# 3D  PRINTING  APPLICATIONS  FOR VETERINARY  FIELD

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**In the current scenario, 3D printing provides a useful revolution in different medical and allied fields. The potential of 3D printing applications is due to its flexibility and customisation. Due to its different successful applications, this technology also provides the application for veterinary medicine. 3D printing uses computer-aided design (CAD) data to create a physical model layer by layer with a wide variety of material. It efficiently manufactures a 3D anatomical model which can be further used for educational purposes, pre-surgical planning and also to perform the actual surgery. In the veterinary field, a 3D model printed by this technology allows a surgeon to perform mock surgery before performing the actual surgery on animals. 3D printing has excellent capability of reverse engineering by which a missing part of the animal like a bone is created and printed and implanted. This technology seems perfect to perform preoperative assessments in veterinary medicine.**

**Key  words:** 3D printing, Applications, Customisation, Orthopaedics, Veterinary

3D printing, is a disruptive technology, can be well used for manufacturing of any veterinary implants with lesser wastage of material because in this process material is added layer by layer, and there is focused use of material and waste recycling (Vaishya *et al.*, 2018). It is helpful for the manufacturing of different prosthetics of an animal with an exact match with required strength that remains strong for long life (Dorbandt, 2017). With the help of this technological advancement, veterinarians can now quickly identify animal's injuries by capturing data through computed tomography (CT) scan. This data is further converted into a 3D model using different softwares and converted to a printable file format. This file is used further for printing a replica object by appropriate 3D printing technologies and materials (Vaughan, 2018). By using 3D printing, in veterinary, a creation of perfect match of bone for the animal becomes feasible. Here 3D scan/CT data is appropriately used for actual clinical applications. It helps to decrease surgery time and reduces the risk of operation for a compound fracture. This technology has excellent potential to make a full-colour model,

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which helps to provide information on blood vessels and other tissues of animals.

In today's world, millions of animals are disabled due to trauma, fractures and other medical problems. 3D printing seems quite helpful to improve animal life and provide them comfort. A metal 3D printed orthopaedics plate was manufactured and used during the surgery of a dog. This plate was designed by using a 3D laser scanning process and printed by metal printing technology. The result shows good accuracy as compared to the traditional process (Quinn-Gorham and Khan, 2016). One more case of one-year-old dog was conducted to become operation more precision. In this case, dog spine data is captured with the help of CT data and printed exact shape titanium implants. This implant was designed with ten screw holes and has been fitted precisely in a dog's spine (Boissonneault, 2018). Therefore there is potential to solve other typical problems with better results. The combination of appropriate scanning technology and 3D printing technology has the potential for making a life-sized replica of the individual animal.

In veterinary orthopaedics, 3D printing is used mainly for the creation of bone models, complex patient-specific implants and surgical guides. 3D printed veterinary models provide significant benefits in surgical planning during the treatment of complex mandible reconstructive surgeries, oral/maxillofacial fractures, and angular limb and skull deformities. Veterinary surgeons use 2-dimensional image data for surgical planning, which does not provide complete information about injury and surrounding tissues (Vaughan, 2018). With scientific advancement, this emerging technology can be utilised in veterinary medicine for the treatment of complex cases. Major applications of 3D printing in veterinary are shown in Fig 1.

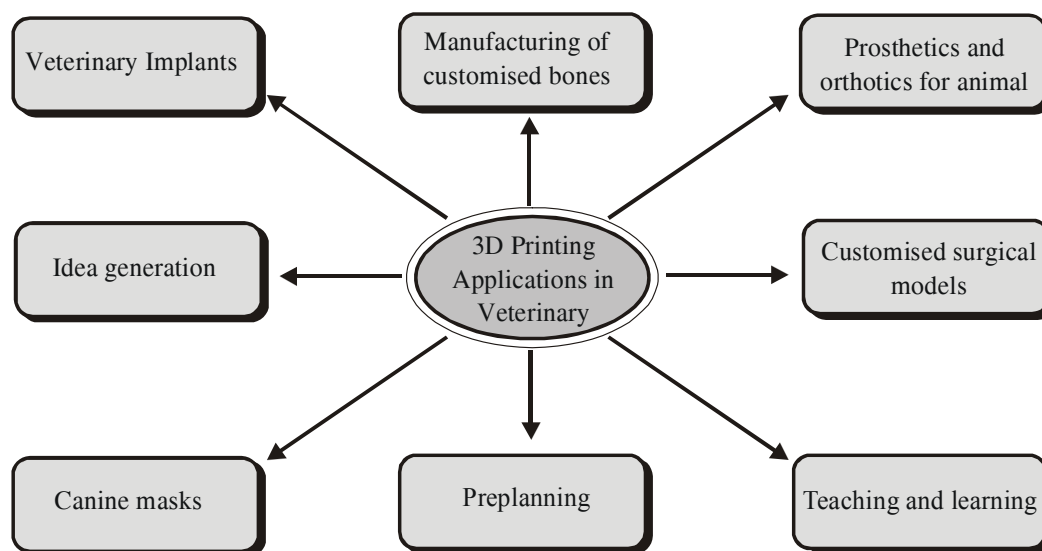This technology can be used appropriately in



**Fig. 1. 3D printing applications in the veterinary field**

similar conditions for animals such as fractures, limb deformities, patellar luxation, humeral condylar fissures and spinal fractures. Due to its unlimited geometric freedom of manufacturing, 3D printing creates precise fit veterinary implants.This technology provides excellent flexibility for the manufacturing of any intricate design. In the research and development of the veterinary field, it is a promising tool to solve different complex problems and applications (Graham, 2018). Veterinary surgeon can now easily understand the conditions of bone defect with the help of a 3D printed physical model. This technology increases the welfare of animals and provides a flexible solution with minimum side effects. It increases the success rate of operation for veterinary care.

In future, it is the primary technology for medical school, which is helpful in teaching practice on veterinary. 3D printing can change the future of veterinary, by which any animal specific implant can be well manufactured and implemented. With higher demand and usage, the cost of customised implants is bound to come down.

3D printing is an excellent tool for the veterinary student, by which 3D veterinary models are created quickly, where students can study and practice on the same. It enhances communication and become an excellent tool to communicate with the client concerning the treatment. It solves various problems of making customised tools, devices and provides an optimal solution to animal welfare (Paudyal, 2017). The applications of 3D printing technology are found efficient in multiple cases of veterinary and to impact the surgical procedure in veterinary.

## REFERENCES

Boissonneault T, 2018. Give a dog a (3D printed, titanium) bone. 3D Printing media network: https://www.3dprintingmedia.network/dog-3d-printed-titanium-bone/

Dorbandt DM, 2017. Three-dimensional printing of orbital and peri-orbital masses in three dogs and its potential applications in veterinary ophthalmology. Vet Ophthalmol, 20(1): 58-64

Graham K, 2018. Veterinary medicine making great strides with 3D printing. Digital Journal: http://www.digitaljournal.com/tech-and-science/technology/veterinary-medicine-making-great-strides-with-3d-printing/article/532856

Paudyal S, 2017. How 3D printing is revolutionizing veterinary medicine. Prescouter: https://www.prescouter.com/2017/12/3d-printing-veterinary-medicine/

Quinn-Gorham DM and Khan JM, 2016. Thinking outside of the box: The potential of 3D printing in veterinary medicine. J Vet Sci Technol: doi:10.4172/2157-7579. 1000360

Vaishya R, Vijay V, Vaish A and Agarwal AK, 2018. Computed tomography-based 3D printed patient-specific blocks for total knee replacement. J Clin Orthop Trauma, 9: 254 259

Vaughan D, 2018. 3-dimensional printing in veterinary medicine. American Veterinarian.; https://www.americanve terinarian.com / journals/amvet/2018/february2018/3dimensional-printing-in- veterinary- medicine