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BRAIN STROKE THERAPY-EXOSKELETON

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Abstract: Stroke is usually the sudden death of brain cells due to lack of oxygen, caused by blockage of blood flow or rupture of an artery to the brain. A stroke occurs when part of the brain loses its blood supply and stops working. This causes the part of the body that it controls to stop working as well.Wearable exoskeleton that need to be portable,lightweight, safe.. Most current hand exoskeletons have been designed specifically for rehabilitation, assistive or haptic applications to simplify the design requirements. There are several treatments for the stroke like endovascular treatments, surgical treatments etc. but the best treatment for the paralysis, strokes, is the physiotherapy. Usually, the therapy is done manually with an assistant. We propose a method in which the physiotherapy is done automatically with the help of simple mechanisms.

Exoskeleton robots were designed to increase strength and endurance of human limbs. This kind of robots could be used to increase the physical ability of either disabled or ordinary people for executing motion or manipulation tasks. The important point is to design such a shape that could be used safely, and accurately. This function could assist in walking, running, jumping or lifting objects that are beyond the human abilities to carry. In this paper, an upper body exoskeleton robot for rehabilitation applications is presented. This exoskeleton could be used for physiotherapy of whole arm of a patient, when the physiotherapist wears the armband device and performs predefined actions. The manufacturing points including 3D printing of the main parts and prototype of the robot with control instruments and designed mobile application for controlled over IoT.

Keyword: stroke, rupture, exoskeleton, physiotherapists, manufacturing,3D printing

1.INTRODUCTION

India is a country with growing population, emerging technologies with scarce resource where these effects every aspect of our country which includes clothes, food, groceries, cosmetics and along with that hospitals and medicine too. Today we have 426 people subjected for accidents. It may affect them mentally and physically.

Many hospitals don't have the required equipment's or medicines but now physical rehabilitation possibilities are increasing. For individuals with physical or neurological problems, physical rehabilitation is essential. Such a therapy mostly focuses on (i) increasing the effective range of motion (RoM) of the impaired joints, and (ii) repeating activities of daily living (ADLs). Robotic devices can replicate the manual labor of the therapist, while improving patients 'motor recovery and functional independence.

Due of the complicated anatomy and tremendous movement of the hand, designing appropriate robotic devices for hand limitations is even more difficult. To get beyond these designers could make hand devices simpler by limiting mechanical features to specific jobs and levels of incapacity. Modern stationary devices for physical therapy work well, however the majority of them are built like exoskeletons. All patients cannot have their locomotors function restored at the current medical level. therapeutic exoskeletons are employed for social rehabilitation as well. In this situation, an exoskeleton is worn for a prolonged period of time and is intended to ensure that nonfunctioning limbs can move. Existing prototypes are intended to aid in the post-operative recuperation of individuals who have lost their capacity to move. Additionally, the Design is envisioned as having the potential for industrial applications to improve healthy person's physical capabilities. Powerful mechanism, such as lift and move heavy object Exoskeleton robot is a mechanical system has close contact human beings. Virtual environments (VEs) to new sensory modalities. Tactile feedback reproduces surface texture, while force feedback reproduces strain. They propose to be used for the rehabilitation of patients with problems of the locomotion system. In exoskeleton, reasonable application of elastic elements can effectively reduce motor power and work, so as to select smaller motors and batteries. In addition, elastic elements can increase the flexibility and safety of Exoskeleton. Hand exoskeletons and similar devices have received continued interest as they can support more complex arrangements of forces.

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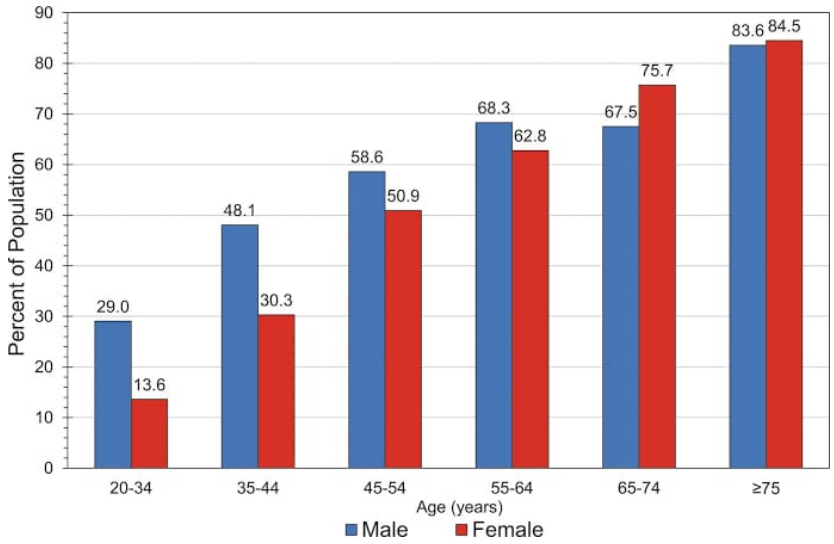

Fig 1: Stroke statistics 2022

2. EXISTING SYSTEM

Ischemic strokes are the most common type of stroke. They happen when a blood clot blocks the flow of blood and oxygen to the brain. These blood clots typically form in areas where the arteries have been narrowed or blocked over time by fatty deposits (plaques).Combination of medicines to treat the condition and prevent it happening again is usually recommended.As Medicine is a wide range of technology, we have several existing systems that includes as follows

2.1 Motor skills exercise

Stroke is one of the leading causes for disability worldwide. Motor function deficits due to stroke affect the patients' mobility. Motor function impairment, even the simplest tasks become difficult and frustrating. Picking up small objects, and fastening buttons can also be lost in the period following a stroke event. Rehabilitation training is the most effective way to reduce motor impairments in stroke patients. Fine motor skills play a major role in our ability to perform everyday tasks in an efficient manner. They're what allow us to accurately grab an item, type words on a keyboard, and tie our shoelaces. After a stroke, individuals may struggle with tasks that involve fine motor skills. Fortunately, these skills can be improved through repetitive practice.

Some of the motor activities for adults after stroke are:

1. Therapy ball exercises
2. Therapy putty exercises
3. Music Glove hand therapy
4.Rubber band resistance
5.Play the piano

2.2 Mobility Training

Mobility training combines mobility exercises that increase the range of movements and motions your body can perform. These include flexibility, but also balance, pliability and strength. The full combination is the best way to avoid injury. Mobility difficulties affect everyone differently. Your physiotherapist will assess how well you move, sit, stand and walk. They will then work with you to set goals and develop a rehabilitation program to meet your needs. It's important to get all four types of exercise: endurance, strength, balance, and flexibility. Promotes good posture (looking at you, desk-workers), Helps prevent knots and injuries, Relieves tension associated with sedentary lifestyles or over-exercising, Improves all-round functional fitness performance. These are the benefits of mobility training Each one has different benefits. Doing one kind also can improve your ability to do the others, and variety helps reduce boredom and risk of injury.

Mobility exercise includes:

1. Wrist Curls
2. Shoulder Openers
3.Sit to Stand
4.Lateral Trunk Bends

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5.Forward Trunk Bends

2.3 Constraint Induced Therapy

Constraint-induced movement therapy is a form of rehabilitation therapy that improves upper extremity function in stroke and other central nervous system damage patients by increasing the use of their affected upper limb. Constraint-induced movement therapy is effective because it stimulates the brain and promotes neuroplasticity. Neuroplasticity is the central nervous system's ability to reorganize itself and make adaptive changes. Due to its high duration of treatment, the therapy has been found to frequently be infeasible. Constraint induced movement therapy or CIMT is centered on retraining the brain following damage to improve functional use of the weaker arm and hand.
CIMT involves two main components:

- Restraint of the unaffected arm using a mitt, sling or cast to encourage use of the weaker arm
- Repetitive practice of functional tasks with the weaker hand. Activities may include picking up or stacking small objects and functional everyday tasks

2.4 Range of motion therapy

Range of movement exercises are of 3 types:
1.Active range of motion (AROM): performed by the patient independently.
2.Active assisted range of motion (AAROM): performed when the patient needs assistance with movement from an external force because of weakness, pain, or changes in muscle tone.
3.Passive range of motion (PROM): usually performed when the patient is unable or not permitted to move the body segment, and the clinician, or family member, moves the body segment.

3.PROPOSED SYSTEM

This Exoskeleton provides an at-home option for therapeutic hand exercises to improve patients' dexterity and restore function using 3D printing. It has servo motors that bend and straighten the fingers, providing the stretching and repetitive exercise needed to restore lost hand function. Low pressure and comfortable materials make this device safe and desirable for repeated use. The minimalist form factor of soft robotics allows users to go about their daily activities without discomfort or frustration while wearing the glove in its unpowered state, and then smoothly transition into the 3D printed gadget like gloves powered assistance when they begin their therapeutic routine. The control system is portable and lightweight and can be placed on anywhere.
Using IoT and an application in mobile phones, the people anywhere can use them and control the patient's physiotherapy without the help of attendees. These robotic gloves using 3D printing operate on the tendon's principle. By temporarily moving the muscles to the hand, this design mimics the installation of the tendons in the human hand. The repetition of exercises is crucial to the recovery process.

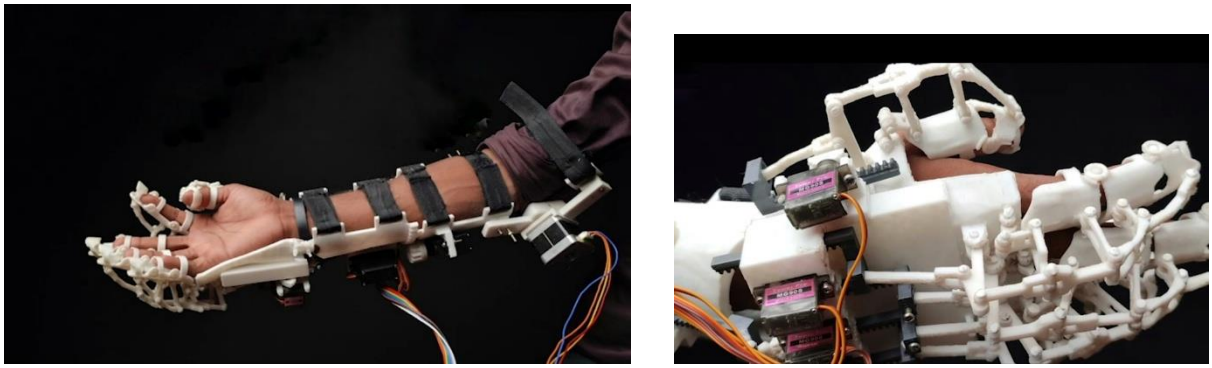

Fig 2: Proposed system

4.CONCLUSIONS

A five-fingered, battery-powered, 3-D printed, force-augmentation orthotic exoskeleton for the human hand was created in this study. With the five-digit exoskeleton, individuals may continue to independently operate each finger. Subjects were able to maintain autonomous finger mobility, pick up a typical object like a water bottle, as well as smaller, more delicate objects like a smartphone, while wearing the exoskeleton.

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This device can be extended and can be used anywhere on our body by changing the design of 3D printing accordingly. Comparatively to gloves made up of cloth that feels sweaty and clumsy for patients this device provides comfortable treatment where they don't need to travel too.

Hence, the device's parts could be independently 3-D printed at a minimal cost, allowing for quick repair of damaged sections. This device can be managed with a mobile phone from anywhere- thanks to IoT. As a result of its modest weight, it is convenient and comfortable to use.

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