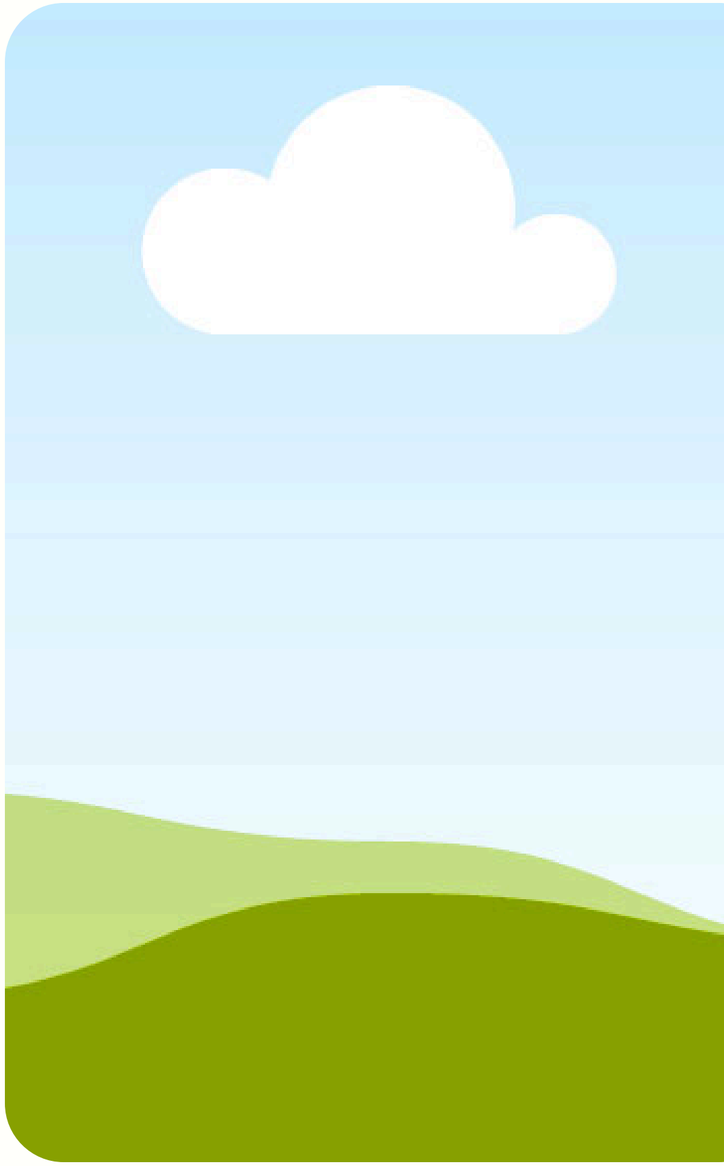
Dentistry Sanitization

By: Michael Samuel Dela Cruz



INTRODUCTION
(EMPATHIZE)

Important talking points

- Oral Health
- Problem with Dental Packaging
- UV-C Light
- Final Design
- Product Renders

Promblem

The widespread use of dental instruments entail plastic waste

- Packaging material for dental tools contain plastic, antimicrobial coating and medical paper, which are difficult to dispose.
- A minimum average of **22.3 grams** of plastic for each patient
- A average clinic invest more than **2000 units** of disposable plastic annually.

CURRENT PROCESS OF REUSABLE DENTAL EQUIPMENT

- Dental Instruments are imported from outside sources, and come in difficult to dispose packaging .
- Once used, instruments are sent back to sourced facility
- Cleaned and repackaged and sent back to dental clinics

“26 SUBJECT TO SECTION 37, NO PERSON SHALL IMPORT OR SELL A CLASS II, III OR IV MEDICAL DEVICE UNLESS THE MANUFACTURER OF THE DEVICE HOLDS A LICENSE IN RESPECT OF THAT DEVICE OR, IF THE MEDICAL DEVICE HAS BEEN SUBJECTED TO A CHANGE DESCRIBED IN SECTION 34, AN AMENDED MEDICAL DEVICE LICENSE.”

Factors to Consider for Redesign

SUSTAINABLE

Consider material choice, that waste is reduced

- Recyclable Materials
- Individual components for easy disposal

EASE OF USE

Allow the instrument to be easily brought to patient site

- Small enough and ease of use
- Involve some sort of encasement for instruments

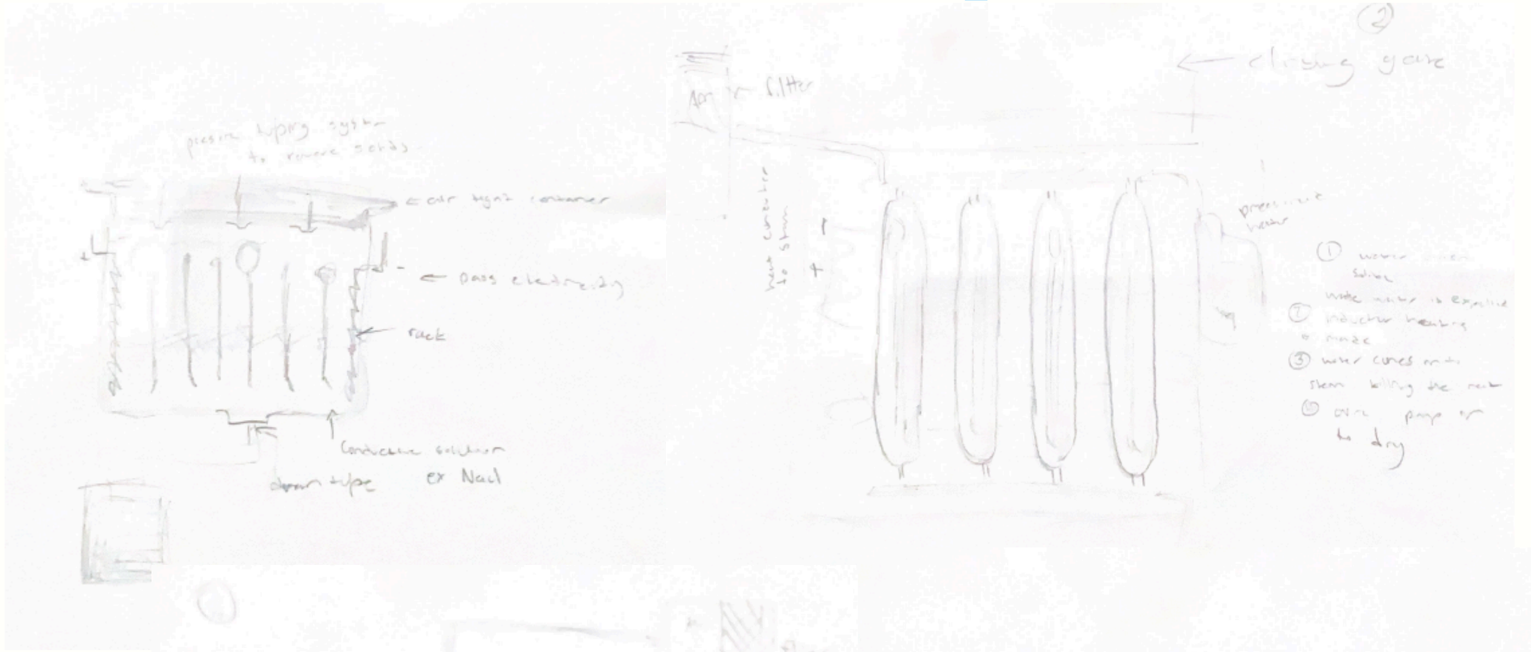
SANITIZE

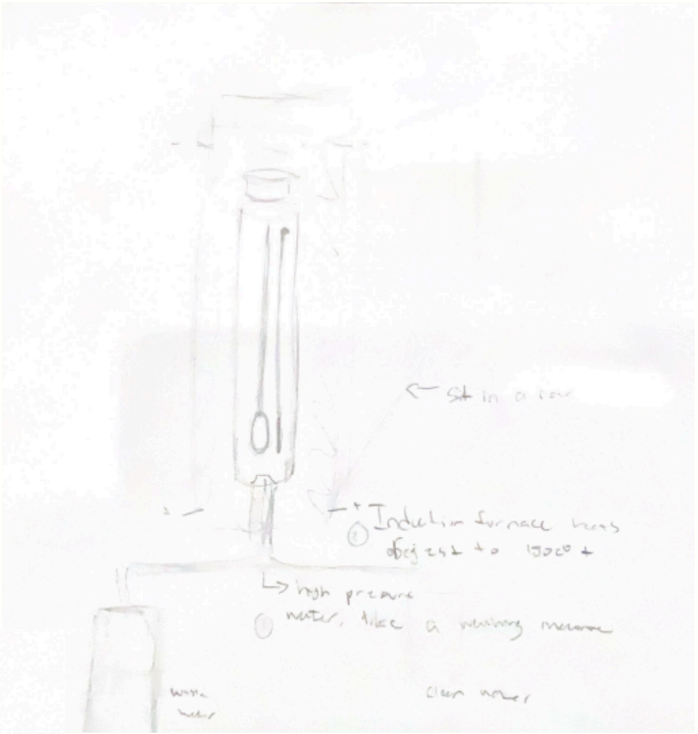
Instrument should still be sanitize to a degree that it safe enough to be used for regular dental visits.

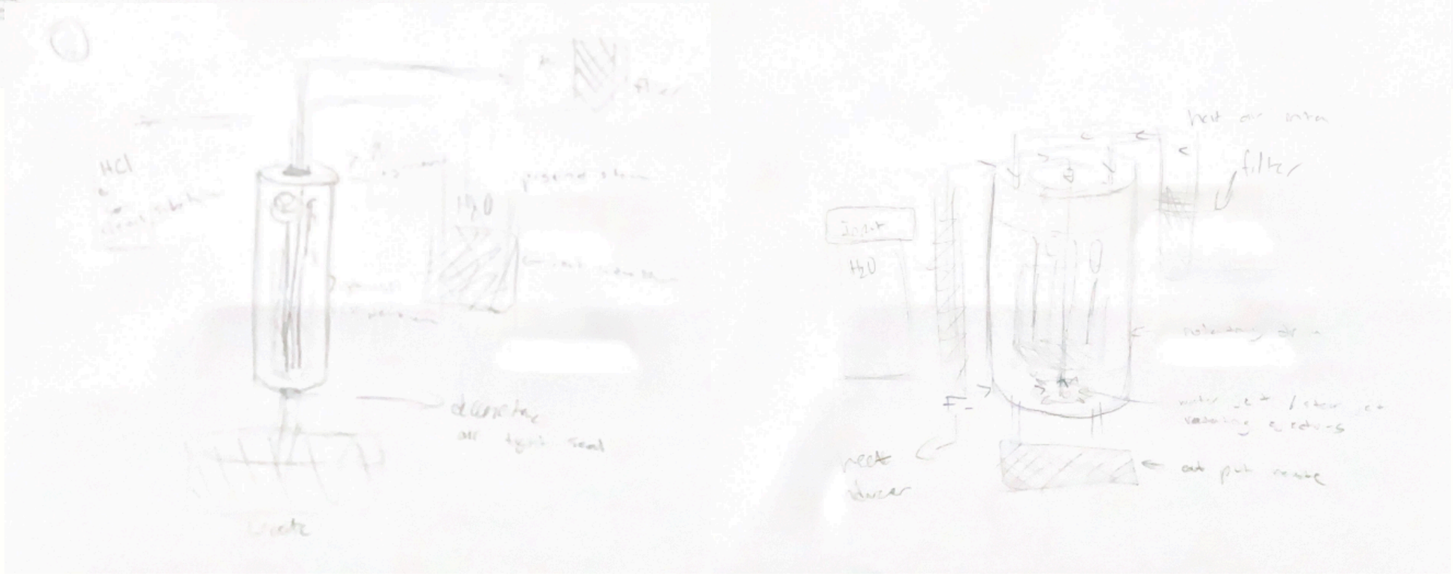
- Exterminate any harmful pathogens
- Methods should reflect common ways of sanitation

Brainstorming

Initial concept







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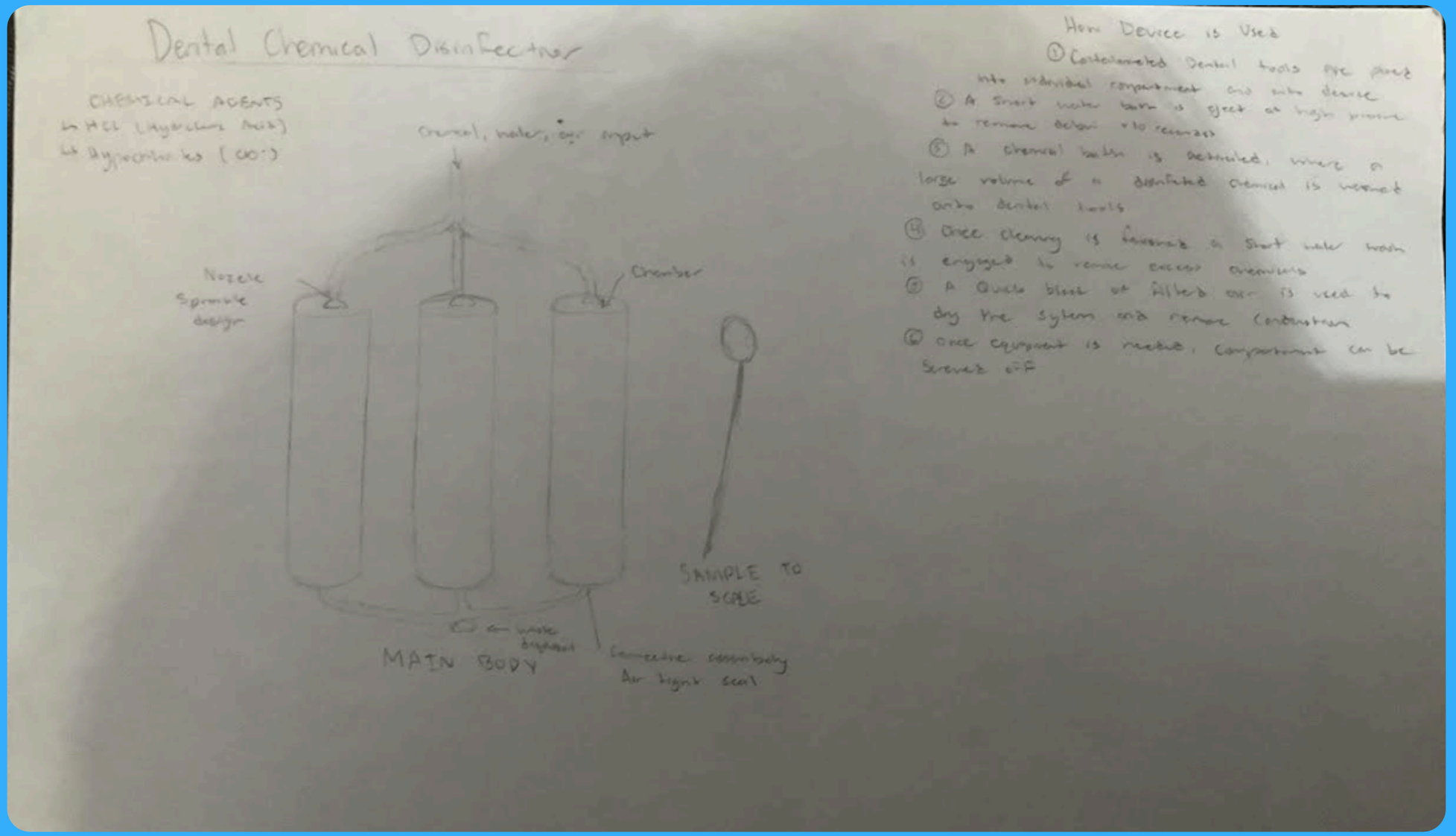

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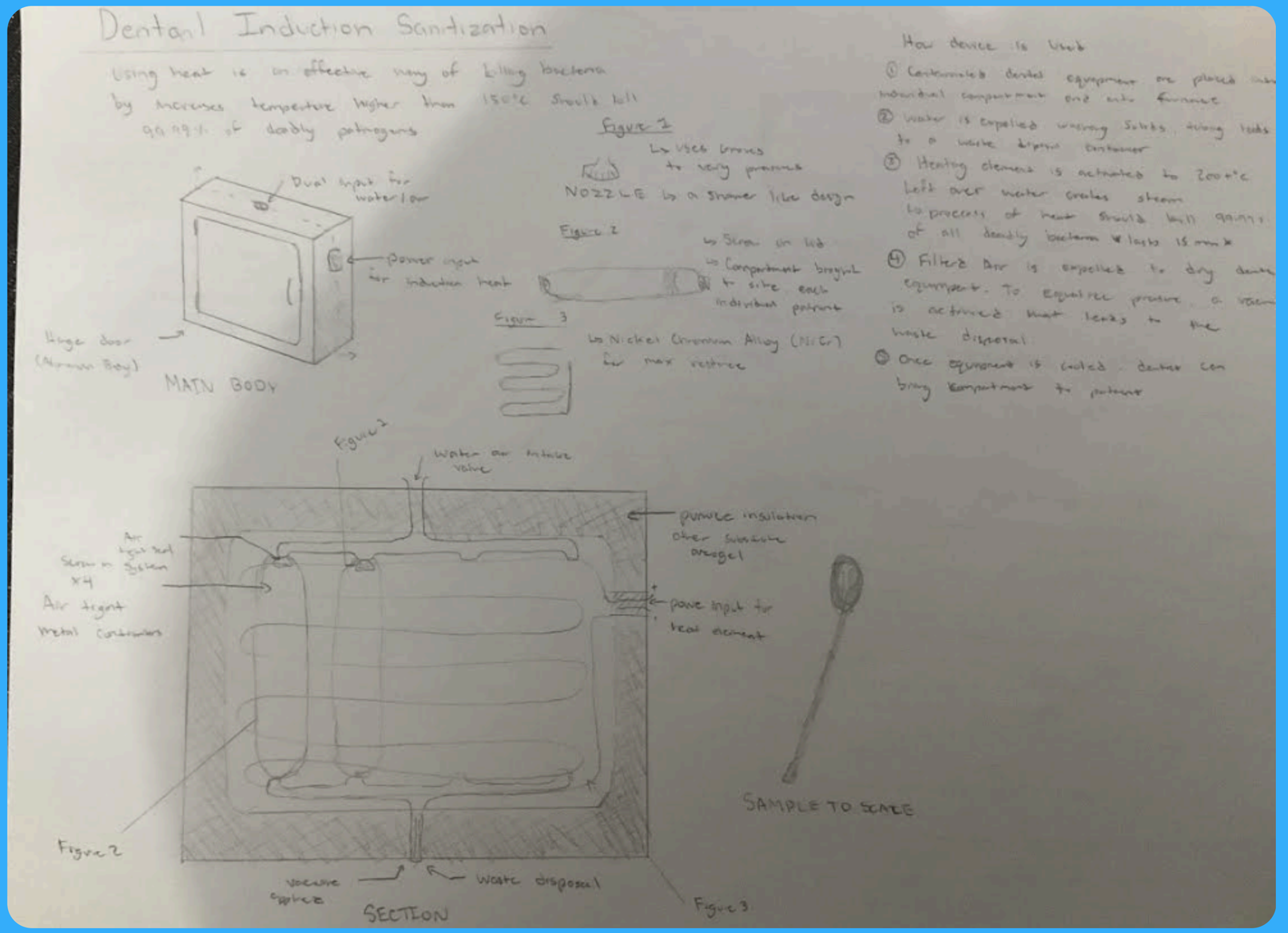

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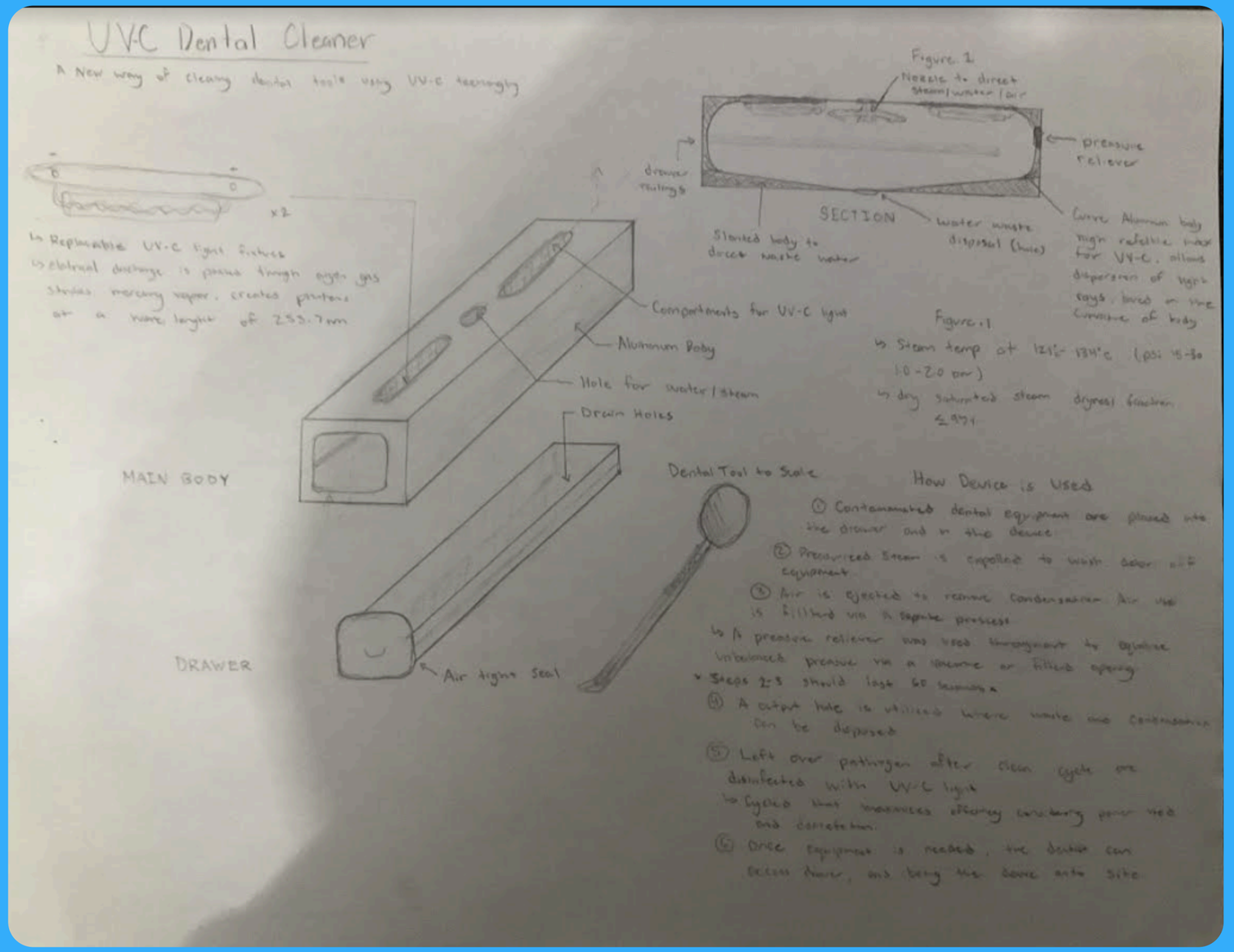


Factors for Design

Ways to Sanitize

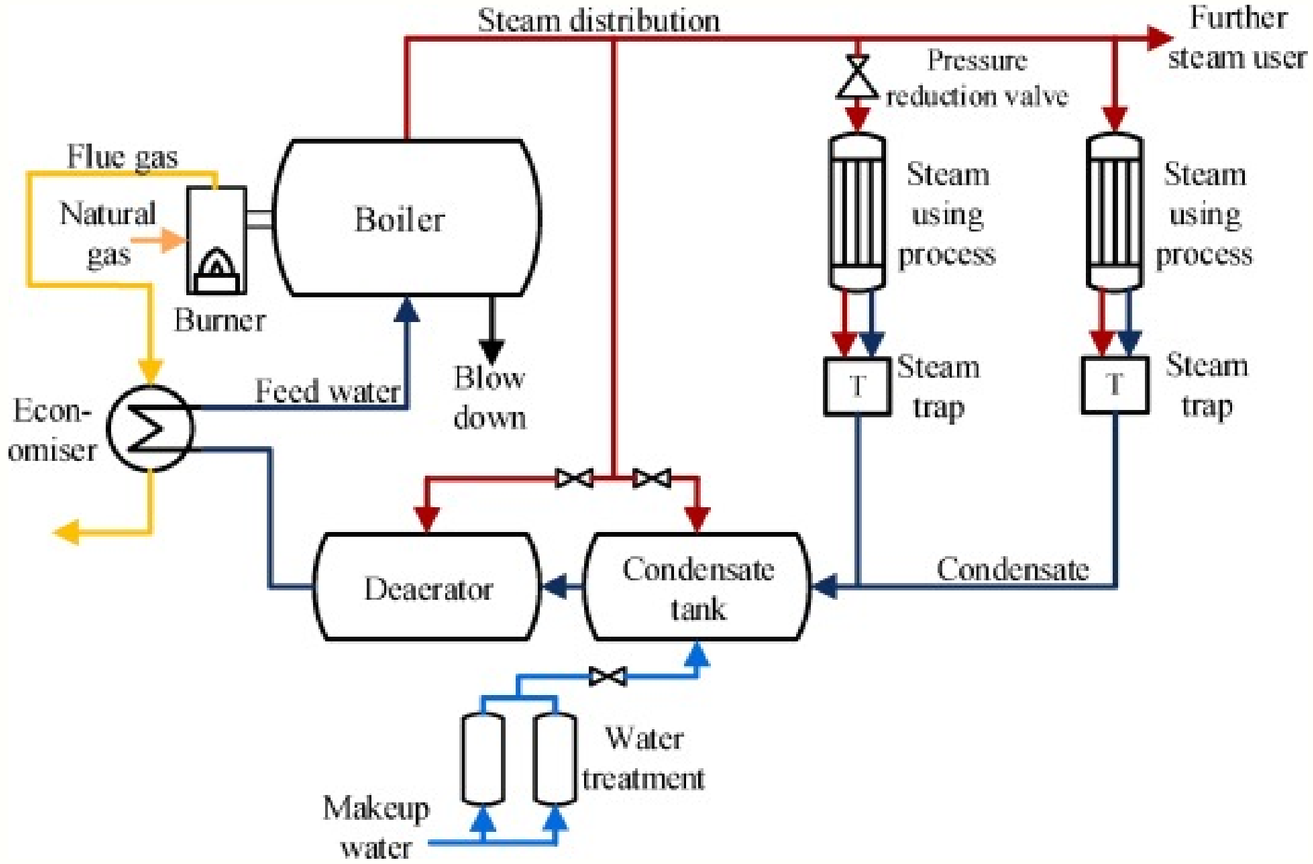
- UV-C
- Steam
- Water
- Acid
- Heat

General Design

- 1 part for external element are added, waste expelled
- 2 part compartment where instruments are placed

Steam

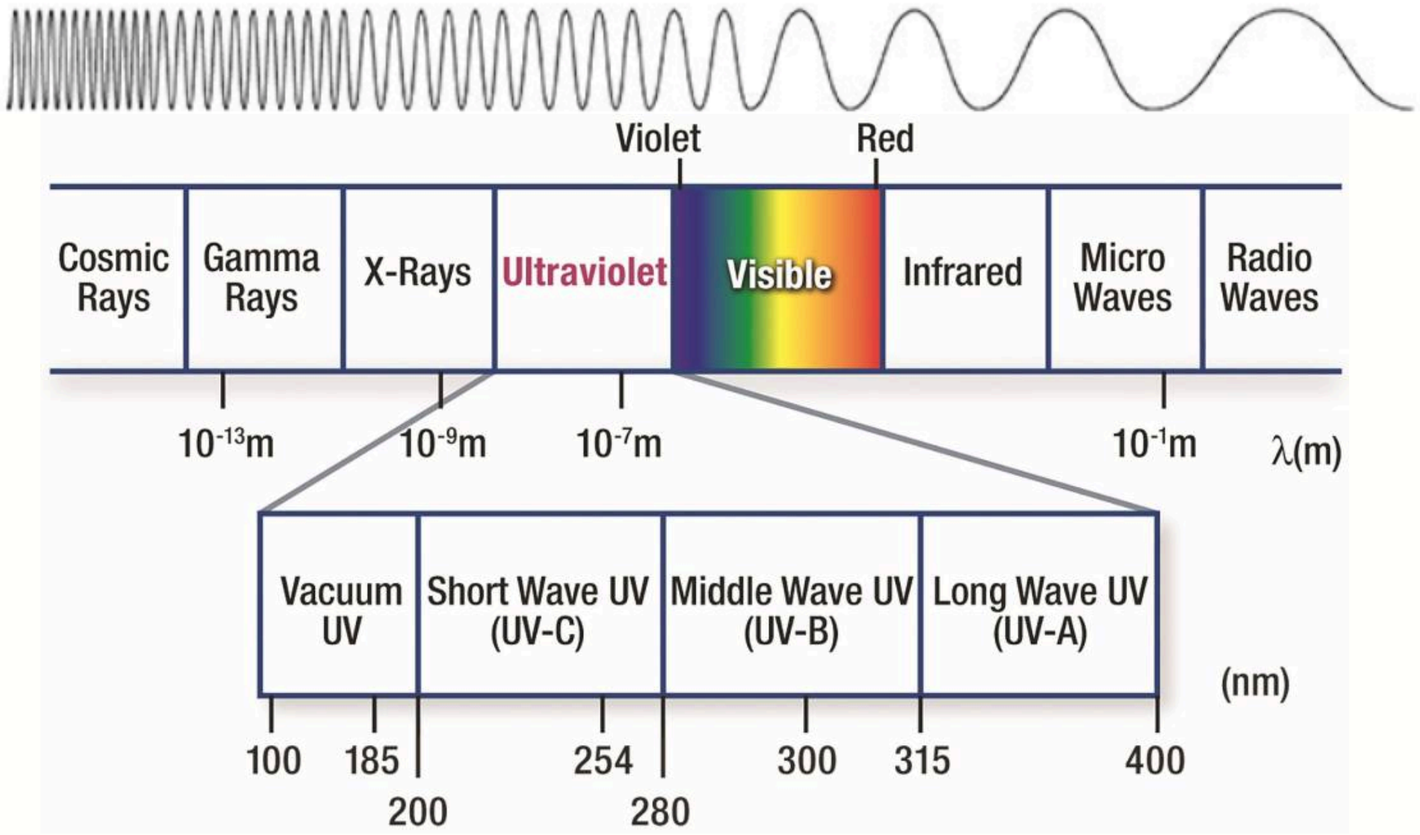
- Water vapor
- Recommended that steam should be expelled at 50psi
- Temperature of steam should be 130C enough of kill a majority of bacteria.
- Use this to remove solids



UV-C Lights

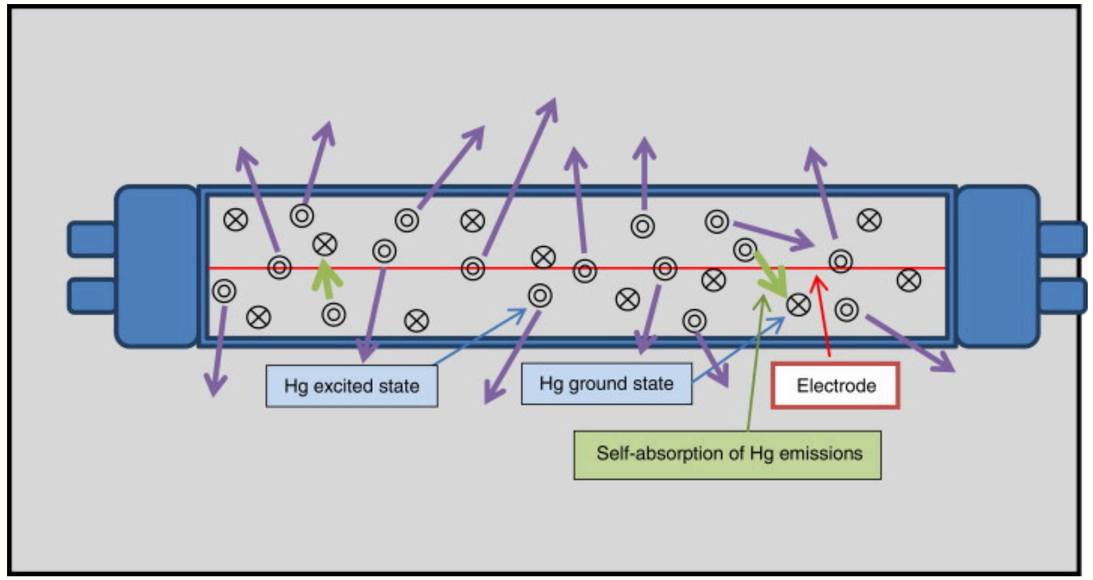
- UV-C (100 to 280 nm)
- Recognized for it powerful antimicrobial affects
- It commonly seen in lamps in hospitals

Electro Magnetic spectrum



UV-C Lights Production

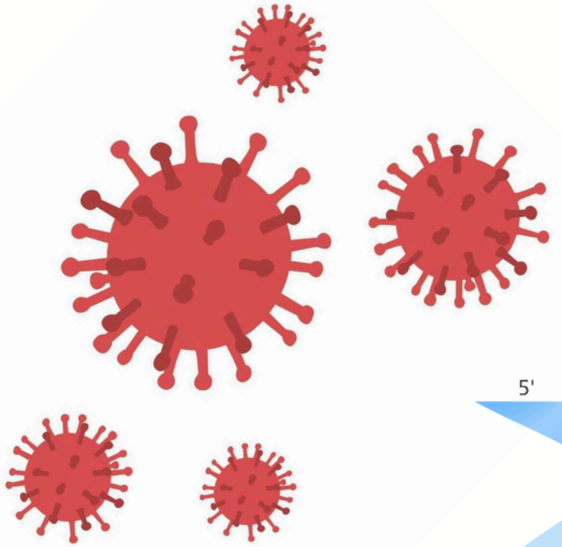
- The most effective and common way of producing UV-C light involves **mercury vapor**
- Electrical discharge causes electrons in mercury to jump orbits (excited)
- This makes mercury unstable so it will return to a ground state (stable)
- This process releases energy in form of photons (UV-C light).

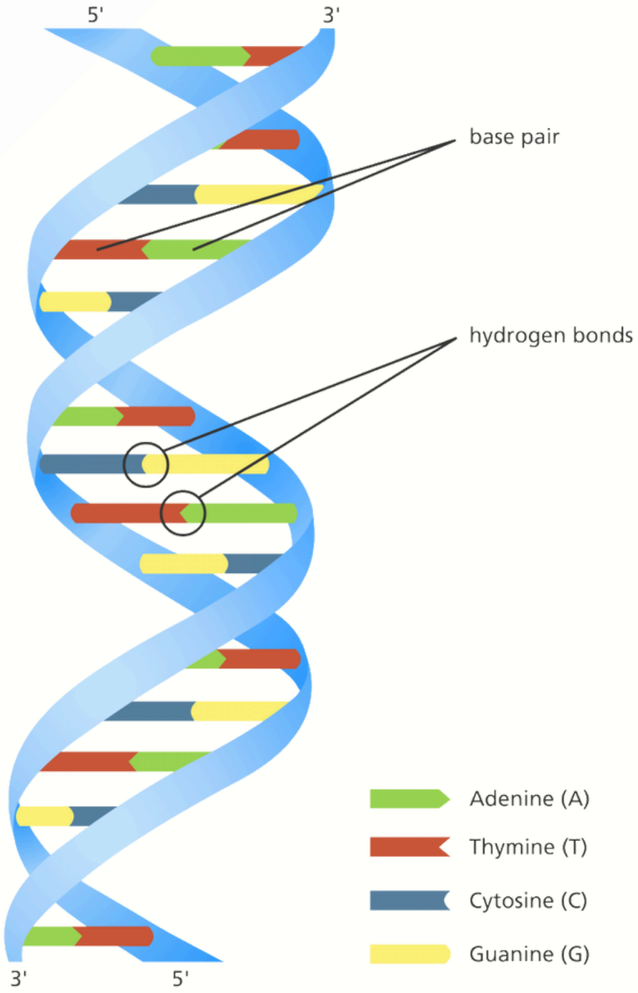


UV-C : DNA

- Pathogens are either multicellular or unicellular organisms
- To reproduce, they need information, DNA or RNA
- DNA is made from nucleotides (ACTG)

If DNA is disturbed it may not reproduce properly



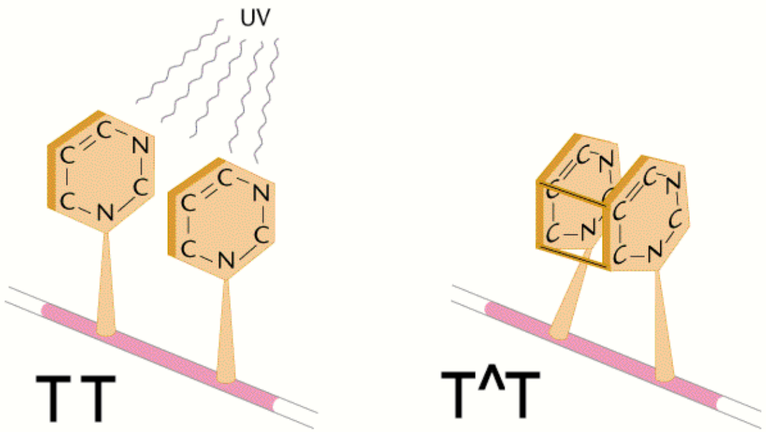


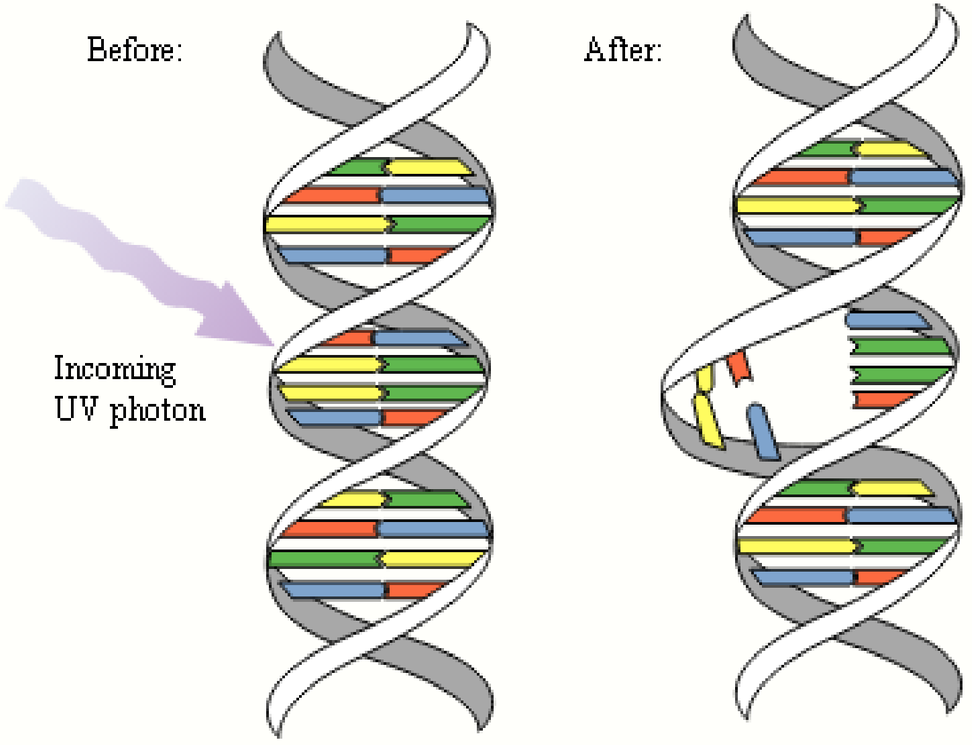
UV-C Killing Pathogens

- When UV-C is emitted, it is absorbed by the DNA
- This light energizes adjacent thymine pairs
- This creates a covalent bond between the two, then its respective guanine pair.

This is known as a **Thymine dimers**

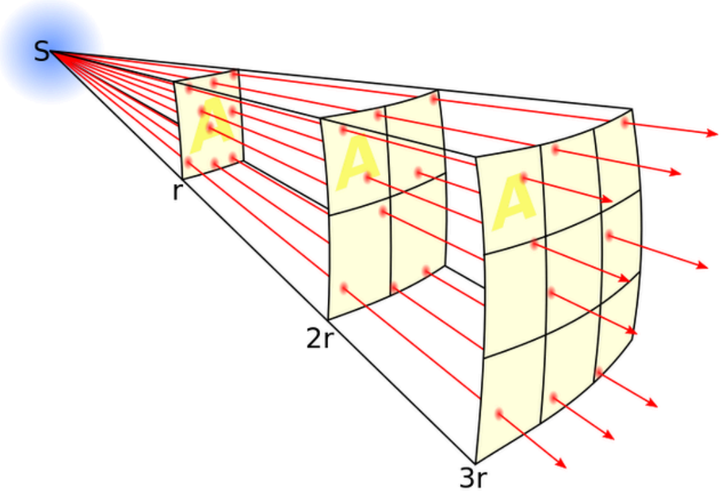
- <u>Thymine dimers prevents the DNA from replicating correctly, therefore the cell can’t reproduce</u>





UV-C : Measuring Effectiveness

- It is more effective if the light source is very close to the objects, for max intensity



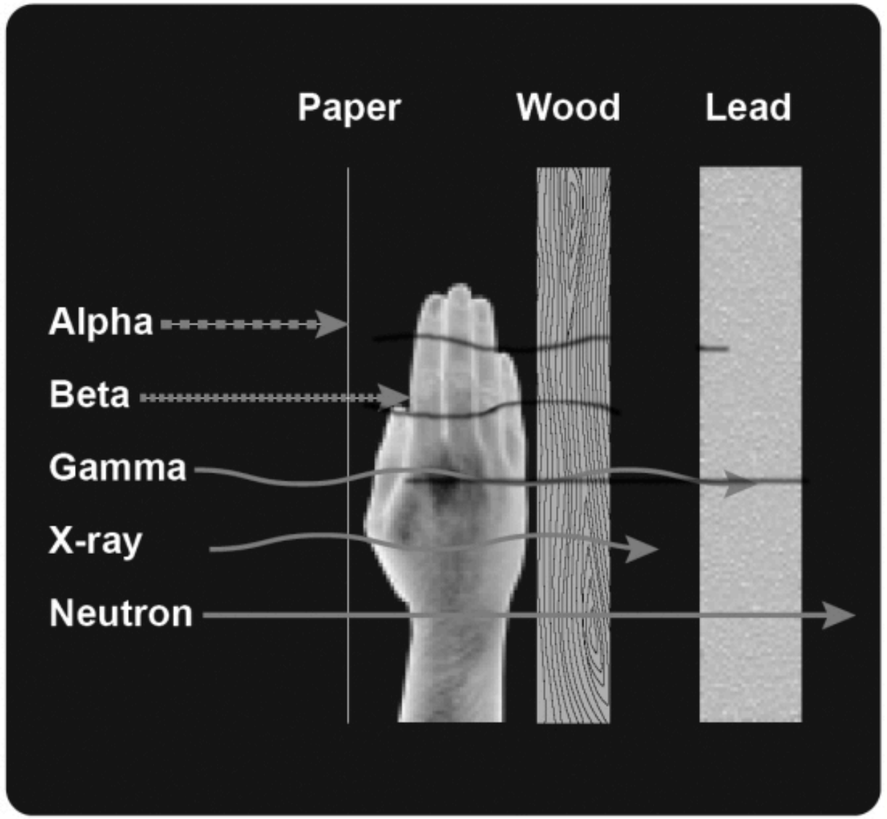
$$D = I \times T$$

- D = Dosage of the bacteria (mJ/cm^2) millijoules
- I = Intensity of the UVC light (mW/cm^2)
- T= time

Covid-19 has a Dosage of 22 mJ/cm^2

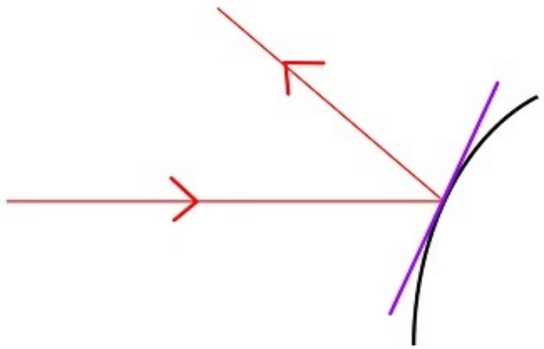
UV-C : Health Risks

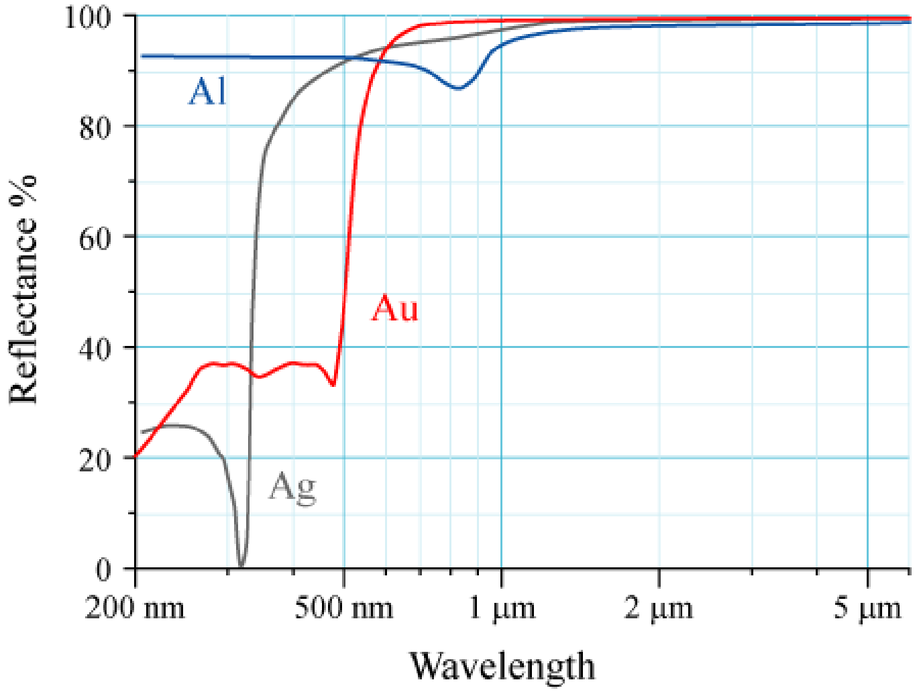
- UV-C light is nonionizing meaning it doesn't have enough energy to remove an electron.
- Upon for prolong exposure causes, burns, increased risk of cancer
- Light can be on with out the absences of unwanted contact.



Aluminum Body

- Aluminum is recyclable, technical nutrient
- Aluminum has a high refractivity for all wavelength of light
- Reflect ray around an enclosed body
- Curved objects allow for more disbursed rays

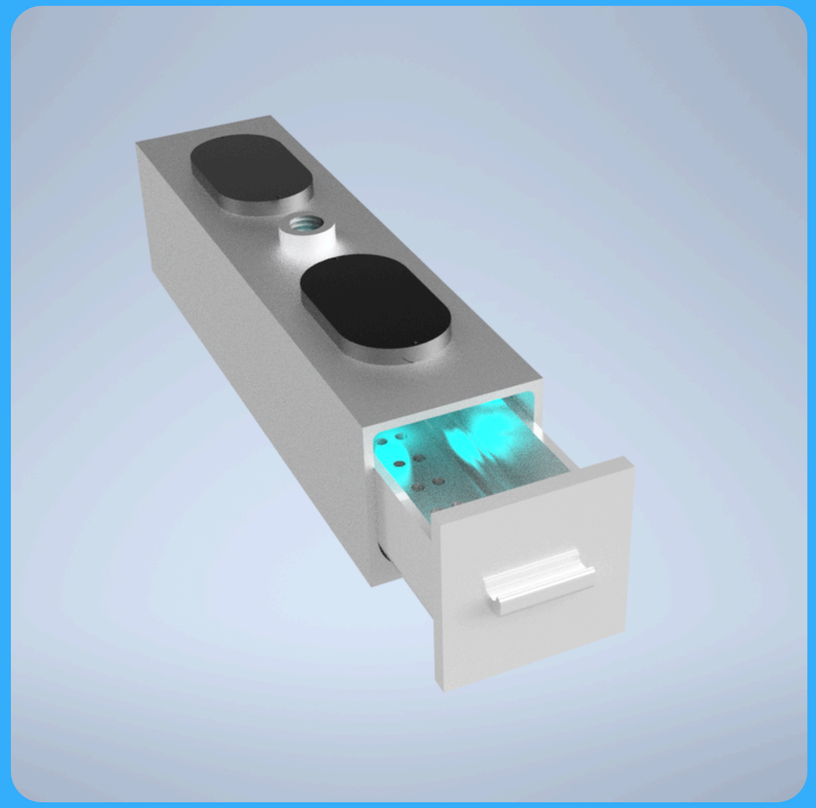


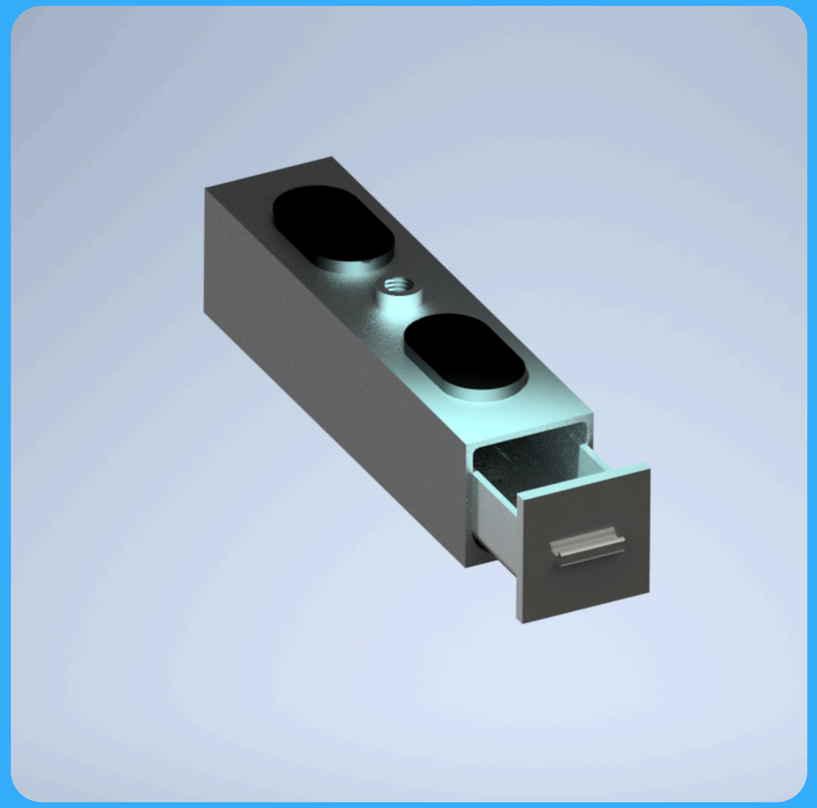


THESIS: ULTIMATELY, THROUGH UV-C TECHNOLOGY AND A SEALED STERILE ENVIRONMENT, CAN BE MORE SUSTAINABLE THAN CURRENT DENTAL SANITATION PROCESSES.

FINAL INVENTOR RENDERS

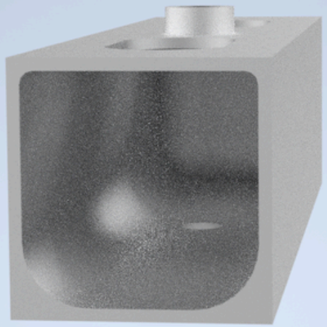
UV-C MEDICAL INTRUMENT CLEANER

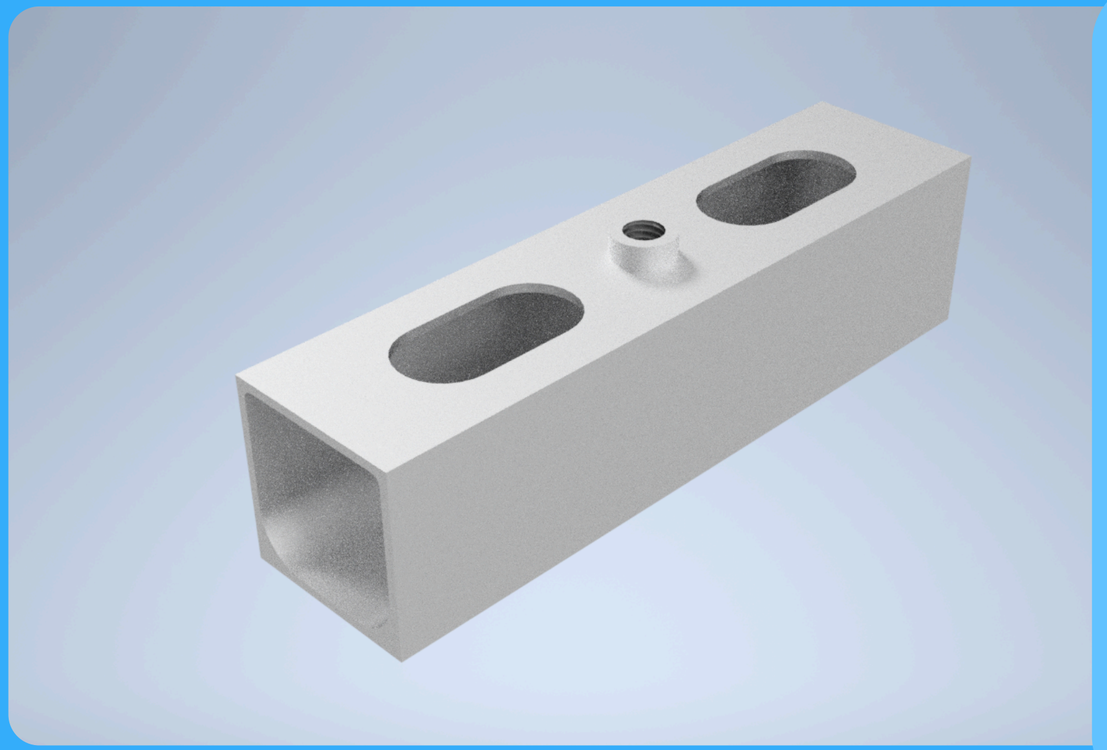




- Dimensions:
2‘‘x 2‘‘x 8‘‘
- 3 main components

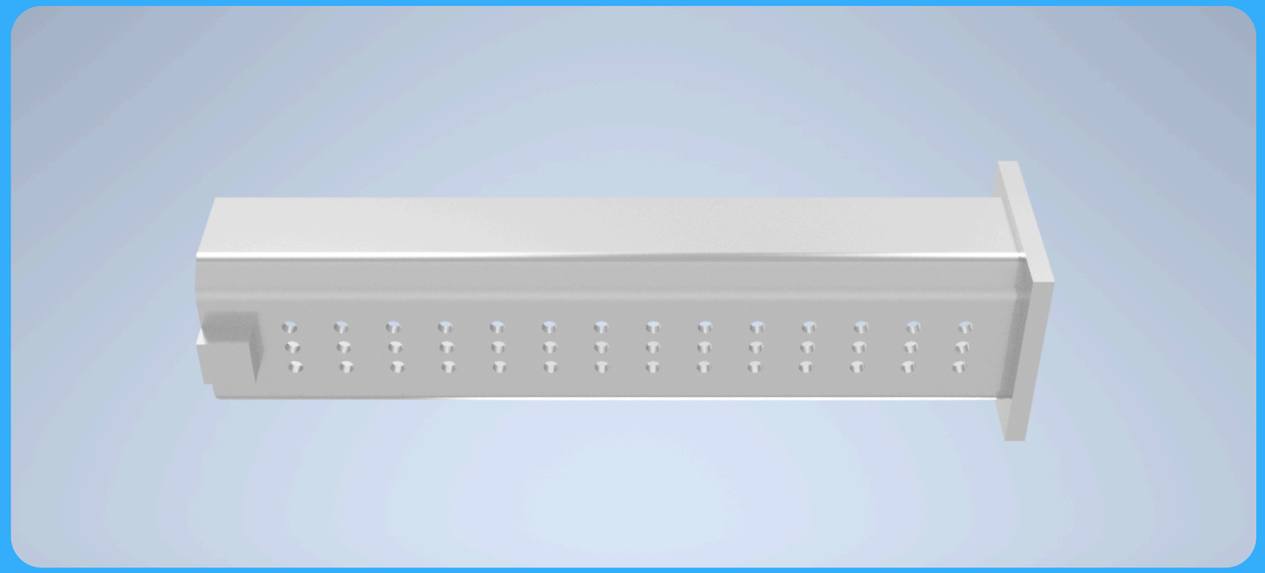
BODY





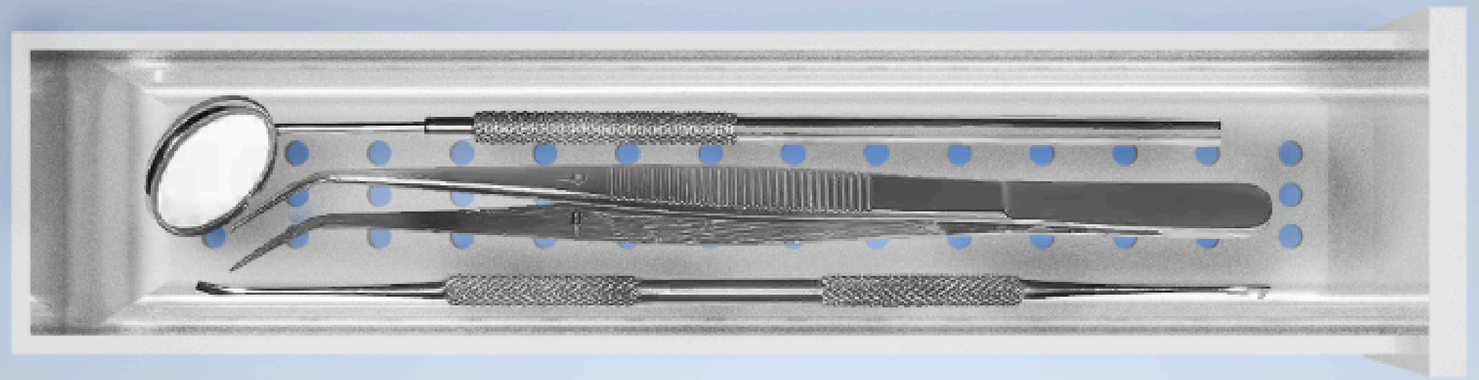
- Curved interior body to allow ease for drainage
- 2 holes for input of steam and output of waste
- 2 rectangular opening for UV-C lights which have the ability to be replaced

DRAWER



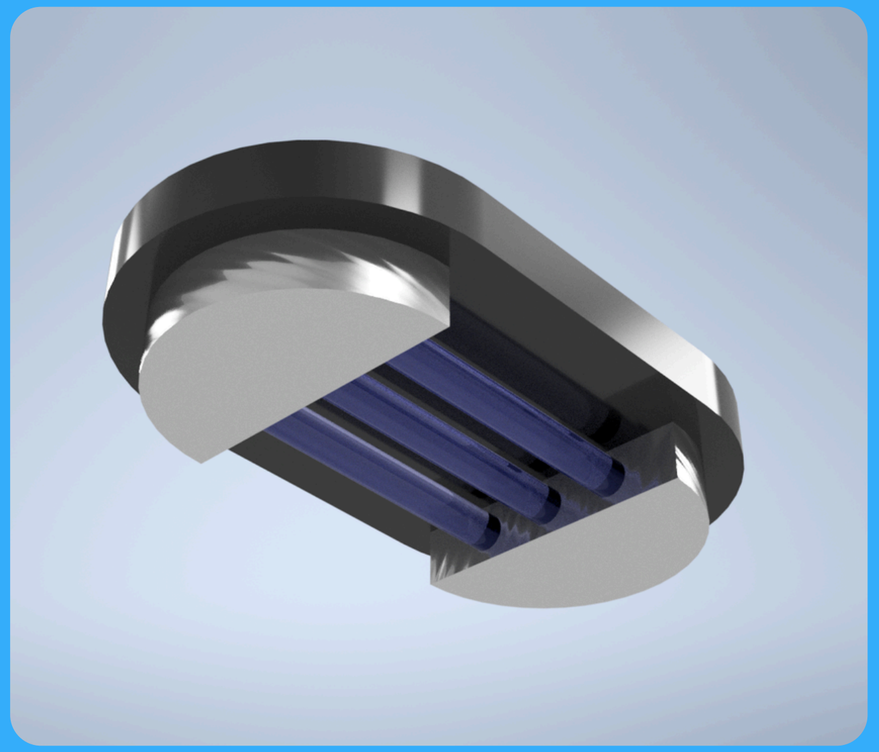
- Drawer stability
- Drain holes
- Slides in with air tight seal
- Handle for ease of use

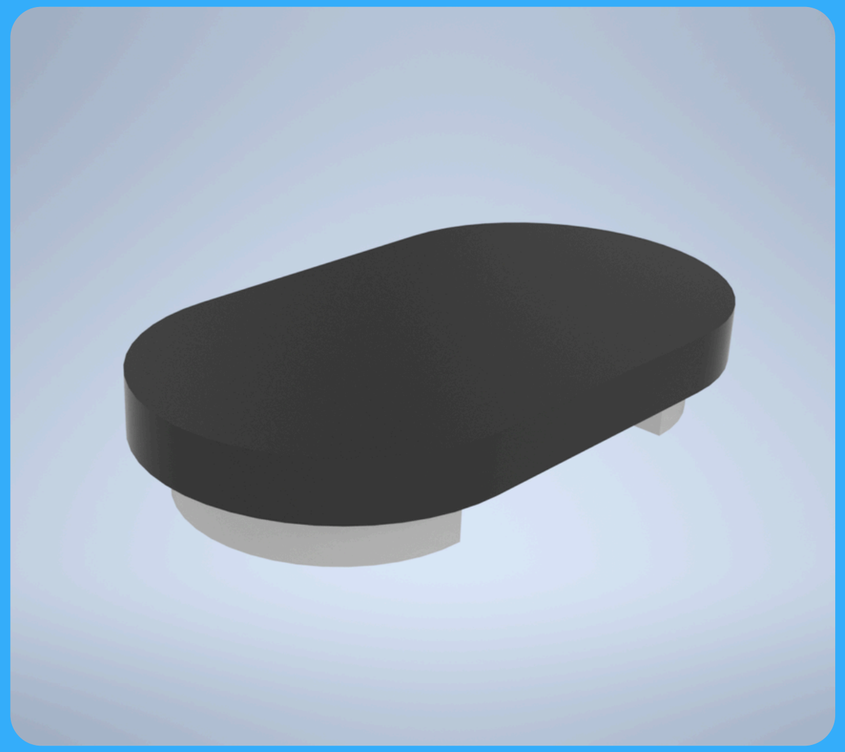
TOOLS FOR SCALE



- Curved body to prevent water pool up
- Fit dental tools up to 7‘‘

LIGHTS





- 2 UV-C lights each with 3 bulbs
- Replaceable with a lithium ion battery
- Disposed separately

CONCLUSION

- Applied to other medical uses not in the dentistry
- Sized up to fit different needs
- simplicity design allows for mass production

Resources

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