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3D-printed shoes to treat birds with deadly foot disease

They offer more precise way to protect avian feet with sores, calluses caused by condition

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Miguel, a male southern caracara, having his bespoke shoes removed by veterinarian Ellen Rasidi before his discharge into Jurong Bird Park's retirement aviary. The bird, who developed pododermatitis as a result of arthritis, saw remarkable improvement after 2½ months of wearing the shoes. PHOTOS: JURONG BIRD PARK

3D-printing technology has found a surprising application in customised shoes that protect birds of prey in Singapore against a potentially fatal foot disease.

The silicone-made bird shoes have been refined over two years by Jurong Bird Park's avian veterinary team and the Keio-NUS Cute (Connective Ubiquitous Technology for Embodiments) Centre at the National University of Singapore (NUS).

In a joint statement yesterday, Jurong Bird Park and NUS said the shoes, which were cast from 3D-printed moulds of the feet of some of the park's birds, have been used to treat a medical condition of the birds that is known as pododermatitis, or bumblefoot.

Pododermatitis results in pressure sores, tissue swelling and calluses. If left untreated, it can become disabling and even fatal, the statement said. The shoes are designed to redistribute pressure on the weight-bearing surface of the patient's feet.

While the condition can be treated with bandages, 3D-printed technology provides a more precise way of protecting birds' feet, said Dr Xie Shangzhe, acting deputy vice-president of conservation, research and veterinary at Mandai Wildlife Group.

The park's first patient with pododermatitis was Walter, a 21-year-old female hooded vulture, who recovered 17 weeks after her first shoe treatment in 2019.

But love caused Walter's affliction to return.

After the vulture was released to the Birds Of Prey aviary, she started displaying courtship behaviour with a male and preparing a nesting area on a hard, high rock ledge.

Extended periods of perching on the ledge caused the bumblefoot condition to recur and Walter had to be fitted with the shoes again and observed from August to October this year.

The bird's symptoms improved dramatically and the shoes have since been removed.

"She will be discharged from her observation ward into a special aviary for retirees of the park's Kings Of The Skies show where another hooded vulture resides," the statement said. "If she's in the mood for love again and nesting behaviours are observed, Walter will be provided with a suitable nesting area to prevent re-occurrences of the condition."

Associate Professor Yen Ching Chiuan, co-director of the Keio-NUS Cute Centre, noted that another advantage of 3D printing is the flexibility to customise shoes according to the size, shape and condition of each bird's feet.

Designing for bird feet was no easy feat, however, as the shoes had to be comfortable for the bird yet easily removable for cleaning, and durable as well as the patients may peck at them with their sharp beaks.

In August, the bespoke shoes also helped Miguel, a 31-year-old male southern caracara.

Miguel, who developed pododermatitis as a result of arthritis in his old age, saw remarkable improvement after 2½ months of wearing the shoes, the statement said.

Miguel's shoes have since been removed and he has been discharged into the retirement aviary to spend his golden years with fellow retiree birds of prey.

This is the second time Jurong Bird Park has worked together with the Keio-NUS Cute Centre to use 3D-printing technology for veterinary care.

In 2018, the centre designed and fitted a 3D-printed prosthetic casque for Jary, a great pied hornbill, whose own casque was removed due to cancer.

Jary has since made a full recovery and no longer needs his prosthesis, the statement said.

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Miguel's shoes (left) came with space to accommodate pododermatitis lesions and his foot sores have healed well, allowing the bird to be on his feet quite comfortably (below).