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EVALUATION OF 3D PRINTED BIOMIMETIC CANINE ANTEBRACHIAL DEFORMITY ORTHOPEDIC TRAINING MODELS

Keywords: veterinary orthopaedics, 3D printing, surgical training

Surgical training is paramount for the continuous development and proficiency of orthopedic surgeons. This study aimed to develop high-fidelity models for a specialized workshop focusing on corrective osteotomies of the canine antebrachium. Specifically, the study addressed three levels of antebrachial deformities—categorized as easy, moderate, and hard—to provide a comprehensive training experience.

The development of orthopaedic models began with the acquisition of detailed CT scans of canine forearms, which served as the foundational data for creating anatomically accurate 3D models. To ensure the models met the specific requirements for surgical training, several critical conditions were established. These included the ability to drill and cut the models without causing melting or deformation, the formation of chips during drilling, adequate bone screws thread holding power, and suitable hardness and elasticity to simulate real bone behavior. The 3D models were processed to include a cortical layer, a beam porous internal structure representing the spongy bone layer and an intramedullary canal, enhancing their realism. The models were fabricated using methacrylate based custom resin using Digital Light Processing (DLP) technology, which provided the precision necessary for such intricate structures. Post-printing, the models underwent finishing processes and were assembled into complete antebrachium structures using flexible connectors to simulate the natural movement and flexibility of canine limbs. The developed models were used in an orthopedic workshop attended by numerous participants, providing a valuable hands-on experience. Based on the feedback from presenters and participants, it was noted that one of the models required scaling down to smaller size for improved utility in subsequent workshops.

In conclusion, this study successfully demonstrated the development and application of 3D printed biomimetic models for training in corrective osteotomies of the canine forearm. The models proved to be effective educational tools, offering a realistic and practical training experience for orthopedic surgeons. Future work will focus on refining the models further and expanding their application to other types of orthopedic deformities and training scenarios.