Semester Project -03

Occupational Therapy Kit

for patients suffering from ALS/MND

By Aryan Gajwe

Mdes 2nd Year

Prof. Purba Joshi

Project Guide

IDC School of Design अभिकल्प विद्यालय + NeuroGen Brain & Spine Institute Centre for Cell Therapy and Neurorehabilitation ISO 9001:2015 Certified

Approval Sheet

The Design Project III titled Occupational Therapy Kit for patients suffering from ALS/MND by Aryan Gajwe Roll Number 206130001 is approved in fulfillment of the Masters Degree (Industrial Design) at the IDC School of Design, Indian Institute of Technology Bombay

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Project Guide

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Declaration

I declare that this project report submission contains my own ideas and work, and if any pre-existing idea or work has been included, I have adequately cited and referenced the original author(s).I also declare that I have adhered to all the principles of academic honesty and integrity and have not misinterpreted, fabricated or falsified any idea/ data/ fact source in my submission. I understand that any violation of the above will be cause for disciplinary action by the institute and can also evoke penal action from the sources.

Aryan Gajwe 206130001
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July 2023

Abstract

This study aims to design an occupational therapy kit for individuals in stages 1 and 2 of ALS/MND, to be used conveniently at home. The kit will consist of a variety of exercise tools targeting muscles in the fingers, palms, wrists, elbows, and shoulders. The objective is to help patients maintain their range of motion, improve grip strength, and reduce muscle wasting in their upper limbs.

The designed kit emphasizes affordability, accessibility, and portability, allowing individuals to engage in therapy sessions without the need for frequent hospital visits. The tools within the kit are designed to be intuitive and user-friendly, facilitating ease of use. Additionally, exercises performed with the assistance of these tools can be personalized by the occupational therapist to suit the specific needs and condition of each patient.

By providing a comprehensive therapy kit, this study seeks to enhance the accessibility and effectiveness of occupational therapy for individuals with ALS/MND. The convenience of using the kit at home promotes consistent engagement in therapy, enabling patients to proactively manage their condition. This approach holds the potential to improve the maintenance of upper limb function and enhance the overall quality of life for individuals living with ALS/MND in the early stages of the disease.

Acknowledgement

I would like to express my heartfelt gratitude to all those who have contributed to the success of my project. This endeavor would not have been possible without the unwavering support and encouragement of my family, friends, and peers. Their belief in me and their constant motivation kept me going even during the most challenging times.

I am deeply indebted to my mentor, Prof. Purba Joshi, for her invaluable guidance and mentorship throughout the project. Her expertise, insightful feedback, and unwavering support were instrumental in shaping my ideas and pushing me to excel.

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Contents

Contents

Chapter 01

Introduction

What is MND?

In MND, the motor neurons start dying causing muscle weakness in various parts of the body. Thus the affected nerves stop sending messages to the muscles gradually leading to weakness and thinning (atrophy/ wasting) of those muscles. This is known as neurodegeneration.

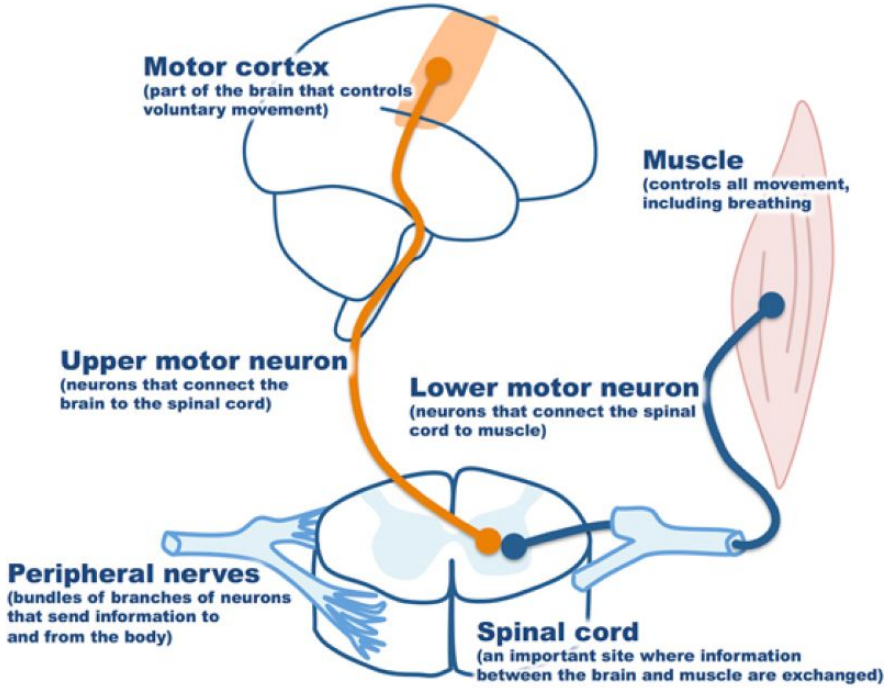
MND has a significant effect on people and their families. Patients may have trouble moving around, speaking, swallowing, and breathing as the condition worsens. Maintaining independence and a high standard of living is extremely difficult due to MND's persistent nature. Furthermore, it is impossible to emphasise the emotional and psychological toll on patients, carers, and loved ones.

MND affects a diverse range of individuals worldwide, regardless of age, gender, or ethnic background. It is estimated that around 2-5 individuals per 100,000 are diagnosed with MND each year. Although the exact cause of MND remains largely unknown, a combination of genetic and environmental factors is believed to contribute to its development.

While there is currently no cure for MND, significant advancements have been made in understanding the disease and developing supportive care strategies to manage symptoms, enhance comfort, and prolong survival. These include assistive technologies, multidisciplinary care teams, respiratory support, and palliative care services that aim to improve the overall well-being of individuals living with MND.

MND has also been presumed to have a genetic origin where in the disease may be transmitted from one generation to the other. Some of the genes have been identified that may cause MND. When there is a gene involvement it is called as familial MND. However MND may be present without any family history (sporadic). But 90% of the times MND is sporadic and only 10% is of the times a definite genetic cause is identified.

Incidence of ALS in USA is 2 per 100000, in Canada it is 2.4 per 100000, in UK it is 2.16 per 100000 however the incidence rate in India has not been identified. [1]



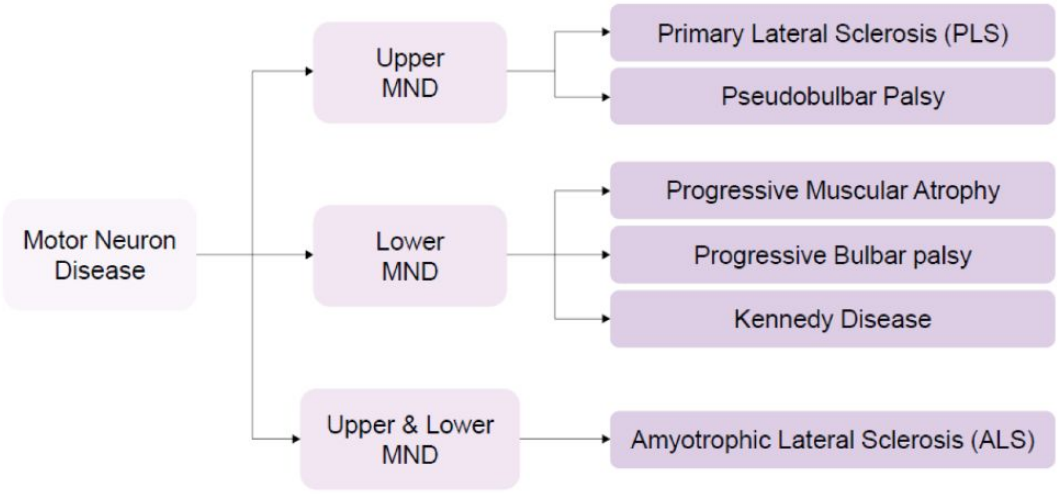
In MND, connections from the brain to the spinal chord (upper motor neurons) and from the spinal chord to the muscle (lower motor neurons) may die. As there neurons die, control of muscles are lost.
https://www.mndandme.com.au/what-is-mnd/what-is-mnd/

Types of MND

MND leads to the degeneration of these motor neurons. It can affect:

- Upper motor neurons (UMN) in the brain that descend to the spinal cord or,
- Lower motor neurons (LMN) that exit the spinal cord to activate muscles or,
- Both upper and lower motor neurons.

These motor neurons are the vital communication links between the brain and the voluntary muscles, controlling their movement.



Types of MND

The UMN & LMN diseases can further be divided into the following categories as per the type of progression and the symptoms. They are further classified as per whether the disease is onset via the limbs or via the “bulbar” region (speech, swallowing and chewing) They are also different in terms of rate of progression, severity & life expectancies.

1. UMN disorders
- in which the neuron originating from the brain and ending in the spinal cord are damaged.

a. Primary Lateral Sclerosis(PLS) - This is a rare form of MND and where mainly the legs undergo weakness and, in some cases, the arms. In most cases, speech, breathing, and swallowing remain unaffected till the advanced stage is reached.

b. Pseudobulbar palsy - In this, there is the progressive weakness of facial muscles, mastication muscles, and laryngeal muscles, causing facial expression, difficulty to chew and swallow, and progressive difficulty of speech.

2. LMN disorders
- in this, the nerve originating from the spinal cord and spreading through the body are damaged.
a. Progressive muscular atrophy(PMA) - Common symptoms in this disease are weakness in legs and arms. Speech, breathing, and swallowing are rarely affected and found only at an advanced stage.
b. Progressive bulbar palsy(PBP) - There is progressive difficulty in swallowing, chewing, and talking. The average life expectancy is between 6 months to 3 years from the point of symptoms.

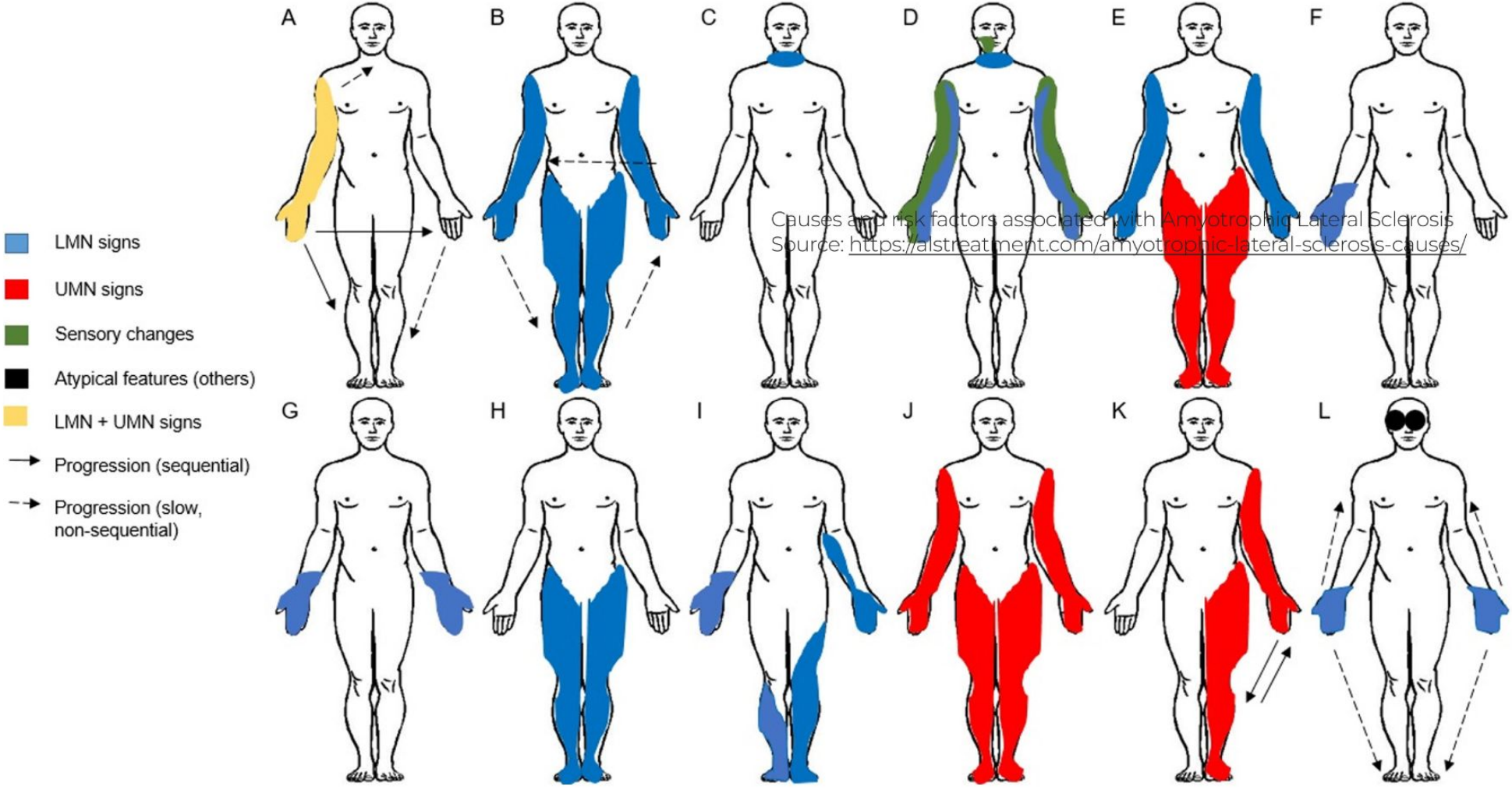
c. Spinal muscular atrophy(SMA) - This is a genetic disorder, and the severity of the condition is different for every patient. There is progressive wasting of hip and shoulder muscles.
d. Kennedy disease - This disease runs in the family and is an inherited disorder that has been seen more in males than females. It causes weakness in the upper and lower extremities[2].

Types of MND

	UMN Syndrome	LMN Syndrome
Type of Paralysis	Spastic Paresis (Partially paralysed rigid muscular tone)	Flaccid Paralysis (loose muscle tone)
Atrophy	No – Disuse Atrophy	Severe Atrophy
Fasciculation **(involuntary muscle contraction & Relaxation) &** **Fibrillation** **(irregular heartbeats)**	Absent	Could be present
Deep Tendon Reflex **(reflex when tendons are struck)**	increase	Absent
Pathological Reflex **(Pathologic reflexes are reversions to primitive responses and indicate loss of cortical inhibition)**	Positive Babinski Sign (Flexion of foot when palm of foot is stroked)	Absent
Superficial Reflex **(Superficial reflexes are motor responses to scraping of the skin)**	Absent	Present

Source : https://boneandspine.com/upper-motor-neuron-and-lower-motor-neuron-syndromes/

Further classifications

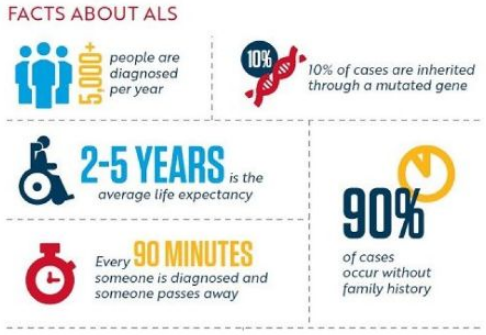


Causes and risk factors associated with Amyotrophic Lateral Sclerosis
Source: https://alstreatment.com/amyotrophic-lateral-sclerosis-causes/

Source : Atypical Motor Neuron Disease variants: Still a diagnostic challenge in Neurology
https://pubmed.ncbi.nlm.nih.gov/30846210/

MND – Amyotrophic Lateral Sclerosis - ALS

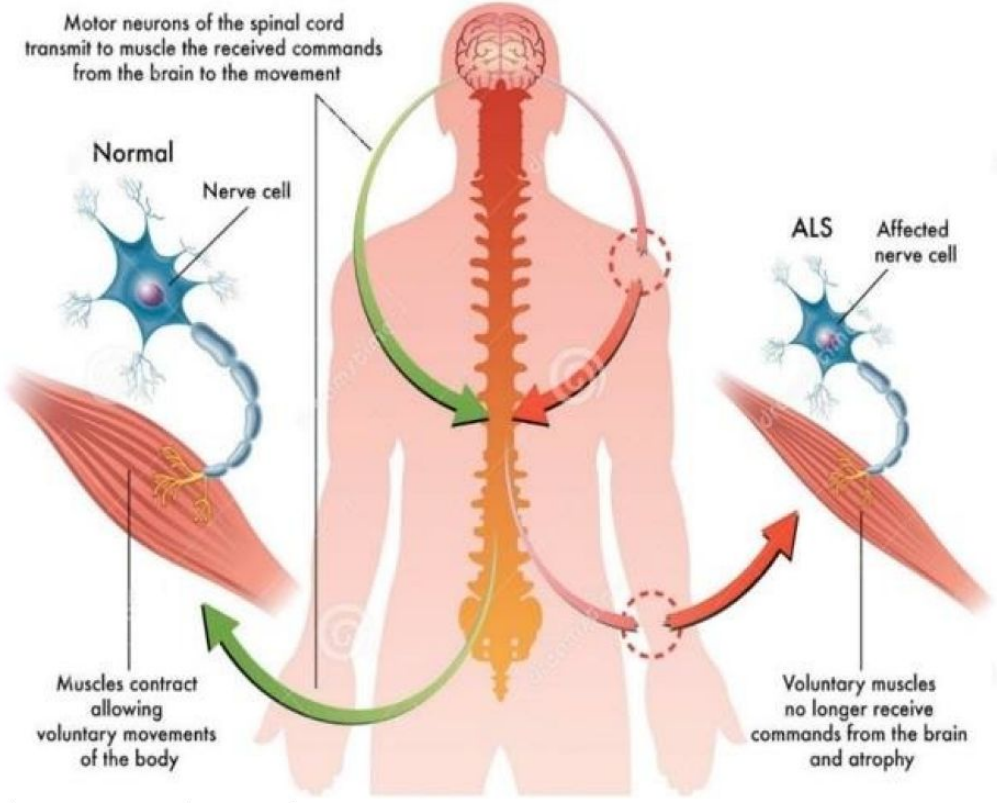
ALS, or amyotrophic lateral sclerosis, is a progressive neural disease that affects the motor neurons in the brain and the spinal cord. A-myo-trophic comes from the Greek language. "A" means no. "Myo" refers to muscle, and "Trophic" means nourishment – literally translating to "No muscle nourishment." When a muscle has no neural stimulus, it "atrophies" i.e., it wastes away. "Lateral" identifies the areas in a person's spinal cord where these motor neurons are located. As they degenerate, the muscles attached to them start hardening ("sclerosis") in the region.



ALS Facts & Figures
Source : https://www.dell.com/en-us/perspectives/how-ai-helps-give-als-patients-a-voice/

Age of onset
ALS can be classified based on the age of onset. The peak age of onset is said to be 58 to 63 for sporadic ALS (non hereditary) and 47 to 52 for familial ALS (hereditary). Also about 10% of all ALS cases begin before age of 45 (young onset ALS), and about 1% begin before age of 25 (juvenile ALS) [3].

Survival rate
Half of all patients affected with ALS MND have a life expectancy of least three or more years after diagnosis. 20% of the patients live five years or more and up to 10% of them live more than 10 years [4]



Motor neuron degenration
https://www.researchgate.net/figure/Amyotrophic-LateralSclerosis-ALS_fig1_320285827

Causes

The exact causes of Amyotrophic Lateral Sclerosis (ALS), also known as Motor Neuron Disease (MND), are not fully understood. However, research suggests that a combination of genetic and environmental factors may contribute to the development of ALS. Here are some key factors associated with ALS:

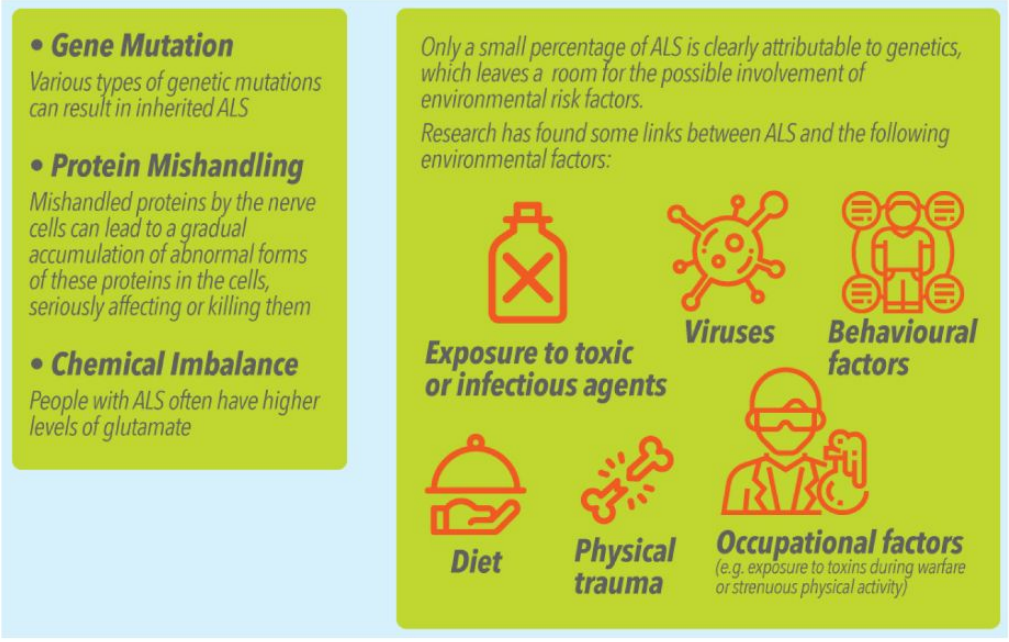
1. Genetic Factors: A small percentage of ALS cases, approximately 5-10%, are inherited or familial ALS (fALS), resulting from specific gene mutations. Mutations in genes such as SOD1, C9orf72, TARDBP, FUS, and others have been identified as associated with fALS. These genetic mutations can lead to abnormal functioning of motor neurons and their subsequent degeneration.

2. Sporadic ALS: The majority of ALS cases, around 90-95%, are classified as sporadic ALS (sALS). Sporadic ALS occurs without a clear family history of the disease and is thought to result from a complex interplay of genetic and environmental factors.

3. Environmental Factors: Various environmental factors have been studied for their potential association with ALS. These include exposure to certain toxins or chemicals, such as lead, mercury, pesticides, and heavy metals. However, the specific causal relationship between these factors and ALS development requires further research.

4. Excitotoxicity and Oxidative Stress: Excitotoxicity, a process in which excessive stimulation of neurons leads to their damage or death, and oxidative stress, an imbalance between free radicals and antioxidants, are believed to contribute to the degeneration of motor neurons in ALS. These processes may be influenced by both genetic and environmental factors.

It is important to note that ALS is a complex and multifactorial disease, and the interplay between genetic predisposition and environmental triggers is still being explored. Ongoing research aims to uncover additional factors that may contribute to the development of ALS, providing a better understanding of the disease and potential targets for therapeutic interventions.



MND - Symptoms

General Symptoms

Motor neuron disease (MND), including amyotrophic lateral sclerosis (ALS), presents a wide range of signs and symptoms, which can make diagnosis challenging and often delayed. One distinguishing feature of MND is that it primarily affects muscle weakness while leaving sensations unaffected. The disease can initially manifest in the limbs or the mouth. If any of the following symptoms are observed, it is crucial to seek immediate medical attention:

- **Muscle weakness:** Gradual loss of muscle strength and control.
- **Muscle wasting:** Progressive muscle atrophy and shrinking.
- **Muscle fatigue:** Easily becoming tired and experiencing muscle exhaustion.
- **Muscle spasticity:** Stiffness and tightness in muscles, leading to reduced range of motion.
- **Muscle cramps:** Involuntary muscle contractions causing pain and discomfort.
- **Muscle twitches:** Uncontrolled, spontaneous muscle contractions, also known as fasciculations.
- **Dysphagia:** Difficulty in swallowing due to weakened throat and tongue muscles.
- **Dysarthria:** Impaired speech and articulation due to muscle weakness.
- **Respiratory failure:** Weakening of the respiratory muscles, leading to breathing difficulties.
- **Cognitive and mood changes:** In some cases, ALS can be associated with cognitive impairments, such as changes in memory, thinking, and behavior, as well as mood disturbances.

Due to the progressive nature of MND, there is currently no known cure. However, supportive care and symptom management play a critical role in the treatment of people with ALS (PALS). The focus of care is on addressing the various symptoms and providing necessary support to enhance quality of life. Multidisciplinary approaches involving healthcare professionals such as neurologists, occupational therapists, physiotherapists, speech therapists, and palliative care specialists are essential in managing the complex needs of individuals with ALS.

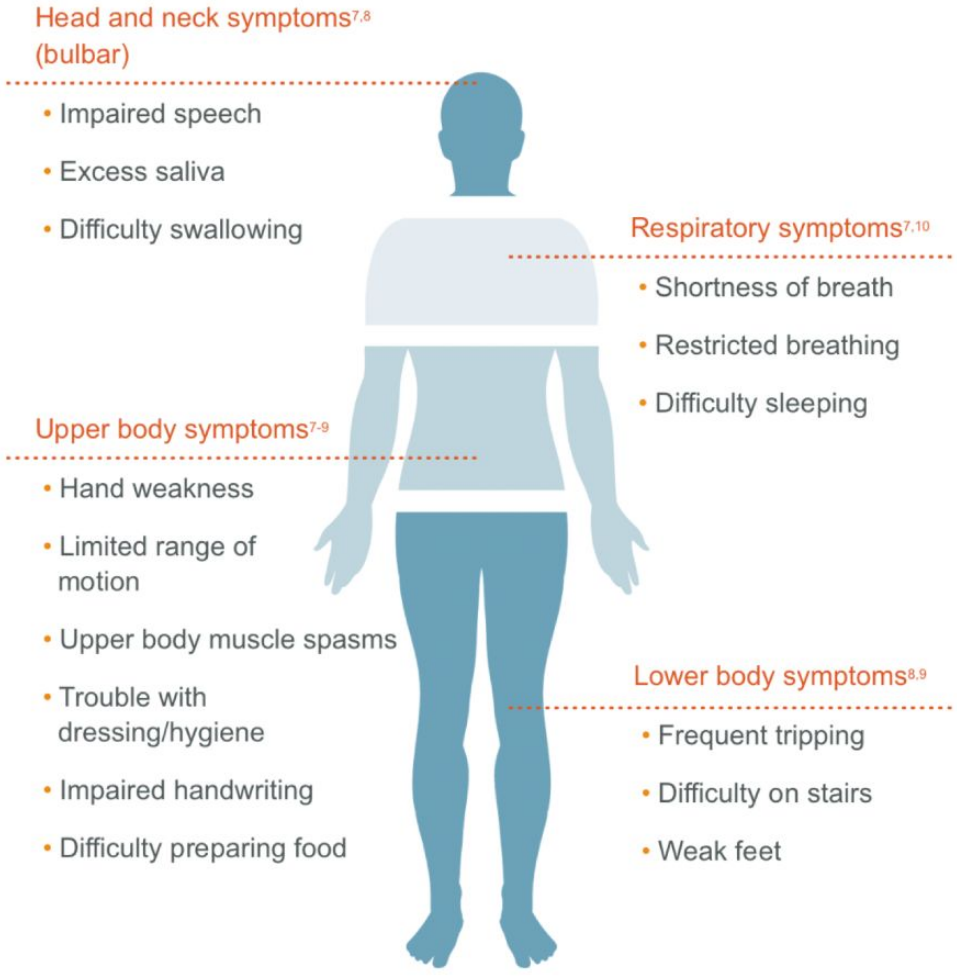


Fig 8: Symptoms of ALS classified by region
Source: https://www.alspathways.com/als-overview/

MND - Common Secondary Complications

Some of the common comlications of MND are:

Motor neuron disease (MND), including amyotrophic lateral sclerosis (ALS), can give rise to various complications that impact multiple systems in the body. Some of the common complications associated with MND include:

- **Breathing problems (respiratory complications):** As the disease progresses, weakened respiratory muscles can lead to difficulties in breathing, reduced lung capacity, and the need for respiratory support or mechanical ventilation.
- **Cognitive and Behavioral changes:** Some individuals with MND may experience changes in cognitive function, such as difficulties with memory, thinking, and decision-making. Additionally, behavioral changes, including emotional lability, apathy, and depression, can also occur.
- **Thrombophlebitis/Deep vein thrombosis (DVT):** Immobility, muscle weakness, and decreased mobility associated with MND can increase the risk of developing blood clots, particularly in the deep veins of the legs, leading to thrombophlebitis or DVT.
- **Contractures:** Progressive muscle weakness and immobility can result in the development of contractures, which are permanent shortening and tightening of muscles, causing joint stiffness and limited range of motion.
- **Joint pain:** Joint pain can occur due to abnormal stress and strain on joints caused by muscle weakness and imbalances.
- **Joint subluxation/Dislocation:** Weakening of the supporting muscles and ligaments around joints can increase the risk of joint subluxation (partial dislocation) or dislocation, leading to pain and functional impairment.
- **Fractures:** Fragile bones, reduced muscle support, and increased risk of falls can predispose individuals with MND to fractures, particularly in weight-bearing bones.
- **Constipation:** Decreased muscle tone in the digestive tract can result in slowed bowel movement and constipation.
- **Anxiety related to difficulty of breathing:** Breathing difficulties and the fear of respiratory failure can contribute to anxiety and emotional distress in individuals with MND.

The management of these complications involves a multidisciplinary approach.

Healthcare professionals such as neurologists, respiratory therapists, physiotherapists, occupational therapists, and palliative care specialists collaborate to address and alleviate these challenges, enhance quality of life, and provide optimal support to individuals living with MND.

MND - Progression of Symptoms

General Symptoms

The symptoms and progression of ALS can vary among individuals, but there are general patterns observed in the course of the disease.

- **Early stage:** The initial symptoms often involve muscle weakness, twitching (fasciculations), cramping, or stiffness. Weakness may first be noticed in one limb or one side of the body, and tasks requiring fine motor skills may become more challenging. However, individuals in the early stage typically maintain their independence in daily activities
- **Middle stage:** As the disease progresses, muscle weakness spreads to other parts of the body, and mobility becomes increasingly affected. This stage is characterized by difficulty walking, tripping or stumbling, and muscle fatigue. Daily activities such as dressing, bathing, and eating may require assistance or adaptive equipment. Speech and swallowing difficulties (dysarthria and dysphagia) can also arise.
- **Late stage:** In the advanced stages of ALS, individuals experience severe muscle weakness and may become completely paralyzed. They may be confined to a wheelchair or bed and require extensive assistance for all activities of daily living. Breathing difficulties become prominent as the respiratory muscles weaken. Many individuals with ALS ultimately succumb to respiratory failure, which is the most common cause of death in ALS patients.

However, ALS progresses differently for each person. Average life expectancy after diagnosis is 2 to 5 years, but varies widely.

Fig 9: Progression of Symptoms of ALS

Source: https://www.startstemcells.com/the-stages-of-als-understanding-the-progression-of-the-disease.html

MND - Management and Treatment

ALS is a complex and progressive disease that presents with a wide range of symptoms. To provide effective care, it is crucial to approach and manage all the symptoms comprehensively. Due to the progressive nature of ALS and the continuous changes in an individual's condition, a multidisciplinary approach to care is highly beneficial.

At the initial stages of ALS, individuals may have different needs compared to later stages when mobility is significantly impaired. Therefore, a tailored approach is necessary to address the evolving requirements and challenges faced by the individual. Care providers, including neurologists, respiratory therapists, physiotherapists, occupational therapists, speech therapists, and social workers, collaborate to deliver comprehensive care.

It is important for individuals with ALS to understand that goals and plans may need to be adjusted as the disease progresses. The dynamic nature of ALS necessitates regular reassessment and modification of care strategies to meet the changing needs of the person. This includes adapting assistive devices, implementing new techniques to support mobility and communication, and addressing respiratory needs.

The primary objective at all stages of ALS is to optimize health and enhance the overall quality of life for the individual. This involves managing symptoms such as muscle weakness, fatigue, spasticity, breathing difficulties, and swallowing impairments. Palliative care may also be integrated to address pain, provide emotional support, and assist with end-of-life planning.

By employing a comprehensive and multidisciplinary approach, healthcare professionals can work collaboratively to address the diverse needs of individuals with ALS. This approach ensures that care is tailored to the individual's specific requirements and provides the best possible support to optimize their health and quality of life throughout the course of the disease.

Fig 10: Stakeholders in the ALS Patient Community
Source: Author

MND - Types of Treatment

Mainstream Medication

Fig 11: Mainstream Medication

Source: https://unsplash.com/s/photos/pills

The Mainstream medications include :

- Vitamin & Protein Supplements
- Symptom Management drugs
- FDA approved drugs
- Pain Management drugs
- Drugs for muscle spasms, cramps & spasticity
- Drugs for fatigue, depression , sleep

Physiotherapy

Fig 12: Physiotherapy

Source: https://runwayhealth.ca/physiotherapy-for-the-knee/

This incudes a wide range of ROM, Strengthening, Aerobic & Cardio Exercises along with other types of unconventional techniques such as Yoga, Aqua-Therapy. Etc.

It leads to the increase in Muscle Endurance, Strength and helps in pain management and prevention of fasciculations and cramps.

Occupational Therapy

Fig 13: Occupational Therapy

Source: https://familycarehha.com/blog/what-can-an-occupational...

Occupational Therapy can help you accomplish your activities of daily living (eating, bathing, dressing, writing, shopping, etc.), your work, and your leisure through the use of compensatory strategies, adaptive devices, home and work modifications, and community resources.

Speech Therapy

Fig 14: Speech Therapy

Source: https://alsworldwide.org/podcasts/category/39

This is usually done for patients with respiratory insufficiency, symptoms of dysphagia or dysarthria. The following main criterion are taken care of :

- Energy conservation while speaking
- Slowing speech
- Exaggerated enunciation

MND - Types of Treatment

Nutritionist

Fig 15: Nutritionist aids for ALS

Source: https://als-connect.org

Amyotrophic lateral sclerosis(ALS) is a progressive neurological disease with a high risk of malnutrition. Due to changing disease status, diet modification may need to be done frequently. They also need to meet the patients swallowing requirements & have specialized liquid diets as well.

Respiratory Therapy

Fig 16: Respiratory Therapy

Source: https://alsworldwide.org

In ALS, breathing difficulties can start early or much later. Because of this patients prognosis will be poor. So the non-invasive and invasive mechanical ventilation have been used for patient's care. Following are the alternative approaches to treat respiratory problems. Some devices that are used as respiratory devices are cough assist devices, diaphragmatic pacing .Etc.

Stem Cell Therapy

Fig 17: Stem Cell Therapy

Source: https://johnandrachukmd.com

Stem cell therapy is being explored extensively for MND- /ALS. Stem cells are unique, specialized cells that help to repair, regenerate and replace damaged cells. Stem cell therapy (also called cell therapy/ regenerative medicine) works on the principle of using healthy cells to repair damaged cells. Stem cells are considered to be "blank slates", which means they are programmable.

Gene Therapy

Fig 18: Gene Therapy

Source: https://www.livescience.com/

It involves the genetic repair of the damaged brain cell to deliver a beneficial cell protein, which will stop the disease progression and repair dying nerve cells. It is Currently under clinical trials.

Inferences

From the above studies, The key inferences are as follows :

1. ALS and MND are neurological diseases which affect the physical and mental stature of the patient

2. Excessive care must be taken while designing for such patients by thoroughly understanding the extent of limitations their body can take while performing actions

3. The stages of the disease are very short-lived in nature - which means that the same design cannot be used from one stage to another as the condition of the patient gets more and more complex and difficult to treat. Hence, while designing for such patients, one must either look to create a range of products for every stage or adaptable products that can be used through stages.

4. The nature of the disease itself makes it highly variable (as seen in the types of MND). Hence, while looking at it from a Occupational Therapy perspective, the progression is variable too. We can either look to solving the problems of a niche area of the disease or map out the commonalities between stages and solve for them through standardization.

5. A possible complication while solving could be the difference in exercises for UMN & LMN symptoms due to the difference in muscle qualities.

6. The balance must be maintained while giving them occupational therapy due to complications mentioned – Muscle wasting, fatigue, Grip strength loss, Etc.

Chapter 02

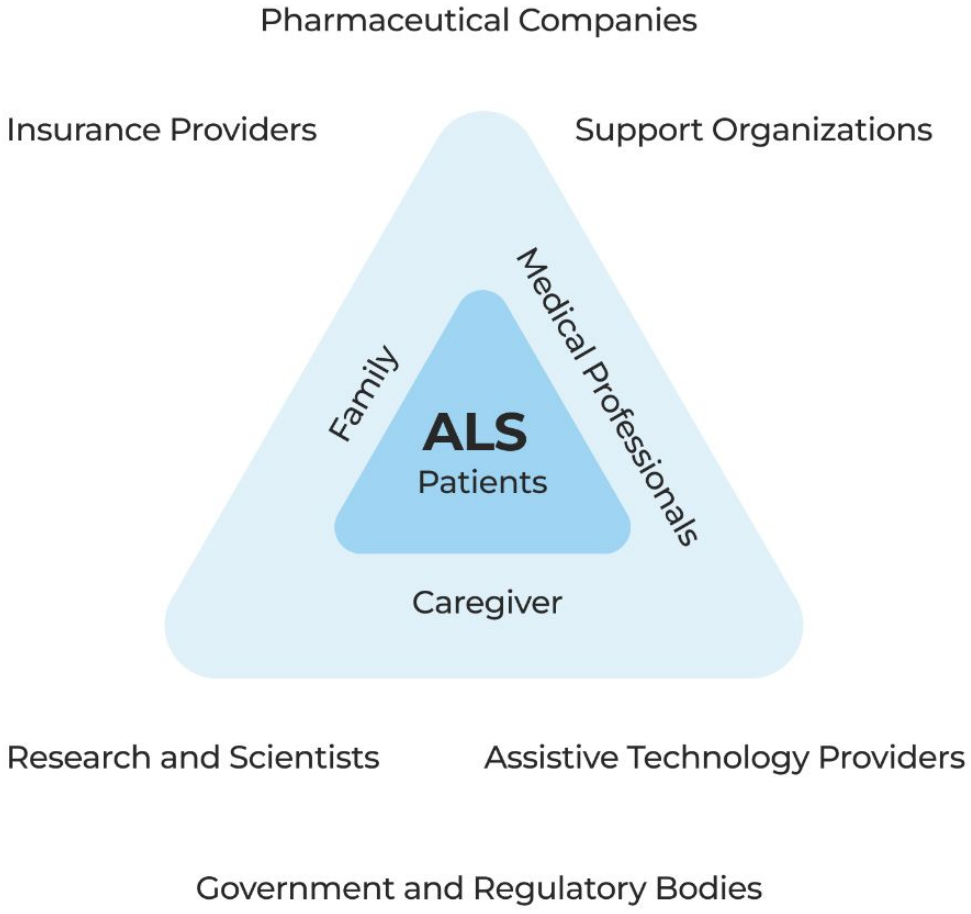
Primary Research

Stakeholder Ecosystem

The stakeholder ecosystem for ALS (Amyotrophic Lateral Sclerosis) patients involves various individuals and organizations that play a crucial role in supporting and providing care for patients. These stakeholders include:

1. **Patients:** ALS patients themselves are at the center of the ecosystem, and their needs, preferences, and experiences are of primary importance.
2. **Family and Caregivers:** Family members and caregivers provide essential support, assistance, and emotional care to ALS patients. They play a significant role in daily activities, managing treatments, and advocating for the patient's well-being.
3. **Medical Professionals:** This includes doctors, neurologists, physiotherapists, occupational therapists, speech therapists, and other healthcare providers who diagnose and treat ALS patients, manage symptoms, and provide specialized care.
4. **Support Organizations:** Non-profit organizations, ALS associations, and advocacy groups offer resources, information, support groups, and financial assistance to ALS patients and their families.
5. **Researchers and Scientists:** Professionals dedicated to studying ALS work towards understanding its causes, developing treatments, and finding a cure for the disease.
6. **Assistive Technology Providers:** Companies and organizations that specialize in creating and providing assistive devices, mobility aids, communication devices, and other technologies that enhance the daily lives of ALS patients.
7. **Pharmaceutical Companies:** Pharmaceutical companies play a role in developing and providing medications and therapies to manage ALS symptoms and potentially slow down disease progression.
8. **Insurance Providers:** Insurance companies and healthcare payers contribute to the ecosystem by offering coverage for medical expenses, therapies, assistive devices, and other necessary services.
9. **Government and Regulatory Bodies:** Government agencies and regulatory bodies establish policies, regulations, and funding initiatives related to ALS research, treatment, and patient care.

The collaboration and coordination among these stakeholders are crucial for ensuring comprehensive and holistic support for ALS patients throughout their journey.



Interview with Doctors

Dr Hemangi Sane

Consultant Physician,
Deputy Director at NeuroGen.

MND condition:

- Arm weakness & Gait.
- Has MND from last 11 years.
- There is progressive weakness in hands and legs with difficulty in getting in and out of the chair and climbing stairs.
- Dependent on caretaker for mobility.
- Has a difficulty in speaking, swallowing and coughing.
- After stem cell therapy, the condition is stable.

Observations and comments

- For legs we have many equipment
- For hand not much has been done yet
- Collaborating between different departments
- Maybe an Exoskeleton
- Limited rotation in elbow
- Poor Grip, Wrist not good
- Google home had made life easy
- Deltoids becomes weak not the shoulder joint.
- Comb my hair
- Wash my face
- Wipe my mouth
- Needs helper all the time when at home
- Hands don't work is the biggest problem
- Hands falls down on the side can't pick up needs to call help
- Typing is bit hard
- "Theory of Everything"

  Gives impact on his desire and how life is
- Apple as a system has helped
- Connectivity

  Because my whole phone can be accessed from laptop
- Can't turn ON the laptop
- Floating keyboard is not on during startup
- Eye tracking on Mobile/Laptop

  We have it but not commercially available

Inferences

- There is a need for assistive equipment for upper body mobility
- due to limited upper limb movement, need of assistive exoskeleton to perform gross motor skills
- Most help always required for tasks that need hands
- Makes use of virtual keyboard, phone always on auto pickup, uses Apple ecosystem
- Can add features to mouse like SOS button, bell and a button to change devices
- Mouse kept on lap over a board, can lead to slipping of hand
- Need for affordable tech for communication like eye tracker, muscle twitch, pressure sensor
- Need for easy cursor navigation to use virtual keyboard, excel, etc

Interview with Doctors

Dr Hima Biju

Department in Charge of Operational Therapy,

Experienced doctor heading the occupational therapy department. Came across various cases of neurological diseases in rehabilitation.

Dr. Hima Biju provided information on two patients who had visited the clinic in the past for diagnosis and treatment.

Patient 1

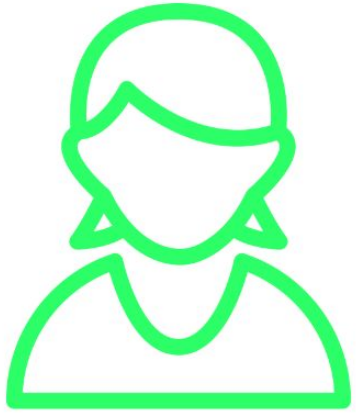
Patient 2

Observations and comments

- Easy Fatigue Ability, need to keep a track of fatigue
- Need to take frequent rest
- Fasciculations (Jumping of Muscles)
- Support of Assistive devices to maintain range of motion and support the muscles.
- Muscle Wasting
- What we value in life is different for different people and that is why the motivation factors differ.
- OT is important to continue performing daily tasks since muscles are constantly being used
- Homemaker, Teacher and a Mom
- She values being able to teach the children
- Wants to be able to make chapatis.
- Upset about losing the ability to move and work around the house
- Positive attitude towards therapy sessions
- Last day for PT and OT in hospital, will continue at home
- Knows muscles are deteriorating day by day
- Software Engineer in IBM
- She valued work over other things
- She said I hire a maid to do bathing and everything but she just wants to work.
- Faced problems using a conventional mouse, but continued working
- Stopped taking therapy after a point.

Interview with patients

Patient 1



Female (Age - 59)
Profession - Primary school teacher

Health condition -
Disease is progressing slowly. There is weakness and pain in arms but still manages to do lots of daily things within her capability. She is also able to drive her automatic car. But with MND, she felt disappointment and frustration at not being able to do things she use to take granted.

Patient 2

Male (Age - 40)
Profession - Business manager in motor sales

Health condition -
Diagnosis at 39 yrs of the age. Still working in his profession. He has arm weakness. He mentioned he feels frustrated for not being able to do normal things properly, like holding a pen and spoon or brushing teeth.

Patient 3

Male (Age - 24)
Profession - Former building worker

Health condition -
Diagnosed with MND a year ago. Fingers started being weak at age 20. Now, has very limited usage of hand unable to work. Lives on his own as he likes to be independent of family. He finds difficulty in dressing, washing, and eating.

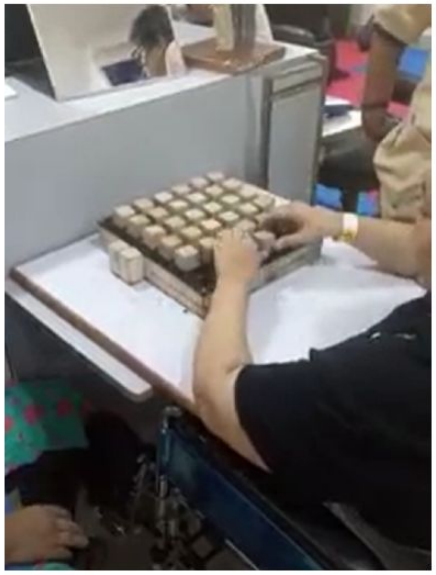
Patient 4

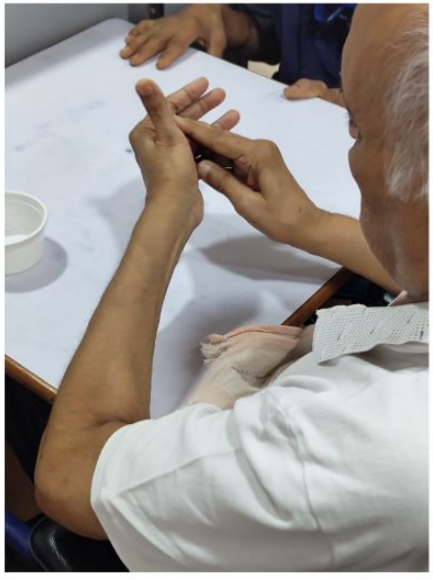
Male (Age - 48)
Kenya, Currently in Hyderabad

Health condition -
Weakness in grip, cant hold small things. Due to weakness in the wrist joint, the wrist drop condition is there, which makes it difficult to perform daily activities. Small sets of experiments were performed with him to understand the abilities and the movements of the body parts. The experiments included picking up the small things, bigger things, using a spoon, eating with it, lifting a glass of water and drinking, etc.

Shadowing patient therapy

We shadowed four patients at Neurogen clinic. We observed their Physiotherapy sessions and Operational therapy sessions. This provided us with valuable information about their symptoms, behaviors, and interactions. It also enhanced learning, empathy, and the patient-provider relationship, providing insights for quality improvement and process optimization, thus helping us create patient-centered products.





Inferences

Doctor interactions and patient shadowing provided valuable insights for identifying design opportunities in occupational therapy. Interviews with patients helped understand their needs, while observing therapy sessions revealed areas for improvement. This informed the development of innovative design concepts to enhance the patient experience and address specific challenges.

Need for a OT kit for therapy at home

What we value in life is different for different people and that is why the motivation factors differ

Fasciculations (Jumping of Muscles)

Most help always required for tasks that need hands

Upset about loosing the ability to move and work around the house

Stiffness in the Morning

Muscle Wasting

OT is important to continue performing daily tasks since muscles are constantly being used

She values being able to teach the children

She valued work over other things

Wants to be able to make chapatis

My main goal is to keep my right hand intact

Last day for PT and OT in hospital, will continue at home

Exercise krta hu, phle hospital jata tha ab ghar pe krta hu

Initial Design Brief

To design an occupational therapy kit for patients suffering from ALS for home use.

Chapter 03

Secondary Research

What is Occupational Therapy?

The goal of occupational therapy, a medical specialty, is to assist people of all ages in regaining or developing the skills required to engage in fulfilling activities and jobs. Enhancing a person's capacity to carry out daily activities that are crucial for their wellbeing, independence, and quality of life is the main objective of occupational therapy.

Individuals with physical, cognitive, psychological, or developmental difficulties that affect their capacity to complete tasks and take part in activities are the focus of the work of occupational therapists. They make an assessment of the person's capabilities, constraints, and objectives before creating individualised intervention plans to meet their unique needs.

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Occupational therapists are essential in helping people reach their full functional potential, foster independence, and participate in activities that are meaningful and significant to them. They work to improve people's general wellbeing and give them the tools they need to engage fully in society.

Fig 8: Occupational Therapy

Source: https://www.fairviewrehab.com/

Difference Between Occupational Therapy and Physiotherapy

Although both occupational therapy and physiotherapy are rehabilitative therapies with the same overall objective of increasing physical ability, their methodologies and focus are different.

The focus of occupational therapy is on supporting people in fulfilling activities and jobs. It focuses on mental, physical, and emotional health with the goal of boosting independence and overall quality of life. While incorporating exercises, manual therapy, and other physical modalities, physiotherapy primarily focuses on diagnosing, managing, and treating physical illnesses and injuries.

Self-care, employment, leisure, and home activities are all included in occupational therapy's broader definition of activities. It makes use of intentional actions, environmental adjustments, and aids to facilitate functional performance. Through therapeutic exercises, manual therapy, and other physical interventions, physiotherapy focuses on regaining physical function, mobility, and strength in patients.

Occupational therapists frequently interact with experts from psychology, social work, and vocational rehabilitation to address broader functional and psychosocial elements, even though both fields work with multidisciplinary teams. To evaluate and treat particular physical disorders, physiotherapists may work in conjunction with doctors, orthopedic experts, and sports trainers. Both occupational therapy and physical therapy are essential to the rehabilitation process, although they differ in their areas of focus and methods of care.

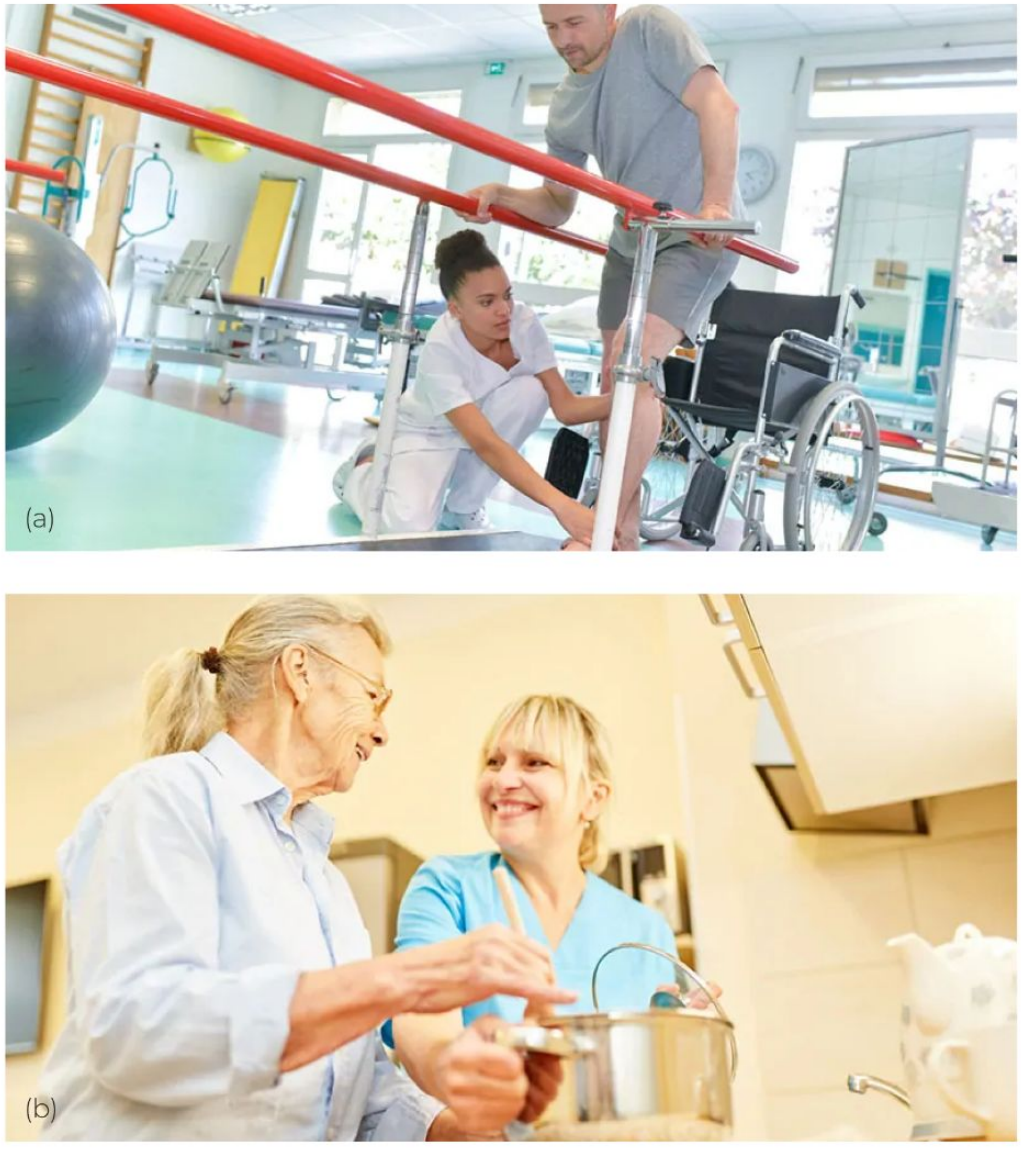


Fig 8: (a) Physiotherapy (b)Occupational Therapy

Source: https://www.myotspot.com/occupational-therapy-vs-physical-therapy/

Role of Occupational Therapists for ALS Patients

ALS, a degenerative disease that affects neurons, gradually impairs motor functions and poses challenges for individuals in performing even simple tasks like dressing. Occupational therapists provide essential support to ALS patients by helping them make healthy food choices, incorporating exercise into their routine, and utilizing assistive technology to enhance independence.

Occupational therapists offer guidance on nutrition to optimize overall well-being and muscle strength. They also assess the patient's abilities and suggest adaptations or specialized devices like buttonhooks or shoe aids to facilitate daily activities.

Emotional support and counseling are integral parts of their care, addressing the psychological impact of the disease on both patients and caregivers. By working holistically with ALS patients, occupational therapists strive to enhance their quality of life and assist them in managing the physical, emotional, and practical challenges associated with the disease.

Occupational therapists frequently interact with experts from psychology, social work, and vocational rehabilitation to address broader functional and psychosocial elements, even though both fields work with multidisciplinary teams. To evaluate and treat particular physical disorders, physiotherapists may work in conjunction with doctors, orthopedic experts, and sports trainers. Both occupational therapy and physical therapy are essential to the rehabilitation process, although they differ in their areas of focus and methods of care.

Fig 8: Occupational Therapist

Source: https://blog.rehabselect.net/8-reasons-for-occupational-therapy-after-a-stroke

ALS Functional Rating Scale

As ALS progresses patients' functions and independence reduces. ALS Functional Rating Scale is a standard scale used extensively for the evaluation of ALS patients' degree of functional impairment.

It is a 12 item scale which measures functions of various muscles. Each item is scored from 0 to 4, where 4 stands for no involvement bt the disease and 0 stands for maximal involvement. The 12 items are summed up to obtain a final score.

The score is calculated by measuring functions of :

Total ALS-FRS score indicates severity of ALS as follows:

>40 (Minimal to Mild) (Stage 1)
39 - 30 (Mild to Moderate) (Stage 2)
<30 (Moderate to Severe) (Stage 3)
<20 (Advanced disease) (Stage 4)

Speech	Turning in bed and adjusting bed clothes
Salivation	Walking
Swallowing	Climbing Stairs
Handwriting	Dyspnea
Does subject have gastrostomy?	Orthopnea
Dressing and Hygiene	Respiratory Insufficiency

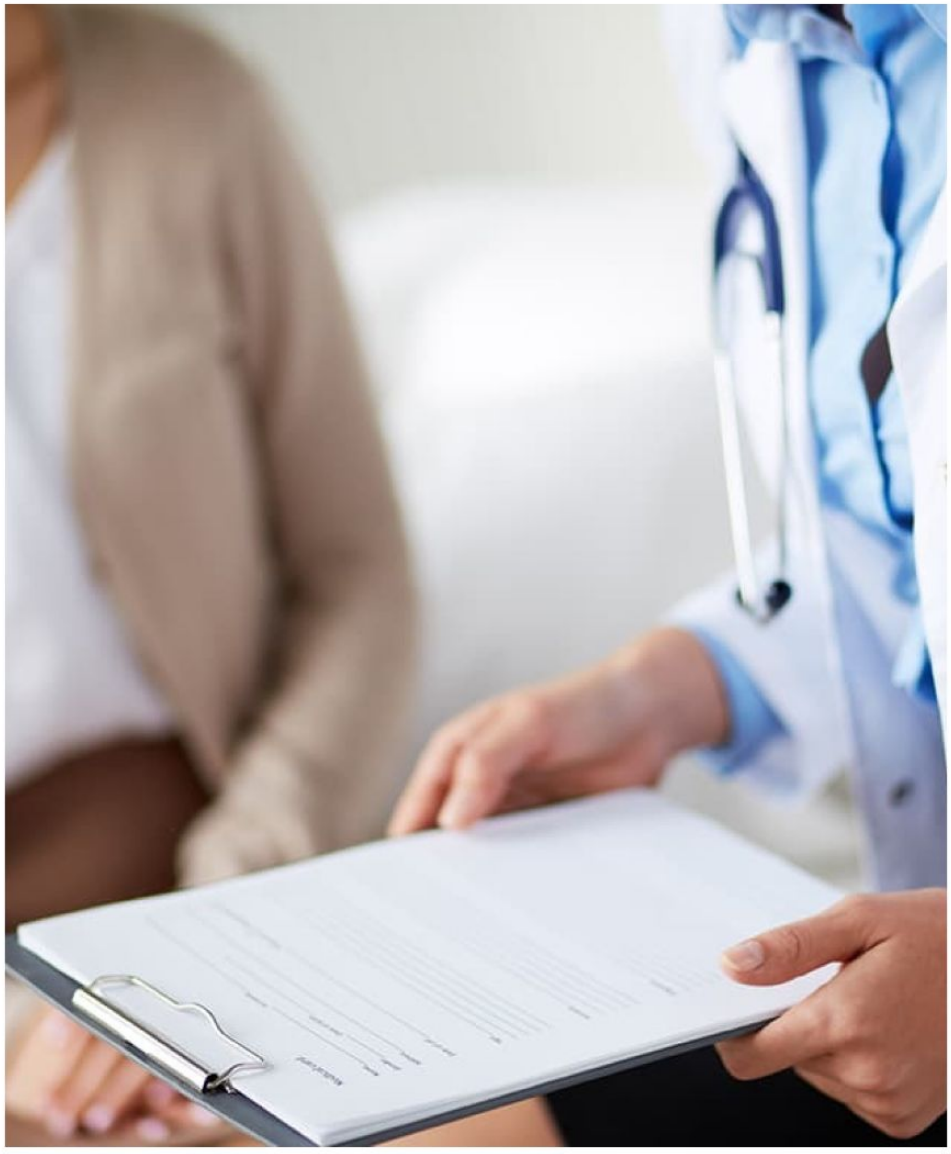


Fig 10: ALS Functional Rating Scale
Source: https://alstreatment.com/als-functional-rating-scale/

Range of Motion

Moreover, occupational therapists extend their investigations to the range of motion of the wrist, forearms, fingers, elbows, and shoulders. By studying the movements involved in supination, pronation, extension, flexion, and other relevant actions, therapists gain insights into exercises performed during occupational therapy. This knowledge is invaluable for designing products that are comfortable to use, as the most optimal grips and motions causing the least discomfort can be identified and integrated into the development of assistive devices and tools.

By combining their understanding of grip ergonomics, muscle fatigue, and range of motion, occupational therapists contribute to the creation of products and interventions that enhance the comfort and functionality of ALS patients. Their research and expertise facilitate the design of assistive technologies that align with the needs and capabilities of individuals with progressively limited hand and arm function, ultimately improving their independence and quality of life.

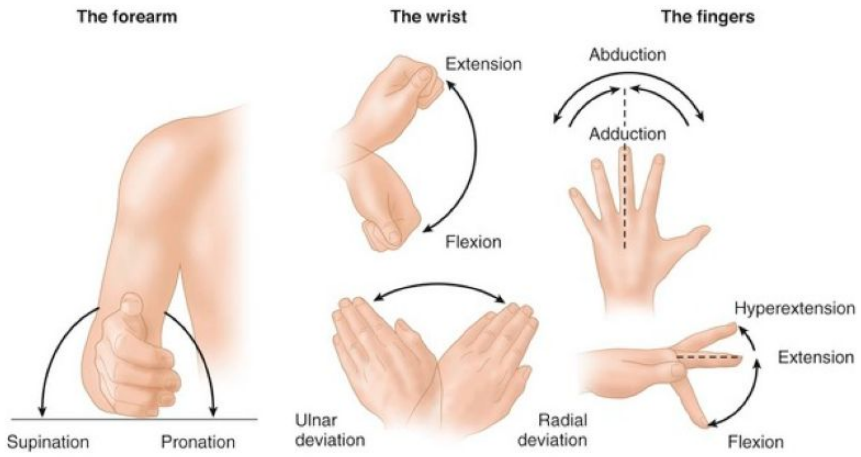


Fig 10: Forearm Wrist and Finger Movement

Source: https://plasticsurgerykey.com/1-examination-of-the-hand-and-wrist/

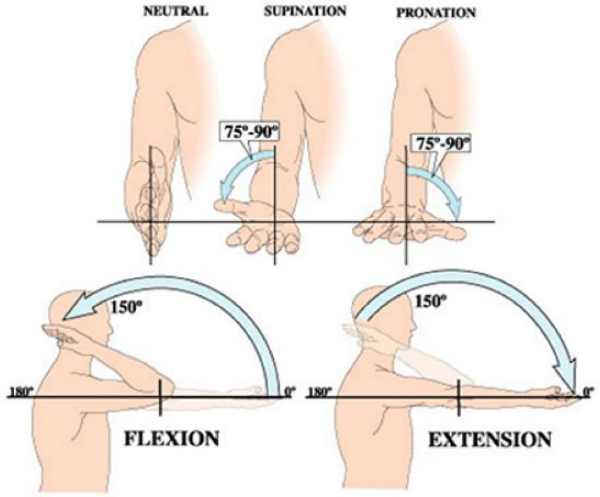


Fig 10: Elbow Movement

Source: https://handsurgeonsnyc.com/elbow-anatomy/

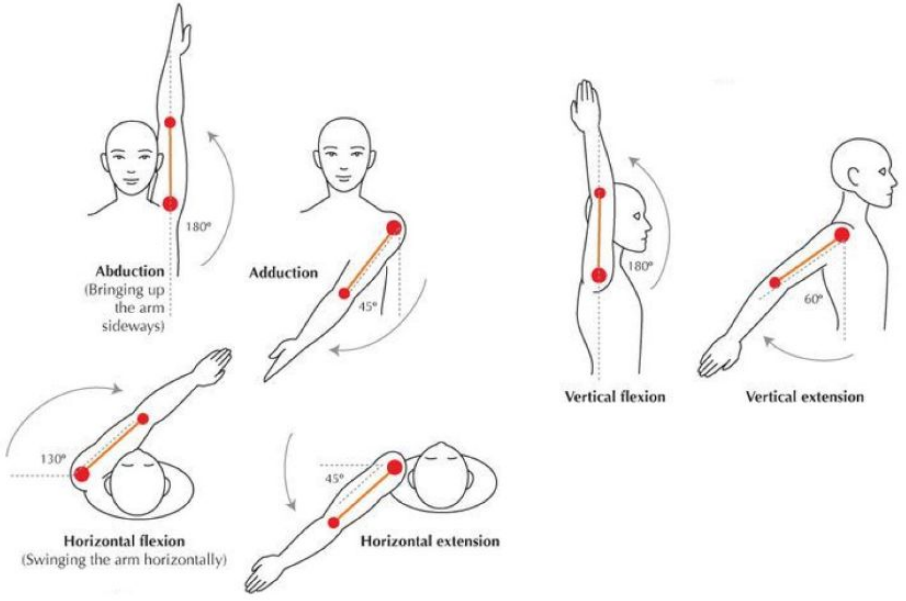


Fig 10: Shoulder Movement

Source: https://oss.adm.ntu.edu.sg/engj0007/form-visualization-kokopellis-sound-shaper/

Types of Grip and Optimal Grip

due to muscle weakness presents significant challenges for individuals. Occupational therapists play a crucial role in assisting patients by leveraging their expertise and creativity to enhance their ability to manage daily activities for as long as possible.

One area of focus in occupational therapy is the development of exercises that target various grips. By studying these grips in patients, therapists can derive ergonomic forms that are better suited to individuals with limited hand and arm function. This understanding allows for the creation of exercises and adaptations that optimize comfort and functionality.

To complement grip studies, occupational therapists also examine the target muscles for signs of fatigue and stress. By analyzing muscle responses during exercises, therapists can modify and customize interventions to minimize discomfort and maximize effectiveness. This approach helps to ensure that exercises are tailored to the specific needs and capabilities of ALS patients.

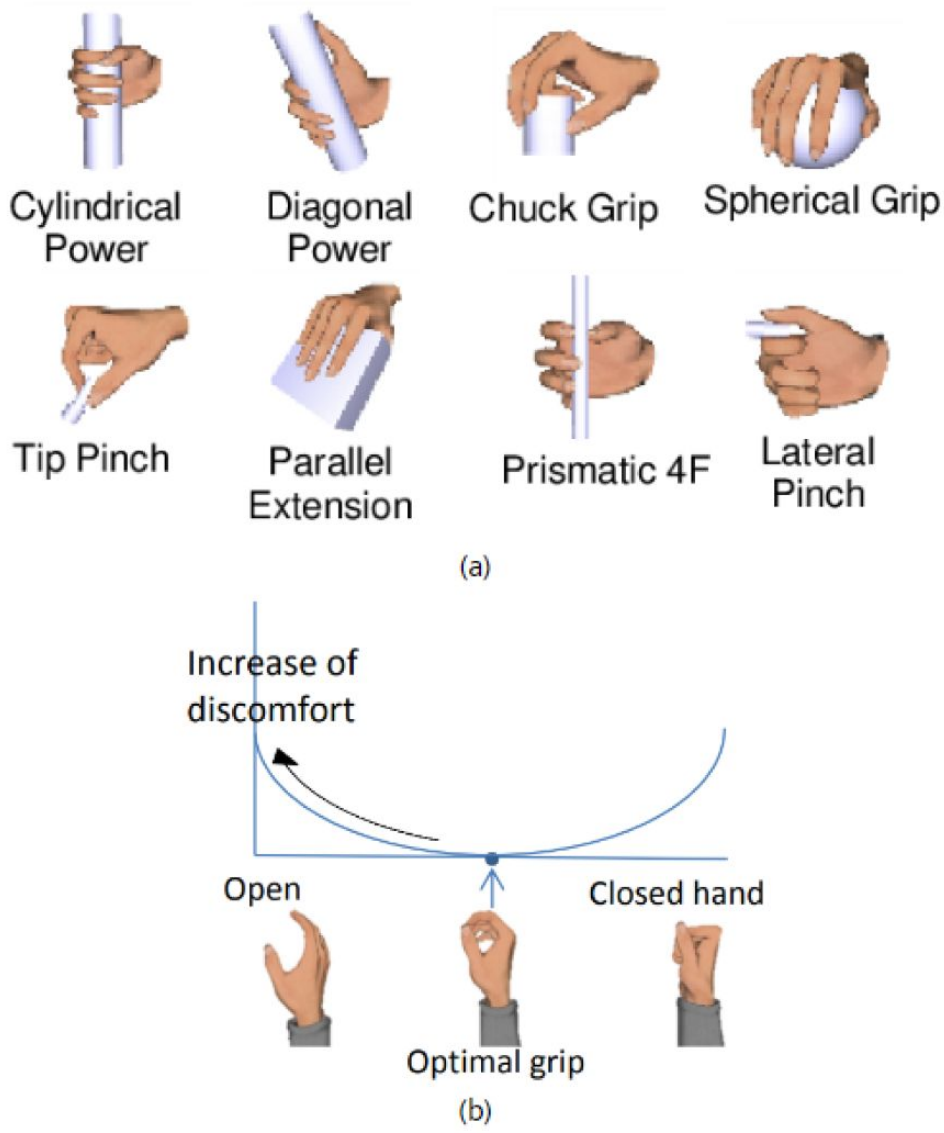


Fig 10: (a) Types of Grips (b) Optimal Grip
Source: https://www.semanticscholar.org/paper

Muscle Wasting and Wrist Drop

Muscle Wasting

Muscle wasting, a common symptom in various conditions including ALS, occurs due to the damage and loss of motor neurons that control muscle movement. The progressive degeneration of these neurons leads to shrinking, weakening, and eventual loss of muscle mass.

As the muscles waste away, their strength and ability to generate movement decrease. This results in difficulties with various movements, such as abduction (spreading apart), adduction (bringing together), and opposition (thumb-to-finger movement) among the fingers. The muscles responsible for these actions become progressively weaker and less responsive.

One noticeable effect of muscle wasting is the change in the appearance of the hand. With the loss of muscle bulk, the palm may appear flatter and lacking a defined shape. The natural curves and contours of the hand may be less pronounced due to the muscle atrophy.

While muscle wasting is a challenging aspect of conditions like ALS, occupational therapy interventions can help individuals maintain functional abilities and improve their ability to engage in daily activities despite the changes in muscle structure and function.

Wrist Drop

As the disease progresses, the muscles responsible for wrist extension and finger movement weaken and lose their function. This makes it challenging for individuals to perform essential daily activities that involve grasping, holding, and manipulating objects. Tasks such as holding things, picking up and positioning objects, using utensils to eat, combing hair, and brushing teeth become difficult due to the limited mobility and weakness of the wrist and fingers.

Wrist drop and associated difficulties in hand and finger movements are not exclusive to MND. Similar conditions can occur in other conditions, such as radial nerve palsy and hand paralysis, where the nerves or muscles controlling wrist and finger movements are affected.

Fig 10: Muscle Wasting

Source: https://onlinelibrary.wiley.com/doi/full/10.1002/jgf2.213

Fig 10: Wrist Drop

Source: https://casereports.bmj.com/content/2018/bcr-2017-221302

Task Analysis

To study daily tasks that people do during their entire day, right from waking up to going back to bed for sleeping.

A self observation was done to understand all the micro activities and what body parts are involved while performing those activities.

In this observation the tasks that are associated with hand moments, were considered.

Tasks	Fingers	Hand	Wrist	Elbow	Shoulder
Operating Phone					
Getting up from bed					
Setting up the bed					
Brushing Teeth					
Combing Hair					
Opening/ Closing Water Tap					
Wear Clothes					
Bathing (Lifting & Pouring Mug)					
Picking Soap					
Taking Medicines					
Drinking Water/Tea					
Turning Keys to Lock					
Money Transactions					

Fig 8: Daily Task Analysis

Source: Nikhil Dhamnaskar (Mdes. 2018-2020)

Task Analysis

Tasks	Fingers	Hand	Wrist	Elbow	Shoulder
Cooking					
Writing					
Opening/Closing Laptop					
Typing					
Writing					

Fig 8: Work Task Analysis

Source: Nikhil Dhamnaskar (Mdes. 2018-2020)

Tasks	Fingers	Hand	Wrist	Elbow	Shoulder
Playing Musical Instruments					
Playing Games					
Drawing					
Tinkering					
Using TV Remote					
Itching					
Swimming					

Fig 8: Other Task Analysis

Source: Nikhil Dhamnaskar (Mdes. 2018-2020)

Occupational Therapy Exercises

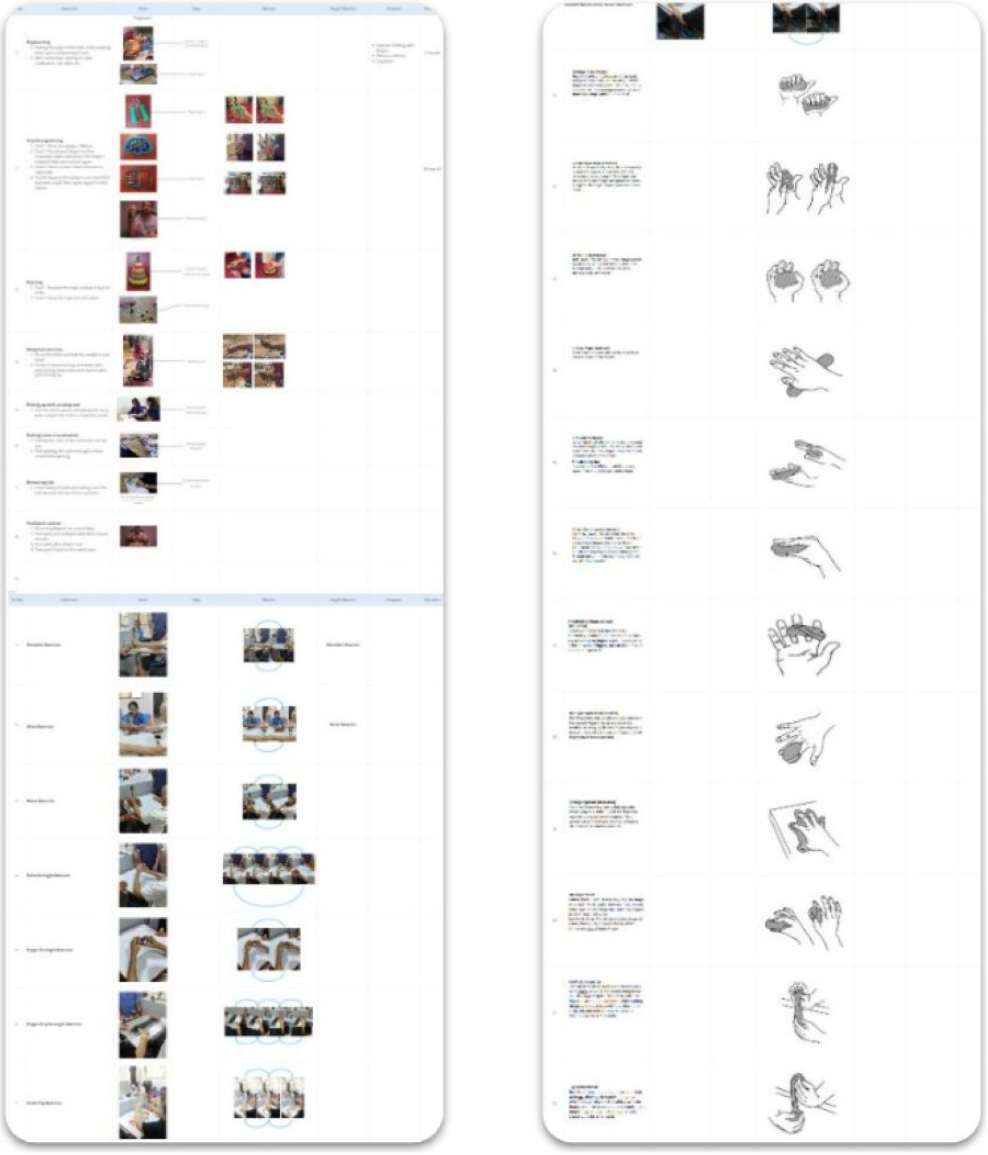


Fig 8: Occupational Therapy Exercises

Source: Author

A meticulously formulated table has been created, consolidating commonly used exercise techniques in occupational therapy.

The table includes columns such as Exercise Name, Equipment / Tools Used, Grip, Motion, Target Muscle Group / Target Area, Purpose, Duration of Exercise. These columns provide information about the exercises, their objectives, execution instructions, targeted areas of the body, required equipment, therapeutic purpose, recommended repetitions and sets, frequency, precautions, and options for progression or variation.

This comprehensive table serves as a valuable resource for occupational therapists and patients, aiding in the understanding and implementation of exercise techniques for effective therapy.

Exercises	Tools	Grip	Motion	Target Muscles	Purpose	Duration

Given below is the link for the table mentioned above;

https://miro.com/app/board/uXjVMadJbMc=/?moveToWidget=3458764555660852708&cot=14

Chapter 04

Market Study

Market Product

ABC KIDS WORLD Wooden Peg Board with 100 Plastic Pegs

A fun and educational eye-hand coordination activity for kids. They can place pegs in shape designs and try to copy them. It helps develop pencil holding skills and promotes learning through play.

Source: https://www.amazon.in/ABC-Kids-World-Peg-Board/dp/B0797NLNL8/ref=sr_1_1?crid=3FSV4NG49U51D&keywords=ABC+KIDS+WORLD+Wooden+Peg+Board+with+100+Plastic+Pegs&qid=1685648100&sprefix=abc+kids+world+wooden+peg+board+with+100+plastic+pegs%2Caps%2C211&sr=8-1

Physical Therapy Putty and Hand Exerciser Kit

The stretchy and colorful therapy putty stimulates hands and reduces stress. The finger exerciser bundle improves hand strength, dexterity, and mobility. Made with soft silicone, it is safe and durable. Suitable for improving focus and relieving emotions in sensory processing disorders.

Source: https://www.amazon.in/Special-Supplies-Physical-Therapy-Exerciser/dp/B09F12GQHQ/ref=sr_1_8?crid=3CJQW88GAJEC7&keywords=hand+therapy+kit&qid=1685643716&s=hpc&sprefix=hand+therapy+ki%2Chpc%2C272&sr=1-8

Biotronix Hand Physiotherapy and rehabilitation Kit Medical Reacher & Grabber

Hand exercise board helps in increasing hand wrist and finger strength Package Content-One finger Disc, One Roller, Three Spring loaded Knobs, 3 Aluminum pegs and 3 Sets of Springs of different tension Brand - Biotronix hand and finger exercise board can be used at home, physiotherapy clinic and occupational therapy center

Source: https://www.flipkart.com/biotronix-hand-physiotherapy-rehabilitation-kit-medical-reacher-grabber/p/itmc31e6c6b2c9dd

MUBBA Finger exerciser Physiotherapy Hand Griper therapy

MUBBA Finger Exerciser and Hand Gripper are durable physiotherapy equipment for finger and hand exercises, increasing muscle strength.

Source: https://www.amazon.in/MUBBA-Finger-exerciser-Physiotherapy-therapy/dp/B09DX8MRYX/ref=sr_1_19?keywords=hand+therapy&qid=1685648265&sprefix=Hand+Ther%2Caps%2C387&sr=8-19

Hospital Products

Fig: (a)Clothes Pin Exercise, (b)Roller Exercise, (c)Pegboard and Velcro, (d)Finger Spring, (e)Hand Gripper

Source: Author

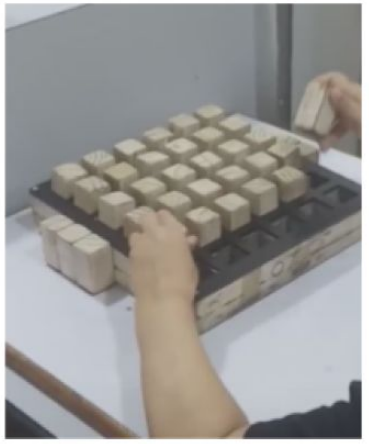
Gaps in Product

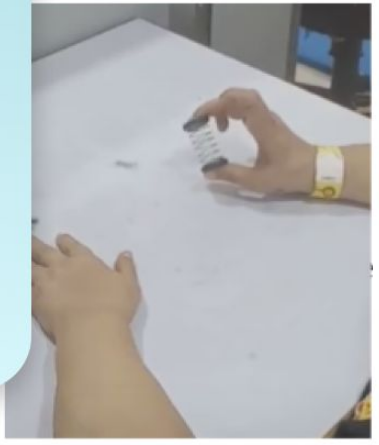
Market Products

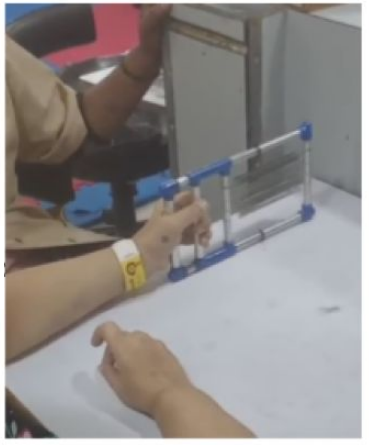
Opportunities

1. A kit which is economical and have multiple exercises in one.
2. A portable tool / product which can be used in homes, while watching TV.
3. A game based exercise kit to make exercise more fun and engaging.
4. Occupational Therapy kit catering to the needs of ALS patients.

Hospital Products







Chapter 05

Design Brief

To design an **occupational therapy kit** that could be used by patients suffering from **ALS/MND in stage 1 and 2**, at the convenience of their own house. The therapy kit will include various **tools for exercise** that target muscles of the **fingers, palms, wrist, elbow, and shoulder.** It should help maintain their range of motion and grip strength, and reduce muscle wasting of their upper limbs.

The kit should be **economical, accessible and portable**. The tools inside the kit should be intuitive and exercises done with the help of the tool could also be personalized by the occupational therapist according to the patient's condition.

Design Directions

Direction 1

DIY Kit made from already existing materials so that it is easily available and replaceable when lost or broken

Direction 2

A Toy or Product that can be interacted in various ways to facilitate different exercises.

Direction 3

A Kit containing exercise tools that are made to target specific muscle group at a time

Clustering Ideas

The ideation process involved categorizing exercises for occupational therapy into areas such as **Finger Grip Strengthening, Movement and Speed, Hand Grip Strength, Movement and Speed, Arm Movement and Strength and activities of daily living.** Alternative exercises were considered within each category to accommodate different abilities. Additionally, game elements were incorporated to enhance engagement and motivation. The goal was to provide a comprehensive range of exercises targeting specific therapeutic goals while keeping the sessions enjoyable. This approach allowed for personalized treatment plans that addressed individual challenges and goals, ultimately improving functional abilities and quality of life.

- Finger Grip Strengthening, Movement and Speed
- Hand Grip Strength, Movement and Speed
- Arm Movement and Strength
- ADLS

Fig: Ideation Sketches

Source: Author

Chapter 06

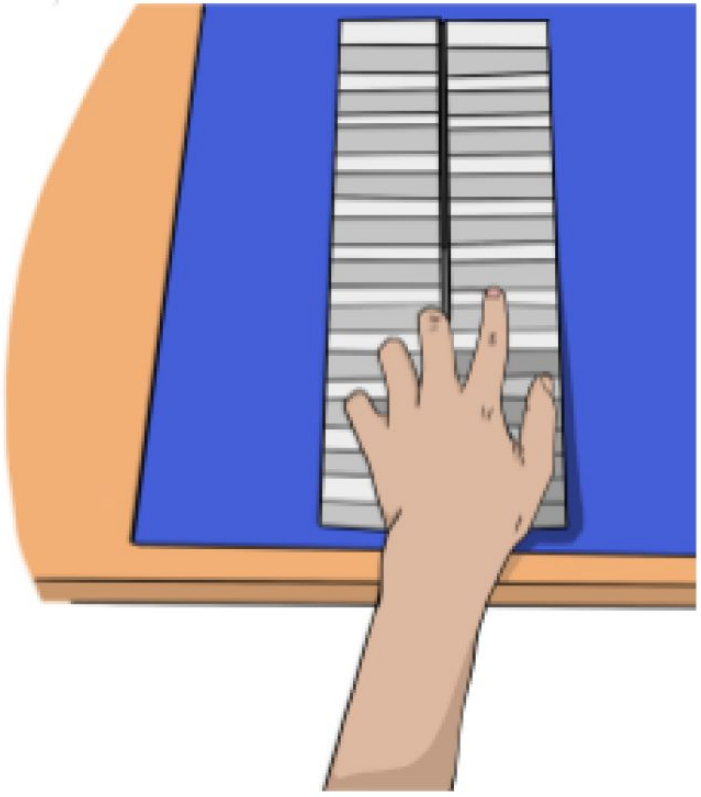
Concepts

Concept 1

Finger Ladder Exercise

The aid is positioned so that it reaches the furthest reach of the fingers, with the elbow extended. Their center of gravity is sufficiently in front of them to allow them to lift themselves up

- **Positioning on a table:**
  - Task involves using the proximal joints, extending the elbow and flexing the shoulder
  - Alternating flexing movements with their fingers and extending them to reach the next step
  - Improves dexterity
- **Positioning on a vertical panel:**
  - Particularly useful when you wish to get the shoulder to a greater degree of flexing

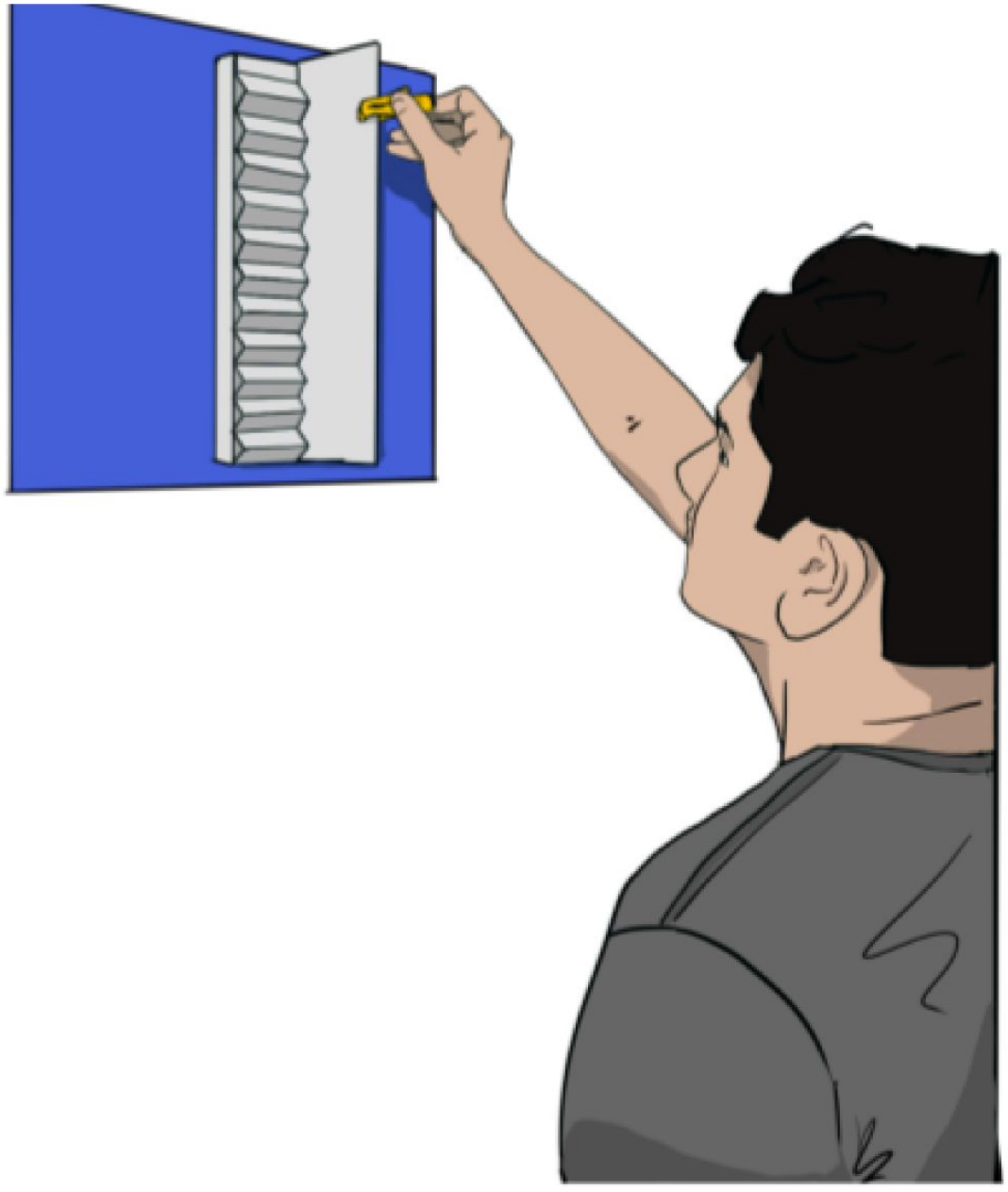


Concept 1

Clothes Pin Exercise

Useful for improvement of fundamental abilities needed for handling scissors, pencils, and other tools. The application of clothespin tasks and instructional materials would promote the following:

- Enhancement of resistance and strengthening
- Development of the hand's arches
- Proficient control of the radial fingers (thumb, index, and middle fingers)
- Stabilization of the ulnar fingers (ring and little fingers)

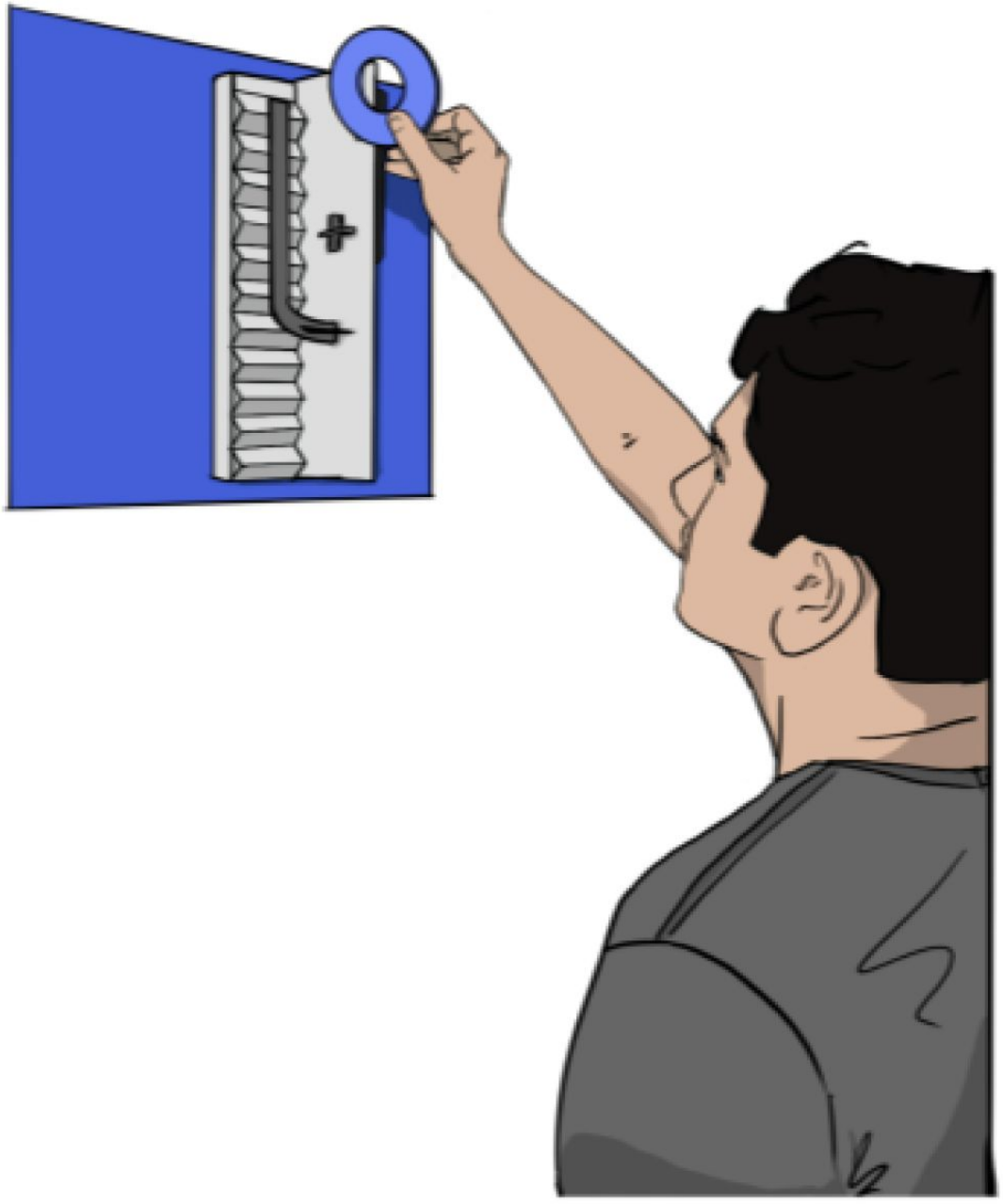


Concept 1

Stacking Exercise

The task is to stack discs into the pole.

- Helps practice the pronosupination of the wrist
- Useful to get the shoulder to a greater degree of flexing

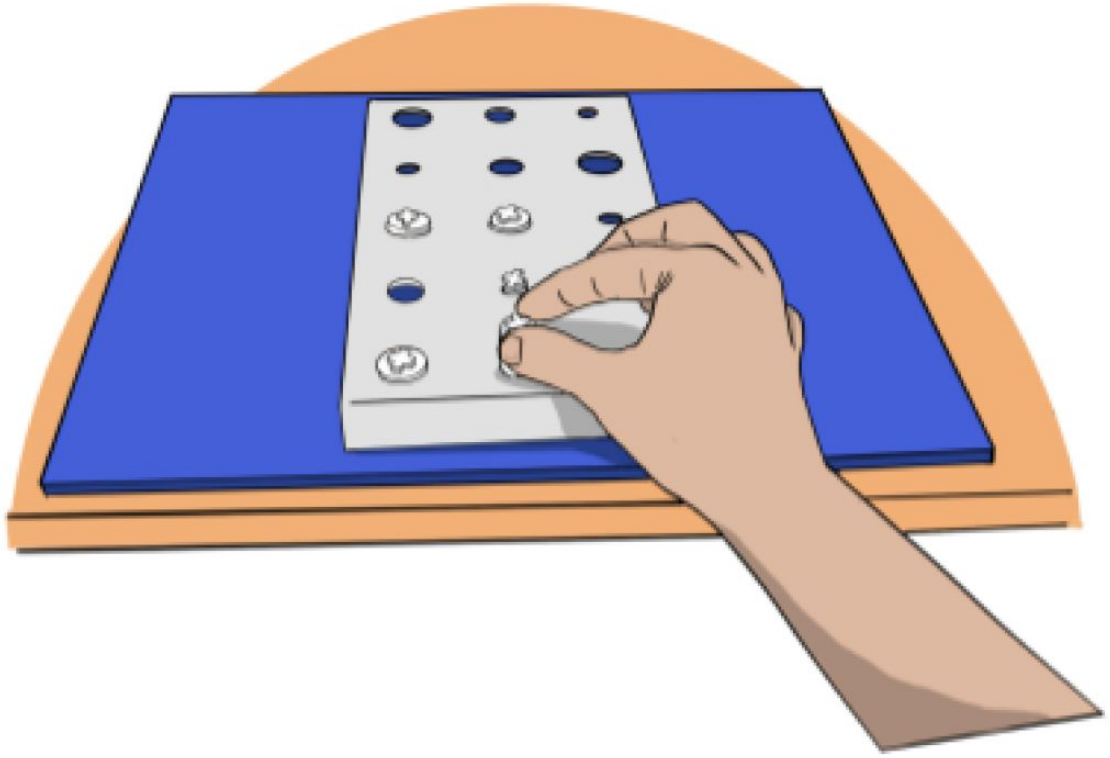


Concept 1

Pegboard Exercise

A rectangular board with circular holes of different diameters- 1 cm, 1.5 cm and 2 cm where cylinders are to be inserted.

- Improves the pinch grip of the patient.
- Gripping difficulty increases with decrease in diameter.

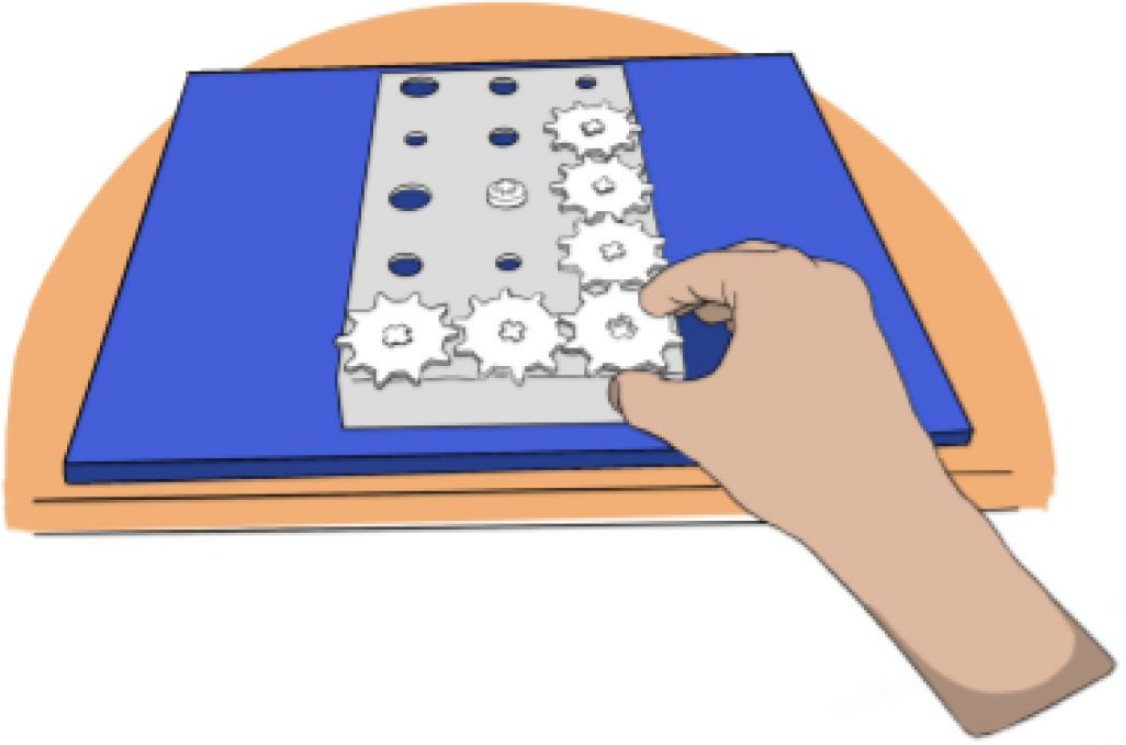


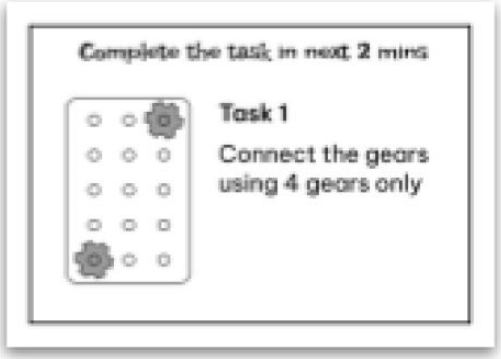
Concept 1

Gear-Game Exercise

The basic aim of this game is to fit the gears into the pegs and form a gear trail.
This has to be done according to the task card given.

- Improves the lateral pinch grip
- Hand-eye coordination
- Gets difficult to fit gears as the diameter of peg decreases
- Inserting the gears into the pegs helps practise the pronosupination of the wrist



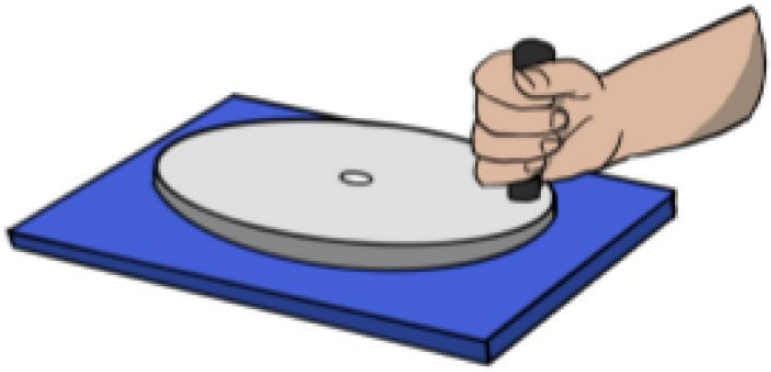


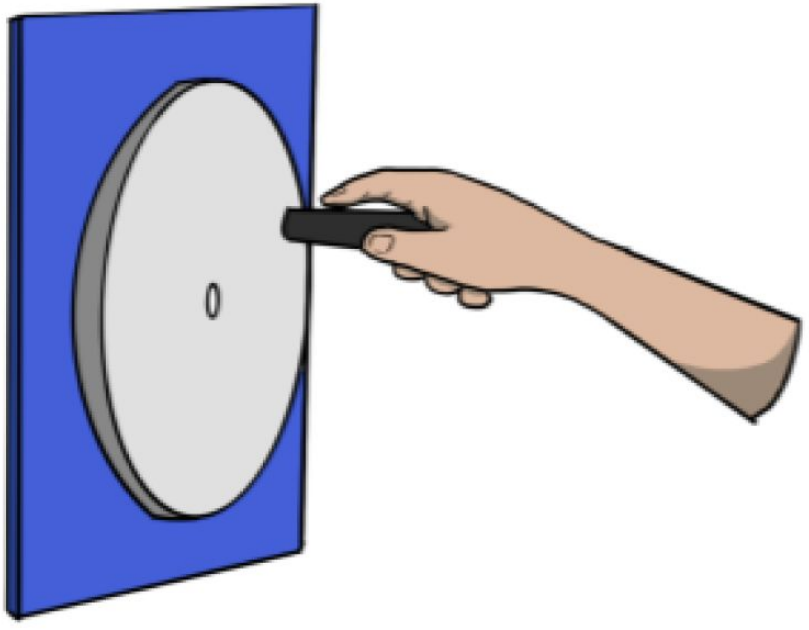
Concept 1

Wheel Exercise

The patient can practise performing a semi-circle or a full circle.
The aid can be placed either on table or mounted on the wall.

- Recover mobility in the shoulder and Elbow

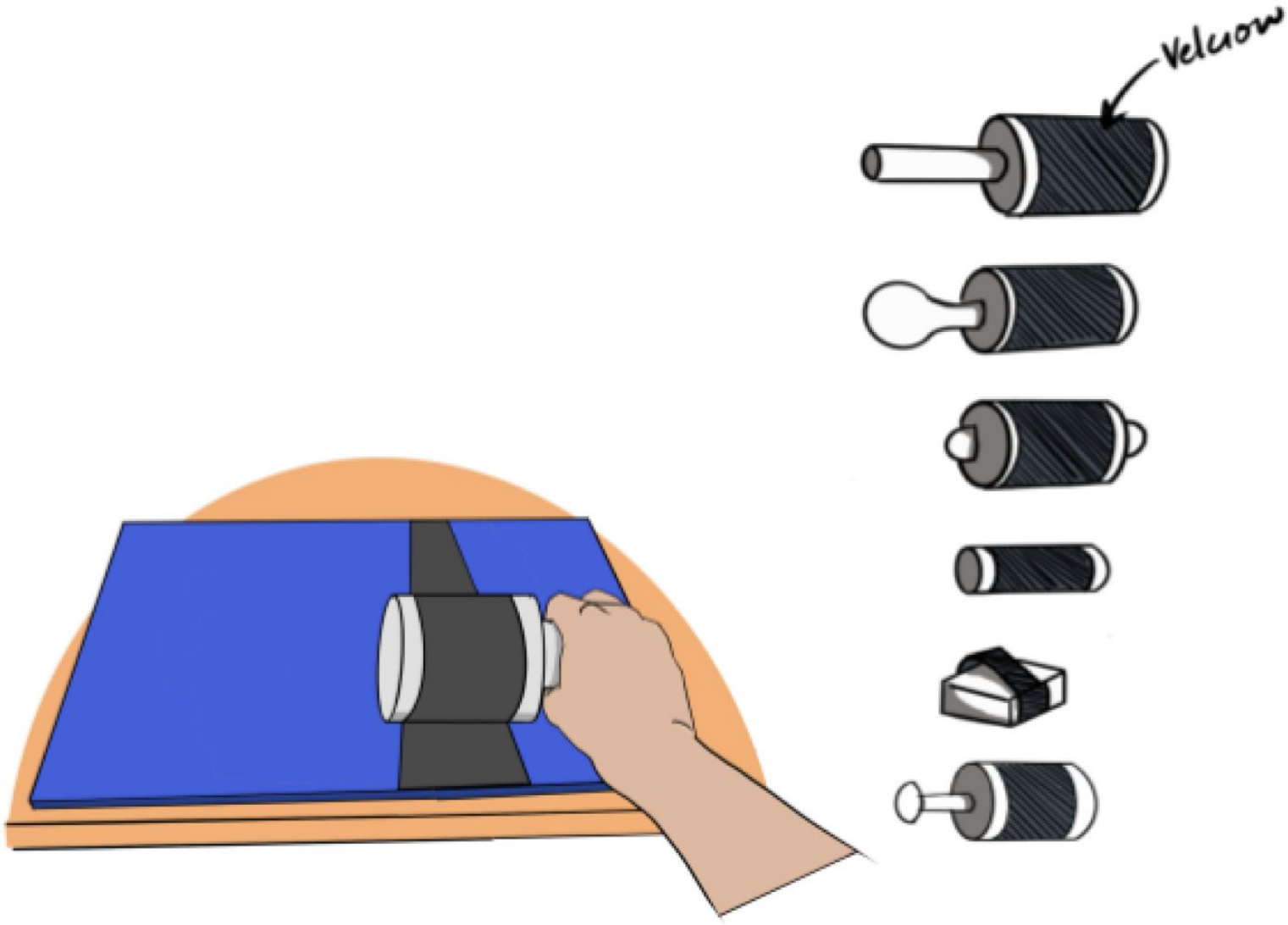




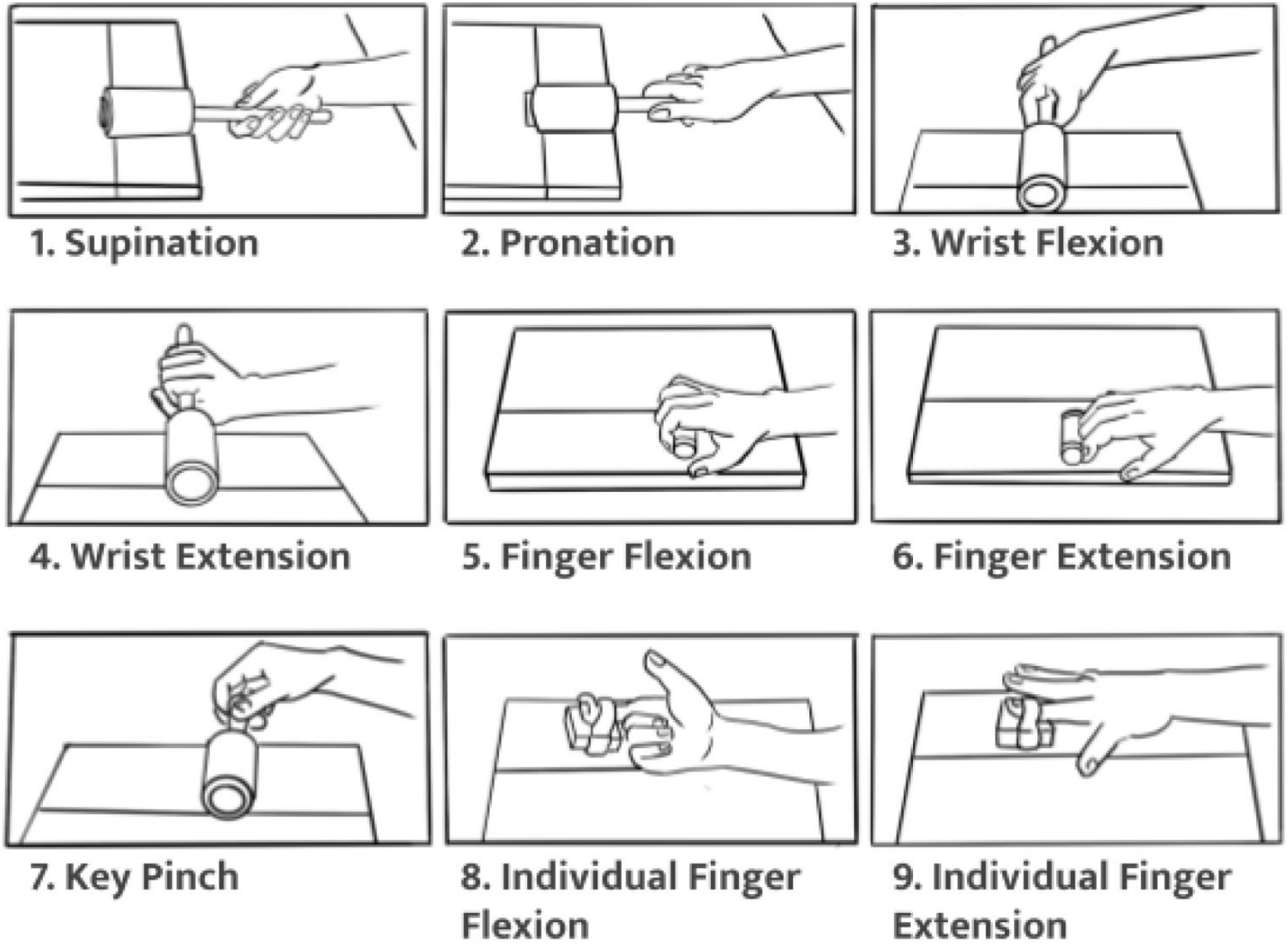
Concept 1

Roller Exercise

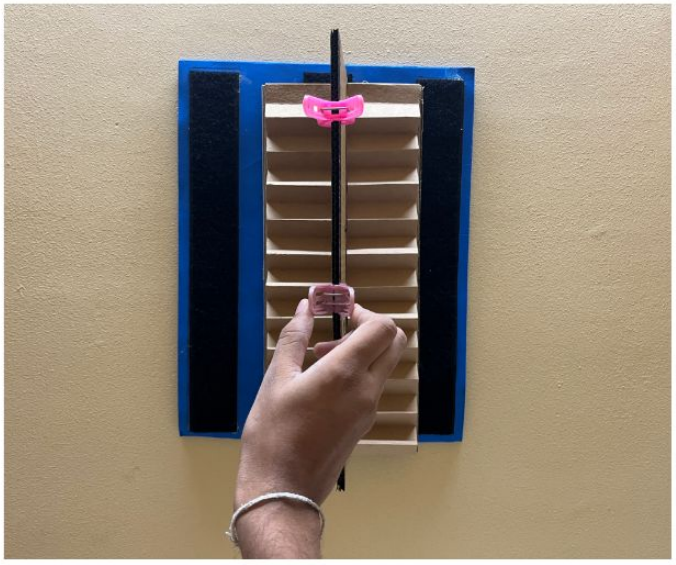
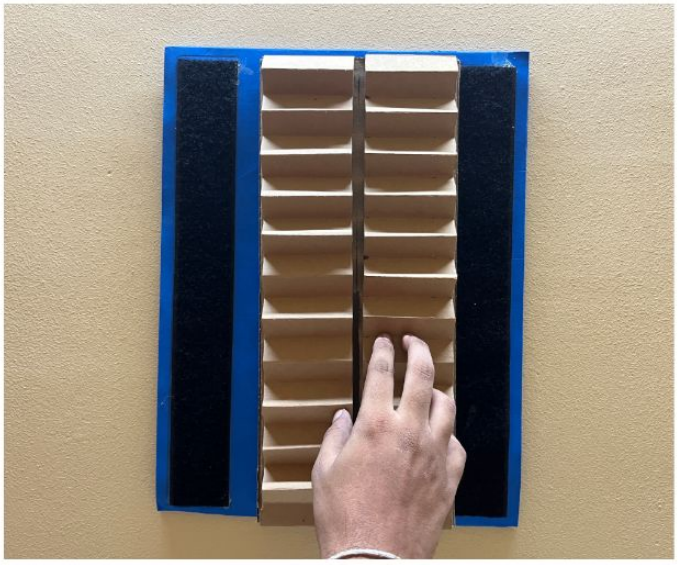
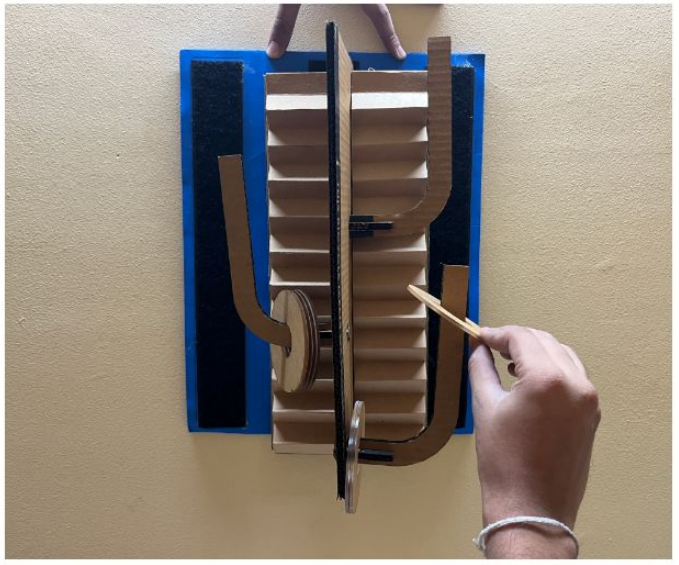
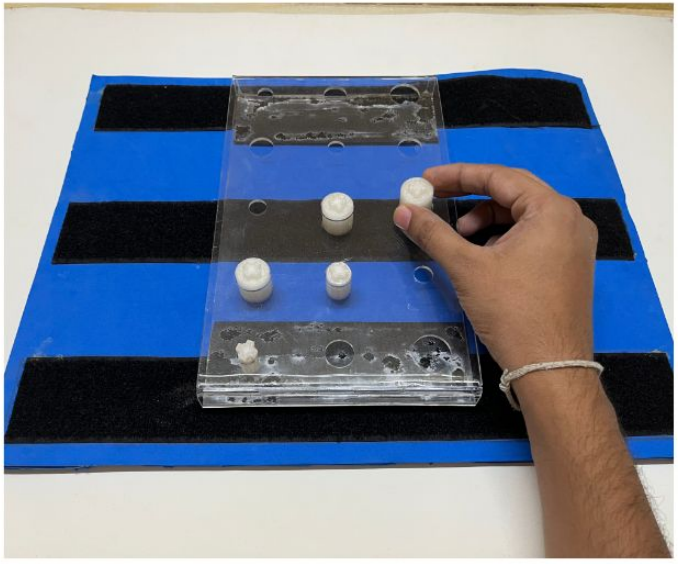
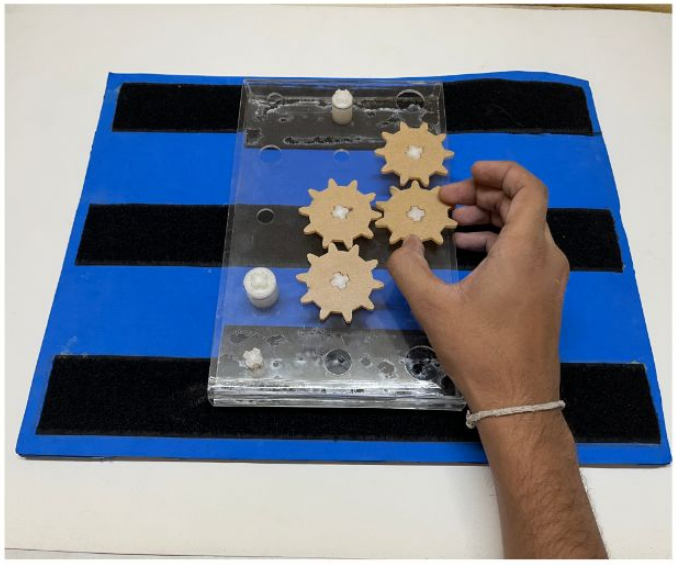
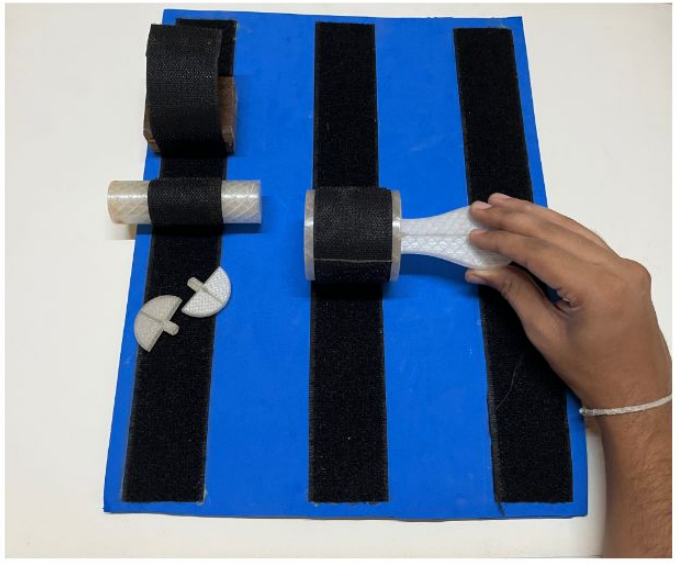
Used for improving
- Manual finger dexterity
- Wrist motions including pronation, supination, flexion, and extension



Concept 1


1. Supination
2. Pronation
3. Wrist Flexion
4. Wrist Extension
5. Finger Flexion
6. Finger Extension
7. Key Pinch
8. Individual Finger Flexion
9. Individual Finger Extension

Concept 1 (Mockup)

Concept 2

Gaming controller for ALS Patients

- **Games = Motivation**

Gamifying the experience of Occupational therapy to motivate the patients to do the exercise regularly.

- **Customizable Exercise**

The exercise/activity can be customised according to the patient's condition.

- **Controlled Exercise**

As sometimes patients tend to exercise more that actually recommended in order to get better quickly, but it ends up being more problematic. So, to prevent this from happening, repetition and difficulty of exercise can be controlled

Concept 2

Gaming controller for ALS Patients

- **Games for motivation and exercise**
  Different games can be made which will help the patients to exercise daily without getting bored.

- **Customizable Difficulty**
  According to the condition of the patient or the stage they are in, we can adjust the difficulty of the game.

Concept 2 (Mockup)






Concept 3

Puzzles

Gamifying the experience of Occupational therapy to motivate the patients to do the exercise regularly.

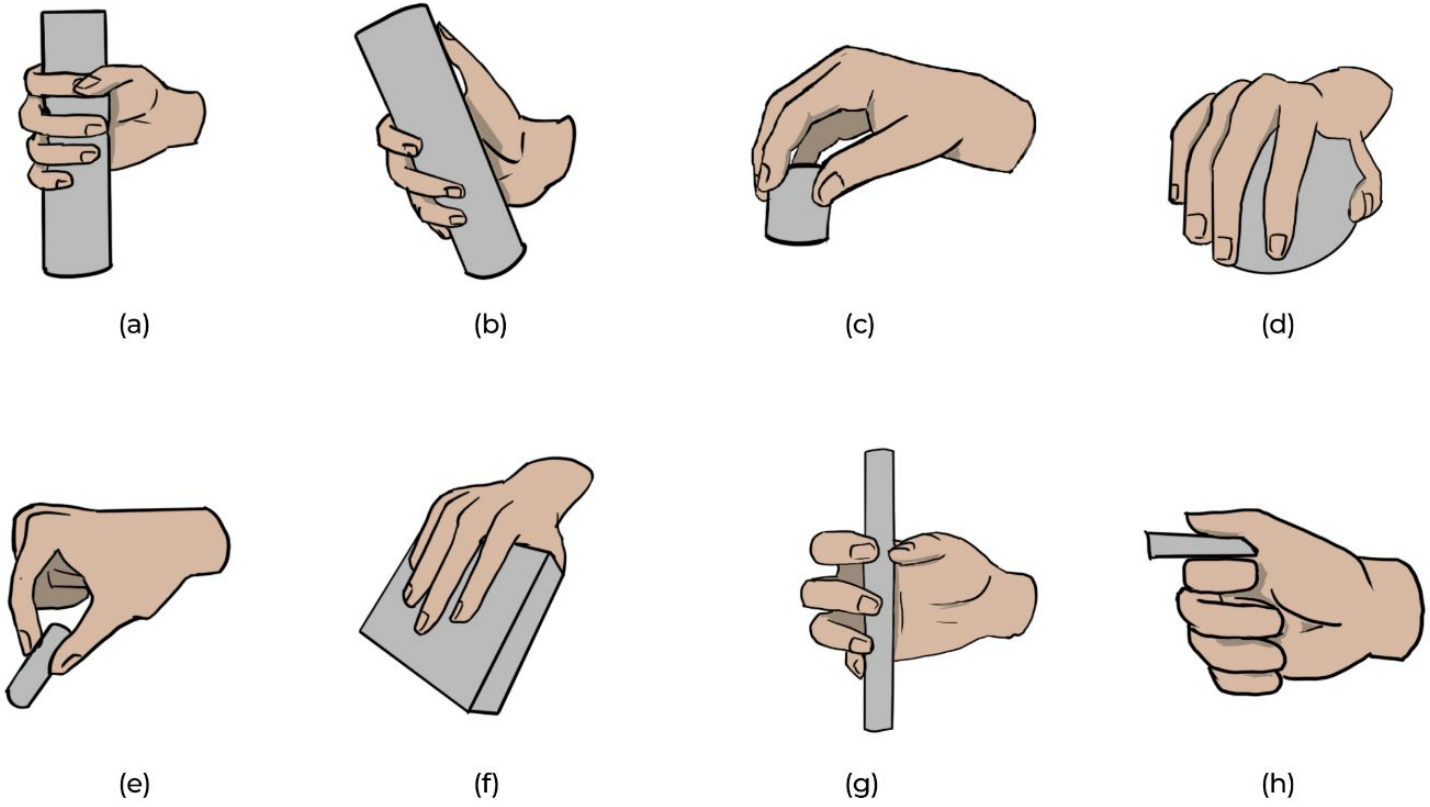
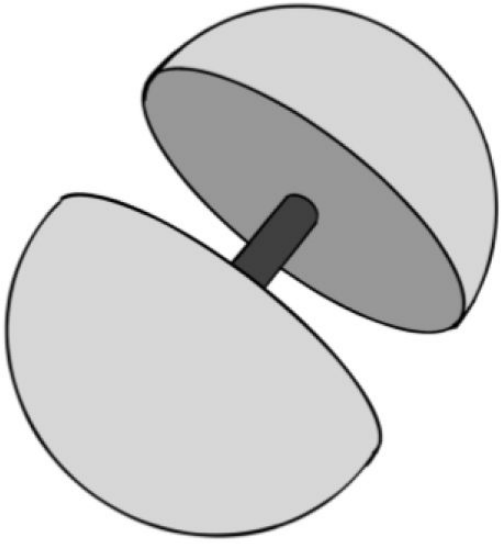


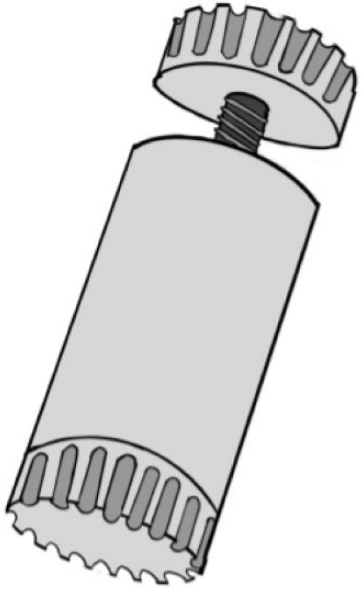
Fig 8: (a) Cylindrical Power Grip, (b)Diagonal Power Grip, (c)Chuck Grip, (d)Spherical Grip
(e) Tip Pinch Grip, (f) Parallel Extension Grip, (g)Prismatic 4F Grip, (h) Lateral Pinch Grip

Source: Author

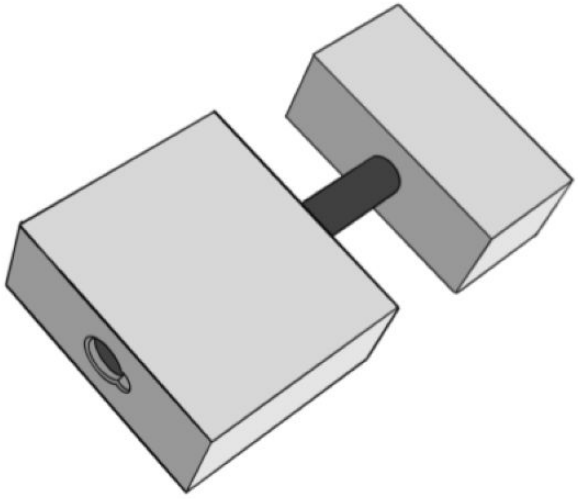
Concept 3



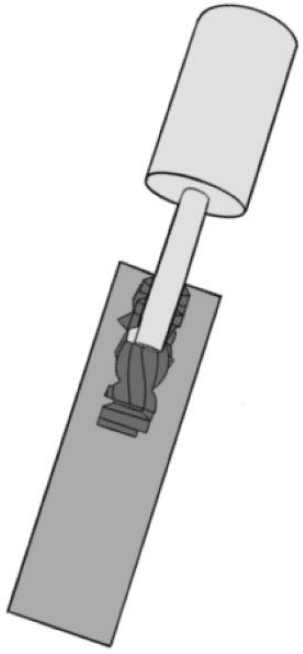
Spherical puzzle for improving spherical type of grip along with wrist improving wrist moment



Puzzle for improving Diagonal and Chuck type of grip by unscrewing the bolts from the cylinder.

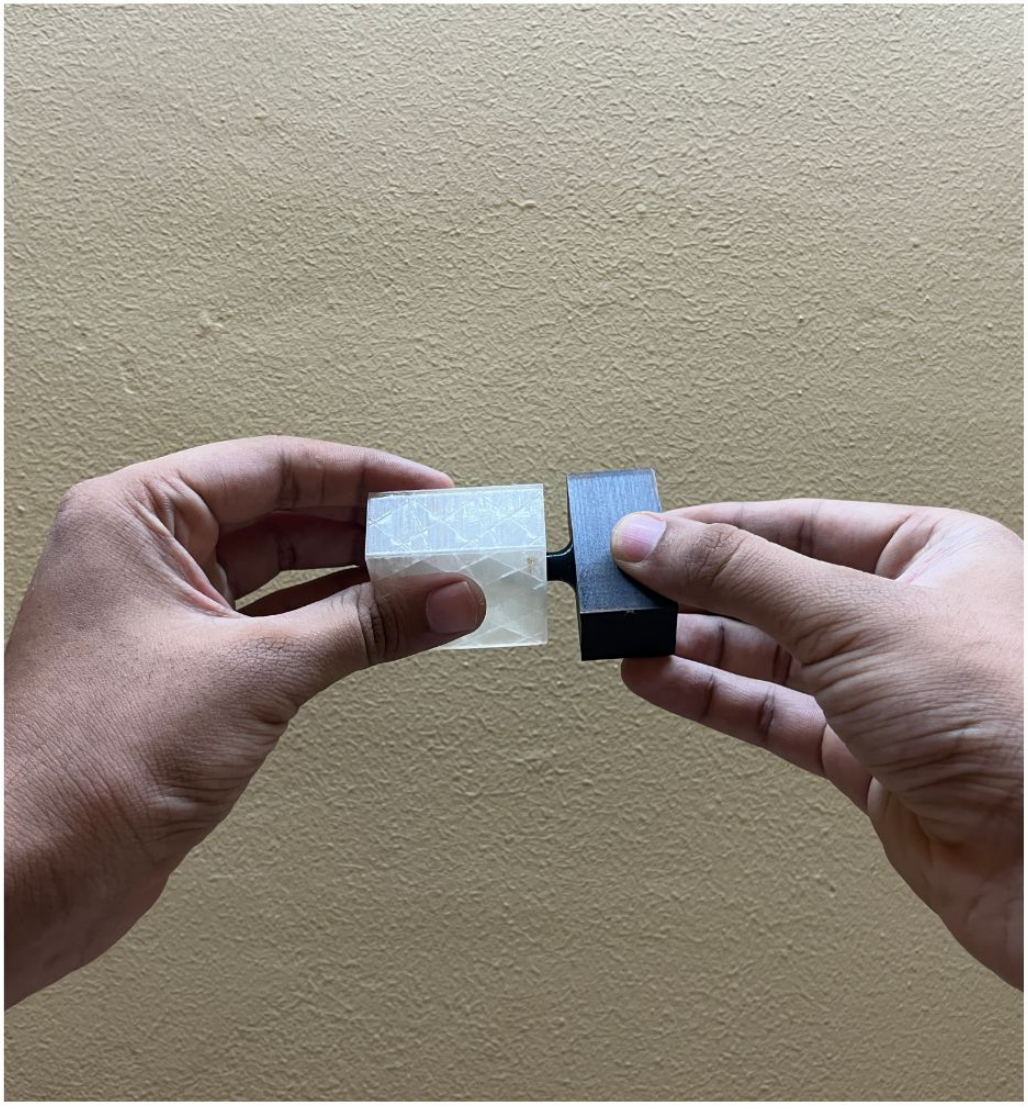


Puzzle to improve parallel extension type of grip



Gamifying the experience of Occupational therapy to motivate the patients to do the exercise regularly.

Concept 3 (Mockup)



Comparison and Evaluation

To test out all three concepts, a criteria matrix was created and then evaluated

Purpose:
- To identify the pros and cons of each concept
- To see which direction most suited for the user

	Economical	Accessible	Portable	Enjoyable	Customizable	Targeting Multiple Muscles
Concept 1	Medium	Medium	Medium	Medium	Medium	High
Concept 2	Low	Low	High	High	High	High
Concept 3	Medium	Medium	Medium	Low	Low	Low

The evaluations are in terms of preference i.e, High, Medium or Low

Doctor’s Insights

Dr. Saurav

Dr. Saurav, an expert in the field, provided valuable insights and feedback when the concepts were demonstrated using mockups.

His expertise and perspective helped evaluate the feasibility and effectiveness of the proposed concepts. By observing the mockups, Dr. Saurav was able to provide feedback on the practicality, usability, and potential benefits of the ideas presented.

His insights contributed to the refinement and improvement of the concepts, ensuring they align with the goals of effective occupational therapy. Dr. Saurav's input helped validate the concepts and ensure their suitability for addressing the needs of patients.

Observations and comments

- Add **ADLS** to the exercise
- Listening to music and doing some activities
- In stage I we mostly ask the patient to do ADLS
- Make something AR based
- Shoulder Wheel is a bit complex exercise
- Keys and Locks
- Buttons
- Some game for exercise
- Stage II and III patients do rest exercises
- Jitna hath upr ja skta h utna (finger ladder exercise)
- Make it fun
- Laces
- Zip
- Make this shape in gear game
- Patients generally will do the exercise for a month and then leave it
- We can tell the patient to do one exercise in various ways to target different muscles
- Patient needs validation that yes this exercise helped to do this work

Chapter 07

Final Design

Final Concept

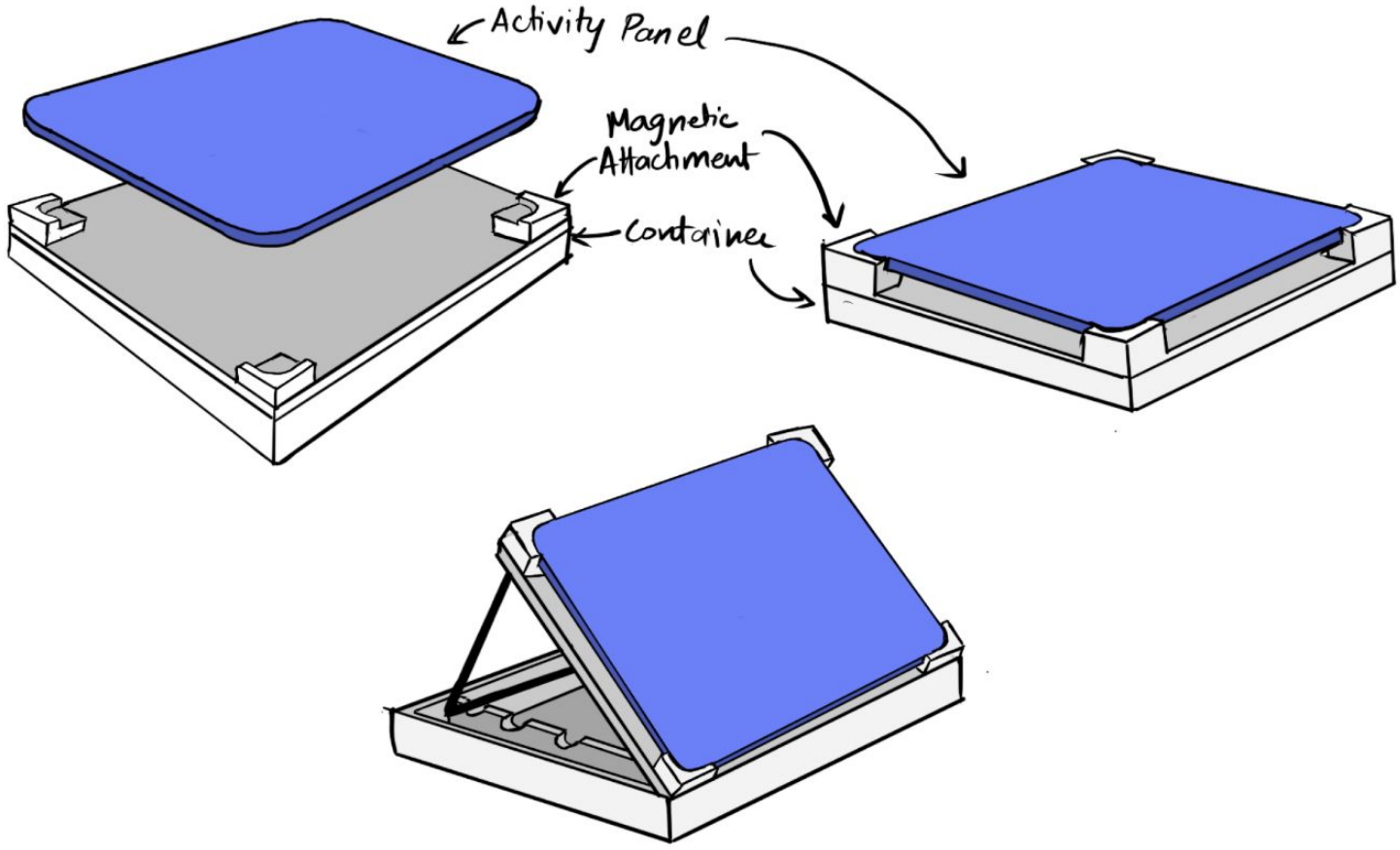
Based on the proposed design brief, concept 1 checked the most boxes in terms of being, **economical, accessible, portable and Intuitive.**

Some modifications were done regarding the **inclusiveness** of the kit. Where the patient can sit and exercise while being around their family and not facing a blank wall.

Final Concept

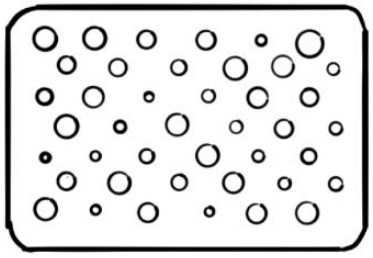
The final concept is a modified version of Concept 1, resembling a board game with different panels for various exercises. Each panel represents a different exercise or activity targeting specific areas of rehabilitation. The game-like design adds an element of fun and engagement to the therapy process, making it more enjoyable for the patients.

Overall, this concept transforms the therapy experience into an interactive and engaging activity, promoting adherence and consistency in the therapy routine. It not only facilitates the physical rehabilitation process but also contributes to the mental and emotional well-being of the patients.



Final Concept

The starter kit includes ADLs, pegboard, stacking, and clothes pin exercises. These exercises target various aspects of occupational therapy, such as functional independence, fine motor skills, coordination, and grip strength. They provide a comprehensive set of activities to improve daily living tasks and enhance physical abilities.

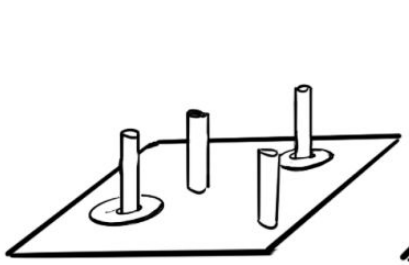


PEGBOARD

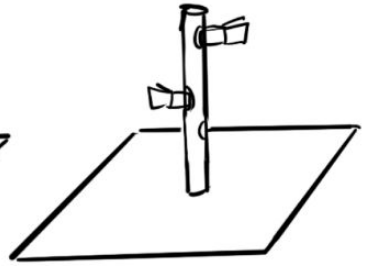
GEAR GAME

STACKING

CLOTHES PIN EX

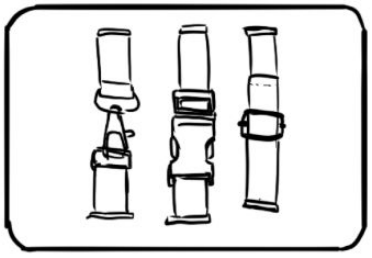


Stacking

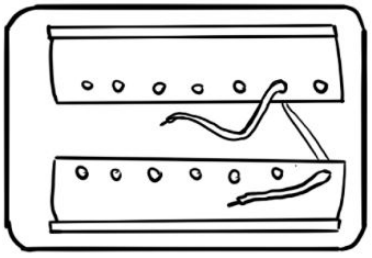


Clothespin

Activities of Daily Living

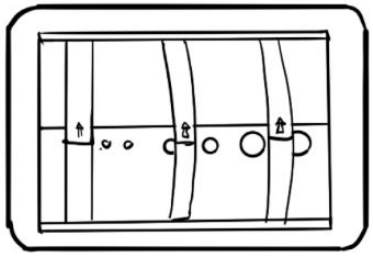


Belts and Buckels



Shoe Lace, Tie

[Cards with different lace types]



Buttons, Velcro strap

Snap Buttons, Zip

Chapter 08

Design Details

Mood Board

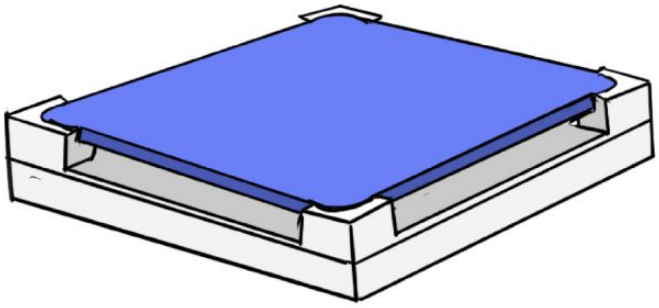
Form Exploration

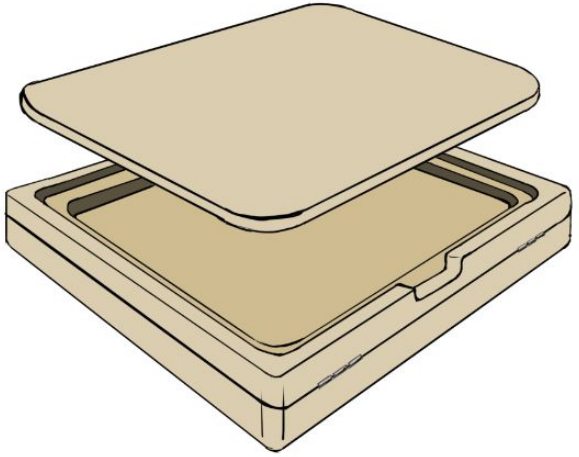
Taking inspiration from children's toys, the form of the final concept went through several iterations, focusing on keywords like safety and softness. The aim was to create a design that is visually appealing, ergonomic, and user-friendly for ALS patients.

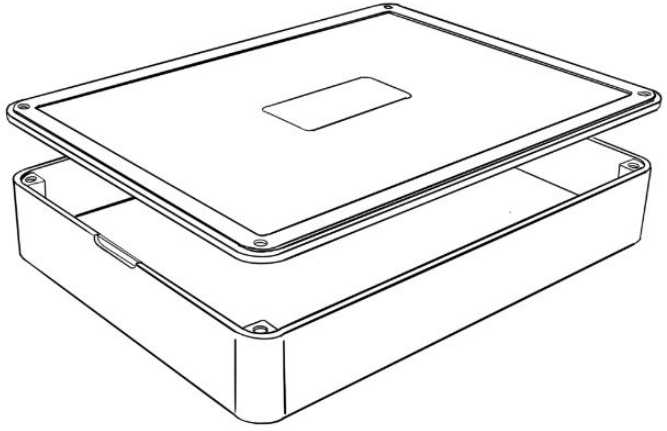
The forms were developed with rounded edges and soft materials to ensure a safe and comfortable user experience. Consideration was given to the size, weight, and texture of the components to accommodate the physical limitations and sensory sensitivities of ALS patients.

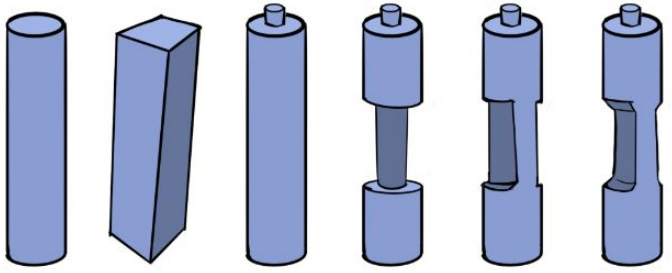
The iterations aimed to strike a balance between aesthetics and functionality, ensuring that the design not only appeals to the target users but also facilitates ease of use and engagement.

Through this iterative process, the final concept's form evolved to be visually appealing, safe, and soft, providing an enjoyable and accessible experience for ALS patients during their occupational therapy sessions.



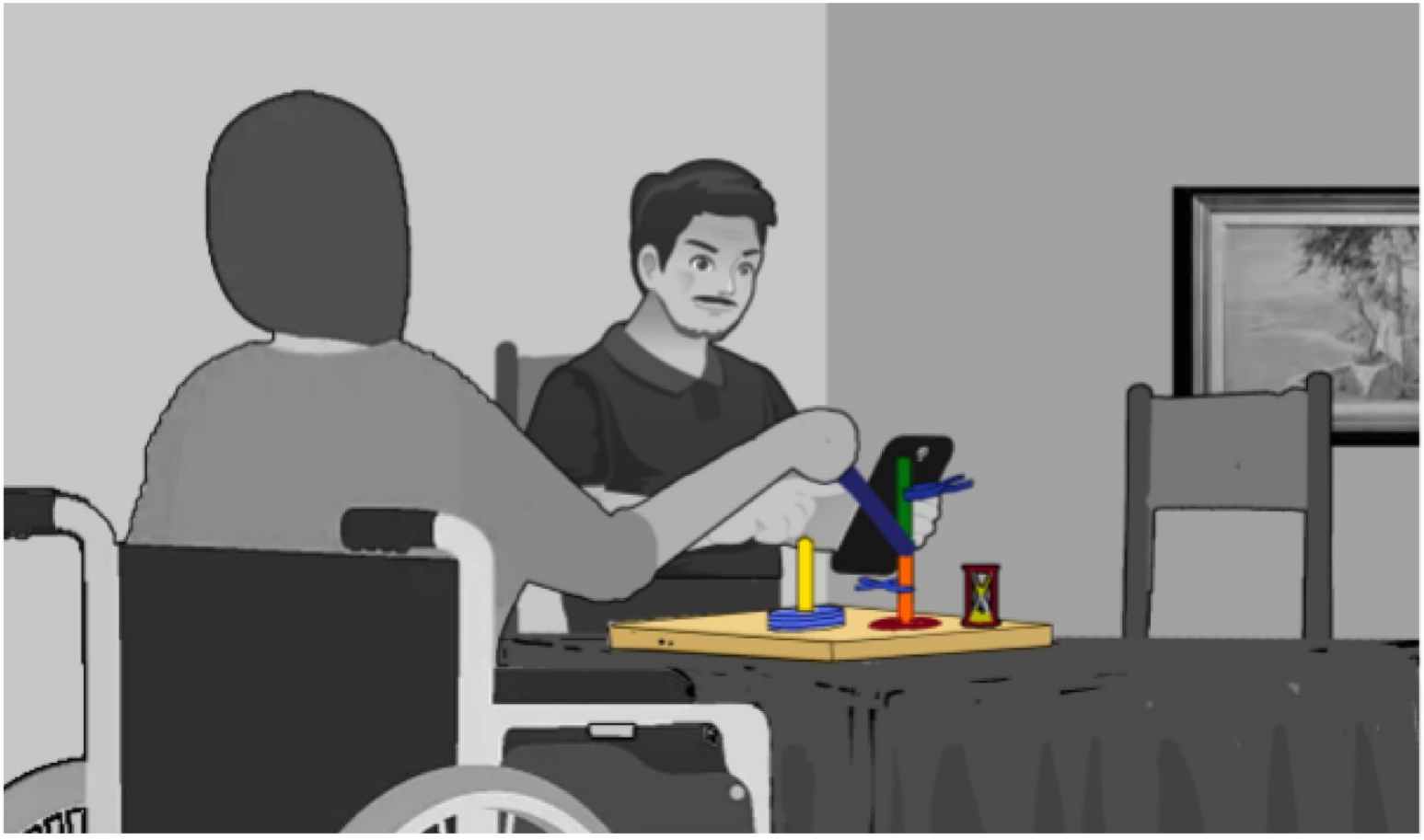






Story Boarding

Rita at home with OCTI



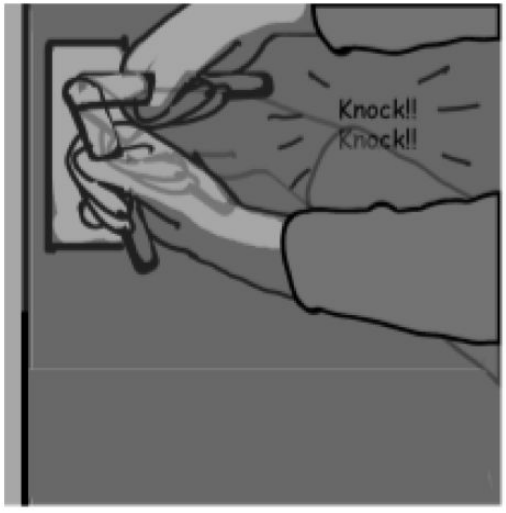
With a bit of an inclusiveness and gamifying the exercises, Rita doesn't feel lonely and bored anymore.

No one is there to cause any disturbance.

She can have her own time using the kit while watching TV or talking to her friends and family.
Now she doesn't have to move all around the house for doing her exercises.

Story Boarding

Rita at home without OCTI

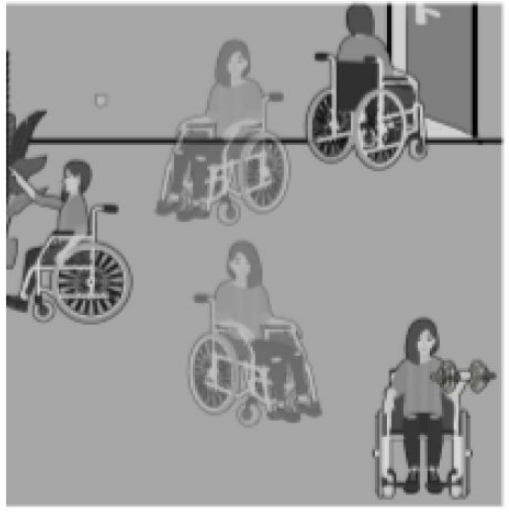


Disturbance

"Everytime I start doing exercise on the door some or the other person needs to pass through the door."

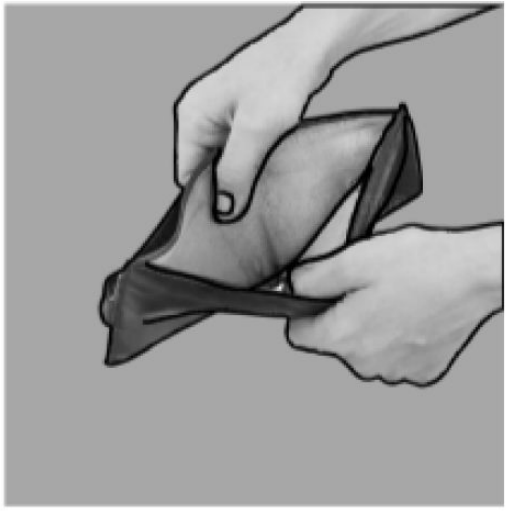
Loneliness

"Being here facing a blank wall and doing the exercise makes me feel lonely."



Inconvenience

"I need to roam all around the house to do different kinds of exercises. It is exhausting and inconvenient for me."



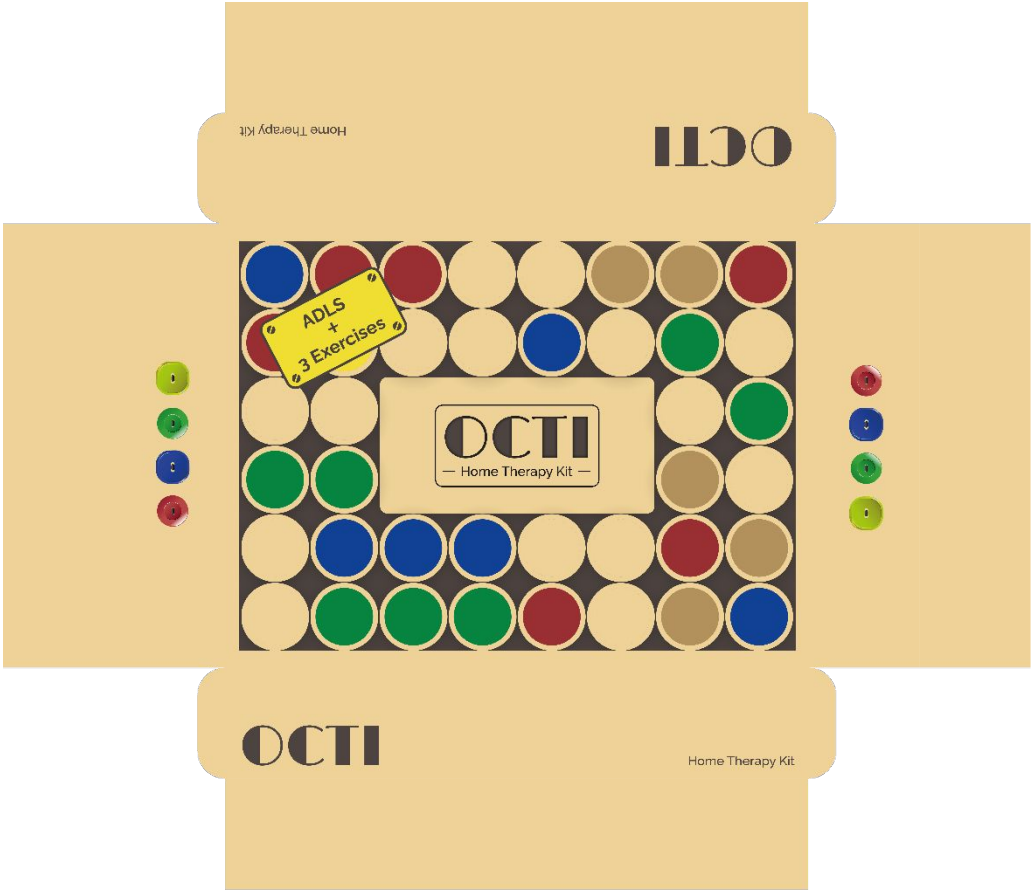
Financial Problems

"Regular therapy sessions are expensive and time consuming. And the OT kit available in market are not ALS specific, also only target one exercise at a time."

Logo

Octi brand name was selected for occupational therapy kit or Home therapy kit

Packaging


Home Therapy Kit
OCTI
ADLS
+
3 Exercises
OCTI
— Home Therapy Kit —
OCTI
Home Therapy Kit


About the Project:
Project By
Aryan Gajwe
Guided By
Prof. Purba Joshi
IDC School of Design
NeuroGen
OCTI
— Home Therapy Kit —

Booklet

OCTI
— Home Therapy Kit —

Welcome to OCTI, the fun home therapy kit for ALS/MND patients, that gets you to do those boring exercises in a more enjoyable and challenging way.

OBJECTIVE OF THE KIT

To help patients become a little more independent and reduce the progression of ALS.

GET READY

The kit contains multiple exercises which are ADLS (Activity of Daily Living), Pegboard, Stacking, Clothespin Exercise.

To start with opening the lid you will find various components/pieces inside the box. On the lid is the ADLS exercises and the other components are for pegboard, stacking, clothespin exercise.

ADLS

Activity of daily living

ADLS is one of the most important exercise to do everyday and a step forward to do things on your own.

How To Play

Zip Unzip - Tic Tac Toe

1. Zip and Unzip the bag multiple times to get used to the motion. At first it will be challenging but eventually you will get the hang of it.
2. Unzip the bag to reveal few pieces for you to play tic tac toe with one more player. It's not just a game but something that will help you improve grip strength as it will have a resistance of a velcro.

How To Play

Tie the Lace

1. You will be given a card with shoe lace patterns on it. You just have to follow the pattern and tie the lace accordingly.
2. To maker things easy just tie the multiple shoe laces into a not as shown in the figure.
3. While doing these exercises you can also time yourself to get your adrenaline flowing.

For next exercise
Please turn the page

How To Play

Free the Panda

Papa Panda is sad :(
Someone captured his son and needs your help to free him.

1. Help him free his adorable son from the prison.
2. While going through it you will face various challenges but you need to be brave and complete all the challenges and free the poor baby from the prison.
3. To make it more challenging you can time yourself. At first try you can start with a 5 min sand clock and reduce or increase the time accordingly.

PEGBOARD

Pegboard Exercises

A rectangular board with circular holes of different diameters- 1 cm, 1.5 cm and 2 cm where cylinders are to be inserted.

- Improves the pinch grip of the player.
- Gripping difficulty increases with decrease in diameter.

How To Play

1. You are given few pegs with different diameters and few challenge cards.
2. You just need to replicate the pattern made in the challenge card.
3. To make it more challenging you can time yourself using the sand clock inside the box. The minimum time required for the player to complete is given on the card itself.

Stacking

Stacking Exercise

The task is to stack discs into the stacked up pegs.

- Helps practice the pronosupination of the wrist
- Useful to get the shoulder to a greater degree of flexing

Bonus Game

Now after stacking according to the challenge card you will have to sort the donuts according to the colors. But you can only remove one donut from the stacked pegs at a time.

How To Play

1. Start by stacking the pegs on to each other as shown in the challenge cards.
2. Now their are multiple donuts inside the boxes with varied thickness. You just need to arrange them according to the card
3. To make it more challenging you can time yourself using the sand clock inside the box. The minimum time required for the player to complete is given on the card itself.

Clothespin

Clothespin Exercise

Useful for improvement of fundamental abilities needed for handling scissors, pencils, and other tools. The application of clothespin tasks and instructional materials would promote the following:

- Enhancement of resistance and strengthening
- Development of the hand's arches
- Proficient control of the radial fingers (thumb, index, and middle fingers)
- Stabilization of the ulnar fingers (ring and little fingers)

How To Play

1. With the help of stacking challenge card you can do this exercise.
2. You must have noticed a small flattened surface in the middle of the peg it is where you will clip the clothespin
3. To make it more challenging you can time yourself using the sand clock inside the box.

The accompanying booklet provides clear instructions and exercise guidance to help ALS patients become more independent and potentially slow the progression of the disease. It offers step-by-step instructions, diagrams, and photographs to ensure correct exercise technique. By consistently following the exercises, patients can maintain muscle strength, mobility, and overall functional abilities.

Chapter 09

Prototype and Renders


OCTI
Home Therapy Kit


ADLS
+
3 Exercises
OCTI
Home Therapy Kit
Home Therapy Kit
OCTI
Home Therapy Kit
OCTI


OCTI
Home Therapy Kit


Challenge 01
2 min
Challenge 01
5 min

Activities of Daily Living (ADLS)

ADLS is one of the most important exercise to do everyday and a step forward to do things on your own.

Exercises

1. Zip Unzip - Tic Tac Toe

1. Tie the Lace

1. Free the Panda

Pegboard

A rectangular board with circular holes of different diameters- 1 cm, 1.5 cm and 2 cm where cylinders are to be inserted.

1. Improves the pinch grip of the player.
2. Gripping difficulty increases with decrease in diameter.

Stacking

The task is to stack discs into the stacked up pegs.

1. Helps practice the pronosupination of the wrist

2. Useful to get the shoulder to a greater degree of flexing

Bonus Game

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- Stabilization of the ulnar fingers (ring and little fingers)


Homie Therapy Kit


DCT
Home Therapy Kit
DCT


DCT
Home Therapy Kit

Chapter 10

Conclusion

Feedback

I am pleased to share that the jury appreciated my work and provided positive feedback on my project. They specifically liked the finishing of the prototype and acknowledged the effort put into its execution. However, they did mention that the placement of the pegboard in the kit seemed a little awkward. This led the jury to brainstorm and propose some excellent solutions to address this issue.

My project guide, Prof. Purba Joshi Ma'am, expressed great satisfaction with the outcome of the project. The other jurors also seemed pleased and had few questions, indicating that the project met their expectations. They particularly appreciated the fact that I sought insights from doctors during the initial stages of concept development, recognizing the value of incorporating expert input into the project.

During the presentation, Prof. B.K. Chakravarty Sir asked me a thought-provoking question: "If in the future, you were asked to guide a student on a similar project, what would you suggest the student to work on more?" In response, I would advise the student to delve deeper into emerging technologies, consider incorporating user feedback throughout the design process, and conduct thorough research on the specific needs and challenges faced by the target user group. Encouraging the student to adopt a collaborative and multidisciplinary approach would foster innovation and maximize the project's impact.

Overall, the positive feedback from the jury, their active brainstorming, and the guidance provided by my project guide demonstrate the success of my project and the meticulous effort I invested in its development.

DDS Exhibit

DDS Exhibit

DDS Exhibit

Chapter 10

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