

DEVELOPMENT OF WRIST CONTINUOUS PASSIVE MOTION (CPM) DEVICE FOR CARPAL TUNNEL SYNDROME

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ABSTRACT

In this study, an attempt has been made to treat Carpal Tunnel Syndrome (CTS), a disease that occurs in the hand causing pressure on the median nerve of the wrist joints. It is frequently treated in two ways: non-surgically or surgically. Both patients require Continuous Passive Motion (CPM) as a treatment for reducing pain in the joints. These movements assist patients in reducing median nerve pressure and stiffness that occurs in the wrist joint, thereby improving and restoring wrist movement. The proposed device has two Degrees of Freedom (DoF) to enable wrist rehabilitation. The proposed device is able to produce automated movements with adjustable angles based on the movement of the servomotor which acts as axis of rotation. Movements including the wrist extension, wrist flexion, ulnar deviation and radial deviation are incorporated. A mobile application known as a "Wrist CPM Device App" was developed to enable patient control with a smartphone. In this app, there are four adjustable control parameters, such as lower degree, upper degree, speed of the movement, and number of cycles. From this study, it can be concluded that the device would be beneficial for CTS patients by presetting the range of the wrist joint to practice portable home physiotherapy. Thus, the wrist CPM device is successfully developed as a cost-effective, and user-friendly module to meet the customer needs.

Keywords: Carpal Tunnel Syndrome, Continuous Passive Motion, Wrist Extension, Wrist Flexion, Ulnar Deviation, Radial Deviation, Wrist Rehabilitation

INTRODUCTION

Carpal Tunnel Syndrome (CTS) is caused by compression of the median nerve at the wrist joint resulting in difficulty to move hands. Carpal tunnel is made up of a few joints that are kept apart by readily convertible ligaments and the cross carpal ligament, which serves as its cover. There are nine tendons and the median nerve that all travel through the carpal tunnel. Inflammatory response and expansion of the median nerve, joint pain and hypertrophy of the tendons, thickening of the cross-carpal ligament, or a combination of these may all lead to symptoms of carpal tunnel syndrome. Pathology and strain on the median nerve occur regardless of the immediate cause.

Continuous Passive Motion (CPM) therapy involves using a device that helps patient to do exercise without putting much effort. It generally uses a motorized setup that can be setup to produce repetitive joint movements with preset angles prescribed by the physiotherapist. There are different types of CPM devices depending on the type of joint for which it is prescribed such as hip, knee, ankle, shoulder, elbow and wrist. CPM is generally used to promote Range of Motion (ROM) in the patients who have undergone surgery and having joint stiffness. Wrist joint connects the forearm and hand anatomically. It has four main movements namely flexion, extension, radial and ulnar deviation. The wrist