Name: _____ Date: _____ Class: _____

Bone Crusher Design Worksheet Answer Key

Research Questions

1. **What are some possible complications that might arise from surgical repair?**
   An infection might occur from opening the patient (as with any surgery). The patient might have an allergic reaction to anesthesia, blood clot or bleeding. Depending on the location of the surgery, the patient might be bedridden for weeks or longer.

2. **What challenges do biomedical engineers face when designing devices to surgically repair fractures? (Remember that the device must operate in the aqueous environment of a living body.)**
   The device must be biocompatible. That means that the materials must be able to interact with the human body without causing adverse effects, such as infections or material degradation. The body contains water and it is not acceptable for the material to degrade over time.

3. **What situations require surgical repair instead of casts?**
   Open fractures require surgery since part of the bone protrudes from the skin. Fractures that are comminuted or displayed need surgical repair because the bones are not correctly aligned to heal correctly.

4. **What kinds of materials would NOT be useable within a living organism? Explain.**
   Certain metals are not feasible for use in the body because they degrade when in contact with water.

5. **What issues can occur if a metal implant is used?**
   (Or what are some ways way that metal implants can cause more damage than healing?)
   If a metal implant bears too much weight, the bone experiences atrophy (the bone begins to waste away). The heat generated by friction when screws are implanted can cause bone damage.

6. **What kinds of challenges does the human immune system present when healing fractures?**
   The immune system attempts to remove foreign objects in the body by attacking it. The body delays the healing of fractures, which is caused by the cells produced when a fracture occurs. When the body has a fracture, the immune system produces the same cells as when the body has an infection.

7. **Which bones required the most force to break? The least?**
   Explain why you might see a pattern here.
   Femurs require the most force to break because they are located in a part of the body that must withstand massive forces such as when running and jumping. The bone that requires the least amount of force to fracture are ribs because they are thin and shield the lungs, but otherwise do not support the body. The bone in the body that is most commonly broken is the collarbone. Bottom line: The bones that regularly support the most weight, impact and force are denser because they perform this role in the body; thus, by their very nature, they are the bones that require the most force to break.

8. **Look back at your predictions and test data.**
   Were your predictions of bone strength accurate? Explain.
   Answers will vary, depending on students' predictions.

9. **Research all the types of methods of bone repair available. Specifically, for the bone and fracture type of your bone, what types of treatment methods have been used in the past and are being used today? Does your bone fracture require surgical repair or are non-surgical treatments enough? Why are certain methods recommended for certain bones and fracture types?**
   Answers will vary, depending on students' fraction types.

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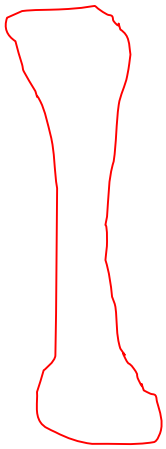
Observations & Design Plans

Draw the bone before fracturing.

Bone type: femur



Draw the bone after fracturing.

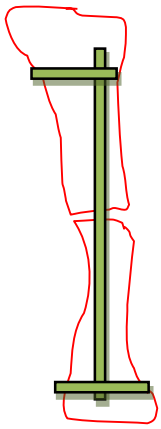
Type of fracture: transverse fracture

What possible methods of repair could be used in this situation?

***Example answers*: cast, external fixation, plates and screws, intramedullary nailing, etc.**

example answers

Draw the repair method your group recommends to fix the fracture your bone incurred.



List reasons why your recommended repair method is best for your bone's break.

Answers will vary.

List any disadvantages of this repair method that might occur or be important to be aware of.

Answers will vary.