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Anatomy of the Rotator Cuff

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In
Medical Illustration

Anatomy of the Rotator Cuff

by
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Abstract

Health literacy is the level at which an individual can obtain, comprehend, and retain general health information and available health services. Health literacy determines more than just how well a person understands medical information. It affects how well they can navigate the medical world. There are problems that often reoccur in patient education materials. Most patient education materials should be written at a 5th or 6th grade level (Health Literacy, NIH 2015) whereas most materials are written at an 11th grade level, or higher. Many illustrations included in resources are complex and not designed to give a general overview of the anatomy. Available educational resources are not optimal for patient comprehension and retention. There are 3 simple solutions that can improve patient education materials. Readability tests should be performed on all literature prior to publication for patient use. The creation of clean, simple illustrations that focus only on the lesson being taught. The third solution would be to design educational resources that aid in patient comprehension and retention of procedures and diagnoses.

Table of Contents

List of Illustrations

Introduction

There are more than 80 million orthopedic and sports medicine related physician visits each year (Health Literacy, NIH 2015). Despite patient numbers there is a deficit in the availability of patient education resources. There is an extensive list of materials available both online and in print for medical professionals but these resources can be difficult for patients to comprehend. The materials are often convoluted with advanced language and topics. Patients are unable to obtain information that would help them choose the best options for their care (Health Literacy, NIH 2015). It is common for patients to be uneducated about the procedures, medication, and care that they receive. This problem is not only because they are unable to comprehend the material but because of how the information has been presented. Many issues found in this area of medicine could be resolved if patient education materials were presented on a level that patients could clearly understand (Health Literacy, CDC 2015). The core of all these issues is language. The use of correct language is always the key to creating an appropriate resource for a target audience. By performing simple readability tests patient education materials can be written in a language accessible to patients. To fill this need all reading materials will need to have a readability test performed on them. The reading level should be no higher than a 6^{th} grade level (Health Literacy, HRSA 2014).

To bring all the information together into a central location, a patient education website, an informational booklet, and posters are needed. The website will have simple navigation tools, readable text, and consistent layout. To show the application of these proposed modifications to current patient education materials a set of webpages were created to illustrate rotator cuff anatomy and injuries. With rotator cuff tears as an example, the website will include pages dedicated to anatomy, causation, symptoms, injury descriptions, treatment, surgery, physical

therapy, and recovery. The informational booklet will to supplement the material presented on the website. A set of posters will be designed for use in clinics, hospitals, and medical offices.

Section I: Scientific Background

To understand the importance of health literacy in creating a medical world that is beneficial and effective for patients across the country one must examine the factors that shape and mold health literacy. Health literacy is defined as the degree to which an individual has the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions. There are two groupings of people in the health world. They are classified as lay people and medical professionals. A lay person has no professional or specialized knowledge in a subject. A medical professional has extensive professional or specialized knowledge in a subject. Most patients are categorized as lay people (Health Literacy, CDC 2015). As a result, most patients lack in depth knowledge of their illnesses, diseases, and ailments. They often struggle to understand and retain information passed to them by their healthcare providers. It is common for medical professionals to be unaware of the language level that is needed to properly convey information to their patients. Although, they feel the language they are using is simple enough many concepts can be misunderstood by patients and lead to problems, such as, misuse of medications or improper aftercare procedures.

Health literacy affects a person's ability to navigate the healthcare system, share personal information, engage in self-care and chronic-disease management, and understand medical direction. Without proper education and supplemental materials healthcare providers cannot effectively help a patient comprehend what to expect from public health systems (Health Literacy, CDC2015). There are formulas that have been designed to test the readability and literacy level of a writing. Readability in the context of health literacy measures the level of comprehension needed to understand a piece of writing. A material may be written for learners ranging from kindergarten through doctoral levels. The average level for patient materials should

be at grade 6 (Health Literacy, NIH 2015). When several documents specifically designed for patients have been tested many have been tested at being at a grade 12 level or higher (Health Literacy, HRSA 2014). For a patient that didn't complete high school or is from a country outside of the US, comprehending material written at this level would be difficult. It would be irresponsible to let someone make serious decisions without having complete knowledge of the ramifications of their actions.

Factors that Affect Health Literacy

Several factors affect an individual's health literacy. These factors include communication between patient and providers, culture, and patient and provider knowledge.

Communication

Communication is, arguably, the most important part of human interaction. The ability to communicate with others allows for the sharing of ideas and concepts across a broad spectrum. Because the literacy level between patients and providers can differ drastically, there can be a breakdown in communication. If a healthcare provider is not able to articulate important details to a patient it can often lead to harmful consequences. That is why a consistent, government regulated system is needed to provide proper education for patient at a level of communication that they can understand.

Culture

A unique characteristic of American society is that it is a diverse melting pot of cultures and identities. While this is a unique and wonderful thing it can raise issues for both medical

professionals and patients. Culture is often a barrier that many come across when navigating the medical world. Health literacy can often be undermined by a lack of understanding of cultural norms for certain cultural groups. A patient may be prescribed medicines or treatments that may not follow their cultural beliefs or guidelines. If a healthcare provider isn't able to articulate the details of a patient's journey for a procedure or treatment a patient may undergo part of the prescribed path but may not want to proceed with another because they do not culturally agree with the process. This can result in hazardous consequences for the patient. If the part of the treatment that they refuse is vital they could limit their recovery. A patient must understand fully the ramifications of a procedure so that they can make any major decisions while options are still available to them. Cultural barriers often come with language barriers. Many healthcare facilities may not be equipped or staffed with appropriate resources for certain groups of people. The inability to fully understand the information being passed on by healthcare officials can hamper or complicate a patient's recovery process or even their ability to access necessary information to understand their condition. This can make navigating the health world very difficult for people of a different cultural background.

Knowledge

There are many myths that circulate through society about certain health conditions. They can include false information about alternative medicines or procedures that can cure an ailment. There are many myths that negatively portray proper procedures and techniques that can save lives. A medical professional may be able to dispel these common misconceptions when they consult with a patient but they need to use language that is at an appropriate literacy level (Health Literacy, NIH 2015). Otherwise a patient may further mistrust the information.

Visual Factors that Affect Health Literacy

Aside from the patient/provider relationship there are visual factors that affect a patient's health literacy. There are two major elements that are common problems for patients in visual information and education. Complex illustrations and a lack of a cohesive package of learning materials.

Complex Illustrations

There are many educational illustrations, animations, and videos that are geared to explaining medical procedures and treatments. The main issue with the materials is that they lack simplicity. They are great for medical students or experts in the field, but a patient may have difficulty understanding the information. Illustrations for patients should be simple and highlight the most important concepts of the lesson. For example, a patient probably won't need to know the name of every artery or vein, or every origin and insertion of each muscle. However, they do need to understand the basic anatomy and how long the recovery time will be for a procedure. Media designed to match a learner's background will improve a patient understanding.

Lack of Cohesive Education Package Design

There is a lack in the availability of a complete package of information for patients. There are many websites and printed media that explain many conditions, surgical procedures, treatments, etc. but they are at different reading levels and, mostly, at high reading levels. The most important problem is that they lack cohesiveness. There is no one source that provides a complete package. Patients have to visit several different websites to obtain basic information

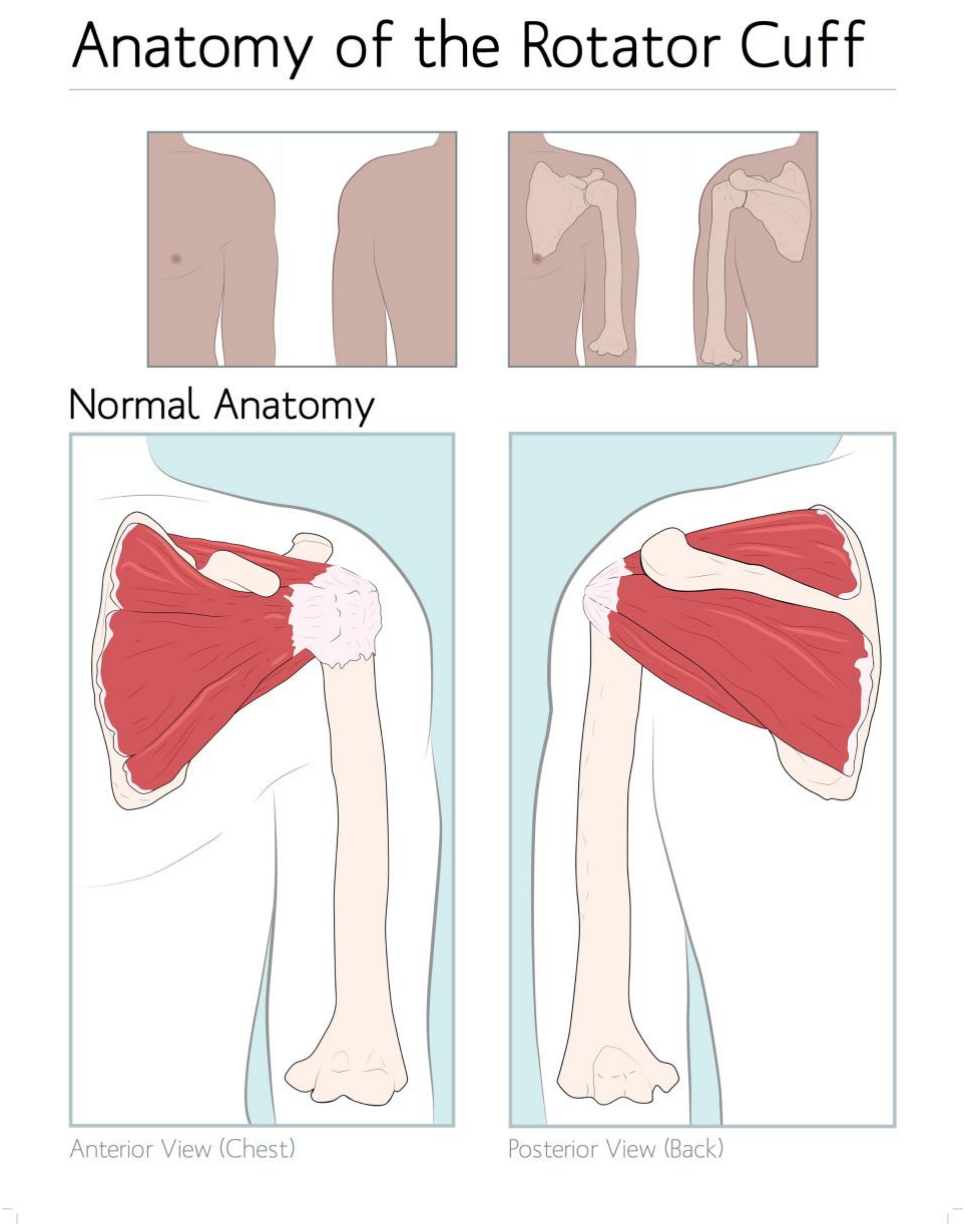
about procedures, risk factors, medication and treatment, recovery, and physical training. This can result in misinformation.

Section II: The Body of Work

This project includes:

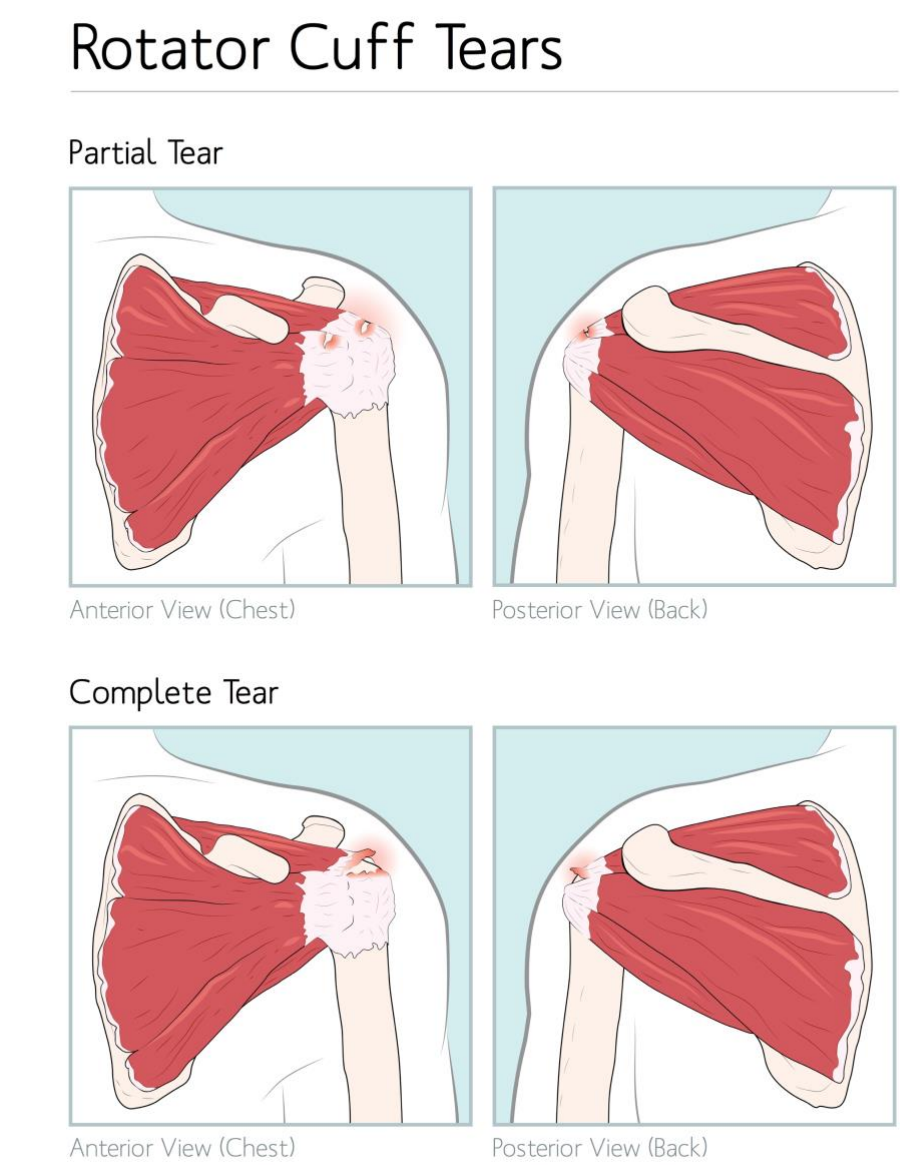
- 2 Anatomy Posters
- 2 Physical Therapy Posters
- Informational Booklet (13 pages)
- 5 Project Outline Plaques
- Animation
- Website

Rotator Cuff Poster: Anatomy of the Rotator Cuff



This illustration was created digitally using Adobe Illustrator; the final product was printed. This poster was designed to show the basic anatomy of the rotator cuff. The large illustration only shows the bones and muscles involved in the rotator cuff. The smaller illustrations highlight the external anatomy and location of the rotator cuff in the body. Any medical terms that are used are supplemented with a lay term.

Rotator Cuff Poster: Rotator Cuff Tears



This illustration was created digitally using Adobe Illustrator; the final product was printed. Paired with the basic anatomy poster (listed above) this poster shows the two types of tears that can occur for a rotator cuff. This poster provides a closer view of the anatomy, shown in the "Normal Anatomy" poster.

Physical Therapy Poster: Internal Rotation

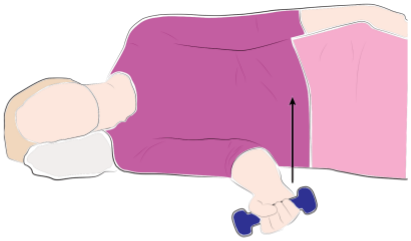
Internal Rotation

Needs

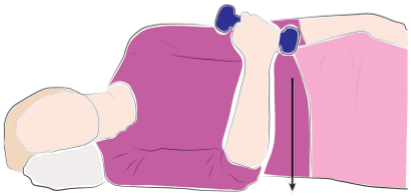
1. Hand weight (up to 5 lbs)
2. Pillow

Steps

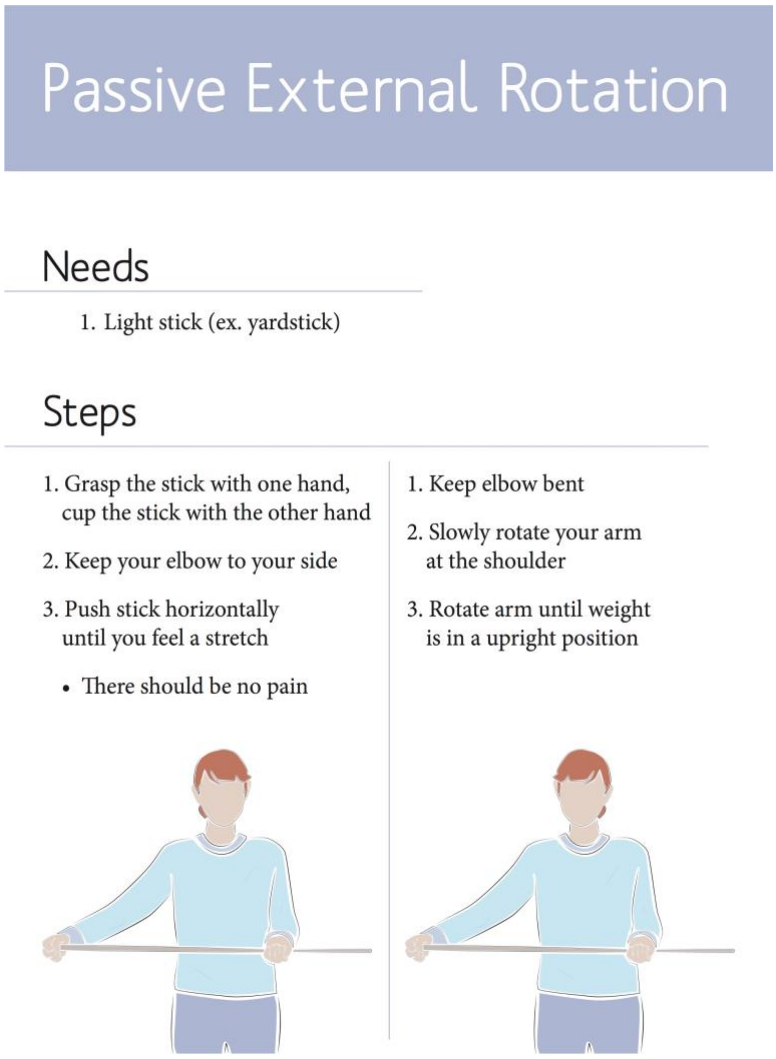
1. Lie on flat surface with your head on a pillow
2. Lie on affected shoulder
3. Hold affected arm against your side
4. Bend elbow at a 90° angle



1. Keep elbow bent
2. Slowly rotate your arm at the shoulder
3. Rotate arm until weight is in a upright position

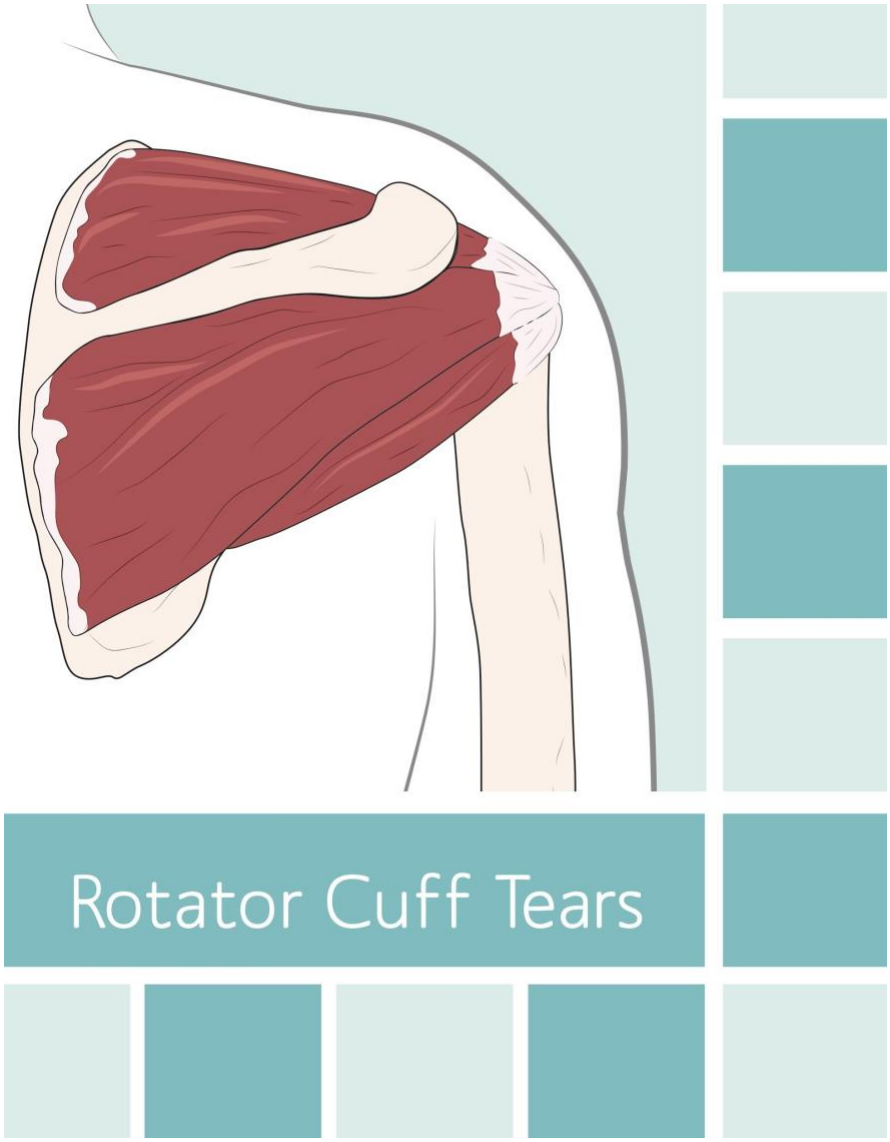


Physical Therapy Poster: Passive External Rotation



These illustration was created digitally using Adobe Illustrator; the final product was printed. These posters show physical therapy exercises used by patients after surgery. These illustrations are intended to supplement the text. The illustrations help patients to comprehend the exercise. The arrows were included to illustrate the direction of movement explained in the instructions.

Rotator Cuff Tears Booklet: Cover Page



This illustration was created digitally using Adobe Illustrator; the final product was printed. This is the cover for the informational booklet. The cover is simple with an image of the anatomy and a descriptive title for the information inside.

Rotator Cuff Tears Booklet: Table of Contents

Contents

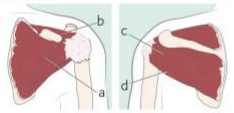
This is the table of contents for the informational booklet. This directs the reader with simple titles to help them navigate the booklet.

Rotator Cuff Tears Booklet: Anatomy

Anatomy

The rotator cuff is a group of muscles that hold your shoulder in place. They help your arm move up, down, away from your body, and towards your body.

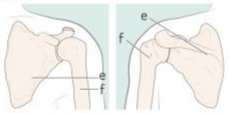
Muscle



The muscles of the rotator cuff:

a. subscapularis **c.** infraspinatus
b. supraspinatus **d.** teres minor

Bone



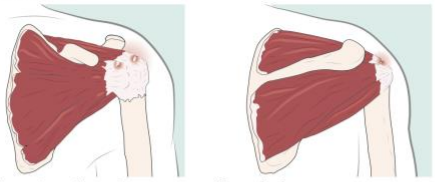
The bones of the rotator cuff:

e. scapula
f. humerus

Rotator Cuff Tear

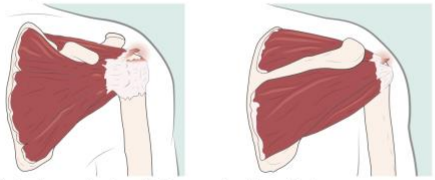
A tear- when one or more of the tendons separates from the humerus.

Partial Tear



A section of a tendon separates from the humerus.

Complete Tear



A tendon or tendons fully separates from the humerus.

Notes

4 visit www.shevonbarnes.com/rotatorcuff to access more information.

This is the anatomy section of the informational booklet. This illustration is rendered with simple line work, flat colors, and subtle use of highlights. A key was used for labeling muscles and bones to keep the information in the illustrations direct. The text has been tested using a Flesch-Kincaid modeled readability test.

Rotator Cuff Tears Booklet: Causes

Causes

Types of Tears:

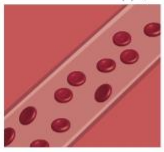
- **Acute Tear**- usually a result of a sudden injury like a fall or lifting something heavy.
- **Chronic Tear**- result of wear over time.

Chronic tears are often caused by:

Repetitive stress

Repeating the same motion over and over again can wear down the tendons of the muscles.

Lack of blood supply



The blood supply to tendons lessens with age and without an adequate blood supply tendons lose their ability to repair themselves.

Bone spurs

An overgrowth of bone can occur as a person ages. Lifting the arm can cause these growths to rub against the tendons of the rotator cuff.

Notes

Rotator Cuff Tears Booklet: Risks

Risks

There are certain risk factors that increase your chances of having a rotator cuff tear.

Notes

Those at risk:

Athletes

Athletes such as baseball pitchers and tennis players.

Those over 40

As you age your body is slower to repair itself. So those over 40 have a higher risk of rotator cuff tears.

Individuals that make repetitive over head motions

Individuals that have jobs in construction (e.g. carpenters and house painters) are more at risk for rotator cuff tears.

Rotator Cuff Tears Booklet: Symptoms

Symptoms

Pain will persist even with pain medications. The pain will also eventually get worse. Simple activities like
- brushing your hair,
- reaching into a cabinet,
- and lifting items

will become increasing more difficult.

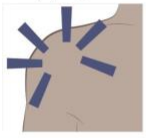
Pain

Pain when sleeping on shoulder
Pain when arm is lowered or lifted
Severe pain in shoulder after fall or injury

Weakness

Weakness in upper arm

Snapping Sound



Snapping sensation when moving arm
Crackling sensation

Notes

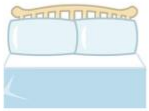
Rotator Cuff Tears Booklet: Treatment

Treatment

Non Surgical Options

non-steroidal anti-inflammatory drugs (NSAIDs)

strengthening exercises/physical therapy



rest- limiting overhead activities

activity modifications

Pros- risks associated with surgery

- infection
- permenant stiffness
- problems with anesthesia
- chance of long recovery
- injury to nerves

Cons-limits of non-surgical options

- strength doesn't improve
- tear may become larger
- activity may need to be limited

Notes

Rotator Cuff Tears Booklet: Surgery

Surgery

Types of Rotator Cuff Surgeries

Open Procedure

Technique

- large incision at shoulder
- may need to detach deltoid

Reason

- for extensive or severe tears
- multiple procedures (ex. removal of bone spurs)

All-Arthroscopic Procedure

Technique

- 3-5 small incisions made
- camera placed in one incision
- instruments placed in remaining incisions
- surgeon uses television screen to perform surgery

Reason

- least invasive method
- outpatient surgery

Mini-Open Procedure

Technique

- Use of both arthroscopic and open techniques
- Arthroscopic- bone spur removal, or to repair tissue damage
- Open techniques- repair rotator cuff tear

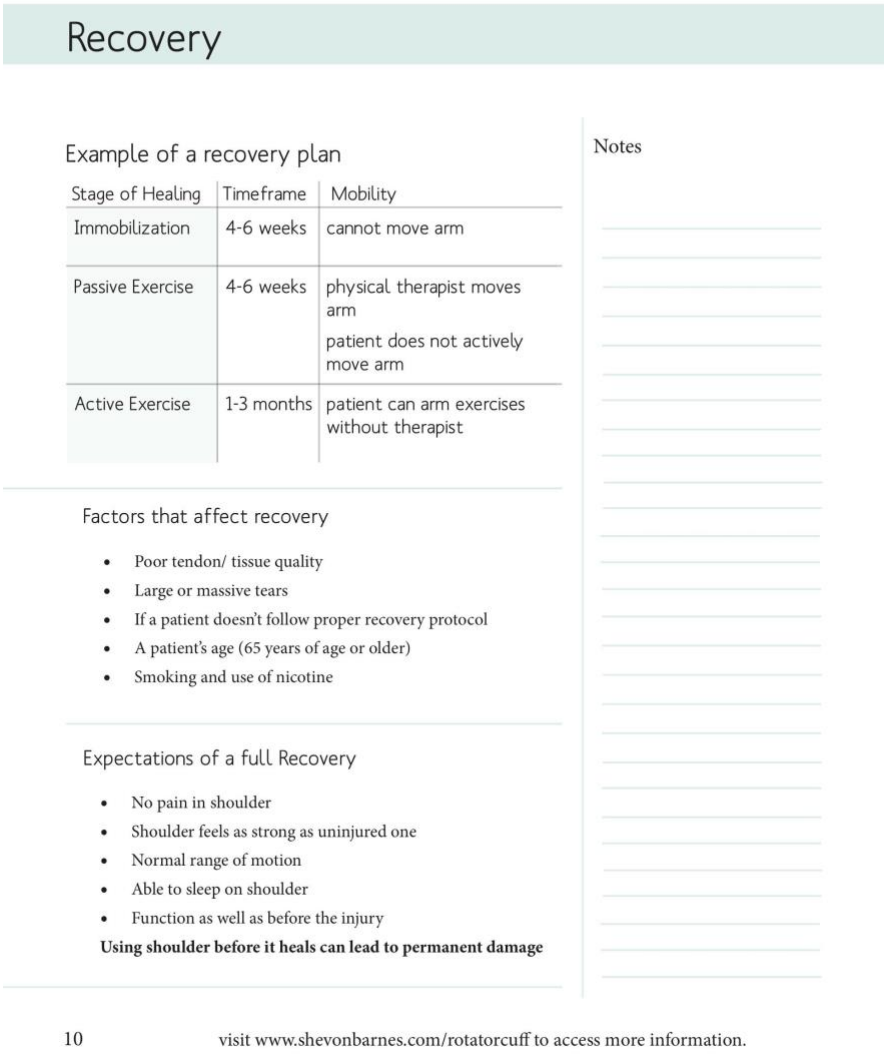
Reason

- least invasive method
- outpatient surgery

Notes

visit www.shevonbarnes.com/rotatorcuff to access more information.

Rotator Cuff Tears Booklet: Recovery



Recovery

Example of a recovery plan

Stage of Healing	Timeframe	Mobility
Immobilization	4-6 weeks	cannot move arm
Passive Exercise	4-6 weeks	physical therapist moves arm patient does not actively move arm
Active Exercise	1-3 months	patient can arm exercises without therapist

Factors that affect recovery

- Poor tendon/ tissue quality
- Large or massive tears
- If a patient doesn't follow proper recovery protocol
- A patient's age (65 years of age or older)
- Smoking and use of nicotine

Expectations of a full Recovery

- No pain in shoulder
- Shoulder feels as strong as uninjured one
- Normal range of motion
- Able to sleep on shoulder
- Function as well as before the injury

Using shoulder before it heals can lead to permanent damage

Notes

10 visit www.shevonbarnes.com/rotatorcuff to access more information.

Recovery is the area of major and minor surgery that most patients have the least education. This section was included to give patients a realistic timeline and understanding of what recovery entails for this type of surgery. The text has been tested using a Flesch-Kincaid modeled readability test.

Rotator Cuff Tears Booklet: Physical Therapy Exercises #1

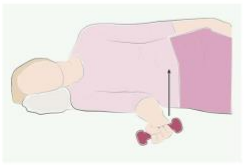
Physical Therapy Exercises

Internal Rotation (Strengthening Exercise)

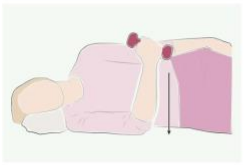
Needs

1. hand weight (up to 5 lbs)
2. pillow

Steps



1. Lie on flat surface with your head on a pillow
2. Lie on affected shoulder
3. Hold affected arm against your side
4. Bend elbow at a 90° angle



1. Keep elbow bent
2. Slowly rotate your arm at the shoulder
3. Rotate arm until weight is in a upright position

Muscles used:

- subscapularis
- teres minor

Repeat these steps:

8-10 times, 2x a day

Days per week:

3

Notes

Rotator Cuff Tears Booklet: Physical Therapy Exercises #2

Physical Therapy Exercises

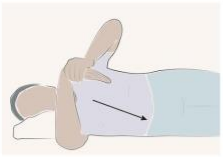
Sleeper Stretch (Stretching Exercise)

Needs

pillow (optional)

Steps

Lie on flat surface
(pillow is optional)



1. Lie on injured shoulder
2. Bend arm
3. Place hand of uninjured arm over the injured hand

1. Use hand of uninjured arm to push affected arm down
2. Stop pushing when you feel a stretch in the back of your injured shoulder
3. DO NOT put pressure on writst

Muscles used:

- infraspinatus
- teres minor

Repeat these steps:

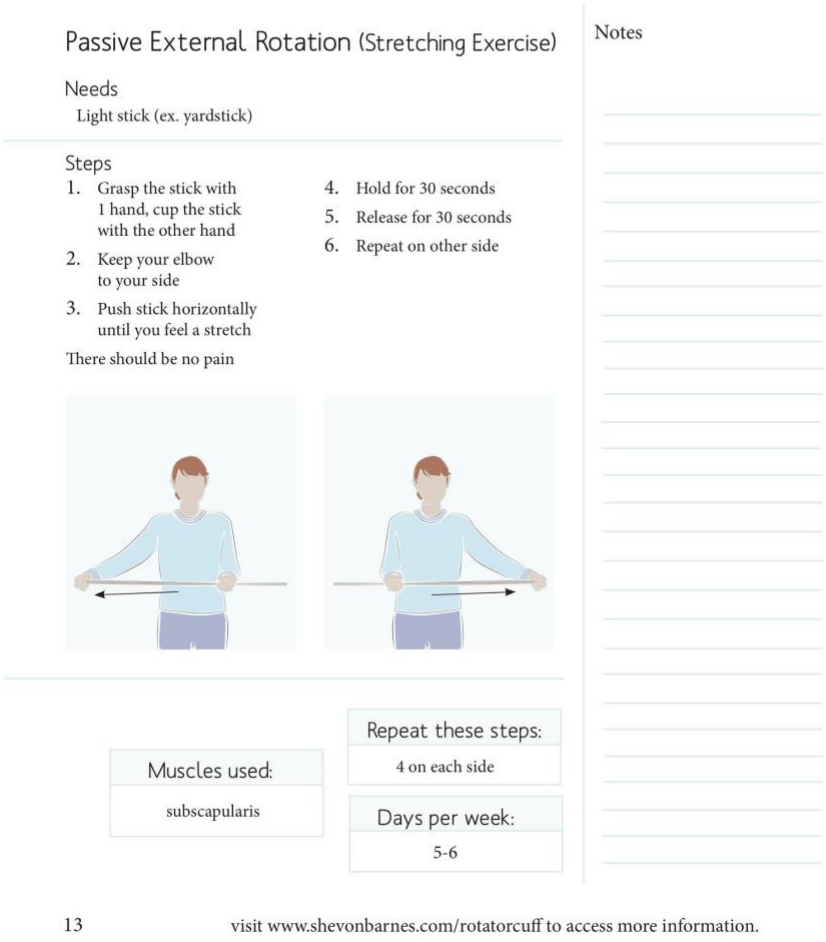
4 times, 3x a day

Days per week:

everyday

Notes

Rotator Cuff Tears Booklet: Physical Therapy Exercises #3



Passive External Rotation (Stretching Exercise)

Needs

Light stick (ex. yardstick)

Steps

1. Grasp the stick with 1 hand, cup the stick with the other hand
2. Keep your elbow to your side
3. Push stick horizontally until you feel a stretch

There should be no pain

4. Hold for 30 seconds
5. Release for 30 seconds
6. Repeat on other side

Notes

Muscles used:

subscapularis

Repeat these steps:

4 on each side

Days per week:

5-6

13 visit www.shevonbarnes.com/rotatorcuff to access more information.

This is the physical section of the informational booklet. This illustration is rendered with simple line work, flat colors, and subtle use of highlights. Imagery in this section of the booklet was used to enhance the subjects being addressed. The text has been tested using a Flesch-Kincaid modeled readability test. These three sets of illustrations illustrate 3 physical therapy exercises used by patients after surgery. This section is included because one of the most important elements to a full recovery after not just rotator cuff surgery but all surgery is physical therapy. To gain full mobility a patient must follow the procedures given to them by their healthcare provider. Despite the importance of this step many patients do not know a intensive and painful this step can be. So it is imperative that they are educated on this part of their recovery. The text has been tested using a Flesch-Kincaid modeled readability test.

Health Literacy Plaque #1

This illustration was created digitally using Adobe Illustrator; the final product was printed. This plaque explains what health literacy is and why it is important. The text has been tested using a Flesch-Kincaid modeled readability test.

Health Literacy Plaque #2

This illustration was created digitally using Adobe Illustrator; the final product was printed. This plaque informs readers of three issues that current patient information has today. It follows the theme of the work with a simple explanation the problems with the materials. The text has been tested using a Flesch-Kincaid modeled readability test.

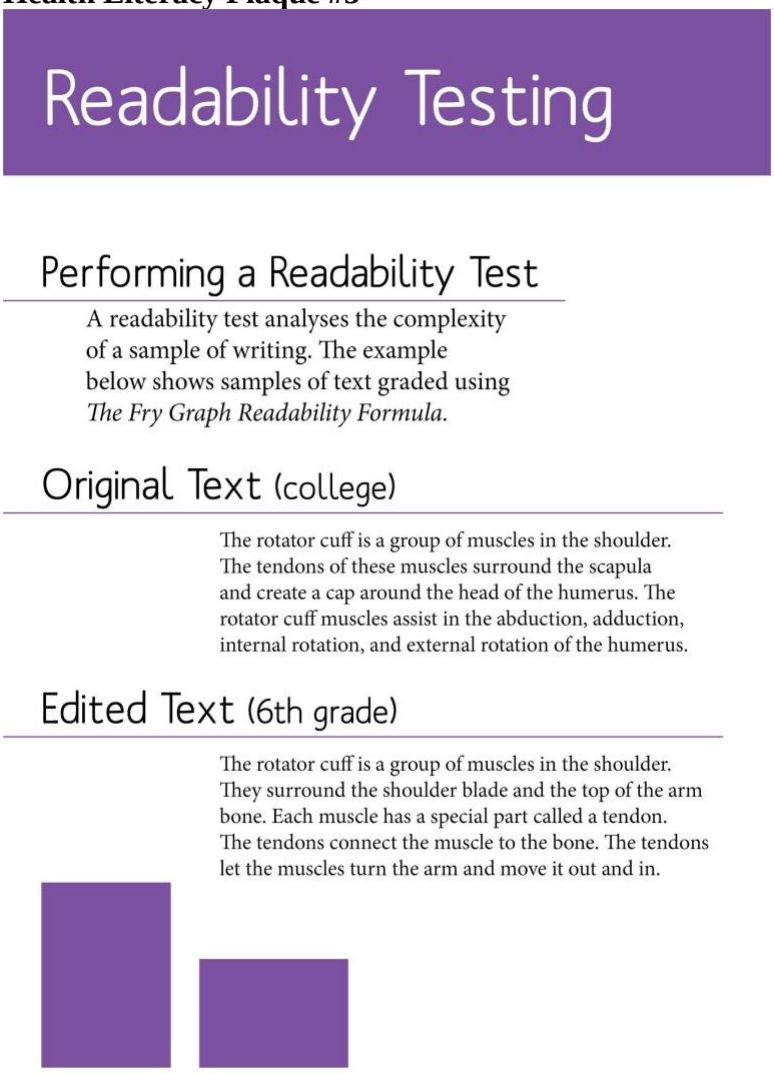
Health Literacy Plaque #3

This illustration was created digitally using Adobe Illustrator; the final product was printed. This plaque informs readers of three solutions listed in the "Problems" plaque. It follows the theme of the work with a simple explanation of the solutions to the problems. The text has been tested using a Flesch-Kincaid modeled readability test.

Health Literacy Plaque #4

This illustration was created digitally using Adobe Illustrator; the final product was printed. This plaque gives a simple charted explanation of the goal, topic, and deliverables of the project. The text has been tested using a Flesch-Kincaid modeled readability test.

Health Literacy Plaque #5



This illustration was created digitally using Adobe Illustrator; the final product was printed. This plaque illustrates how a Readability Test is performed. The text has been tested using a Flesch-Kincaid modeled readability test.

Rotator Cuff Tears & Pain Management Animation (link: https://youtu.be/q72pnpLS7UA)

The images below are taken from the animation that educates patients on symptoms, risks factors, and causes of rotator cuff tears. It also highlights some of the pain management and treatment side effects associated with surgery. To keep the subject matter light and interesting a character was chosen that was both entertaining and educational. The animation provides critical information in a way that engages the viewer, leading to higher retention of the information. The animation is completely non- verbal. But it provides simple bulleted points of information.

Rotator Cuff Tear: Symptoms

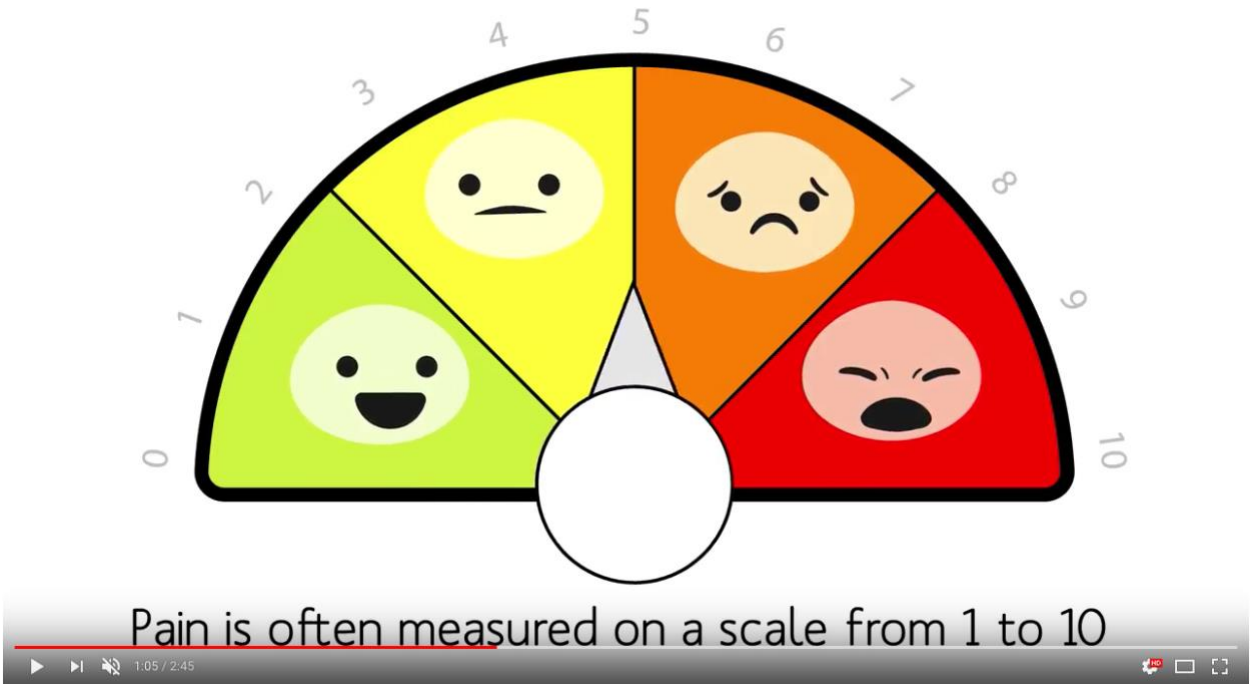
A snapping or crackling sound

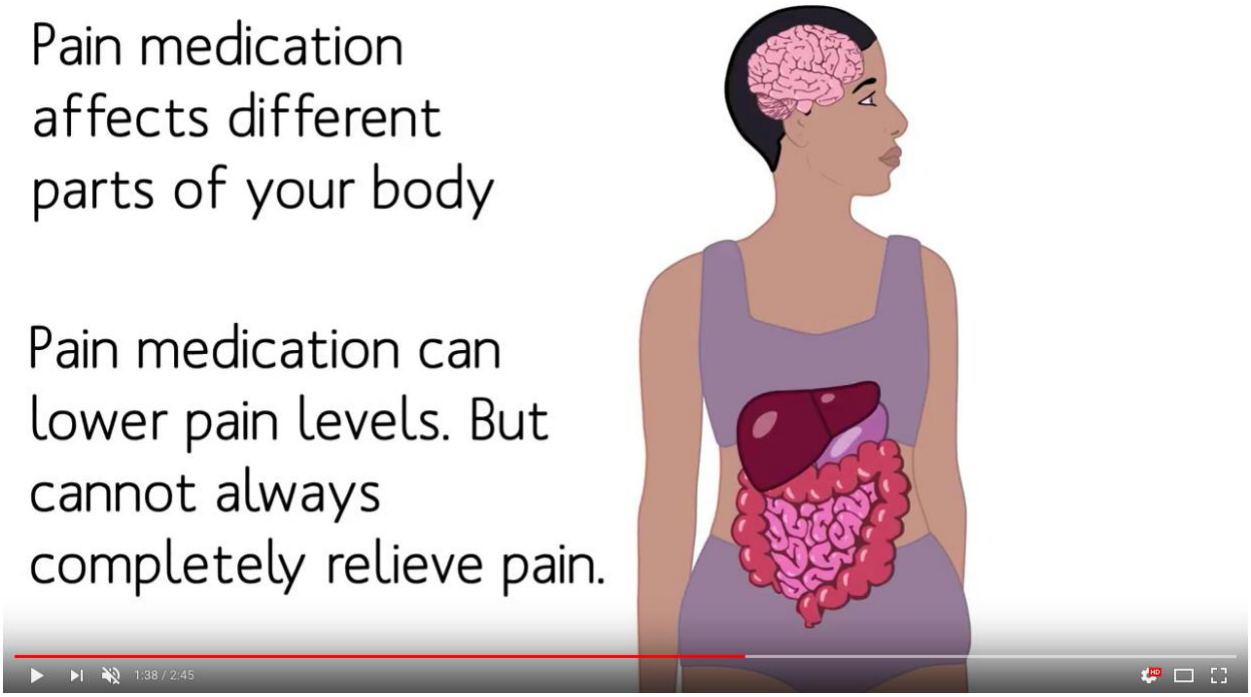
0:31 / 2:45

Rotator Cuff Tear: Those at Risk

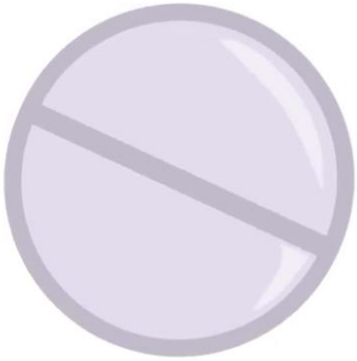
People over 40

0:46 / 2:45


0
1
2
3
4
5
6
7
8
9
10
Pain is often measured on a scale from 1 to 10
1:05 / 2:45


Pain medication affects different parts of your body
Pain medication can lower pain levels. But cannot always completely relieve pain.
1:38 / 2:45

Opioids are used for pain management



Examples of Opioids

Oxycodone

Codeine

Morphine

1:55 / 2:45

Opioids are used for pain management

Symptoms of Opioids

Drowsiness

Nausea

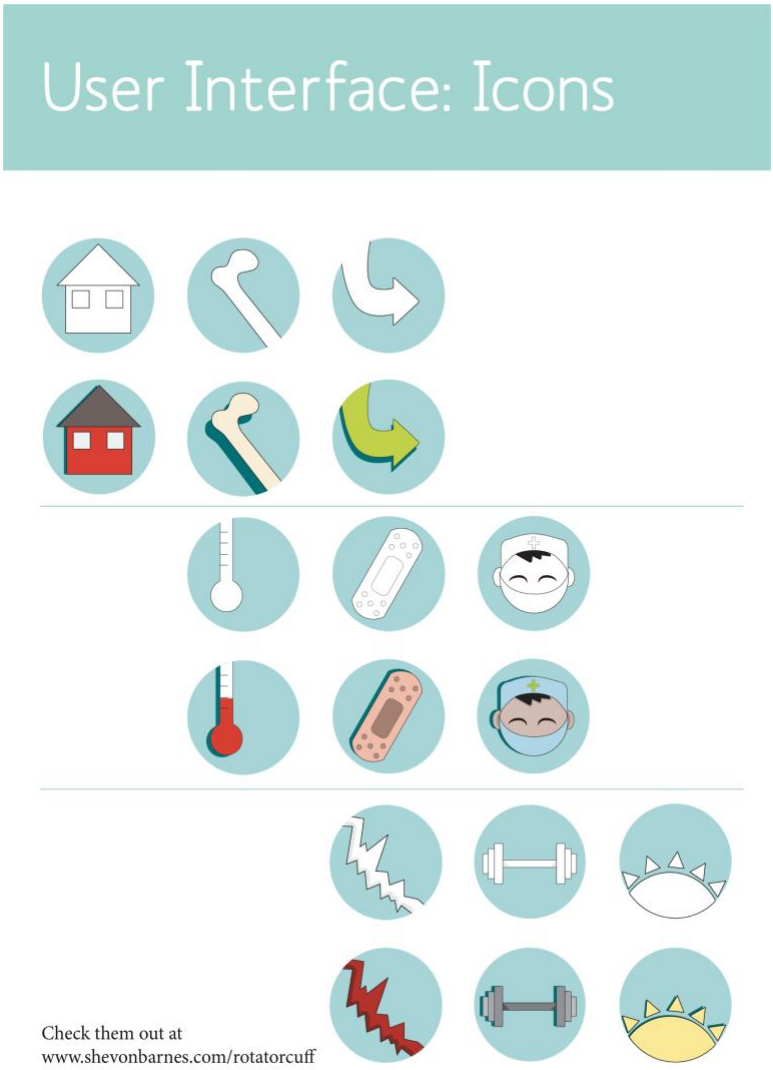
1:31

2:02 / 2:45

Rotator Cuff Tears Website

This website is an example of the application of creating a cohesive experience for patients. Using the rotator cuff as an example this product simulates the ease of use that is possible if website tools, icons, and information are modified to meet the needs of its target audience.

User Interface Icons



This illustration was created digitally using Adobe Illustrator; the final product was printed. These icons were used as navigation tools on the rotator cuff website.
These icons enhance the user experience. These navigation tools illustrate what information will be available on the website. The house icon represents the home page, the femur icon represents the anatomy, the arrow represents causes, the thermometer represents symptoms, the bandage represents treatment, the masked face represents surgery, and the sun represents recovery.

Conclusion

The objectives for this body of work were to create a website, a pain management animation, an informational booklet, and set of educational posters that had simplistic, cohesive design and provided knowledge using a reading scale no higher than a sixth grade education. Each element of this project is synonymous. The color scheme, typeface, and layout are consistent across all four media types. It is obvious that all the materials are part of a package. This increases readability for patients. The simple yet engaging design of the illustrations insure that the focus of each piece is on the necessary information. The color and line work engage the reader without having to rely on heavy details. Although, the images are simple they each supplement and convey an important theme in the process for this procedure. Because the level of readability is crucial to the success of health literature. A Flesch-Kincaid readability test was performed on all of the written material in this project. All of the written material was scored at a sixth grade reading level or lower.

After learning about the deficiencies in public health communications. I would like to create learning aids for other illnesses, disease, and conditions. I would dig deeper into long term solutions and more importantly try to implement them and do extensive testing to further refine the designs and concepts that I have already developed. I have learned that there are many paths to achieve a goal. There is not one answer but a continuous flowing of knowledge that grows and changes and through research and development products get better and more effective. I learned the value of process work and how important each stage of development is. From the first line to the final stroke, the who process was a journey. I learned how vast the world of medical writing is. To writing a patient information pamphlet to a scholarly article. The audience is everything and I see how those themes and concepts translate to medical illustration.

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