

VetMed: Affordable Muzzle

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Overview of Presentation

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- Project Design Specifications
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 - Zipper
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Client:

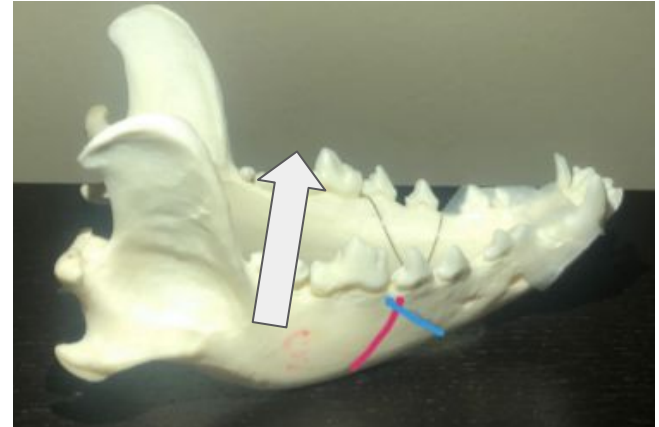


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Canine Mandibular Fracture and Current Treatment

- Approximately 90% of maxillofacial injuries in dogs are mandibular fractures
- Most commonly occur at the mandibular carnassial tooth [1]

- Stabilized through surgical repair
 - Multiple anesthetic events; expensive [2]
- Tape muzzles
 - Pressure on fracture site



[3]

Problem Statement

Our client is in need of a nylon muzzle that provides superior support over the standard tape muzzle

- Must evenly distribute the forces exerted by a dog bite
 - 620.33-1,091.1 N [4]
- Quantitatively prove nylon muzzle provides more stability
 - Finite element analysis
 - Cantilever and suspension bridge mechanics

Product Design Specifications

Performance Requirements:

- Distributes the force throughout the mandible
- Nylon muzzle vs. tape muzzle

Safety:

- Allows dog to perform necessary functions
- Does not disrupt blood supply to oral tissues
- Washable

Size:

- Three sizes
- Adjustable strap

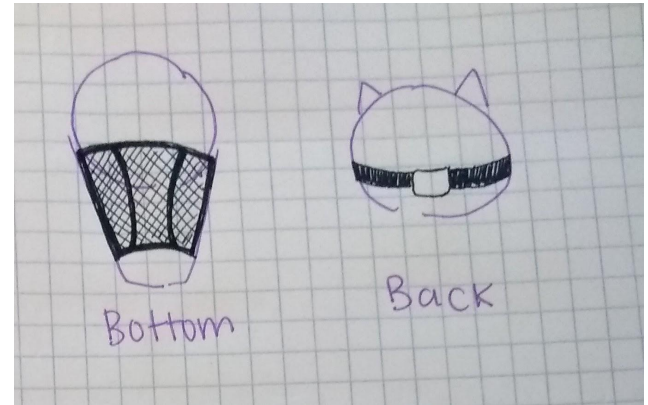
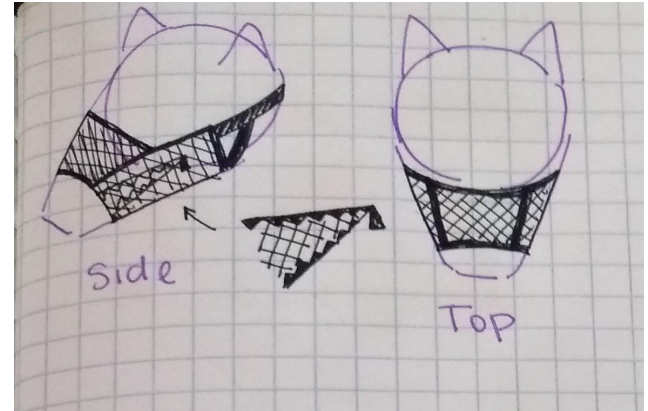
Design 1: Zipper

Design Description:

- Muzzle featuring zipper on sides of mouth with mesh underlayer

Pros/Cons:

- (+) Allows movement for eating and drinking
- (-) Zipper may be difficult to open and close



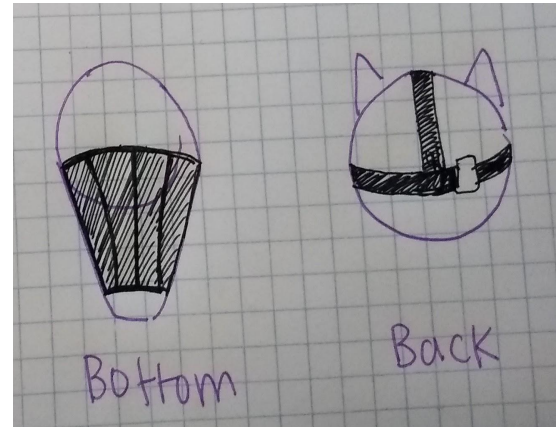
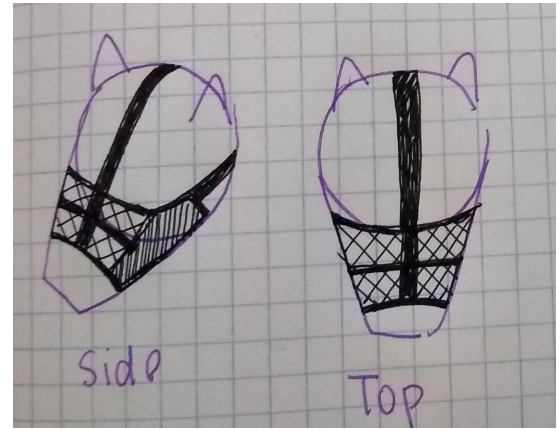
Design 2: Mesh

Design Description:

- Nylon bottom piece and mesh top piece
- Overhead strap buckles in the back

Pros/Cons:

- (+) Allows better breathability
- (+) Can prevent build up under muzzle
- (-) Mesh may rip
- (-) Loses support in top piece



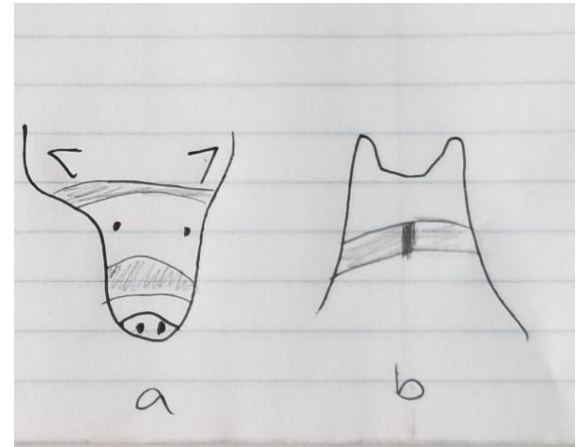
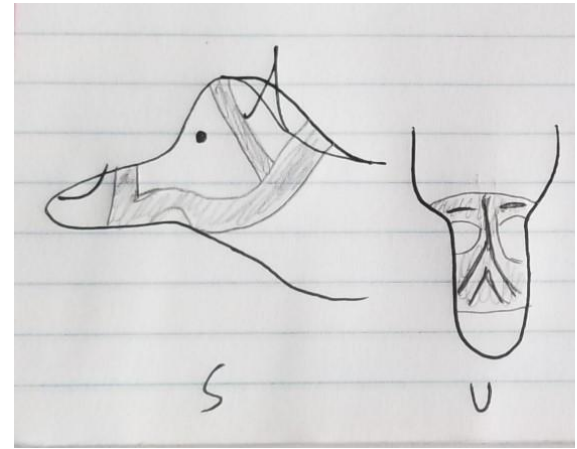
Design 3: Molar

Design Description:

- Muzzle with open areas around molar area of jaws
- Overhead strap between eyes and ears

Pros/Cons:

- (+/-) Avoids putting pressure on molar areas
- (-) Overhead strap may slip or be difficult to put on



Design Matrix

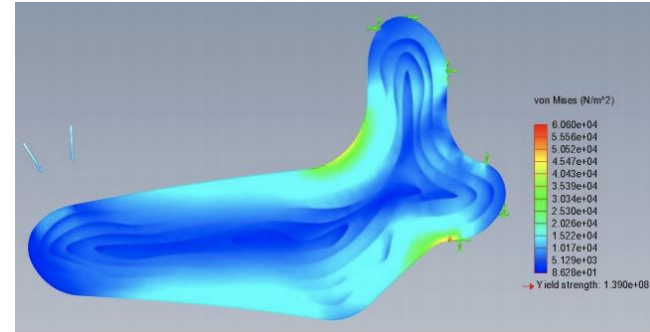
Designs Criteria (*weight)	<u>Design One</u> Zipper		<u>Design Two</u> Mesh		<u>Design Three</u> Molar		<u>Existing Design</u> Tape	
Safety (25)	9/10	22.5	9/10	22.5	4/10	10	3/10	7.5
Support (25)	8/10	20	8/10	20	6/10	15	0/10	0
Ergonomics (15)	7/10	10.5	8/10	12	5/10	7.5	1/10	1.5
Adjustability (15)	8/10	12	7/10	10.5	6/10	9	7/10	10.5
Material (10)	9/10	9	9/10	9	9/10	9	2/10	2
Cost (5)	6/10	3	8/10	4	8/10	4	10/10	5
Ease of use (5)	8/10	4	7/10	3.5	5/10	2.5	3/10	1.5
Total (100)	81		81.5		57		28	

Proposed Final Design: Mesh

- **Design Criteria**
- **Combination of designs**

Future Work

- Construct model of canine cadaver mandible
 - FEA analysis of bite forces
- Assemble prototype
 - Proper size with dimensions
 - Create testable model of muzzle
- Conduct FEA on mandible with muzzle constraints
 - Analyze stress concentrations on cadaver
- Help prove muzzle capabilities



FEA analysis on simplified mandible [5]

References

- [1] Kitshoff AM, de Rooster H, Ferreira SM, Steenkamp G. A retrospective study of 109 dogs with mandibular fractures. *Vet Comp Orthop Traumatol*. 2013;26(1):1-5.
- [2] Umphlet R, Johnson A. Mandibular fractures in the dog, a retrospective study of 157 cases. *Vet Surg*. 1990; 19: 272-275.
- [3] Withrow, S.J. (1981). Taping of the mandible in treatment of mandibular fractures. *J. Am. Anim. Hosp. Assoc.* 17: 27.
- [4] S. E. Kim, B. Arzi, T. C. Garcia, and F. J. M. Verstraete, "Bite Forces and Their Measurement in Dogs and Cats," *Frontiers in Veterinary Science*, vol. 5, 2018.
- [5] W. Wightman, L. Richmond, Y. Kim, C. Van Horn, and K. Gasper, "VetMed: Design and Mechanical Analysis of Patient-Specific Mandibular Reconstruction Implants," *UW- Madison, BME Design 200/300*, Dec. 2019.

Questions?



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