There are three physical criteria to determine whether an elderly individual is able to live independently on his or her own. These physical actions are stair climbing, walking, and the ability to rise from a seated position. Of these three, the action of chair rising is the most difficult. The combination of shifting weight and maintaining balance makes it stressful on elderly bodies. As the human body ages it begins to degenerate. Muscle tissue begins to weaken and joints begin to deteriorate. For this reason geriatric products have been produced to help maintain the independent living for the elderly population. This design project investigated the development of one geriatric product that targets the chair-rise motion, the lift chair. Lift chairs assist the elderly in the action of standing up by adding support during the standing process.

The fundamental problems with lift chairs today are a combination of practical and visual aspects. Modern lift chairs today require an external power source to operate the lifting mechanisms. The lifting motion used by contemporary lift chairs simply props the chair on its front edge as the lifting motion. This action is not the most effective way in implementing the sit-to-stand motion. In addition, lift chairs are often extremely expensive ranging from $500 to upwards of $1500.

The overall visual appearance of lift chairs have not changed for decades. The design is due for a visual upgrade that will entice new potential buyers.

In order to fully understand the functions of the chair, research had to be done for all aspects of the chair design. The kinesiology of the sit to stand motion needed to be studied for elderly individuals. This will pinpoint the problem areas within the body during this activity. One study determined there are 4 phases to the chair-rise action\(^1\). The study concluded that Phase II is the most physically demanding.

Also different aspects of chair design correlate with the physical strength needed to stand from a seated position. For example, one study showed that chair seat height can compensate for limited knee range\(^2\). Also, increased trunk forward lean can decrease knee torque maximums\(^3\), and arm use can decrease the knee forces generated in the action of chair rise\(^4\).

The final design utilizes a crossed four-bar linkage that is actuated by a slider link located in the base. The slider is connected to hydraulic pistons that activate the lifting action.

The lifting action is powered by two hydraulic pistons. Each is fit into the base plate to maintain the aesthetic integrity of the design while allowing the chair to complete its full motion. The piston will sit within the base plate of the chair. A machined cavity will be created to ensure that the piston will not move during the lifting process. To ensure there is no unwanted motion the piston will be directly mounted to the bottom of the base plate via 4 bolts.

**References**

4. Seedhom BB, Kayama K: Knee forces during the activity of getting out of a chair with and without the aid of arms.