INTRODUCTION

TMJ ankylosis is fibrous or bony fusion of the joints connecting the lower jaws to the skull. The cause of this disorder is usually idiopathic or secondary to maxillofacial trauma, infection, or unknown disease. The fusion of the TMJ presents as a rapidly progressive inability to open the mouth and oral problems from dental malocclusion. Secondary entrapment and swelling of the tongue from this disorder could lead to death. Because of these symptoms, TMJ ankylosis is a severe and life-limiting issue leading to affected patients not being able to eat, drink, pant, and groom.

The current treatment for TMJ ankylosis in dogs and cats is a salvage procedure called a gap arthroplasty. During this procedure, the extra bone growth (ankylosic tissue) is removed, including the entire TMJ. This allows for mouth opening for fundamental needs of eating and drinking, but there are some significant drawbacks to this procedure. The patients will live the rest of their lives with unstable mandibles and the possibility of recurrence of the TMJ fusion. In human patients, however, the standard of care is a total temporomandibular joint replacement (TMJR) using a TMJR prosthesis. The cause of this disorder is usually idiopathic or secondary to maxillofacial trauma, infection, or unknown disease. The fusion of the TMJ presents as a rapidly progressive inability to open the mouth and oral problems from dental malocclusion. Secondary entrapment and swelling of the tongue from this disorder could lead to death. Because of these symptoms, TMJ ankylosis is a severe and life-limiting issue leading to affected patients not being able to eat, drink, pant, and groom.

This group designed the first of its kind TMJR prosthesis for canine and feline patients. Because this prosthesis is novel, it is unknown how it will perform during normal ranges of motion and bite forces. The goal of this project was to evaluate the motion of healthy canine and feline cadaver mandibles before and after the implantation of a novel companion animal TMJR prosthesis. We hypothesized that the mandibular motions in the sagittal, frontal, and transverse planes of intact TMJ and TMJR do not differ by more than 50%.

METHODS

8 canine and 8 feline cadaver skulls donated from the VMTH necropsy service for unrestricted use were used in this study. All muscles of mastication were excised from the skulls (temporalis, masseter, medial and lateral pterygoids, and the digastricus), while the TMJ was left intact. Hardware was placed to simulate muscle attachments to generate a mechanical muscle pull. Custom load cell holders were placed between the teeth to measure bite force.

The skulls were fixed onto a custom load frame with the skulls (temporalis, masseter, medial and lateral pterygoids, and the digastricus), while the TMJ was left intact. Hardware was placed to simulate muscle attachments to generate a mechanical muscle pull. Custom load cell holders were placed between the teeth to measure bite force.

We tested the displacements of the mandibles under 3 different conditions.

1. Intact TMJ
2. Unilateral TMJR prosthesis
3. Bilateral TMJR prosthesis

For each condition, we collected displacement data during a left bite, a right bite, and mouth opening.

The displacements were recorded in the x, y, and z planes for 3 regions of interest:

1. Zygomatic arch
2. Middle of the lateral aspect of the mandible
3. Rostral point near the left mandibular canine tooth

FUTURE DIRECTIONS

This project includes the first experiments in a series of tests validating the short-term and long-term performance of a novel TMJR prosthesis for companion animals. Specifically, additional mechanical validation of the TMJR prosthesis will be performed, including evaluating the stiffness and ultimate strength of prosthesis fixation, implant fatigue, and liner wear.

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