Ergonomically Designed Folding Chair to Promote Correct Spinal Alignment

Anthony Lazzerini, Mark Boesen, Alejandro Garcia
Advisor: Dr. Ghazi Malkawi
Mechanical Engineering

Abstract

The purpose of this self proposed and student funded project was to alter the position of the common folding chair. This chair is catered to the comfort of the spine while sitting. Many common folding chairs have a slight inclined seat angle with the horizontal. This project increased the seat angle as well as the back rest angle. A comfortable rocking chair position was applied to the folding chair. A novel implementation of a telescoping back rest system was added to allow each user to adjust for their own comfortability. Another goal was to produce a rough prototype model that could be further optimized for a relatively low cost through mass production.

Introduction

Many Americans have developed bad posture due to sitting for many hours of the day. The common workplace and the advancement of technology has led to many people sitting hunched over staring at a computer screen for most of the workday. Sitting for long hours can lead to the weakening of the glute muscles which can lead to anterior pelvic tilt. Too much anterior pelvic tilt causes the lumbar section of the spine to curve more and can lead to lower back pain. The problem that needs to be solved is to combat anterior pelvic tilt while sitting to correctly align the spine and take pressure off the lumbar section of the spine.

Methods and Materials

Low carbon steel was the main material for this project. It is held together by standard fasteners and welding. Parts were made by cutting, drilling, and 3-D printing some components.

Results

The chair was able to withstand a static load test of 400 pounds as well as in the FEA. Most of the stress was concentrated on the steel bolts, which are grade 5 steel. All other forces are placed along the steel tubing and hold up exceptionally well.

Conclusions

The increased seat angle of 8 degrees with the horizontal posteriorly rotates the pelvis and helps to relieve lower back pain as one sits in the chair. The telescoping back rest system allows users to adjust the back rest height for personalized comfort. The successful implantation of a rocking chair position to a folding chair has been achieved. The chair is comfortable to sit in, can hold 400 pounds, and can fold up. The increased back rest angle of 116 degrees also makes sitting in a posture deteriorating slouched position harder. The prototype was produced, and mass production of the model would reduce unit cost.

Acknowledgements

We would like to thank Northern Illinois University for their continual support of an education. We would also like to thank Dr. Peterson for leading this class, as well as Dr. Ghazi Malkawi and Sonali Rawat for their ongoing continual assistance of the project.