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The Advancing Safety and Comfort Wrist Guard using Gel Pad and Nylon

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ABSTRACT –Wrist fractures, often resulting from falls or high-impact activities, pose a significant health concern. Wrist guards, designed to reduce the risk of fractures, have become an important protective tool. This study examines the influence of materials on the effectiveness and performance of wrist guards in fractures including Gel pads, Neoprene and Nylon materials. Additionally, the ergonomic aspects of material selection to ensure wearer comfort and compliance, important factors for the practical use of wrist protectors. This design aims to provide a brief overview of the current state of knowledge regarding wrist protective materials and their role in fractures also improving the effectiveness of wrist protectors, thereby increasing their utility across a variety of contexts, including occupational safety, and daily activities.

KEYWORDS: Wrist Guard, Gel Pad, Nylon, Neoprene.

1.0 INTRODUCTION

Stroke A wrist fracture, also known as a broken wrist, is a common injury that involves a break or crack in one or more of the bones in the wrist. The wrist is a complex joint formed by the connection of the forearm bones (radius and ulna) to the hand bones (carpals) [1]. Fractures in this area can occur because of various traumatic incidents, such as falls, sports injuries, or accidents [1]. Some of the signs and symptoms that may cause wrist pain are, stiffness, swollen fingers, having difficulty to make a fistful, tingling sensation, pain numbness or tingling that worsen, a soft clicking sound when moving the wrist, unexpected piercing pain at the hand and inflammation at the wrist. Treatment options depend on the severity of the fracture and may include immobilization with a cast or splint, medication for pain management, and in some cases, surgical intervention to realign and stabilize the broken bones [2].

A wrist guard is a protective device designed to provide support and reduce the risk of injury to the wrist during various activities. It is commonly used in sports, particularly those that involve high impact or repetitive stress on the wrist joints. Wrist guards are also employed in occupational settings to prevent injuries related to repetitive motions or potential falls [3]. According to Dr. Swigart, the range of treatment options for wrist fracture include Wearing a cast or splint, usually for five to six weeks, followed by physical therapy to gain strength and restore range of motion. Surgery to fix the break and using pins to hold the bone in place. The pins are usually temporary [7]. After the surgery, patients wear a cast or splint for several weeks, and then have physical therapy. Patients are required to wear a cast for two to three weeks, and then transition to a removable brace and begin physical therapy [2].

2.0 LITERATURE REVIEW

2.1 Wrist

Wrist is the joint connecting the hand to the forearm. It is composed of multiple small bones called carpals. The wrist allows for a range of movements, including flexion, extension, abduction, and adduction. Tendons, which connect muscles to bones, play a crucial role in hand and wrist movements [3]. The wrist work in coordination, allowing us to perform activities ranging from basic daily tasks to intricate manual work. The opposable thumb is a distinguishing feature that facilitates precision grip, enabling humans to manipulate objects with great control

2.2 Carpal Fracture

Fractures of the carpals other than the scaphoid are exceedingly rare and comprise approximately 1.1% of all fractures [9]. Fracture happens when physical trauma, excessive force, or other underlying medical issues cause a disturbance in the continuity or integrity of a bone [5,7]. Figure 1 shows a carpal fracture recovery based on the severity of the injury and the chosen treatment. It may take several weeks to months for the fracture to heal completely, and rehabilitation is often crucial for restoring full functionality to the wrist.

Figure 1. Carpal Fracture

2.3 Range of Wrist Movement

Wrist guards are essential for protecting the wrist joint and related structures throughout a variety of physical activities, especially those that carry a higher risk of impact or damage, such as falls and accidents. Wrist guards and wrist active range of motion (AROM) are related because of their possible effects on injury prevention and rehabilitation.

Limiting the wrist joint's range of motion, particularly in the dorsiflexion (extension) direction, is how wrist guards work to support and protect the wrist joint. As a physical barrier against hyperextension, they assist to avoid acute injuries such as fractures and sprains that could impair wrist range of motion. Though they can help lower the risk of some injuries, wrist guards must fit and designed properly to prevent excessive restriction of wrist range of motion during everyday activities [4].

Figure 2 illustrates the range of movement wrist. It's important to weigh the pros and cons of wearing wrist guards for continuous protection or for people who have previously sustained wrist injuries. After an accident, wrist range of motion is often improved or restored with exercises included in physiotherapy and rehabilitation programs. Wrist guards provide support and allow for

controlled, progressive movement, which can aid in recuperation when worn for these types of activities.

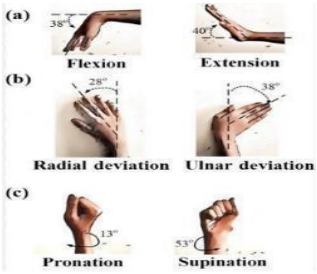

Figure 2. Range of Movement Wrist.

2.4 Wrist Guard

Figure 3 show wrist guards are designed to relieve discomfort, reduce strain, and speed up the recovery process for individuals suffering from wrist illnesses or accidents. Additionally, they can be worn as a precaution when participating in sports, repetitive tasks, or medical conditions like carpal tunnel syndrome that put strain on the wrists. A wrist guard's comfort and effectiveness are dependent on the materials used, such as neoprene and gel cushions. To treat the physiological and anatomical aspects of wrist health, these wrist protectors are a helpful tool. They assist in decreasing the likelihood of wrist fractures, sprains, strains, and other injuries caused by high- impact sports or repetitive wrist motions. [11]. Furthermore, the therapeutic features like gel pad inserts for heat or cooling therapy add to their usefulness in fostering recovery and offering comfort.

Figure 3. Wrist Guard.

3.0 METHODOLOGY

3.1 Hardware

3.1.1 Gel pad

Figure 4 show a gel pad in a wrist guard which typically refers to a cushioning or protective element designed to provide comfort and support to the wrist. Wrist guards are commonly used in various activities such as sports, fitness, and rehabilitation to protect the wrist from injury or strain. Adding a gel pad to a wrist guard attempts to improve comfort by giving the wrist a supple and supporting surface. Additionally, it distributes and absorbs impact pressures, which is advantageous in situations where the wrist may be repeatedly stressed or struck. This can lessen the chance of getting hurt. They might contribute to a more comfortable. and less sweaty experience by helping to disperse heat produced during athletic activity. Some wrist guards with gel pads may have features designed for easy cleaning and maintenance. This is important to prevent the buildup of sweat, Odor, or bacteria, especially in sports and fitness applications.

Figure 4. Gel pad in wrist guard.

3.1.2 Neoprene

Neoprene is a commonly used material in wrist guards, as well as in various other types of orthopedic and sports support equipment. Neoprene is a synthetic rubber material that is known for its flexibility, durability, and water- resistant properties. Figure 5 show neoprene in wrist guard is inherently water-resistant, making it a suitable material for activities involving exposure to moisture or sweat. Neoprene is generally hypoallergenic and unlikely to cause skin irritation. This makes it a suitable material for individuals with sensitive skin.

Figure 5. Neoprene in wrist guard.

3.1.3 Nylon

It Wrist guards can also be made of nylon, which is another typical material. Strong and long-lasting nylon is well-known. Designed to withstand abrasion, nylon wrist guards are appropriate for situations where the wrist may be subjected to impact or repetitive motion. Figure 6 illustrate Nylon in wrist guard. It is generally breathable, allowing air to circulate through the material. This feature can be beneficial in preventing excessive heat buildup and sweat, particularly during physical activities. Nylon is typically easy to clean and maintain. Wrist guards made from nylon can be wiped down or hand- washed as needed, making them suitable for regular use.

Figure 6. Nylon in wrist guard.

4.0 DATA ANALYSIS

Many issues pertaining to sweating, heating, and uncomfortable movement were discovered when researching standard wrist guards. Table 1 show comparison standard wrist guard and innovation wrist guard. This hot issue stems from the velvet-like material used in most

wrist guards which prevents breathing or ventilation Because nylon is permeable and absorbs moisture. it is an innovative material for wrist guards that addresses perspiration. Additionally, the wrist guard in this invention uses a gel pad to reduce warmth and act as a cushion, making the wrist softer and more improves its comfort. Thus, neoprene, a synthetic rubber material valued for its water-resistant qualities, flexibility, and durability, can solve the issue of discomfort during movement while guaranteeing safety when utilizing the wrist guard.

Issue	Standard wrist guard	Innovation wrist guard
Heat	high	low
Sweat	high	low
Comfortable movement	low	high

Table 1: Comparison between standard wrist guard and innovation wrist guard.

5.0 CONCLUSION

This wrist guard takes a comprehensive approach to wrist protection by incorporating both nylon and a gel pad. Through impact force mitigation, this improvement prioritizes user comfort and adaptability while simultaneously addressing safety issues. The design will need to be continuously improved for comfort and safety, just like any creative product would, through constant study and user input.

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