**Engineering Specification #1 – Safety**

The purpose of this test is to verify that the all foreseeable hazards in the Failure Modes and Effects analysis have been counteracted.

**Start Date**: ____5/14/08_____ **Finish Date:**_____5/14/08_____

**Engineers set-up experiment:** Jonathan Bawas, Carl Mangelsdorf, James Nardo, Jeffrey Tempest, Jen Zelasko

**Equipment Needed:**

1. None

**Experiment Set-up:**

1.) **Review FMEA to ensure preventative measures are in place.**
2.) **If preventative measure is not in place, explain why.**

## FMEA of Final Design Concept – Balance Training Bicycle

*NOTE: Risk Priority = Severity x Occurrence x Detection*

| Failure | Corrective or Preventative Measure | Preventative Measure is in place? | | If no, give explanation as to why. |
|---|---|---|---|---|
| | | Yes | No | |
| ***Tilt Resistance Mechanism:*** | | | | |
| Mechanism fails (cable or connections break). | Second backup cable attached between handlebars and pulley stand. | X | | |
| Pinch points. | Place cover/guard over entire tilt resistance mechanism. | X | | |
| Power to winch is shut off. | None needed. | X | | |
| Winch exceeds range limit of spring compression. | Use travel limit switch on winch to cut off power when specified point in cable is exceeded. Or, place "winch stopper" on cable to make audible noise and to stop pull of cable when specified point on cable is reached. | X | | |
| ***Axle:*** | | | | |
| Axle could shift forward if kicked, or during transprtation. | Turn a groove into the axle that the set screw in the bearing will rest in, to prevent axle from sliding forward/backward. | X | | |
| Cross member is a trip hazard. | Keep cross member as low as possible. (Below 12 inches.) | X | | |
| ***Handlebars:*** | | | | |
| Handlebars could fall when angle is being adjusted. | Handlebar hinge rotates to 65 degrees max. | | X | Hinge rotates 180 degrees. |
| Bacteria growth on handle grips. | Use grips that are made out of material that is able to be wiped down / cleaned (rubber/plastic/nylon/leather). | X | | |
| ***Portability:*** | | | | |
| Heavy weight of bike. | Ensure the force necessary to lift the rear of the bike is no more than 35 pounds. | | X | The lifting action has been altered so that the lift starts from 30 inches off the floor (lift from seat), instead of at the floor (support legs). This modification increases the recommended weight limit to 50 lbs. The force needed to lift the rear of the bike when lifting from the seat is less than 50 lbs. |

| Failure | Corrective or Preventative Measure | Preventative Measure is in place? | | If no, give explanation as to why. |
|---|---|---|---|---|
| | | Yes | No | |
| ***Steel Frame:*** | | | | |
| Rusting/deterioration of surface on steel assembly. | Anodize/protective coating (paint) on metal frame materials. | X | | |
| Entire bike frame becomes unstable or falls over while in use. | Support legs extend out far enough to counteract the moment created by the heaviest (300 lbs) patient. | X | | |
| | | | | |
| ***Spring Loaded Pin Adjustments:*** | | | | |
| Pin does not fully engage when making adjustments. | Use spring plunger pin that automatically engages into accessible slot. Use of color, i.e. red when not fully seated, click in place (sounds and feel).Tube to guide pin through entire shaft (may not be necessary with small diameter shaft). | X | | |
| | | | | |
| ***Human Error:*** | | | | |
| Recommended weight limit is exceeded. | Place highly visible Weight Limit warning label/sticker (front of handlebars). | X | | |
| Patient attempts to mount bike while it is not in the Upright Locked Position. | Warning Label/sticker on side of seat: "Place bike in Upright Locked Position BEFORE mounting" (possibly use picture illustration). | X | | |
| PT trips over back support legs. | Place anti-fatigue rubber mat with cutouts around support legs to provide flat standing platform. | | X | Support legs are not a major trip hazard. Placing a mat around the support legs would pose a greater trip hazard. |
| Hand slipping off handlebar. | Use ergonomic rubber grips, and place tear-away hand straps on handlebars. | X | | |
| Foot slipping off pedal. | Use pedals fitted with rubber foot straps to allow foot to slide back, but not forward or side-to-side. | X | | |
| Patient slipping off seat. | It is assumed that the PT will use the Velcro Belt on all patients, and will have control of patient at all times. Use textured seat to increase friction. | X | | |

**Conclusions:**

All preventative measures are in place to prevent the foreseeable hazards of the finished prototype with the exception of the handlebar hinge which is able to rotate more than the recommended 65 degree preventative measure. If not supported properly during adjustment, handlebar may fall and hit top of patients thigh resulting in discomfort.