

IDP 603 | Design Project III | IDC | IIT Bombay

Design of a surgeon friendly laparoscopic device for electrosurgery procedures

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LAPAROSCOPY

A laparoscopic surgery is a minimally invasive surgery where the surgeon creates small incisions on patients body in order to insert instruments and a light with camera to perform surgical procedures.

LAPAROSCOPIC V/S OPEN SURGERY

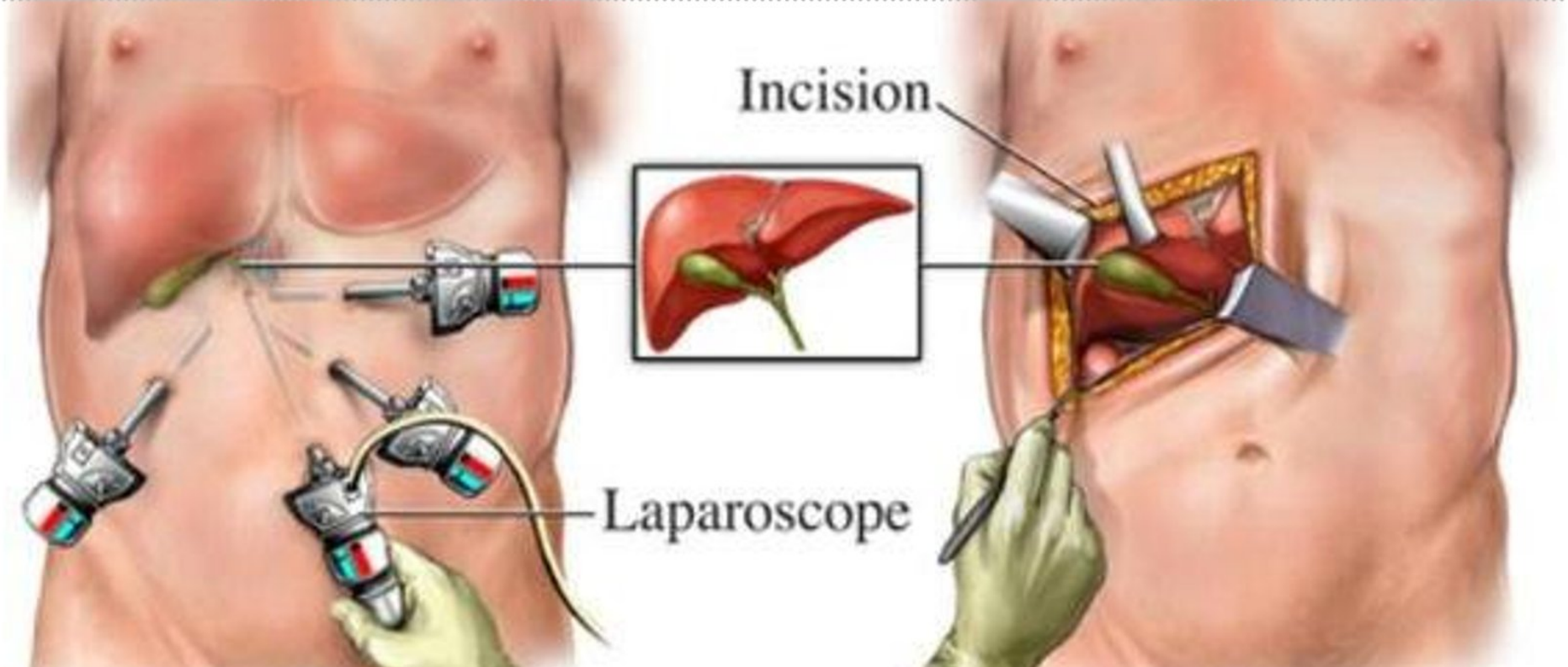


Image source: <https://in.pinterest.com/pin/358951032773233798/>

ELECTROSURGERY

use of alternating current passing through the patient to cut and coagulate the tissues

ELECTROSURGERY | monopolar and bipolar

Monopolar cautery

Active electrode at surgical site
Return electrode at another site



Current flows through the body

High voltage
Coag – 3,000-9,000
Cut – 1,350-4,000

Bipolar cautery

Active and return electrodes within the instrument

Current flow confined to tissue between electrodes

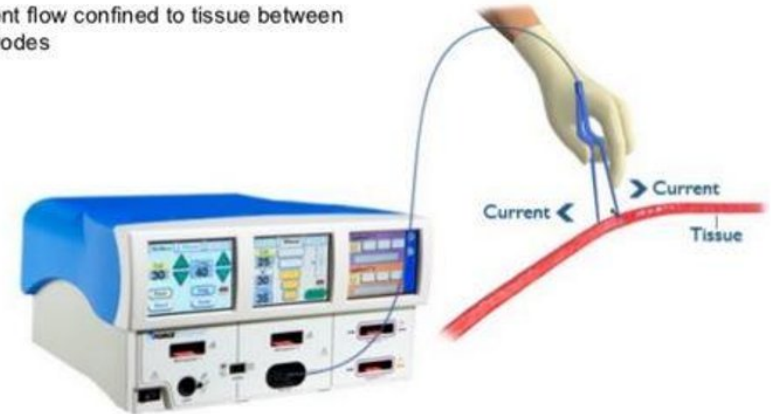


Image source: <http://www.slideshare.net/AnthonyDeSalvoMD/electrosurgery-saftey>

EXISTING SOLUTIONS | Observations

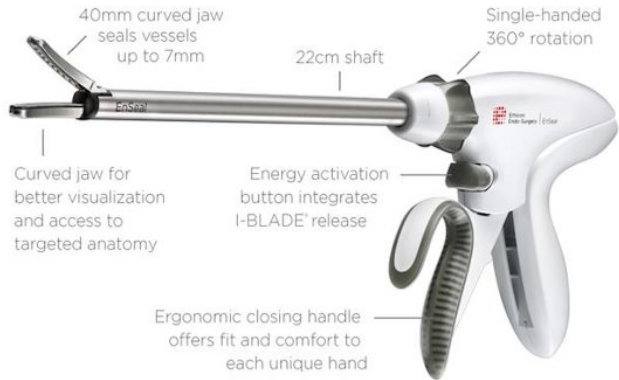


Image source: <http://www.ethicon.com/>



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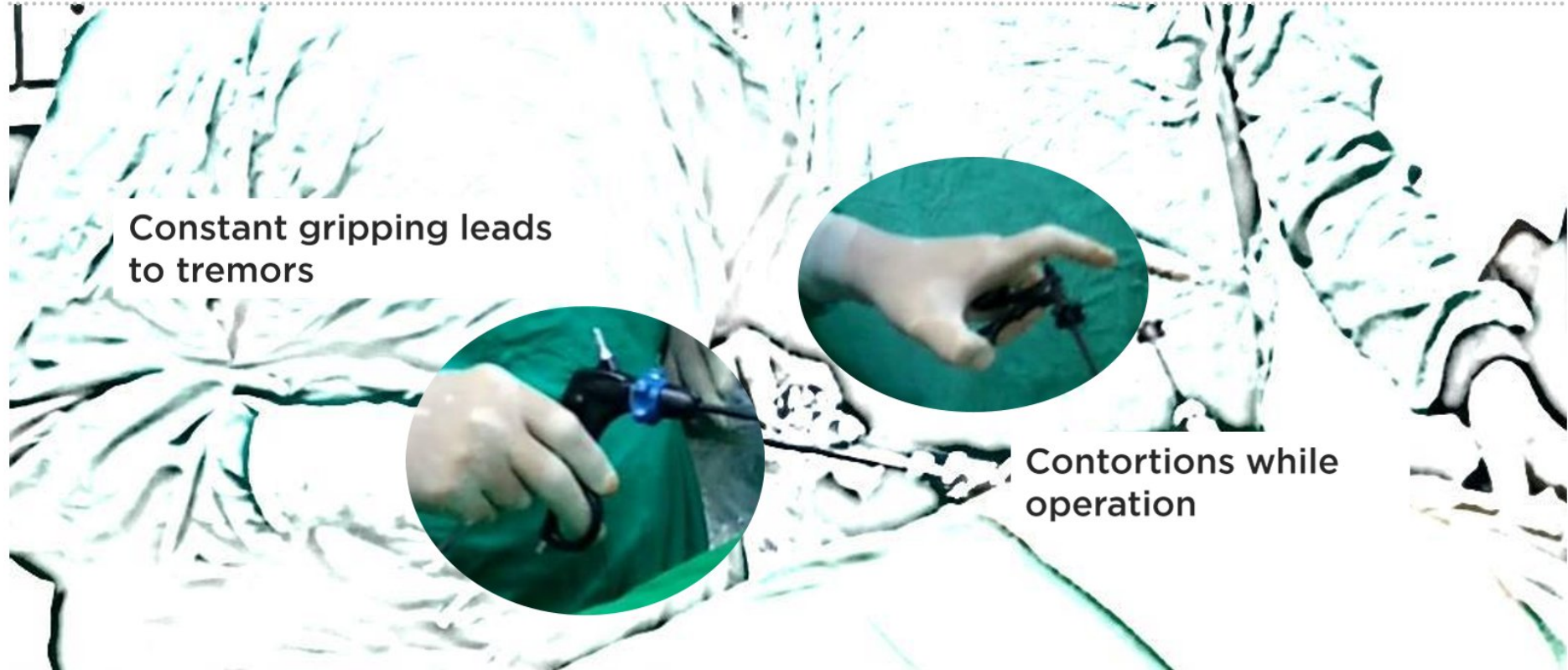
Image source: <http://www.medtronic.com/>



PRIMARY STUDY | Observations



PRIMARY STUDY | Observations



PRIMARY STUDY | Observations



PRIMARY STUDY | Observations



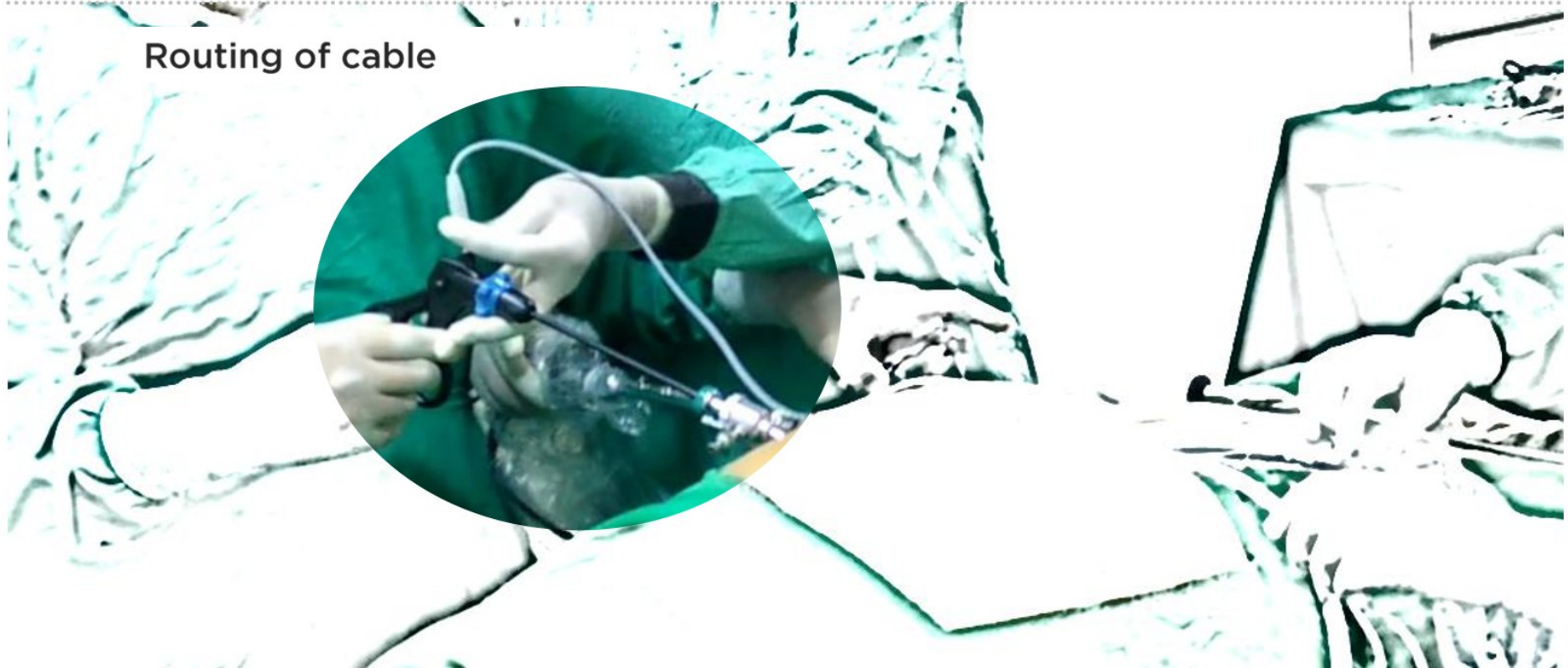
Storage of instruments
during use

PRIMARY STUDY | Observations



PRIMARY STUDY | Observations

Routing of cable



PRIMARY STUDY | Observations



PRIMARY STUDY | Observations



Position of the screen

Electrosurgical Unit (ESU)



BRIEF

To design a surgeon friendly laparoscopic device for electrosurgery procedures

BRIEF | Needs

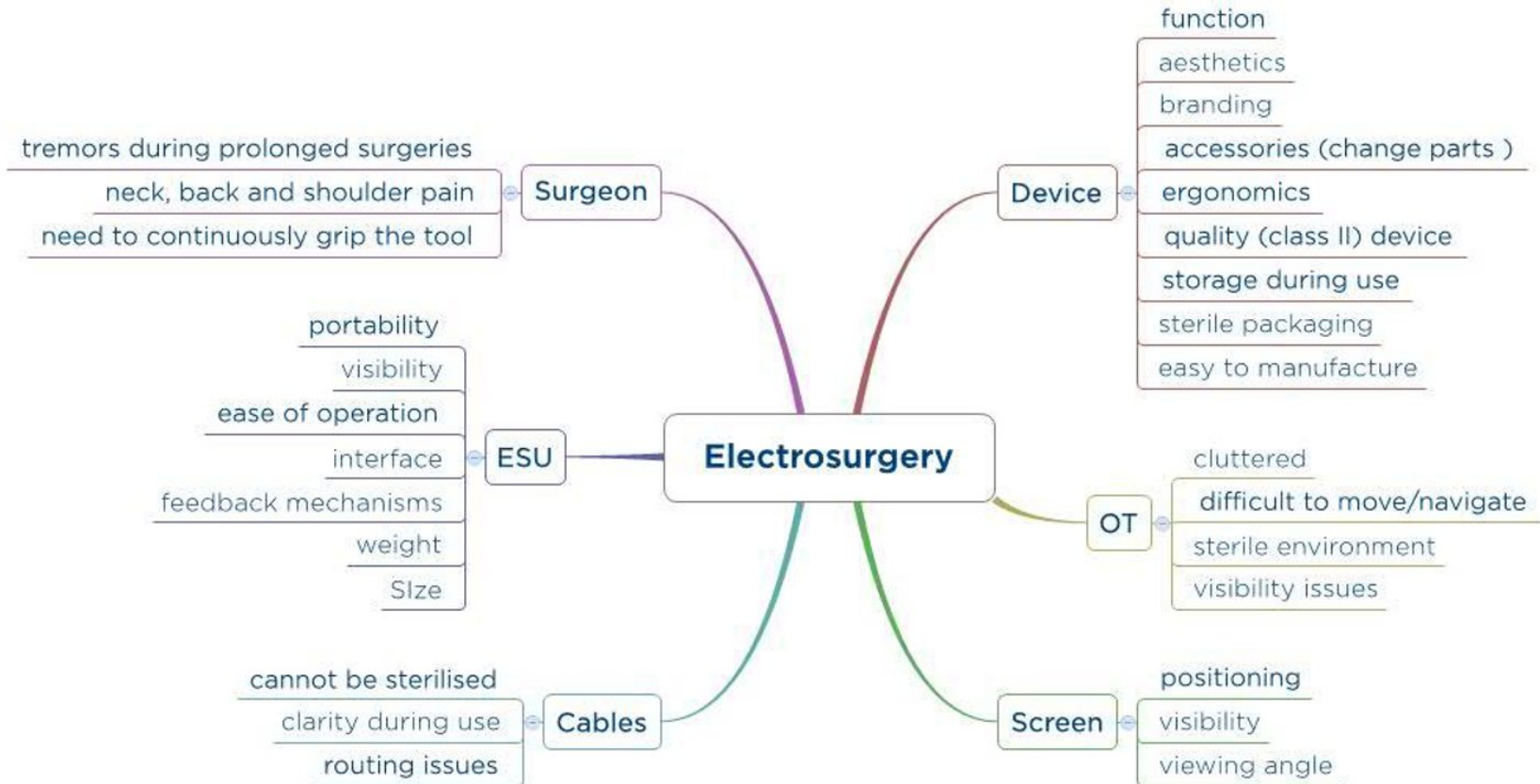
The device should be ergonomic, manoeuvrable and easy to use.

As it is a class II device, it should be able to withstand required sterilisation procedures.

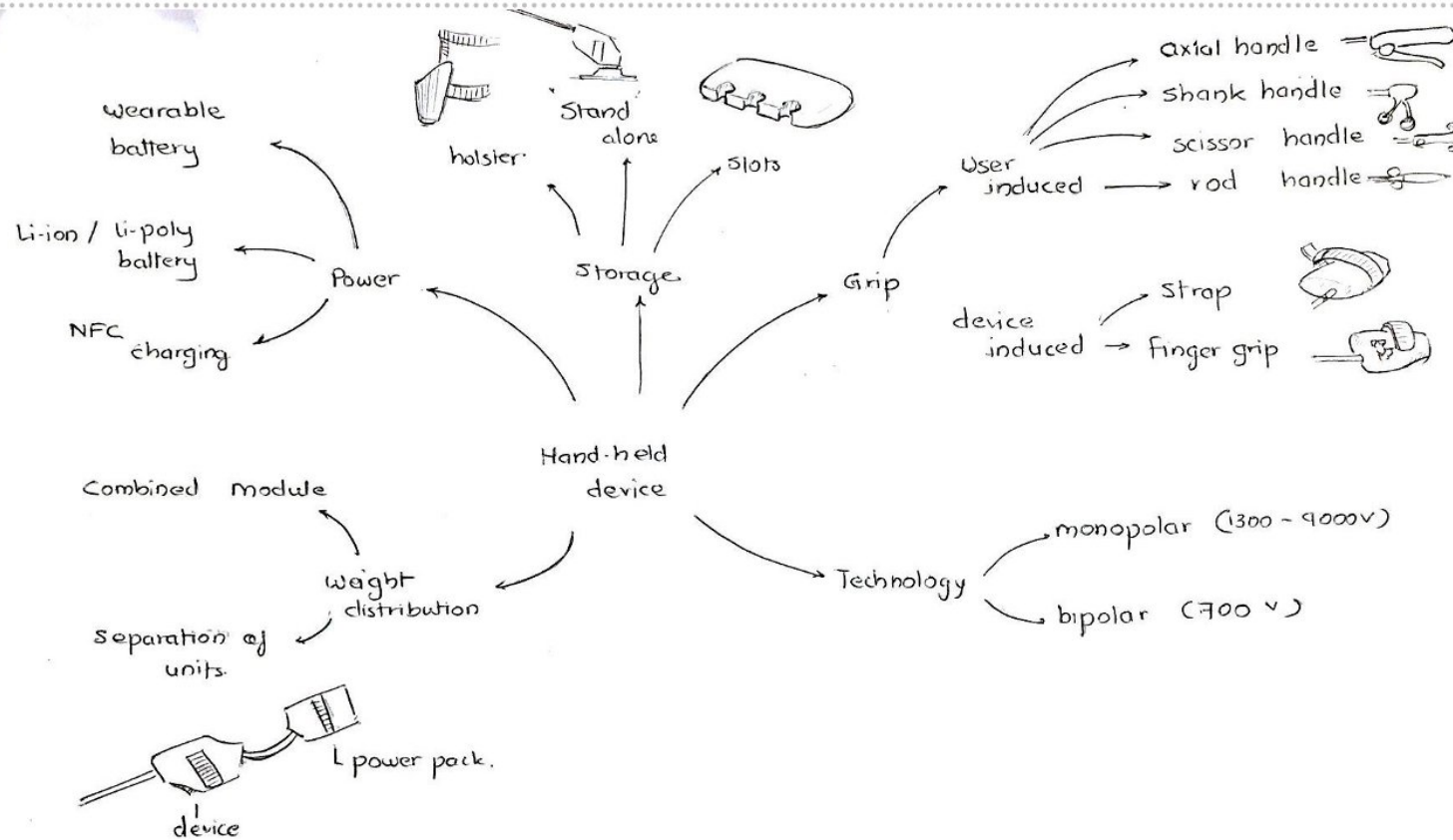
Provision for surgeon to rest his arms and fingers during the operation should be provided.

The device when stored during operation should not allow the tip to touch any surface.

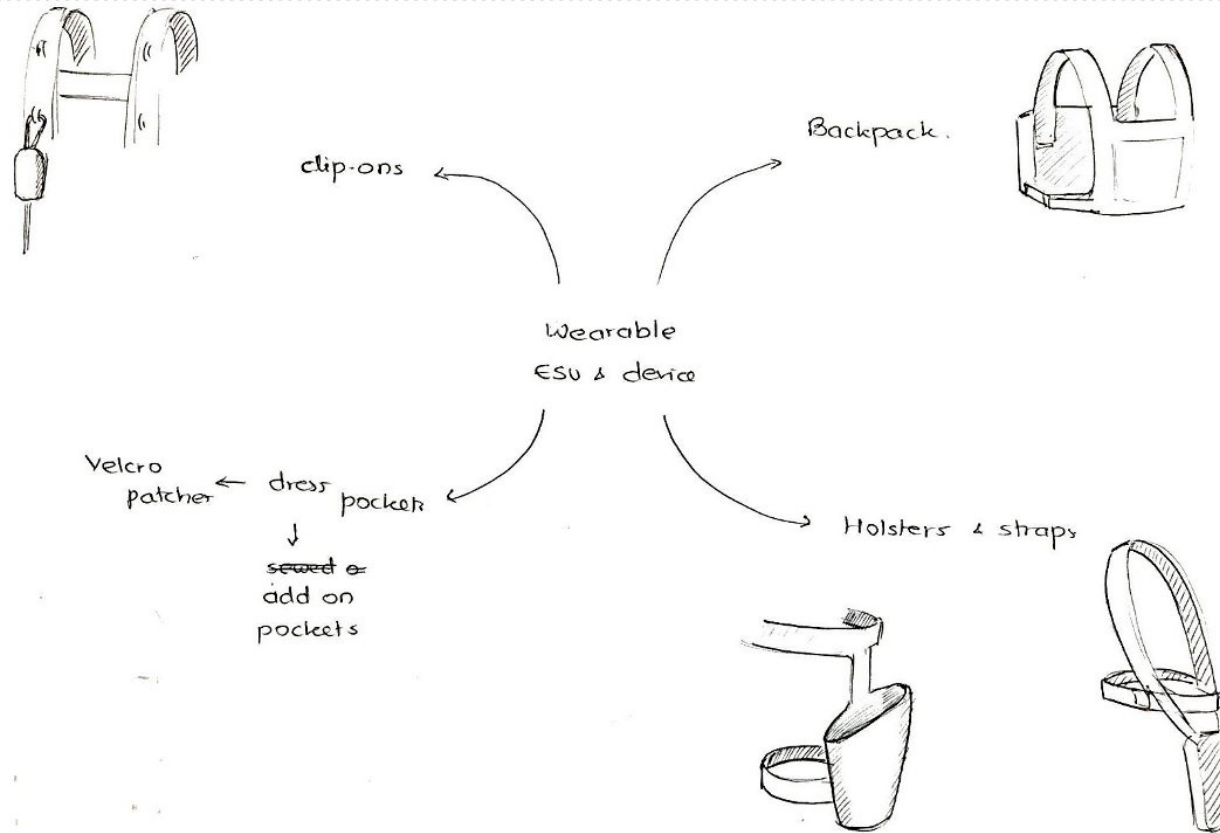
IDEATION | Mind map



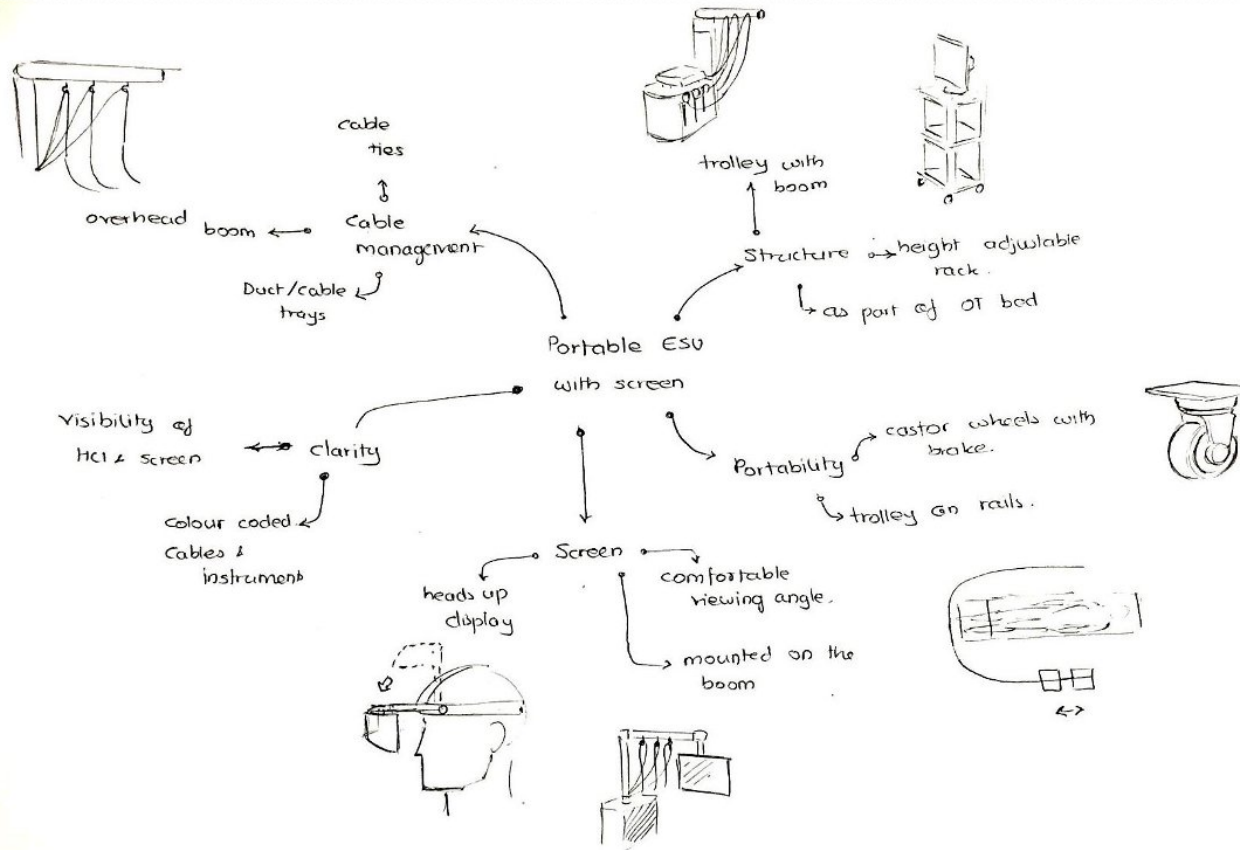
IDEATION | Initial approaches



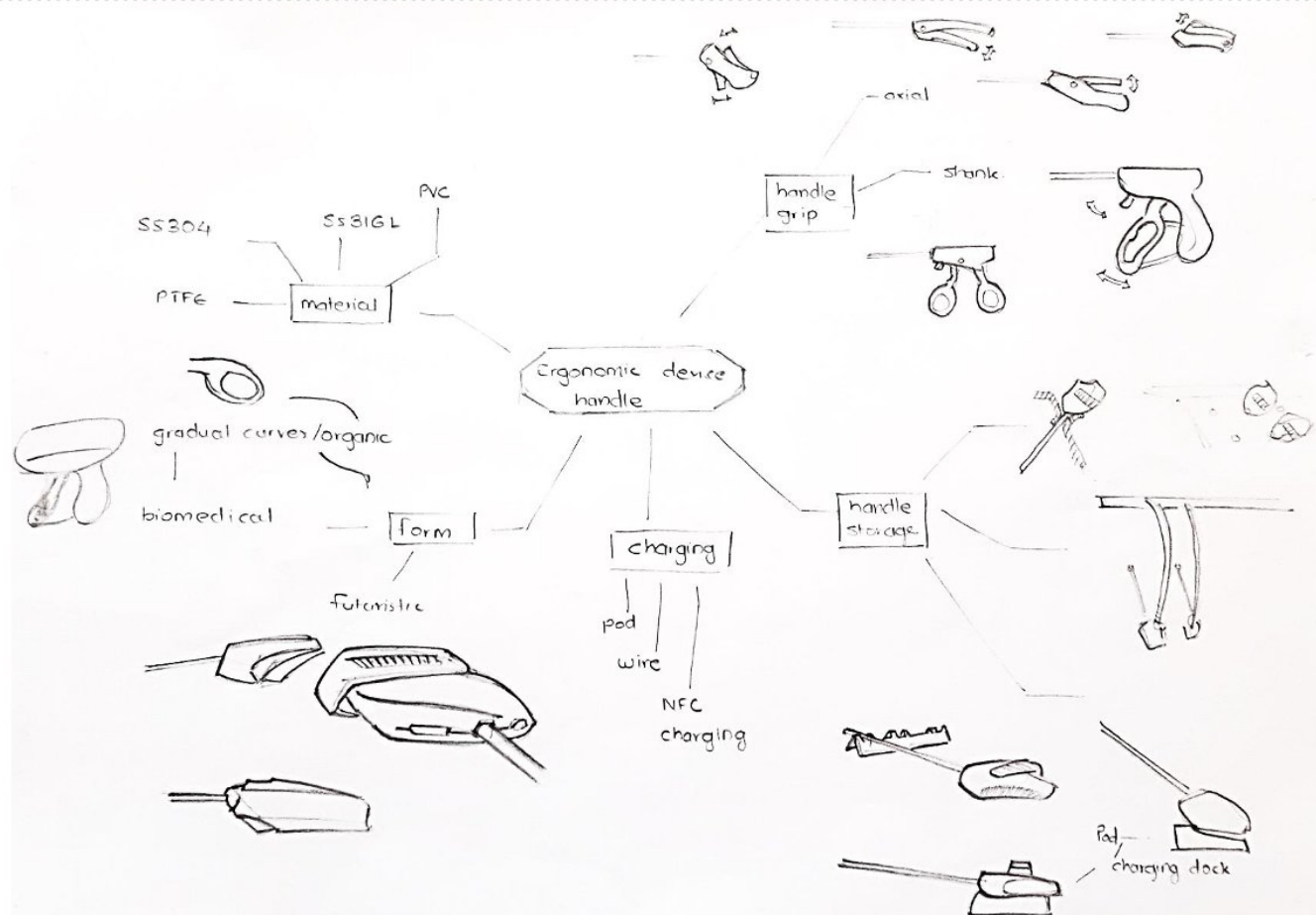
IDEATION | Initial approaches



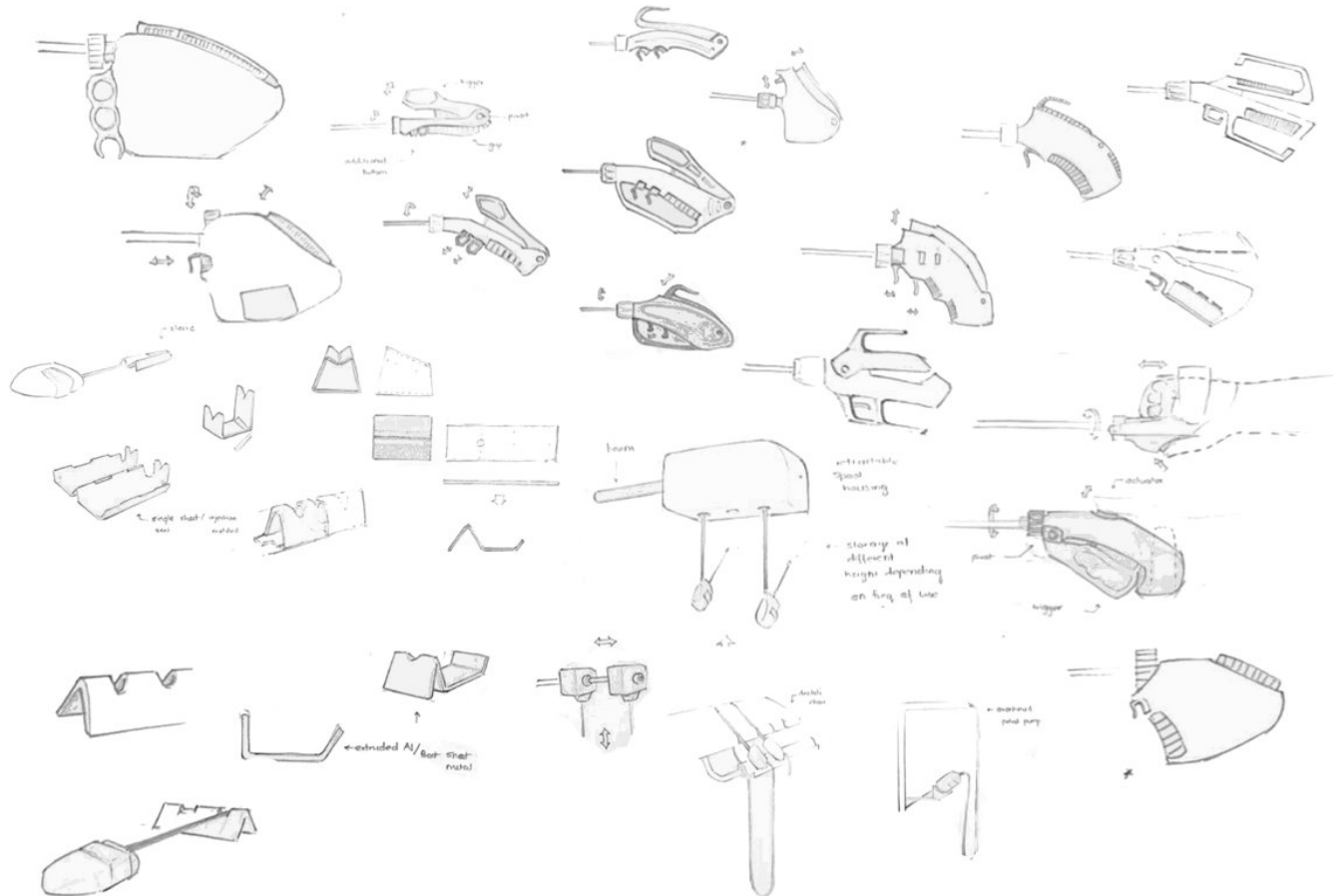
IDEATION | Initial approaches



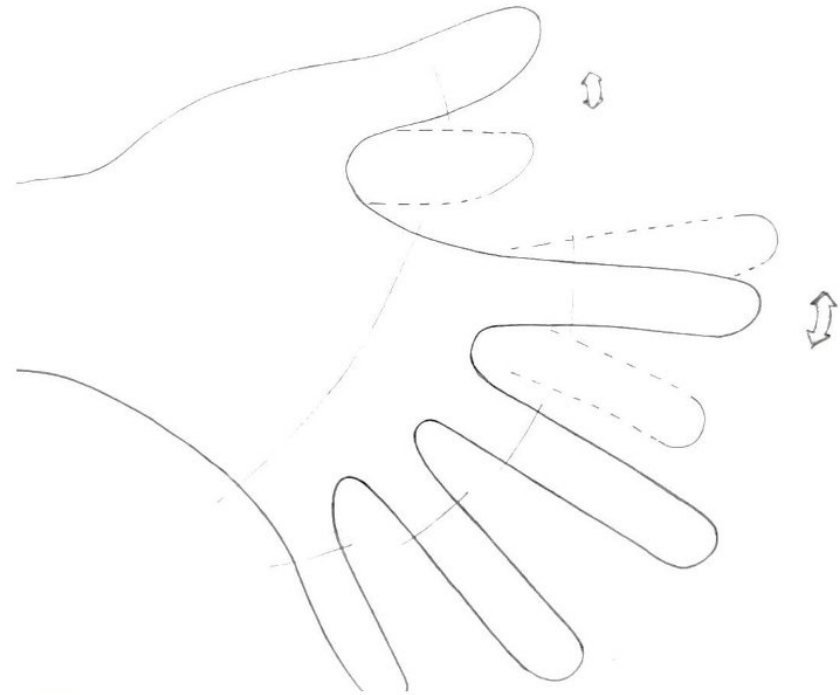
IDEATION | Designing the device



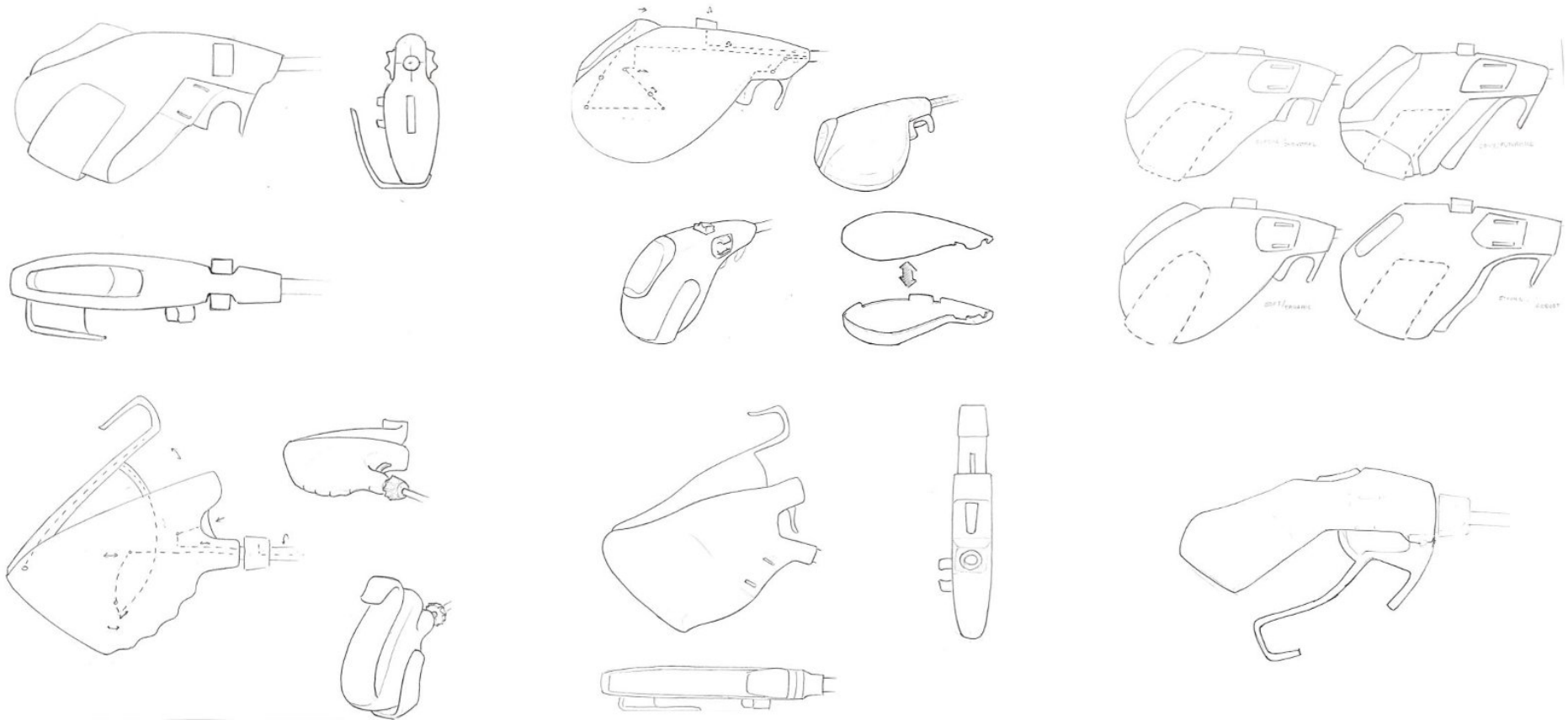
IDEATION | Designing the device



IDEATION | Determining limits



IDEATION | Initial concepts



IDEATION | Initial concepts

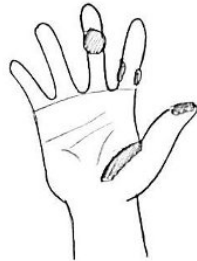


IDEATION | Concept evaluation

concept



pressure
points



pros

compact

comfort and ease
of motion

no learning curve

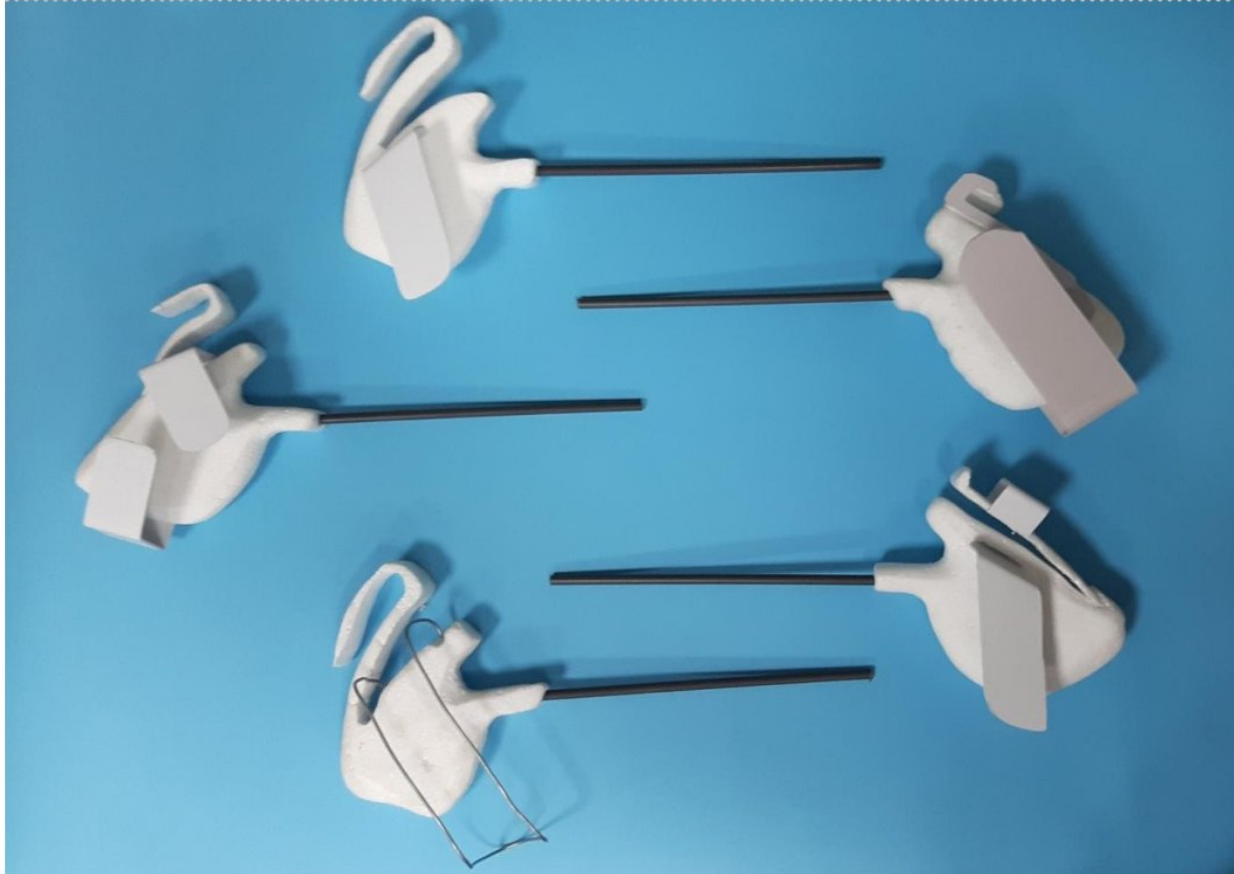
cons

range of trigger
motion

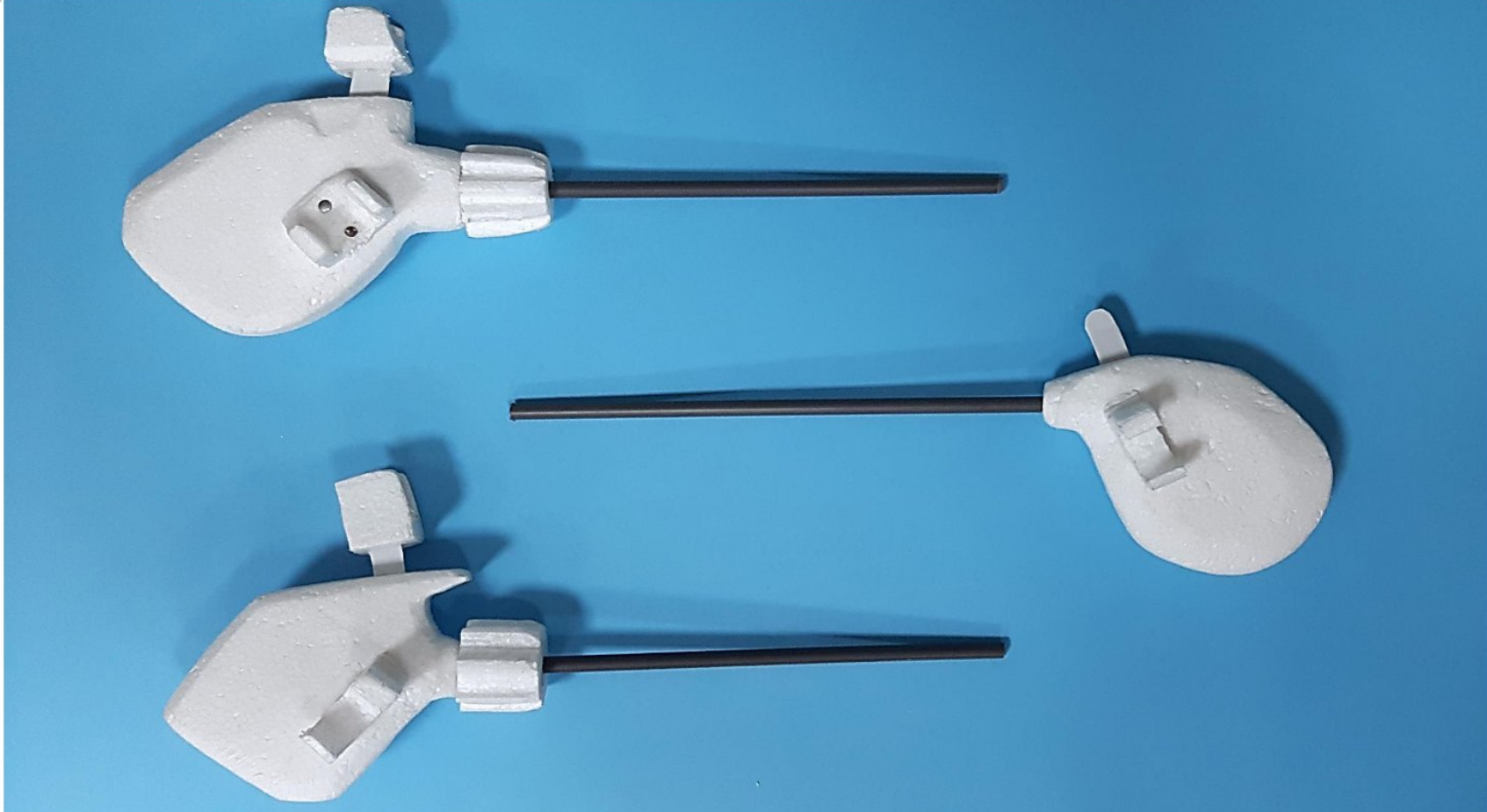
thumb extension

early finger
fatigue

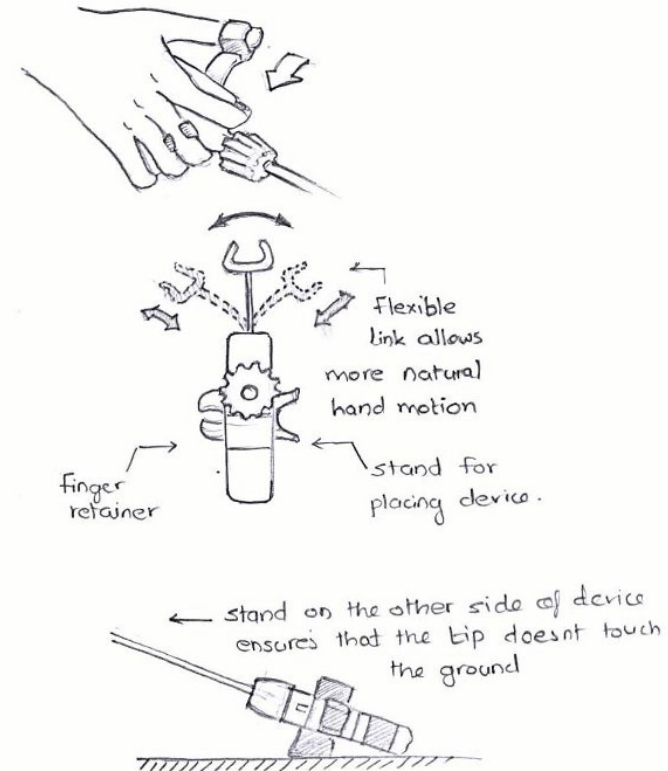
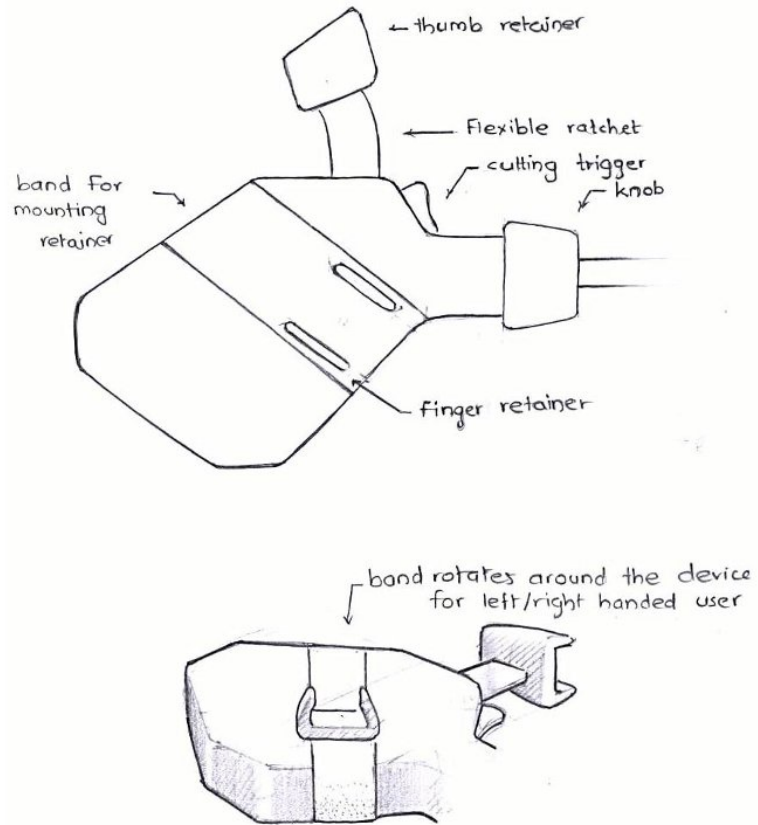
IDEATION | Grip and retainers



IDEATION | Grip and retainers



IDEATION | Chosen direction

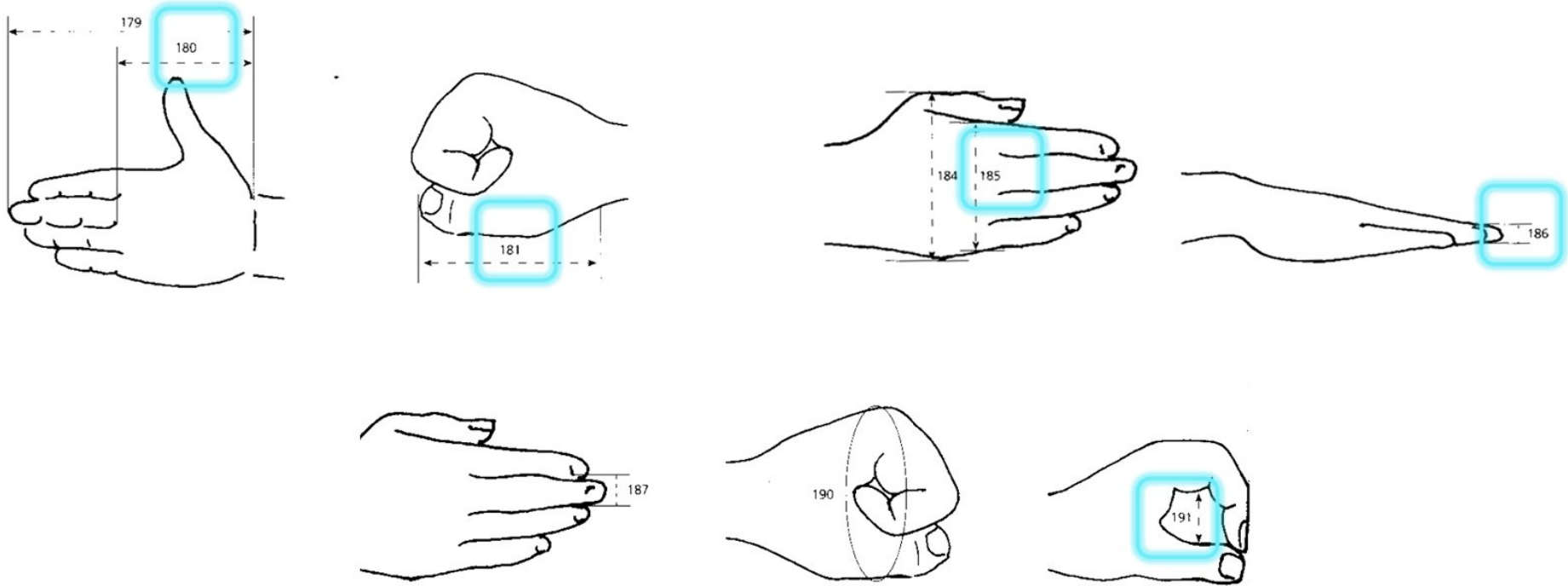


IDEATION | Image board

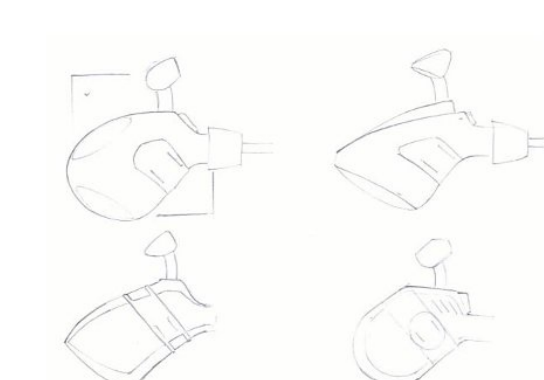
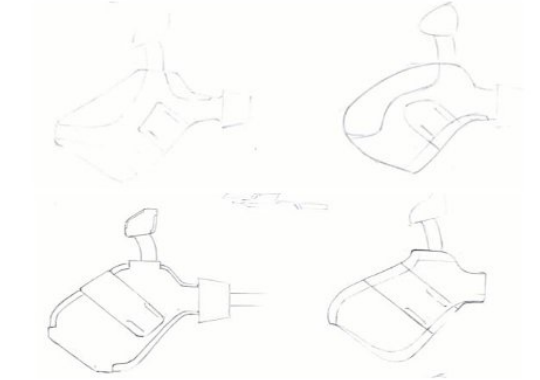
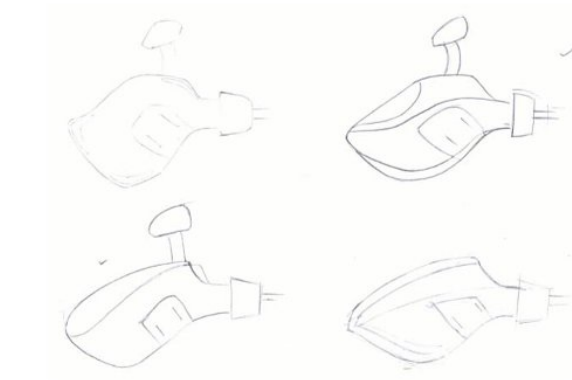
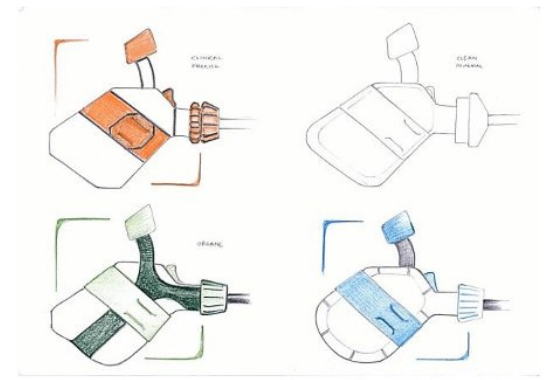
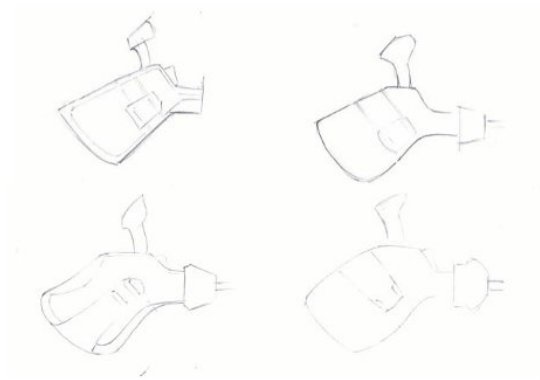
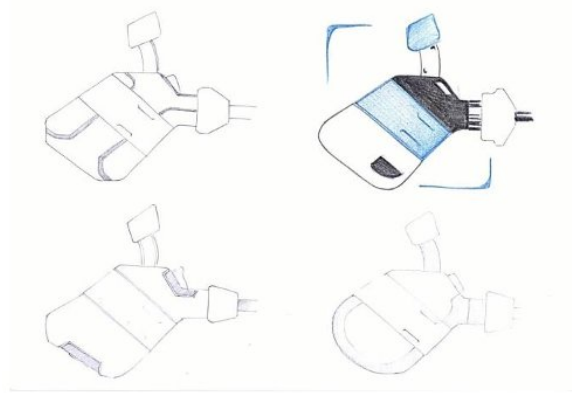


Soft
Futuristic
Clean
Light

IDEATION | Anthropometric data



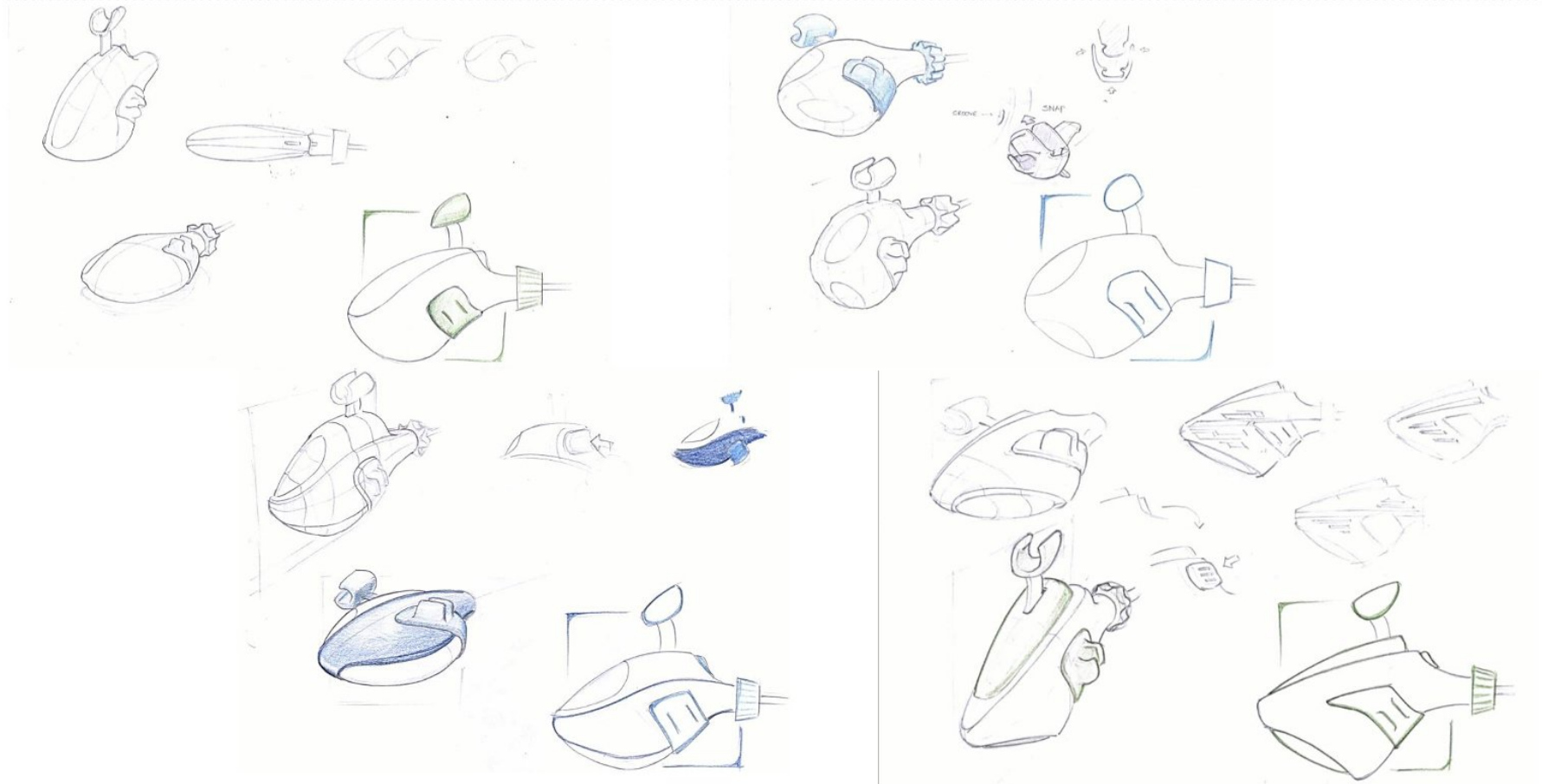
IDEATION | Search for the “right” form



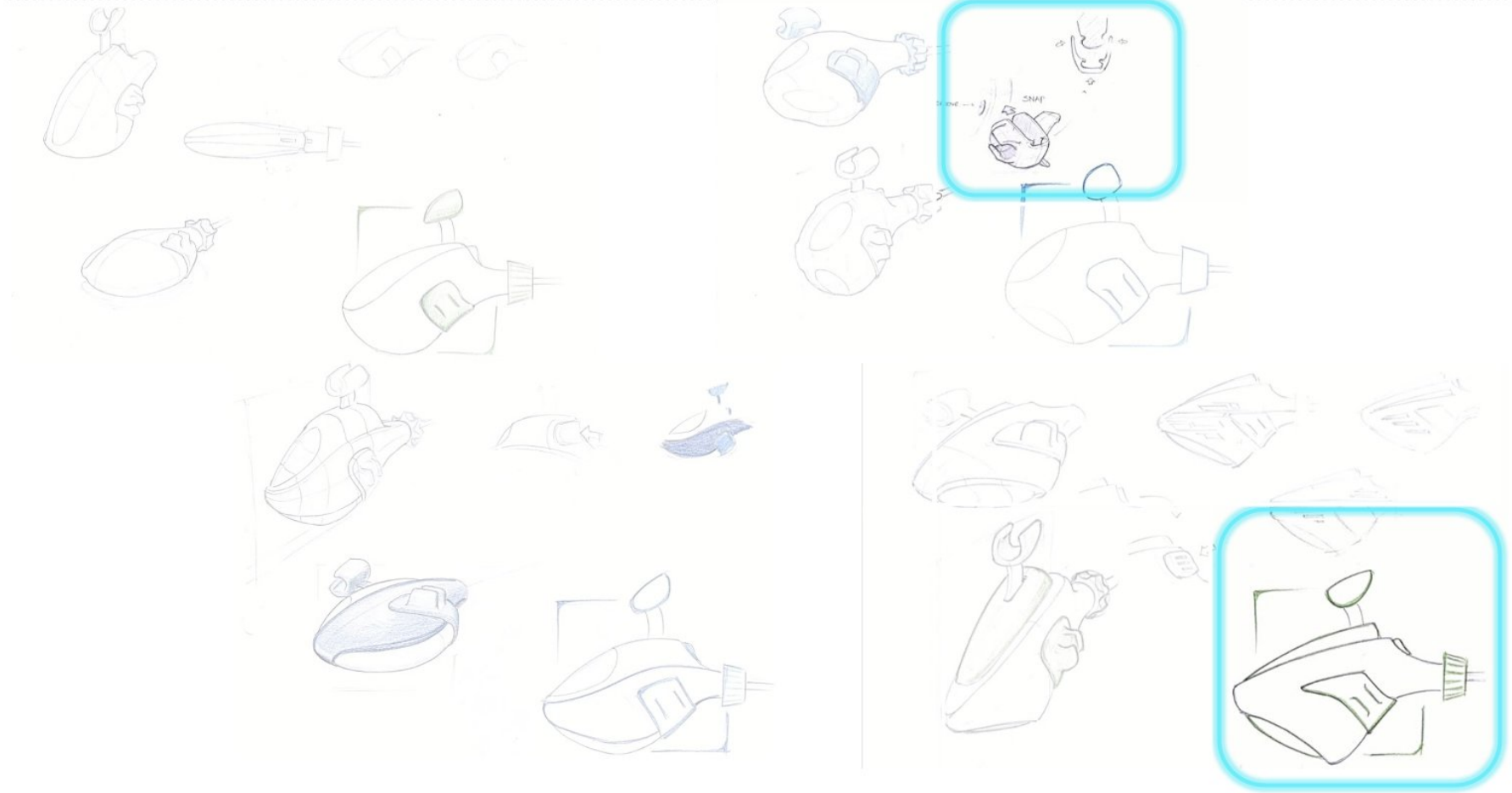
IDEATION | Search for the “right” form



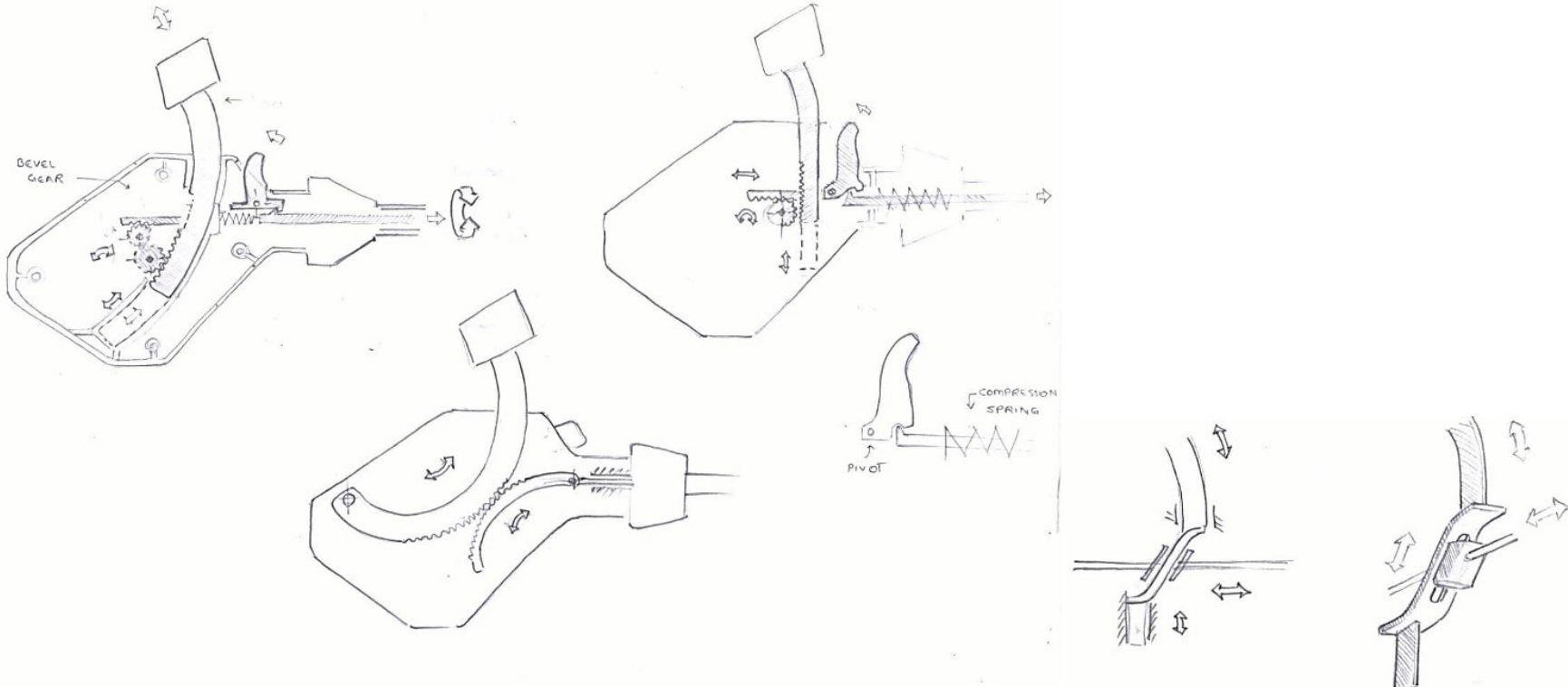
IDEATION | search for the “right” form



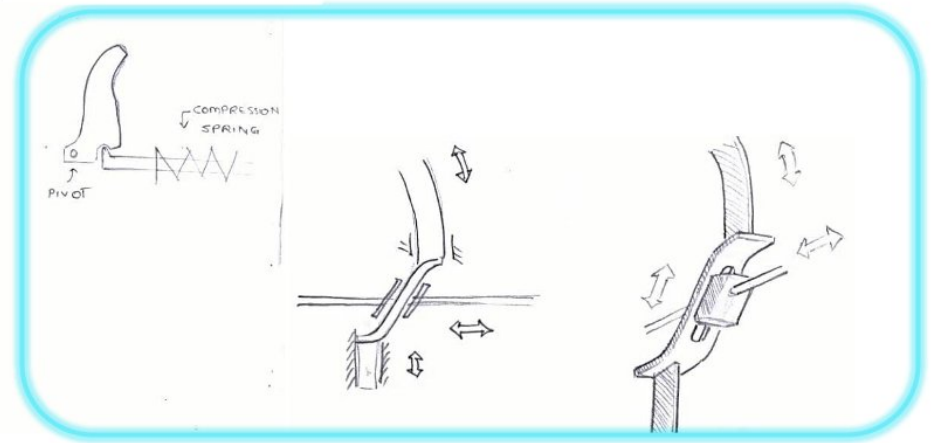
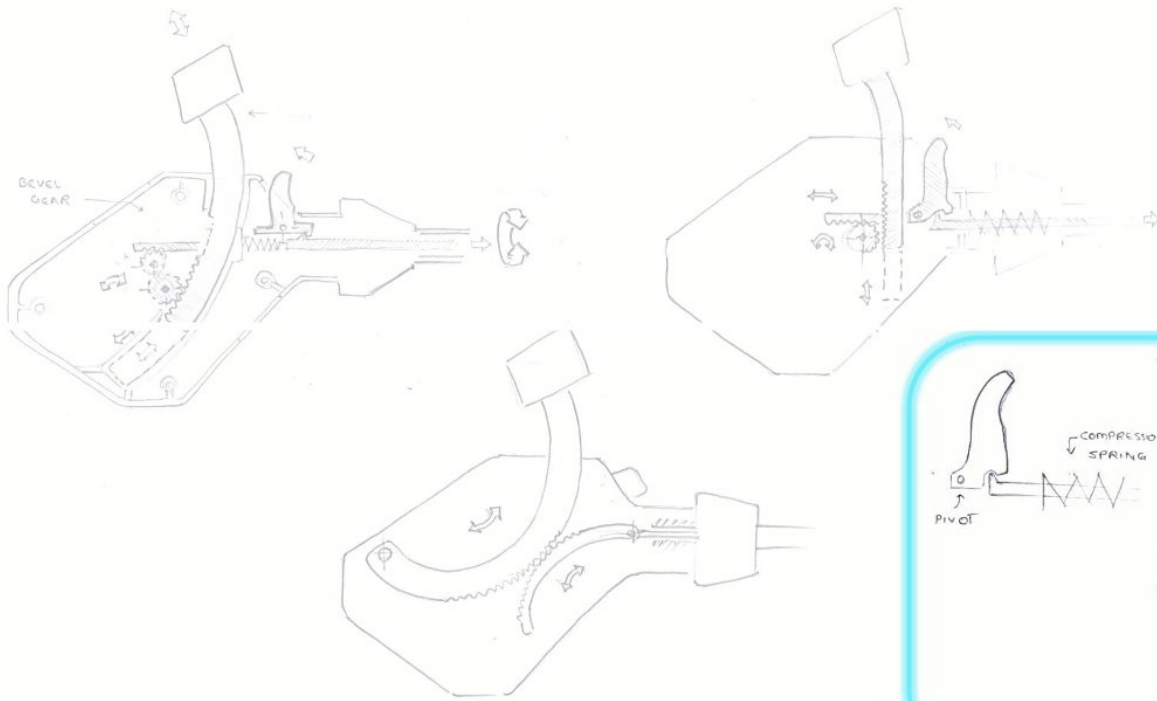
IDEATION | search for the “right” form



IDEATION | how will it work?



IDEATION | how will it work?



BRANDING

fileXhand

fileXhand

fileXhand

fileXhand

fileXhand

fileXhand

fileXhand

fileXhand

fileXhand

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BRANDING

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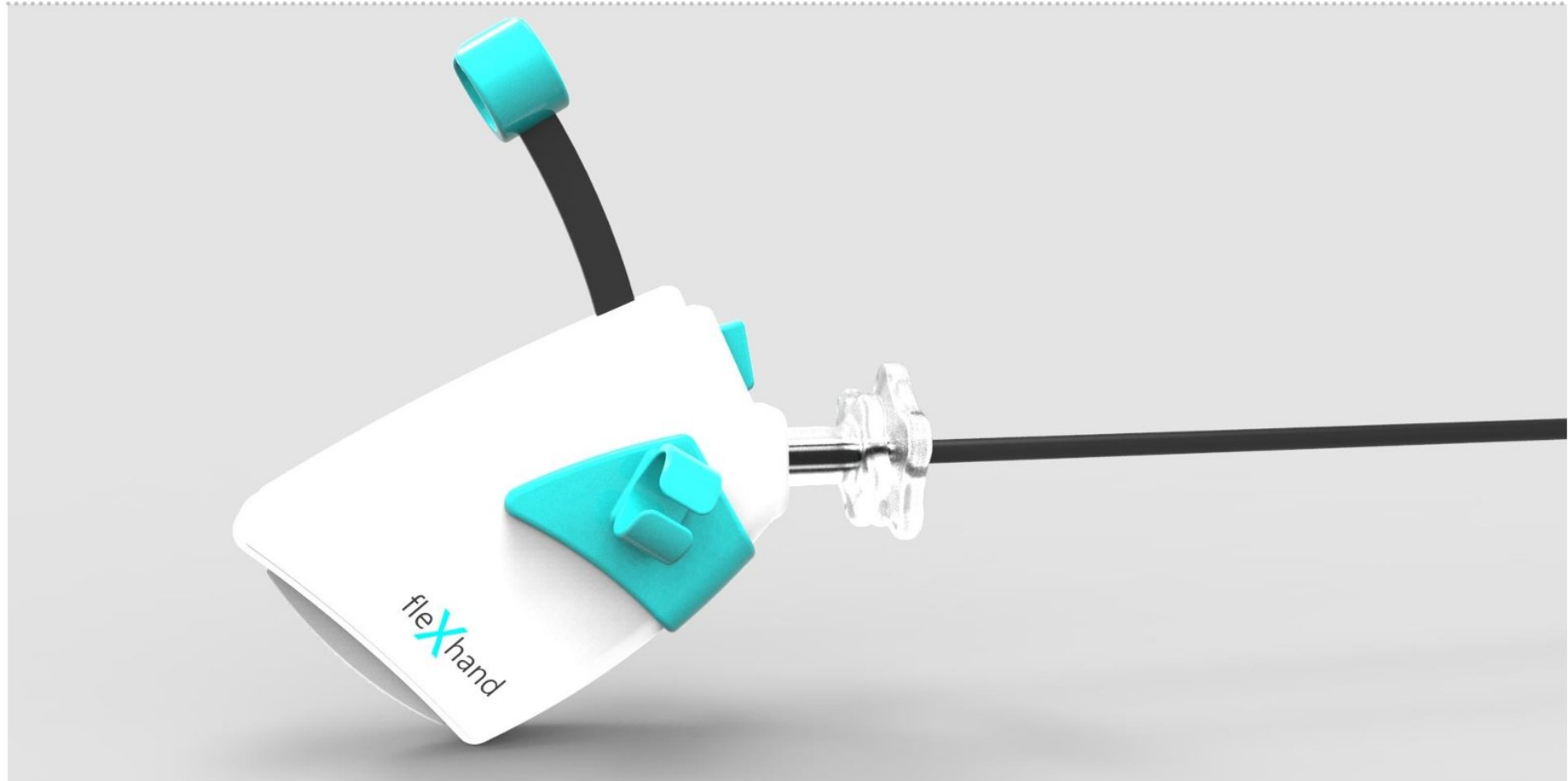
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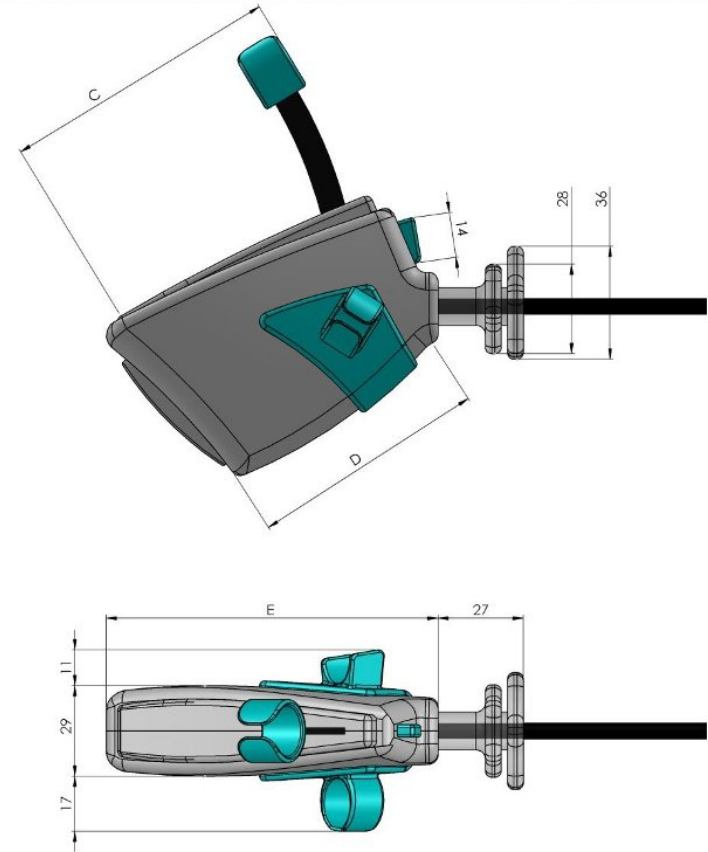
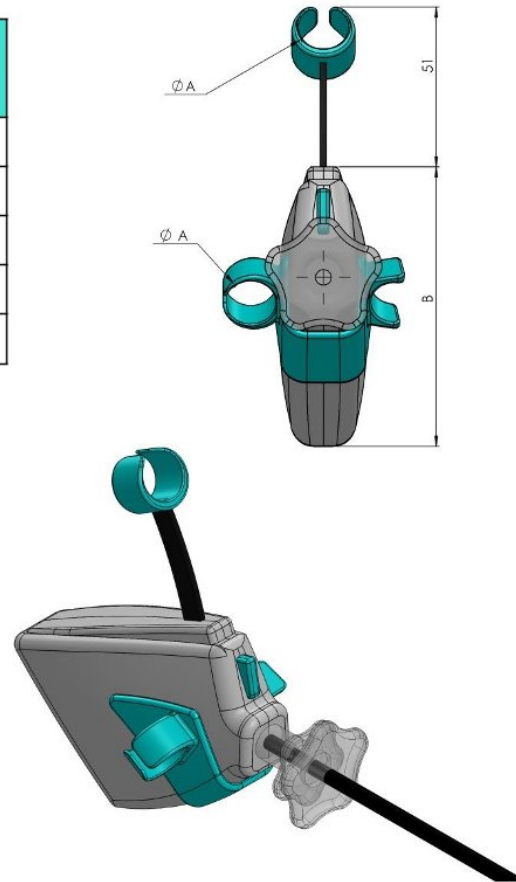
fleXhand

FINAL CONCEPT

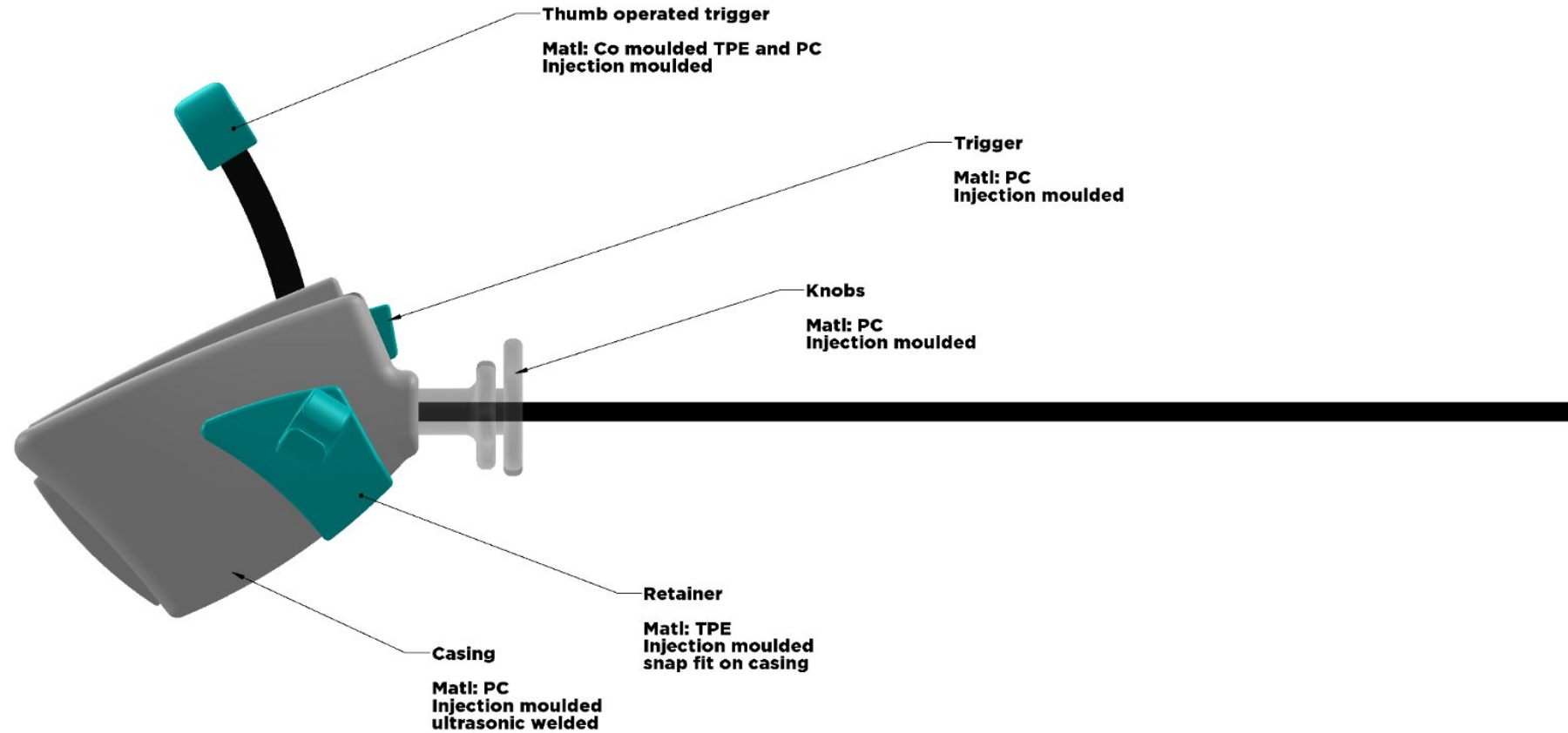


FINAL CONCEPT

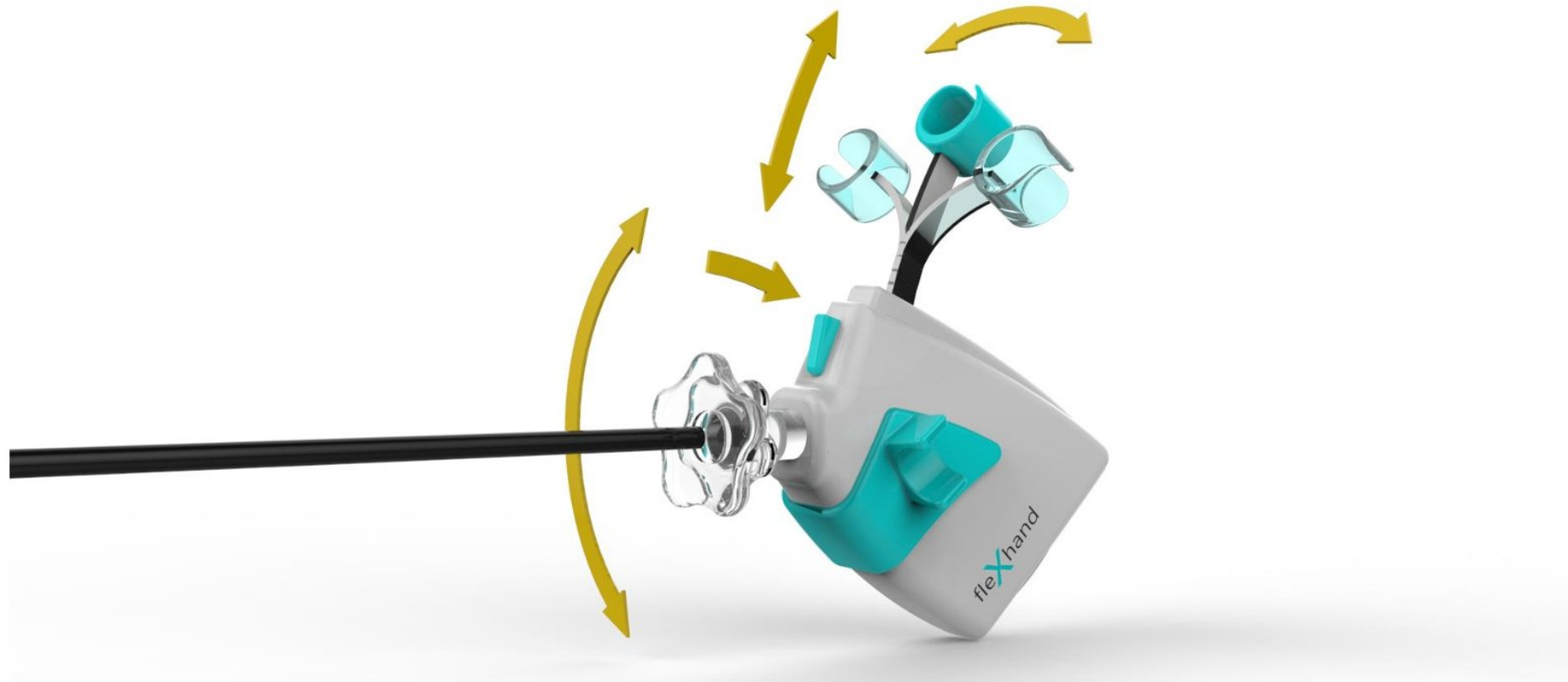
Dim. (percentile)	Small (15 th)	Medium (50 th)	Large (85 th)
A	12.5	14	16
B	71	79	87
C	86	98	110
D	71	79	87
E	89	97	105



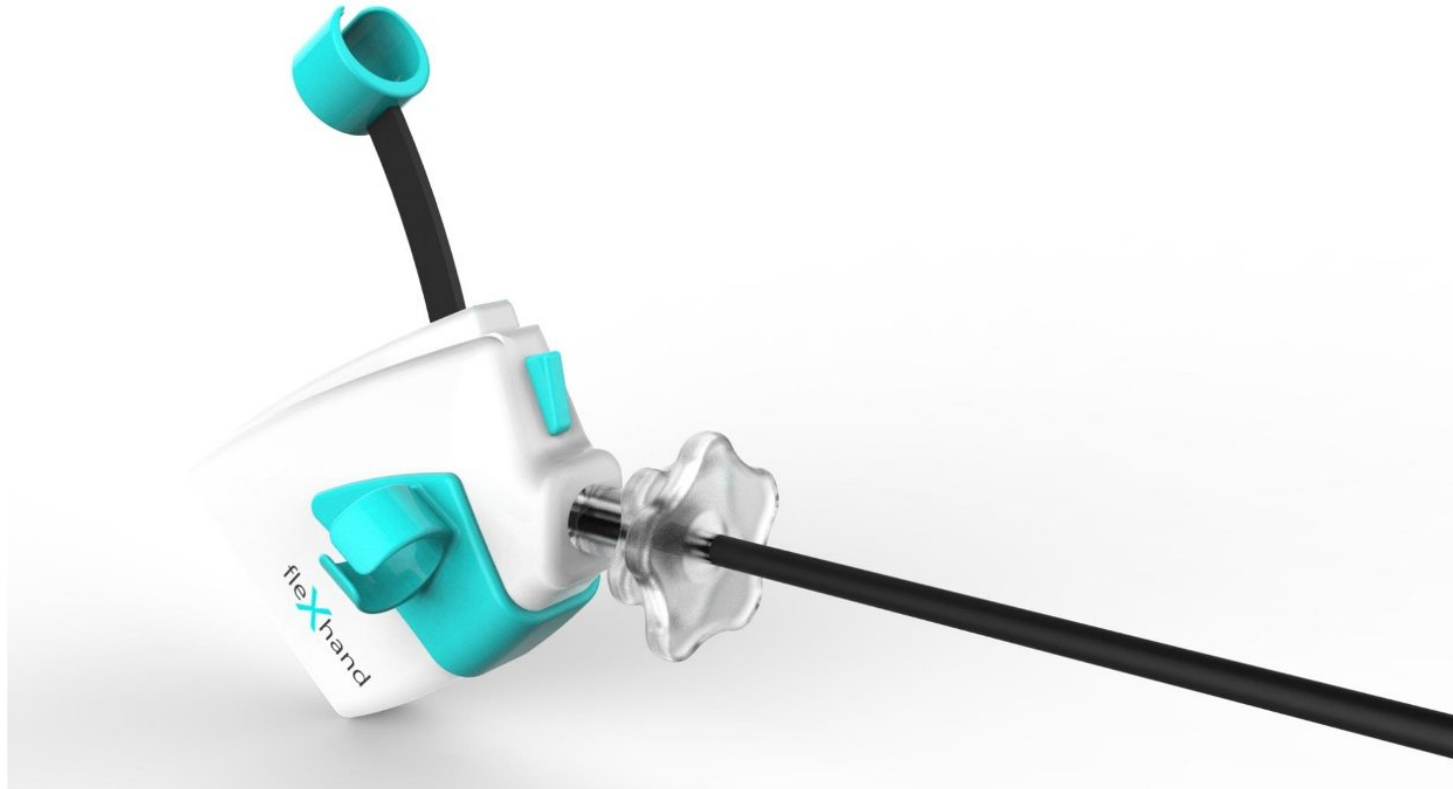
FINAL CONCEPT



FINAL CONCEPT



FINAL CONCEPT



VALUE PROPOSITION | #1

Flexible thumb trigger, allowing right as well as left handed operation.

VALUE PROPOSITION | #2

Thumb and index finger retainers ensure grip while allowing surgeon to relax the fingers.

VALUE PROPOSITION | #3

Index finger retainer also has a stand which ensures that the tip of the device does not touch the surgical tray when not in use.

VALUE PROPOSITION | #4

Simplified mechanism for ease of manufacture, assembly and maintenance.

VALUE PROPOSITION | #5

The cable goes under the device, causing less hindrance

MARKET SIZING

Device will be placed in same price bracket as other laparoscopic devices

The target market also remains the same as that of the current devices in the market

According to directory of hospitals in India:

Total no of hospitals = 65,054 (private +state)

COMMERCIALIZATION PROCESS

Design and IP protection

Engineering, testing and validation, licencing

Manufacturing and deployment strategy

Agreements with distributors and hospitals along with marketing

fin.