Design for environment

Engineering

Case Study: Design of an Automated Bone-Lengthening Device with the Environment's Consideration This project entails redesigning of an automated bone lengthening device. The previously created design was intended tobe used in the distraction osteogenesis process in the femur and tibia. The devices used in the current medical practice are however much intrusive than this proposed system. The proposed system reached the prototype phase and therefore was not tested. The device from this design will however consider the test results of the old device as well as feedbacks from a team of Orthopaedic trauma surgeons. The design consist a system of two pieces of telescoping rods and utilizes an internal wireless motor, which will be actuated remotely. A power screw attached to the motor driver rod is expected to have sufficient strength and resistance to force. These properties ensure no undesired movement from the user and bone regeneration forces occurs. The motor will have to be small enough to remain inside the device. Addition of load bearings to the device ensures that the user can exert full weight on the device without failure.

The drivers of DFE for the project

These drivers entail both internal as well as external factors. This device, being expected to be implantedin patients body, need to meet all the compatibility requirements. Some of the expected goals of this design include:

Bone Lengthening Mechanism

The specification of the required rates of bone lengthening will be required. The device will then be adjusted accordingly. The self-locking provision for the device ensures that rods do not return. The power screw provides the lengthening force.

Minimal Pain

The device will be designed with steel roads with smooth surfaces as well as edges. This will, therefore, eliminate any physical injury on flesh as well as bone contact walls. The device' moving parts will be internally fitted to avoid injury. Titanium-steel alloy, being un-reactive, means that no toxic substances resulting from reactions will be released. These reactions usually occur as electrochemical dissolution. Release of any toxic substance could cause pain (Edwards, 1996).

Biocompatibility

As earlier stated, the device is to have smooth surface and edges to avoid injury. Since the device is to beembedded in thebody, the points of connection of the two rods should be made airtight. This will ensure that the device's inner environment is separated from the body fluids avoiding any possible contamination. Corrosion of implanted metals in human bodies has been a major challenge. The device being made of titanium-steel alloy avoids any possibility of corrosions. Suitable fixing attachments will also be designed. They will be attached to both ends of the device and into the intended part of the bone(s).

User friendliness

This device will be designed to be as user-friendly as possible. Despite the manual operation of the remote control, the device is automated. However, full automation can be implemented by replacing the manual remote control with an automated mechanism. In this automated mechanism, it will consist of a programmable controller that will switch the motor either on or off.

Expected environmental performance

Environmentally friendly materials.

The titanium steel alloy usually, has high strength to weight ratio as compared to the competing stainless steel. Surface engineering on the titanium can be done. This therefore, extends the performance of the titanium beyond its natural capabilities.

Recyclability

The components of the expected design are 100 percent recyclable. The steel and titanium steel alloy can be fully recycled. The other components such as the motor can be reused.

Emissions

Titanium steel alloy is inert and therefore, no emission because of reactions with the environment can occur. The design however, meets high standard cleanliness.

Conclusion

The automated bone-strengthening machine, if successfully designed will be a great invention for the medical sector. It will be an improvement on previous ways to treat bone deformation cases such as osteogenesis. This design will be user-friendly as well as cost effective. Being an automated device, it is expected to work even more effectively.

Reference

Edwards, C A. The Physico-Chemical Properties of Steel. London: C. Griffin & Co, 1996. Print.