

**Is it a bird? No, it's . . .**

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### **Project summary**

An orthopedic support to stabilize the scapula (shoulder blade) during physiotherapy treatments for shoulder capsulitis.

### **Project report**

#### **INTRODUCTION**

Medicine is a vast, highly complex and constantly evolving field. Innovations to improve how medicine is practised are always very important. Since any idea can produce interesting results, we told ourselves that anything was possible and developed an interest in a particular field of medicine: physiotherapy. Occasional meetings with a physiotherapist led us to discover a need in the area. We developed an orthopedic device that facilitates the treatment of shoulder capsulitis.

## DEVELOPMENT

### **Research method**

We began by considering the nature of the materials that we could use. We visited large construction supply stores to compare as many materials as possible. From the many materials available, we narrowed our choice down to two. We based our decision on such characteristics as hardness, malleability, thickness and texture. We asked a physiotherapist for his opinion on the design of our orthopedic device. We studied the different parts of the shoulder in order to understand how it functions and how it is manipulated.

### **Topic summary**

#### **What is capsulitis?**

Capsulitis is a shoulder condition characterized by increasing pain, stiffness and limited motion. It can occur without cause and is said to be idiopathic. How is it diagnosed? It always starts with a more or less lengthy painful stage. Physiotherapy treatment is recommended to help heal capsulitis, which is where our device comes in handy. We had to ensure that the scapula remained fully functional so that the patient could continue moving his or her shoulder, despite any stiffness. It is important to ensure that all the shoulder muscles remain active in order to avoid muscle atrophy. It is also very important to be gentle.

The two parts of the shoulder that we will focus on as far as treatment involving the use of our device is concerned are the humerus and especially the scapula. The normal upward range of motion for the shoulder is 180°. This upward rotation is made possible by the humerus (120°) and the scapula (60°). The range of motion for a person with

capsulitis, however, is limited to a maximum of 20° to 40°. When administering treatment, a physiotherapist tries to increase mobility gradually through various stretches and rotations. In order to administer such treatment, the scapula must be completely stabilized. If the scapula is not stabilized, any gains in shoulder mobility will also result in hypermobility of the scapula, which will not help the patient's condition. The physiotherapist must immobilize the scapula throughout the treatment, which is not easy. He must hold the scapula firmly in place with his fingers, sometimes for long periods of time in order to get a good stretch, which often results in hand pain. The device that we developed takes care of this problem by fully stabilizing the scapula during manipulations.

The three stages of capsulitis are as follows:

Stage 1: pain (1 to 8 months)

Stage 2: pain and stiffness (9 to 16 months)

Stage 3: only stiffness persists (12 to 40 months)

### **Movements performed with the orthopedic device**

Three or four movements are performed during treatment:

Upward flexion

Abduction

Rotation

It is important to specify that the more limited movements with capsulitis are external rotation and abduction. With our device, the physiotherapist has greater control. He can be sure that he is stretching the capsule and not the scapula—since the scapula is immobilized—and make the desired gains. He does not need to concentrate on holding the scapula in place and can focus entirely on capsular movement.

## **Scientific process**

**Aim:** To create an orthopedic device that facilitates physiotherapy treatment for shoulder capsulitis.

### **Materials used:**

Vinyl carpeting	Wire
Coroplast plastic	Backpack loops
2 m of Velcro	Hinges
Screws	

### **Comparison of two prototypes**

<b>PROTOTYPE 1 (FAILED VERSION)</b>	<b>PROTOTYPE 2 (FINAL VERSION)</b>
Materials: coroplast plastic	Materials: vinyl carpeting
Too stiff	Greater flexibility
Shape not suitable (too square)	Moulds to shape of body
Provides inadequate support of scapula	Provides better support of scapula
Not effective on patient	Tested on patient and approved by a physiotherapist

### **Prototype 1 (failed version)**

Like all new designs, initial versions rarely resemble the final version. Several factors resulted in our initial version being poorly functional. To begin with, our primary objective of stabilizing the scapula failed. Since the device was too stiff and did not mould well to the desired shape, it failed to apply the necessary pressure on the shoulder. The device got high marks for its esthetic appeal, but did not rate from a practical standpoint. We used hinges to attach the various parts of the device, which made it too square.

### **Prototype 2 (final version)**

Our final version moulded more easily to the body. The material was much more flexible and malleable. It covered the upper part of the pelvis right up to the armpits. We used Velcro to attach two straps to the side of the device. Tightening the straps made it possible to apply pressure to the lower part of the scapula. We also used a backpack shoulder strap, which stabilized the scapula from the top. It is important to note that, in addition to moving outward, the scapula also tends to move upward. The mechanism for tightening the device is comparable to a ski boot binding. The comfort of this second prototype was also improved. We inserted a thin padding so that the material would not irritate the patient during treatment.

### **CONCLUSION**

Our idea was a success and the design worked well. We developed a device that satisfied a need in the field of physiotherapy. We can confirm that it is effective, since it was tested on patients with shoulder capsulitis. Physiotherapists approved and applauded our innovation. It greatly improved treatment and helped physiotherapists in their work. Our device should be more widely used.