Care Cards

Chelonian Shell Repair

Chelonians will require shell repair following traumatic damage from either being dropped, stepped on, hit by car, run over with a lawn mower, or attacked by a dog. Additionally, shell repair will be necessary following any surgical procedure invading the carapace or plastron. The chelonian shell heals slowly but remarkably well and turtles have been observed in the wild with obvious scars from previous shell fractures. Shell defects will usually be bridged within one to two years. Environmental exposure of the coelomic cavity does not impair normal respiration in chelonians. Turtles do not have a functional diaphragm, and their respiratory gases are exchanged with the help of the intrapulmonary smooth muscles and the extrapulmonary skeletal muscles.

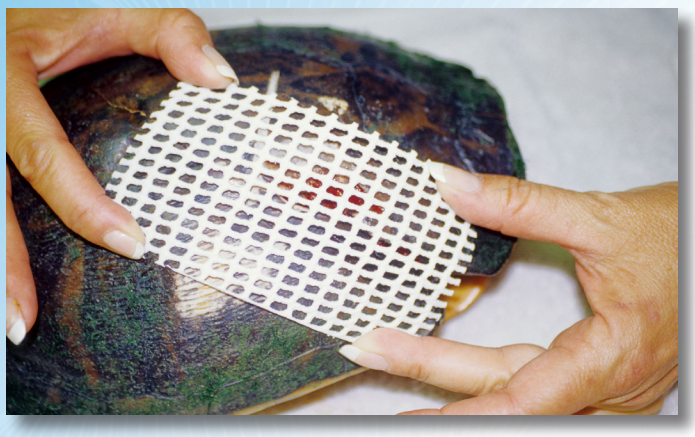
The treatment of traumatic shell fractures should always begin with a complete patient evaluation. The force required to fracture a chelonian shell commonly will cause additional damage including: shock, internal bleeding, pulmonary bruising, and possible nerve damage leading to paresis or paralysis. Some turtles will have an anesthetic risk due to this additional damage.

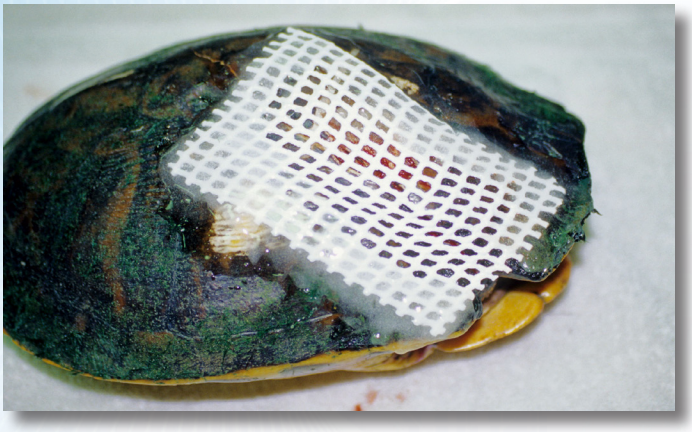
Although fresh wounds will be contaminated, they usually are not infected. These should be thoroughly flushed and cleaned with a sterile saline solution and repaired quickly to help prevent infection. On the other hand, wounds that are more than a couple hours old will be infected. The correct treatment for infected shell fractures requires the use of both systemic antimicrobial agents as well as medicated bandages. The bandages should be changed frequently until a healthy granulation bed of fresh tissue is noted. Aquatic turtles provide a challenge to this protocol. However, a bead of cyanoacrylate ester (Super Glue®) around the margin of the bandage will enable it to adhere for 24 to 48 hours. For semi-aquatic turtles, I recommend a one hour swim twice daily to maintain adequate hydration and feeding.

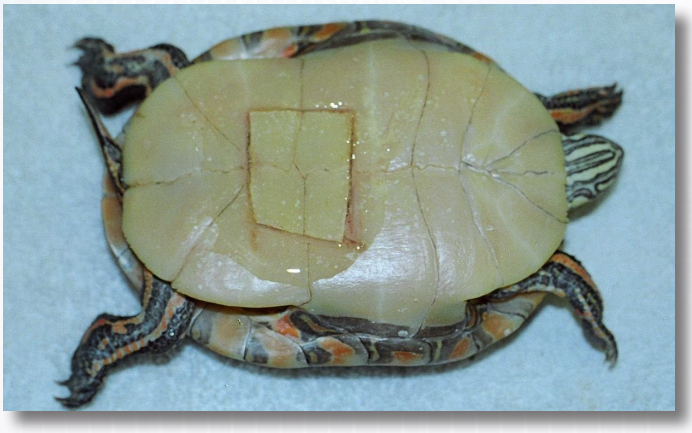
Anesthesia should be used when repairing shell fractures to prevent pain and excessive movement during the procedure. Rapidly polymerizing, 5-minute epoxy resin and fiberglass mesh are the most commonly used products for fracture repair. Clear epoxy is preferred and when necessary, it can be tinted with food coloring to match the shell. Alternatively, dental acrylics, used for beak repair in birds, can be used. These products come in a variety of colors to more closely match the normal shell coloration. The dental acrylic will set up more quickly than epoxy, thus enabling the procedure to be performed in less time. The fiberglass mesh patches should be oval or round to prevent unraveling or puckering at the edges. The mesh should be steam or gas sterilized prior to its use. The pieces should be cut to extend 2 to 3 cm on both sides of the defect.

Prior to repair, any devitalized pieces of shell should be removed and the fragments returned to their normal position. Dental instruments can be used to elevate any depressed fragments. The shell around the defect should be lightly abraded to create a rough surface. This will allow the epoxy to bond better to the shell. The surface should be cleaned with acetone or ether. Be careful when cleaning to prevent any leakage inside the defect.

Epoxy resin and hardener are mixed one to one and applied to the shell on both sides of the fracture. The mixture is allowed to harden for a few moments prior to the application of the mesh patch. If the resin is too runny it will seep between the mesh strands. Alternatively, if the mixture is allowed to harden too long the mesh will not adhere to it at all. The shell fragments should be held in apposition while the epoxy is hardening.







A fresh batch of epoxy should be mixed and lightly applied over the central portion of the mesh to create a seal. Care must be taken when covering the defect to prevent any resin from dripping inside the wound. One layer is usually sufficient for most fractures. When applying additional layers of epoxy and mesh, the surface should be lightly abraded prior to each application. In aquatic turtles, a final coat of slower polymerizing marine resin used for boat repairs should be applied on the second or third day. This will allow the shell to be continuously immersed in water during healing.

Regardless of the material used, the shell will take one to two years to heal. Large defects may never fill in completely; however, the turtle should be fine as long as the patch remains intact. The patch can be left indefinitely with adult turtles. In juveniles, the patch must be removed around six months. Normal growth occurs at the margin of the bony plates and scutes. Chelonians should not be allowed to hibernate during shell healing.

Removal of the fiberglass mesh can be accomplished by using a hand-held motorized file or bur. The resin is carefully removed and the patch elevated off the shell using a dental pick. Protective face and eye equipment should always be used when removing patches. I recommend a disposable face mask and eye goggles. The dust created during routing is extremely irritating to the eyes and respiratory tract. Most patches will naturally loosen in 6 to 18 months. If necessary, old patches can be removed and new ones applied until the lesion is healed.

References:
1.) Mader, Douglas: Reptile Medicine and Surgery, W.B. Saunders Company, 1996.
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3.) Marcus, Leonard: Veterinary Biology and Medicine of Captive Amphibians and Reptiles, Lea & Febiger, Philadelphia, 1981.
4.) Frye, Fredric: Biomedical and Surgical Aspects of Captive Reptile Husbandry, Veterinary Medicine Publishing Company, Kansas, 1981.

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