THE IMPORTANCE OF GRIP STRENGTH

By

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Many daily functions and sporting events require high activity levels of the flexor musculature of the forearms and hands. These are the muscles involved in gripping strength. From sports like wrestling, tennis, football, basketball, and baseball to daily activities such as carrying laundry, turning a doorknob, and vacuuming, some degree of grip strength is necessary to be successful. For example, without adequate grip and forearm strength, tennis players may run the risk of developing lateral epicondylitis, otherwise known as tennis elbow. Often overlooked or taken for granted, the strength of ones grip plays a key role in injury prevention and overall strength development (2,7,23,29). The purpose of this literature review is to dissect the importance of grip strength and how it correlates to physical performance.

Muscles Involved In Grip Strength

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 (27)”. There are four major joints of the hand, Carpometacarpal, Intermetacarpal, Metacarpophalangeal, and interphalangeal joint, with “9 extrinsic muscles that cross the wrist and 10 intrinsic muscles with both of their attachments distal to the wrist (10).” These muscles include the pronator radii teres, flexor carpi radialis, flexor carpi ulanris, flexor sublimis digitorum, and Palmaris longus on the extrinsic layer and the flexor profundus digitorum, flexor

policus longus, pronator quadratus, flexor pollicus brevis, and abductor pollicus brevis on the intrinsic layer. Each of these muscles is active during gripping activities.

According to German Sports Scientist Jurgen Weinick, “the characteristic structure of the hand is related to its function as a grasping tool. Grasping ability 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 (28).” From this statement, it can be concluded that the anatomy of the hand is more geared toward flexion than extension. Further proof lies in the research of Li, Zatsiorsky, and Latash on the strength of finger flexor vs. finger extensor musculature during isometric tasks. Their findings revealed the flexor mechanism of the fingers to be 62% stronger than the extensor mechanism (18).”

Methods of Assessment for Handgrip Strength

The most common method of assessment for grip strength is the use of a handheld dynamometer. This is a form of what is referred to by Dal Monte and Dragan as a biomechanical measurement. “Biomechanical measurements allow sports coaches to appreciate the bioenergetics and efficiency of sports movements; training can then aim to achieve a maximal energetic output with minimal expenditure of energy, avoiding at the same time possible fatigue and stress lesions in the locomotory system (5).”

Handheld grip strength dynamometry is used to measure the muscular force generated by flexor mechanism of the hand and forearm. There are three main categories of handgrip dynamometers. These include spring-loaded compression, air compression, and hydraulic compression devices. According to Waldo, “since grip is a force, not a pressure, it should be measured in pounds or kilograms. A hydraulic dynamometer is the most accurate choice (27).”

When testing grip strength there are many variables that need to be normalized before testing. The testing protocols need to be consistent with regards to time of day, posture, anthropometric measures and dynamometer adjustments. Goh et al (2001) performed a study on the effects of one night of sleep deprivation and its effects on hormonal profile and performance. Their baseline performance measurement was handgrip strength. During the study, the researchers performed grip strength and hormonal profile testing at different times throughout the day. Their findings revealed "changes in grip strength occurred as a function of time of day. Grip performance increased progressively during the day, but declined during the night (8)." Cappaert (1999) had similar findings, concluding "grip strength also showed time of day differences with the peak in the afternoon (3)." He further concluded, "time of day differences in endocrine function, as measured by plasma cortisol and B-endorphin as well as levels of catecholamines in the urine, mirrored the differences in muscular strength (3)."

Posture and elbow positioning during handgrip testing has also been found to play an important role in the strength results. Various studies have shown grip strength to be greater with less flexion at the elbow (17, 20, 25). The normalization of anthropometric measures such as body height, mass, finger length and perimeter can also have an effect on the outcome of grip strength testing. One such study revealed "there were highly significant relationships between maximal handgrip strength of the dominant hand and general anthropometric variables in all age-groups (26)." Without normalization of testing protocols, the results may be influenced by the aforementioned variables.

Handgrip Strength as a Predictor of Physical Functioning

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 (2006) found a direct correlation in grip strength and overall body strength in very old and oldest females. The study

revealed that, “grip strength was moderately correlated with overall body strength in the very old and oldest populations (23).” Fry et al (7) also found a correlation between grip strength and performance in American Men Junior Weightlifting. Though in theory, one would believe the two are correlated and more studies may be necessary for other populations. Many of the research studies correlated grip strength to various other physical variables including nutritional status, rotator cuff weakness, fatigue, and overall physical function.

In his book Science of Sports Training, sport scientist Thomas Kurz recommended the measurement of handgrip strength using a hydraulic dynamometer to reveal the physical readiness of an athlete. This information provides valuable data to the coach with regards to an athlete’s potential training status. If the athletes grip strength is percentage kilograms below baseline or previous workout, the athlete may be fatigued. If the opposite is true, the athlete will have recovered optimally and performance may increase. This theory draws parallel to the findings of studies performed by Michiko et al (1999), Hunt et al (1985), and Frederiksen et al (2002). Each of these studies used handgrip dynamometric testing to evaluate physical functioning in surgical, lifestyle disease, and mid to late life subjects. The findings of each of these studies correlated less than optimal physical functioning or fatigue with lower strength scores in handgrip dynamometric testing. In a recent report by the ACSM, it was concluded that, “handgrip muscular endurance has been shown to suffer a delayed decline on the second morning following intoxication (1).” This research provides further evidence toward the correlation between immune functioning and handgrip strength.

Grip strength may also play a role in injury prevention and rehabilitation. In many cases, strengthening of the grip has been a prescription for rehabilitation from injuries such as golf and tennis elbow. According to Poliquin, “these ailments are often caused by improper strength ratios between the elbow muscles and the forearm muscles. If the elbow flexors, like the biceps

and brachialis, are too strong for the forearm flexors, uneven tension accumulates in the soft tissue and results in elbow pain (21).” Health of the rotator cuff has also been correlated to the strength of ones grip. Yasou et al (2005) found “grip strength had a significant correlation with the muscle strength of 45 degrees shoulder abduction and external rotation in the affected (injured) side (29).” A similar study performed by Budoff, results revealed an increased prevalence of rotator cuff weakness on the ipsilateral side of a hand injury or disorder (2).

Nutritional status has also been correlated to handgrip strength. Guo et al (1996) and Kenjile et al (2005) found grip strength to be a strong predictor of an individual’s nutritional status. These findings draw parallel to the findings of the anthropometric measurement studies. Ones nutritional status will lead to specific levels of body mass, which in turn has been found to correlate directly to grip strength. This simple method of non-invasive measurement may provide nutritionists and medical professionals with valuable screening data, prior to further more invasive testing.

Grip Strength Training

To the general public, the direct training of ones grip strength has been mostly limited to spring loaded hand squeeze devices and variations of tennis ball squeezes. Though these are ways of strengthening ones grip, there are many less conventional methods, but possibly more effective methods of training grip strength. Many exercises currently used in gyms and fitness centers across the country indirectly work an individuals grip. According to Ratamass et al, “pulling exercises such as dead lifts, bent over rows, and pull-ups all greatly depend upon the athlete’s level of grip strength. Therefore, resistance training to improve grip strength may be critical to athletic success in several sports (22).” Poliquin states, “the quickest way to develop your grip is to forego the use of lifting straps when you train your upper body (21).” This method of training will ensure greater isometric strength demand of the gripping muscles to stabilize or

hold the resistance. Poliquin also reveals, “when your grip strength improves, less neural drive is needed for the forearm and hand muscles to perform other exercises. That is why many trainees report breaking training plateaus in a host of lifts, ranging from dead lifts to curls, after doing a grip specialization routine (21).”

More focused grip training variations can be traced back to the early events of strongman training and competition. In this type of competition, athletes are required to lift and carry heavy objects in their hands for extended periods of time, requiring great amounts of force and endurance in the flexor musculature of the hand and forearm. Events such as the farmer’s walk, Truck pull, Atlas stones, Husafell Stone, Power Stairs, and Hercules hold all require incredible amounts of handgrip strength and endurance. Some of these events have found their way into performance training for athletes. In particular loader tires, farmers walk handles, and rope pulling devices can now be found at training centers focused on increasing athletic performance.

Another unconventional method of training ones grip strength is through the use of grip enhancers and free weight bars of varying thicknesses . According to Ratamess et al, “these bars have the potential of enhancing grip strength because of the higher degree of difficulty performing exercises while grasping the bar in an area of range of motion where gripping ability is relatively weak. Studies have shown an ascending/descending strength curve such that grip force declines in proportion to the diameter of the bar or cylinder used (22).” In their study, Ratamess et al found a reduction in the 1 rep max of pulling exercises with greater bar thicknesses. Though their findings did not reveal any changes of 1 rep max in pushing exercises with greater bar thickness, the neural drive of the hands and forearms to hold and stabilize the bar could have an effect on performance in higher repetition ranges.

In conclusion, the simple method of handgrip dynamometry has been found to reveal more than an individual's handgrip strength. From nutritional status to physical functioning, this method of assessment can provide the practitioner with a cost effective, non-invasive screening tool to evaluate client's well being. Further studies with regard to the correlation between handgrip strength, overall strength and overtraining or fatigue status may be warranted.

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