Biomechanical analysis of grip strength in upper limb rehabilitation

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Abstract. This research is based on biomechanics as a science that involves concepts of engineering, mechanics, physic, anatomy, physiology, and many others, to study the human body with the desire to solve certain problems that may affect the performance of an individual in their work or personal level. This work is an investigative process in these areas of scientific and applied disciplines, in which the attention is focussed on the hand as a valuable tool for the occupational performance of the human being, since through it is possible to touch, move, grasp, or manipulate objects. Injuries to this limb may be due to various causes, which require complex surgeries and long periods of rehabilitation to be reversed. This research highlights the importance of certain physical concepts that must be understood by the rehabilitation expert in order not to affect the surgery and thus guarantee the maximum functionality of the patient at the end of the recovery cycle.

1. Introduction

The hand is the element of the human body that interacts with the environment either to move, touch, manipulate or grasp objects, which makes it a necessary limb for daily life and work due to its functionality and ability to adapt to the shape of objects. As a factor that decreases work productivity or functionality, when it is affected by injuries, the maximum force that would be exerted under normal conditions is diminished.

However, the correct diagnosis and treatment of injuries has its own philosophy, since each injury compromises the biomechanics of the tendon, which motivates its in-depth study. The extensor tendon can be injured in different ways, generally the most common injuries are caused by lacerations, crushing, and forced flexion of the joint which, when extended, can cause laceration of the tendon insertion with or without fracture of the phalanx. Biomechanical analysis to characterize the force exerted by the hands is performed by means of readings obtained from dynamometers, either mechanical or hydraulic, where the results correspond to the force exerted by the whole hand.

Several previous clinical studies [1,2] have provided valuable information on this type of injury, for example it is known that: (a) extensor tendons in all areas tolerate controlled active mobility; (b) breaching and rupture are rarely a problem in carefully applied postoperative regimens where forces and excursion are controlled; (c) more digital joint mobility can probably be allowed than previously thought possible; (d) wrist position is critical in decreasing restrictive forces on the flexor system and is a factor in the true tendon excursion obtained with digital mobility; (e) those tendons have probably been