
P3 Report

“Adaptive Writing And Cutting Device For Individuals With Hand Arthritis”

DEP703

By

216130016

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Guided by : Prof Purba Joshi

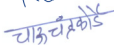
Approval Form

This is to certify that the Industrial Design Project entitled " Adaptive Writing And Cutting Device For Individuals With Hand Arthritis " by Uppili Nithin Soorya B, Roll no 216130016, is approved for partial fulfillment for the Master of Design degree in Industrial Design.

Prof. Purba Joshi (Project Guide)



Signature of the Chair Person:



Signature of the Internal Examiner:



Signature of the External Examiner:



Date : 28.06.2023

Declaration Form

I declare that this written report represents my ideas in my own words, and where other's ideas or words have been included I have adequately cited and referenced the original sources.

I also declare that I have adhered to all principles of academic honesty and integrity and have not falsified, misinterpreted or fabricated any idea, data, facts or source in my submission.

I understand that any violation of the above will be caused for disciplinary action by the Institute and can also evoke penal action from the source, from which proper permission has not been taken or improperly been cited.

Signature : 

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Abstract

The ability to use essential tools such as scissors and pens is often taken for granted, but for individuals suffering from rheumatoid arthritis, these seemingly simple tasks can become incredibly challenging and frustrating. Rheumatoid arthritis is a chronic autoimmune disease that primarily affects the joints, causing pain, stiffness, and inflammation. The condition can significantly impair fine motor skills, making it difficult to grip and manipulate objects like scissors and pens. Being able to use these tools effectively is crucial for daily tasks, such as writing, cutting paper, or even performing basic self-care activities. The inability to use these tools can lead to a loss of independence, reduced quality of life, and increased dependence on others for assistance.

While technology has certainly introduced digital alternatives, the tactile experience and versatility provided by these tools remain unmatched. Adaptive tools and techniques can be developed to assist individuals with such conditions, but these alternatives may not fully replicate the functionality and ease of use offered by traditional scissors and pens.

This project focuses on designing and developing an adaptive writing and cutting device specifically for individuals with hand arthritis. Limited availability and high costs of existing products for arthritis have been identified through research and interviews with rheumatoid arthritis patients.

The proposed device aims to overcome these limitations by integrating adaptive features tailored to the needs of individuals with hand arthritis. It employs ergonomic design principles, specialized grips, mechanisms to reduce strain on arthritic joints and adjustable components to accommodate different hand sizes and levels of dexterity. These redesigned tools seek to alleviate the burden faced by individuals with hand arthritis, enabling them to perform tasks with greater ease and enhancing their overall well-being. By enabling comfortable and controlled movements, our intervention will enhance functionality and autonomy, improving the lives of those affected by rheumatoid arthritis.

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1. Introduction

1.1 What Is Arthritis

Arthritis is a relatively common condition in India and affects 15% people i.e. over 180 million people in India.

Arthritis is the swelling and tenderness of one or more joints. The main symptoms of arthritis are joint pain and stiffness, which typically worsen with age. The causes of many types of arthritis are not fully known. Most forms of arthritis are thought to be caused by a fault in the immune system that causes the body to attack its own tissues in the joints. This may be inherited genetically. The most common types of arthritis are osteoarthritis and rheumatoid arthritis.

Common Symptoms of Arthritis:

- Joint pain, tenderness, and swelling.
- Stiffness, especially in the morning or after periods of inactivity.
- Reduced range of motion and difficulty in performing daily activities.
- Warmth and redness around the affected joints.
- Fatigue and muscle weakness.
- In some cases, deformities or changes in the affected joints may occur.



Fig. 1 Arthritis hand

1.2 Types of Arthritis

Understanding the common types of arthritis can help individuals recognize symptoms, seek timely medical intervention, and manage their condition effectively. There exist about 100 different types of arthritis, out of which some are very common and others are extremely rare.

- Osteoarthritis-affects old age people
- Rheumatoid arthritis-most common type of arthritis
- Psoriasis arthritis-is a chronic inflammatory arthritis
- Juvenile arthritis-occurs in children
- Gout- type of inflammatory arthritis

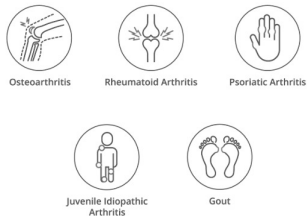


Fig 2 Types of arthritis

1.3 Understanding The Types of Arthritis And Area of Focus

	Osteoarthritis	Rheumatoid arthritis	Psoriatic Arthritis	Juvenile arthritis	Gout
Cause	Osteoarthritis develops when the cartilage and other tissues in the joint degenerate or undergo structural change. Simple joint wear and tear is not the reason for this. Instead, the disintegration, which typically occurs gradually over time, might be brought on by changes in the tissue.	Rheumatoid arthritis is an autoimmune illness that develops when your immune system mistakenly targets the tissues in your own body. Rheumatoid arthritis damages the lining of your joints, resulting in a painful swelling that may eventually lead to bone erosion and joint deformity, unlike osteoarthritis, which causes damage from wear and strain.	Psoriatic arthritis is a kind of arthritis that occurs in certain persons who have psoriasis, a condition that creates red areas of skin covered in silvery scales.	When the body's immune system targets its own cells and tissues, juvenile idiopathic arthritis develops. Although the exact cause is unknown, both environment and heredity appear to be involved.	Hyperuricemia, a condition when there is too much uric acid in the body, is what causes gout. Purines, which are present in your body and the foods you eat, are broken down by the body to produce uric acid.
Symptoms	Joint swelling. Affected joints might hurt during or after movement. You may be unable to move your joint through its whole range of motion.	Swelling in the joints especially hand and joint. (Extreme cases may cause deformity)	Swelling in the knees, ankles, feet, and hands is common. In most cases, just a few joints are inflamed at a time. They get painful, puffy, sometimes hot and red. When your fingers or toes are damaged, they may take on the form of a sausage.	Swollen, stiff, and painful joints in the knees, hands, feet, ankles, shoulders, elbows, or other joints, often in the morning or after a nap	Pain, swelling, redness, and tenderness in one or more joints, most commonly the big toe, can occur suddenly and severely.
Affected joints	Hand, knee, hip, spine	Wrist and finger		Hands, knees, ankles, elbows and/or wrists	Joints, ankle, knee, foot and toe
Age group affected	45 or older	30 to 60	30 to 50	6 months to 16 years	30 to 50
Treatments	Physical therapy Medication Stretching Surgery	Physical therapy Medication Stretching Surgery	Antibiotics Physical therapy	Antibiotics Physical therapy	Antibiotics Gentle exercise

Area of focus

Table.1 Types of arthritis comparison

1.4 Rheumatoid Arthritis

Rheumatoid arthritis (RA) is a chronic autoimmune disease that primarily affects the joints. While there is no cure for rheumatoid arthritis, early diagnosis, proper medical treatment, and lifestyle modifications can help manage symptoms, reduce joint damage, and improve the quality of life for individuals living with this condition.

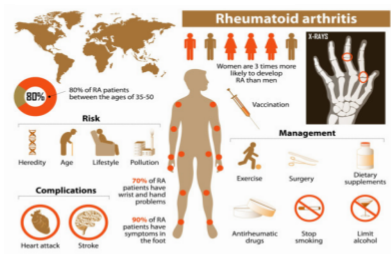


Fig. 3 Infographics of rheumatoid arthritis

Source from www.ihealtheareandylst.com

1.5 Stages of Rheumatoid Arthritis

The four stages of rheumatoid arthritis (RA) are also known as

- Early-stage RA,
- Moderate-stage RA,
- Severe RA, and
- End-stage RA.

Symptoms may not appear until moderate-stage RA (Stage 2).

Stage 1: Synovitis

During stage I, you may start having mild symptoms, including joint pain and joint stiffness.

Stage 2: Pannus

In stage II of rheumatoid arthritis, the continued inflammation has led to a thinning of the cartilage.

Stage 3: Fibrous Ankylosis

Ankylosis is a term for when bones start to fuse together at a joint, causing unusual lack of mobility.

Stage 4: Bony Ankylosis

Bones fuse together with actual bone tissue instead of just a connective fibrous tissue.

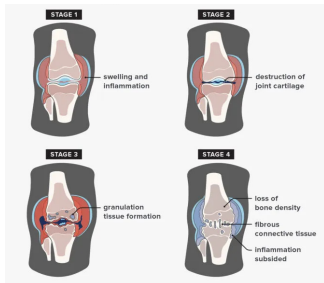


Fig. 4 Stages of degeneration of bones
Source from www.medicalnewstoday.com

2. Primary Research

2.1 Interview With RA People 01

Name: xyz

Age: 42 Female

Profession: Teacher

RA suffering since: 10 years

"I wish to be independent and capable of doing my daily tasks by myself"

Pain on the joints



Fig. 5 Patients pain points



Fig. 6 Interviewing RA patient

Problems:

Performing routine home chores is challenging. Being unable to complete the work effectively, experiencing pain in all of the joints, and experiencing fatigue all day. Her right hand is deformed and swelled. She frequently has joint stiffness, which limits her range of motion when performing certain tasks, leaving her feeling helpless and frustrated.

Deformity in her finger makes her difficult to hold product like scissor. She feels limited in her ability to engage in any hobbies or work. It is difficult to sit on the ground and do work.

As a teacher, I had to do a lot of writing with a pen for a long time, and it caused me discomfort in my fingers and wrists.

Interview 02



Name: xyz

Age: 56 Female

Profession: Teacher

RA related suffering since: 2017

Pain will start from the moment she gets up in the morning and feels stiffness and pain through out the body. Likes to perform household chore but due to inflammation and restricted motion the enthusiasm gets affected and have to depend someone to get the work done.

Interview 03



Name: xyz

Age: 53 Female

Profession: Homemaker

RA related suffering since: 2021

Getting up from the bed is a big task and need some assistance to help her get up. Holding any object itself is challenging, because it slips a lot from her hand which leads to frustration. To over come this she kept maid to perform household chores like, mopping, washing utensils and cooking. Have used assistive device like walker, crutches to perform basic activity.

Interview 04



Name: xyz

Age: 50 Male

Profession: Office worker

RA related suffering since: 2008

While working he feels difficulties in standing and sitting, which is creating pain on his knee. But still prefers cycling to keep his joints in motion. Most of the times he experiences lacking of grip which leads to slipping away of object from hand.

Interview 05

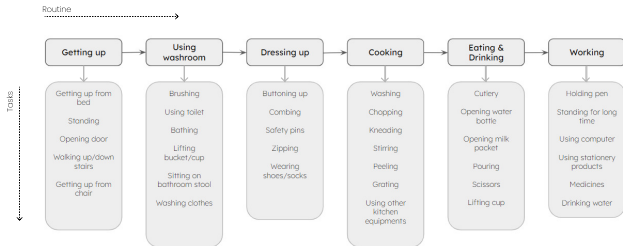


Physiotherapist

"The main goals of arthritis treatments are to reduce symptoms and improve quality of life"

Suggests persons with RA to exercise every day to increase their joint flexibility and prevent bone fusion. Recommends hot/cold treatment to overcome and treat pain and inflammation. People with RA who are in the latter stages of the disease can cope better with assistance device.

2.2 Journey Mapping

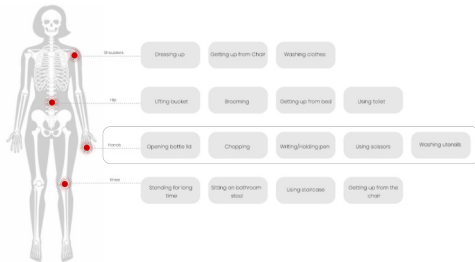


User journey mapping has been done to understand the daily routine of women who is suffering from rheumatoid arthritis.

Living with rheumatoid arthritis is an ongoing journey of physical and emotional challenges. The user journey mapping revealed that individuals with rheumatoid arthritis experience a wide range of difficulties, frustrations, and adaptations in their daily lives.

2.3 Joints Associated With The Tasks

Through this sorting it was found that patient experiences more pain in their hand while doing every day household chores.



Area of intervention

Hand - Most affected part

2.4 Inference

In individuals with rheumatoid arthritis, multiple joints can be involved, although the specific joints affected can vary from person to person. Typically, the small joints of the hands, wrists, and feet are commonly affected, leading to symptoms such as pain, stiffness, swelling, and limited range of motion.

The involvement of these joints can significantly impact day-to-day tasks that require manual dexterity, fine motor skills, and mobility. Simple activities such as gripping objects, writing, typing, buttoning clothes, or tying shoelaces may become challenging and painful for individuals with rheumatoid arthritis.

Moreover, weight-bearing joints like the knees, ankles, and hips can also be affected, which can make walking, climbing stairs, and maintaining balance more difficult. This can affect a person's ability to perform routine activities like walking to the kitchen, getting in and out of a car, or standing for extended period.

3. Secondary Research

3.1 Why Does RA Develop in the Hand?

There is not always a precise cause for RA of the hand. This disease is more likely to develop in middle aged or elderly patients. Also, certain patients may have a genetic likelihood of developing RA of the hand. Ultimately, RA of the hand develops when there is swelling or inflammation of the joint lining. Referred to medically as the synovial membrane, the joint lining can become inflamed and leak into surrounding areas. Eventually, RA produces a chemical substance that erodes the structure of the affected joint.

What are the Symptoms of RA of the Hand?

RA of the hand symptoms tend to get progressively worse with time. At first, patients will likely experience minor irritation or inflammation. But when RA begins to erode the joints and other tissues, patients can develop contracture or deformity and experience serious pain.

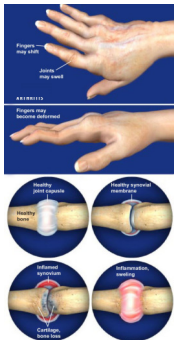


Fig. 7 Bone degeneration in hand joints
Image from www.orthoriversida.com

3.2 Effects of RA in hands

The hands are one of the earliest and most common areas affected by rheumatoid arthritis. Research suggests an estimated 90 percent of people with RA experience pain, stiffness, or swelling in joints in their hand, and often results in problems performing daily activities.

- **Joint Inflammation:** RA causes chronic inflammation in the joints of the hands, leading to swelling, warmth, and tenderness. This inflammation can result in pain and stiffness, making it difficult to perform everyday tasks.
- **Joint Deformity:** Over time, untreated or poorly managed RA can lead to joint deformities in the hands. The inflammation and damage to the joint structures can cause joints to become misaligned, resulting in changes in finger and wrist alignment.
- **Reduced Grip Strength:** Rheumatoid arthritis can lead to a decrease in grip strength due to joint pain, inflammation, and joint damage.
- **Limited Range of Motion:** Stiffness and swelling in the hand joints can restrict the range of motion. Individuals with RA may experience difficulty in fully extending or flexing their fingers, making it hard to perform precise movements like grasping small objects or manipulating tools.

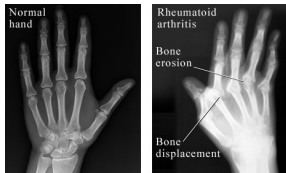


Fig. 8 Stages of degeneration of bones

Image from www.nyp.org

- **Nodule Formation:** Rheumatoid nodules, which are firm lumps, can develop under the skin in areas commonly affected by RA, including the hands.
- **Functional Impairment:** Joint inflammation, deformities, reduced grip strength, and limited range of motion can lead to functional impairment of the hands. Activities like writing, typing, buttoning clothes, opening jars, and even simple self-care tasks may become challenging and require adaptations or assistive devices.

3.3 Radiographic Findings

Fig 6, 60-year-old female with long-standing rheumatoid arthritis. Hand radiographs shows erosive changes in the PIP and MCP joints as well as the wrist. Ulnar subluxation of the fingers at MCP joints is also present.

Fig 7, 59-year-old female rheumatoid arthritis. Hand radiograph shows extensive erosive changes and osseous loss in the wrist and metacarpophalangeal joints with telescoping and ulnar deviation at the MCP joints. Severe demineralization is also present.

Fig 8, Frontal view of the hand in a 40-year-old female with rheumatoid arthritis. Severe pancarpal joint space loss is present as well as juxta-articular demineralization. Distal interphalangeal joints are spared.



Fig. B X-Ray images of hand
Source from www.rny.org

3.4 RA Hand Onset

From the onset of rheumatoid arthritis, patterns were present in the development of hand deformities. There were two subsets in these patterns: a conservative subset with only type 1 thumb deformities, at most, and a progressive subset including hands that developed significant deformities. Multiple finger deformities, including swan-neck deformities, and type 2 and 3 thumb deformities could be a useful indicator of the progressive subset.

Joint appearance :



Fig. 10 Joint appearance

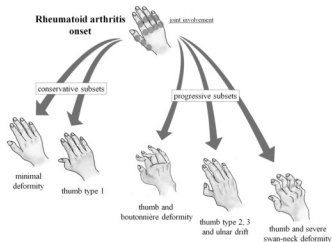


Fig. 11 Stages of degeneration of bones
Source from www.assets.researchsquare.com

3.5 Joints of The Hand

The hand is a complex functional limb including over 30 muscles and more than 20 joints that allow performing a wide range of activities with a high level of precision.

The PIP (proximal interphalangeal), DIP (distal interphalangeal), and MCP (metacarpophalangeal) joints are important structures of the hands that play a crucial role in various day-to-day tasks.

The PIP joints are located between the middle and the end of each finger, excluding the thumb. These joints enable bending and straightening movements, allowing for gripping objects, grasping, and performing intricate tasks such as writing, typing, and playing musical instruments.

The DIP joints are situated at the very end of each finger, closest to the fingertips. They allow for flexion and extension movements, enabling actions like picking up small objects, gripping, and pressing buttons.

The MCP joints are located at the base of each finger, connecting the finger bones (phalanges) to the hand bones (metacarpals). These joints are responsible for the bending and straightening of the fingers and are crucial for activities such as gripping, pinching, and holding objects.



Fig. 12 Stages of degeneration of bones
Image from www.assets.researchsquare.com

3.6 Types of Hand Deformities

Individuals with RA may experience different types of hand conditions, depending on the rate and manner in which their joints and ligaments deteriorate due to the disease.

"All of these changes result from the inflammatory destruction to the joints of the fingers that occur with arthritis, causing increased pain, stiffness, swelling, and limited functional use of the hand for gripping, grasping, and pinching."

1. Boutonniere deformity
2. Swan-neck deformity
3. Hitchhiker's thumb
4. Ulnar drift
5. Carpal tunnel syndrome

3.6.1 Boutonniere Deformity

It affects your ability to straighten the middle joint of a finger or – less commonly – a toe. Your joint is stuck in a bent position and won't straighten. At the same time, the joint toward the tip of your finger or toe (extremity) is flexed upward.

Signs and Symptoms

- You have swelling and pain at the middle joint of the finger or toe. If your thumb is affected, it will be bent at the first joint.
- You can't straighten out your finger or toe.
- The tip of your finger or toe is flexed up.
- Your joints are stiff, which gets worse over time.

Treatment

Nonsurgical treatment is a splint that keeps your PIP joint straight, but allows your other joints to move. You'll have to wear the splint continuously for four to six weeks. Your provider might also suggest exercises.



Fig.13 Stages of degeneration of bones

3.6.2 Swan Neck Deformity

In a swan neck deformity, the middle joint of a finger is extended (bent back) more than normal. The end joint is flexed (bent down).

Signs and Symptoms

- This deformity can cause difficulty bending the middle joint because of the location of the tendons. A snapping sensation can happen during bending. Long-lasting deformities can become stiff.

Treatment

One non-invasive option involves a special type of ring for the middle joint that can be used to help correct the position and stop the snapping.

Surgical treatments are many and varied. They mainly involve prevention of the abnormal middle joint extension. Some involve repositioning of the tendons on the side of the middle joint. If the middle joint is stiff or arthritic, the joint may be replaced or fused in a slightly bent position.



Fig. 14 Stages of degeneration of bones

3.6.3 Hitchhikers thumb

Hitchhiker's thumb (distal hyperextensibility) means your thumb joint is extremely flexible and has an abnormal range of movement. When you give a "thumb's up" sign, your thumb joint moves backward more than 50 degrees. Hitchhiker's thumb typically isn't painful but it can be associated with various genetic diseases and conditions.

Signs and Symptoms

- If you have very flexible (hypermobile) thumb joints, you may have hitchhiker's thumb (distal joint hyperextensibility).
- Joint and muscle pain and stiffness; frequent joint and ligament injuries, including dislocations and sprains; thin, stretchy skin.

Treatment

Medication is not the primary treatment for hypermobility, but can be used as an adjunct treatment for related joint pain. Nonsteroidal anti-inflammatory drugs are the primary medications of choice.

Regular exercise and exercise that is supervised by a physician and physical therapist can reduce symptoms because strong muscles increase dynamic joint stability.



Fig. 15 Stages of degeneration of bones

3.6.4 Ulnar Drift

Ulnar deviation is also known as ulnar drift. This hand condition occurs when your knuckle bones, or metacarpophalangeal (MCP) joints, become swollen and cause your fingers to bend abnormally toward your little finger. It's a result of inflammation weakening the surrounding tendon structures.

Ulnar deviation can occur due to chronic inflammation from rheumatoid arthritis (RA).

Signs and Symptoms

- swelling, warmth, or pain in the wrist, hand, and finger joints
- limited range of motion of the fingers
- reduced grip strength

Treatment

Anti-inflammatory medications can control chronic inflammation and help reduce swelling and pain in the hand.

Splints and hand braces can keep the fingers in place while adding extra support to the wrist.

People may choose to undergo surgical procedures to fix a damaged ligament.



Fig. 16 Stages of degeneration of bones

3.6.5 Carpal Tunnel Syndrome

Carpal tunnel syndrome is caused when the space (the carpal tunnel) in the wrist narrows. This presses down on the median nerve and tendons (located inside the carpal tunnel), makes them swell, which cuts off sensation in the fingers and hand.

Symptoms

- Numbness at night.
- Tingling and/or pain in the fingers (especially the thumb, index and middle fingers).

Treatment

Non-surgical treatments are usually tried first. Treatment begins by:

- Wearing a wrist splint at night.
- Taking nonsteroidal anti-inflammatory drugs, such as ibuprofen.
- Cortisone injections.



Fig. 17 Stages of degeneration of bones

3.7 Products in the market for arthritis people

Exercising tool



Splints & Braces



Massager



Assistive aid



Dressing aid



Kitchen aid



Office aid



There are different categories of assistive device/products available in market. Assistive products are designed to provide support, enhance independence, and improve the quality of life for individuals living with arthritis. These products aim to minimize the challenges and limitations caused by joint pain, stiffness, and reduced mobility.

Area of Focus

4. Research Analysis

4.1 Inference

The impact of rheumatoid arthritis on the hands and the resulting joint deformities highlight the significant functional limitations that individuals with this condition face in their lives.

Simple activities such as gripping objects, writing, typing, buttoning clothes, or opening jars can become challenging and painful for individuals with rheumatoid arthritis. The pain and limited range of motion in the affected joints can further impact activities like cooking, grooming, and carrying out personal care routines.

The deformities commonly associated with rheumatoid arthritis in the hands include ulnar deviation and boutonniere deformity. These deformities can significantly impair hand function, limiting the ability to perform day-to-day tasks that require dexterity, and grip strength.

4.2 Empathy Through Roleplay

Since hands of RA patients are the most commonly affected body part, hence this exercise was carried out to identify the challenges they encounter in terms of gripping. People with rheumatoid arthritis (RA) often encounter numerous challenges in their day-to-day lives when performing tasks that involve using their hands.

Empathizing

In this roleplay i have tested 20 everyday product, that people use and perform task everyday, in some of the task joints like shoulder, elbow, wrist are also involved. All the interactions involved fine motor skills and range of motion.

Note: Despite experiencing the limited flexion (folding) of hand with the use of masking tape on my hand, people with RA will also experience pain and stiffness in their hands, which we have to keep in mind while designing a product for these people.



Fig.18 Stages of degeneration of bones



Fig.19 Stages of degeneration of bones

4.3 Observations

Throughout this exercise, I interacted with 20 different types of things that people will use in their daily lives. I was using different products with diverse shapes, sizes, materials, and mechanisms that have been developed for normal people to utilize.

Various forms of hand movements and gripping were used to complete the objective during this exercise. Because of the lack of grip, the level of confidence was lower while executing specific tasks.



1. Brushing



2. Using soap



3. Washing clothes



4. Drying clothes



5. Opening water bottle



6. Syrup bottle



7. Cutting vegetable



8. Washing utensils



9. Spectacles



10. Using Mobile phone



11. Remote control



12. Using mouse



13. Writing



14. Stapler



15. Zipper



16. Scissor



17. Piezo ignitor



18. Using nail clipper

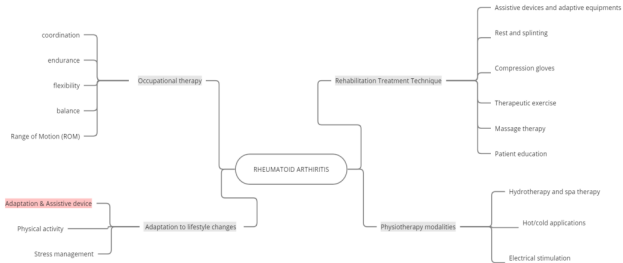


19. Sprayer



20. Lock and key

4.4 Design Opportunities



4.5 Problem Identification

Writing

People with RA who are all working are having difficulty writing with their pen owing to the fine motor skills necessary to grasp the pen and are suffering discomfort in their hand.

Scope for design intervention (Pen): Pen with ergonomic gripping solution.



Writing

Scissor

Since scissors are the most frequent used stationery product in home and business environments that is used for cutting items, RA individuals experience difficulty while holding scissor for an extended period of time while doing a task.

Scope for design intervention (Scissor): Ergonomic handle for improved grip and less effort



Using Scissor

5. Design Brief

"Designing an adaptive writing and cutting assistive device for individuals with rheumatoid arthritis to perform everyday task which requires fine motor skills. The device should be intuitive, easy to use and aesthetically appealing"

"

Objectives:

- To reduce fatigue and pain in their hand
- To reduce effort while performing the task
- To encourage the use of the assistive device without hesitation

Key requirements:

Ease of use
Adaptability
Cost effective

6. Market Survey

There are different categories of assistive device/products available in market. Assistive products are designed to provide support, enhance independence, and improve the quality of life for individuals living with arthritis. These products aim to minimize the challenges and limitations caused by joint pain, stiffness, and reduced mobility.

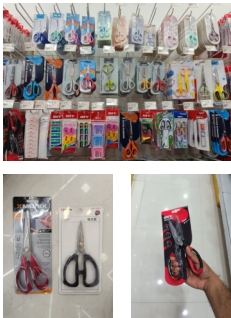


Fig. 20 Market Survey

6.1 Market study (Pen)



Big Fat Pens for Arthritis and Hand Pain - Pack of 5

Brand: Therapeutic
4.3 ★★★★★ - 2,409 ratings

₹2,573

Interpretation

Silicon grip for non slip

Bigger grip

Aesthetically not pleasing



PenAgainA - Ergosof Silver

Brand: Baumgartner
2.7 ★★★★★ - 4 ratings

₹1,483

Interpretation

Contour design and support

Index and thumb finger gripping

Ergonomic design



Pilot Dr. Grip Retractable Ballpoint Pen, Medium Point, Navy Barrel with Blue Ink, Single Pen (36101)

Visit the Pilot Store
4.7 ★★★★★ - 3,148 ratings

-44% ₹1,668

MRP: ₹2,500

Interpretation

Easy of use certified

Cushioned grip

Retractable for easy operation

Market study (Pen)



The Pencil Grip Heavyweight Ballpoint Pen with Grip, Ergonomic and Best Pens for Smooth Writing, 2.4 Oz- TPG-651

Visit the The Pencil Grip Store
4.2 ★★★★★ - 555 ratings | 20 answered questions

\$17.95

Interpretation

Added weight as gripping

Due to added weight no need to put downward pressure

Ergonomic grip design

Retractable mechanism



SP Ableware Arthwriter Hand Aid Writing Aid (735140000)

Visit the SP Ableware Store
3.1 ★★★★★ - 16 ratings

-43% \$13.90 (13.90 / Count)
List Price: \$24.95

Interpretation

All finger grasp/grip

Can accommodate different dia pen/pencil

People with severe deformity can use



Writing Bird - Writing Bird - NC21003

Visit the North Coast Medical Store
3.5 ★★★★★ - 35 ratings

Price: \$24.95 (\$24.95 / Count)

Interpretation

No gripping needed

Similar to mouse

Device holds the pen/pencil

Ergonomic hand positioning

6.2 Market study (Scissor)



FISKARS Stainless Steel Easyaction Scissors 26Cm |

Visit the Fiskars Store
4.8 ★★★★★ 241 ratings

-20% ₹3,784

M.R.P.: ₹4,730

Interpretation

Pricey

Weight

Spring return mechanism



Peta Self Opening Multi-Function Shears

Write a Review

Your Price: \$17.95

Retail Price: \$21.95

Interpretation

Re-opening spring scissor

Wide opening handle

Serrated blades



Easi-Grip Loop Handle Scissors

★★★★★ In Reviewing Write a Review

Your Price: \$13.95

Lightweight scissors are ideal for people with decreased hand strength.

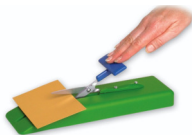
Interpretation

Thin handle

Ambidextrous

Squeeze handle

Market study (Scissor)



Mounted Table Top Scissor - Plastic Base

[Visit the Fun and Function Store](#)

4.3 ★★★★★ 19 ratings

Price: **\$35.99**

Interpretation

Portability is difficult

Aesthetically not pleasing

7. Task Analysis (Scissor)

Observations

In the fig.1 Here, an arthritis sufferer offers advice and techniques for cutting while holding scissors for those with arthritis and other hand-related problems. She is demonstrating how to hold the scissors using the index, middle, and ring fingers in case the thumb hurts.



Women with arthritis discuss which scissors to buy for individuals with arthritis in this specific video. Since she was unable to open her fingers wider, she is not endorsing long scissors in this statement. She mentioned how nice it was to hold the scissor because of its soft silicon handle.



Task Analysis (Scissor)

Observations

Due of the weight of the scissor, the user in this image is resting her scissor on the table as she cuts the paper. The spring action mechanism in these Fiskar simple action scissors makes it easier to open the scissors after each and every cut.



With this scissor, she loved the longer handle, which she found pleasant to grasp and use. The relevance of blade material, sharpness, and scissor pivot were also stated.



7.1 Task Analysis (Pen)



Changing the position of holding
Hold pen/pencil in between index and middle finger to avoid pressure built on the thumb finger.



Rubber band to help with pressure and position
Pen supports on the web space of thumb



Bulk Up the area where we are holding on to.
Wrap around the grip area, which provides padding and reduces the amount of pinch



Adding negative tilt reduces the strain in wrist and thumb

Task Analysis (Pen)



Pick up the pen with your thumb and index finger.
The tripod grip is the ideal grip.

Rest your middle finger on the pen.
Hold the pen at an angle rather than
vertically.



Loosen your grip to
avoid finger pain.

Rest the heel of your hand
on the page.

The pen should be at an
angle, enough so that you
can press the tip to the
page.

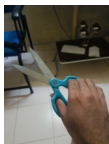


8. Testing scissors

Before moving on to ideation, numerous scissors with varied ergonomic handle designs and blades were tested to determine the strain point and to record the finger's holding position while cutting through materials.

Factors considered:

- Handle design
- Material
- Finger accommodation
- Position of holding
- Pain points



9. Taxonomy

Hand and Grasp Taxonomy

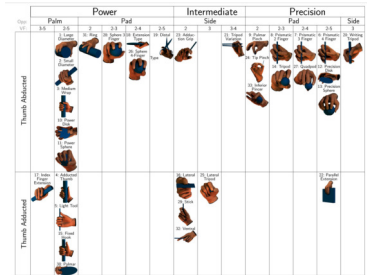
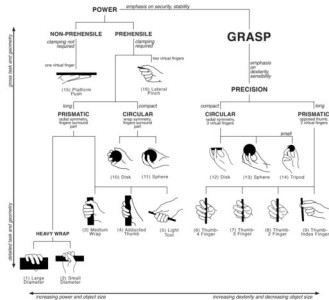


Fig. 21 Grasp taxonomy

10. Parts of pen and scissor

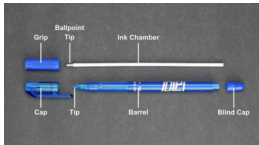


Fig. 22 Parts of pen

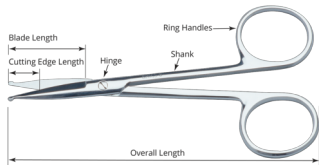
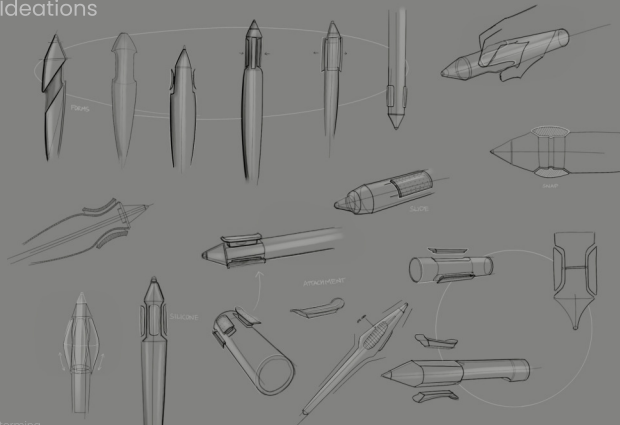


Fig. 23 Parts of scissor

11. Ideations

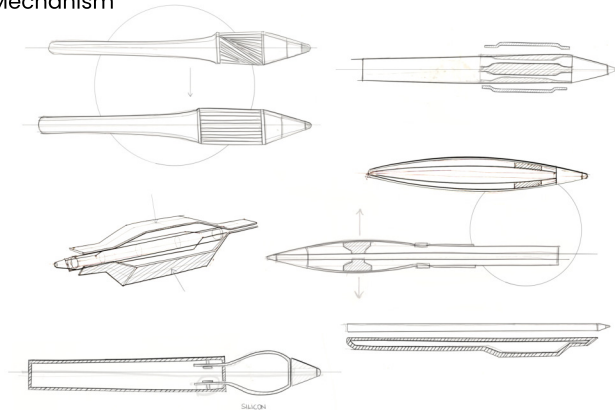
Pen



Brainstorming

Sketches

11.1 Mechanism

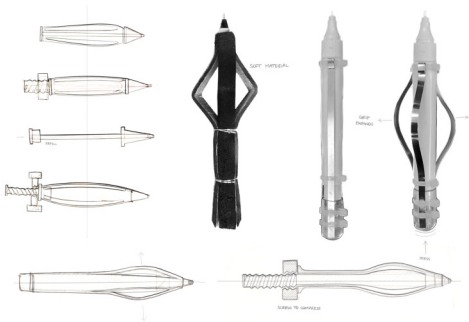


11.2 Ideations 01

Concept RIG

Goal is to

- Varying grip size
- Customizable
- Easy operation
- Aesthetically pleasing

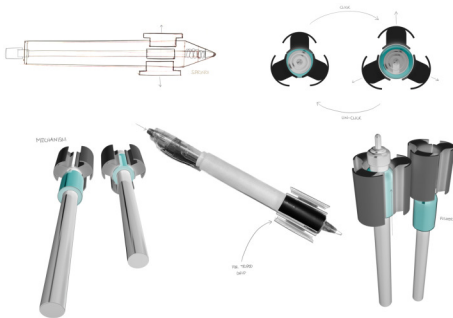


11.3 Ideations 02

Concept RIG

Goal is to

- Make use of existing design of a clickable pen
- Avoid extra attachment of grip on pen
- Fidget



11.4 Ideations 03

Concept RIG

Goal is to

- Provide triangular grip
- Multipurpose
- Magnet as therapy
- Fidget

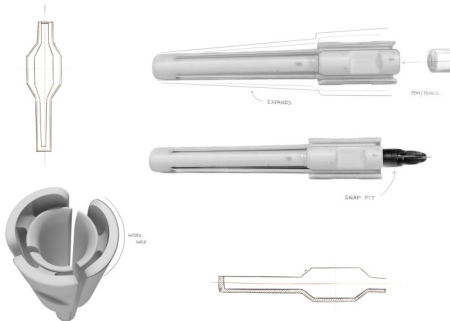


11.5 Ideations 04

Concept RIG

Goal is to

- Accommodate different dia pen/pencil
- Provide tripod grip
- Adaptability
- Aesthetically pleasing
- Wider grip
- Easy installation
- Easy manufacture

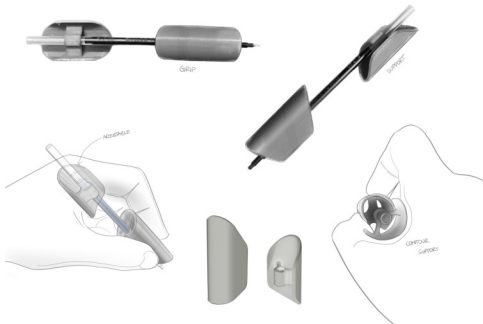


11.6 Ideations 05

Concept RIG

Goal is to

- Provide support to thumb web space
- Reduce unwanted wobble
- Added weight



11.6.1 Refining Design

Adaptive writing aid



Initial Idea



Detailing the mounting
to accommodate
pen/pencil



Introducing gooseneck
pipe to provide firm
support on the web
space of thumb

Concept Rig

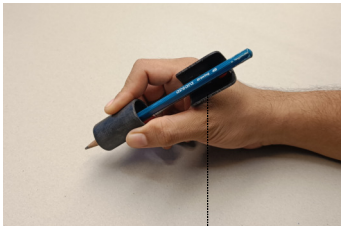


Monolithic design to
avoid extra
manufacturing cost
and to improve the
aesthetic look

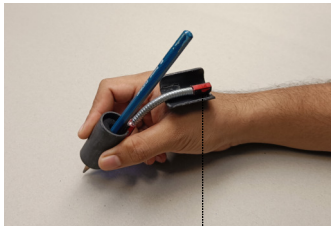
Chosen Design

11.6.2 Features

Adaptive writing aid



Adjustable web support



Supporting on the web space while writing

11.7 Final Product

Adaptive Pen Grip



Monolith design



Holder for the pen



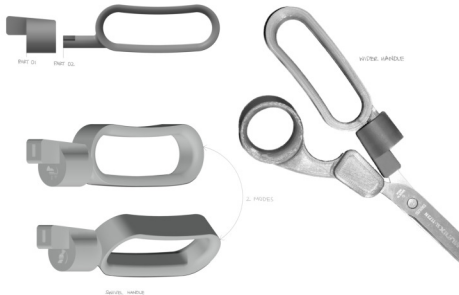
Bendable design

12.1 Ideations

Concept RIG

Goal is to

- Reduce strain created on the fingers, which includes index, middle, ring and pinky finger.
- Provide freeness to the finger movement while cutting
- Avoid flexion of fingers
- Swivel motion

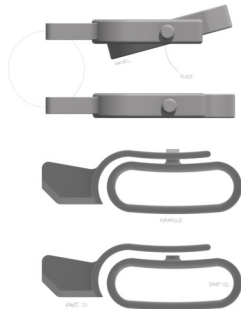


12.2 Ideations

Concept RIG

Goal is to

- Maintain natural position while holding
- Corrects the position of fingers holding

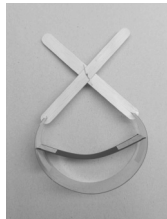
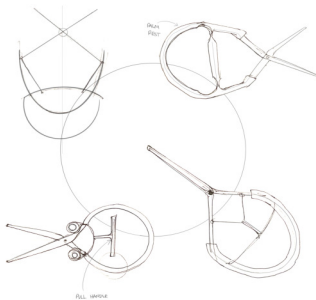


12.3 Ideations

Concept RIG

Goal is to

- Palm operated
- Maintain the neutral position of hand
- Avoid strain in finger joints



12.3.1 Refining Design

Concept RIG



Initial Idea



Figuring out the mechanism



Design of the form to accommodate scissor and to attain full closing of the scissor



Refining the design of live hinge to ensure smooth operation while opening and closing

Selected form for testing

13. Testing

3d Printed Model



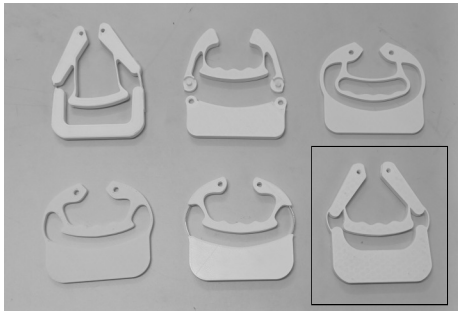
Didn't know how to hold



User using the products say there is less strain created in their hand when compared to normal scissor

14. Refining The Form

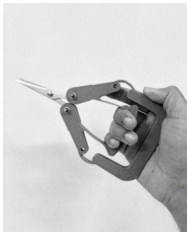
Based on user feedback, the shape and size of the scissor handle were adjusted to simplify the product's appearance and enhance the handling of the scissor.



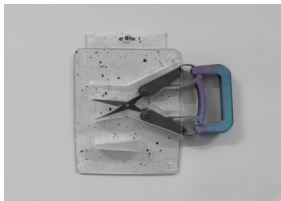
Selected form (Final)

15. Final Product

Scissor



Final prototype of the scissor



Packaging design for scissor

16. Reference

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