ANIMAL KEEPERS'
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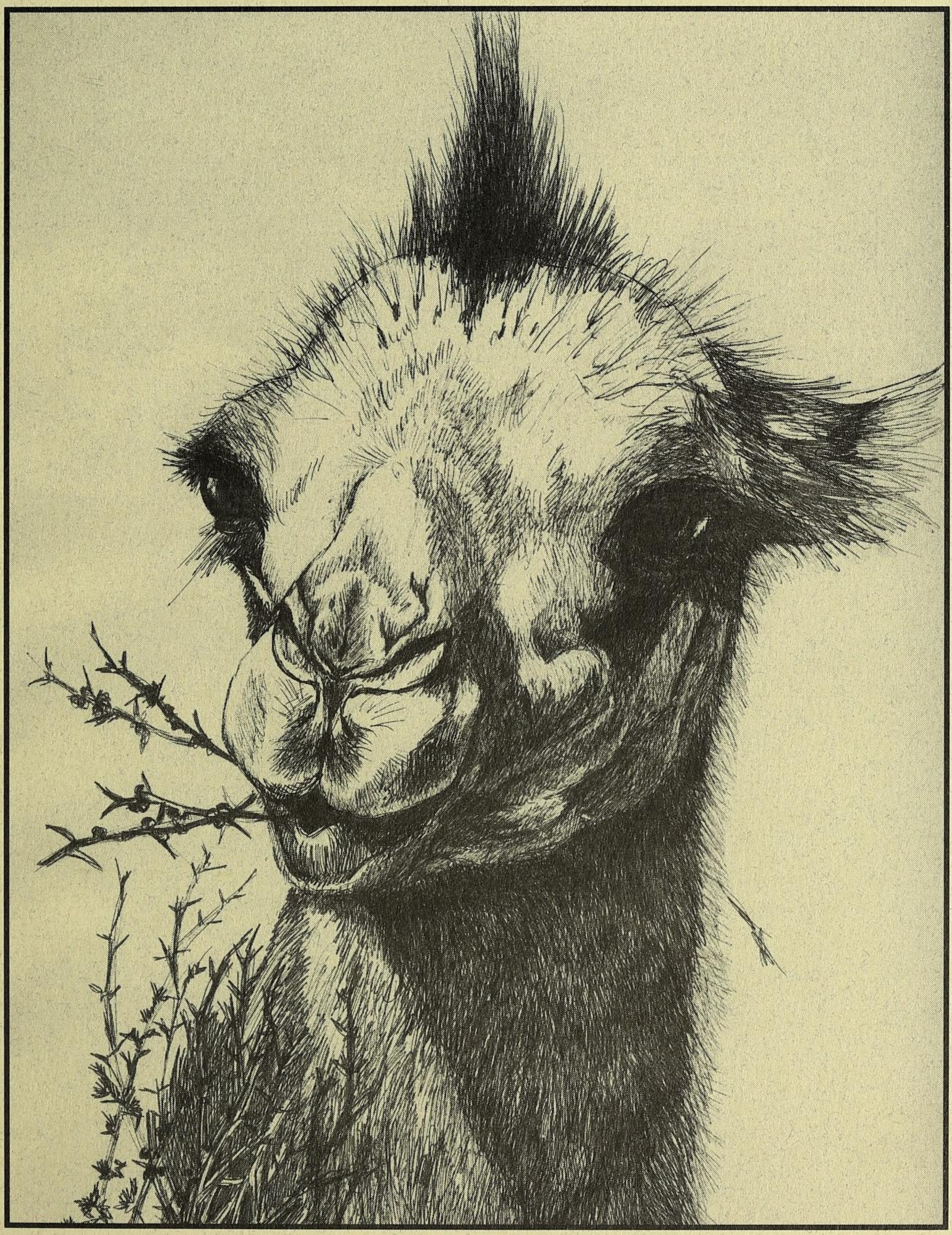

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MISSION STATEMENT

(Revised April 2009)

American Association of Zoo Keepers, Inc.

The mission of the American Association of Zoo Keepers, Inc. is to advance excellence in the animal keeping profession, foster effective communcation beneficial to animal care, support deserving conservation projects, and promote the preservation of our natural resources and animal life.

Conditioning 0.1 Eastern Black Rhinoceros (*Diceros bicornis michaeli*) for Behavioral Restraint in Diagnosis and Treatment of Vitiligo

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Abstract

In February of 2006, Imara, a two-year-old female Eastern black rhinoceros, presented with areas of pink skin around both of her nares and in her facial creases. In order for the veterinarians to diagnose Imara, she was conditioned under behavioral restraint for biopsy of the facial skin.[4] Facial skin biopsies were also obtained from four other rhinoceroses under behavioral restraint to better assess the skin disorder.[4] From the biopsy results, the veterinarians diagnosed Imara with the skin disease vitiligo.[4] Vitiligo is a skin disorder in which areas of skin have a loss of pigment due to the destruction of pigment cells that result in white, or in Imara's case, pink skin.[3] As the vitiligo progressed, the veterinarians decided to treat Imara's depigmented skin with UV-B phototherapy.[4] Imara was conditioned under behavioral restraint for the phototherapy treatment. Keepers utilized operant conditioning to enable the veterinary staff to perform the facial skin biopsies and treatment of Imara's vitiligo.[2] This paper discusses the husbandry and conditioning techniques for diagnosis and treatment of Imara from a keeper's perspective from February 2006 to May 2008.

Introduction

Imara, a female Eastern black rhinoceros (*Diceros bicornis michaeli*) was born 8 February 2004 at the Kansas City Zoo. She was born without complications and was a healthy rhinoceros calf. Imara's dam, sire, sibling, and an unrelated male were also housed in the Rhino barn. Her dam Luyisa, a 15-year-old rhinoceros, was imported from the Addo Elephant Park in South Africa to the Kansas City Zoo in 1997. Her sire Rudisha or "Rudy," another 15-year-old rhinoceros, came to the Kansas City Zoo in 1995 from Sedgwick County Zoo in Wichita, Kansas. Imara was the second offspring of Luyisa and Rudy. Kipenzi, her sibling, was born four years earlier.

For the first two years of her life Imara was a healthy rhinoceros, having no serious or prominent medical conditions. When she was about two years of age, keepers began to notice areas of skin around her nares turning pink. Upon closer inspection, keepers also noticed pink skin in the creases of her face around her eyes and mouth (Fig. 1). Imara's behavior was normal and there were no signs of skin irritation or swelling around those areas.

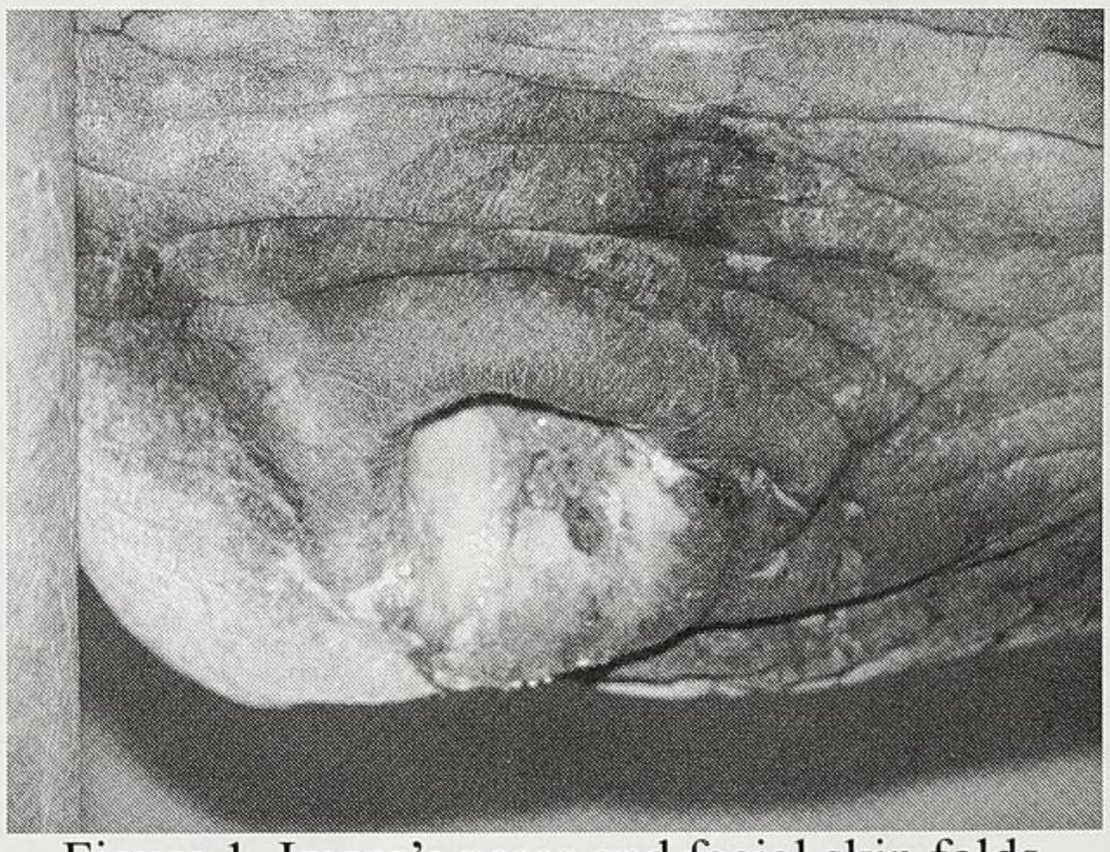


Figure 1. Imara's nares and facial skin folds.

When the veterinarians were shown the pink skin around Imara's face on 4 February 2006, they diagnosed her with focal depigmentation of the skin.[4] Since Imara was already trained to line up parallel to the bars in her stall for blood collection, the veterinarians opted to collect blood samples on Imara for further diagnosis of her skin condition.[4] Using produce as positive reinforcement, Imara was targeted to the front end of her stall, with the command "come," and then continued to be targeted along the bars until her body was lined up against the bars. With the

command "steady," the veterinarians were able to collect blood from the inside of Imara's front leg.

As the months progressed, the depigmentation began to spread on her face and progress to her appendages, such as her lip, chin, abdomen, legs, and tail (Fig. 2, 3, 4).[4] Imara's back and sides remained pigmented, showing no signs of pink skin.

Figure 2. Imara's facial skin folds.

Figure 3. Imara's front legs.

Figure 4. Imara's underside.

Conditioning for Biopsy

In December of 2006, the veterinarians opted to collect skin biopsies on all five of the black rhinoceroses housed in the barn to further asses the focal depigmentation.[4] Conditioning for behavioral restraint began with Imara and continued with the other four rhinoceroses. Keepers were able to train 2.3 rhinoceroses to accept a skin biopsy performed on the side of the face under a local anesthetic by injection with the site being surgically scrubbed in a matter of weeks. The conditioning steps were the same for each rhinoceros, but the timelines varied based on each individual's response to the training.[2]

Each rhinoceros had to be conditioned to voluntarily allow the injection and to remain still for the procedure that could last up to 15 minutes, depending on the amount and quality of the samples obtained. The rhinoceroses were already trained to line up parallel to the bars of their holding stalls, allowing the keepers and veterinarians easy access to the side of their face. Keepers used their fist as a target and gave the command "come" for the rhinos to walk up to the corner of their stall. Then the keepers targeted the rhinoceroses along the bars, until they were lined up tightly against the front of the stall. They were also already trained to hold still when given the command "steady," and they were already familiar with the look and feel of a needle, as blood was drawn from their front legs regularly. However, keepers now had to desensitize the rhinoceroses to the feeling of a needle in their face. Due to the anesthesia, they were not expected to feel the actual skin biopsy, however, the keepers felt it was important to desensitize them to hard pinching on their cheek, in case of any sensation felt from the biopsy.

Keepers began with lining the rhinoceroses up against the bars and pinching their face. They were

reinforced for holding steady. All five of the rhinoceroses responded to the pinching with very little or no hesitation. Keepers felt that they could progress from the pinching straight to a blunt needle, due to the rhinoceroses' good disposition, and previous experience with needles. The blunted needle was pressed against their face at a variety of sites. After a few sessions with a blunted needle the keepers introduced a normal needle. The rhinoceroses were reinforced for holding steady during the use of these needles. The last step before the biopsy procedure was to desensitize the rhinoceroses to gauze being scrubbed on their face.

During the biopsy, each rhinoceros was given the command "steady" and reinforced for holding still with produce. Keepers cut the produce into small pieces to decrease movement of the rhinoceroses' jaws during the procedure. The rhinoceroses were also fed minimally during the biopsy because their heads had to remain still when the skin was being cut out and collected. All five of the rhinoceroses did well during their procedures (Fig. 5).

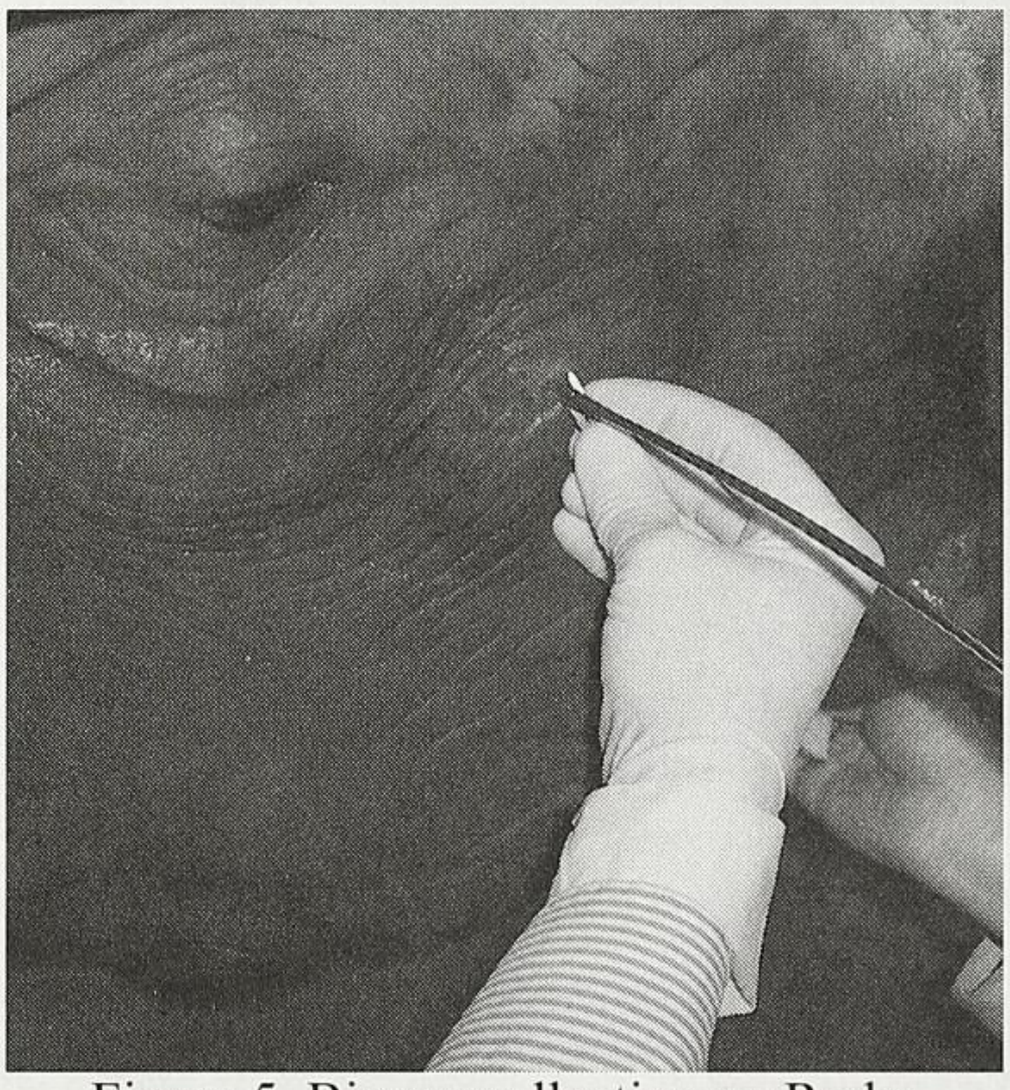


Figure 5. Biopsy collection on Rudy.
(Photo: Kirk Suedmeyer, DVM)

Husbandry Practices

In March of 2007, it became necessary to alter the daily husbandry of Imara in order to prevent skin damage from solar radiation. Keepers, veterinarians, and management were concerned with her depigmented skin burning when exposed to direct sunlight out in her yard or on exhibit. Husbandry guidelines were put into place to insure Imara's health and well-being.

Imara was allowed outside in her yard or on exhibit if the depigmented areas of skin that were exposed to the sunlight were covered with a thick layer of mud. Mud is a natural sun protectant for a rhinoceros. The only limitation to this method was that the mud had to be applied by two or more keepers at a time, which was time consuming. Otherwise, Imara had to stay inside the barn during the day most of the time. However, she was given access outside in her yard overnight, temperature permitting, from 1700-0800hrs when the solar radiation was not as strong. Keepers gave her access to her yard before they left for the day and secured her back inside the barn upon arrival the following morning. If it was a very cloudy, overcast day, Imara was allowed outside in her yard or on exhibit.

In September of 2007 a roof was constructed over Imara's yard. This allowed her to have access outside at all times without the concern of her exposed depigmented skin burning in the sun. Occasionally on cloudy, overcast days, in addition to her yard, Imara was given access to other yards without cover.

Treatment

The veterinarians analyzed the biopsy results and diagnosed Imara with the skin disease vitiligo. Vitiligo is a skin disorder in which areas of the skin have a loss of pigment, due to the destruction of pigment cells, that result in white or pink skin.[3] The veterinarians decided to pursue treatment of Imara's depigmented skin because of the increasing concern of her skin burning in the sun.[4] The limitation of time Imara was allowed outside and on exhibit was a concern to keepers, veterinarians, and management who felt

Figure 6. UV-B Phototherapy Treatment.

that her quality of life as a rhinoceros was compromised due to her skin disorder. UV-B phototherapy was chosen by the veterinarians for treatment.[4] UV-B phototherapy consisted of placing a wand (the size of a large hairbrush) that would emit UV-B light over the depigmented skin (Fig. 6). The phototherapy wands were used on specific parts of the affected skin three times per week.[4] During the phototherapy sessions keepers and veterinary staff were required to wear UV protection on their eyes and keepers had to wear gloves and long sleeves when treating Imara's face, to avoid potential damage from the UV light. Imara's eyes were protected from the UV light with pieces of cardboard held over her eyes.

Conditioning for Phototherapy Treatment

Imara had to first be conditioned under behavioral restraint to allow the phototherapy treatment. Since she was already trained to line up parallel to the bars of her holding stall for blood collection, keepers used that as a starting point to line her up and accept a brush that looked similar to the phototherapy wand held up to her skin. A timer was introduced that beeped when the set minutes expired, to desensitize her to the sound. Keepers also had to desensitize Imara to the pieces of cardboard held up to her eyes. Produce was used to reinforce her for holding steady when the brush was held up to her skin, the cardboard was held up to her eyes, and when the timer suddenly beeped. Once the keepers felt comfortable with behaviorally restraining Imara to accept the phototherapy, the treatment began.

Imara was lined up tightly against the bars by targeting her over to the front of the stall and then targeting her along the bars until her body was turned and completely parallel to the bars, usually starting on her left side. Keepers used produce as the reinforcement, the command "come," and held a fist as a visual cue to target her to the bars. When the phototherapy began, the command "steady" was given at periodic intervals to keep her from fidgeting and shifting around, and a small but steady amount of produce was given as a reward for holding her position at the bars for the entire treatment time on that side of her body. Imara learned to recognize the sound of the beeper on the timer as a cue to turn herself around in the stall, and so that behavior was captured. With the command "turn around" and making a circle with an index finger as a visual cue, Imara would make a sharp turn against the wall and turn her body around. Keepers were then able to target her along so that the right side of her body was parallel to the bars. With the same training techniques as before for holding her position, the right side of her body was treated. When treating the areas on her face, keepers would release her hold at the bars, in which she would walk away to the back of her stall. Keepers would then ask her to "come" and target her so that her body was perpendicular to the bars. The front of her face would protrude out of the large gap in between the bars, thereby making her treated area easily accessible. During the phototherapy on her face, pieces of cardboard were placed over her eyes. The command "steady" again was given at periodic intervals with a small but constant amount of produce as a reward to keep her in place while her face was treated.

Treatment started on 3 May 2007. A time progression was used to insure that Imara's skin would not burn or blister from the UV light. The areas treated were a lateral and distal area on the left and right hips, an area on the left and right elbows, an area on the caudal wrists, and the lip and nares region of the face. There were nine areas on her body that were treated for a total time of approximately 22 minutes in which she had to remain still. Treatment time usually took up to 45 minutes, as Imara would sometimes walk away from her position, in which she would then have to be targeted and lined back up against the bars to continue treatment. The phototherapy was given the same time each treatment day, usually around 1400hrs CST. Imara was not allowed outside during treatment days after the phototherapy sessions until the roof in her yard was constructed. She was unable to go on exhibit on treatment days. The treatment lasted approximately one year and ended on 21 May 2008.

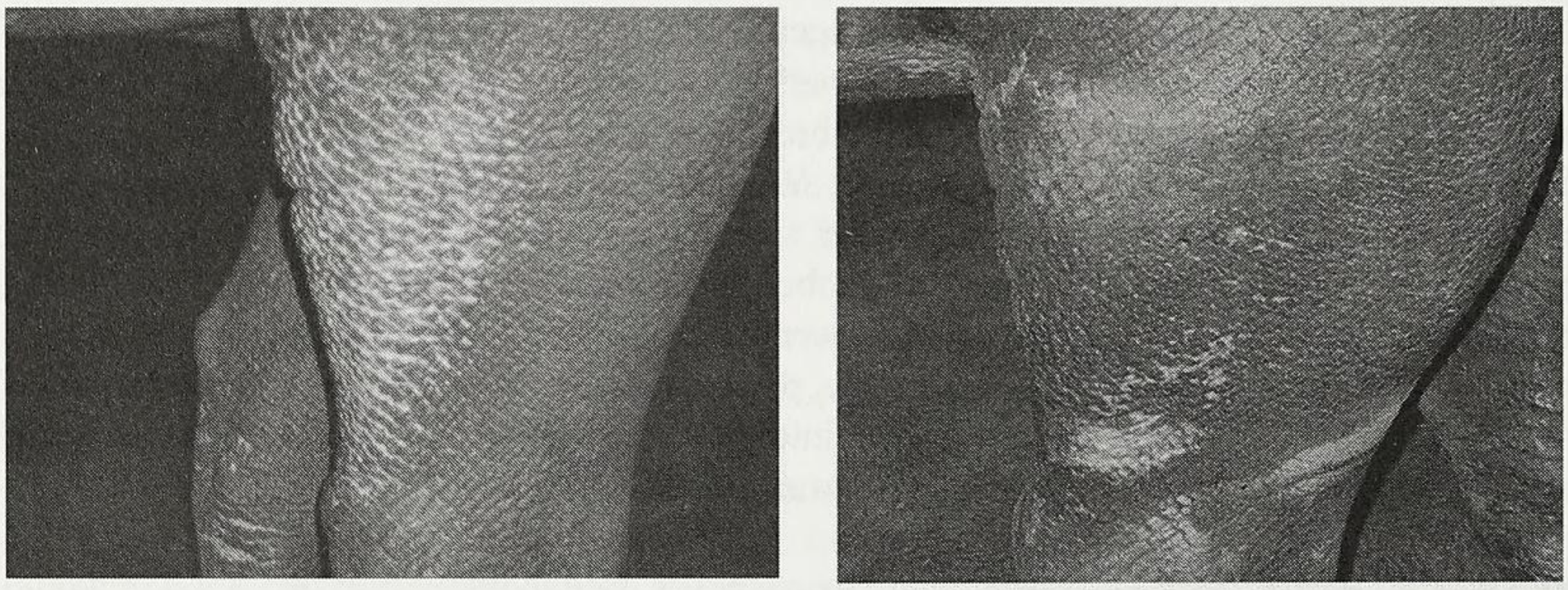
Discussion

While behavioral restraint using operant conditioning was the chosen method for the diagnosis and treatment of Imara, chemical immobilization and chute restraint were two other options.[1,2] There are

multiple risks associated with using anesthesia including: an animal injuring itself just before and after administration of the immobilization drug from agitation or stress, adverse physiological affects from the drug, which in turn would limit an emergency procedure on an animal as large as a rhinoceros, and anesthetizing an animal could compromise an unknown health condition.1 Lastly, the frequency at which the phototherapy treatments were given did not make it feasible for anesthesia. Chute restraint can be a beneficial diagnostic and treatment tool, however, it also has risks. The benefit of using a chute for medical procedures is that it keeps the animal restrained in a small space, thereby not allowing excessive movement. However, an animal can easily injure themselves when confined to a chute if they were to become agitated or startled in the enclosed space. The stress level for an animal could also be increased, which in turn can affect the quality of samples obtained during a procedure.2 Lastly, if the chute were to have been used for the procedures outlined in this paper, there would have been a delay in the process. Imara and the other rhinoceroses had not been conditioned to be locked down in a chute at the time of Imara's diagnosis and treatment. The best option for Imara and the other rhinoceroses was behavioral restraint performed under operant conditioning. This method gave the rhinoceroses the choice to participate, and thereby greatly reduced their risk of adverse health affects, injury and stress. This technique has also been used successfully in the past for a variety of husbandry and medical procedures.

Conclusion

In May of 2008, treatment for vitiligo concluded on Imara. The phototherapy treatment was successful in that the areas treated showed significant signs of repigmentation (Fig. 7). After the phototherapy treatments ended, Imara was cleared for short-term exposure to the sunlight. Keepers began giving her access outside in the sun for short periods of time, and slowly started to increase her time over a progression of several weeks. She was carefully monitored for any reaction to the sun, and keepers were to report red blotchy skin, blistering skin, or lethargy to the veterinarians. After several weeks, Imara showed no ill effects from the sun, and she was cleared to be treated as normal with access to her exhibit again, regardless of the weather conditions.



4/9/07
Pre-treatment Right Elbow

5/20/08
Post-treatment Right Elbow

Figure 7. Pre and Post-treatment comparison. *(Photo: Ginger Takle, DVM)*

Imara still has areas of depigmented skin on her body, and she will probably never again be completely pigmented. She has been treated to the point that her quality of life as a rhinoceros has been restored. However, if new depigmented areas develop that warrant phototherapy, she is well conditioned for the treatment. The black rhinoceros training program at the Kansas City Zoo allowed for blood collection, facial skin biopsies, and phototherapy treatment to be performed on a rhinoceros voluntarily under behavioral restraint. The behavioral restraint was critical for the successful diagnosis and treatment of Imara. This training can also be correlated with future medical procedures if needed, such as obtaining blood pressures, radiographs, ultrasounds, and many others.

Using behavioral restraint instead of chemical immobilization or chute restraint is a safer and more beneficial option to explore when medical procedures on an exotic animal are necessary.[2]

Thank You

Thank you to Dr. Ginger L. Takle, Dr. Wm. Kirk Suedmeyer, and the entire animal health staff at the Kansas City Zoo for taking such great care of our beloved rhinoceroses. A huge thank you to the entire Savannah Team, Tim Wild our supervisor, Tracy Divis, Eric Vaught, Adam Ramsey, Sarah Ksiazek, Andy Kallem, Kate Knowlton, Kelly Briggs, Jordan Long, and Jeremiah Outman for their help with the procedures. Thank you to the Kansas City Zoo animal management Liz Harmon and Joni Hartman. Thank you to Martha Fischer and Cory Nordin at the St. Louis Zoo for their support in writing this paper. Lastly, thank you to Imara, for being such an awesome rhinoceros to work with.

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