



Dental Handpiece Scope



BME
Design

Overview: The Dental Scope

Client: Dr. Donald Tipple
Advisor: Dr. Peter Favreau

Team Leader: Jonah Mudge
BWIG and Communicator:
Lucas Ratajczyk
BPAG: Nur Saidin
BSAC: Tirhas Dempsey

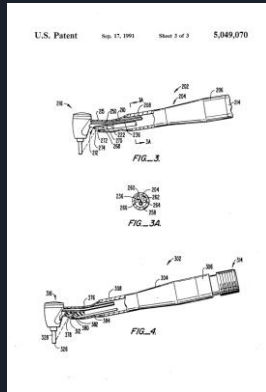




Problem Statement

- During procedures such as crown replacement, seeing the operation site can be challenging for dental professionals
 - Requires use of mirror, intuition
 - Challenging with small oral cavities
 - Need video feed device able to differentiate decay, dentin, enamel
- Possible solution:
 - Live feed to video screen
 - Color filters to help differentiate between tissue
 - Dentin (yellow), Enamel (gray)
 - Viewing device able to operate despite tooth debris and saliva

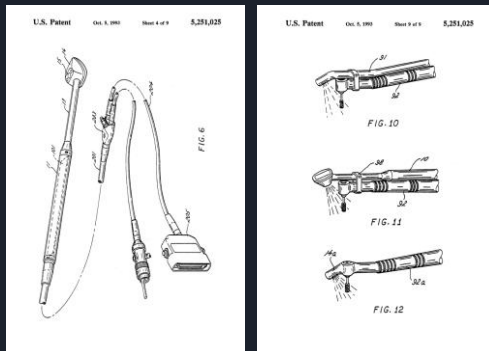
Background



Dental drill integral camera and optics (US5049070A)

<https://www.p2i.com/>

A very multi-functional, nano-technology based solution used to give electronics a waterproof coating. [1]



Electronic video dental camera

(US5251025A)



牙科高速涡轮手机
LED E-GENERATOR HIGH SPEED HANDPIECE

产品描述: 风光高速手机, 3孔喷水, 防回吸
手机接口气压: 206-231Kpa(2.1-2.35kgf/cm²)
综合治疗机压力表气压: 277-316Kpa(2.8-3.2kgf/cm²)
水压: 198Kpa(2kg)
转速: 300000-320000rpm
机头高度: 13.02mm
机头直径: 12.5mm
夹针方式: 按压式
适用车针: 1.59mm-1.6mmx21mm-23mm(直径x长度)
噪音: < 70dB

Product Description: LED E-Generator high speed handpiece.
triple water spray. Single water spray handpiece
interface air pressure of HP: 206-231Kpa(2.1-2.35kgf/cm²)
Air pressure at the gauge in the dental unit: 277-316Kpa(2.8-3.2kgf/cm²)
Water pressure: 198Kpa(2kg)
Speed: 300,000-320,000rpm
Head height: 13.02mm
Head diameter: 12.5mm
Clamped way: push button
Applicable burs: 1.59mm-1.6mmx21mm-23mm(diameterx Length)
Noise: < 70dB

WS-B208

https://www.alibaba.com/product-detail/turbine-dental-handpiece-high-speed-dental_60435825385.html

An example of a dental drill with drill head dimensions (~13 mm tall and 12.5 mm in diameter) [3]

Background (Continued)



81-85 series warming filter [4]



<https://opencv.org/>

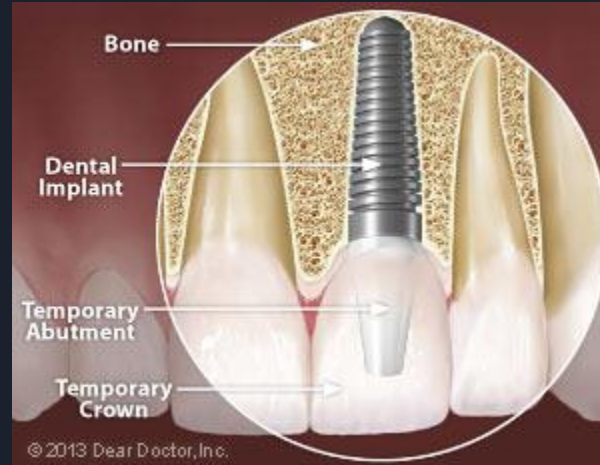


8.5 x 11.3 mm 1080p video
(30fps) [5]

Background (continued)



Crown implant/ bridge surgery
[6]



PDS

- Create a small uninvasive camera to mount on top of a dental, drilling handpiece in order to make hard-to-see teeth visible.
- The main focus of the project is to create a functioning camera mounted on the dental drill.



<http://www.ridgeline dental.com/index.asp?N=dentist-Eugene-OR-Dental-Technology&C=761&P=13860>

- The device can be made of hard plastic, or stainless steel (hypoallergenic).
- The camera will need to be waterproof and impact proof.
- The camera needs to be able to project a live video feed onto a TV screen.
- The camera and surrounding equipment needs to be able to be put into a human mouth without causing harm to the patient or the camera.

Previous Design

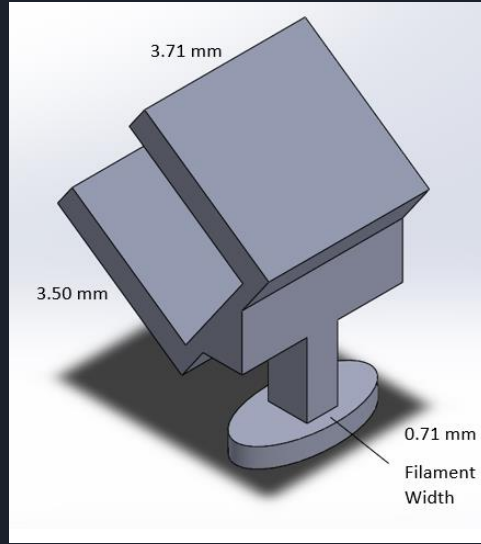
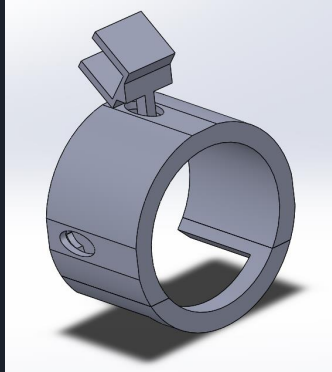
Some successes...

And some failures.

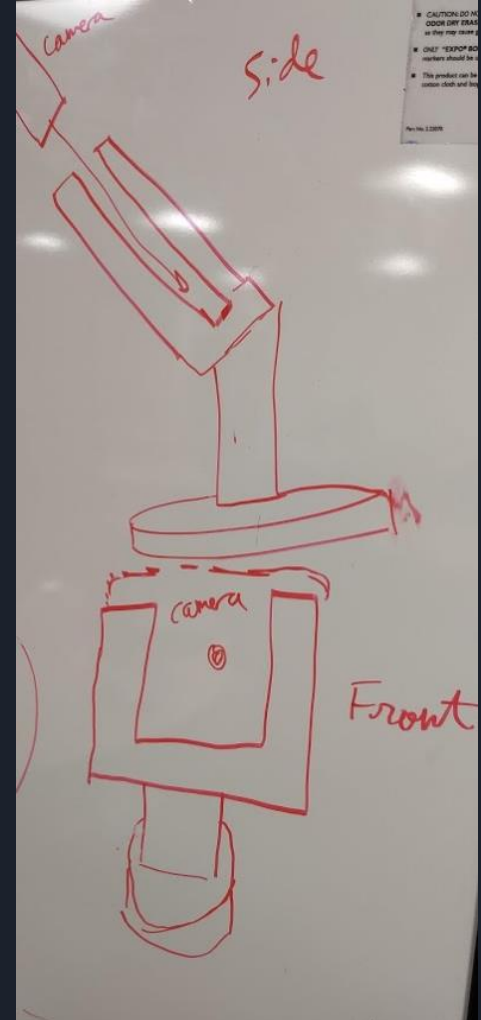
Glued on due to
stem failure



Design 1



Previous design



Strength

2

Hypoallergenic

1

Cost

2

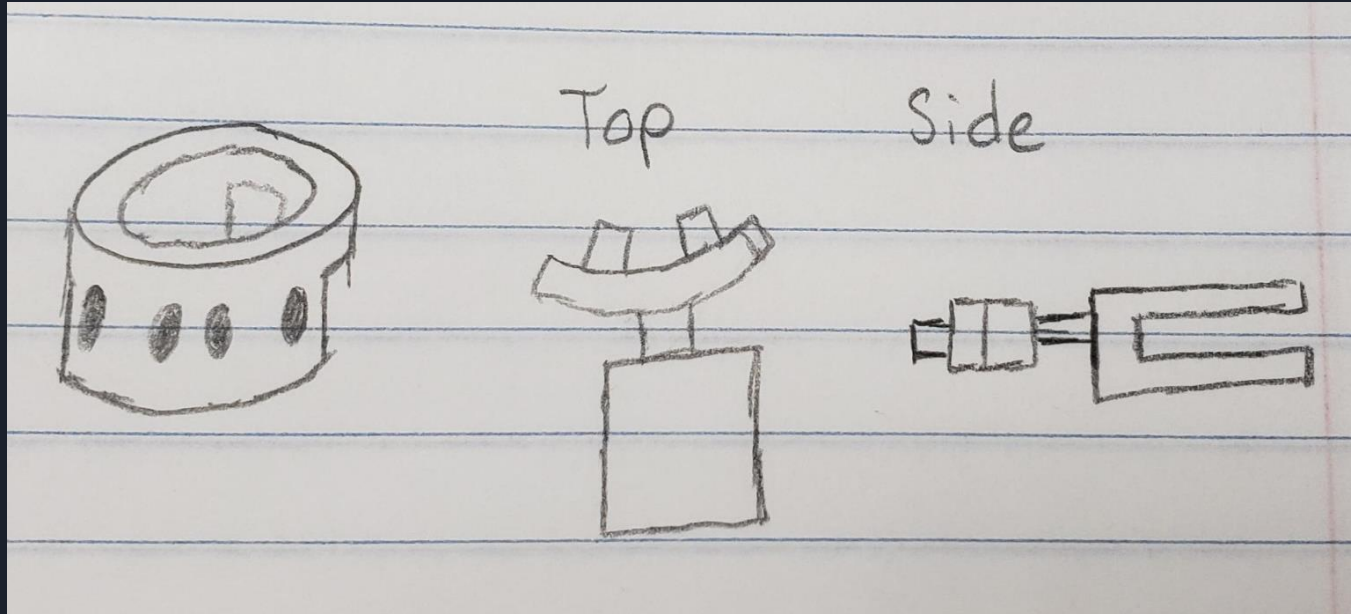
Stability

2

Maneuverability

1

Design 2



Strength
1

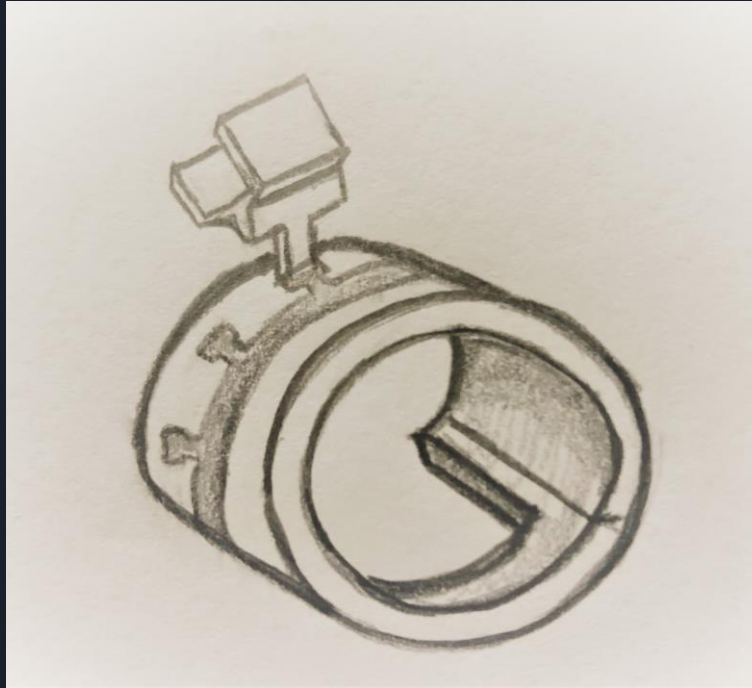
Hypoallergenic
3

Cost
2

Stability
2

Maneuverability
3

Design 3



Strength

2

Stability

Hypoallergenic

3

Maneuverability

1

Cost

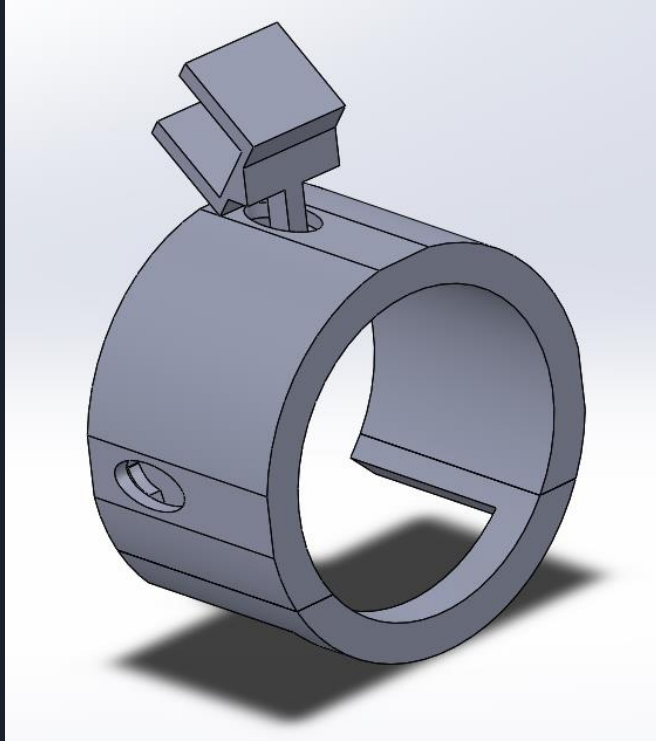
3

1

Design Matrix

Criteria (weight)	Design 1 Lucas	Design 2 Jonah	Design 3 Tirhas
Strength (25)	5/5 (25)	3/5 (15)	3/5 (15)
Hypoallergenic (20)	3/5 (12)	3/5 (12)	1/5 (4)
Cost (10)	3/5 (6)	5/5 (10)	1/5 (2)
Stability (25)	1/5 (5)	5/5 (25)	5/5 (25)
Maneuverability (20)	1/5 (4)	3/5 (12)	5/5 (20)
Total (100)	54	74	66

Final Design



Design 1 SolidWorks Concept

- 3D printed from plastic (possibly single use)
- More robust stem for improved stability
- Modular for easy attachment/removal



Future Work

- Fabricate a prototype of the new final design
- Improve the wiring scheme
 - Extend wire range
- Enhance the user interface and implement image contrast enhancers
- Make a version of the prototype that has the camera and wiring integrated into the drill that can be marketed to dentists
- Integrate a 3D scanner that can be used for CAD/CAM Dentistry (same-day crowns)
- Conduct surveys with real dentists participating in product trials



References

[1] "Global Leader in Liquid Repellent Nanotechnology," P2i. [Online]. Available: <https://www.p2i.com/>. [Accessed: 04-Oct-2018].

Waterproof coating solution to be used.

[2] Martin Ademovic (1990) Patent US5049070A. *Dental Drill integral camera and optics*. Malachi Partners A Florida LLC. [Accessed 4 Oct. 2018]

[3] Alibaba.com. (2018). *Turbine Dental Handpiece High Speed Dental Handpiece Price - Buy Dental Turbine Handpiece, Dental High Speed Handpiece, Push Button Handpiece Product on Alibaba.com*. [online] Available at: https://www.alibaba.com/product-detail/turbine-dental-handpiece-high-speed-dental_60435825385.html [Accessed 4 Oct. 2018].

[4] Weitz, A. (2015). *A Guide to Filters for Lenses*. [online] B&H Explora. Available at: <https://www.bhphotovideo.com/explora/photography/buying-guide/a-guide-to-filters-for-lenses> [Accessed 4 Oct. 2018].

[5] <https://www.adafruit.com/product/1937> accessed 18 Feb. 2019

[6] "Single-Tooth Implants." Oral Health and Dental Care. Accessed February 8, 2019. <https://www.colgate.com/en-us/oral-health/cosmetic-dentistry/implants/single-tooth-implants>.



Acknowledgments

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