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Design and Fabrication of Cerebral Palsy Adjustable Chair

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ABSTRACT: Cerebral palsy children have respiration, muscle control & speech problems. Previously done medical study states that inclination in seat surface improves respiratory & muscle control. Also reduce speech problems.

AIM: - The aim of these project is to prepare design and fabricate chair with height adjustability, anterior 15 degree & posterior 15 degree tilting seat without backrest. And to develop coordination, build strength, improve balance, maintain flexibility, maximize independence.

KEYWORDS: Cerebral Palsy

I. INTRODUCTION

Cerebral palsy is a neurological disorder caused by brain damage or insufficient oxygen supply before birth during birth or immediately after birth. Cerebral palsy affects body movement, muscle control, muscle coordination, muscle tone, reflex posture and balance. Cerebral palsy affect muscles and person's ability to control them. The objective of the research is to prepare a design and fabrication of a special chair for cerebral palsy patient from information given by doctor and occupational therapist. the appropriate sitting requirement for children with cerebral palsy is very important because the main problems faced by children with cerebral palsy is that they will often spend more time sitting Rather than standing during the day of the school and at home. It is vital that their adaptive sitting provides positioning that is optimal for both health and function.

II. RELATED WORK

Information gathered from OT clinic the number of available chairs in local market cannot accommodate the number of patients. This chair is of high cost because it has to be custom made and order from overseas. In Malaysia there are few medical store which provide special seat for cerebral palsy

Children's. But this chair has to upgrade because the product is not mobile. Therefore this project is carried out to produce a special seat for cerebral palsy patients with ergonomic consideration.

EASE OF USE

Increasing levels of muscular fitness, cardiorespiratory fitness and joint ROM have been associated with

- Improved functional capacity and mobility.
- Reduced risk of depression and improved quality of life.
- Maintaining healthy weight.
- Reduced risk of osteoporosis (weak bones that increase the risk of a fracture).
- Lower incidence of type 2 diabetes.

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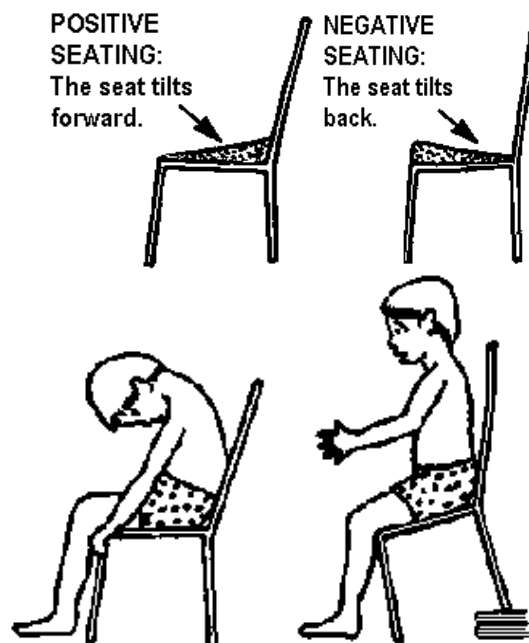
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- Reduced risk for falls and related injury.
- Reduced back pain.
- Lower risk of hypertension, cardiovascular disease, stroke, and heart attack.

III. OBJECTIVE

1. The objective of research is to determine a suitable design for developing cerebral palsy seat and to evaluate the product safety. From the information given by doctor and occupational therapist.
2. Problem of leakage is enhanced by changing hydraulic system to lead screw system.
3. One of the Objective is to provide adjustable vertical up and down motion.
4. Further objective is to provide tilting motion in upper base to adjust the angle between leg and body in sitting position.
5. Main objective is to minimize the production cost and maintenance cost.
6. One of the main objective is to design chair with Indian body standards.



IV. MATERIALS

The work material selected for the study is SS304.

1. 40mm x 60mm pipe.
2. 30mm x 60mm pipe.
3. 10mm x 20mm pipe.

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TABLE 1:PART, MATERIAL AND DIMENSION OF THE CHAIR

| Part | Material | Dimension |
|--------------------|------------------|----------------------------------|
| Sliding wheel (x4) | MS | 0.9'' |
| Lead screw | EN8 carbon steel | M20 X 4mm (pitch) x500mm length. |
| And nut | Brass | M20 X 4mm internal (ACME THREAD) |
| Cross bar (x4) | SS304 | 700mm |
| Nut and Bolts | Alloy | M10 M12 |
| Bearing (UCP 202) | - | ID 15 mm |

TABLE 2: CHEMICAL COMPOSITION OF SS304

| SX | Mn | P | S | Si | Cr | Ni |
|-----|-----|-------|-------|-----|--------------|--------------|
| 304 | 2.0 | 0.045 | 0.030 | 1.0 | 18.0 to 20.0 | 8.0 to 10.50 |

TABLE 3: MECHANICAL PROPERTIES OF SS304

| | SS304 | |
|------------------------------|---------|---------|
| | Typical | Minimum |
| Tensile strength, MPa. | 600 | 515 |
| Elongation (present in 50mm) | 60 | 40 |
| Hardness (Brinell) | 170 | - |
| Fatigue limit, MPa | 240 | - |

V. METHODS

A. Design preparation

1. Making design in 'Solidworks' Design Software.
2. Analysis of design in 'Ansys'.

B. Fabrication process used in manufacturing of cerebral Palsy chair are as follows:-

1. Cutting :-the cutting is a process in which material is changed to specific geometry by removing unnecessary material by various kinds of tooling.
2. Drilling :-In drilling, hole is made in metal part using various machines.
3. Grinding: - grinding is process of removing excess material from metal part. It is also used to give smooth finishing to final product.
4. Welding: - it is a process of joining materials, usually metal parts or Thermoplastic. It is also done by melting metal and adding filler which when cools it form strong joint.

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VI. DESIGN SPECIFICATIONS

1. Lead Screw:-

* It is made of EN 8 carbon steel, which provides high strength (It can withstand 390 N to 590 N according to design requirement.)

* It has 20 mm diameter and 4 mm pitch with sufficient thick threads which reduce wear and tear while performing.

2. Wheel Assembly: -

Wheels with plane circumference is used which has maximum contact area not like v-shaped, u-shaped wheels.

3. Bearings:-

UCP 202 bearing is used to fit lead screw for reducing work stress and friction.

VII. RESULTS

The adjustable sitting inclination chair was fabricated with stainless steel. These chairs have three frames: lower, middle & upper. Lower frame used for transport purpose, middle frame provides height adjustment from 14 inches to 24 inches. While upper frame provides 0 degree to 30 degree inclination to seat, Lead screw mechanism is used to avoid losses.

VIII. CONCLUSION

Design allows doctors to treat different age children at same time, because of its ability adjust height.

Due to inclination patients muscle strength greatly improved. Due to use of lead screw system maintenance cost is reduced & losses are avoided.

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