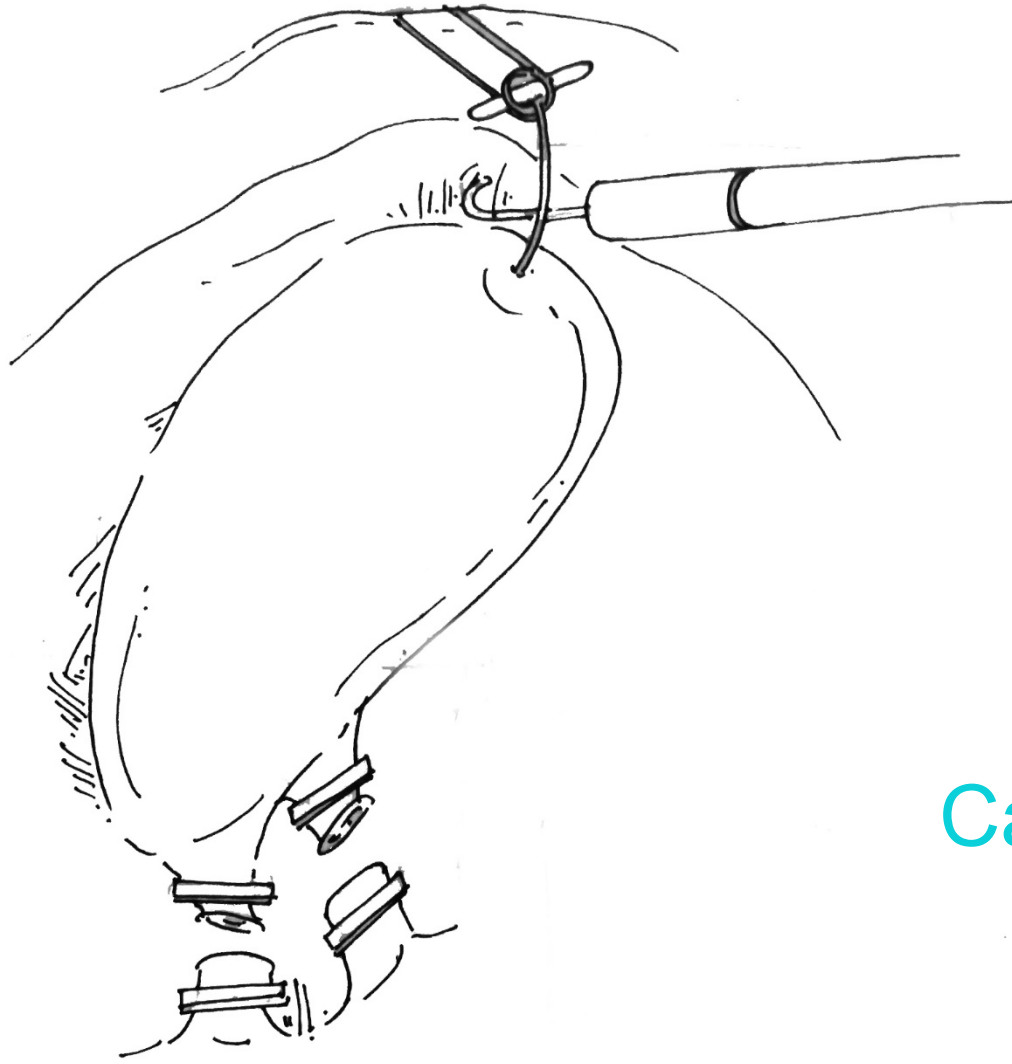
Attaching the hook to the peritoneum

A separate grasper needs to be inserted.



Cauterizing the tissue

Clamping and separating the
cystic duct and artery

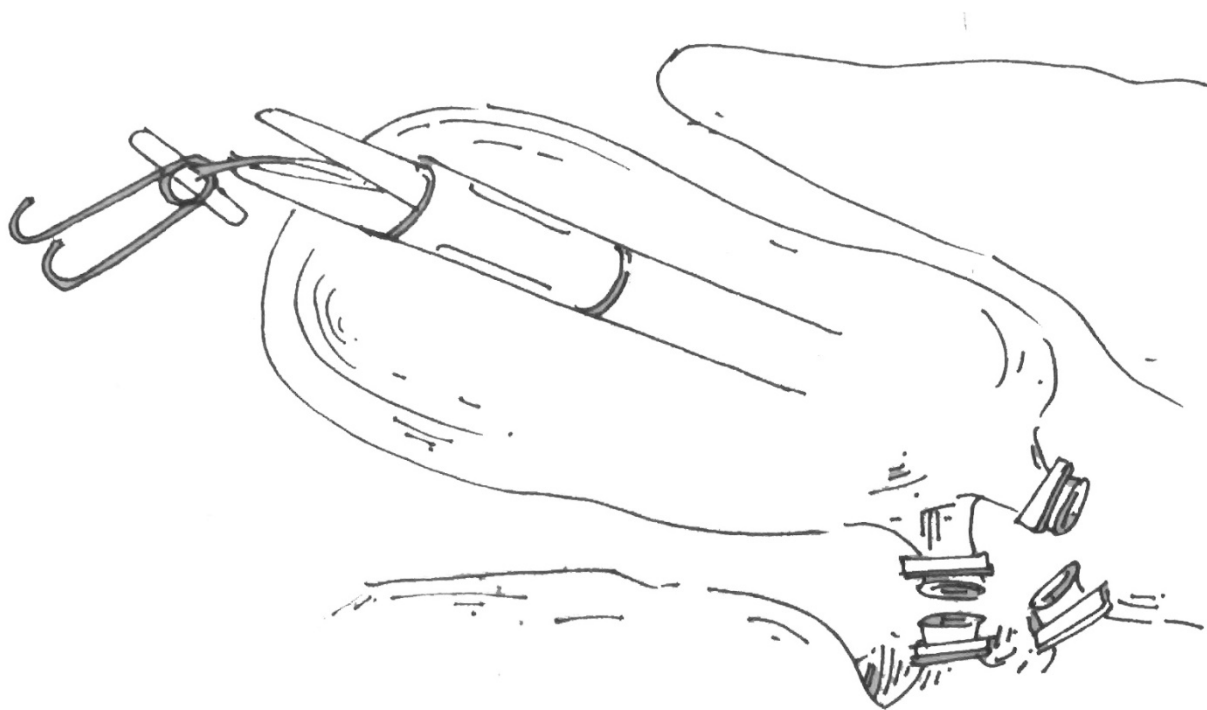


Cauterizing the tissue

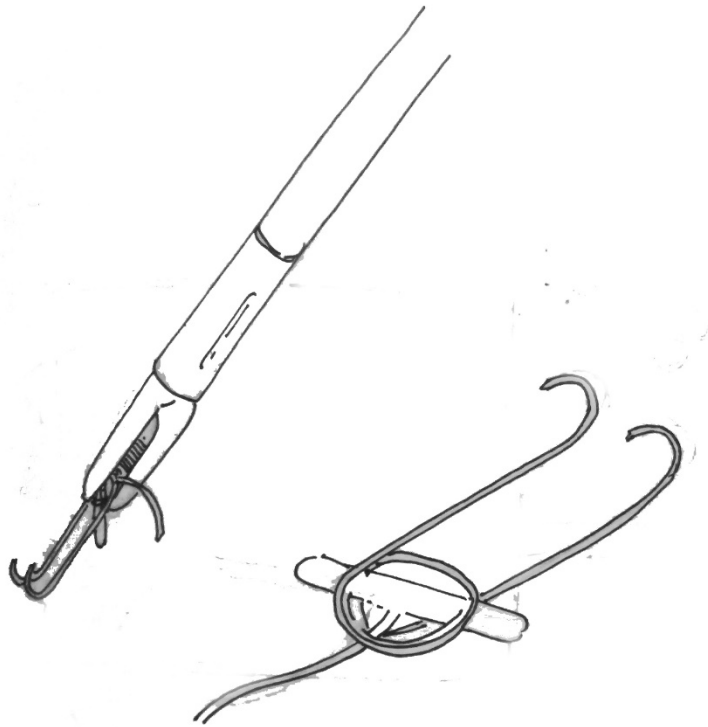


Removing the hook

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.

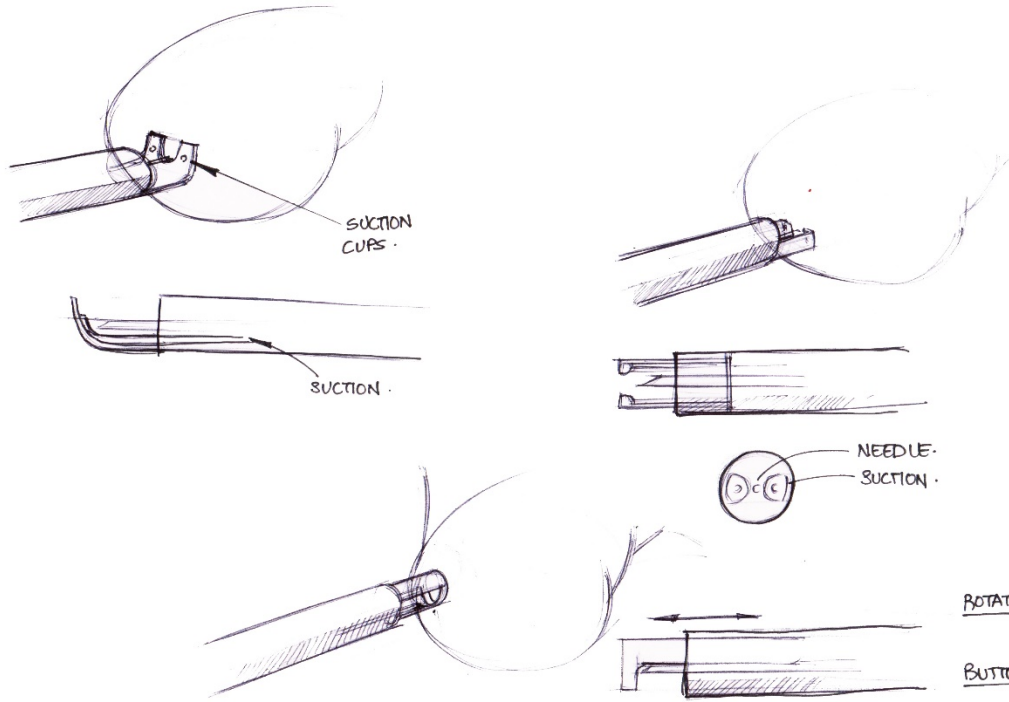
1. PINCH
2. CLAMP
3. STRETCH
4. PULL
5. STICK
6. FRICTION
7. VELCRO
8. MICRONEEDLES
9. FORCEPS
10. HOOKS
11. SILICON MAT
12. INTERLOCKING TEXTURES
13. ROLLERS IN OPPOSITE DIRECTION
14. VACCUUM CUPS
15. RINGS THAT GROW OR TRANSFORM
16. HAIR MASSAGER

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

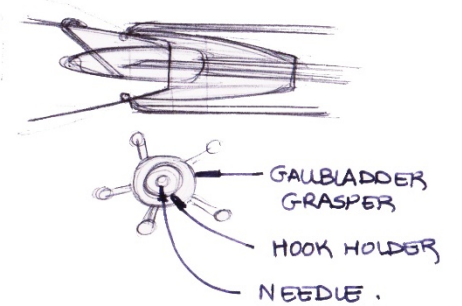
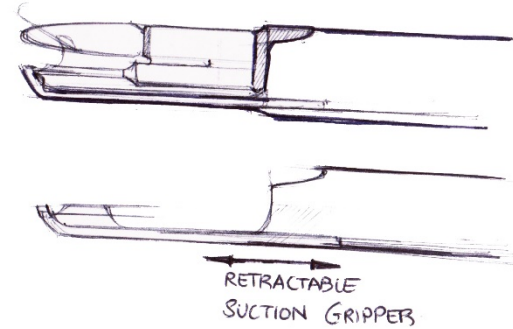


ROTATE: FOR ADJUSTING THE SUCTION ARM.

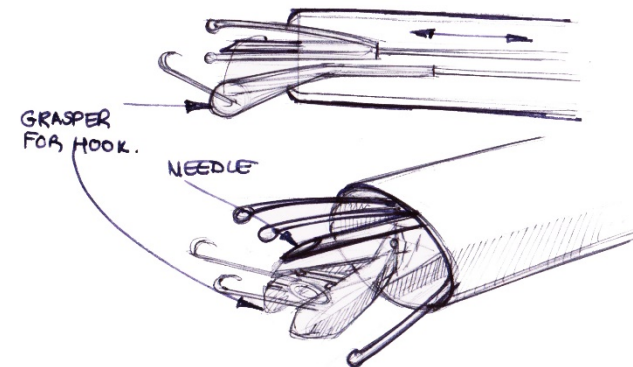
BUTTON: FOR GENERATING SUCTION.

HALF TRIGGER: FIRE THE NEEDLE.

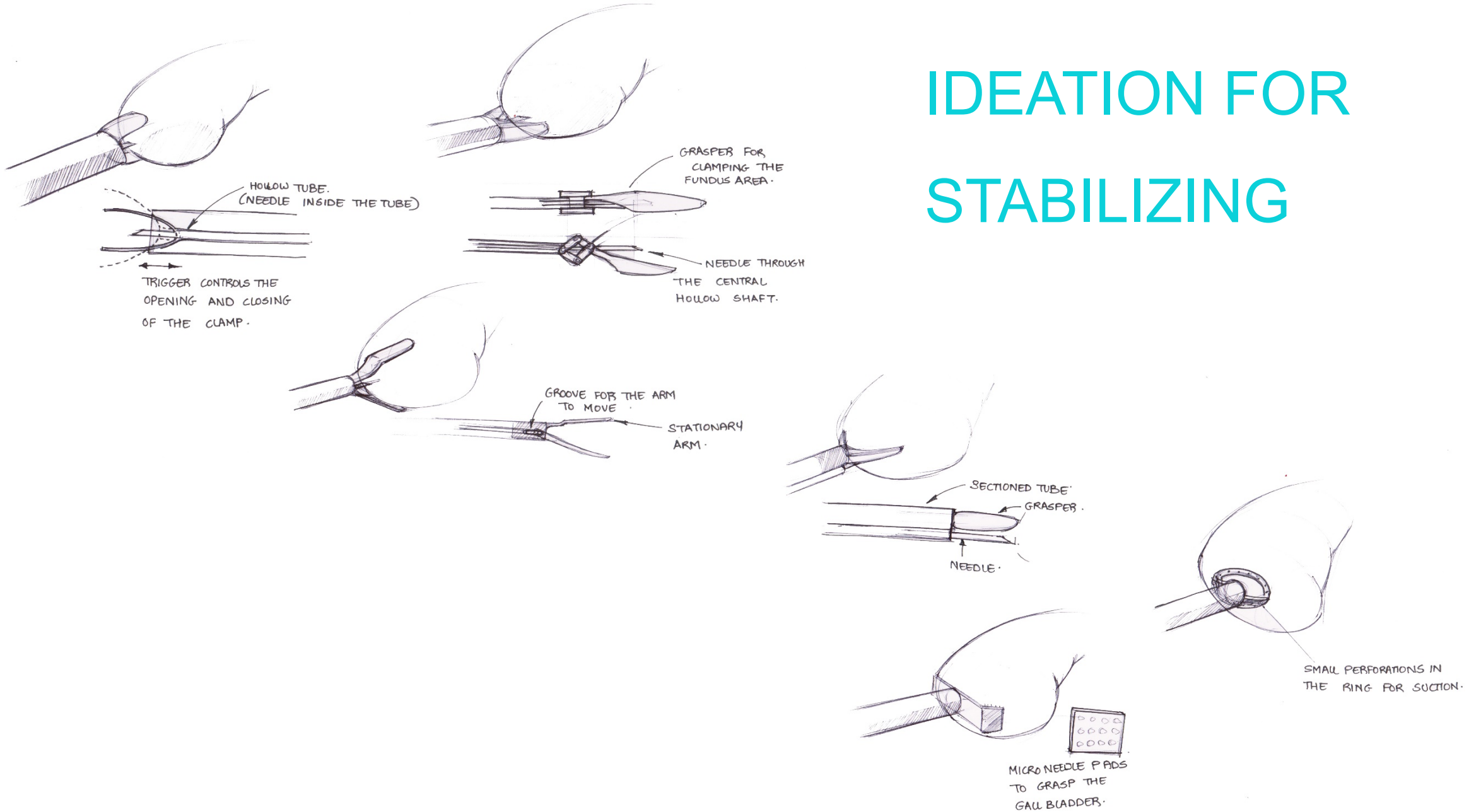
FULL TRIGGER: DEPLOY THE TAG.



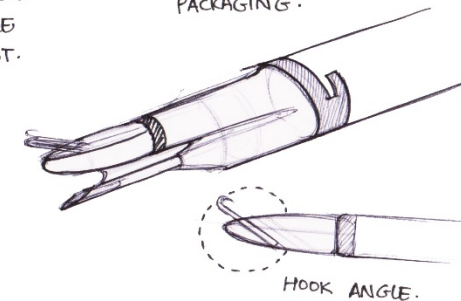
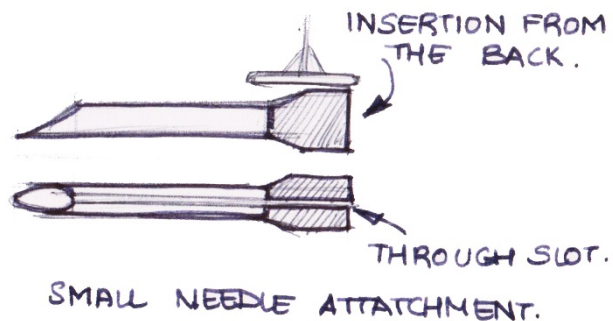
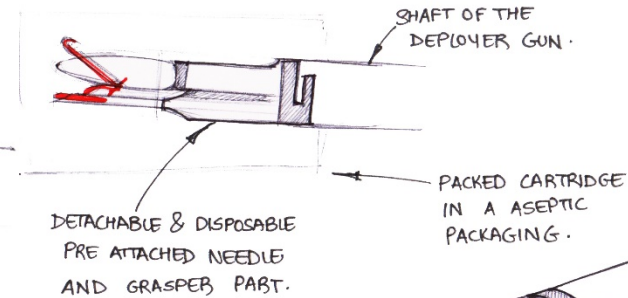
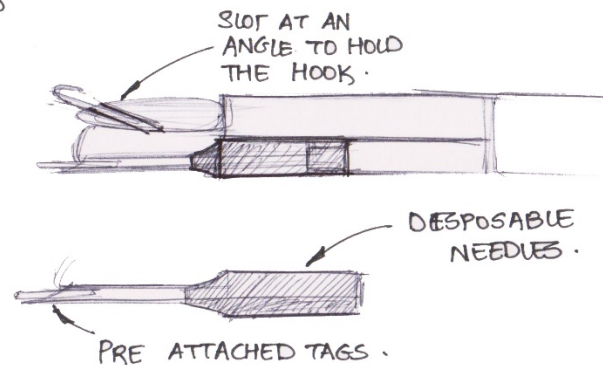
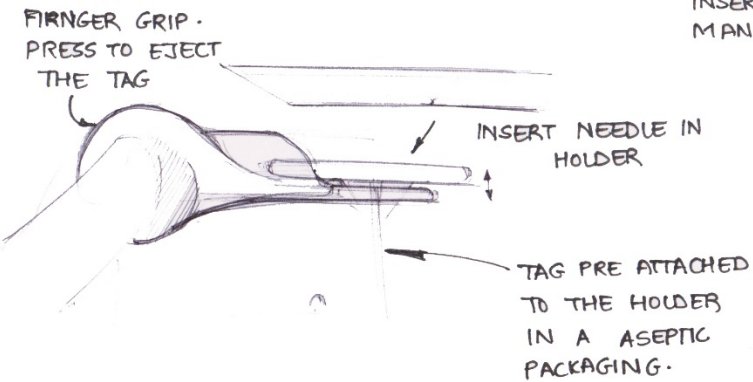
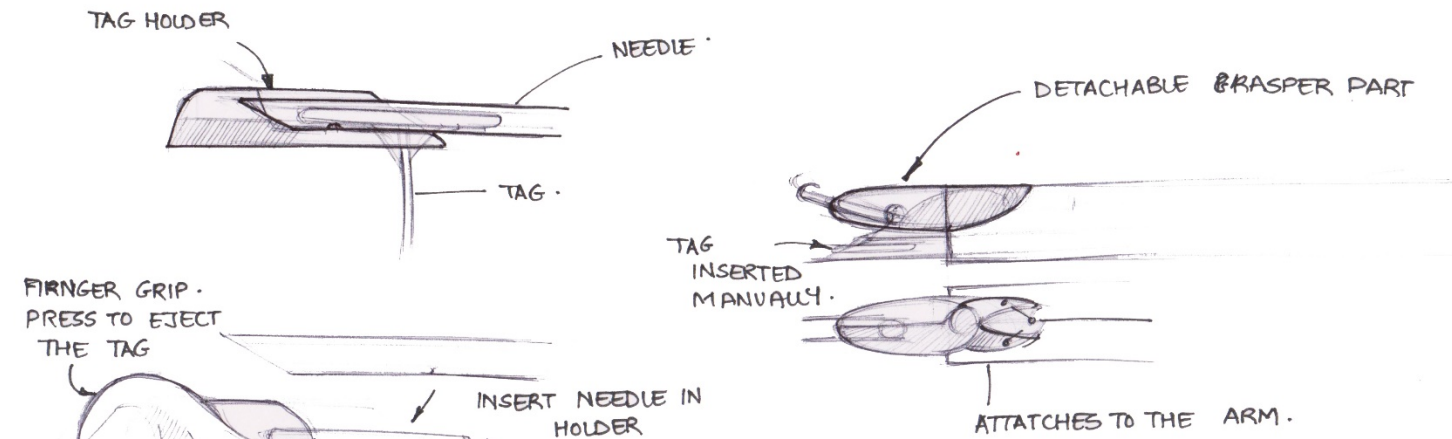
Stabilizing the gallbladder is a crucial step in the entire process as it facilitates easy and effective deployment of tag



IDEATION FOR STABILIZING



IDEATION FOR HOOK & TAG

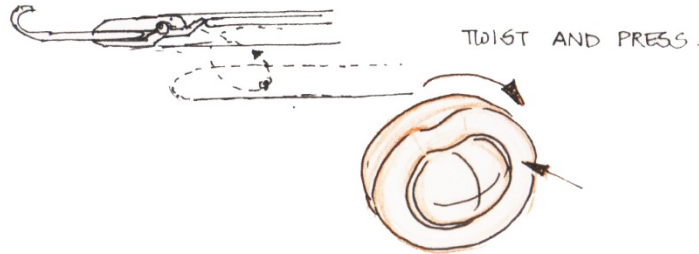
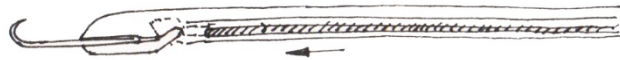
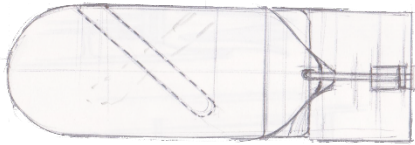
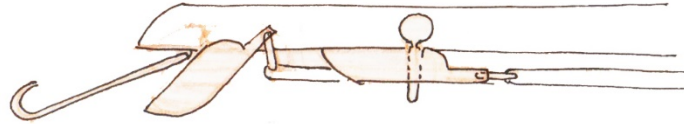
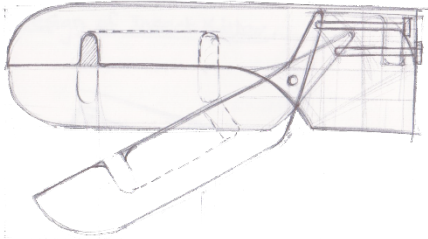
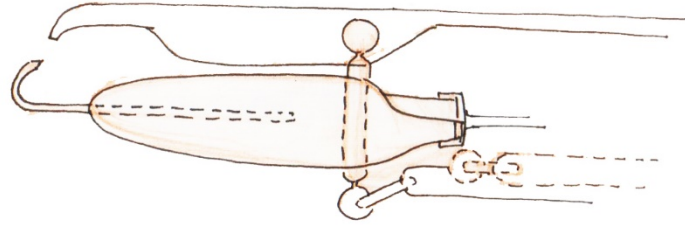
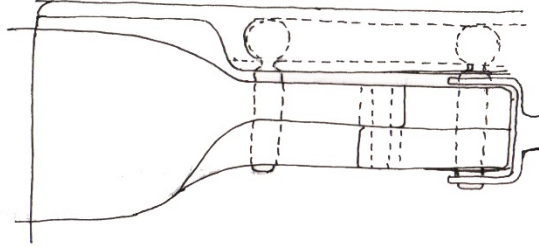
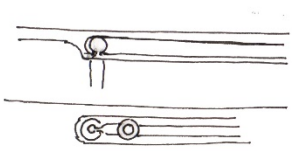


- GRASPING PROBLEM.

NO. OF STEPS/MOTIONS REQUIRED:

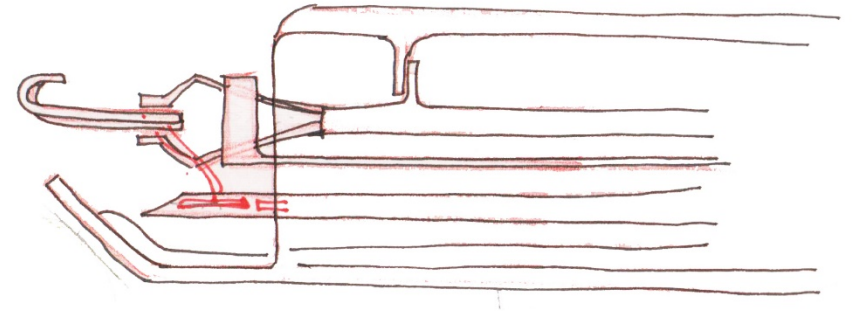
1. ATTACHING THE TIP.
2. GRASPING (THINK OF A SOL.)
3. DEPLOYING PIERCING THE GALLBLADDER. (LINEAR).
4. DEPLOYING THE TAG. (CAN BE RECOIL OR SPRING LOADED).
5. REMOVING THE NEEDLE
6. ATTACHING THE HOOK TO THE PERICARDIUM.

IDEATION FOR HOOK PLACEMENT

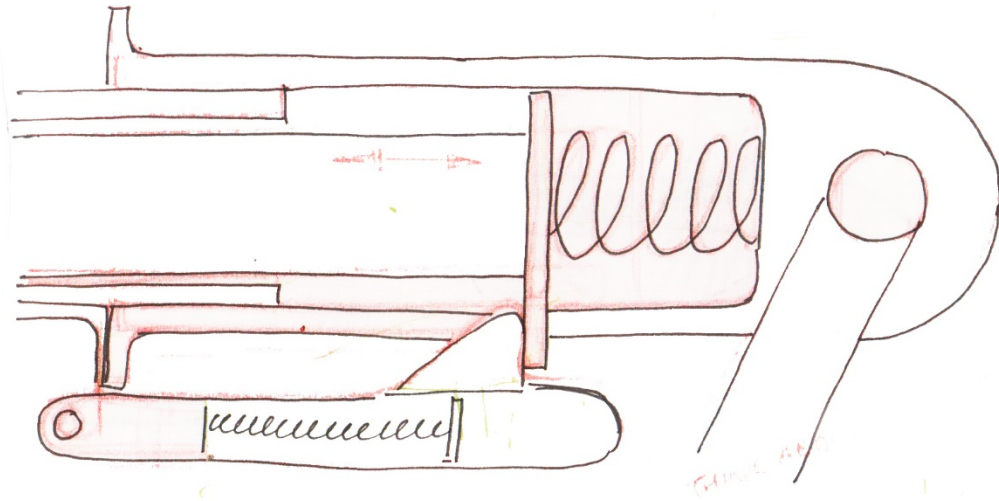


TWIST AND PRESS.

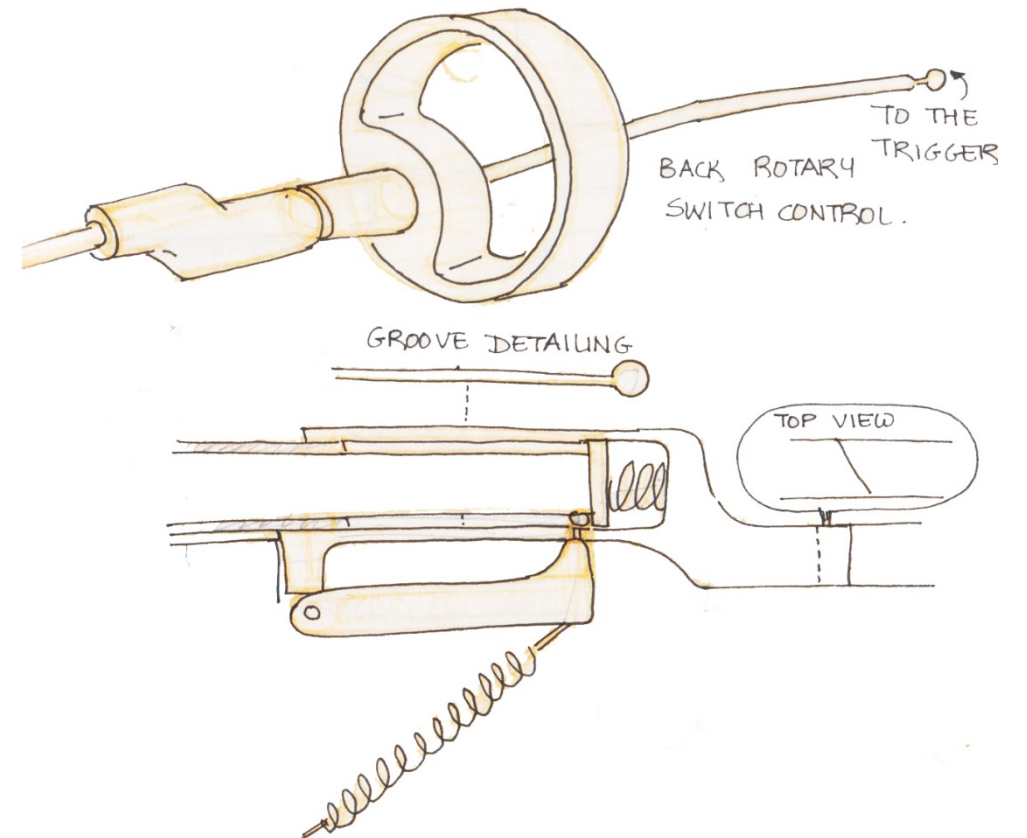
The grasper will have two sleeves that will open in succession to expose the grasper tip and to release the hook

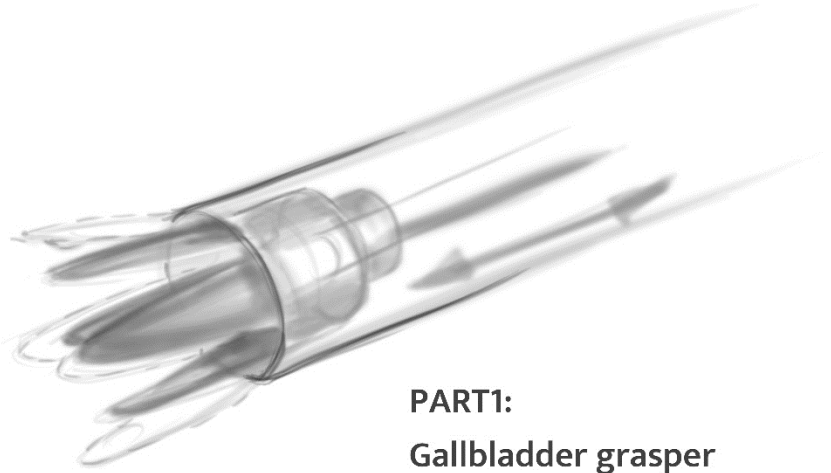


IDEATION FOR NEEDLE & PLUNGER

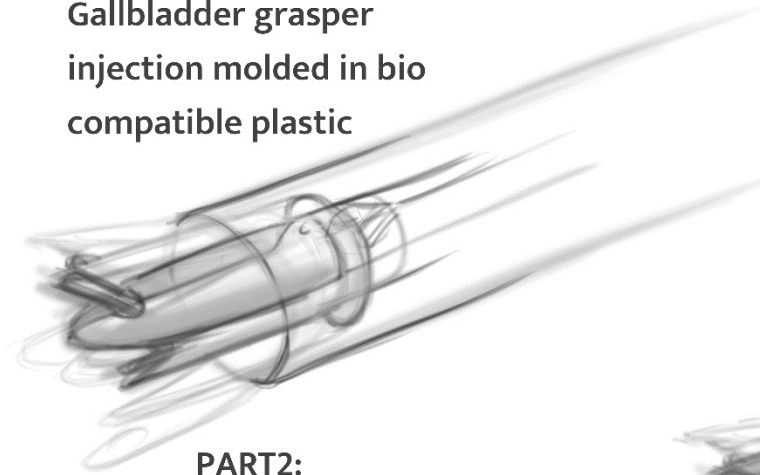


The needle and plunger require a successive movement.



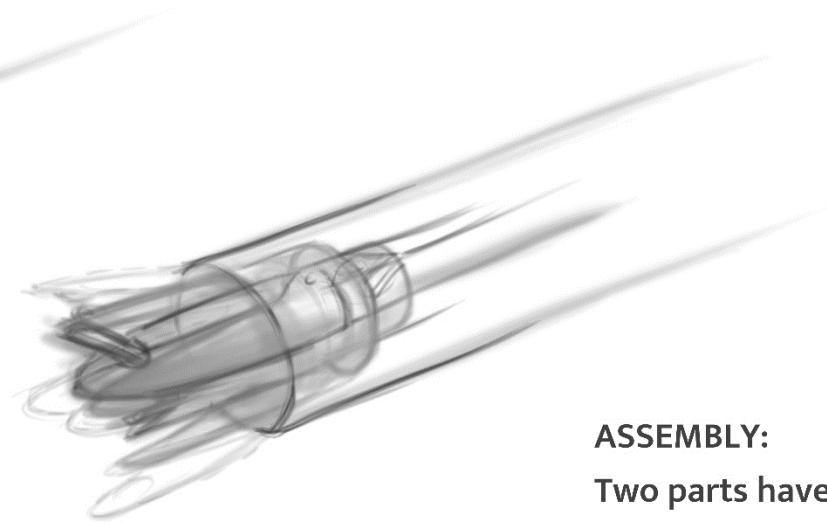


PART1:
Gallbladder grasper
injection molded in bio
compatible plastic



PART2:
Hook and tag preattached
to a disposable tip

CONCEPT 1



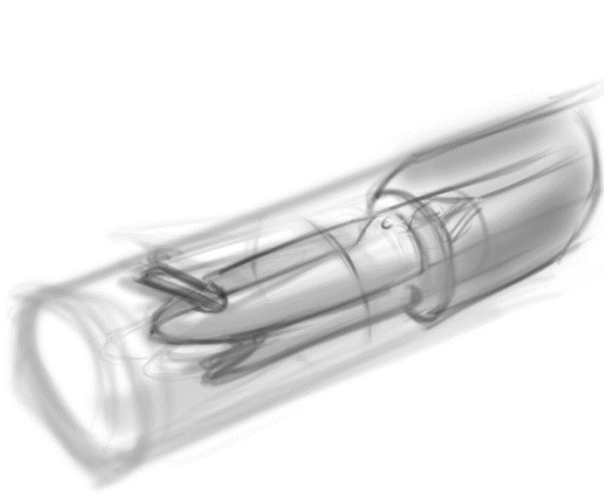
ASSEMBLY:
Two parts have to be attached.
Prepacked in a aseptics packaging

Linear movement for the gallbladder grasper.

Linear movement for the hook deployer

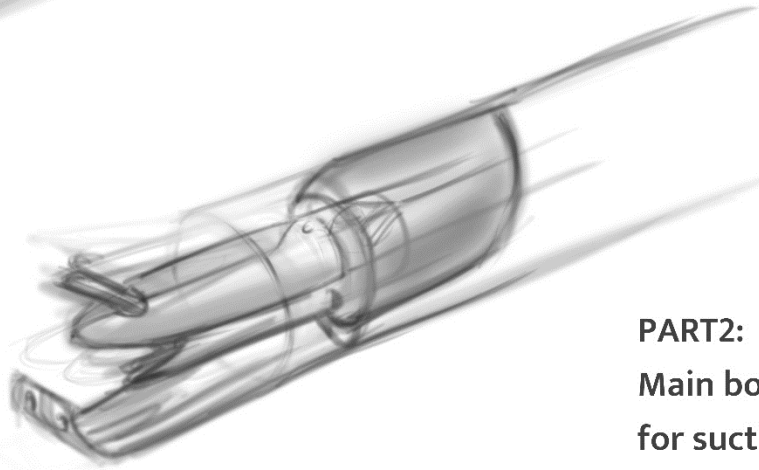
Half trigger press for the needle to pierce

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 attatchment
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"> 1. Easier to clean and maintain 2. Less number of components 3. Requires light pressure 	<ol style="list-style-type: none"> 1. Less possibility of damage as the head is made from silicone 2. Very little pressure is required 3. Possibility to develop similar devices 4. Easier to operate individually
Disadvantages	<ol style="list-style-type: none"> 1. Can puncture the gallbladder 2. The grip is not that good 3. Requires more space 4. Will require a grasper from port 3 to hold the liver 	<ol style="list-style-type: none"> 1. Has multiple components 2. Validation is essential for suction and to check the pressure required to hold it

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.

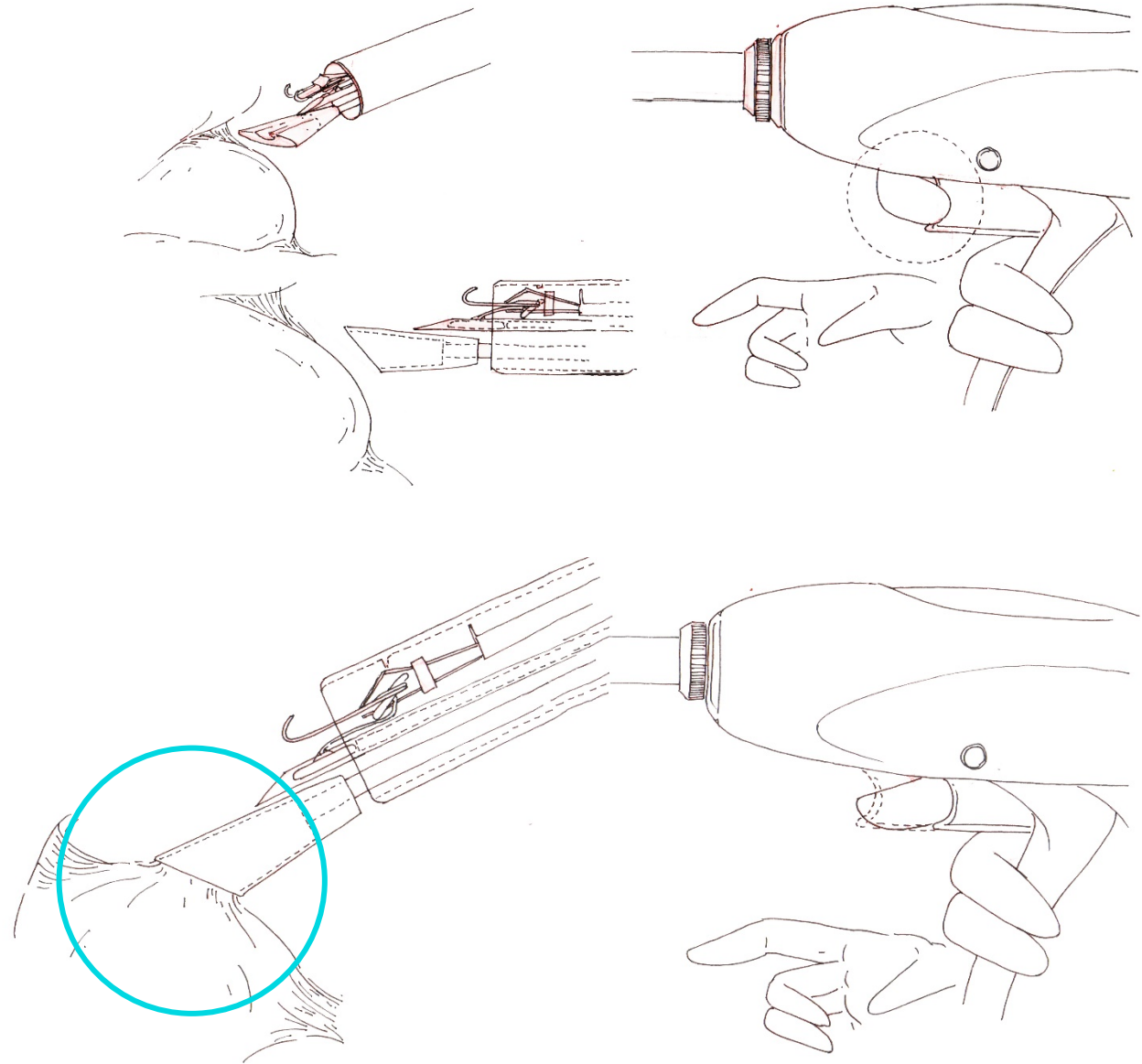
Exposing the grasper

7.

Releasing the hook

8.

Retracting the grasper



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.

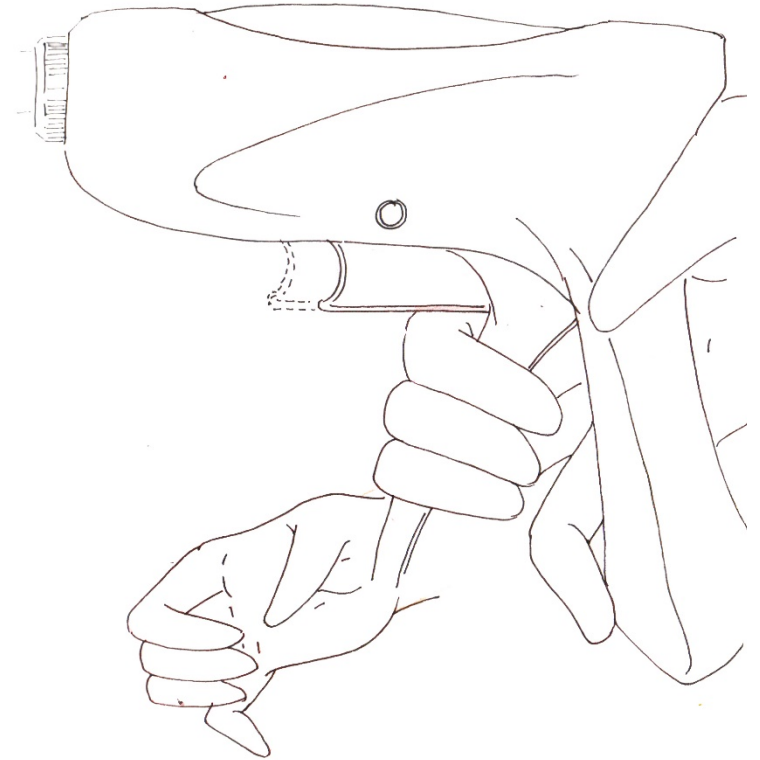
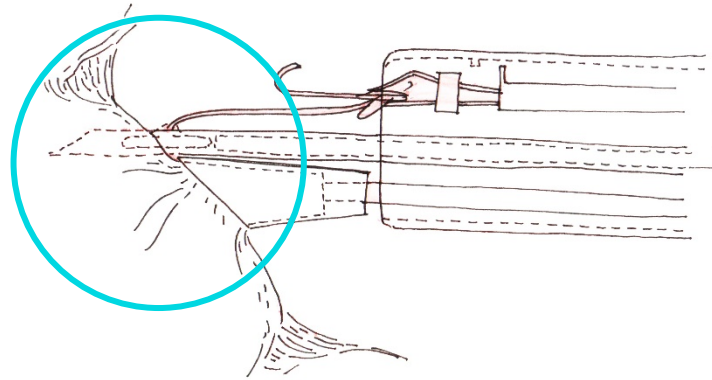
Exposing the grasper

7.

Releasing the hook

8.

Retracting the grasper



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.

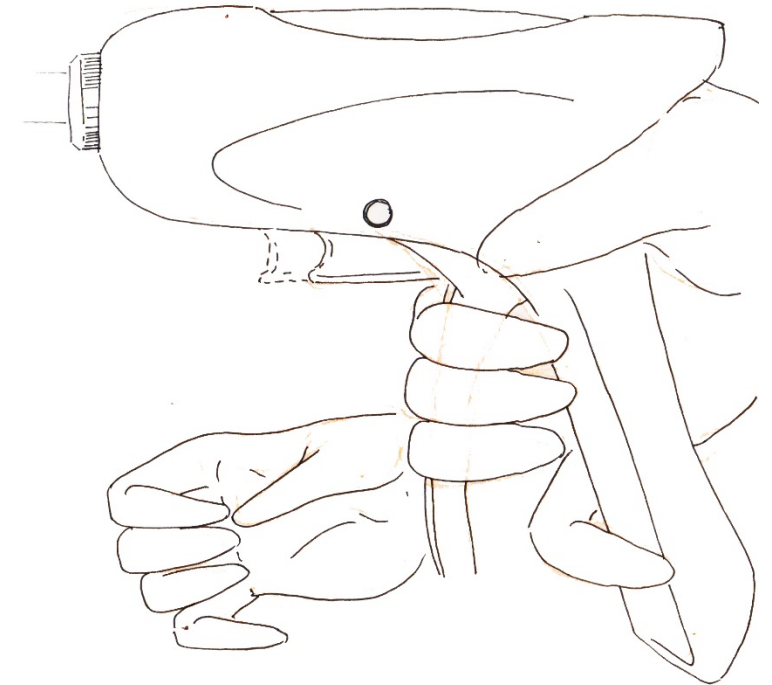
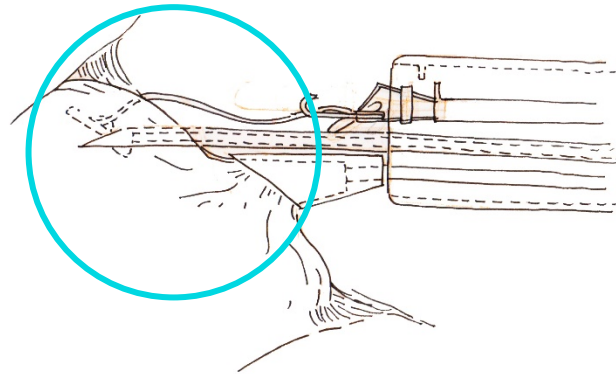
Exposing the grasper

7.

Releasing the hook

8.

Retracting the grasper



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.

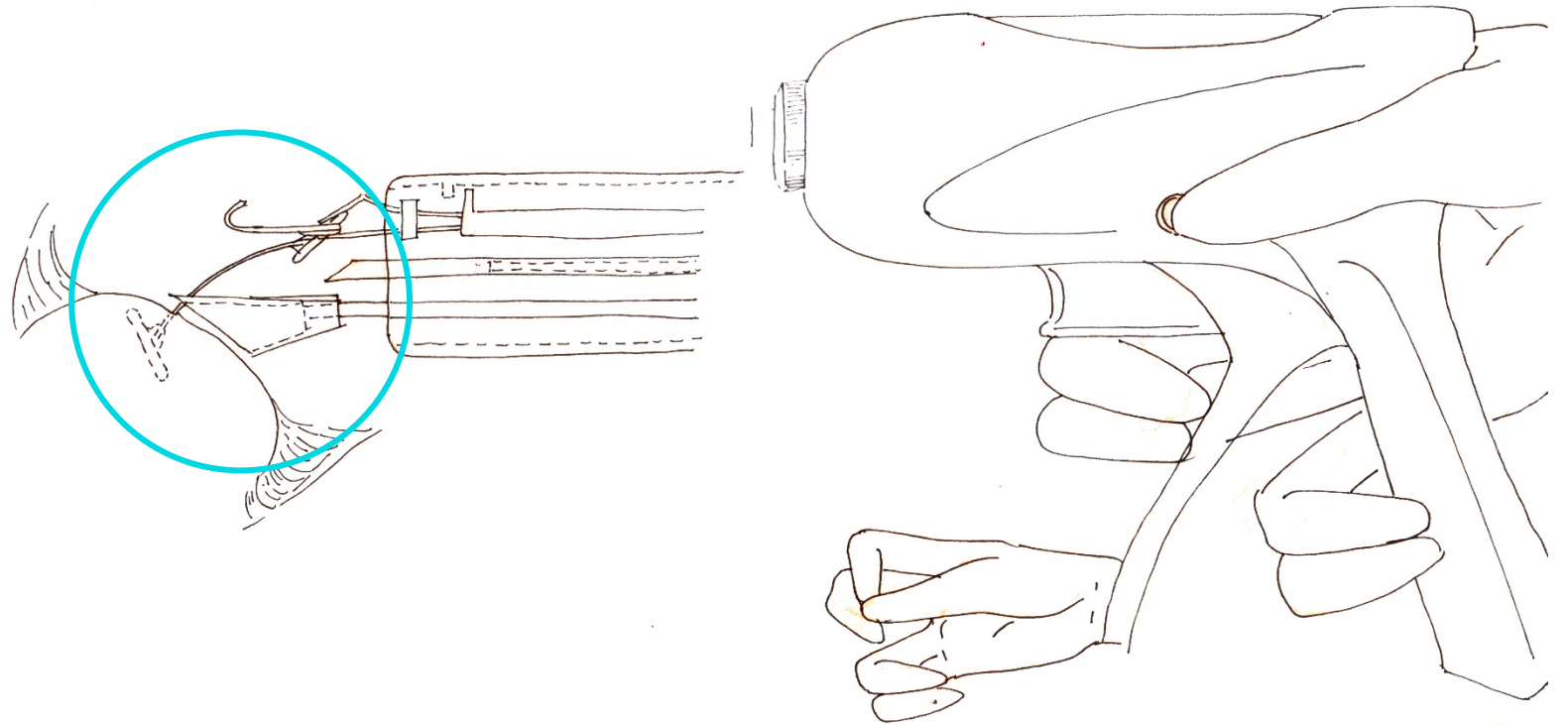
Exposing the grasper

7.

Releasing the hook

8.

Retracting the grasper



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.

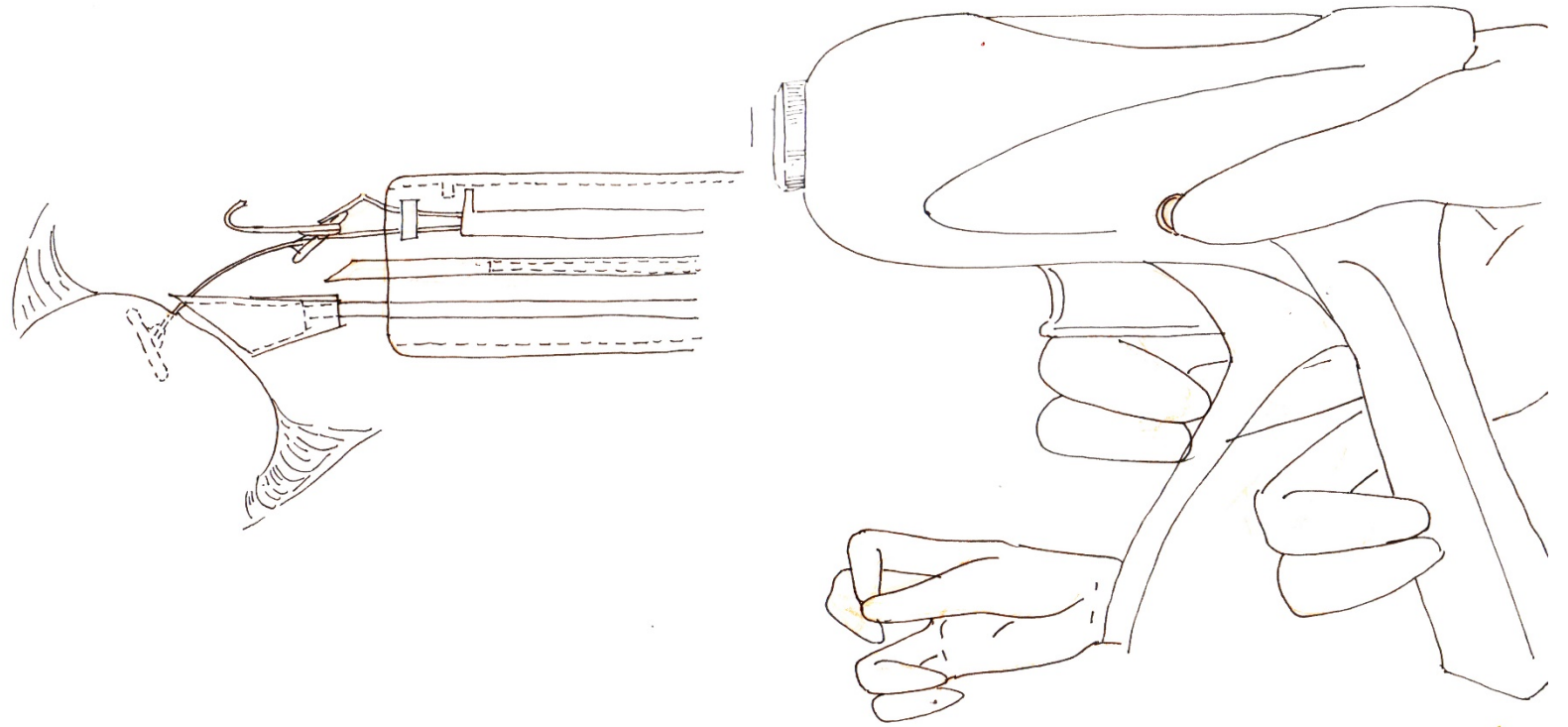
Exposing the grasper

7.

Releasing the hook

8.

Retracting the grasper



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.

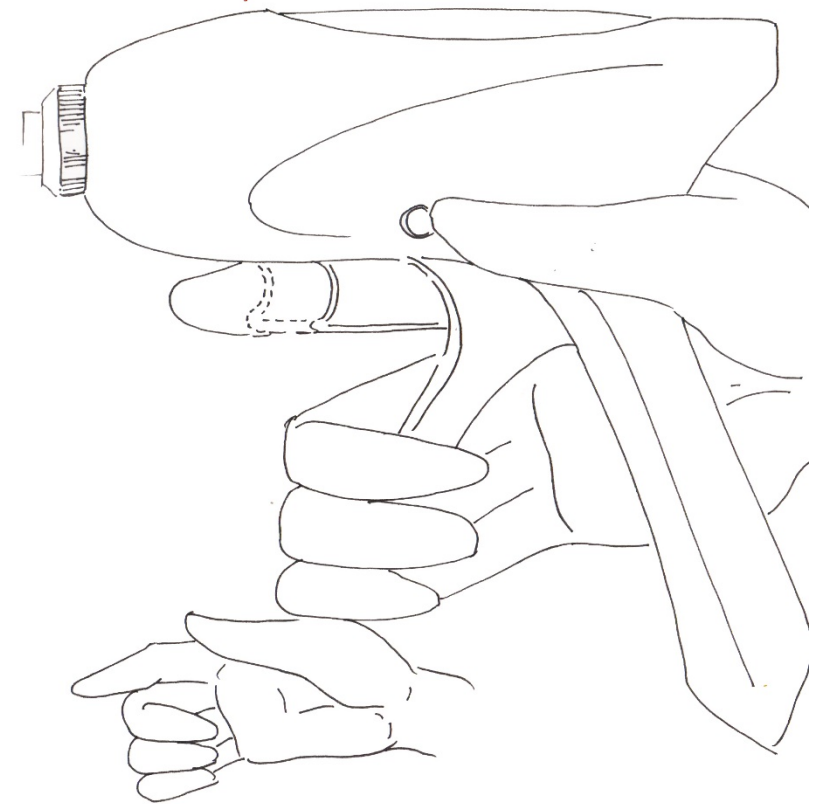
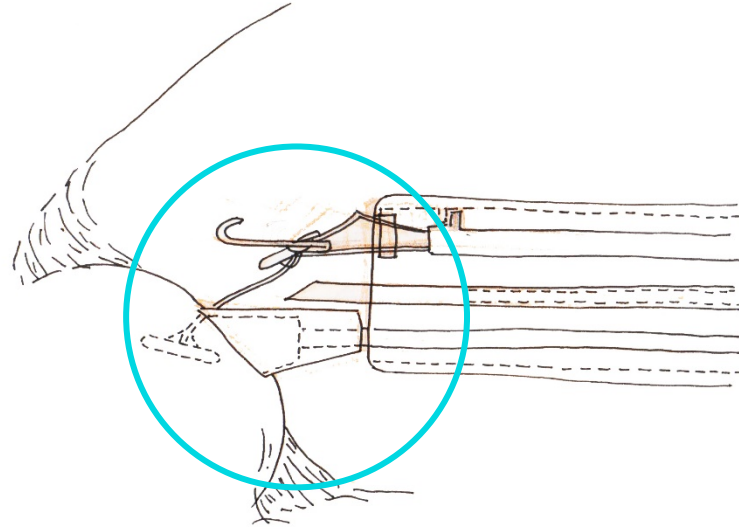
Exposing the grasper

7.

Releasing the hook

8.

Retracting the grasper



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.

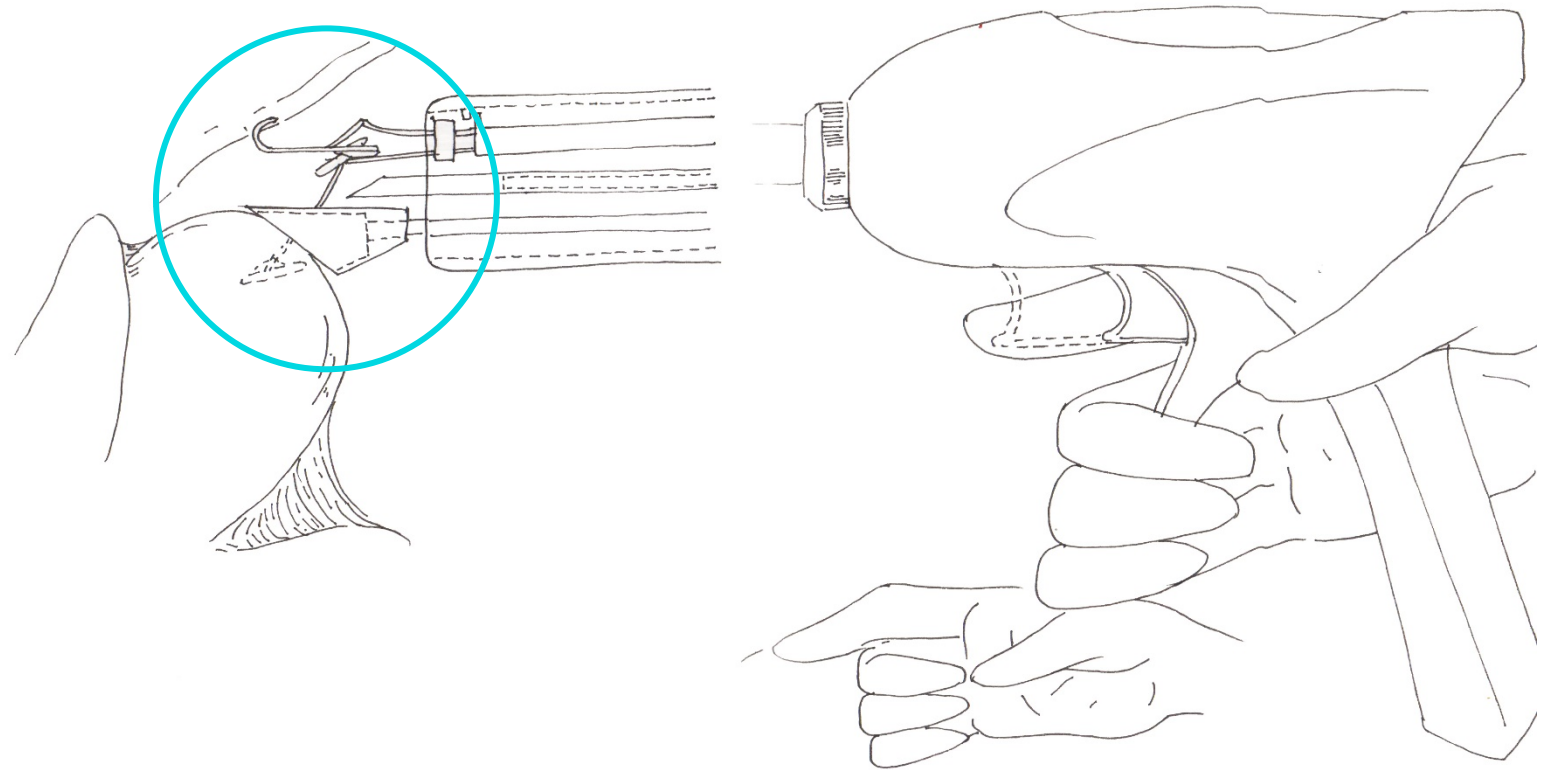
Exposing the grasper

7.

Releasing the hook

8.

Retracting the grasper



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.

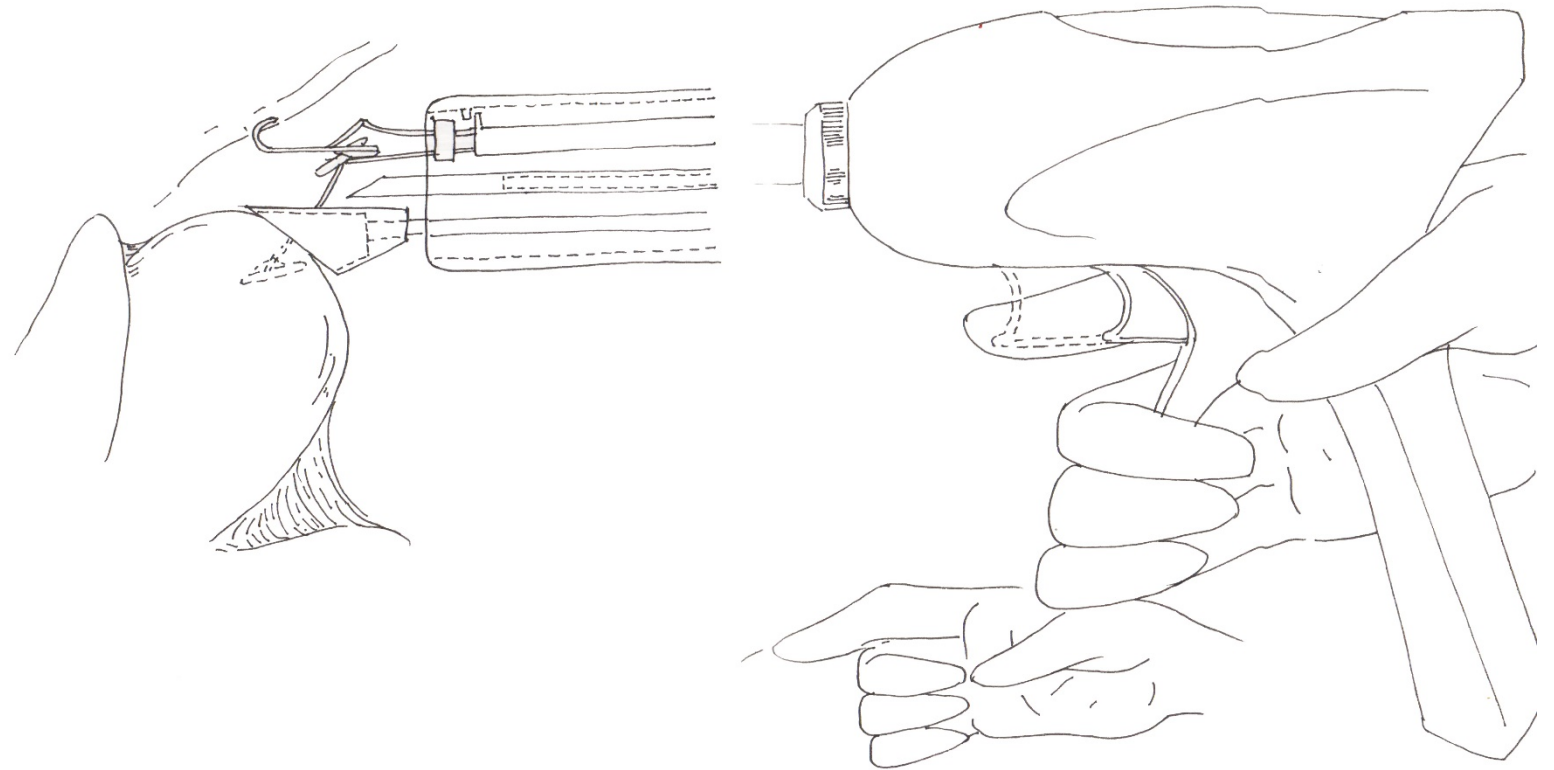
Exposing the grasper

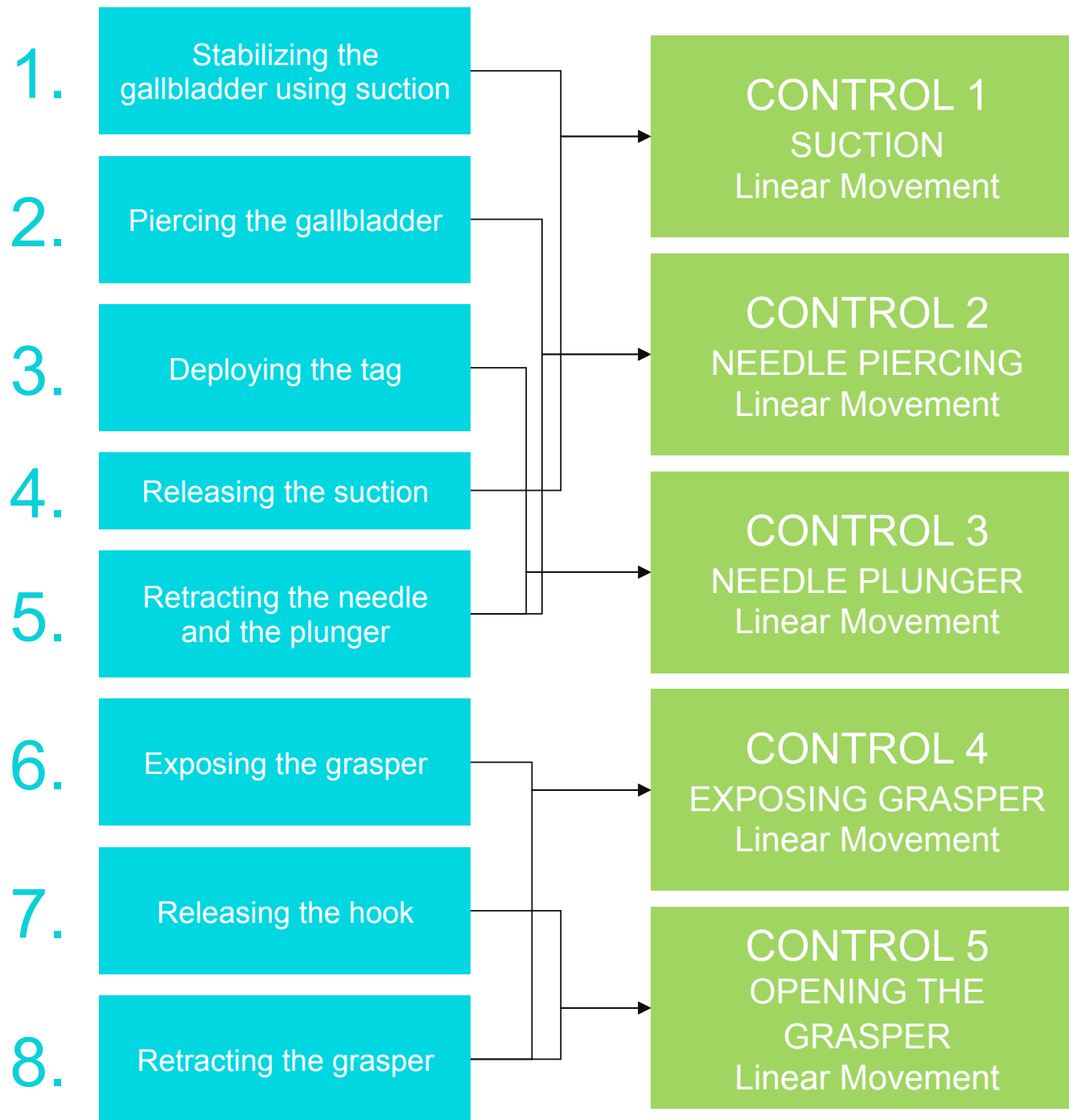
7.

Releasing the hook

8.

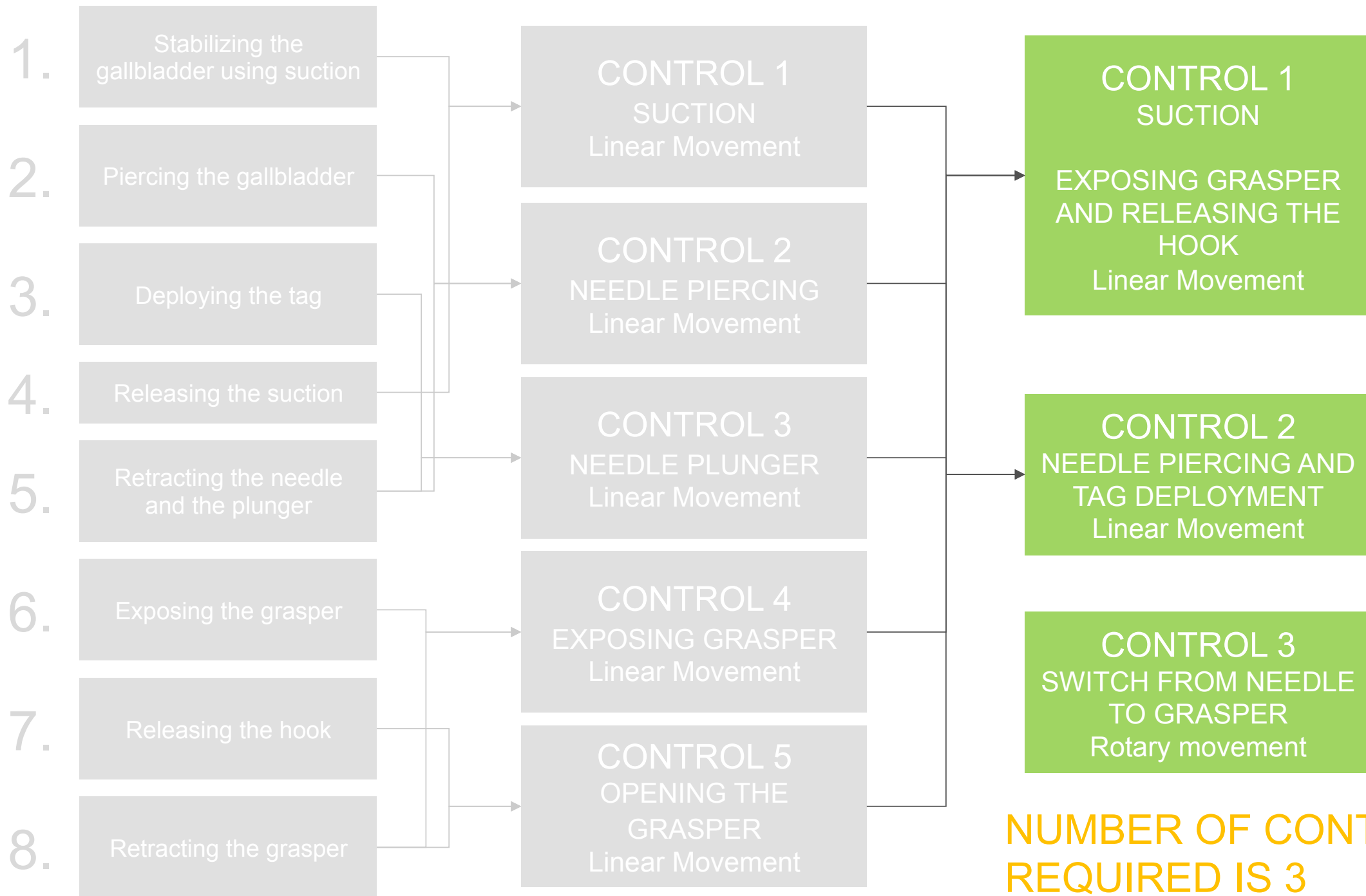
Retracting the grasper





NUMBER OF
CONTROLS
REQUIRED IS 5.

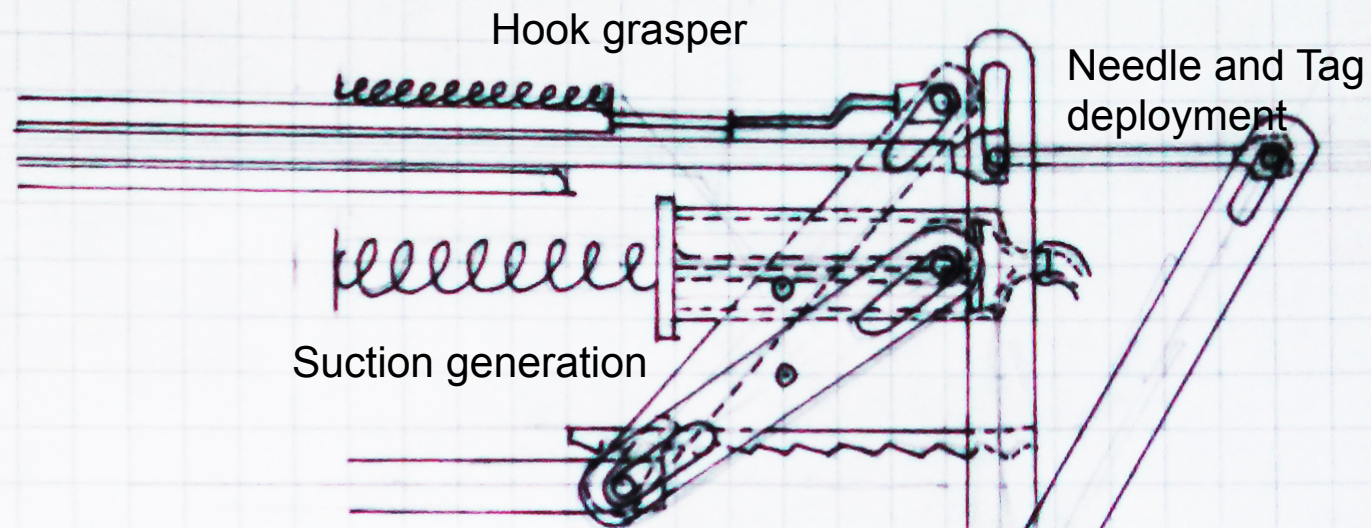
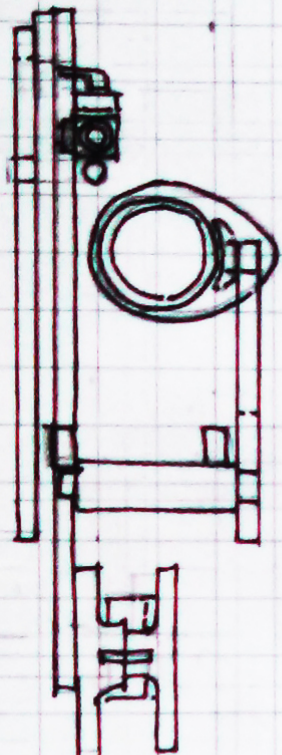
Can this be reduced?



NUMBER OF CONTROLS
REQUIRED IS 3

MECHANISM

CONCEPT



MECHANISM CONCEPT



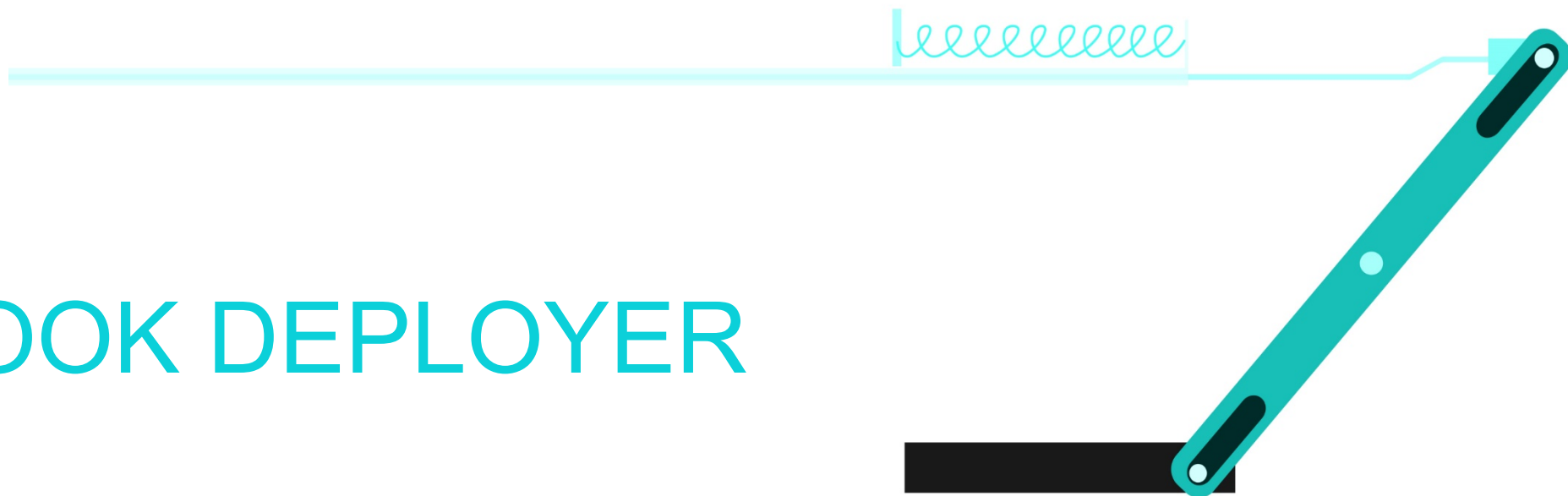
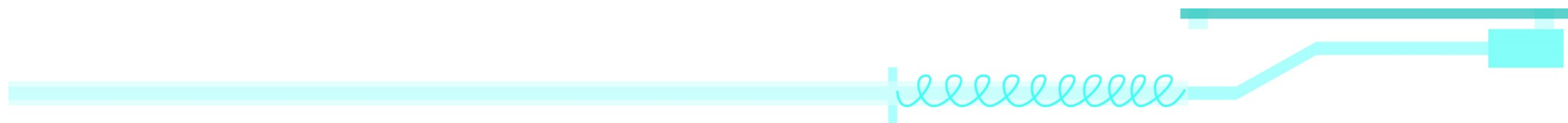
SUCTION



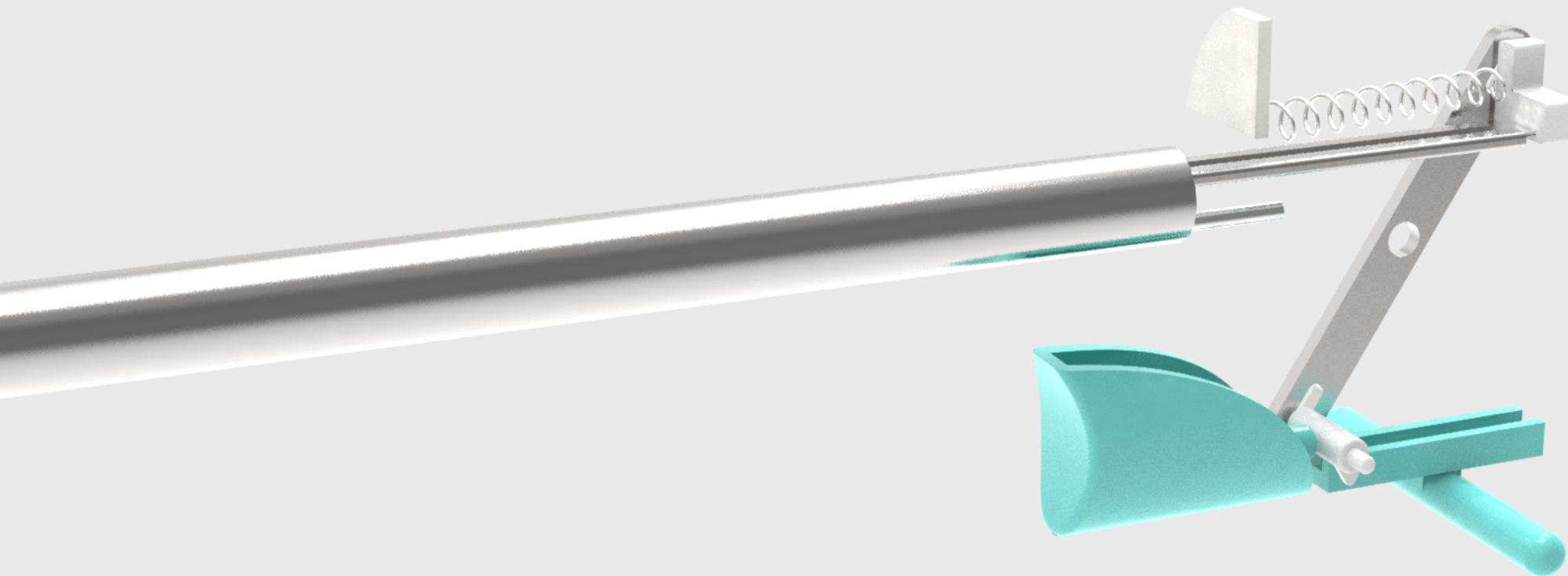
Syringe and Plunger: Polypropylene
injection molded

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

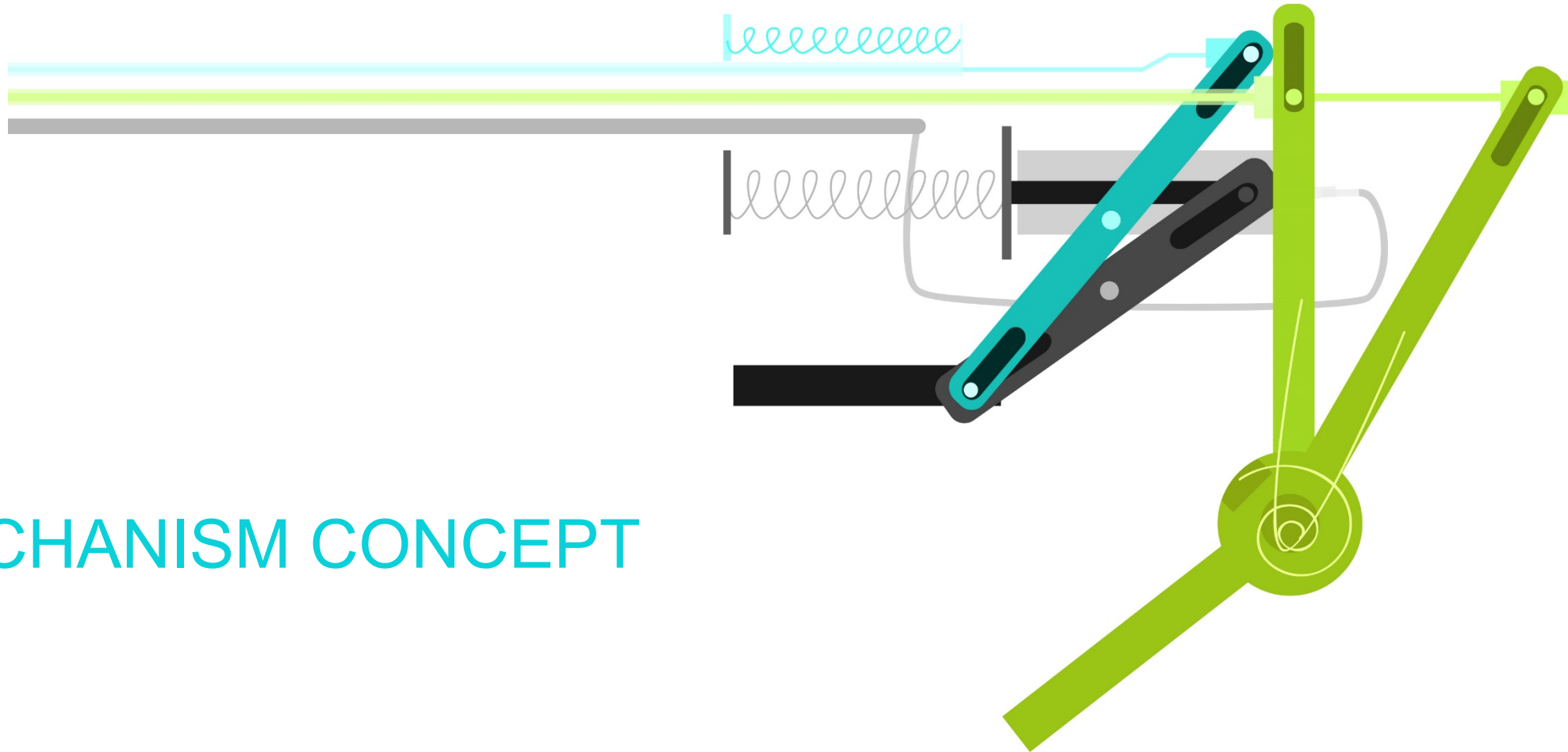
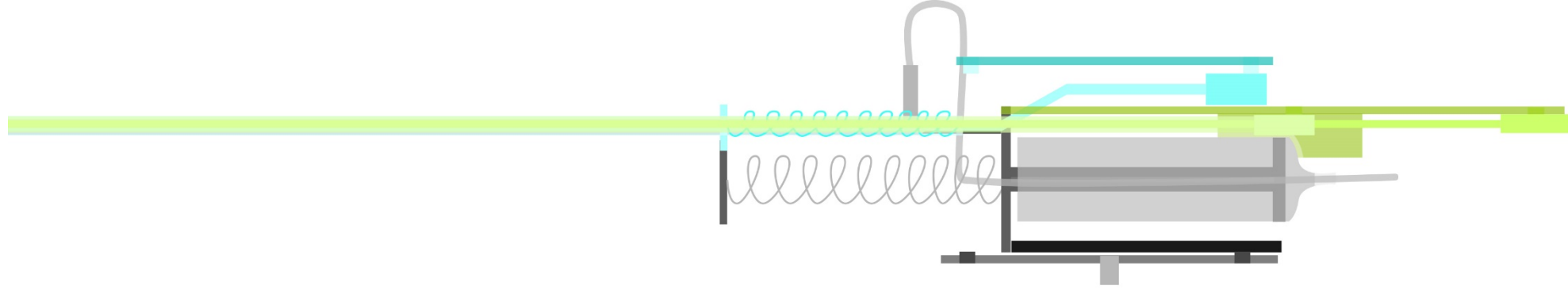


NEEDLE AND PLUNGER

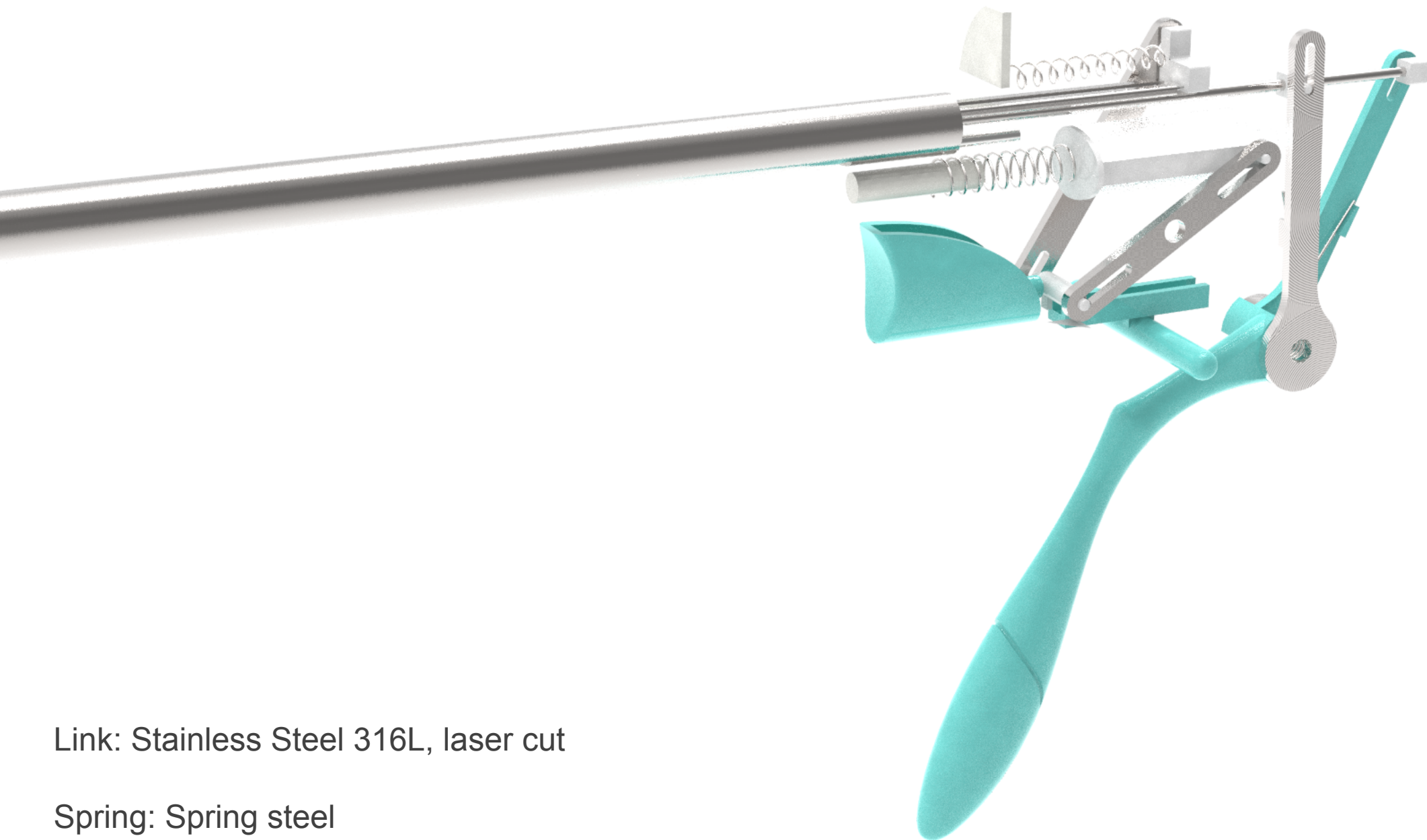


Needle and Plunger: Stainless Steel
316L

DISPLACEMENT: 20MM + 20MM



MECHANISM CONCEPT

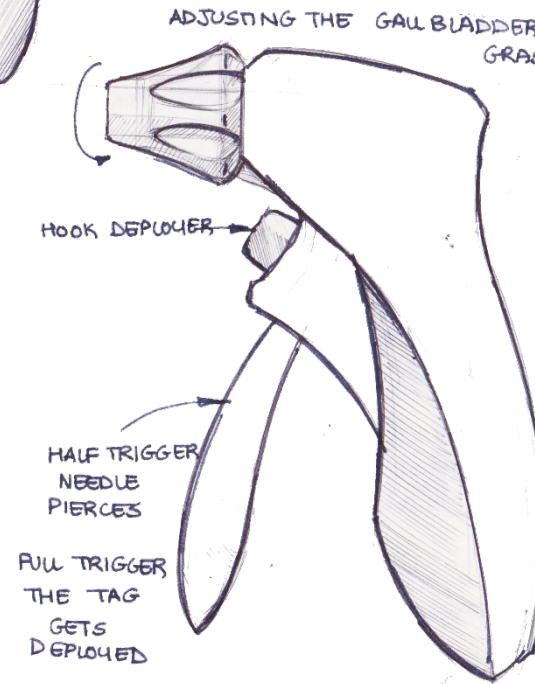
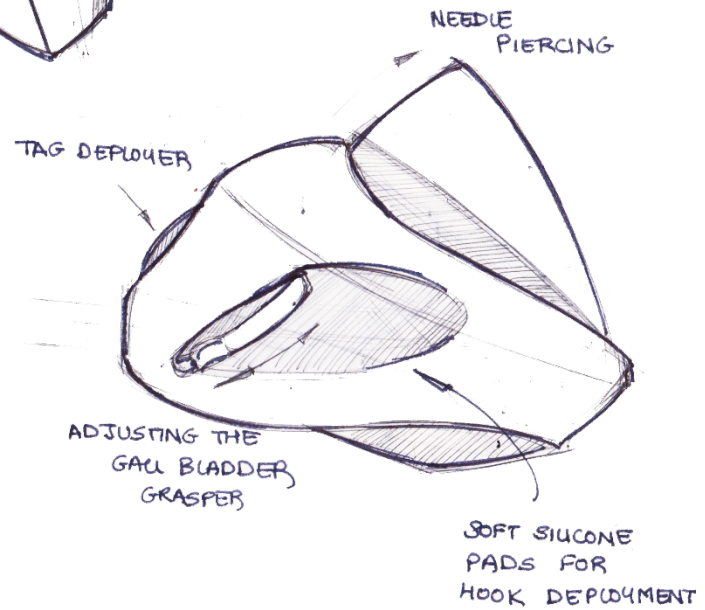
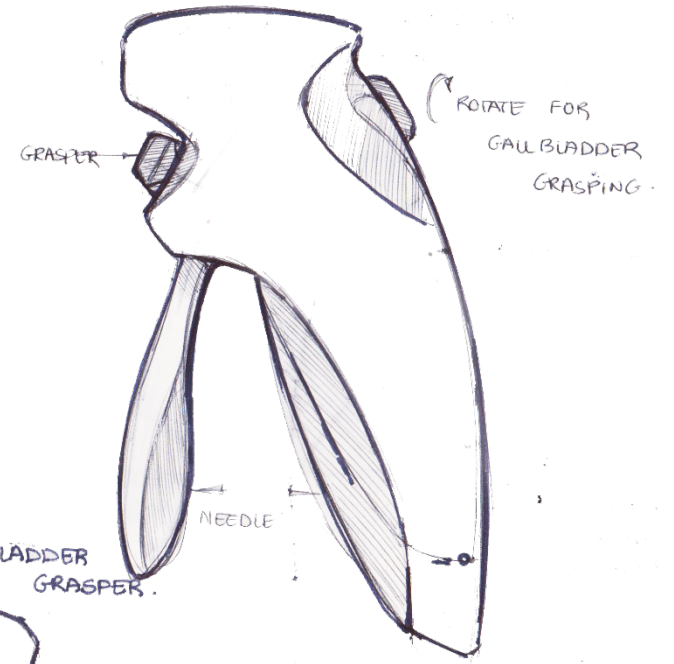
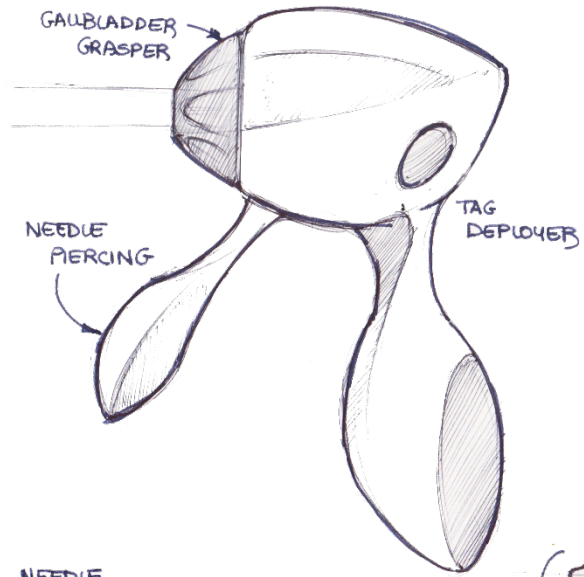
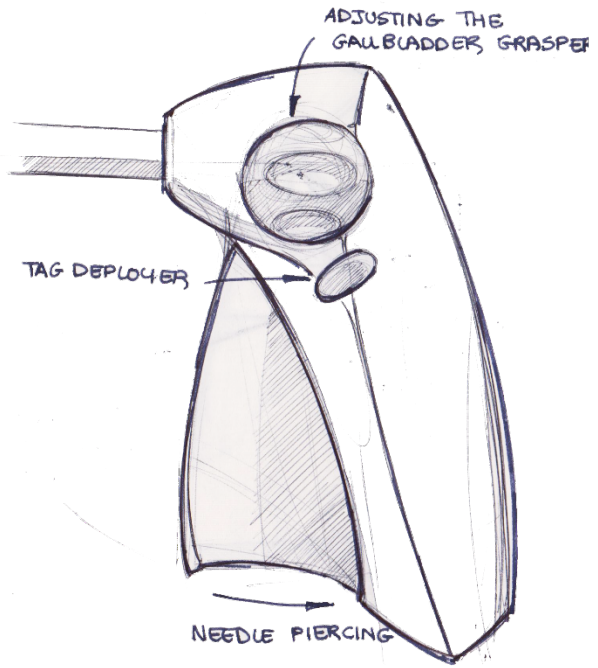


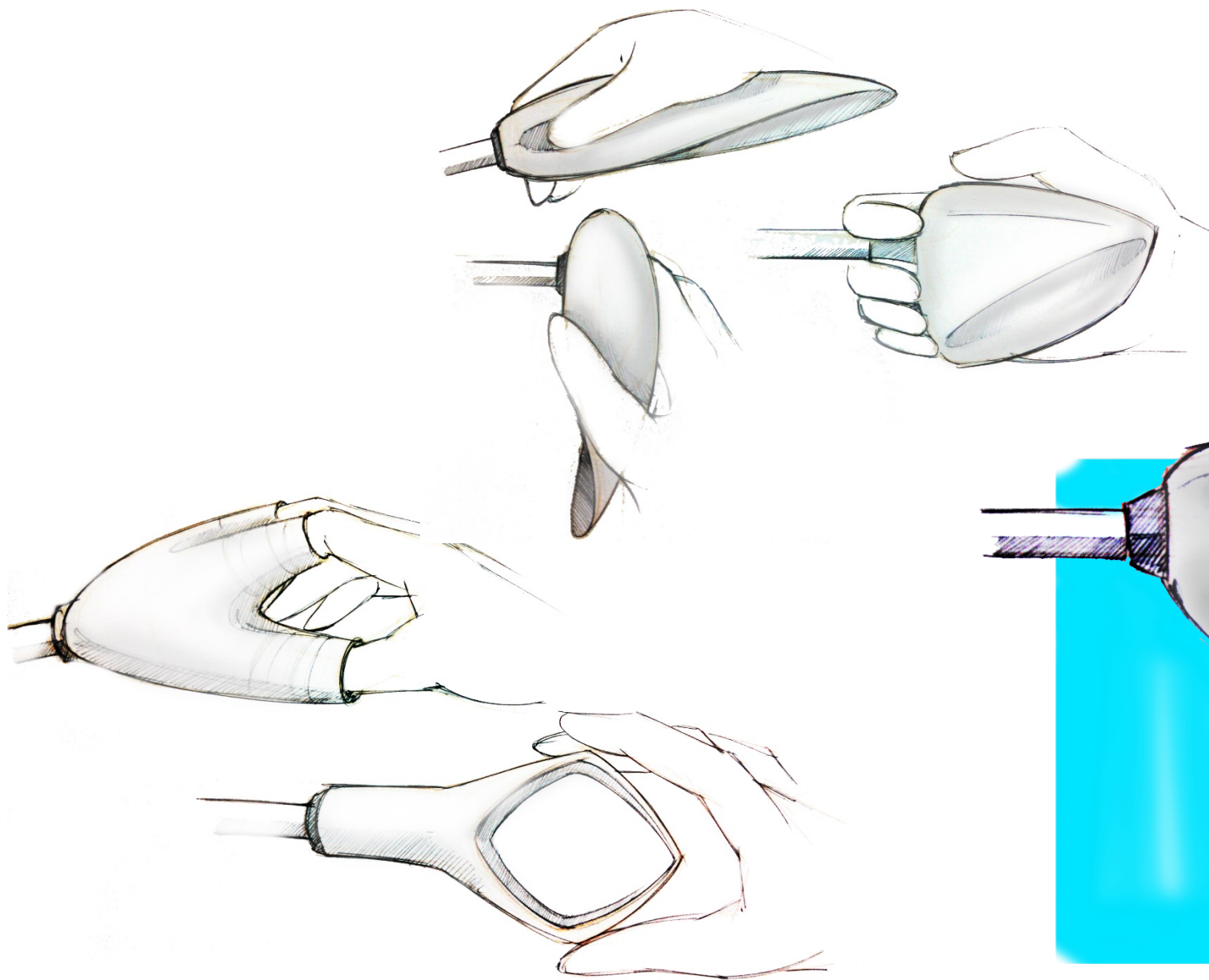
Link: Stainless Steel 316L, laser cut

Spring: Spring steel

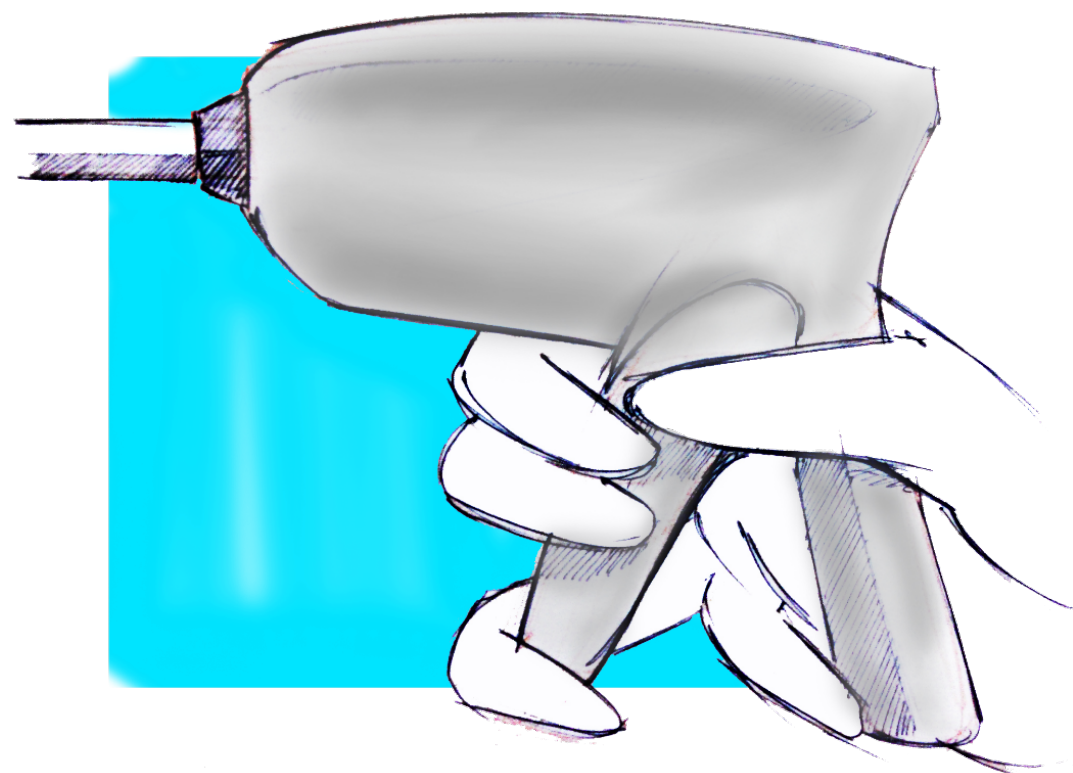
IDEATION

FOR GRIP

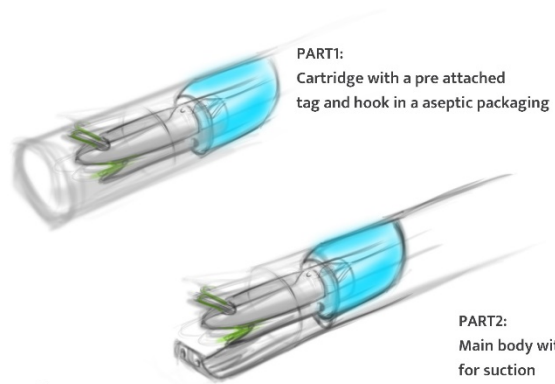




Operate 3 different controls
Precision movement
Stable grip
Ease of use





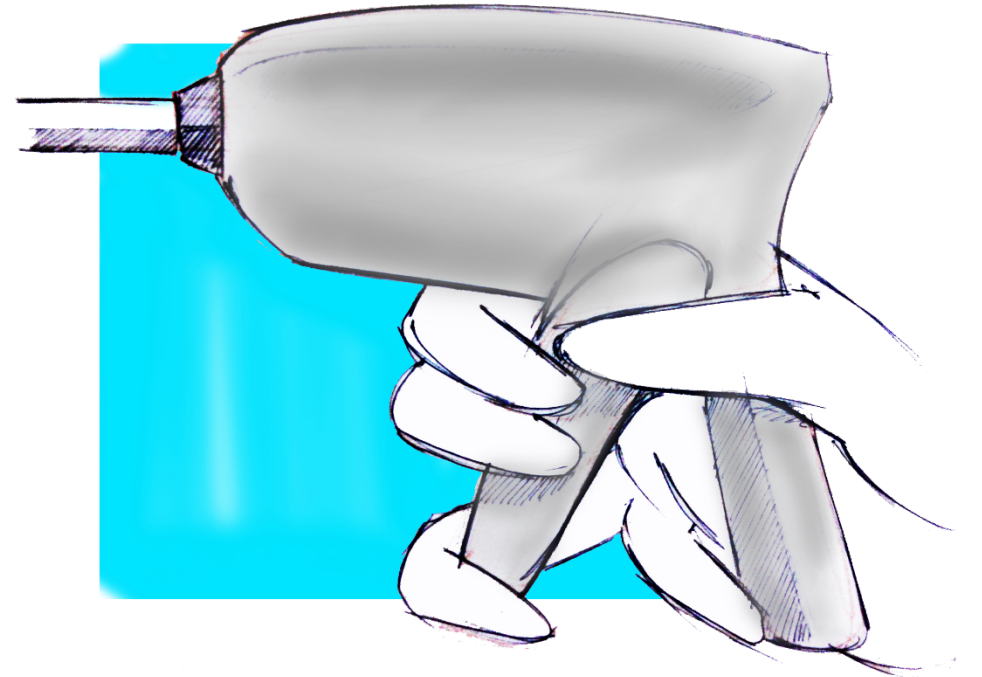


PART1:
Cartridge with a pre attached
tag and hook in a aseptic packaging

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

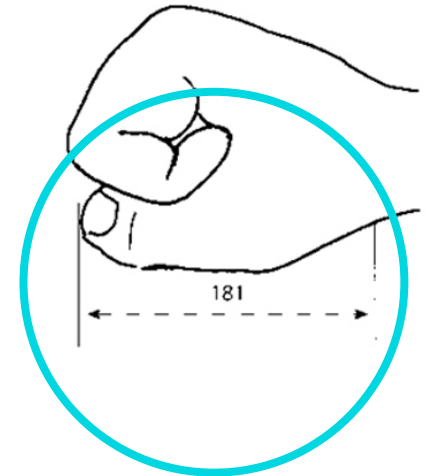
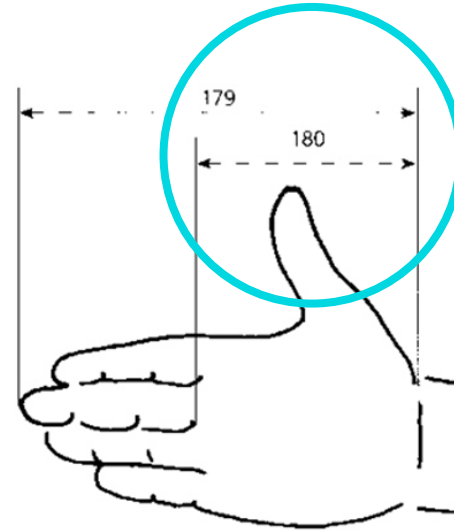
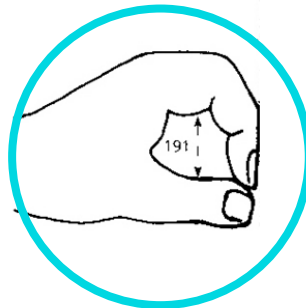
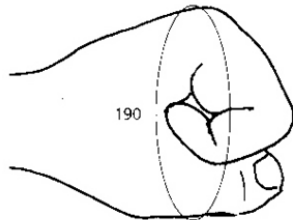
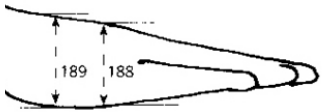
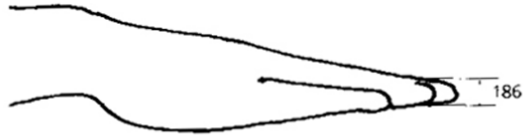
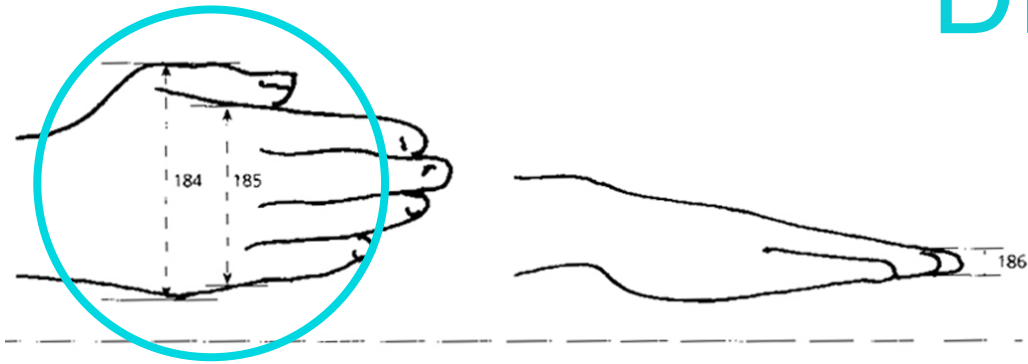
CONCEPT 2



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.

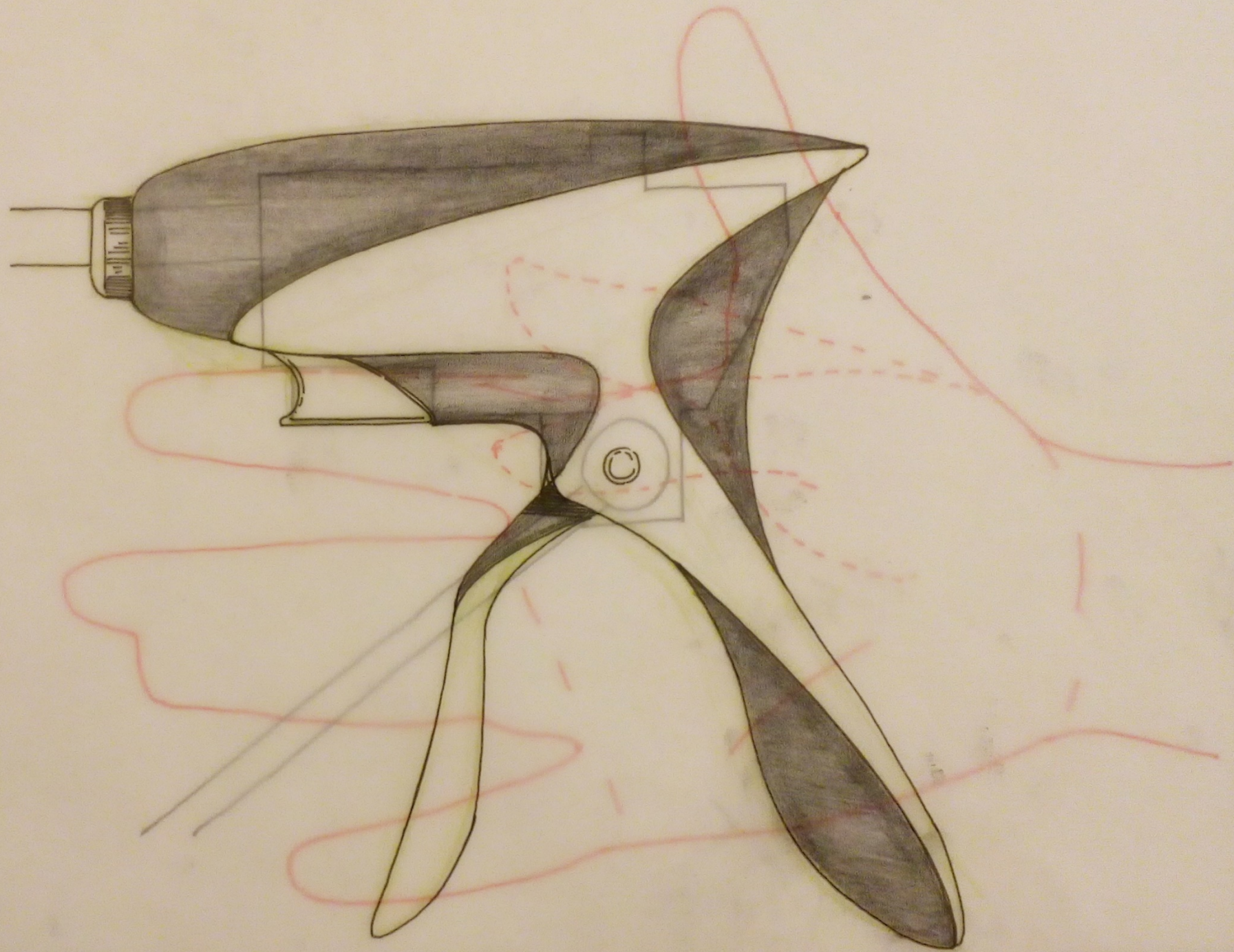


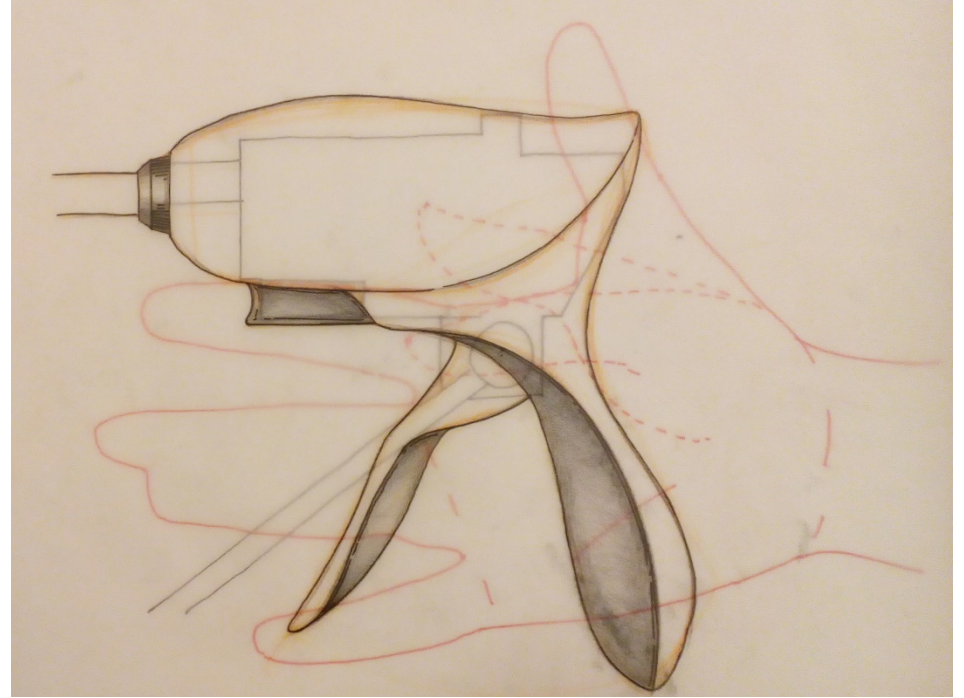
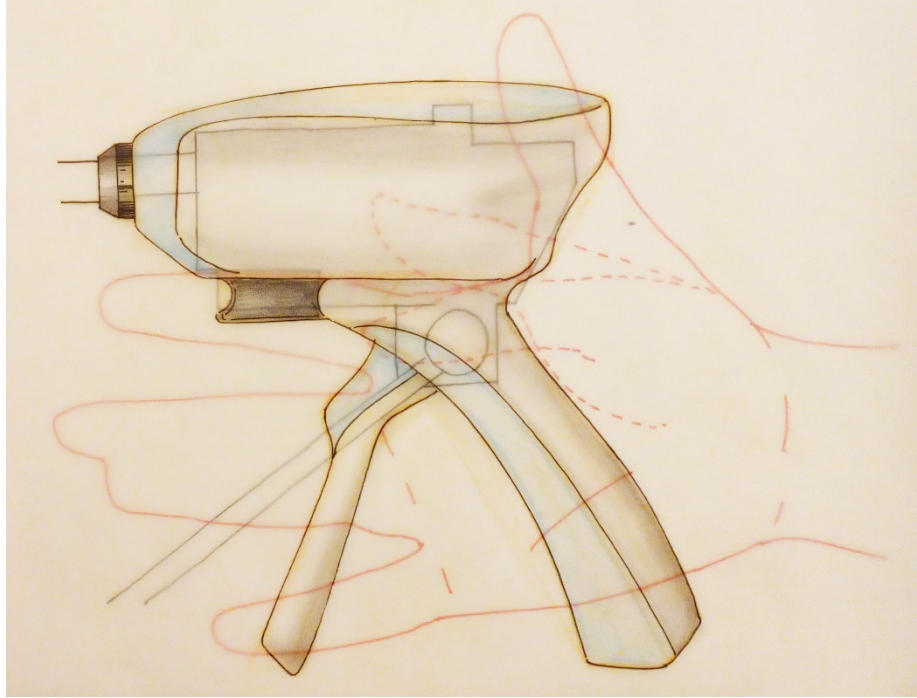
FORM

EXPLORATION



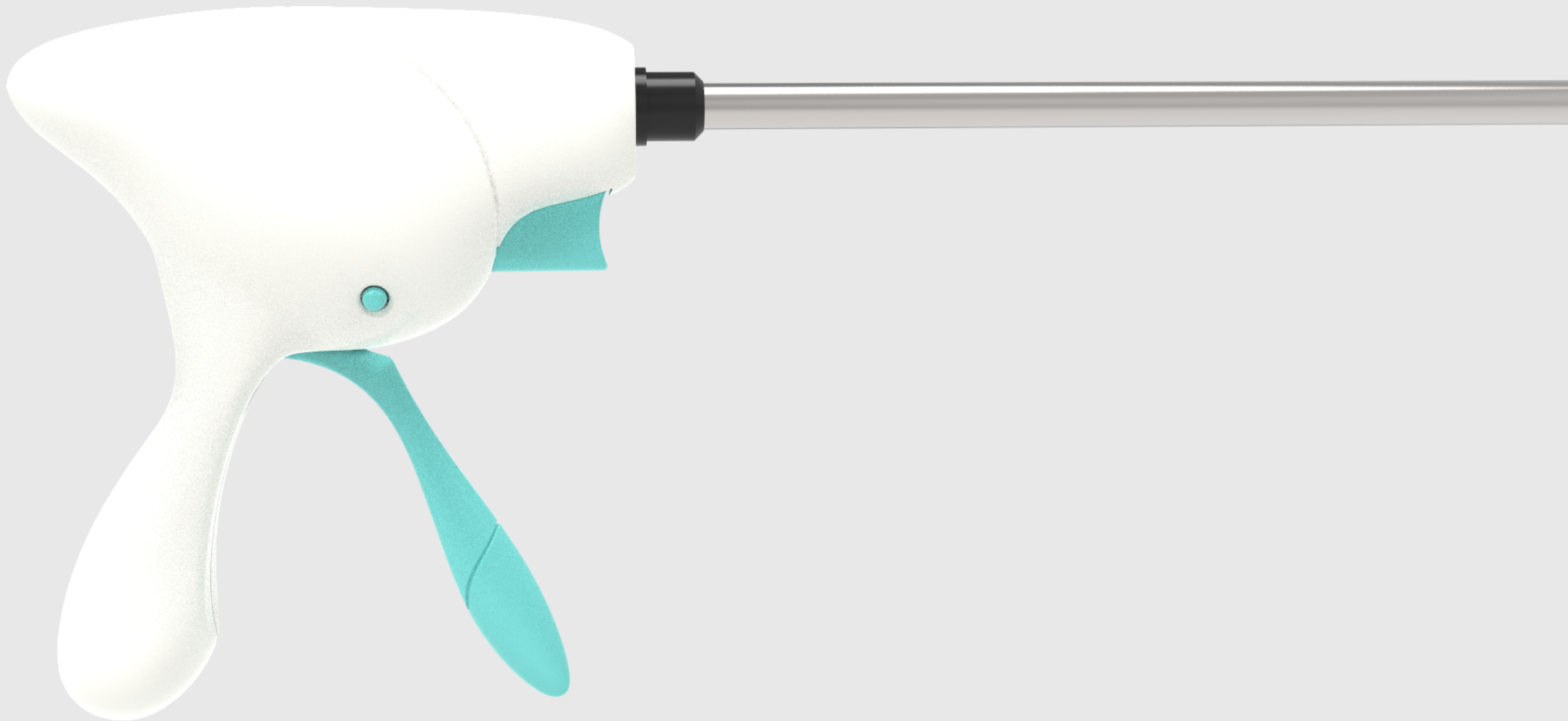
COMFOR
T
ORGANIC

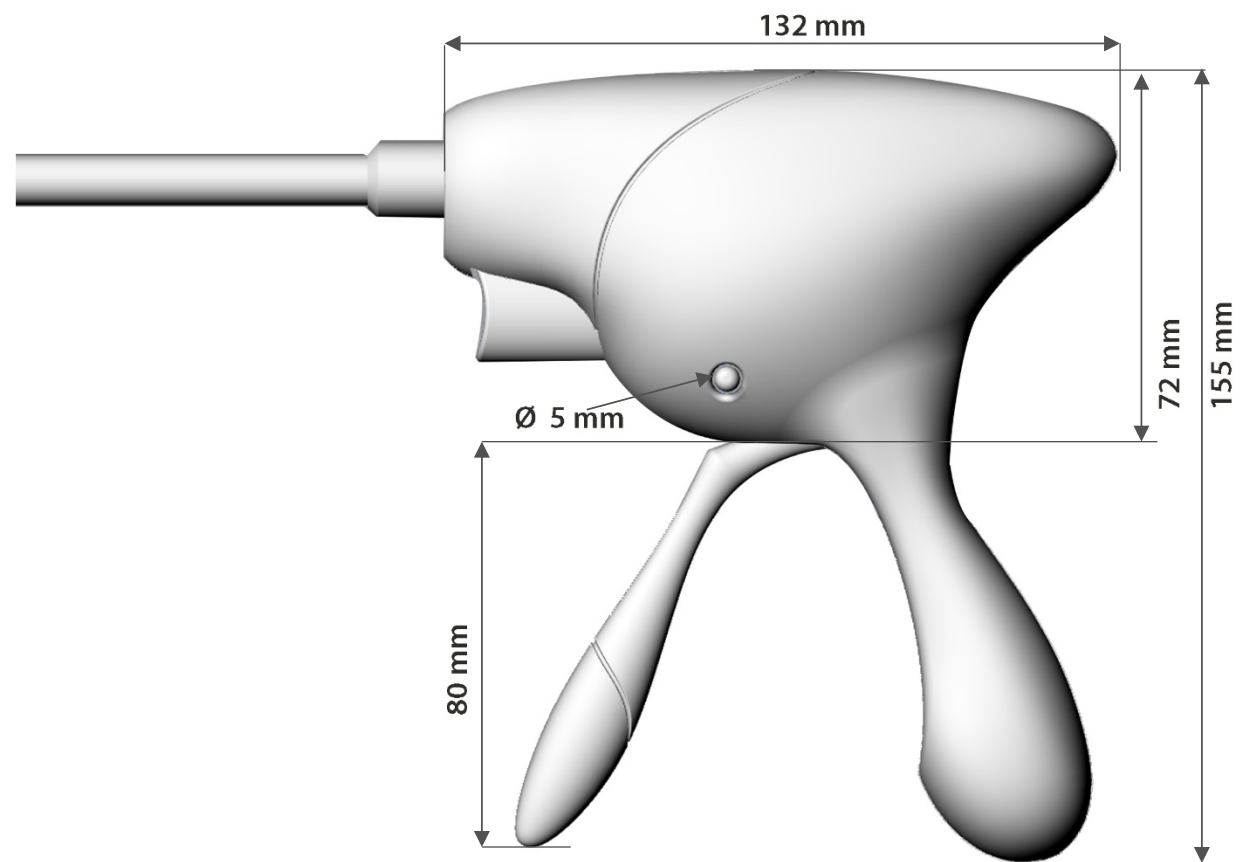
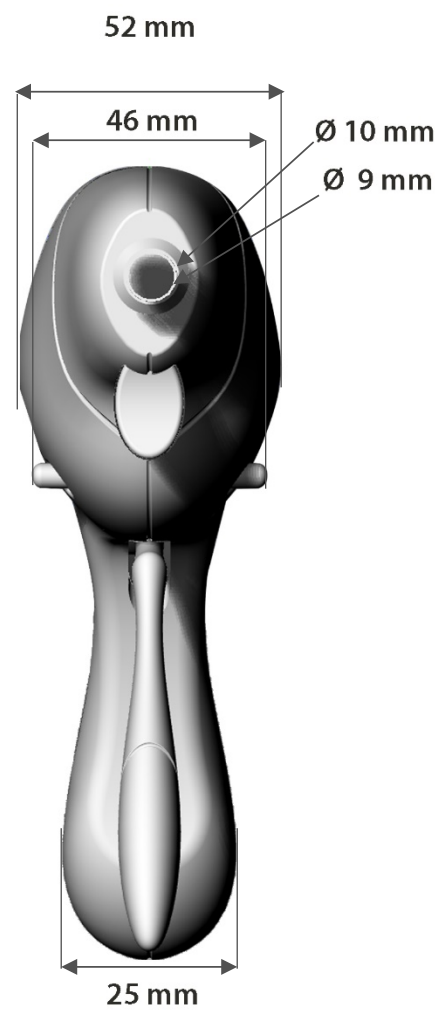


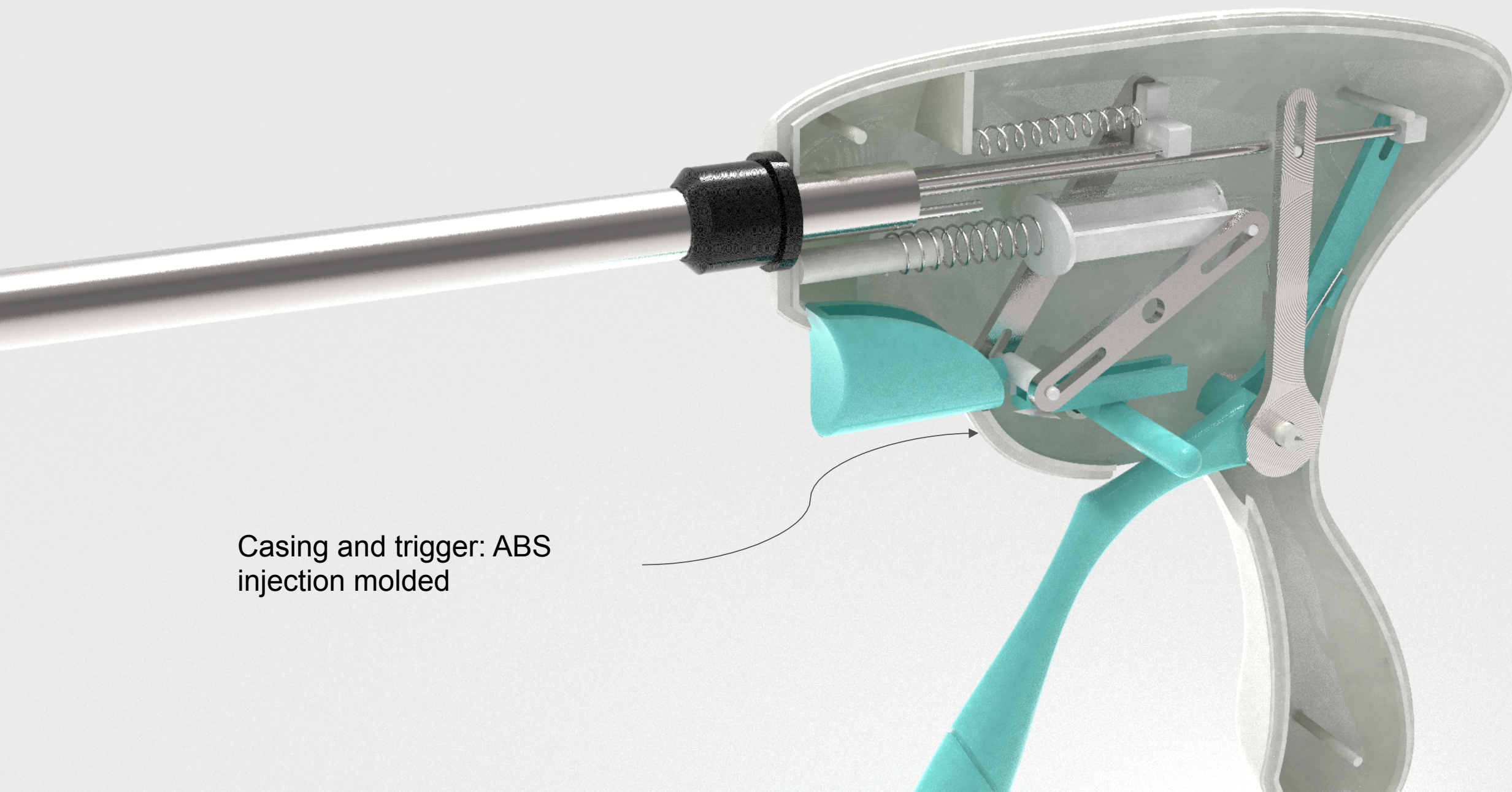




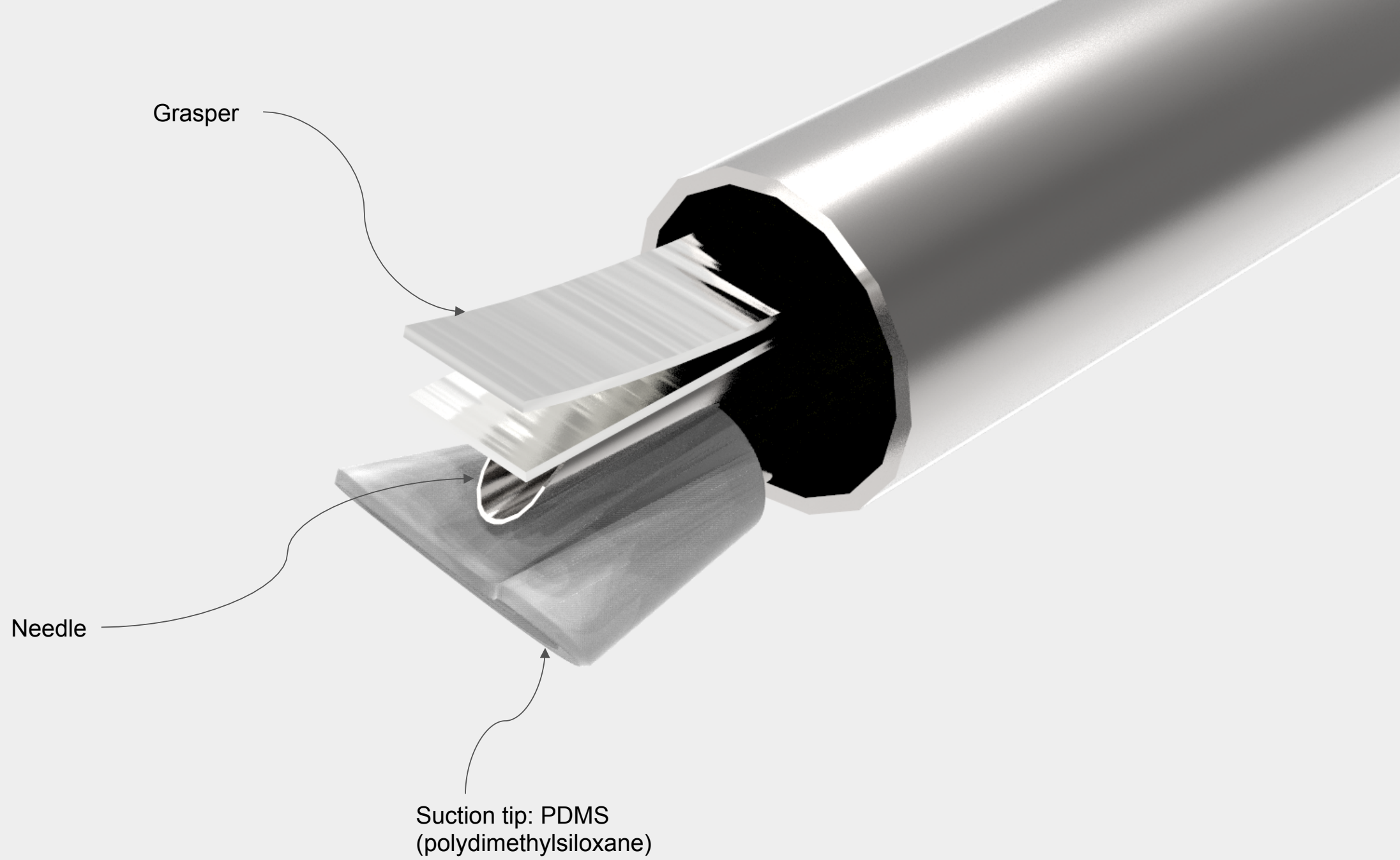








Casing and trigger: ABS
injection molded



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