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DESIGN AND DEVELOPMENT OF ANATOMICAL PLATE FOR ZYGOMATIC ARCH FRACTURES IN CATS

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Feline cranio and maxillofacial injuries, accounting for 14.5% of all feline fractures, are prevalent and mainly involve mandibular and maxillary fractures. These injuries often result from road traffic accidents, falls from heights, bite wounds, and gunshot injuries. Conservative treatments generally prove ineffective, especially for severe cases, highlighting the need for more advanced surgical solutions. Among these injuries, zygomatic arch fractures are notably complex. Given the feline zygomatic arch's thin and delicate bone structure, existing fixation methods often need to be revised. To address this issue, this study focused on designing and developing an anatomical plate specifically for zygomatic arch fractures in cats. The project encompassed several critical steps to ensure both functionality and anatomical accuracy.

Initially, CT data from 40 healthy cat skulls were reconstructed, considering both male and female morphological differences to develop a universal skull model. This model was the foundation for the plate design, ensuring compatibility across a wide range of feline skull anatomies. The plate design process accounted for various anatomical constraints impacting technical boundaries, such as plate thickness, width, and the type and size of screws, to optimize the fit and function of the plate. The initial prototype was 3D printed using high-accuracy resin through Digital Light Processing (DLP) technology, allowing for precise detail and the identification of necessary corrections. After successful adjustments, the final prototype was printed in Ti6Al4V alloy, known for its strength and biocompatibility. Post-processing of the titanium plate included grinding, CNC machining of locking screw holes, mechanical polishing, and electrochemical final polishing to achieve a mirror-like finish and reduce the risk of irritation or infection.

The anatomical plate prototype was designed to provide a reliable and effective solution for the surgical treatment of zygomatic arch fractures in cats. This plate aims to improve surgical outcomes and reduce the complications associated with current treatment options by addressing the unique challenges posed by feline skull anatomy. Future work will involve clinical trials to validate further the efficacy and practicality of this innovative orthopedic device.