Assessment of Handgrip Strength in Egyptian Elderly Population

Thesis

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Summary

Reliable and valid evaluation of handgrip strength is of paramount importance in determining the effectiveness of various surgical or treatment procedures. In addition, normative data are needed to provide an objective index of the functional integrity of upper extremity, to interpret evaluation data, and to set realistic treatment goals.

This study was conducted to assess handgrip strength in Egyptian elderly population in comparison to younger adults. In the study, 618 subjects (300 males and 318 females), aged 25-85 years, were divided in 12 age groups each representing (6 - 9)% of the total number of participants, and were evaluated for handgrip strength using the Baseline pneumatic squeeze hand-held dynamometer.

Handgrip strength of the dominant hand has been measured for all participants in the study, while in a group that included 100 males and 100 females of different age groups, the handgrip strength value of the non-dominant hand was measured as well, in order to compare between both.

This study showed normative values of handgrip strength in different age groups of the Egyptian population. In older age groups (60-85 years) mean values of handgrip strength were found to be between (10.74-12.54) in males and, (9.45-11.12) in females. The study showed a negative correlation between

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List of Abbreviations

AD	Alzheimer's disease.
ANOVA	Analysis of variance.
ASHT	American Society of Hand Therapy.
BMD	Bone mineral density.
BMI	Body mass index
DEXA	Dual energy x-ray absorptiometry.
EWGSOP	European Working Group on Sarcopenia in Older People.
Lt	Left.
OA	Osteoarthritis.
PSI	Pounds per square inch.
Rt	Right.
SD	Standard deviation.

Introduction

The hand is the basic manipulative organ in human body, and handgrip force participates in all manipulative activities realized by the cranial part of the body ***(Dopsaj et al., 2009)***. Human hand acts as a receptor of much information from the environment and in everyday life; all kinds of grips are of vital importance for ordinary activities of daily life. The hand is capable of complex and precise functions, which can be divided into grasping abilities measured by the strength and manual dexterity ***(Secker and Jeejeebog, 2007)***.

Grip is an action or activity of the hand in moving, grasping, or taking hold of an object between any two surfaces of the hand, the thumb may or may not be involved. Grip can be categorized either power grip or precision handling. Power grip is a forceful act resulting in flexion of all finger joints, with the thumb acting as a stabilizer to the object held between fingers and the palm. Precision handling is the skillful placement of an object between fingers or fingers and the thumb ***(Levangie and Norkin, 2001)***.

Handgrip strength is an easily obtainable measure of physical health and muscle function. Reliable and valid evaluation of hand strength is very important in determining the effectiveness of various surgical or treatment procedure ***(Muralidhar and Bishu, 2000)***.

Grip strength has long been thought of, as a possible predictor of overall body strength, but little if any research that correlated the two was found. Smith et al, found a direct correlation between grip strength and overall body strength in very old and oldest females. The study also revealed that, grip strength was moderately correlated with overall body strength in the very old and oldest populations ***(Smith et al., 2006)***.

Grip strength has a specific role in ergonomics especially for hand tool using. In ergonomics, a hand tool must be designed such a way that provide a better fit for the user. Fit in terms of comfort and efficiency of use, is particularly important for tools used for long-term projects for occupational activities. It also reduces the risk potential injuries associated with using of hand tool ***(Zhang et al., 2002)***.

Wide range of instruments is available to measure both dynamic and static handgrip strength. Grip strength measurement devices fall into four categories: hydraulic, pneumatic, mechanical and strain gauges ***(Richards and Thomas, 1996)***.

The American Society of Hand Therapists, suggesting a standardized arm positioning for hand strength tests, concluded that the position of upper extremity might influence measurements and recommended that the patient should be seated with his shoulder adducted and neutrally rotated, elbow

flexed at 90 degrees and the forearm and wrist in neutral position ***(Fess, 1992)***.

Reference values are essential if informed decisions are to be made about the normality of an individual's status relative to the population ***(Rothstien and Echternach, 1993)***. Such values are particularly important when it comes to hand grip dynamometry, as grip strength is used not only to describe the status of the hand but also to characterize overall upper extremity strength ***(Bohannon, 2005)***.

Hands undergo many physiological and anatomical changes with aging, though the effects of normal aging on adult hand function and dysfunction are still poorly understood. The ability of older persons to carry out daily tasks independently is largely dependent on the maintenance of sufficient aerobic capacity and muscle strength ***(Carmeli et al., 2003)***. Handgrip strength is considered a commonly used proxy for global muscle strength ***(Lauretani et al., 2003)***. However, one of the main difficulties in evaluating the grip strength of elderly patients is the absence of valid norms. Hence, the need for such norms in elderly ***(Desrosiers et al., 1995)***.

Aim of the Work

To assess handgrip strength in the Egyptian elderly population, in comparison to younger adults.

Importance of Handgrip Strength

The human hand is unique in being free of habitual locomotor duty and devoted entirely to functions of manipulation. Its effectiveness in these activities is due to particular configuration of the bones and muscles, which permits opposition of the pulp surface of the thumb to the corresponding surfaces of the other four fingertips in a firm grasp, together with a highly elaborated nervous control and sensitivity of the fingers ***(Barut et al., 2008)***.

The hand is a very complex structure capable of not only a multitude of motor tasks but also of relaying sensory information about the temperature, the shape and texture of objects to the brain ***(Blair, 2002)***.

Many daily activities involve interaction with objects that are grasped in the hand. The manipulative ability of the human hand requires effective force and dexterity. Power grip is a forceful act resulting in flexion of all finger joints. When thumb is used, it acts as a stabilizer to the object held between the fingers and the palm ***(Shectman et al., 2004)***.

Power grip is the result of the following sequence:

- Opening of the hand.
- Positioning of fingers.
- Approaching the fingers to the object.
- Maintaining a static phase that actually constitutes the grip.

(Levangie and Norkin, 2001).

Grasping ability of the hand is made possible by the fact that, the thumb can be opposed to the fingers. The fingers and the thumb act as a versatile pair of pliers. They need the palm of the hand as a flat base, on which the object grasped can be held ***(Weinick, 1990)***.

The anatomy of the hand is more geared towards flexion than extension. Studies on the strength of finger flexor versus finger extensor musculature during isometric tasks, revealed the flexor mechanism of the fingers to be 62% stronger than the extensor mechanism ***(Li et al., 2001)***.

There are 35 muscles involved in movement of the forearm and hand, with many of these involved in gripping activities. During gripping activities, the muscles of the flexor mechanism in the hand and forearm create grip strength while the extensors of the forearm stabilize the wrist ***(Waldo, 1996)***.

There are four major joints of the hand, carpometacarpal, intermetacarpal, metacarpophalangeal, and interphalangeal joints, with 9 extrinsic muscles that cross the wrist and 10 intrinsic muscles with both of their attachments distal to the