VETMED:

Design Team:

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Client:

Dr. Graham Thatcher

Advisor:

Dr. John Puccinelli

Problem Statement

Maximize function and improve workflow for the treatment of Class II Malocclusion in Canines.

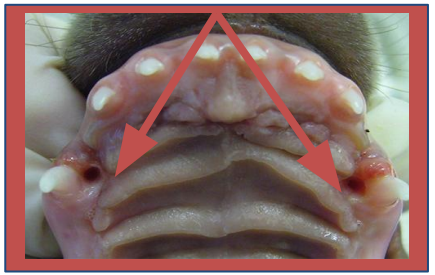
Presented By: Lily

Class II Malocclusion in Dogs

- Class II malocclusion is a common genetic skeletal deformity where the lower jaw is relatively shorter than the upper jaw.
  - Common among purebreds
    - A study of 139 purebreds, 14 of them had MAL2 (10%) [1]
  - Specific Teeth placement
- This condition leads to destruction of the palate and gum tissue of the upper jaw.
  - This negatively affects the canine's quality of life by inhibiting necessary instincts

Figure [1]: Normal Occlusion [2]

Figure [2]: Class II Malocclusion [2]



Figure[3]: Puncture Wounds [2]

Presented By: Lily

Current Treatment Options

- Removal - Extraction of Teeth
- Destruction - Shortening of Teeth
- Tipping Orthodontics
  - Crown extensions
  - Incline Plane

Figure [4]- Crown Extension [3]

Figure [5]- Incline plane [3]

Figure [6]- Shortening of Teeth [3]

Presented By: Daniel

Current Design and Gap

Carved Incline Plane

1. Take a CT scan of Canine's jaw
2. Generates a 3D printed mold
3. Carves out incline plane on mold
4. Sends carving of the incline plane to an engineer to be designed and printed

Cost

- Cost of CT Scan and Anesthesia
- Pay for engineer to design and 3D print incline plane

Workflow

- Tedious to carve out specific incline plane
- Wait on engineer to create the product

Figure[7]: carved inclined plane

Presented By: Daniel

Design Specifications

- 3D Printable Incline Plane Device
  - Device should be patient specific and easily modifiable
  - Device should be created from a CT scan of the patient
- Improved Software Workflow
  - Software should be user friendly
  - Software should not require the assistance of a software engineer
- Shortens current manufacturing time of ~ 1 week
- The device's weight will be dictated by size the patient's' mouth
- Reduce current costs:
  - CT Scan ~$100-500 [4], Anesthesia ~$90-200 [5], 3D Print ~$10-15 [6]

Presented By: Owen

Design 1: Ring Design

- Small amount of material needed to be 3D printed
- Simplifies and reduces variables that are patient specific
- Universal design allows for quicker workflow
- Less structurally complicated than other designs
- Easily replicable

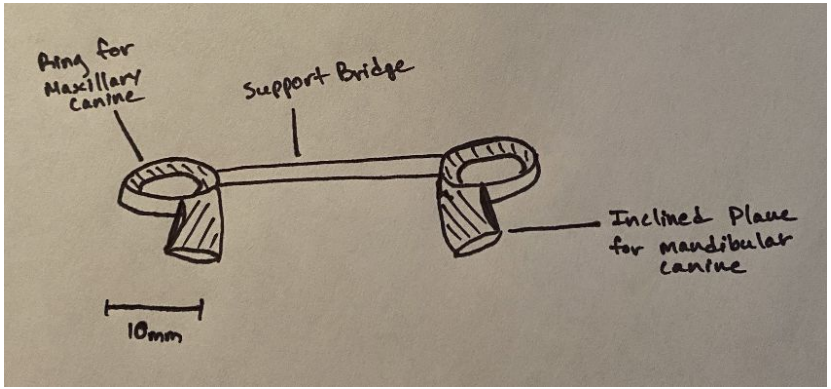


Figure [8] - Our new design inspired by an expired patent [7]

Presented By: Ben

Design 2: Separate Incline

- Design from previous group
- Eliminates bridge component therefore reducing amount of filament needed
- Reduces required workflow slightly
- Structurally the most sound

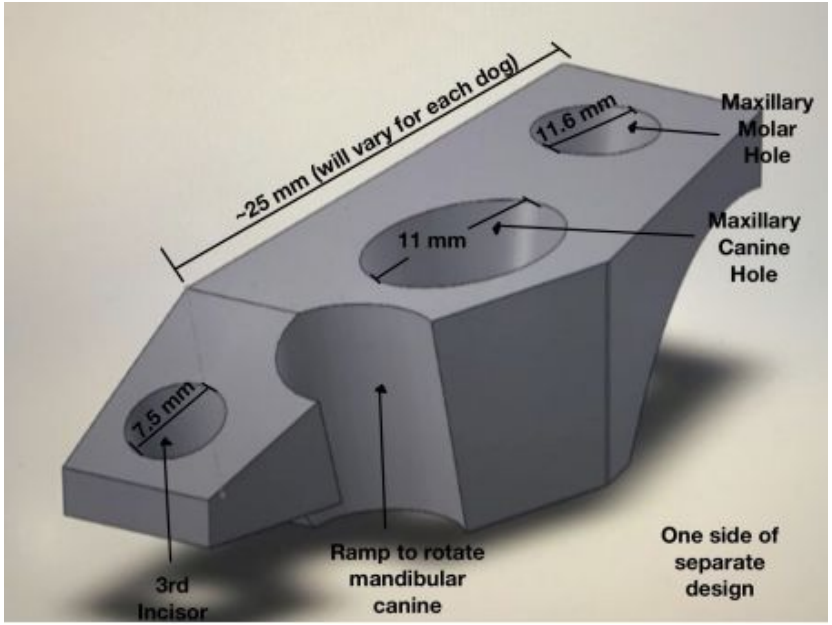


Figure [9] - Design from the previous group [8]

Presented By: Ben

Design 3: Dental Retainer

- Detailed dental mold
- Fits on the upper jaw
- Incline planes built into the retainer

Figure [10] - Retainer mold [9]

Figure [11] - Example retainer to fix class II malocclusions [9]

Presented By: Ben

Design Matrix(Inclined Plane)

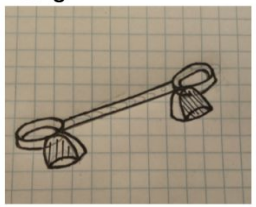
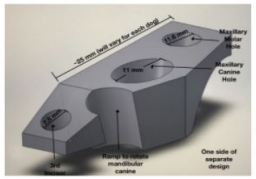
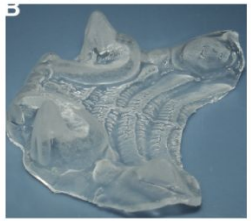
Criteria	Design 1 - Ring Design	Design 2 - Separate Incline	Design 3 - Dental retainer
			
Effectiveness / Durability (30)	4/5 (24)	3/5 (18)	4/5 (24)
Ease of Manufacturing (20)	5/5 (20)	4/5 (16)	3/5 (12)
Cost (20)	5/5 (20)	5/5 (20)	4/5 (16)
Safety (15)	5/5 (15)	5/5 (15)	5/5 (15)
Compatibility (10)	5/5 (10)	3/5 (6)	1/5 (2)
Treatment time (5)	4/5 (4)	3/5 (3)	1/5 (1)
Total (100)	93	78	70

Figure [12] - Design Matrix of Incline Plane Designs

Presented By: Giovanni

Design Matrix(Materials)

			
Criteria	Design 1 - Dental LT Resin (V2)	Design 2 - Polymethyl Methacrylate (PMMA)	Design 3 - 3D Printable Titanium
Durability (biofunction) (30)	4/5 (24)	5/5 (30)	5/5 (30)
Safety (biocompatibility) (25)	5/5 (25)	5/5 (25)	5/5 (25)
Cost (25)	3/5 (15)	4/5 (20)	1/5 (5)
Ease of Fabrication (availability) (10)	4/5 (8)	4/5 (8)	2/5 (4)
Weight (5)	4/5 (4)	4/5 (4)	2/5 (2)
Comfort (5)	5/5 (5)	5/5 (5)	3/5 (3)
Total Score (100)	80	92	69

Figure [13] - Design Matrix of Materials

Presented By: Giovanni

Future Work

- Make our design easily integratable with the software
  - Design should be easily changed based on each patient
- Solidworks modeling of our design
  - Create 3D Model
  - Perform 3D Stress Analysis
- 3D Printed prototypes

Presented By: Tony

Acknowledgements

Special thanks to...

Our client: Dr. Graham Thatcher

Our advisor: Dr. Puccinelli

Presented By: Tony

References

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